IEEE Broadcast Technology

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

2023 NAB Show Attendance Swells To More Than 65,000; story on p. 5

BTS IEEE

Second Quarter 2023

President's Message

Paul Shulins, BTS President

Greetings fellow BTS Members!

Now that we are in the second quarter of 2023, we're starting to see so much excitement and engagement in our industry. It seems like travel is back in demand, and folks are already actively participating in committees more and more this year. I am especially grateful to our ExCom members who came together this February in New Brunswick, New Jersey to talk about BTS, and identify areas we can improve and serve our members better. We have a very active and engaged group, and I expect to report great progress this year in our direction to grow our membership in all regions, especially those where we are underrepresented.

I also want to let you know that one of my initiatives is to collaborate with other societies both within the IEEE and externally. I have already been engaged with the Society of Broadcast Engineers here in the United States, and I would welcome input from you on others worldwide that might be good partners. As a start, we organized an ice cream "social" outside our booth at the NAB Show in April, and with the cost of this "social" shared with the SBE and the Society of Motion Picture and Television Engineers (SMPTE). I was pleased that we could put this together, and am sure it will lead to more collaboration and cross promotion in the future. We have a long way to go to reach the levels I would like to see in terms of member services and engagement. Working with other societies is a great way to help in this regard.

After our first PULSE event this year hosted by Jim Stenberg, we're preparing for the BMSB in China that's coming up in a few months, and I want to thank Peter Seibert, Yian Wu, and the BMSB planning committee for their hard work on this important academic conference! Likewise, Jim Stenberg is chairing our other signature event, the fall ABS. The location and date for the event are still being finalized, but this information should be available shortly so that you can start making plans to attend.

Our Distinguished Lecturer program is getting back on track as well, and we are making sure that funding is made available for in person travel for DL lectures around the globe. We currently have 20 distinguished lecturers with expertise in different areas. I encourage you to visit the BTS we site to find out more about their specialties and credentials, as well as instructions on how your Chapter can request a virtual or in-person presentation by one of these experts.

I would also like to highlight our Young Professional's program. This was established to help students make the transition from graduate and undergraduate schooling, to becoming young professionals within the IEEE BTS community. This is done through interactions at our conferences, access to our job board, and through YP webinars and workshops throughout the year. Please check our website to see the latest events geared toward this program.

Given the pent-up excitement we've seen for in-person meetings, and much higher attendance at trade shows, I am very optimistic that 2023 will be a great year for the September IBC. The show is well on its way to achieving close to pre-pandemic attendance levels, and that bodes well for our revenue stream.

As we see the line between consumer electronics and broadcasting becoming more blurred, and the development of overlapping areas between technologies, (particularly in consumer electronics and broadcasting), events like the Consumer Electronics Show, and relationships with manufacturers of consumer goods becomes more relevant every day. We're going to increase our efforts to collaborate with these organizations and companies to further the value of broadcasting to the public.

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Inside

Cover: ATSC 3.0, IP broadcast technology, and the cloud, along with the latest in broadcast equipment were all part of the 2023 NAB Show.
Cover Photo Credit: NAB photo

From The Editor

The Lights Are Coming On Once Again!

By James E. O'Neal, Editor-in-Chief,
BTS Life Member

Early on in the current global pandemic I reflected on these pages about a World War II-era song that seemed to have special meaning as the various restrictions on travel, shortages of household and other items, and more or less continuous bad news was filling the airwaves and newspapers. That song—"When The Lights Come On Again All Over The World"—foretold of better times once the war was over and populations didn't have to live in fear of nighttime enemy bombings and could once again turn on the lights in their homes at all hours. As we all know, that dark period in history finally ended and prewar conditions—although changed somewhat—resumed. I think that now as we enter the fourth year of the pandemic, the worst is indeed behind us and the lights are starting to come on again. I'm glad to report that fewer and fewer cases of Covid-19 are being reported and once again people are traveling, gathering together, and, in general, resuming where they were forced to leave off in early 2020. I just returned from a small two-day regional conference centered on radio and television history held in a neighboring state, my first such "outing" since 2019, and it was encouraging to see the unusually large (better than pre-pandemic) turnout for the event. I was looking forward to attending my first NAB Show since "the lights went" out, but unfortunately, that was not to be due to a fairly serious injury I suffered near the end of 2022 and the ensuing regimen of physical therapy that has extended past April and did not allow me to be away from home for more than a couple of days at a time.

A Salute To A Century (Almost) Of NAB Shows

As I write this, the 2023 NAB Show is just a few weeks away and I'm getting the usual (pre-pandemic level) number of invitations to press events, which is indicative of the

University of Maryland Libraries

The early NAB Shows were quite different than those going on now. The few exhibits greeting attendees were basically limited to those from the organization itself and a few member stations.

number of exhibitors and others who will be making the trek to Las Vegas once again to view the latest and greatest in broadcast technology and to learn about new developments through the numerous seminars and other educational events available during the five-day show. Incidentally, the first "NAB Show" (it was termed a "convention" back then and for many years afterward) was held way back in the fall of 1923, just a few months after some farsighted early radio station owners and industry figures saw value in banding together to ensure that these fledgling broadcasting enterprises would be better prepared for the challenges that were sure to be encountered in a new industry that was then just feeling its way in the well-established world of commerce. And yes, there were many challenges, some of which we still face, including a shortage of broadcast spectrum, payment of excessive royalties on both recorded music and even the equipment used. Those early NAB "shows" would seem quite different from what we're used to here in the 21st century, as they were typically held in a single hotel (attendance didn't break the 1,000 number until the 1940s), included such "extracurricular" events such as golf tournaments with the awarding of trophies, and at least one (held off-convention site, fortunately) trap shooting event. The almost never-ending lineup of new technology exhibits such as we now experience didn't exist either, as during the first decade or so of broadcasting's history, commercial equipment manufacturers were few, with a number of the early stations making their own transmitters, audio mixers and other equipment. Exhibits at the early shows consisted mainly of promotional efforts by the NAB and some of the radio stations the organization represented.

How things have changed during the past century!

Actually, the 2023 NAB Show isn't really the 101st such gathering of broadcasters and content producers, as we might think. The pandemic put the brakes on the 2020 and 2021 events, and the 1945 show was halted before it could happen also. In that case, it was a governmental order banning the gathering of more than 50 people that were not part of the same community. This ban, which came early in the final year of World War II, was intended to free up transportation and hotel rooms that were badly needed by military and defense industry personnel. It applied to all "*trade shows, exhibits, conferences, assemblies and conventions, including those of industrial, commercial, labor, fraternal, social, professional, religious, civic, [and] governmental organizations*." So, in truth, this year's show is really only the 98th; however, this far out, who's counting!

As I mentioned, new technology really wasn't the focus of early shows. This did change in a big way during the 1930s, with more and more manufacturers embracing the broadcasting industry and developing new and innovative technologies, such as the unveiling of one of the first—if not the first—audio processors, Western Electric's model 110A, in 1937. FM and television followed in rapid succession, as did color television, UHF broadcasting, microwave communication links, video recording, the first solid-state broadcast devices, automation technology, microprocessor-based devices, innovative lighting technologies, robotic cameras, the move to digital platforms, including recording on hard drives, high-definition high-dynamic range television, the move to IP-based infrastructures…. The list goes on and on, with even more cutting-edge technological innovations displayed at this year's NAB Show. I just wish that I could have attended this year's event. Hopefully, the physical therapy sessions will prove their worth and I'll be back up to speed in time to attend the 2024 Show. I'm really looking forward to it! I'm also looking forward to an event that will be happening even sooner—the BTS Fall Symposium. Plans are being made for another great event, and hopefully, my injured shoulder will have healed and I'll be able to attend and look forward to seeing a large number of familiar faces, along with some new ones.

We Still Need Your Stories And Reports

I'm sure that you're getting tired of hearing my appeals for stories and reporting of events for this publication, but it's getting increasingly difficult to fill the pages of **Broadcast Technology** with fresh content, and your assistance is needed more than ever. I want to extend a special thanks to our regular contributors of the industry sector and other columns that appear in each issue and a special "tip of the hat" to Amal Punchihewa, who has become a regular contributor with his reporting on events in the Asia-Pacific region. I'd also like to express my thanks to my friend Fred Willard who provided his early career "learning moment" account for our "Downward Path To Broadcast Engineering" feature. Please follow the lead of both of these individuals and send me your accounts of events that are happening now, or—in Fred's case—something that happened early in your career. Thanks. I also want to extend thanks once again to veteran broadcast industry reporter Phil Kurz for providing coverage of this years "bigger and better than ever" NAB Show.

A 'Changing Of The Guard' Is In Progress

As many of you know, I've been editing **Broadcast Technology** for more than a dozen years now and have decided that it's time to let someone else have a go at the reins. This is Bill Hayes, a name that is certainly well known to all BTS members. Bill has provided input for this issue of **BT** and will be working together with me on the third-quarter issue. Plans call for him to assume full duties as editor-in-chief for the final 2023 publication. I have no immediate plans to completely "disappear from the scene," and will be around to assist in whatever way that I can with **Broadcast Technology**. I'll have more information about this change for you in the next issue. Stay tuned!

James O'Neal
Editor
Broadcast Technology
IEEEBTSeditor@gmail.com

NAB Show Passes 100-Year Mark

Attendance up 25 percent from 2022 event

By Phil Kurz

LAS VEGAS

The lives of people, institutions and organizations are often said to be more like a swinging pendulum than an arrow in flight.

Advancement through time is frequently a series of swings, ebbs and flows between upward trajectories and then the inevitable retreat away from the crest to a lesser station, only to begin the process again.

So too it was with the 2023 NAB Show, April 15-19 in Las Vegas, which rebounded from the pandemic-induced drop in 2022 of 52,468 registered attendees as the pendulous swing higher took this year's registrants to the 65,013 mark.

The 2023 edition of the show not only will be remembered for the 25 percent swing to the upside from last year, however. The show marked the centennial anniversary of the industry gathering, which began October 1923 at the Commodore Hotel in New York City with 23 attendees—with representatives from 16 early radio stations among them.

"We are thrilled to have so many exhibitors, attendees and partners from around the world join us in Las Vegas to help celebrate 100 years of innovation," said NAB president and chief executive officer, Curtis LeGeyt. "More than any other year, everyone is filled with so much enthusiasm and energy as they engage on the show floor, in special sessions and throughout the entire event."

Continued Mission; New Tool

Since its beginning, the terms "broadcasting" and "local" have fit together like a hand in a glove in the United States. LeGeyt underscored that relationship during his Fireside Chat welcome April 17 with Univision Los Angeles news anchor Gabriela Teissier.

"…[T]here is this renewed appreciation, and I think invigoration for local," he said, referencing how local stations served their communities with vital information as the Covid-19 pandemic raged. "That's not something that Amazon and Apple are ever going to be able to cover."

Emphasizing broadcaster's commitment to delivering news, sports and entertainment for free to the public, LeGeyt noted ATSC 3.0 makes it possible for broadcasters to enhance the experience of viewers, not simply with higher 4K resolution and immersive audio, but with other features that better serve the public than is possible with the legacy ATSC 1.0 over-the-air DTV standard.

"You are talking about… watching a particular newscast, and you want to be able to delve into a particular story, get more information, the interactive abilities to be able to do that, and when you are thinking of live sports, we need to be there as an industry providing the viewer experience that's going to match all of the most innovative products out there, " said LeGeyt.

"…[T]he fact that ATSC 3.0 is going to enable us to do all of that while providing it through that free signal and also [be] hyperlocal. That's something to be really excited about. I think it is very, very clear that where broadcasters are going to thrive is free, local live."

While commending the broadcast industry for its efforts so far, which have brought NextGen TV to more than 60 markets covering over 60 percent of U.S. TV households, LeGeyt stated that the Federal Communications Commission must participate in advancing the new digital TV standard further.

"…[T]he FCC has a role here in providing the assurance that this [NextGen TV] is something that is really happening here, that they are committed to seeing it through," he said.

Later that very day, FCC chairperson Jessica Rosenworcel addressed LeGeyt's urging, laying out a pair of key steps her agency is taking to ensure the nationwide rollout of NextGen TV is successful. Rosenworcel told attendees that she has shared a draft 3.0 order and rulemaking to advance broadcaster ATSC 3.0 rollout that "minimize [the] cost and disruption for viewers who still rely on ATSC 1.0 programming."

The chairwoman also announced the Future of Television Initiative, a public-private partnership to consider and address the challenges ahead for industry and consumers alike in transitioning to 3.0. An idea NAB proposed to Rosenworcel, the initiative will have three working groups: one to address consumer issues, another focused on completing the transition and the third looking at post-transition rules.

Curtis LeGeyt, NAB president and chief executive officer, participates in a "fireside chat" with Univision's Gabriela Teissier.

"The first, as I think it should be, is all about consumers," said Rosenworcel. "Like I noted a moment ago, ATSC 3.0 is not backwards compatible. That means it does not work with existing sets so many consumers have in their homes right now.


Jessica Rosenworcel

"For this new technology to move forward, we're going to have to find a solution. I can't emphasize this enough. We can't saddle consumers with unworkable sets or big expenses just to continue watching the local television they know and trust. So, we are going to have to figure this out."

Advancing Consumer NextGen TV Uptake

The working group on consumer uptake might do well to look at several developments coming out of the 2023 NAB Show. Even before the convention officially started there were indications of multiple paths forward presented during the Public Media Venture Group's Public Media Technology Summit at the Renaissance Hotel, adjacent to the Las Vegas Convention Center.

One centered on the NextGen TV logo program, an effort of Pearl Television, the Consumer Technology Association and the NAB, to ensure that NextGen TV sets, gateways and other devices conform to the 3.0 standard and can receive what broadcasters are transmitting.

During a summit session, Anne Schelle, managing director of Pearl TV, praised Tolka, a company that develops software stacks for set-top box and television manufacturers. The company, which is working with Atlanta DTH on a 3.0 set-top box, will soon achieve logo certification, according to Schelle.

Noting that Tolka only began working on the 3.0 stack certification in September, Schelle observed that the company and many others entering the NextGen TV marketplace are benefiting from Pearl TV's Fast Track initiative to expedite development of 3.0 receivers.

Asked what the target consumer price of the Tolka-ADTH set top box would be, Alex Day, vice president of business development for the company replied that it would be around $50. (The ATSC exhibit at the show featured several NextGen TV consumer set-top boxes and dongles that will soon be available to consumers.)

Two other summit developments dealt with how public broadcasters could assist in consumer uptake of 3.0 receivers.

Jerome McDonald, chairman of the Western Sanders Country TV District—a translator service district in Montana—floated the idea of public-safety-oriented special service districts funding with bond initiatives consumer 3.0 receivers as part of an effort to enhance emergency communications services for residents in their jurisdictions. There are more than 30,000 special service districts in the United States, many, such as fire prevention and flood control, with a public safety focus.

During the summit keynote, Jerry Whitaker, ATSC vice president for standards, proposed on behalf of ATSC president Madeleine Noland, that a public broadcaster in a rural area equip viewers with NextGen TV receivers and do a flash cut to ATSC 3.0.

The ATSC president, Madeleine Noland, was unable to present the idea herself due to a flight delay. However, she later elaborated on the concept during a show floor interview.

"We are not trying to boil the ocean here," she said. "We're not talking about trying to seed the entire United States of America. We can do a project that's of a manageable size where the beginning, the middle and the end are in sight."

The concept may be particularly appealing to public broadcasters because it fulfills their public service mission


(L-R): Pearl TV's Anne Schelle; LG Electronics USA's John Taylor; Sony's Luke Fay; and Tolka's Alex Day participate in a discussion on getting NextGen TV technology into the homes of consumers.

and could eliminate the digital divide in a rural area or tribal land where internet service lags the rest of the country, she said.

Another significant piece of the NextGen TV adoption puzzle was on display among 16 other exhibits in the ATSC booth in the West Hall of the Las Vegas Convention Center. The display presented an effort by LG Electronics and WPBT South Florida PBS in Miami that is enabling the public broadcaster to implement an aspect of the 3.0 standard dubbed Broadcast IP.


Dave Arland

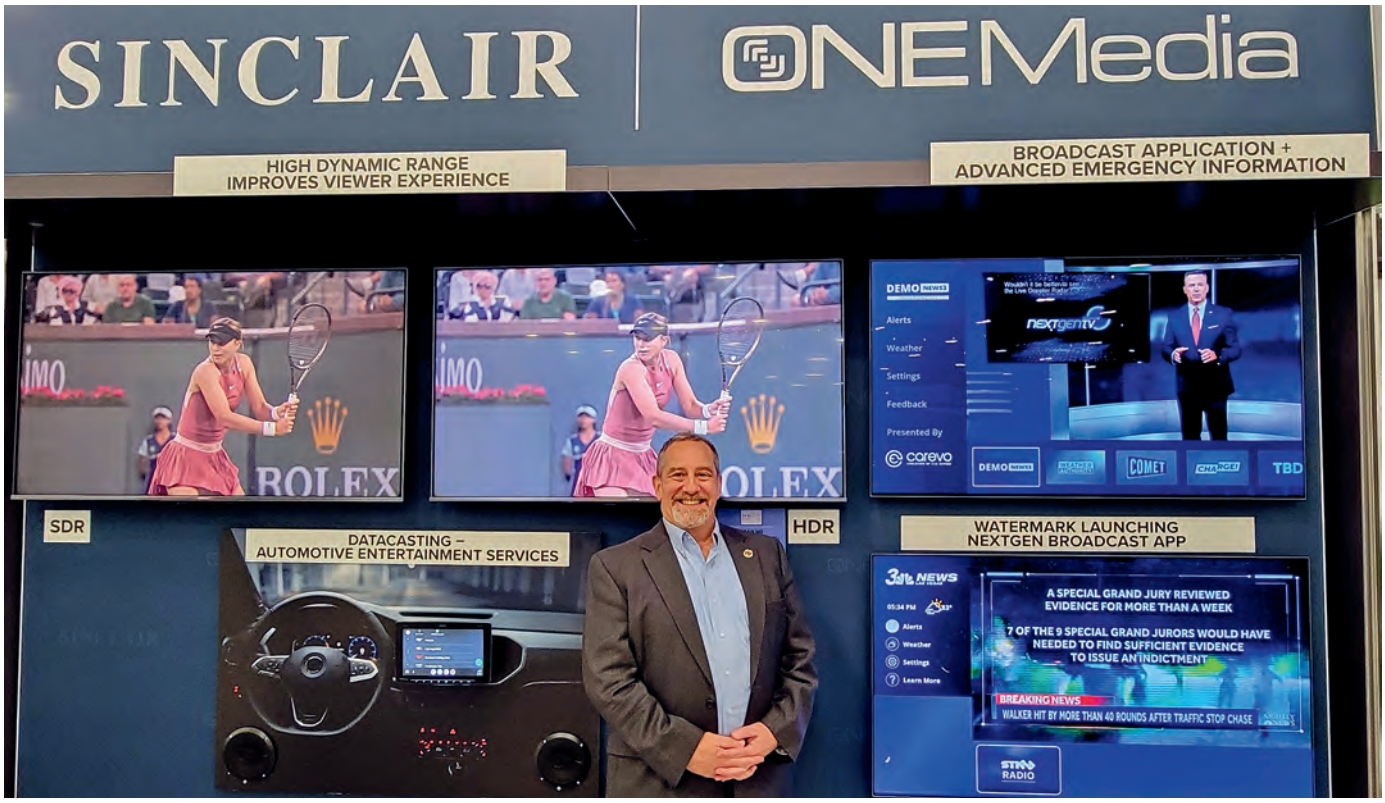
Not being a part of the current Miami ATSC 3.0 mezzanine, but desiring to be a part of the deployment, the public broadcaster is using its Broadcast IP implementation to allow viewers to see the station as part of the OTA-delivered 3.0 electronic program guide. However, when viewers with LG Electronics smart TV sets connected to the internet tune to the station, they receive its programming over the top. Sony reportedly is working on implementing Broadcast IP, and Samsung and Hisense are expected to support it as well, according to ATSC spokesperson Dave Arland.

Elsewhere in the ATSC booth, a display demonstrated the improvement HDR brings to 1080p video. Fox Sports footage, encoded by Ateme, was played on Samsung television that was purchased prior to the show in order to underscore that "out of the box, this standard and the sets that are out there could display this kind of content as soon as the networks flip the switch and begin to do HDR," said Arland.

Right next to the HDR demo was a working demonstration of the Pearl TV RUN3TV app. A Sony NextGen TV purchased at Best Buy in Las Vegas prior to the show was displaying the OTA 3.0 signal of Scripps-owned KTNV. Because the set was also connected to the internet, it retrieved and displayed the RUN3TV app, offering viewers a variety of supplementary content. Pulling the OTA program back into the corner of the screen, the app enabled viewers to access content such as up-to-the-moment weather conditions being sent live from the station. Currently, RUN3TV is deployed in about 20 markets.

Among the many other displays in the booth was a demonstration of ATSC work on an inter-tower communications network being done by teams from Spain, Canada, and South Korea. The network leverages the fundamental done by Yiyan Wu and his team from Communications Research Centre (CRC) Canada to find an alternative to microwave and fiber studio-to-transmitter links for 3.0 SFN deployments.

Another ATSC booth exhibit demonstrated how NextGen TV can be used to enhance accessibility. A joint display put on by Sinclair, Pearl TV, Comcast, NBC and Dolby



Matthew Goldman, senior director of Media Engineering & Architecture at the Sinclair Broadcast Group poses in front of Sinclair's ATSC 3.0 exhibit.

showed two NextGen TVs side-by-side, with one receiving Sinclair's 3.0 OTA signal, which included content to demonstrate the ability to play Spanish and English audio as well as a descriptive audio track for those with visual impairments in Dolby Atmos. The receiver was fed from a Comcast cable set top box, demonstrating that the same accessibility features can be delivered in 3.0 via cable TV.


Madleine Noland

"I am in love with that display because it would be the first time a person who is visually impaired or wants a different language gets it in full surround like everybody else," said Noland.

Not only was the ATSC booth frequently crowded with attendees from the broadcast community, but members of the FCC staff and representatives from Brazil's broadcast authority were also represented. Noland noted that Brazil has adopted many key aspects of the ATSC 3.0 standard as part of its own TV 3.0 system, and reported that Brazilian President Luiz Inácio Lula da Silva has issued an executive order instructing broadcast regulators to accelerate the TV 3.0 effort.

Beyond The ATSC Booth

Besides the ATSC booth, the NextGen TV Korean Alliance showcased some of the latest developments in ATSC 3.0 including a backwards-compatible MIMO system for delivery of 8K television via 3.0, advancements in Broadcast Real Time Kinematic (RTK) positioning, datacasting and accessibility.

South Korea's Electronics and Telecommunications Research Institute (ETRI) together with KBS, Aircode, EQ4aLL and LowaSIS, demonstrated the ATSC 3.0 Avatar sign language service for emergency communications.

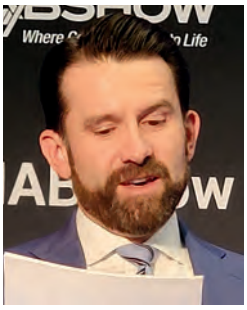
The cloud-based disaster media service platform enables disaster information to trigger the Avatar sign language server to generate sign language video to be inserted into a terrestrial 3.0 transmission to alert the public.

ATSC's Noland noted that similar work is underway at NHK in Japan, and that ATSC is at work on integrating portrait-oriented video into the 3.0 standard. "One of the applications of portrait video will be sign language," she said. "You could envision having a portrait mode picture-in-picture with sign language that is automatically generated by an AI machine that gets smarter and smarter."

Sinclair Broadcast Group held its own press conference at the NAB Show during which it announced its plan to roll out a broadcast data distribution platform to facilitate local, regional and eventually national data delivery via an ATSC 3.0 OTA network.

"We are no longer just a linear provider of video programming. We are now repurposing our channels to be so much more. Case in point is datacasting," said Sinclair's president and chief executive officer, Chris Ripley.

Working with SK Telecom, CAST.ERA, which it jointly owns with SK Telecom, and Saankhya Labs, Sinclair will develop and deploy a wireless broadcast backbone for IP data delivery across the country that will enable Sinclair and other broadcasters to begin generating revenue by providing capacity to data distributors interested in one-to-many reach, such as for delivery of software updates for edge-heavy industries like building and automation, automotive and critical infrastructure, he said.


Chris Ripley

The distribution platform will dynamically allocate available capacity in the cloud and will be guided by machine-learning capabilities, making datacasting a "uniquely efficient option" compared to other data distribution methods, said Ripley.

Of course, there was much more to the 2023 NAB Show than NextGen TV developments. The Broadcast Engineering and IT Conference, for example, explored a diverse array of topics ranging from OTT, connected TV and media workflows to AI, cybersecurity and innovations in radio.

As with the 2022 edition of the show, the LVCC South Hall remained closed, leaving the Central, North and new billion-dollar West Hall to host the exhibits. Some 1,200 exhibitors presented their latest offerings to floor traffic that generally appeared to be busy.

For its part, the IEEE Broadcast Technology Society booth outside the North Hall was well attended with some visitors learning more about the organization, others signing up to become members and still others enjoying the April 16 ice cream and beer social, held jointly with the Society of Broadcast Engineers and the Society of Motion Picture and Television Engineers.

"It looks like the traffic is increasing from last year, and our close relationship with NAB has really worked out well," said Ralph Hogan, immediate past president of IEEE BTS.

Fade To Black

Not only will the 2023 NAB Show be remembered for its celebration of 100 years of the gathering, but this year's event will also mark the beginning of a significant upswing in attendance, exhibits and program as the second year back from the pandemic and the damper it put on the reconstituted event last year.

It also may be remembered as the breakout for ATSC 3.0, the singular event regulators, broadcasters, vendors, academicians and pundits might one day point to where NextGen TV truly appeared to be over the hump and destined for reality.

With so many NextGen TV developments coming out of the show, it would appear the 3.0 pendulum is now clearly on its upward trajectory and the direction of the television broadcast industry is set to begin its next 100 years.

Pictures From The 2023 NAB Show

Some of the visitors to the booth included (L-R) Jim Stenberg, Teresa Crippen, Paul Shulins, Greg Best, Bill Hayes, Guy Bouchard, who posed with BTS staffer Margaux Toral (third from right).

This year's NAB Engineering Award recipients included several BTS members. Seen here are (L-R): Glyn Walden, Jim Stenberg, Tom Silliman, Ben Dawson, Mike Cooney, Doug Lung, Merrill Weiss, Bob Orban, and John Turner. (The individual behind Doug Lung is unidentified.)

In addition to providing information about the Society, the BTS booth was also home to a Tuesday evening 'beer and ice cream' social co-sponsored by the Society of Motion Picture and Television Engineers and the Society of Broadcast Engineers.

Tuesday evening also featured the very popular NAB amateur radio operator reception. Seen here enjoying the activities with BTS member Jim Stenberg (left) are Brian Szewczyk and Bill Gould.

ATSC Insider

By Madeleine Noland and Jerry Whitaker,
Advanced Television Systems Committee

A Busy Spring For ATSC 3.0

A great deal of work has been accomplished since our previous column—both in standards development and field implementations.

A/300:2023 Published

The latest version of A/300, "ATSC 3.0 System," has been published. Officially known as A/300:2023-03, this Standard is the central document of ATSC 3.0, presiding over the entire suite of Standards and Recommended Practices, that together, comprise the full system. A/300 normatively references a particular version of each of the other standards, and each referenced document is interoperable with the others. This allows product developers to address a particular version of A/300 in a given product release, which is important for communication with customers and for interoperability with other products.

Another element of the annual update of A/300 is an updating of references, both in and to other ATSC Standards and Recommended Practices. This step results in updated versions of all documents in the ATSC 3.0 suite, thereby keeping each internally consistent with the remainder of the suite.

The ATSC's goal is to update A/300 annually. The balance between stability and evolution suggests that an annual cadence is a good target. This cadence is just that: a target. More frequent updates are possible if needed, and if no changes are merited, then a given version of A/300 could run for more than a year. A/300:2023-03, published in April, is the fifth version of A/300 that employs the versioning strategy.

ATSC 3.0 features a modular document architecture, allowing the ATSC to update one part of the standard without impacting others. Extendable foundation technologies were chosen to ensure smooth transitions into new capabilities. The "bootstrap" signals the parameters of the emission so that receivers don't need to be "hard-coded" with assumptions about emission. It also allows a receiver to find only those physical layer frames it understands, allowing it to gracefully skip "next-next-gen" frames. And physical layer pipes (PLPs) enable broadcasters to emit both legacy and future services in the same bitstream. These capabilities allow ATSC 3.0 to serve as a platform that evolves over time as technology and business requirements change.

This year's ATSC NAB Show exhibit featured multiple demonstrations and exhibits from ATSC members, as well as the first public showing of ATSC 3.0's ability to transport content to multiple transmitter sites without relying on fiber or microwave radio linkage.

All ATSC Standards and Recommended Practices can be downloaded at no charge from the ATSC website, *https://www.atsc.org/documents/.*

Implementations Continue Apace

In the United States, ATSC 3.0 services are now available in 69 markets, reaching more than 60 percent of U.S. households. The most recent additions include Miami, Florida; Boston, Massachusetts; Des Moines, Iowa; and San Francisco, California.

As it happens, Boston, the 10th-largest television market in the United States serving more than 2.5 million households, is the hometown of Madeleine Noland, ATSC President and co-author of this column. Six broadcast stations are on the air with NextGen TV services there, including WUNI (Univision); WCVB (ABC); WFXT (Fox); GBH

Table 1: Documents Comprising the ATSC 3.0 Standard

Document	Name
A/300:2023-03	ATSC 3.0 System
A/321:2023-03	System Discovery and Signaling
A/322:2023-03	Physical Layer Protocol
A/323:2023-03	Dedicated Return Channel for ATSC 3.0
A/324:2023-03	Scheduler / Studio to Transmitter Link
A/330:2023-03	Link-Layer Protocol
A/331:2023-03	Signaling, Delivery, Synchronization and Error Protection
A/332:2023-03	Service Announcement
A/333:2023-03	Service Usage Reporting
A/334:2023-03	Audio Watermark Emission
A/335:2023-03	Video Watermark Emission
A/336:2023-03	Content Recovery in Redistribution Scenarios
A/337:2023-03	Application Event Delivery
A/338:2023-03	Companion Device
A/341:2023-03	Video – HEVC
A/342:2023-03 Part 1	Audio Common Elements
A/342:2023-03 Part 2	AC-4 System
A/342:2023-03 Part 3	MPEG-H System
A/343:2023-03	Captions and Subtitles
A/344:2023-03	ATSC 3.0 Interactive Content
A/360:2023-03	ATSC 3.0 Security and Service Protection

Table 2: ATSC 3.0 Recommended Practices

Document	Name
A/325:2023-03	ATSC 3.0 PHY Lab Performance Test Plan
A/326:2023-03	ATSC 3.0 PHY Field Test Plan
A/327:2023-03	Guidelines for the Physical Layer Protocol
A/339:2023-03	Audio Watermark Modification and Erasure
A/350:2023-03	Guide to the Link Layer Protocol
A/351:2023-03	Techniques for Signaling, Delivery and Synchronization
A/361:2023-03	Security and Content Protection
A/362:2023-03	Digital Rights Management
A/370:2023-03	Conversion of ATSC 3.0 Services for Redistribution
A/380:2023-03	Haptics for ATSC 3.0

(PBS); WBZ (CBS) and WBTS (NBC). Here are a few notes from this author's first-hand experience with the new system.

"The first thing I noticed is the unmistakable improvement in video quality. Boston stations, like most NextGen TV stations, are using 1080p, and I immediately saw that the viewing experience is dramatically enhanced over 1080i or 720p. As a Bostonian, I watch a fair number of sports events and truly enjoyed viewing the Super Bowl and Celtics basketball in the new format. The PBS station, GBH, is also offering an interactive app, which features access to more information about the channel, a click-to-donate QR code, as well as the ability to select alternate content. Reception is stronger and more stable than with ATSC 1.0 even though the 3.0 transmitter is located further away than most of the 1.0 transmitters. I'm looking forward to exploring even more features that are available now, including Voice+, as well as eager to see how service formats evolve."

Automotive Team Enters Phase 2 And Caribbean Team Efforts Begin

ATSC Planning Team 5 on Automotive (PT-5) is set to resume regular meetings. After successfully leading the first phase of PT-5's work, the Board gratefully thanks Dr. Jong Kim (LG Electronics) for all the work the Team has accomplished, including publication of two major reports on this important sector, which are available on the ATSC website. To kick off the second phase of the effort, Dr. Kim will transfer team leadership to Mark Barrington (Sinclair Broadcast Group). Under Mark's lead, PT-5 will build upon the work to date, continuing its mission of developing automotive/vehicular opportunities for both B2B and B2C applications, such as robust broadcast updates for telematics and navigation, sensors for autonomous vehicles, and in-car infotainment systems, along with infotainment content.

ATSC is also pleased to announce the formation of a new ATSC Caribbean Implementation Team (IT-7). This team, led by Mark Corl (Triveni Digital), will provide a focal point for communication to and from Caribbean nations and the ATSC regarding ATSC 3.0 adoption and implementation, working closely with national and regional organizations in the Caribbean to develop and support harmonized regional solutions and strategies. Among other tasks, the team will support Jamaica as it moves forward quickly with their digital switchover, and Trinidad and Tobago, which announced it will launch ATSC 3.0 services starting this year. Recognizing that there may be significant overlaps among Caribbean nations in the types of questions they may have and support they may request as they consider adopting ATSC 3.0, this Team will be perfectly positioned to move discussions forward in the region.

(For information about joining these and other initiatives within ATSC, please see "Get Involved" further down in this column.)

ATSC At The 2023 NAB Show

The ATSC pulled out all the stops to showcase the latest ATSC 3.0 news and updates at the April 2023 NAB Show in Las Vegas. Attendees found a broad range of opportunities to learn about deployments around world, new consumer devices, and the latest technological advancements in development.

Some 40 ATSC members showcased their latest work, and the ATSC's own booth anchored the "Connect" area in the beautiful West Hall. We offered 17 different demonstrations, including 12 kiosk exhibits, four large exhibits presented by Gaian Solutions, Pearl TV, Sinclair, and Saankhya Labs, and the debut of another of ATSC team, the IT-5 Tower Network Implementation Team. For the first time, show-goers experienced how networked broadcast towers could be utilized to move content as an alternative to fiber or microwave—a key feature of ATSC 3.0 that is now being developed.

Networking opportunities were in full swing throughout the show, including five events at the ATSC booth, the NAB International Reception sponsored by ATSC, and many others. It was wonderful to see colleagues reconnect and new friendships blossom.

Save The Date—ATSC Celebrates 40 years At Its NextGen Broadcast Conference

Make your plans to attend the ATSC NextGen Broadcast Conference taking place in Washington, D.C. June 13–15, 2023. The members-only Annual Meeting and networking events will be offered Tuesday through Wednesday afternoon. The full Conference, open to all attendees, kicks off with a 40th anniversary party and award ceremony on the evening of Wednesday the 14th. The full conference continues on Thursday with its signature high-value programming, compelling exhibits and ample networking opportunities. Please visit the ATSC website for registration and program details. See you there!

Get Involved

ATSC Membership offers the opportunity to shape the industry through standards development, educational opportunities, and networking with peers, business partners, and leaders across the globe. Membership includes access to members-only activities including technology and planning team meetings, and documents and projects in development. Specifically:

- Involvement in developing and approving Standards and Recommended Practices for the digital terrestrial transmission industry.
- Involvement in Planning Teams exploring new technologies and verticals that are emerging in the broadcast industry.
- Develop and share information on the implementation of ATSC Standards and Recommended Practices.
- Coordinate/harmonize with standards-setting bodies around the world.
- Access to the flow of information through the ATSC members-only workspace.

continued on page 23

DAB Radio News And Views

By Les Sabel, S-Comm Technologies

Establishing A DAB+ Digital Radio Service – Part 2

This article follows up on the column that appeared in the previous issue of **Broadcast Technology**, and addresses the establishment of DAB+ digital radio service.

Most countries find it difficult to start the process of next generation systems adoption. This can be due to a variety of reasons, including commercial, financial, and/or technological. For the transition from analog to digital radio, there are also additional issues such as the lack of a digital dividend as seen in DTT migration, and usually no prescribed analog radio switch-off date. This situation led to the development of the WorldDAB ebook, "Establishing DAB+ digital broadcast radio."

What The Ebook Covers

This ebook describes the complete DAB+ establishment process from initial interest all the way through to analog switch-off. The topics covered include the seven major stages in establishment: Initial investigations; Demonstrations; Formal standard adoption and regulation including coverage requirements and frequency planning; Systems planning and design, which covers both transmission and multiplexer network design; Rollout activities, including construction, content, receivers, and marketing; Operations, including ongoing content development and marketing; and finally, Analog switch-off.

The ebook is primarily focused on proving guidance to new adopters, countries that are in the early stages of adopting digital radio; however, it also provides guidance to countries which have already started the process and indeed even those who are nearing permanent service status.

A Sample Of The Contents

Here a sample is provided of the ebook contents under network design, section 8.2.2: *Multiplexing systems* and section 8.2.3: *Network architectures*:

8.2.2: Multiplexing Systems

The multiplexer system is the heart of the overall DAB system. It ingests the audio content from broadcasters, along with the Program Associated Data (PAD) information and other metadata, and produces a Time Division Multiplexed (TDM) data stream in the Ensemble Transport Interface (ETI) format for delivery to transmission and other distribution sites.

Modern multiplexer systems are software-based, and usually run on standard computing server platforms, and are often hosted within a Virtual Machine (VM) environment.

An example block diagram is shown in Figure 1, where the audio and PAD source is shown on the left in orange. Those sources are typically audio and PAD playout systems which

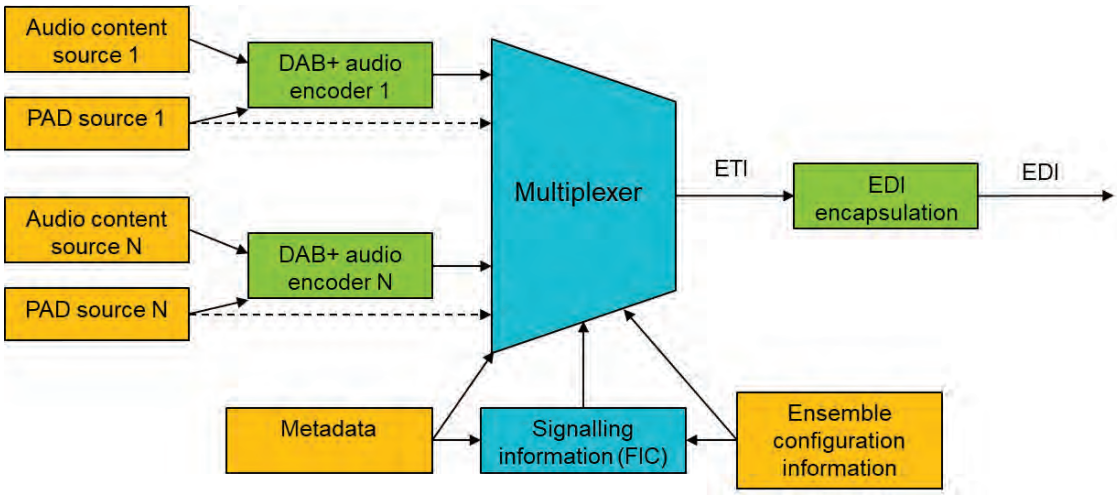


Figure 1. Basic components of the multiplexer system

deliver the audio content to the DAB+ audio encoder. The audio format may be analog, AES digital, or more commonly, AES67-based Audio over IP (AoIP). The PAD is often collected by a PAD server and delivered either to the multiplexer or the audio encoder for embedding in the X-PAD component of the audio stream.

The multiplexer system receives the DAB+ encoded audio, along with the PAD from the various sources, and assembles them into a set of services which are then assigned to subchannels in the signal to be transmitted. The resulting ETI stream also includes the Fast Information Channel (FIC), which contains the necessary configuration information to allow the receiver to understand the structure of the ETI stream and its contents. That configuration information includes parameters such as the assigned subchannel, the service label, the subchannel bit rate and the amount that is reserved for X-PAD, the audio encoding parameters, and so forth. Full details of the system can be found in the main DAB Standard[1] with the DAB+ audio encoding being defined in another ETSI document.[2] The ETI stream produced by the multiplexer system is usually encapsulated within an IP stream using the methods defined in ETSI document TS 102 693.[3]

DAB can also deliver data services in a similar manner, typically using enhanced packet mode. Those services can include EPG, TPEG and a range of other data services, including custom applications.

DAB+ encoding and multiplexing systems are provided by several commercial infrastructure system manufacturers in a range of formats, from custom hardware-based to standard computing server platforms, with or without VM architectures, to cloud-based implementations.

To ensure a high degree of availability, multiplexer systems are usually constructed as 1+1 redundant systems where the main and redundant multiplexer system are hosted on physically different platforms and usually fed by different IP and power systems.

PAD server systems are usually provided as separate software systems but may be hosted on the same server platform as the multiplexer system.

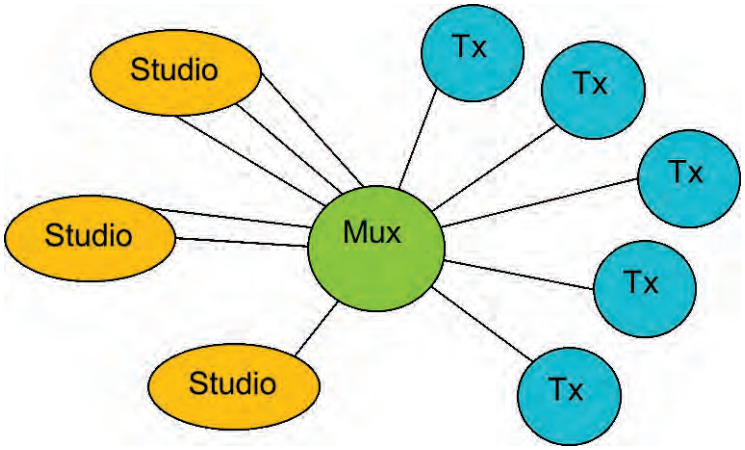


Figure 2. An example of a star network

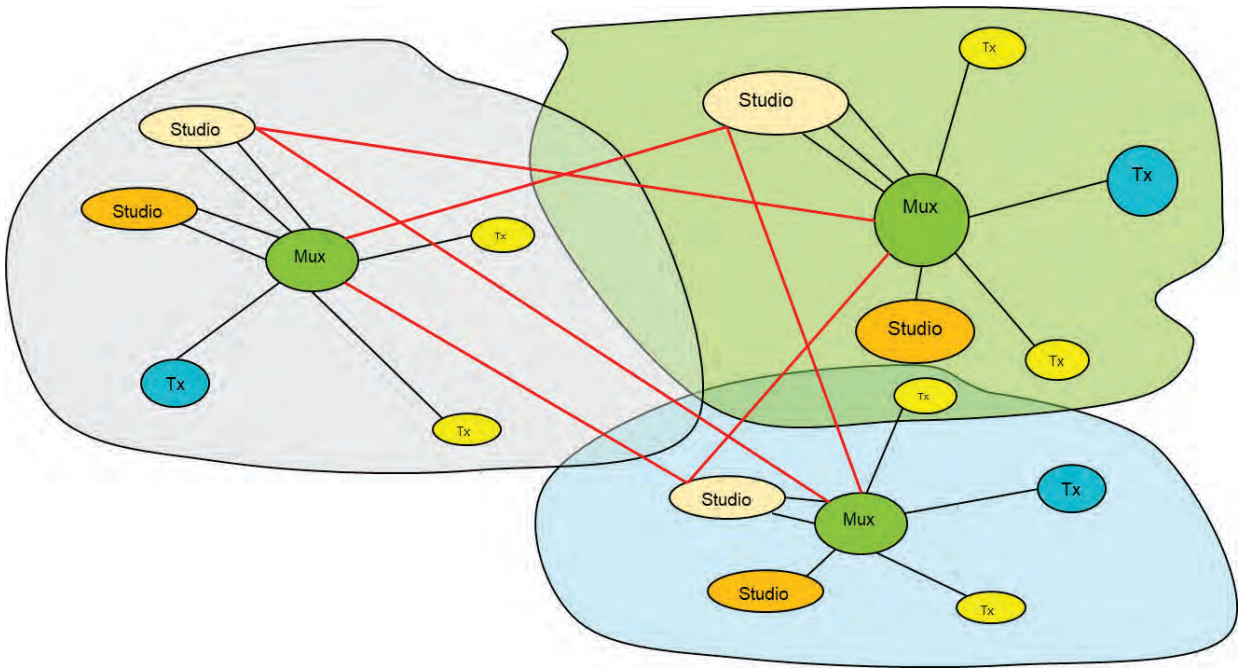


Figure 3. Cross-coverage area contribution using direct to multiplexer delivery

Audio encoders may similarly be hosted on the same server platform for the case where the audio delivery is economically practical, typically using AoIP. Otherwise, they can be hosted on separate and often remote platforms, particularly where the multiplexer system serves several different broadcasters.

8.2.3: Network Architecture

Multiplexing networks generally have a contribution network which delivers the audio and PAD from the studios to the multiplexer and a distribution network that delivers the resulting ETI/EDI stream to the transmission sites. Figure 2 shows an example of the use of star networks for both the contribution and distribution networks. This type of network is often used for coverage of a specific area, whether a regional license area or a national network.

When operating across multiple coverage areas that have their own local content, the contribution network may also be a mesh or partial mesh network. Figure 3 shows the case where content from a studio in a coverage area is also used in other areas; this can be the case where national content is produced in different locations. The cross-coverage area links are shown in red from the network of studios colored light orange to each individual multiplexer. Using this approach leads to many contribution links, the number of which grow quickly as the number of areas increase. Figure 4 shows an alternative where the studios are interconnected, and the studio located in the coverage area delivers content to the local multiplexer. This approach can reduce the number of individual links and save contribution network costs.

In some cases, it can be more economical, and operationally easier, to gather all multiplexing and encoding systems at a single operations site. Such a network will typically have a star architecture where all contributing audio and PAD sources are delivered to the central multiplexing site which then delivers the resulting EDI streams to the transmission sites like that shown in Figure 2. The biggest concern with such an approach is the cost of the contribution and distribution links, which may stretch across a country. In some cases, however, this may not be a big issue, especially for broadcasters who also produce television services, such as many public service broadcasters like the BBC (British Broadcasting Corporation) and the ABC (Australian Broadcasting Corporation). This is because in many cases, the links for DAB require low capacity relative to those required to distribute television streams, often to the same transmission sites, and hence the DAB contribution and distribution comes at little or no cost, as the capacity used sits in the essentially spare capacity of high-capacity links, often fiber optic-based networks.

At the opposite end of the scale are regional commercial and community transmissions that serve communities in regional and rural settings. In these cases, it is often more economic to site the multiplexer at the main transmitter site and use low-cost microwave links to deliver the audio and PAD content to that site. The multiplexer can then connect directly to the transmitter via a site-based IP network.

As both the contribution and distribution networks have the high capacity in direction, and in the case of EDI distribution—going only in one direction, with error correction

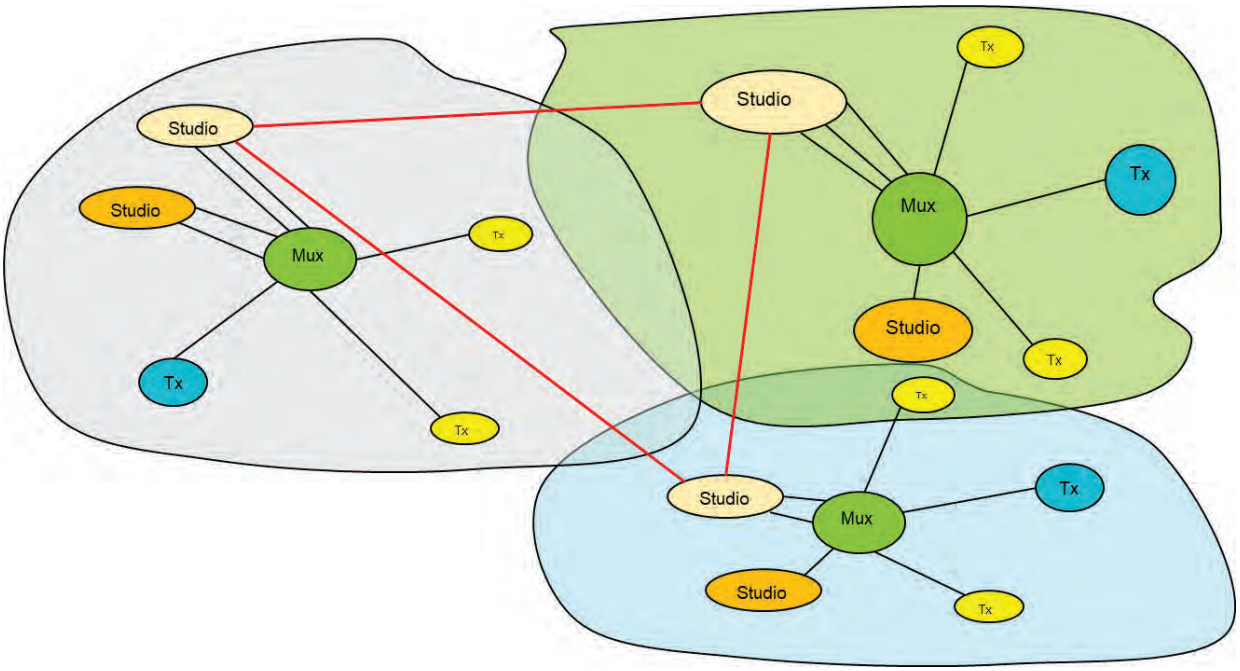


Figure 4. Cross-coverage area contribution using inter-studio content delivery

being applied in the EDI stream and also additional encapsulating layers—satellite broadcasting systems can be a very cost-effective distribution method. This is particularly the case for national or wide area distribution. For example, DVB-S2[4] can be used to distribute EDI streams on encapsulated satellite links. The planned network for Algeria is a good example of this, where the central studio content produced in Algiers can be delivered to many tens of transmitter sites across the country using only a few MHz of satellite capacity.

While we have focused on the primary content delivery, we must also remember that DAB+ networks also require monitoring and operational control. This is done through bidirectional networks which are often based on the TCP/IP protocol. Operation and control are performed through equipment web interfaces, while system monitoring is done primarily through SNMP-based network management systems. The network management system is responsible for observing the status of all equipment in the overall network, including encoder status, hardware platform status and performance, network equipment, multiplexers and PAD services, as well as the transmitter site equipment, including the transmitters, power monitors and antenna switch-frames, EDI and transmission signal monitors and the ancillary systems such as power, air conditioning and IP network equipment.

The amount of traffic in network management can be significant and when summed from all sites can be several mbps, so it is important to dimension those systems carefully and consider the impact of system failures, which can cause a surge in control traffic to multiple systems, as well as monitoring of the individual devices through web interfaces.

The Challenges

In addition to the challenges discussed in the first part of this article that focused mainly on stakeholder communications, another challenging area is the financing of the establishment of DAB+ digital radio.

As with a DTT (digital terrestrial television) transition, new contribution and distribution systems are needed, as well as new receiver devices, both domestically and in vehicles. This requires significant outlays by broadcasters, network providers and the listeners themselves.

The establishment of the contribution and distribution networks requires audio encoders, multiplexing systems, and transmission systems. The capital expense (capex) required has been shown to be offset by the much lower operating costs (opex) of DAB+ delivery. This is particularly the case after analog switch-off, as demonstrated by the FM switch-off in Norway (2017) the forthcoming FM switch-off in Switzerland (2024) and the voluntary switch-off of several AM and FM services in the United Kingdom", Germany and Italy.(For more information on how DAB+ is a green solution see the factsheet at *https://www.worlddab.org/public_document/file/1460/Report_Green-Radio_BLM_BR_E_Web.pdf?1636114991*.)

In addition, the use of DAB+ allows the delivery of many more services than is possible in the FM band, particularly in highly populated areas that generally have saturated FM spectrum. This provides an on-going business model to provide both defense from international streaming competitors and the opportunity to grow listening time and consequently increased business opportunities.

Conclusion

As we move forward in the digital age, it is essential for radio broadcasters to embrace digital radio broadcasting. DAB+ provides a long-term solution which can be used in conjunction with other digital delivery mechanisms to ensure the sustainability of broadcast radio and the benefits that it brings.

"Establishing DAB+ Digital Broadcast Radio" by Dr Les Sabel is available at www.WorldDAB.org.

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[1]ETSI EN 300 401, Radio Broadcasting Systems; Digital Audio Broadcasting (DAB) to mobile, portable and fixed receivers

[2]ETSI TS 102 563, Digital Audio Broadcasting (DAB); Transport of Advanced Audio Coding (AAC) audio

[3]ETSI TS 102 693, Digital Audio Broadcasting (DAB); Encapsulation of DAB Interfaces (EDI)

[4]ETSI EN 302 307-1, Digital Video Broadcasting (DVB); Second generation framing structure, channel coding and modulation systems for Broadcasting, Interactive Services, News Gathering and other broadband satellite applications; Part 1: DVB-S2

About The Author

Dr. Les Sabel's *involvement with DAB started when he joined Radioscape, London U.K. in 2002 as vice president of engineering. They were pioneering DAB receivers using Software Defined Radio which was cutting edge at that time. They also produced multiplexing and monitoring systems as software platforms, and among Sabel's responsibilities were standards development, in which he participated in the development of the DAB+ standard in 2005 that is commonly used today. He is currently the principal consultant at S-Comm Technologies Pty. Ltd. and regularly assists WorldDAB, and broadcasters and regulators around the globe with the introduction of DAB digital radio and other aspects of radio communications technologies. He may be contacted at Les.sabel@scommtech.com.au.*

5G MAG

By Jordi J. Gimenez

5G-MAG At The 2023 NAB Show

Jordi Gimenez

This 5G-MAG column summarizes the organization's activities at the 2023 NAB Show, which included an update on 5G-MAG Workgroups, the 5G-MAG Reference Tools development program, and the presentation of a paper at the event's BEIT conference.

Growing Software Support For 3GPP Specifications

3GPP started developing functionalities for multimedia services and applications as part of the Rel-16 and Rel-17 specifications. These include 5G Media Streaming and extensions such as edge processing, analytics and event exposure; improvements to LTE-based 5G Broadcast and hybrid services; 5G Multicast Broadcast Services (MBS); eXtended Reality (XR) and Augmented Reality (AR) experiences. In parallel to this work, 5G-MAG Reference Tools is developing reference software. This is, to date, available in our *repositories:*

- 5G Media Streaming Downlink (5GMSd) with a 5GMSd Application Function supporting all the major interfaces (M1, M3 & M5) and basic functionalities for content ingest and hosting. A 5GMSd Application Server implemented to act as a CDN node
- An Android 5GMSd client including a Media Player (which fetches media content via M4 from the AS) based on Exoplayer and a Media Session Handler
- A 5GMSd-Aware Application with support for the M8 interface to specify a list of available services including media entry points and provisioning session IDs (including interfaces M6 and M7)
- End-to-end MBMS and LTE-based 5G Broadcast system with a set of Rel-17 features supported in a standalone transmitter, modem and middleware
- A FLUTE implementation for multicast file transfer
- Reference applications for testing, including an Android DVB-I player implementation

The upcoming months will bring collaborative efforts towards the support of UE data collection and reporting, dynamic QoS policies, 5GMS over eMBMS, and emergency alerting over LTE-based 5G Broadcast or MBS. Initial thoughts around XR are also envisaged.

5G-MAG Paper Presentation At The NAB Show

"Hands on towards next generation media distribution with 5G-MAG Reference Tools" is the title of the paper presented by Aytac Biber (Qualcomm) at this year's NAB Show BEIT Conference. The paper described the 5G-MAG reference tools developers focus on the implementation of 5G media streaming components. Based on a set of industry relevant use cases, four minimum viable products (MVP's) were identified. The description began with a simple implementation of the 5GMSd Application Server (AS) and 5GMSd Aware Application for media playback and moved to more advanced features, such as media session handling and dynamic configuration of the AS and the 5GMSd Application Function using the M1d and the M3d interfaces. The presented features serve as a foundation for contributors to add more advanced functionality such as DVB-I Hybrid Service over 5G Broadcast and 5G Media Streaming and Premium and Targeted Content Insertion on top.

Open Community Includes Close Collaboration With 3GPP SA4

The 5G-MAG Reference Tools development program is open to the industry. As such, different tools are being used to handle communication, developer team meetings, contributions and fixes. Check our *GitHub*, *Google Group* and *Slack* channels.

Regular communication with 3GPP is essential to progress both implementing specifications while providing useful feedback on them. For this purpose, a regular ***XCHANGE with 3GPP SA4*** has been established. Out GitHub repository on Standards, provides a framework to collect feedback on the relevant specifications.

In addition, developers are invited to provide insight into their contributions under the *DEVELOPER XCHANGES*.

The 5G-MAG Reference Tool community invites the media and ICT community to leverage the open-source tools and reference services for their own trials and services, and to provide feedback in terms of comments, bugs reports or contributions to create a truly collaborative and global reference system. For the next target, it is expected that remaining Rel-17 functionalities as well as initial Rel-18 functionalities will be addressed. Plenty of opportunities are ahead towards supporting XR and new media, as well as uplink streaming or non-public network setups.

Join and contribute!

Approval Of New Work Item

The 5G-MAG Steering Group has approved a new Work Item (WI) on "Advanced Media Services over 5G"

which tasks will be carried out under the Working Group (WG) Use Cases, Requirements and Opportunities. Broadcasters and content providers are experimenting with and trialing an increasing number of advanced media services, including: Interactive video services, In-stadium multiview services, Virtual Reality Experiences, 3D Scene-based media, Volumetric videos or Free viewpoint video. These services may result in special requirements in terms of capturing, contribution, production, encoding, distribution, decoding, rendering, security and user interfaces. Generally, it is expected that the services will be developed independently of the distribution network and will heavily rely on an IP/cloud/CDN-based delivery system. This new WI covers the following objectives:

- Collection of "Advanced Media Services" use cases including reference to existing trials, prototypes and experimental services
- Mapping of these use cases to one or several contribution architectures (if appropriate) and distribution architectures, addressing different service scenarios
- Definition of Quality-of-Experience metrics associated to each of the "Advanced Media Services"
- Collection of relevant network and service requirements on the "Advanced Media Services"
- Mapping of existing 5G specifications against these requirements and identification of potential gaps, possibly supported by early prototyping
- Potential input to 3GPP standardization processes

Media Production Via 5G

5G-MAG work on live media production applications continues, with a feasibility analysis to understand how different features defined in the 3GPP specifications (Release 17 with an outlook on Release 18) can be implemented and configured in deployments. In particular, the current topics under study involve various devices such as cameras, microphones, control and monitoring systems, as well as on-boarding and provisioning for 5G NPNs (non-public networks) and the support of time sensitive communications in 5G Systems.

5G-MAG also welcomes feedback on the recent report that focused on the use of 5G technologies in media production and contribution workflows. Comments on the report can be sent using the GitHub repository for "Request for Feedback" *https://github.com/5G-MAG/Request-for-Feedback*.

President's Message

continued from page 2

Finally, I want to comment on BTS's financial position. It's been a challenging three years for the entire world, so money is still tight, but *BTS* is secure and healthy, and I know that using our resources wisely and conservatively is important. At the same time, we need to move the needle forward and grow. The AdCom and ExCom can, and will, help with ideas and in allocating resources, so we will continue to provide the best programs and opportunities for our members. Having said this, we can't do everything alone! BTS member engagement by participating and offering input is what drives us forward. Please take full advantage of your membership. Visit our website often, learn about our offerings, talk about BTS to your associates and fellow students; but most importantly, participate!

It was good to see many of you at the NAB Show this year; thanks for stopping by the booth and saying" hi." We look forward to a productive second quarter, and as always, I'm open to your comments and suggestions as we continue to move forward in 2023!

Paul Shulins
paulshulins@ieee.org

DRM News

By Matthew Phillips
Vice President Of Global Marketing
CML Microcircuits Ltd

Mass Market Digital Receivers Give Impetus To The Global DRM Roll Out

DRM's attributes position it as the most capable of the current digital broadcast methodologies. However, its global adoption has in the view of some, fallen short of the initial very high expectations. There are multiple reasons for this gap, including the developed world's focus on Internet connectivity, coupled with a reluctance to invest in a medium, radio, which is perceived—despite many facts proving the contrary—to be outdated. This reluctance manifests itself at all levels of the broadcast value chain. If broadcasters aren't incentivized to invest in transmission infrastructure or content, then radio equipment manufacturers will not mass-produce receivers. And without receivers, broadcasters will be even less likely to invest. With sparse content and no easy access to the medium, listener numbers will be low, and the vicious cycle will continue.

However, almost half of the world's population, or around 3.7 billion people, do not have access to the Internet, and this situation will not change significantly in the near term. This lack of connectivity is greatest within least developed countries, (LDCs), which account for around 14 percent of the world's population and over half of those living in extreme poverty. This digital divide was aggravated by the pandemic which saw poverty levels increase and LDCs lag further behind in the key areas of digital economy, public health, and online education.

There is a strong case, therefore, for DRM (whose socio-economic benefits are well documented) in these disadvantaged regions. Combining FM quality at AM coverage levels, DRM can cover hard-to-reach populations with diverse and enhanced content, such as multi-lingual simulcasts of radio programs and the provision of education to unconnected students. DRM also brings economic benefit to the broadcaster, since the costs of upgrading existing infrastructure are relatively low, and the technology's use of bandwidth is highly efficient as is its power consumption.

While these potential benefits for LDCs are widely recognized, the vicious cycle, described above, still has to be broken and an examination of the broadcast market in India gives an insight into how this can be done. Some 500 million people in the sub-continent have no access to the Internet, therefore the Indian government had a compelling reason to get behind DRM, resulting in one of the largest digital radio broadcasting rollouts in the world so far. The 35 MW transmitters and several shortwave transmitters of the public broadcaster, All India Radio, (AIR), reach more than 700 million people with DRM signals. At the same time, thanks to a corresponding initiative in the thriving local automobile industry, about 6 million new cars on Indian roads are equipped with DRM receivers at no extra cost to the owners. This is however only the "early adopter" phase of a new market—with these early adopters being the new car owners. If all stakeholders are to earn a return on their investments, a mass market must be created, which requires adoption of DRM by a significant percentage of the 500 million unconnected people.

Until now the biggest remaining barrier to this adoption has been the lack of suitable, low cost and low power DRM receivers. Many of the aforementioned 500 million people have no access to mains power, let alone automobiles, and the various DRM receivers hitherto available on the market are financially beyond their reach. Figure 1 shows one method of segmenting the market for DRM receivers which highlights the key attributes required for a mass-market device—low-power requirements, low cost, and small form factor.

A New Chip Enables Small, Affordable, And Energy-Efficient DRM Receivers

Due to the complexities of designing with discrete components, early versions of DRM receivers tended to be large, power hungry and relatively expensive. Although some implementations were based on dedicated software hosted on PCs, these did not meet the criteria of the targeted population. Recent advancements in digital technology, fuelled by the explosive growth in embedded IoT devices and the burgeoning market for wearables—and now hearables—have driven massive innovation in digital audio electronic components such as digital signal processors, (DSP), digital-to-analog converters, (DACs) and System-on-Chip, (SoC) technologies. The low-cost, small form factors and low-power consumption of these advanced devices have combined to make compact receiver modules available, such as the DRM1000 by CML Microcircuits and Cambridge Consultants. (See Figure 2 for details of this device.)

This DRM1000 integrates three main devices in its design:

- The innovative CML CMX918, very low-power, low-IF single IC software defined radio tuner IC, which covers the 150 kHz to 108 MHz frequency band and operates from a 3.0 V supply with a current consumption of 25 mA.
- A very low -power µcontroller with integrated digital signal processor. Originally designed for IoT 'edge'

Possible receiver types

Category	Listening Application	Identified User	Receiver Type
A	Portable radio used whilst working or relaxing	Low cost Taxi driver, Builder, Farm Worker, Home maker etc.	Low cost, mono, battery powered portable radio. May use primary cells or rechargeable cells possibly using solar or 'hand-crank' energy
B	Portable Radio used in a fixed location e.g. Kitchen radio or a Desk top radio	Home makers, office workers, indoor factory workers	Low cost, battery or grid powered, grid rechargeable, Stereo reception. Bluetooth Wireless Speaker DRM content server to other rooms over Wi-Fi e.g. DLNA server
C	Portable Radio: audio and data services supported. Wireless connectivity to export data to other devices	Farm Owners for weather, yield advice etc. Distance Education use cases Emergency Warning Function	Desk top receiver with embedded large screen or data connectivity to access transmitted data services. May also include memory to allow time shifting of programs and data
D	In Africa some receiver types may require DAB+ functionality	ABU has mandated both DRM and DAB+ for digital broadcasting	Types A to C but also supporting DAB+
E	Aftermarket Car Radio adapter	Add-on for car radios which are AM/FM only to add DRM reception	Dash mounted unit with DRM radio plus Bluetooth Hands Free Kit and FM transmitter to use with existing car radio
F	Wire connected DRM(VHF) receiver add on for Smartphones	FM radio listener on Smartphone	VHF receiver suitable for DRM and FM reception in form of wire headset
G	Bluetooth Speaker or Bluetooth Headset (or ear buds) with embedded DRM receiver	Headset (personal listening with Smartphone) Speaker with radio control app on phone	Bluetooth wireless audio devices with embedded DRM radio receiver. GUI for receiver operated remotely over Bluetooth connection.

Figure 1. Segmentation of DRM receiver market

processing applications, this device runs baseband software developed by Cambridge Consultants and integrates, AM/FM demodulators, DRM OFDM demodulation, all audio codecs filtering and user interface handling functionality.

- The CML, CMX655 audio codec and Class-D 1 Watt speaker amplifier

The low-power DRM1000 enables the design of extremely small DRM receivers that can play for as long as 30 hours continuously from three AA cells, or alternatively, 12 hours from a 1,200 mAH rechargeable cell. This rechargeable alternative enables rapid recharging—around six hours from solar cell, or in as little as 10 minutes when "hand cranking" methods are used. Receiver manufacturers can take advantage of modules such as the DRM1000 to reduce development cycles and costs, thus accelerating the time to market with low-cost products in a variety of form factors. These technological developments promise to remove the final barrier to DRM adoption in a market such as India, offering the local manufacturing ecosystem an effective path to the mass production of DRM receivers adapted to local market requirements.

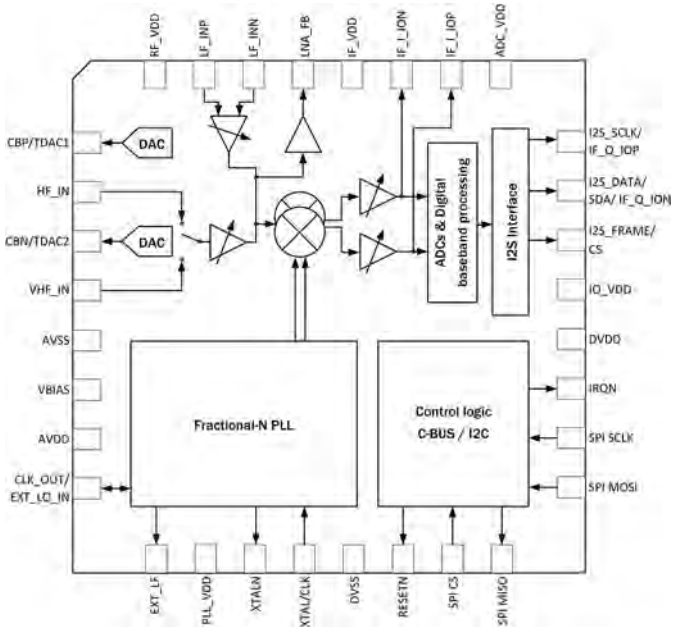

Figure 2. DRM1000 receiver module

India has been used as an example of how DRM can bring real social benefit to a low-income population while still offering commercial returns to technology stakeholders. Other regions across the world, such as South Asia, Latin America and even remote areas of Europe and the United States have their own specific market requirements. In 2022, the Africa Telecommunications Union, (ATU), whose member states include South Africa, Nigeria, Kenya and much of sub-Saharan Africa, launched a strategy which recommends both DRM and DAB+ as the basis for radio digitization across the continent. With

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ABU Sponsors Digital Broadcast Symposium

IEEE BTS Represented At ABU DBS And Regulatory Workshop

By Peter Seibert
BTS Adcom Member and
Distinguished Lecturer

KUALA LUMPUR, MALAYSIA

The technical department of the Asian Broadcasting Union (ABU) organized the Digital Broadcast Symposium (DBS) as an in-person event for the first time since the outbreak of the Covid global pandemic. The March 6-9, 2023 conference involved some 900 participants from 52 countries who met here to learn about new products and services, as well as to participate in workshop sessions and discussions about the latest developments in the wider broadcast industry. Topics covered at the symposium included digital broadcasting trends, emerging technologies, content creation, audience engagement, and revenue models.

The theme of the event, "Back In Business," represented the spirit of the symposium well, as it was the first face-to-face gathering in three years. Participants seemed excited about meeting old business partners and friends again, and discussing business, new developments, or just to exchange the latest gossip over a cup of coffee. While many things can be done online, none of the virtual conference tools can replace personal contact.

Conference Activities

The symposium started with two half-day workshops, the first of which, "Monetization: How Broadcasters Can Leverage AdTech," was organized by IPSB Technologies, a Malaysian technology solution provider. The second workshop was provided by WorldDAB, the global industry forum for the Digital Audio Broadcast (DAB) organization.

The second day of the conference and exhibition opened with keynote presentations from Suhaimi Bin Sulaiman, the director general of Malaysia's public broadcaster, RTM; and RTM's minister of communications and digital, Fahmi Fadzil. The opening session featured speakers from three international standards development organizations, Madeleine Noland from the ATSC, Lindsay Cornell from WorldDAB, and Emily Dubs from DVB. who provided information about the latest developments in their organizations and presented future roadmaps.

During the remaining three days of the conference, participants could attend any of the 11 special sessions covering various broadcast-related topics such as cybersecurity, sustainability, media workflows, media delivery, artificial intelligence, blockchain, IP-centric solutions, and immersive AV experiences. Nine workshops also took place concurrently with the conference sessions, in which participants could "dive deep" into specific topics.

Broadcast Technology Society Participation

The IEEE's Broadcast Technology Society was represented at the symposium as a conference sponsor, with the BTS' vice president, Samina Husain, chairing a session on "AI, Blockchain, And Data Applications In Media." In addition, Peter Siebert, BTS Adcom Member, and Distinguished Lecturer, offered a presentation on 5G technology, "5G Broadcast To Handhelds—Will It Be A Success?" In his presentation, Siebert enumerated various past attempts at receiving live broadcast on a handheld device, all of which were unsuccessful in the long run due to commercial and technical challenges. He stated that with 5G Broadcast there is now a new technology that could be used for live broadcast reception on handheld devices. He noted, however, that the spectral efficiency associated with this technology is lower than the current DTT technologies, ATSC 3.0 and DVB-T2. Siebert added that 5G Broadcast, nevertheless, offers easy integration with the overall 5G infrastructure, which will support new use cases such as hybrid reception in which a handheld device receives the broadcast and unicast signals simultaneously and can switch between the two. He stated that such a hybrid scenario would also allow for targeted ad insertion or support of multiple subtitle languages.

The BTS's Siebert also chaired a conference session on "NextGen Infrastructure and Immersive AV Experiences," which focused on the use of artificial reality (AR) and virtual reality (VR) in studio production work.

In addition to the ABU event, Siebert was invited by the Malayan Telecommunication regulator MCMC to a workshop titled "Is 5G Broadcasting Real—Is the Industry Ready for It?" In the session, several experts were asked to present their views on 5G Broadcast and to answer questions from the audience.

The participation of the IEEE's BTS in these events shows that the organization is regarded as a relevant and trusted source of information in the region and underlines the global role BTS plays in the wider broadcast community. The cooperation with the Technical Department of the ABU has been fruitful, and we will continue to work together on future projects.

Peter Siebert (standing) is seen here in his role as chair of Digital Broadcast Systems' session on 'NextGen Infrastructure and Immersive AV Experiences.' Panelists in the session were (L-R) Mohammed Nozari Pak, IRIB R&D Iran; Ran Chen, CGTN Digital China; Vikas Choudhry, Vizrt India; and Aale Raza from Whiteway System, Singapore.

ATSC Insider

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- Monitor activity around the world that can impact the global digital terrestrial.
- Develop strong relationships with fellow members across the broadcast ecosystem.

About The Authors

Madeleine Noland *is president of the, Advanced Television Systems Committee (mnoland@atsc.org). Widely respected for her consensus-building leadership style, she chaired the ATSC technology group that oversees the ATSC 3.0 broadcast standard before being named ATSC president in May 2019. Previously, as a representative of LG Electronics, she chaired various ATSC 3.0-related specialist groups, ad hoc groups and implementation teams since 2012. A 15-year industry veteran, Noland held key technology management and standards roles at Backchannelmedia Inc., Telvue Corp. and LG. She received* ***TV NewsCheck's*** *"2019 Futurist" Women in Technology Award and was named one of 2018's "Powerful Women in Consumer Technology" by* ***Dealerscope*** *magazine. In 2016, she received ATSC's highest technical honor, the Bernard J. Lechner Outstanding Contributor Award. She graduated cum laude from the University of Massachusetts.*

Jerry Whitaker*, Vice President for Standards Development, Advanced Television Systems Committee (jwhitaker@atsc.org). Whitaker supports the work of the various ATSC technology and specialist groups and assists in the development of ATSC Standards and related documents. He currently serves as secretary of the Technology Group on Next Generation Broadcast Television, and is closely involved in work relating to educational programs. He is a Fellow of the Society of Broadcast Engineers and a Life Fellow of the Society of Motion Picture and Television Engineers. He has served as a board member and vice president of the Society of Broadcast Engineers.*

RF Report

2020 Census Data For TVStudy, Using The U.S. Census 2020 Population Data With QGIS And TVStudy, First Impressions Of The Orange Pi 5

By Doug Lung

The U.S. Census Bureau has released 2020 census data for redistricting and I've found it can be combined with TVStudy (*https://www.fcc.gov/oet/tvstudy*) output data using QGIS (*https://www.qgis.org/en/site/*) to provide 2020 population and household counts. I'll describe how to create a 2020 one-kilometer gridded population, GeoPackage, that can be used to add 2020 population and household data to coverage shapefiles created in TVStudy.

While this example applies to TVStudy output and U.S. Census 2020 data delineated by census block, the same techniques should work with QGIS for combining the output of any RF propagation program with results in a defined grid (points in text or shapefiles) and any other shapefile with data for defined points or areas. As broadcasters consider ancillary uses for ATSC 3.0 data and deployment of distributed transmission systems, such studies could include signal strength into certain buildings, certain land use areas, and, when more complete data is available, demographic coverage.

I'll also provide a short update on my initial experiences with the Orange Pi 5 single board, Rockchip RK3588 single-board computer.

QGIS And U.S. 2020 Census Population

In my column in the Winter 2019 issue of **Broadcast Technology,** I described how QGIS could be used to combine 2010 U.S. Census shapefiles with census block resolution and the results of coverage studies created in TVStudy. Preliminary 2020 data for use in Congressional redistricting as required by Public Law 94-171 is available from the U.S. Census Bureau. I wanted to see if it was possible to use the techniques that I previously described using QGIS and TVStudy to measure coverage based on the 2020 Census.

I found that U.S. Census bureau shapefiles with 2020 total population and household count by census block is available. Additional 2020 Census data is scheduled for release later this year, but it isn't clear if that data will include shapefiles with population counts with demographics by census block. If shapefiles are available, these techniques should work with them.

Voronoi polygons are used to generate polygon "cells" from the evenly spaced global points in a TVStudy shapefile and are then combined with the census blocks from the U.S. Census shapefile to map the blocks and fractions of blocks with population and household data into a new shapefile. This shapefile can then be used to add 2020 Census data to any TVStudy shapefile using global cells with the same cell size. The files will be processed and modified in QGIS. Refer to on-line tutorials or my previous articles for assistance in installing and using QGIS. Let me know if you run into problems, as I can provide example files that can shorten the learning curve.

Getting Started

The first requirement is to create a "coverpts.shp" shapefile in TVStudy that covers an area large enough to encompass the coverage from all the stations you want to study. For this example, we'll use Albuquerque, New Mexico. In TVStudy, start a "General-purpose TV" study. Enter a study name. I used "Albuquerque" for this. Then create a new scenario. I called it "Coverage Points." Add a station. (I used KASA-TV, as they're the largest station in the market.) In the "Study" tab, under "Study Area Mode" select "Unrestricted." Edit the "Default Output Settings" as needed. Since we're only using the shapefiles, none of the text "Output Files" are needed. In "Map Output," check "Shapefile map output;" "Study point coordinates;" "Area, population, households" (for comparison with 2020 Census calculations); and "Map point at grid cell center."

There are a few changes to make in the "Parameters" tab. Select "Analysis" and verify these settings. "Grid type" should be left at "Global" to allow using the results with other studies. "Cell size" should match the size to be used in the coverage studies in the area. I used "1 km." To ensure even spacing of the points, for "Study point location," select "Cell Center." This may not be necessary on coverage studies if "Map point at grid cell center" is checked on the map output settings. Finally, enter the "Maximum desired signal distance." I left it at "300 km," but if a smaller radius will cover the areas to be studied that will speed calculations.

Run the study. Drag the "coverpts.shp" file from the scenario folder ("Coverage Points" in this example) in the TVStudy output into the "Layers" menu in QGIS or use the "Layer | Add Layer | Add Vector Layer" menu item in the menu bar. From the menu bar, select "Project | Properties" and in the

"Measurements" section select "WGS 84 (EPSG:7030)" for the ellipsoid. Select "Meters" and "Square Meters" for the units of measurement. For the map to display properly, the CRS also needs to be set. Select that from the menu on the left and in the "Filter" box enter a description of the study area. In this example, I entered "New Mexico" and selected "NAD83 / New Mexico Central" under "Predefined Coordinate Reference Systems". To avoid confusion after other studies are added, change the layer name. I used "New Mexico Coverpts" here. Using the Processing tool "Create Spatial Reference" under "Vector General" in the Processing Toolbox may help speed the next step.

The coverpts.shp file is a set of points, with each point representing a certain size cell—one square kilometer in this case. The 2020 Census shapefile, however, consists of many polygons of various sizes, some smaller than one kilometer, with the population and household data. To calculate the 2020 population in each of the TVStudy cells we need to convert the points to polygons. This is done using the "Voronoi polygons" tool under "Vector geometry" in the Processing Toolbox. (See Figure 1.) Click "Run" and wait. It will get to 99 percent very quickly but will take much longer to complete. The example here took just over 30 minutes on my Thinkpad X1 Gen 7, but I was doing other tasks, including running a Windows session in a virtual machine while QGIS was processing. This layer is only needed for adding the 2020 Census data so you can leave it as temporary, but given the time to create it I saved it to a GeoPackage in case of a mishap. (See Figure 2.) "Save vector layer as..." Note that since we're not using the station data there is no need to save all the items. We will need the coordinate index, however. for a future step. Figure 3 shows the polygons with the original points in the middle of them.

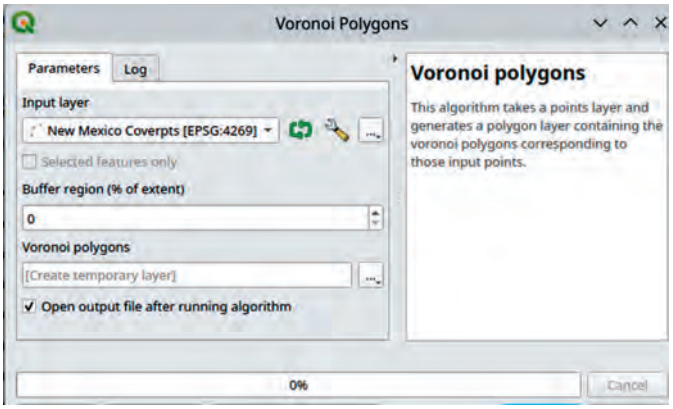


Figure 1. Create Voronoi Polygons

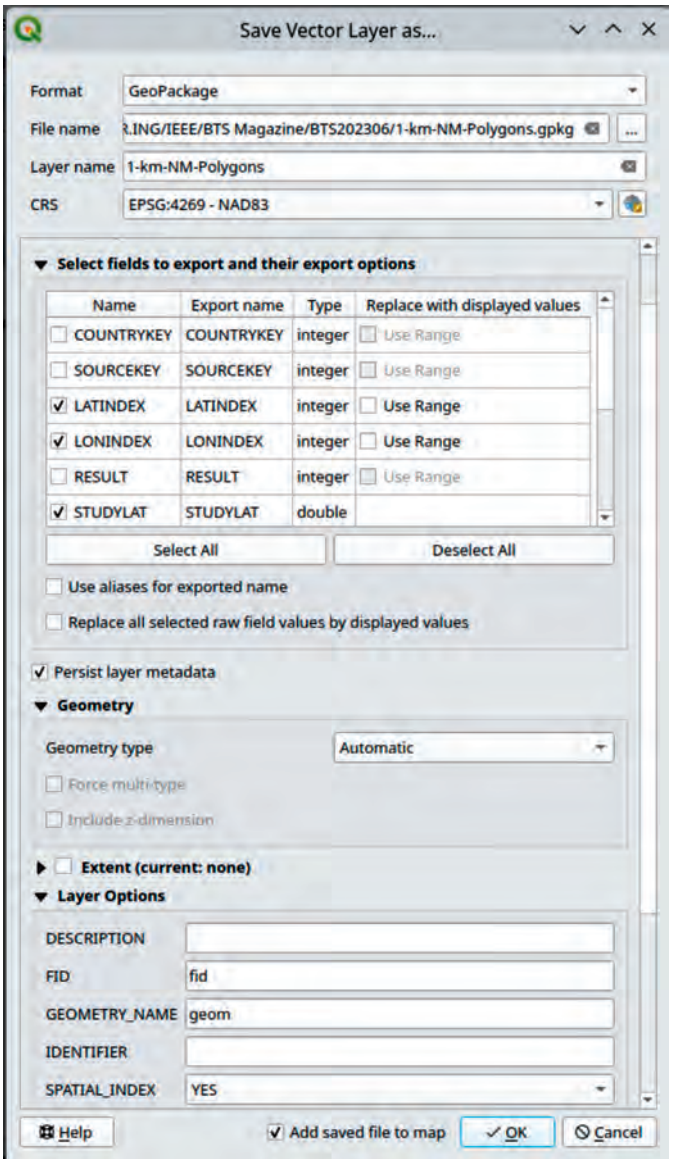


Figure 2. Save Voronoi Polygons as GeoPackage

The next step is to add the 2020 U.S. Census data. At the time this was written, the only source I found was redistricting data available at *https://www2.census.gov/geo/tiger/TIGER2020/TABBLOCK20/*. The number after "2020" is the FIPS code for the state (*https://www.census.gov/library/reference/code-lists/ansi/ansi-codes-for-states.html*). For New Mexico, the code is "35" and the file is "tl_2020_35_tabblock20.zip". After downloading, drag the zip file into the Layers window in QGIS. Figure 4 is an overlay of the Census block areas on our 1 km grid. Notice the highlighted Census block is present in multiple cells along with other Census blocks. Fortunately, QGIS makes it easy for us to combine the two.

As I described in my column on using 2010 Census block shapefiles with QGIS and TVStudy in the Winter 2019 edition of **Broadcast Technology**, the next step is to calculate the population density (people per square meter) in each Census block. This is done using the "Field Calculator" in the Fields menu in the layer's properties window. Click the button on the right in the group of four above the field list to "Create a new field." I used the name "DPOP" for population density. Select "Output Field Type" as Decimal (double). The density will be the population ("POP20") divided by the area. The area

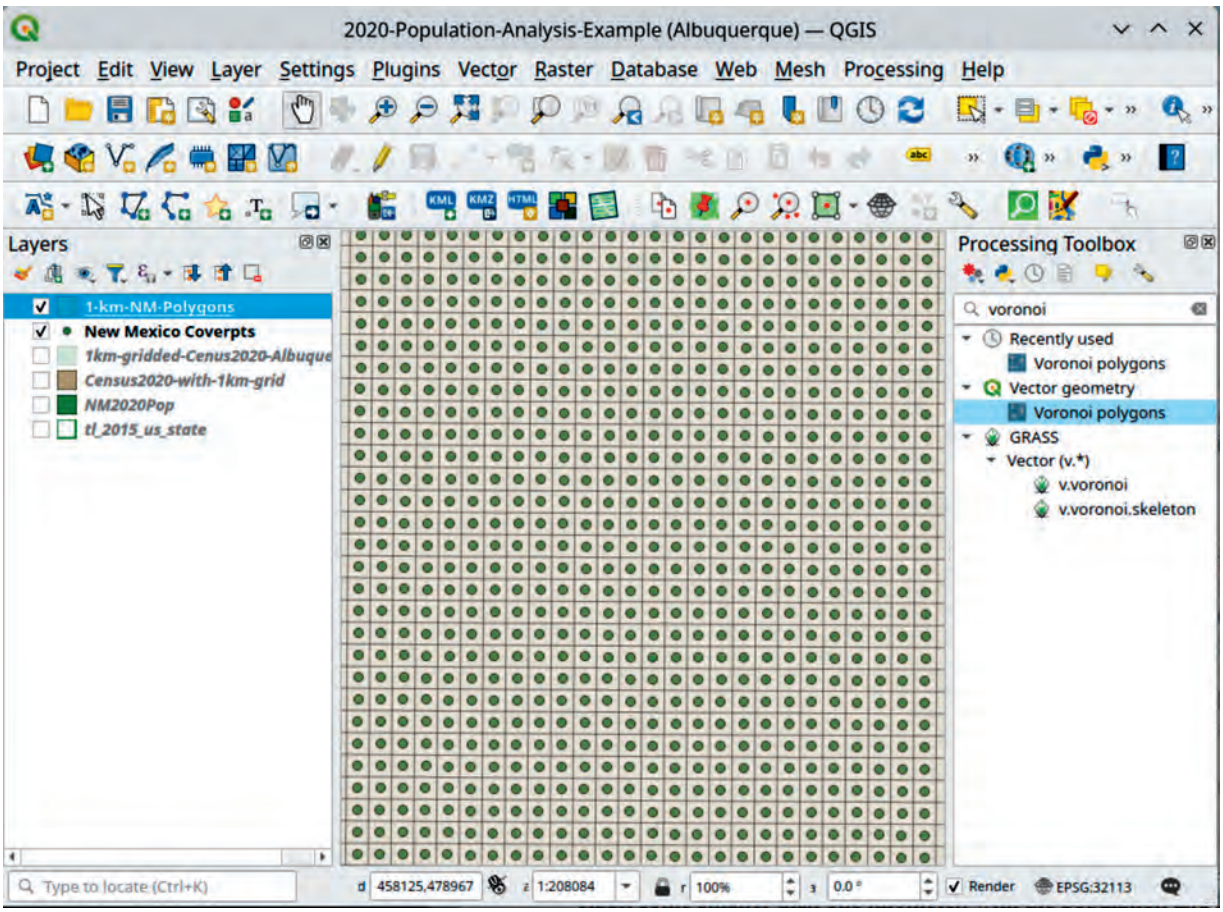


Figure 3. TVStudy points and created polygons

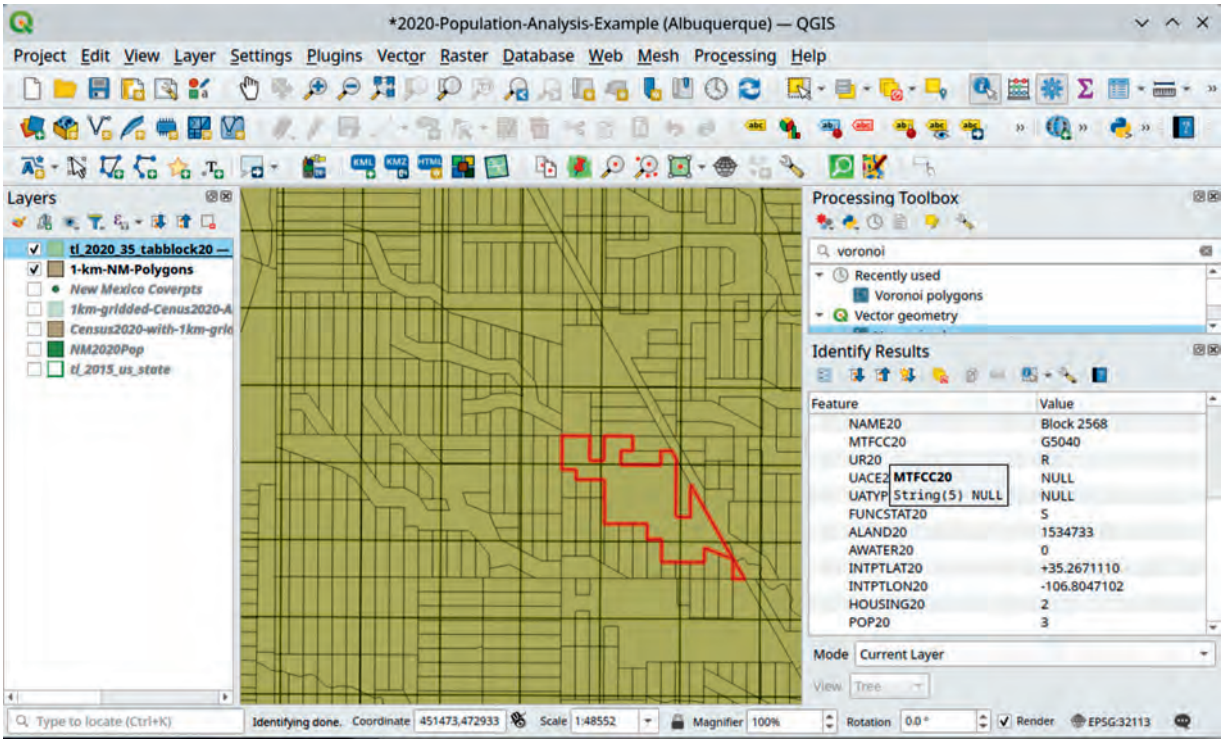
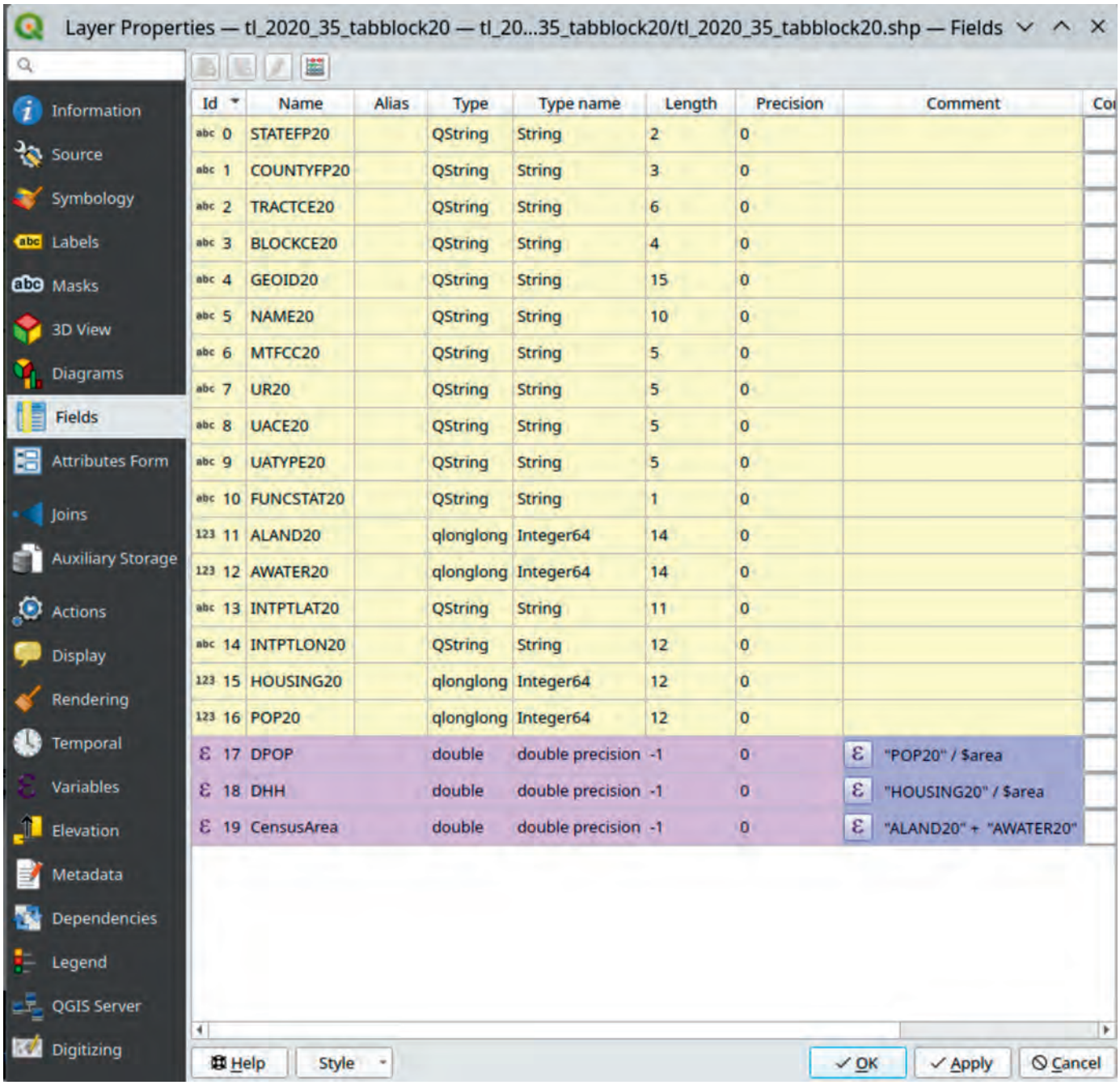


Figure 4. Census blocks and 1-km polygons

can be calculated by QGIS, using "$area" based the ellipsoid selected earlier (WGS84), or by combining the ALAND20 and AWATER20 fields in the Census shapefile. I used $area since the final calculation will be based on the area inside the one-kilometer cell which has to be calculated by QGIS. Create a "DHH" field the same way for household density using the expression "HOUSING20 / $area," I added a CensusArea field that combined the ALAND20 and AWATER20 areas as a check. Figure 5 shows the final field list.

I recommend saving the layer with the added fields as a GeoPackage and removing unused fields to speed calculation and reduce file size. Use the "Export | Save Features As" right click option. I removed the TRACTCE20, BLOCKCE20, GEOID20, NAME20, MTFCC20, UR20, UACE20, UATYPE20, and FUNCSTAT20 fields. Some of these may be useful in other studies. To see what's in each field, refer to documentation at *https://www.census.gov/data/datasets/2020/dec/2020-census-redistricting-summary-file-dataset.html*

The GeoPackage created can be used by itself to determine coverage inside a contour by summing the population of the blocks and fractional blocks inside the contour. However, if terrain-sensitive or interference-free coverage 2020



Id	Name	Alias	Type	Type name	Length	Precision	Comment
0	STATEFP20		QString	String	2	0	
1	COUNTYFP20		QString	String	3	0	
2	TRACTCE20		QString	String	6	0	
3	BLOCKCE20		QString	String	4	0	
4	GEOID20		QString	String	15	0	
5	NAME20		QString	String	10	0	
6	MTFCC20		QString	String	5	0	
7	UR20		QString	String	5	0	
8	UACE20		QString	String	5	0	
9	UATYPE20		QString	String	5	0	
10	FUNCSTAT20		QString	String	1	0	
11	ALAND20		qlonglong	Integer64	14	0	
12	AWATER20		qlonglong	Integer64	14	0	
13	INTPTLAT20		QString	String	11	0	
14	INTPTLON20		QString	String	12	0	
15	HOUSING20		qlonglong	Integer64	12	0	
16	POP20		qlonglong	Integer64	12	0	
17	DPOP		double	double precision	-1	0	"POP20" / $area
18	DHH		double	double precision	-1	0	"HOUSING20" / $area
19	CensusArea		double	double precision	-1	0	"ALAND20" + "AWATER20"

Figure 5. Census Block Added Fields

population and household counts are needed, this file needs to be combined with the file that we created using Voronoi polygons to get the population in each TVStudy one-kilometer cell. Use the "Intersection" tool in the "Processing toolbox | Vector Overlay" to create file that divides the "NMCensus2020" blocks into the "1-km-NM-Polygons." (See Figure 6.)

Note that not all input and overlay fields are selected. Do not select the "fid" fields or you will get a "not unique" error when trying to save the file. A new "fid" field will be created when the layers are combined. The QGIS "Identify Features" cursor tool can be used to inspect the results.

The next step is to add fields to calculate the population and households in the fractional blocks. Add fields using the same procedure outlined earlier for creating the DPOP and DHH fields. Create fields FracPOP and FracHH. (See Figure 7 for an example). A unique index is also needed for matching each of the one-kilometer cells. Concatenate LATINDEX and LONINDEX to create this field. (See Figure 8.)

Figure 9 shows the final list of fields. Don't forget to save the edits by clicking on the "pencil" icon (third button) at the top of the "Fields" screen and selecting Save, then OK at the bottom of the window or the new fields will disappear if they weren't added in edit mode. Export and save the features to a GeoPackage file.

The final step in creating our one-kilometer cells with 2020 population and household data is to use the "Processing toolbox | Vector Geometry | Aggregate" function to combine all the census blocks and fractional blocks in a cell to obtain the total 2020 population and households in the cell. (See Figure 10 for the configuration.)

The only fields used from the 2020 Census layer are FracPOP and FracHH and those are summed. The "first value" is used from the TVStudy fields. Depending on the size of the area and the number of census blocks and fractions of census blocks this will take a long time. The layer calculations containing TVStudy points and New Mexico 2020 census

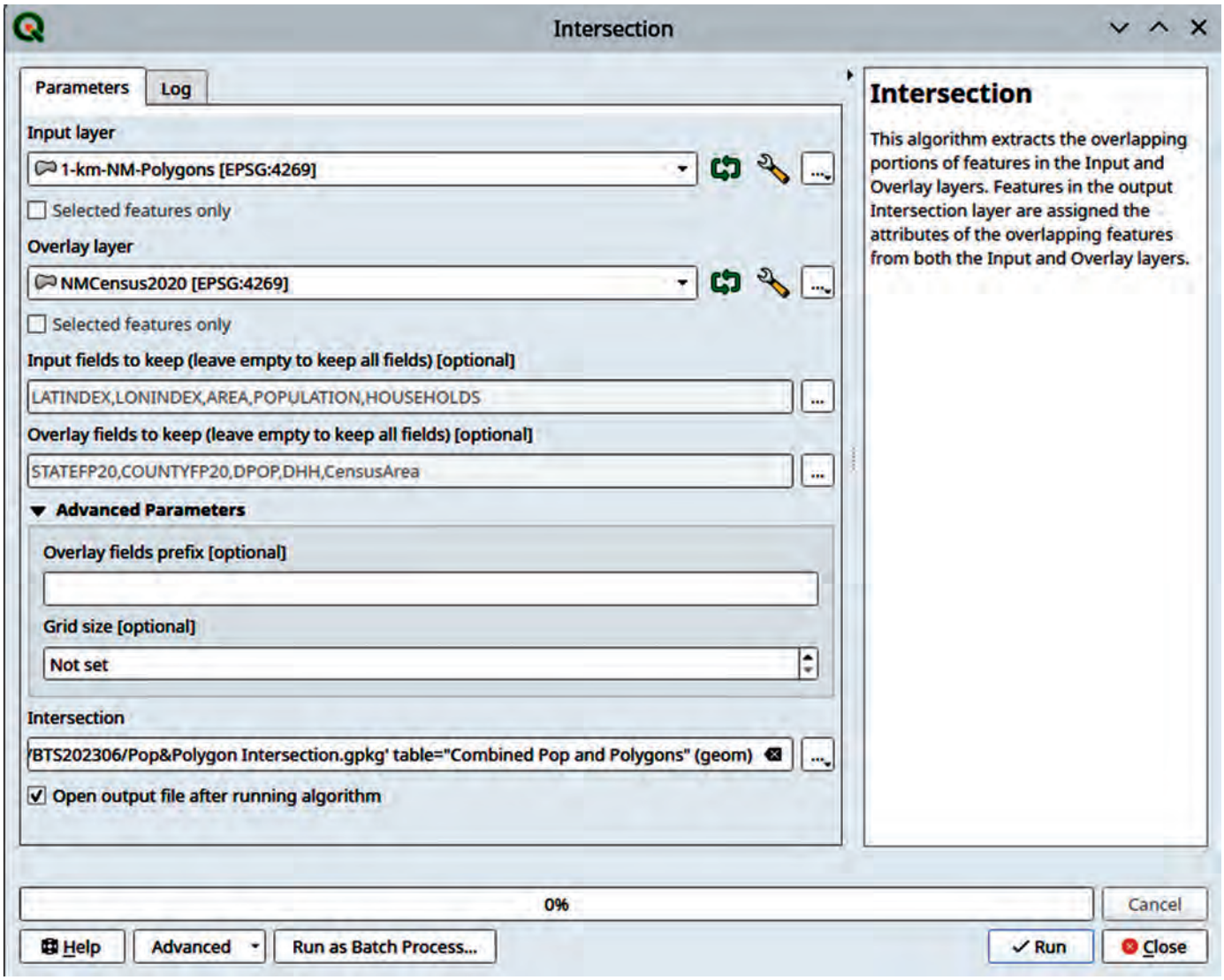


Figure 6. Polygon and Pop Block Intersection Setup

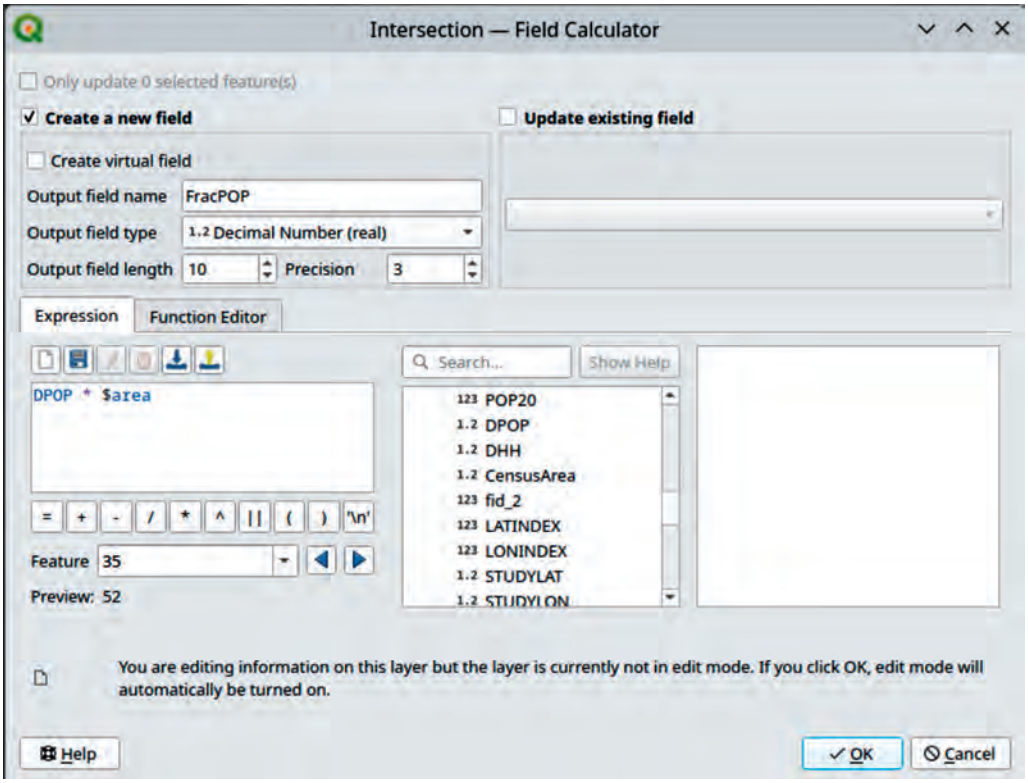


Figure 7. Creating the FracPop field

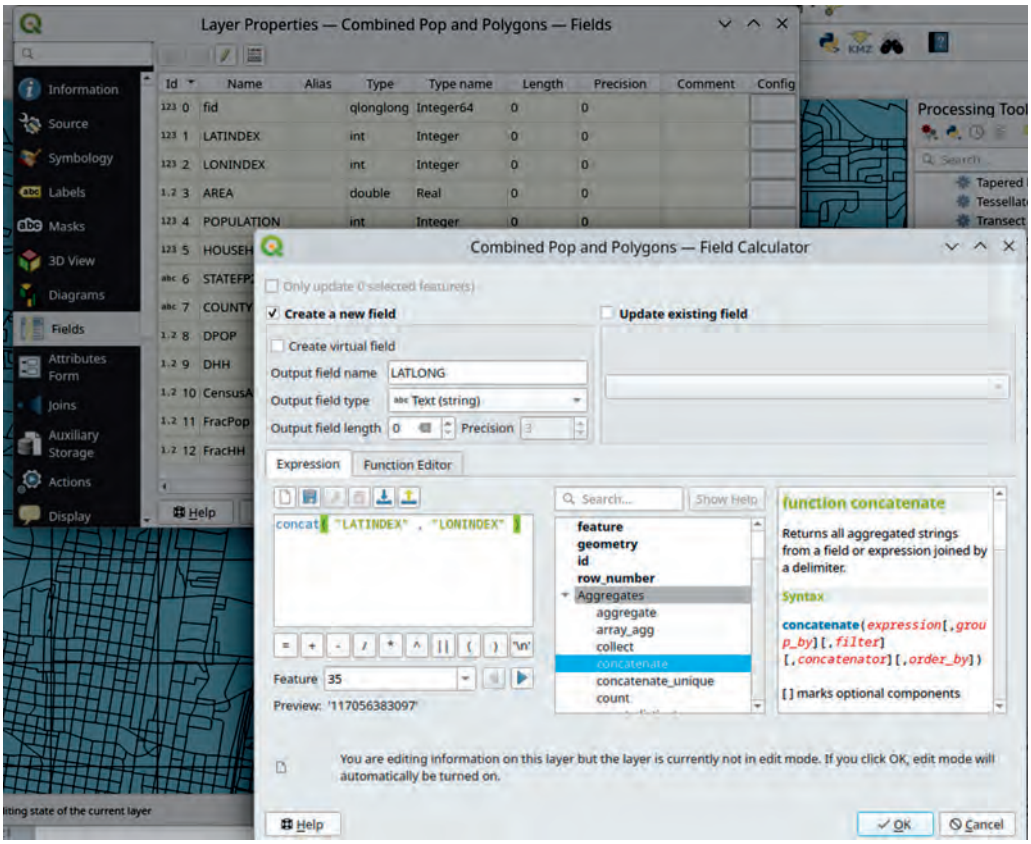
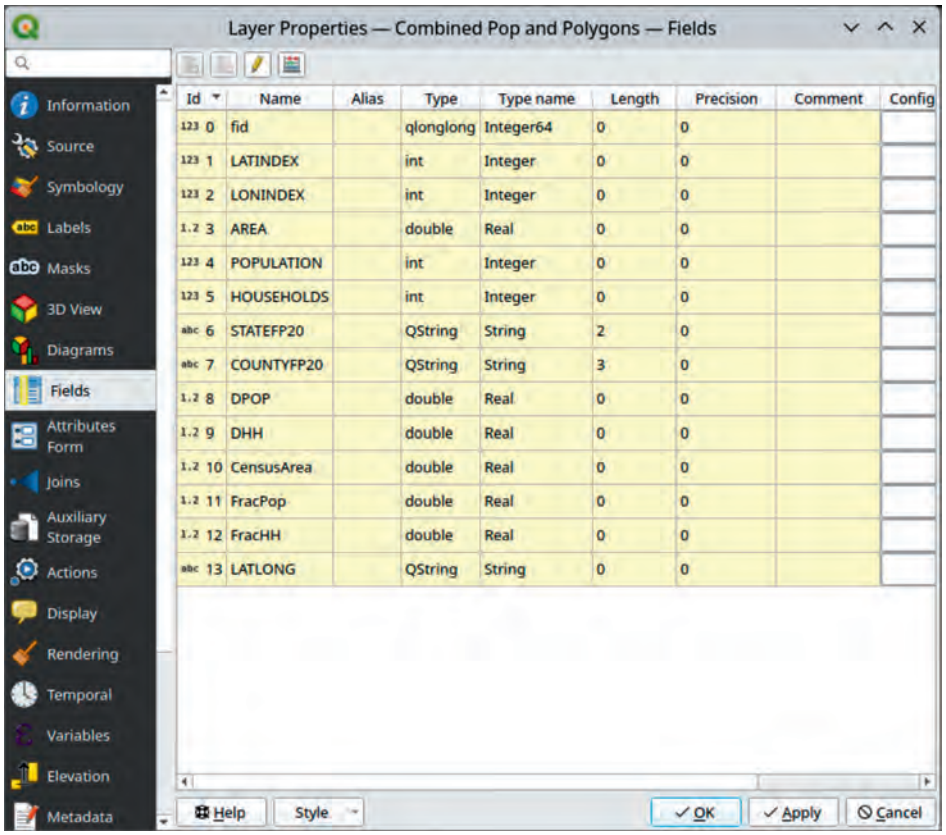


Figure 8. Creating the LATLONG index string



Id	Name	Alias	Type	Type name	Length	Precision	Comment	Config
123 0	fid		qlonglong	Integer64	0	0		
123 1	LATINDEX		int	Integer	0	0		
123 2	LONINDEX		int	Integer	0	0		
1.2 3	AREA		double	Real	0	0		
123 4	POPULATION		int	Integer	0	0		
123 5	HOUSEHOLDS		int	Integer	0	0		
abc 6	STATEFP20		QString	String	2	0		
abc 7	COUNTYFP20		QString	String	3	0		
1.2 8	DPOP		double	Real	0	0		
1.2 9	DHH		double	Real	0	0		
1.2 10	CensusArea		double	Real	0	0		
1.2 11	FracPop		double	Real	0	0		
1.2 12	FracHH		double	Real	0	0		
abc 13	LATLONG		QString	String	0	0		

Figure 9. Combined Pops and Polygon Field List

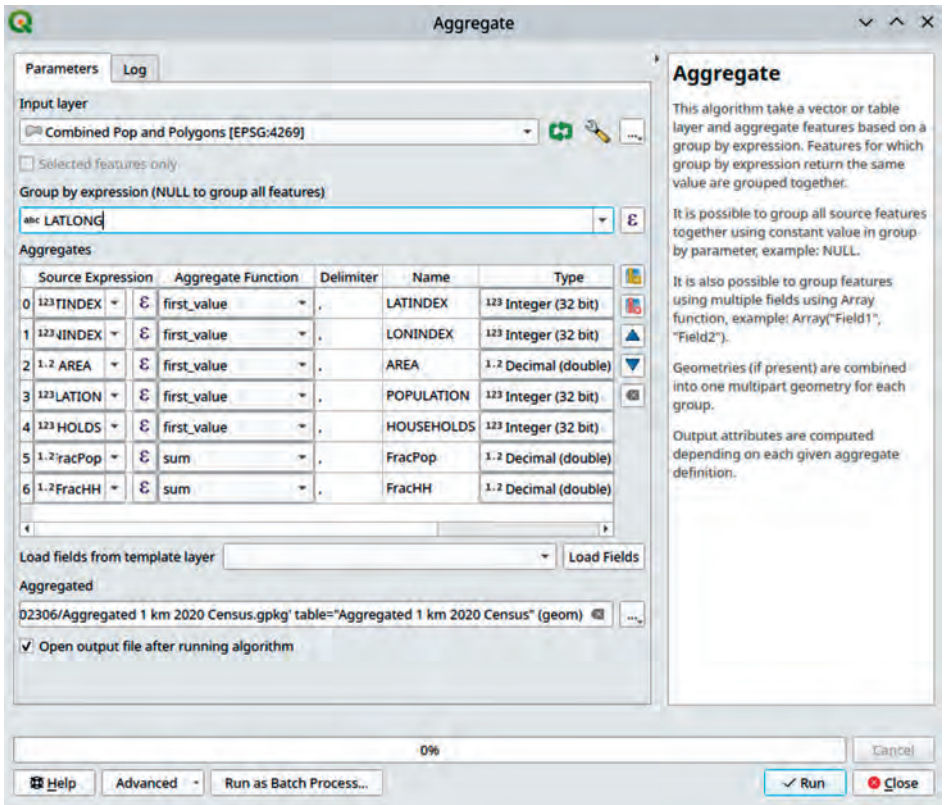


Figure 10. Aggregate Census Blocks and Fractions

data in 300 km radius around Albuquerque took five and a half hours on my Thinkpad X1 Gen 7 laptop. Double check the settings before clicking "Run"! This calculation only has to be done once and after that the resulting GeoPackage layer can be used for quick 2020 Census population counts anywhere in its area.

Here's an example of how to use our new layer to compare TVStudy's 2010 population coverage for KOB in Albuquerque with the 2020 Census population. Create a TV Interference check in TVStudy for KOB. Default parameters can be used but the cell size needs to be 1 km to match the 2020 population layer. Also check the output settings and verify text reports and coverage shapefiles with signal strength, area, population, households, etc. are selected. The Map Output box "Map points at grid cell center" should be checked.

Drag the contours.shp and coverpts.shp files from the study's MX_#1 directory into the QGIS "Layers" window to measure interference-free coverage. In this example, there was only one contour in the contours.shp file. If studying stations with interfering station or DTVTable contours use the "Provider Feature Filter" and "Query Builder" in the layer properties under "Source" to select the desired contour source. Rename the layers to avoid confusion if other studies are added later.

Adding the 2020 Census data to the TVStudy coverpts layer is simple. Use the "Intersection" tool in the "Processing Toolbox". There is no need to duplicate fields already present in the KOB coverpts layer so only select the "FracPOP" and "FracHH" overlay fields in the "Aggregated 1 km 2020 Census" layer. (See Figure 11.) Creating the 2020-KOB-Coverpts.gpkg took less than 30 seconds.

Once the 2020-KOB-Coverpts layer is created it can be used the same as a coverpts layer from TVStudy, with the additional fields (FracPOP and FracHH) with the 2020 census data available for analysis. I used the "Field" editor to change the name of these fields to 2020Pop and 2020HH, respectively.

Figure 12 shows a Query Builder filter 1 applied to the 2020-KOB-Coverpts layer to obtain interference free coverage using the FCC default of assumed service in cells with Longley-Rice errors. The "Basic statistics for fields" tool

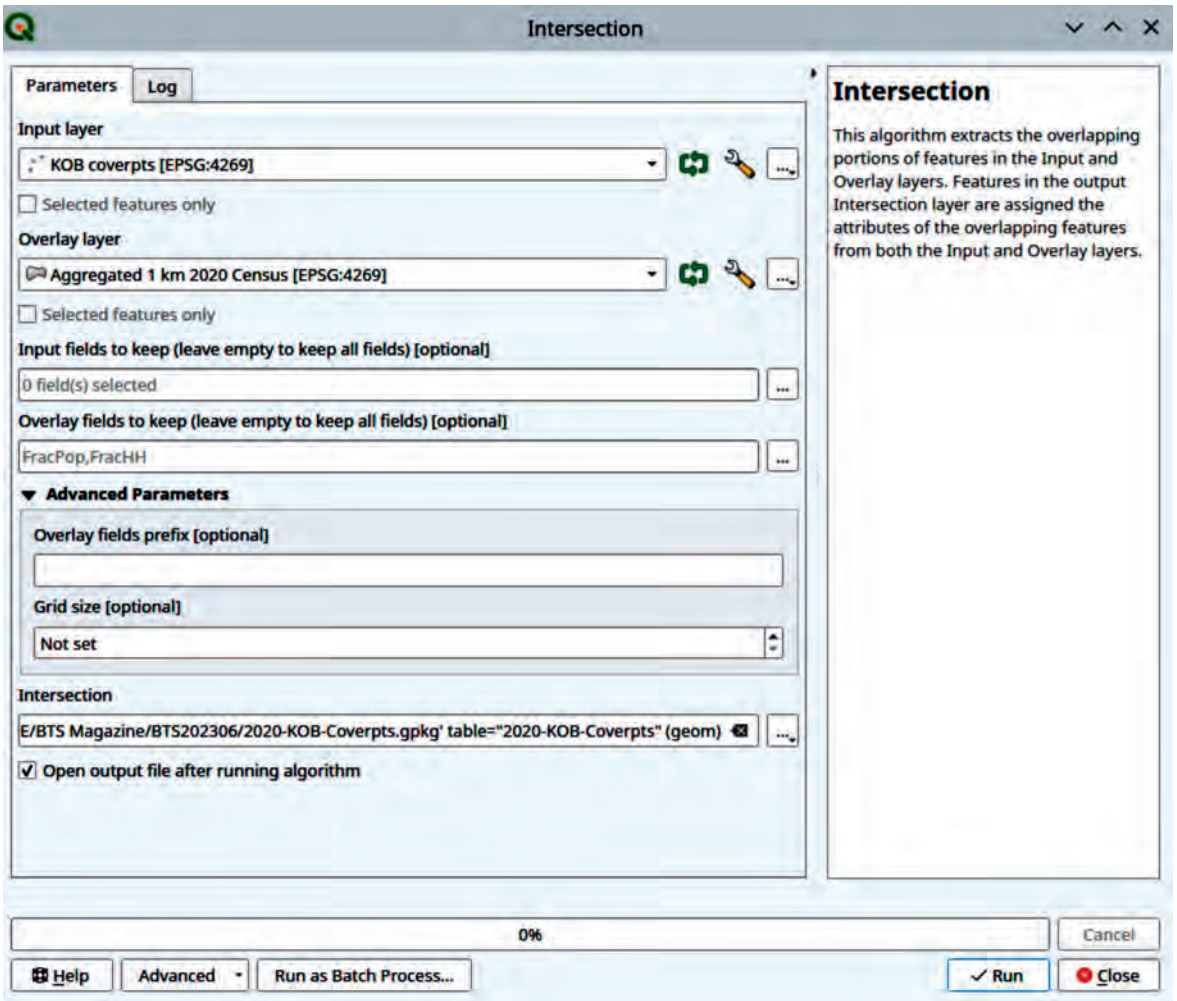


Figure 11. KOB coverpts and 1 km pop data intersection

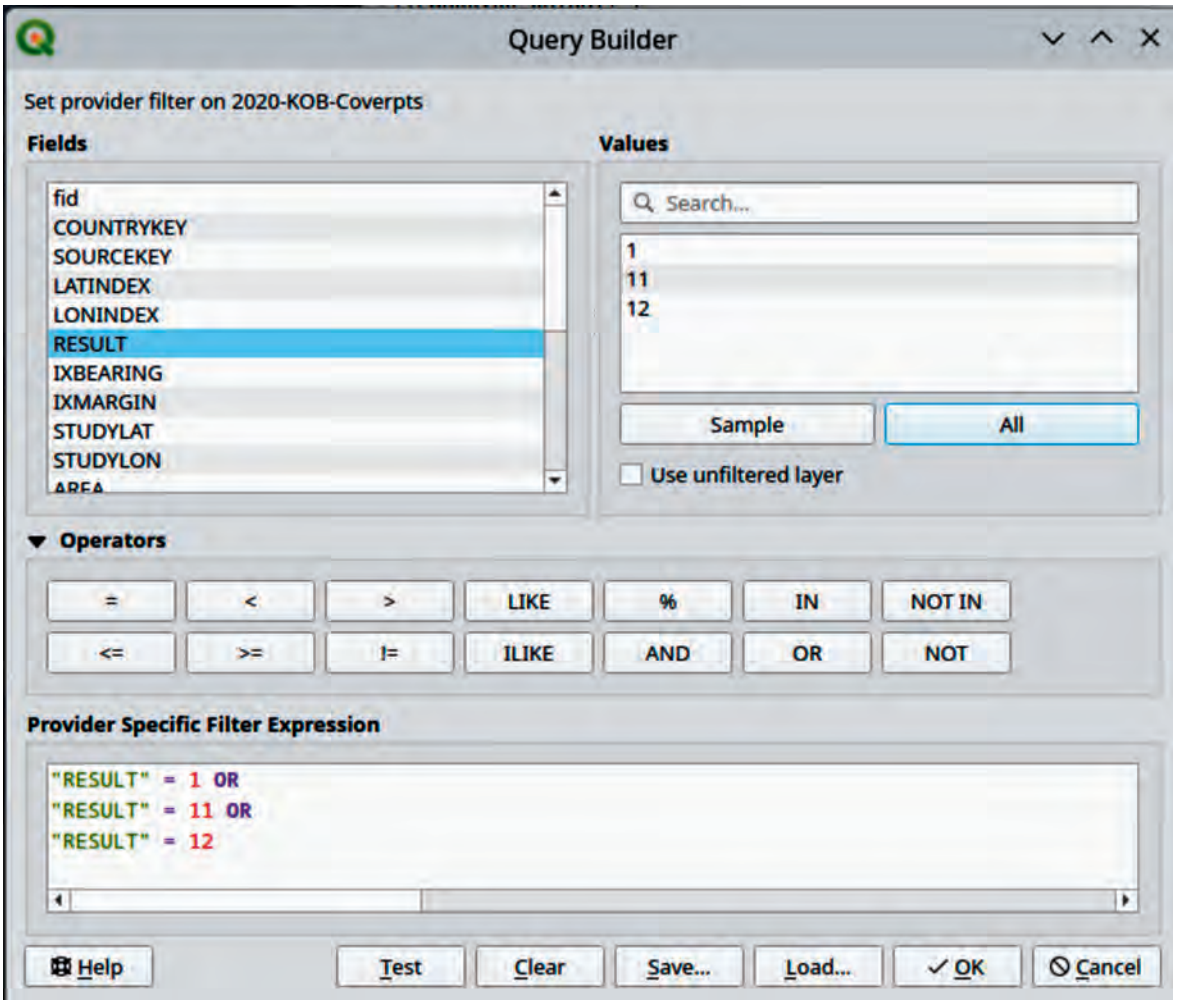


Figure 12. Query Builder for Interference Free Coverage

under "Vector Analysis" in the "Processing Toolbox" can be used to sum the population and household counts in the layer. The results are shown in Figure 13.

The TVStudy 2010 counts agree with those in the study's "parameters.csv" output file.

When converting data into different forms such as a we did here, using population density to combine and split census blocks, its reasonable to expect the resulting data may not match results obtained using other methods. To get an idea of the size of discrepancies, I did a 2020 population count after mapping the "Aggregated 1 km 2020 Census" layer into Bernalillo County (boundaries from my 2015 U.S. Census TIGER/Line shapefile) using the "Intersection" tool and obtained a population of 682,914.6 people. This compares with 676,644 people in the U.S. Census Bureau's Data Explorer (*https://data.census.gov/*) 2020 count for that county, a difference of 0.9 percent. The TVStudy 2010 population count was 666,980 people and this compares to 662,564 people in the Data Explorer's 2010 population total, a difference of 0.7 percent To see how much of this was due to splitting and combining census blocks into 1 km cells I counted the sum of the POP20 in field in the NMCensus2020 layer with a layer consisting only of the 2015 Bernalillo County boundaries. It resulted in a total population of 678,155 people, a difference of 0.2 percent.

I did not split the census blocks at the county boundary, which may account for the difference if some census blocks spanned more than one county. TVStudy cells can straddle contours and boundaries as I showed in my Winter 2019 column, resulting in extra counts. This effect will have much greater impact on a small area—such as a densely populated county—than the full coverage area. If only a small portion of the

Population (TVStudy 2010):	1,110,498.0
Population (2020Pop):	1,149,405.8
Households (TVStudy 2010):	439,446.0.
Households (2020HH):	506,265.4

Figure 13

census block was in the county, this method would have counted the entire population of the block in the county. A more accurate count could be obtained by cropping the blocks or one-kilometer cells at the county boundary and calculating coverage using population density and the remaining area.

Please let me know if you run into any issues following the example I provided here, or if you have other ideas on how to combine data from other sources with that from TVStudy or other RF propagation software.

Orange Pi 5 And SBC Update

I purchased an Orange Pi 5 with 8 GB of RAM, power supply, and an active heat sink case from vendors on Aliexpress, and now have had a chance to do some testing with it. It has become my single board computer (SBC) of choice. It's available on Amazon at a reasonable price or from China at even lower prices. It can be easily expanded with an NVMe SSD, and has sufficient RAM and CPU power to handle tasks like video encoding. Unlike other SBCs such as the Raspberry Pi series and the units I covered in my last column, the Orange Pi 5 has a real-time clock with optional battery backup. That's important for remote logging applications.

I installed an inexpensive Sabrent 512 GB PCIe M.2 2242 SSD and a $10.00 (U.S.) 5 GHz/2.4 GHz USB Wi-Fi adapter that I found on eBay. The Orange Pi 5 does not have built-in Wi-Fi or Bluetooth. The Orange Pi 5 with active heat sink and Wi-Fi adapter are shown in the photo. For testing, I used the Debian Bullseye desktop version from the Orange Pi website and connected a mouse, keyboard and HDMI monitor. I had no problem running any of the DVB tools available for Debian, including Kaffeine, my choice for viewing and recording over-the-air TV. I was also able to compile libdvbpsi and tsduck, two programs that permit very detailed analysis of digital TV transport streams and offer a faster method for scanning TV channels. I'll have details on them in my next column.

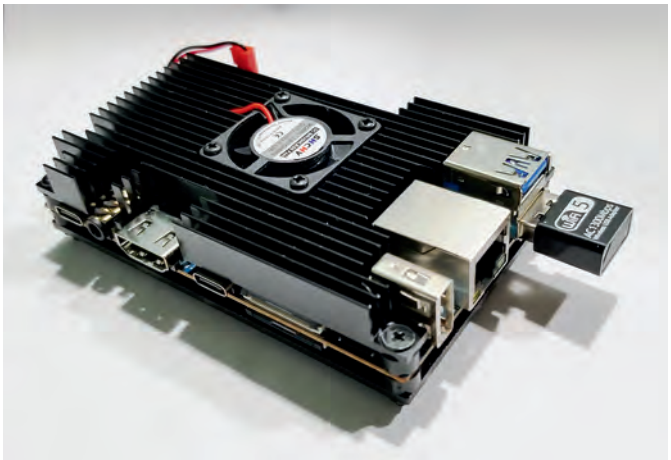


Figure 14. The Orange Pi 5

Email comments and questions are welcome. Contact me at *dlung@transmitter.com*.

DRM News

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the specific needs of Africa in mind, the DRM Consortium, in collaboration with industry players including the BBC, Encompass Digital Media and Fraunhofer IIS, TDF and others, is sponsoring a project proving the suitability of DRM as a delivery mechanism for education content to regions without Internet connectivity.

Whereas broadcasters may have been reluctant to invest in DRM infrastructure in the absence of receivers, modules such as the DRM1000 enable these receivers to be manufactured at scale locally, presenting significant global opportunities and offering to unlock the benefits of DRM to those who would otherwise remain disenfranchised.

About The Author

Matthew Phillips *is the vice president of global marketing for CML Microcircuits Ltd, a fabless semiconductor supplier located in the United Kingdom. He is also a member of the steering board of the DRM Consortium and a member of the IET. He has worked in both engineering and commercial leadership roles in wireless semiconductors for more than 30 years. With applications spanning short range connectivity, global location, local and wide area networks, the IC's that build these diverse systems have been a consuming interest. The social and economic benefits derived from Digital Radio Broadcasting in emerging nations are a significant factor supporting his technical interest in the Digital Radio Mondiale rollout.*

Women In Broadcast

Embracing Equity

Hosted By Samina Husain, BTS vice president

Dall-e.ai

For me equity means zero percent barriers and 100 percent opportunities.

2023 is seeing the return of many events taking place in-person with strong attendance and lively networking, as noted in the Aisa-Pacific Broadcasting Union (ABU) slogan "Back to Business." The BTS was a proud ABU conference session sponsor, and I had the privilege to moderate the session "Artificial Intelligence (AI), Blockchain and Data Applications in Media." The latest and exciting topics for the industry, these presentations raised spirited discussions from the audience. This was very apropos, as the IEEE's BTS has a strong focus on education and technical advancements.

It was especially significant for me to moderate this session, as it occurred on March 8, which is International Women's Day (IWD) 2023. I had the opportunity to open the session with a short presentation on IWD and share some thoughts with the audience. IWD is a day that is recognized globally by countries, by industry, and by organizations, and the ABU, like the IEEE's BTS, is committed to diversity and inclusion, and recognizes International Women's Day and supports the United Nations theme, "DigitALL," which embraces equity.

It is also motivating for me to read the article that follows, which was authored by Subha Dhesikan, a distinguished engineer at Cisco Systems. She shares her thoughts on leveling the playing field, a situation in which everyone has a fair and equal chance. Her experiences have led her to be a key contributor in broadcast media standards activities. She has served as chair of the Network Control API workgroup under the Advanced Media Workflow Association, and published AMWA IS-06. She has also authored and contributed to standards in both the IETF and the IEEE. Subha holds 31 patents.

As we look towards the future, there are some observations to keep in mind. According to the International Telecommunication Union, today there are 1.1 billion girls that are now under the age of 18 years, and in 30 years, 65 percent of these individuals will be seeking jobs that do not yet exist. These jobs will be shaped by digital transformation, and without digital adoption or education, these young girls will not have opportunities. As we embrace equity and recognize IWD, I implore each of your organizations to continue to support this important initiative and enable a positive future of opportunities.

International Women's Day (IWD) is a global day celebrating the social, economic, cultural, and political achievements of women. The day also marks a call to action for accelerating gender parity.

IWD is one of the most important days of the year to:

- celebrate women's achievements
- educate and raise awareness for women's equality
- call for positive change advancing women
- lobby for accelerated gender parity
- fundraise for female-focused charities

This year International Women's Day 2023 campaign theme: #EmbraceEquity

For International Women's Day and beyond, let's all fully #EmbraceEquity. Equity isn't just a nice-to-have, it's a must-have. A focus on gender equity needs to be part of every society's DNA. And it's critical to understand the difference between equity and equality.

IWD 2023's campaign theme aims to get the world talking about why "equal opportunities are no longer enough."

The United Nations' women's group has set the theme for International Women's Day. It's "DigitALL: Innovation and technology for gender equality." This theme is aligned with the priority theme for the upcoming 67th Session of the Commission on the Status of Women (CSW-67), "Innovation

ABU conference session speaker Samina Husain with panelists (L-R); Junghyun Kim, deputy manager, KBS South Korea; Tetsushi Okura, senior manager, NHK; Takashi Koyano, corporate officer, NHK's Digital Solution Center; Ruhi Tas, deputy director of information technologies, Turkish Radio and Television; Christian Christiansen, chief operations officer, DAMsmart Asia and Silver Trak Digital; Joao Neto co-founder and chief executive officer, Voice Interaction.

and technological change, and education in the digital age for achieving gender equality and the empowerment of all women and girls".

I invite you to visit the following websites to learn more about the subject:

1) *https://www.internationalwomensday.com/theme*
2) *https://www.unwomen.org/en/news-stories/announcement/2022/12/international-womens-day-2023-digitall-innovation-and-technology-for-gender-equality*

Upward Spiral Of Confidence To Advancement

By Subha Dhesikan
Distinguished Engineer
Cisco Systems


Subha Dhesikan

After 25+ years in the tech industry, and currently as one of the women Distinguished Engineers at Cisco, I am often asked by fellow female colleagues and by organizations about my experiences and lessons learned on improving diversity. Here are some of my reflections.

Upward Spiral

Early in my career, I struggled to speak up in meetings, but lacked confidence, especially in the presence of senior leaders. I was unsure as to whether my technical contributions were worth sharing, and therefore, I held back. With direct encouragement and support from my then manager, I summoned the courage to speak and share my ideas. This was well received, and as others engaged with me on my technical ideas, I lost that fear and found myself having an enthusiastic discussion with various peers and leaders. After a few weeks of such discussions, I was invited by senior technical members to co-author a document.

In looking back, the foundation of confidence that I gained from that experience gave rise to believing in the value of my contributions and that, in turn, boosted my confidence to repeat the exercise.

Over time, I realized three things: (1) I had worthy technical contributions, (2) people were interested in my ideas and willing to discuss them with me, (3) In combining (1) and (2), I felt more engaged and connected at work.

I told myself that to overcome my timidity and to break out of my shell I needed to start contributing in smaller settings. It felt awkward and difficult at first. Every meeting did not go perfectly, but I was gaining confidence with every experience. It had a flywheel effect in that it kept getting easier as I kept doing it repeatedly. And soon enough, I was able to engage with senior leaders confidently and authentically. I call this an "upward spiral of confidence to advancement."

This "upward spiral of confidence" helped me to continuously build on my previous successes. The joy and satisfaction of having done it once helped propel me to the next one. I implore all of you who are afraid to speak up to take a small step in trusting yourself to create your own upward spiral of confidence leading to advancement.

Level Playing Field

Across the industry, there are various mentoring and coaching programs that aim to assist women in creating their own "upward spiral". While these initiatives are commendable, they alone are not enough to create the systematic change necessary for a level playing field. It is essential to target everyone in the organization for mentoring and coaching, as each member plays a role in maintaining a fair environment. Additionally, systematic processes and intentional procedures must be in place that create and reinforce a fair environment.

Efforts centered on primarily women-only events leave an impression that the coaching or change is for women alone, leaving the others with minimal responsibility or accountability to contribute to the change. Such efforts perpetuate a myth that women need help, while in reality what they require is *a level playing field.*

The most effective leaders do not single out women. Instead, they create opportunities for everyone, regardless of gender, to grow in their own environments. They create a level playing field for everyone to have an equal chance to succeed, and those who believe in themselves enjoy immediate and long-term success of their strong belief.

An Uneven Share

Many organizations today primarily target senior women leaders to mentor and coach other women, which can have an unintended consequence. While senior women should be engaged, organizations should not leave them with *an uneven share* of this responsibility. This creates an imbalance in the mentoring and coaching process, and women lose out from benefitting from a diverse population. Moreover, it limits senior women leaders from other ways in which they can provide mentoring and give back. I liked a program introduced internally by Cisco in which all leaders were required to mentor or coach someone who is different from them in any regard. This created balance and gave both the mentor and mentee a learning opportunity, as well as to be exposed to a variety of experiences and perspectives.

In summary, I would say to the organizations that are committed to improve and increase diversity, I urge you to be intentional in creating processes and procedures that level the playing field and to set expectations for all leaders to consciously commit to the same. And to the women, I would ask you to trust and believe in yourself in order to take advantage of the opportunities available to you. This will help you create your own upper spiral of confidence to advancement.

The Downward Path to Broadcast Engineering—No. 31

The Morning I Joined The 27 kV Club

By Fred Willard

For many of us there is a single event in our lives that, as we look back through the decades, is remembered as a pivotal point in our careers. Like a number of us in the broadcast engineering field, I started in another discipline and later migrated into this profession, first working in station operations, then moving to production, and from there to working as a technician, and eventually making the move to engineering.

I realized that as many of us in this (at times) fascinating world of broadcast communications have—engineering pays better and is a lot less volatile than other parts of the business. There's also less competition, as many don't relish working outside in the winter, climbing towers, and getting off work when the sun rises. They'd rather just sit in a nice cool (or warm, depending on the season) office.

I seemed to have a knack for the engineering side of things early on, even without the full collegiate training in physics, math and everything else that goes into the classical engineering curriculum. Just like almost anything else, it's possible to read and train yourself. Every fashionable industry has its underbelly and behind the curtains machinery to make things happen and I wanted to be part of that group!

Back in the early 1980's, before all of the major cable and satellite build-outs, (and also before streaming came into its own), nothing fit that bill better for getting video content to the masses than the high-power television transmitter.

At that time, a first-class FCC license was a prerequisite to put your hands into vulnerable areas and having helped some of my friends with their ham rigs, I eventually passed the test and was awarded my "first phone." However, that document only proved you knew a few old tube theory questions and some basic electronics. It was merely a "license to learn" and did not portend any "common sense." That comes with experience and in sometimes doing things the "wrong" way." (As the old saying goes, an "expert" is someone who—while working in a very narrow field of endeavors—has made every mistake possible.)

However, I'm getting away from my story.

In looking back, the mid-1970s and the entire decade of the 80s might well be considered the "golden era" of the high-power UHF television buildout phase in broadcasting. UHF broadcasters learned early in the game that mere kilowatts of ERP didn't make the grade. They needed megawatts to compete with the coverage their VHF brethren enjoyed. Of course, to generate all of those megawatts of RF, you needed a magnitude more energy in the form of AC (and eventually) power. This was the raw energy that provided me with a lifelong "moment to remember" from a very up-close and personal encounter.

History shows that those that are willing to work "overnighters" in isolated locations with high electrical potentials and sometimes hazardous chemistry—along with all the myriad other dangers presented by large rotating machinery and live steam—are rewarded with continuous employment (and maybe a good retirement, if they make it that far).

In my younger years, this non elegant side of broadcasting was still exciting and appealing, as it was out of the "norm" and provided a great opportunity for hands-on learning.

However, as anyone who has ever worked in the technical side of broadcasting knows, the show must always go on. It's a huge responsibility. If a transmitter or other critical gear wasn't all put back together and ready to go by sign-on, the costs were high indeed. (I should point out that back in the 1980s, not all television stations ran 24/7. Many were content with running an hour or two of entertainment programming after the late news and then signing off with the playing of the National Anthem around 1:00 a.m. or so.)

The Really Big Machine

The UHF transmitter at the station where I worked back then was a true "leviathan" in every respect of the word—much larger than those at other stations owned by this particular network. It was a humbling experience just to be around it.

It was the second-such implementation shipped of that particular early-1970s model, and boasted a one-quarter million watt power output. To produce such a quantity of RF then required five—enormous by today's standards—multi-cavity klystron-power amplifier stages.

Nor did it have a very small physical "footprint," either, even though it was considered "compact" at the time. As I recall, the main assembly of amplifier cubicles was about 23 feet (7 meters) in length and 7 feet (2 meters) deep. The internal cavity klystrons by themselves stood six feet (almost two meters) high and required a special balanced transportation for installation and removal. The associated

transmitter cooling system's heat exchanger was two stories tall, twice that in length, and some 15 feet (about 4.5 meters) deep. (By comparison, nowadays you can generate that amount of UHF energy in the space of a mere four standard equipment racks.)

In setting the stage for my story, it needs to be kept in mind that not only was this transmitter big, but also had a large appetite for electricity—the literature associated with it boasted that it consumed more power than a small town. (Back in the 1960s and early 70s, energy conversation was not a priority.)

The DC power supplies for the klystron amplifiers were equally impressive. They were located outside the building and weighed thousands of pounds each. Bolted to concrete pads as they were, they looked as if they might be more at home in a power company substation. And of course, back in those pre-Occupational Safety and Health Agency (OSHA) days there were no safety interlocks. You could run full power with the power supply cabinet doors wide open, even though they were quite deadly (the tags, as I recall, indicated they could source 27 kV at 11.5 amps!)

The Big Machine's Equally Big Bite

One particularly humid and misty night I and the two others comprising the maintenance crew were assigned the task of locating and remediating an intermittent high voltage arc within the big transmitter. In our troubleshooting, it was necessary to repeatedly power the rig on and then power it off in an effort to isolate this covert arc that was causing one of the ganged amplifiers to shut down due to the intermittent overload condition. I should point out that our employer (fortunately) believed in "safety in numbers"—working alone on such a machine was not even a consideration.

After several hours of turning the amplifier's DC supply on and off, we were finally able to isolate the intermittent arcing to a specific corner of the amplifier cabinet. In order to observe the arc, it was necessary to turn off the room

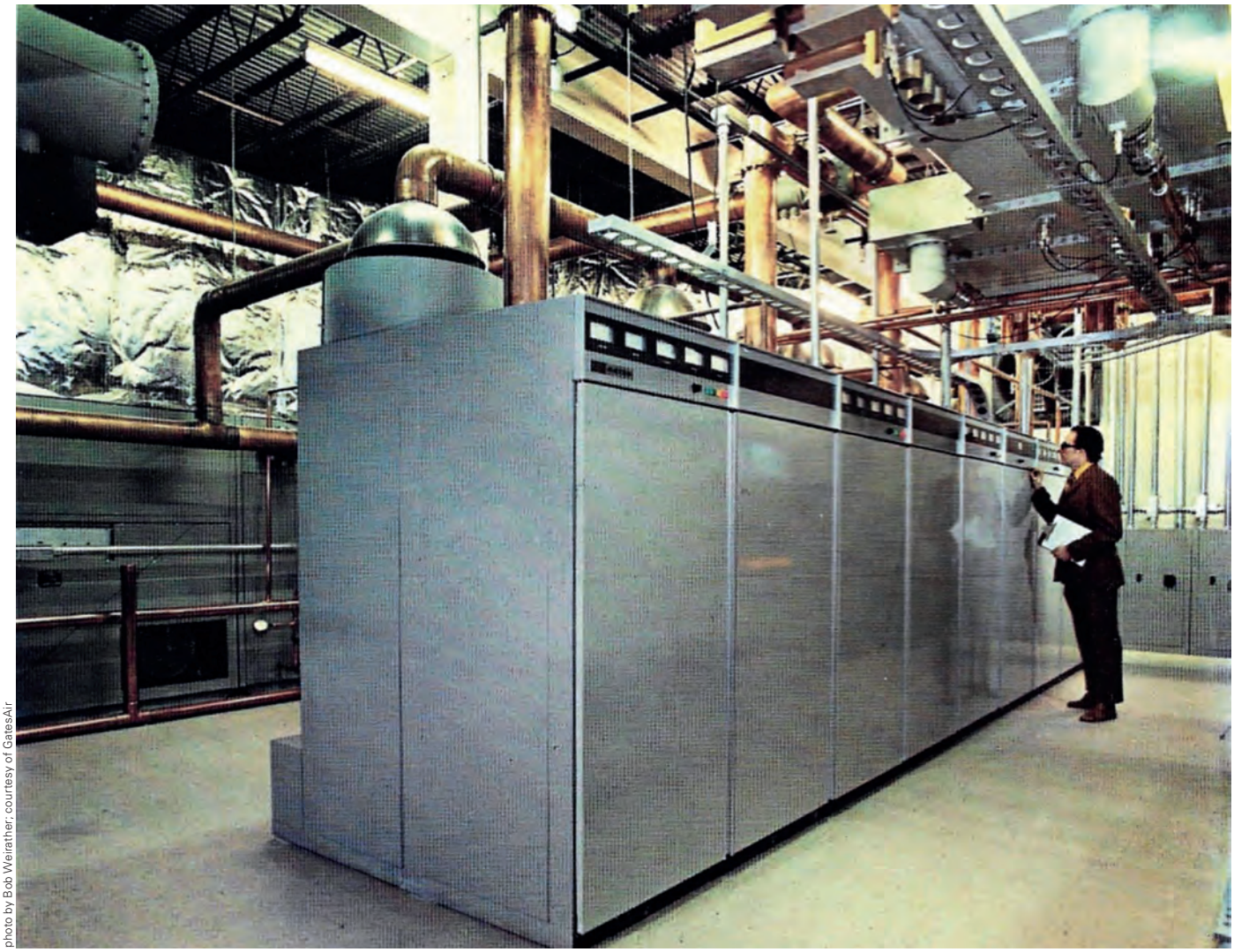


photo by Bob Weirather; courtesy of GatesAir

A 1960s high-power UHF transmitter installation similar to that described in this story

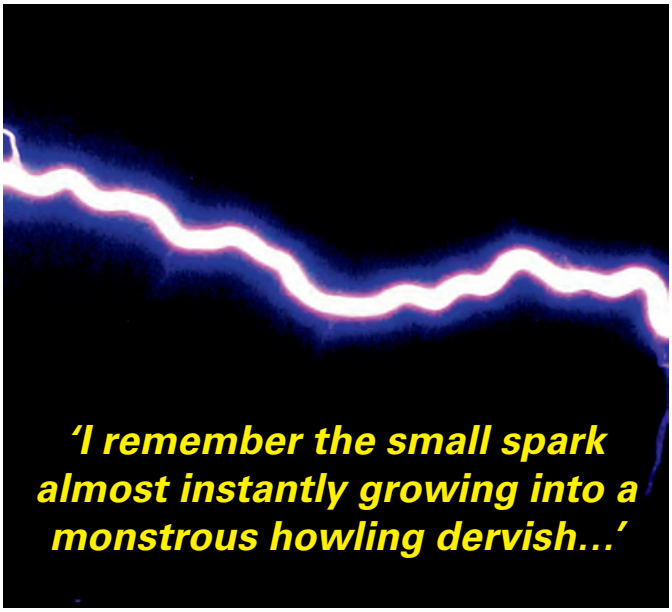
lights and stand close enough to be able to observe the flash as the transmitter was being powered up.

Our procedure was to turn off the primary breaker feeding the misbehaving amplifier's outdoor power supply, then go outside to that power supply, take the long phenolic "shorting stick" supplied and apply it to the high voltage capacitors within the power supply enclosure in order to ground them and dissipate any remaining charge. This normally resulted in a small and satisfying "snap" that gave you confidence the bleeder resistors across the large power supply capacitors had done their job in draining most of the residual charge and that it was safe to proceed with work involving high voltage circuitry. (As I recall, the shorting stick provided was perhaps three feet (about one meter) long, had a curved metallic hook on its "business" end, and was connected via a flexible conductor to a copper ground bus in the enclosure.)

A youthful (pre-27 kV club) Fred Willard

On this particular "overnighter," I was by far the youngest of the three technicians assigned to transmitter maintenance. In looking back, I have to admit that at that point in my life I was a "rail-thin geeky nerd," with a mullet haircut and a bit of a "baby face." I'd raised a diminutive mustache to try and offset my "baby face." After all, this was in the early 80's and at a time when everyone wanted "to do their own thing."

Anyway, it was about 4:00 a.m. when we finally narrowed down the high-tension breakdown zone and were ready to closely inspect the area of the amplifier cubicle where the flashovers were traced. It was my turn to go outside and once again apply the shorting stick just as I and the others had done numerous times that night. We were all tired from our stressful activities, and as I moved the hooked end of the stick towards the power supply's output capacitor, and as we'd been through this drill so many times, I wasn't thinking about whether or not the main breaker had been pulled. Big mistake, right?



What happened next probably took only a few seconds to play out, but everything then seemed to go in slow motion. As the hook neared the shiny cap nut on the white high voltage insulator bushing, the thought passed through my mind that maybe this time we hadn't checked to see if the breaker had been pulled, but my thoughts and reactions were slowed by fatigue, too much caffeine, and too many donuts.

I remember hearing a small "tick" just before contacting that shiny cap nut and thought to myself: "you really made a mistake here, but it looks like you're going to get off with this just being a non-event."

The laws of physics proved me wrong.

It's inbred in all of us to flee from danger, and that I tried to do. However, I neglected to drop the shorting stick as I backed away and watched in awe and horror as that small "tick" became a thin and very noisy white-colored arc. As I continued to back away it didn't just become a longer arc; it also grew fatter, with its color shifting towards the orange region of the spectrum.

My befuddled brain then realized that my distancing the stick was not going to make the arc let go!

This was one of those moments that you realize your own frailty and insignificance in this world.

I remember the small spark almost instantly growing into a monstrous howling dervish, and as I continued to pull back, it transformed into a ball of fire that seemed brighter than the sun.

A Glimpse Of Hades!

Hell itself had been unleashed in front of my face!

The brilliance and heat was sensational and remarkable, and was accompanied by an overwhelming amount of ozone. It was very surreal—like something in a dream you can't escape from. There just aren't words to describe it. I remember thinking I was

floating on a cloud and then becoming temporarily blind from the arc's brilliance.

For a moment I really wasn't sure whether I was still alive or had passed to another realm. Suddenly, arc and the building lights went out leaving everything in total darkness except for a strong negative image of the fireball that had seared its way into my retinae.

I don't remember dropping the shorting stick or making my way back out into the open space, but I guess I did as I realized that the others were now gathered near me. There was complete silence except for the ringing in my ears from the tremendous roar of the arc. Everyone was in awe from the experience with no one speaking. (I think they were surprised that I was still in the world of the living.)

The overload that I'd created tripped the building's main 1,600 amp/480 volt mains breaker. It was so eerie to be in darkness and silence after such an experience.

Luck Was On My Side

Once we calmed down a bit and regained our wits, we reset the breaker. There was no more interest in working on the transmitter that night; it would have to operate at half-power at sign on. We just sat down inside next to each other without much comment. I was shaking for about an hour. All of us realized that we had just seen the face of God or perhaps had looked across a star gate into another dimension. We didn't need to be told that we'd made an incredible error and no comments or elaboration was necessary.

This up close and personal experience with high tension/high current electricity temporarily altered my looks. My face was sunburned from the intense UV, looking like I'd fallen falling asleep on the beach on a sunny July day. My eyebrows and thin mustache had also been scorched by the heat; what remained of the individual hairs were brittle and soon broke off.

The lessons learned that night have remained with me to this day. I suppose the biggest take-away is never to assume anything. That's why airplane pilots follow checklists each time they prepare to take off or land. You can say luck was on our side. In any case, I never looked back and considered myself hooked in this crazy media business from that moment on. More than 40 years have passed, and I can reflect and laugh at how we lived on the edge in our everyday work. The chaps I worked with that night are no longer with us, as they were much older than I was then.

I'm still doing the same work, but now there are even less of us interested in the high energy world of broadcast transmission.

About The Author

Fred Willard *serves as a senior RF engineer for TelevisaUnivision, and has been involved in broadcasting since his high school days. He has been active in both radio and television engineering for more than four decades, installing and modifying high-power television transmission facilities both in the United States and abroad. His employment includes a five-year stint with the Goddard Space Flight Center where he was involved in the early development of high-definition television. He is a graduate of Towson University and is a Member of the Society of Motion Picture and Television Engineers, a Member of the Society of Broadcast Engineers, and a Member of the Audio Engineering Society.*

AIBD Celebrates World Radio Day

By Amal Punchihewa
BTS Distinguished Lecturer
and Dinnierose Raiko
AIBD Program Manager

HANOI, VIETNAM AND KUALA LUMPUR, MALAYSIA

The Asia-Pacific Institute for Broadcasting (AIBD) celebrated the 12th annual World Radio Day this year with both an in-person program—"A World Of Sounds And Peace" that was held Feb. 13 in Hanoi, Vietnam, and an webinar that took place on Feb. 16 and originated from Kula Lumpur, Malaysia.

The initial event, which was conducted in partnership with the United Nations Educational, Scientific and Cultural Organization (UNESCO) focused on the areas of dissemination of peace initiative information and efforts to aid conflict resolution, following on a United Nations theme of "radio and peace." Organizers noted that radio is an important medium that is now challenged by both the turbulent times in which we live and the resulting overload of information, but always strives to be the "sound of peace."

A number of activities punctuated the live event, including a curation of video messages from various regional radio officials, presentations and comments from AIBD members about their activities in connection with World Radio Day, as well as discussions and a web summit that continued the celebration of "sounds for a peaceful world."

Radio's Continuing Importance In The 21st Century

In addition to a reporting of activities at the AIBD celebration of World Radio Day, we would like to offer some insight into when, why, and how we celebrate World Radio Day. Radio has been serving people all over the world for over a century. It continues to be the most easily and affordably accessible communication medium. Radio educates, informs, and entertains all segments of society. It can reach the most remote areas or the most marginalized people, assuring a high degree of inclusivity and less digital divide.

World Radio Day is significant as it recognizes the power of radio as a medium of communication, and as a source of reliable and trustworthy information, and the continued relevance of the medium into the 21st century and the digital era into which we have arrived. The event is an opportunity to raise awareness about the importance of preserving and promoting radio as a means of reliable and trustworthy communication, and to celebrate its impact on societies around the world. Radio reaches people across diverse communities, regardless of their education or socio-economic status, making it a powerful tool for promoting peace, democracy, and human rights. It also plays a fundamental role in counselling, mediation, and reconciliation in working toward achieving harmony in the area of human relations, and the promotion of peace in overcoming civil, national, and international conflicts.

Broadcasting organizations are able to use World Radio Day to showcase their programs and the work they do, while listeners can celebrate by tuning in to their favorite radio stations and programs.

In the Feb. 13 event, UNESCO's representative to Vietnam, Christian Manhart, observed that radio is the most popular medium in the world, and one of the reasons for this popularity is that its programs are relatively inexpensive to produce and can be received via equally inexpensive technology. Such programs are also available to people that reside in a number of areas around the world that are unserved by the Internet, television broadcasts or even newspapers. Manhart added that radio, when it is allowed to operate independently, also provides a powerful communications platform that can assist in both preventing conflicts and for peace building. He stated that it has an important role in defending against misinformation and the spreading of "fake news" which can lead to conflicts and potentially to wars among peoples.

The Voice of Vietnam's president, Do Tien Sy, in speaking about the attributes of radio broadcasting, noted that in addition to being able to respond quickly to changing situations, access to the medium is easily achieved over wide areas, and that is able to promote social cohesion by the exchange of information.

Speakers at the Feb. 13 'World Radio Day' live event in Vietnam.

"Today, media organizations have utilized the great innovation of new media platforms to intensify the effectiveness of radio to align with the world media development," Sy stated, adding that the Voice of Vietnam has always been a pioneer in the areas of innovation and media modernization in meeting the needs of the listening public.

"The Voice of Vietnam's radio channels prioritize interesting and highly interactive programs with open content to encourage audience

engagement," he said. "This approach is instrumental in improving the quantity of radio programs, laying the foundation for radio to be a faithful companion of the public in all circumstances."


Do Tien Sy

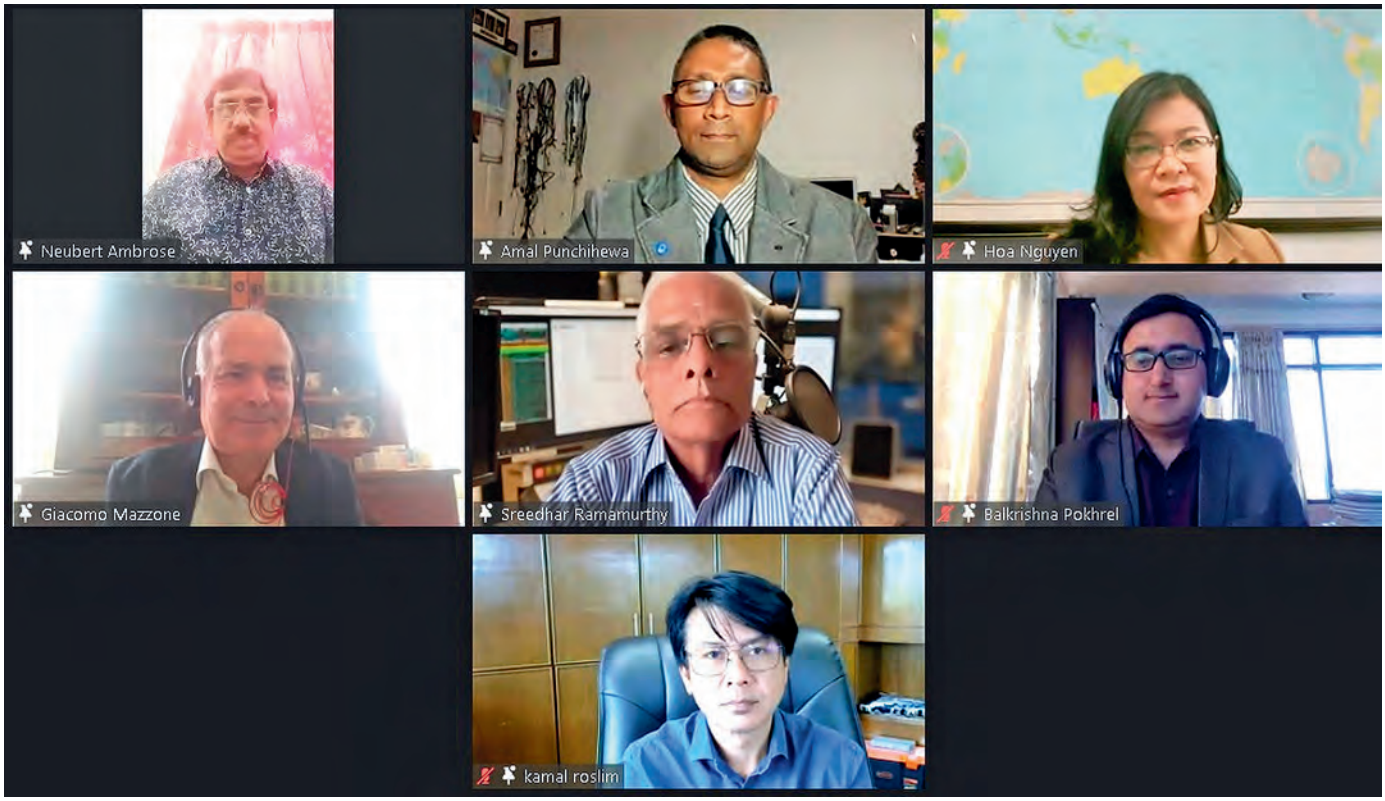
Celebrating World Radio Day Via A Web Event

The observance of the 2023 World Radio Day continued on Feb. 16 with a special three-hour web summit featuring 10 speakers from the Asia-Pacific region and beyond, who shared their views on the importance of radio as an instrument in the peace-building process. Panelists included Giacomo Mazzone, general coordinator of the World Radio Day Committee; Yasser Garrana, head of Radio at the Arab State Broadcasting Union; Nasrullah Md. Irfan, director general of Bangladesh Betar; Surya Prakash, from India's National Institute of Disaster Management; Balkrishna Pokhrel, executive director of Nepal's Association of Community Radio Broadcasters; Kamal Roslim, with Radio Television Malaysia; Hoa Thuy Nguyen, director of international affairs at the Voice of Vietnam; Sreedhar Ramamurthy, a community media practitioner in India; and Neubart Ambrose from Voice of Malaysia.

During the event, Mazzone, observed that his group embraced a lot of broadcast organizations worldwide, with the Asia-Pacific Institute for Broadcasting being one of its prominent members. He also noted that the 100th anniversary of broadcasting within the region was rapidly approaching and that his group was discussing plans for a celebration to commemorate this important occasion.

Others in the discussion voiced the importance of radio in providing a platform for debate and discussion of important matters, its importance in times of environmental crisis and aiding emergency management efforts, and in peace building efforts.

In commenting on this latter attribute of the medium, Sreedhar Ramamurthy, a community media practitioner in India commented that "for the overall peace to be maintained, the community and radio have a very big role."



Participants in the Feb. 16 webinar: (Top row (L-R): Neubert Ambrose, Amal Punchihewa, Hoa Nguyen; (Second row, (L-R): Giacomo Mazzone, Sreedhar Ramamurthy, Balkrishna Pokhrel; bottom row: Kamal Roslim.

In summing up the place and importance of radio in society today, webinar panelist Neubart Ambrose from Voice of Malaysia described radio as one of the "prime forms" of all media due to its universality, reaching audiences when they are "sitting at home, driving,…anywhere." He reflected on the "many rich experiences" gained over the years as a broadcaster in communicating with people and sharing heartwarming stories.

"People look to the broadcaster as the link person (through which) they can share their own stories."

In closing, the authors would like to wish everyone a "Happy Radio Day 2023."

About The Authors

Dr. Amal Punchihewa *is a researcher, educator, advisor and consultant in ICT, Media, and Broadcasting. He is a Chartered Professional Engineer and Fellow of IE) and a Senior Member of IEEE(USA) He is also a Broadcast Technology Society Distinguished Lecturer of. He facilitates and advocates technical guidelines and standards, and provides expertise related to the convergence of media, and evolving technology needs. He is also the technical advisor of the AIBD and a member of the AIBD international advisory board.*

Ms. Dinnierose Raiko *is a program manager at the Asia-Pacific Institute for Broadcasting Development. She is experienced in sports journalism, production and live presentation and broadcast, as well as serving as a commercial TV business development executive of PNG's EMTV. She acquired a Bachelor's Degree in Communication Arts (Journalism) at the Divine Word University (PNG).*

ITU Report

By David Guerra Pereda, BTS Member

Environment Matters

In the previous issue, we presented the results of the first field trials of ITU-R System L, a terrestrial multimedia broadband broadcasting system. The trials were carried out in the higher 500 MHz band, as well as the 600 MHz and 700 MHz bands. According to the results, system L could be a supplement for and coexist with current broadcasting networks for fixed and mobile, outdoor and indoor reception. From this point on, additional assessment work of the technology should be carried out, and the worldwide growing concern about greenhouse gas emissions makes the analysis of environmental impact, a must. Precisely, ITU-R Resolutions 60-2 and 61-2, directly address the environmental issues and call for use of spectrum by means of systems with reduced energy consumption. To this end, Broadcast Network Europe has submitted a contribution to the first 2022 meeting of WP6A (Terrestrial broadcasting delivery).

In the contribution two dimensions of the subject were dealt with: a quantitative review of the energy consumption of broadcasting distribution chains, and a qualitative comparison of unicast IMT (international mobile telecommunications) and DTTB (digital terrestrial television broadcasting) and Broadband Technologies) for audio-visual content delivery. The conclusions, although not surprisingly, are crystal clear.

Three alternatives were considered in the comparison of energy consumption of broadcasting distribution, namely: DTTB, OTT and IPTV. The analysis, carried out by Carstone, with support from Bristol University, compared the energy consumption of the alternatives, both today and up to the year 2035 under a series of scenarios. The results for 2020—given in grams of carbon dioxide equivalent emissions (CO2e) per one-device viewing hour— were 3 g for DTTB, 26 g for OTT and 37 g for IPTV. The figures rise to 4.3 g for DTTB, 35.5 g for OTT and 49.7 g for IPTV, if the emissions resulting from the production of the required products or network components, are included (the power consumption of the TV screen was excluded). The simplicity of DTT reduces power consumption and emissions, dramatically, in both cases.

As for the future, an abrupt end of DTTB would mean an abrupt increase in emissions, a completely unwanted scenario from an environmental point-of-view. Consequently, the key to attain the most sustainable way to distribute and watch TV, remains in a trade-off between DTTB, which would be the preferred option for providing linear content for massive audiences, along with other broadband options for providing on demand video. Long live smart TVs!

In the second type of comparison, a qualitative analysis of what the cost could be by utilizing 5G unicast as a replacement for traditional broadcast to large audiences was performed, which assumed an audience of five million people. Two aspects were analysed: spectrum efficiency and energy consumption.

Spectrum Utilization Considerations

As far as spectrum is concerned, on the assumption of a 3-mbps throughput for audio visual distribution, unicast IMT would need to be allocated 3 MHz of spectrum. Considering 10,000 three-sector sites with 500 users per site, 500 MHz of spectrum would be needed overall. If a 100 percent efficient 2x2 MIMO is added, 250 MHz would be needed. This falls to 125 MHz with 4x4 MIMO and so on. However, higher-order MIMO modes, or using more sites, reduces the required spectrum, but also increases deployment and operating costs of the network.

As for energy consumption, first the additional signalling required by a unicast delivery method must be considered—more bits need to be transmitted to send the same content, although it will benefit from site diversity and from using the resource blocks with the best SINR. The use of higher transmitted powers plays against DTTB, but wider coverage areas provided by antenna height gain due to the higher towers involved, reduces the energy per bit. In view of this, the balance is definitely broken by the fact that the same content bits must be sent several times to reach the assumed 5 million people audience. This is opposed to broadcasting, where the data bit is sent just once once and it reaches all users.

To sum matters up, IMT unicast communications enable the freedom to individually choose what contents to watch, anywhere, any time, but this choice comes at a high price for environment. In the green era we are trying to foster, users should be explicitly made aware of such costs. Hence, for carrying the most popular audiovisual live content, unicast is not really a serious option from the perspective of spectrum use and carbon footprint. Broadcast services should remain available for that purpose along with emerging broadband broadcasting technologies, such as system L, which may eventually take over the task. In this regard, it just remains to be seen how this technology scales in response to nationwide audience cases.

IEEE Offers Free Data Storage For Society Members

Provides 2TB of storage and research data access

In addition to the numerous educational and networking opportunities included in your IEEE Broadcast Technology Society membership, it also includes a free individual subscription to the IEEE's DataPort. All it takes is logging in to the IEEE DataPort and providing your Broadcast Technology Society membership credentials to activate a free individual subscription, a $480.00-per-year value.

IEEE DataPort is IEEE's sustainable data solution that thousands of scientists, researchers, and authors use to access, store, and manage research data. As a society member, you can search and download any of the more than 4,000 datasets on the IEEE DataPort to advance your own research more rapidly. In addition, you can upload your own datasets up to 2 TB to receive citations, obtain a Digital Object Identifier (DO)I, and gain global exposure for your valuable research.

Benefits Available With The IEEE DataPort Data Platform

All datasets added to IEEE DataPort are stored on Amazon Simple Storage Service (S3), a widely used AWS storage service that offers industry-leading scalability, data availability, security, and performance. Every IEEE DataPort member is given an AWS access key to upload datasets to or download datasets directly from AWS. In addition, since IEEE DataPort uses the AWS platform, individuals can use their other AWS computing resource subscriptions such as Amazon Athena, AWS data pipeline, or AWS Glue to perform more advanced analysis.

With IEEE DataPort, it is easy for users to find what they are looking for as all datasets can be searched by topic, author, keyword, or dataset type as shown in Figure 2.

With your free individual subscription, you can access any dataset in the Cloud or by direct download. Datasets with a CC BY license can be copied, analyzed, or used for any other purpose with proper attribution. Since IEEE DataPort is integrated with 170 IEEE journals, you can easily upload your dataset and link it to your manuscript to strengthen your submission and support research reproducibility.

Another benefit of your free IEEE DataPort subscription is the ability to host Data Competitions. The Data Competition module allows users to host time-limited data challenges in which a dataset and DataPort Competition instructions are uploaded by the competition initiator. Members of the

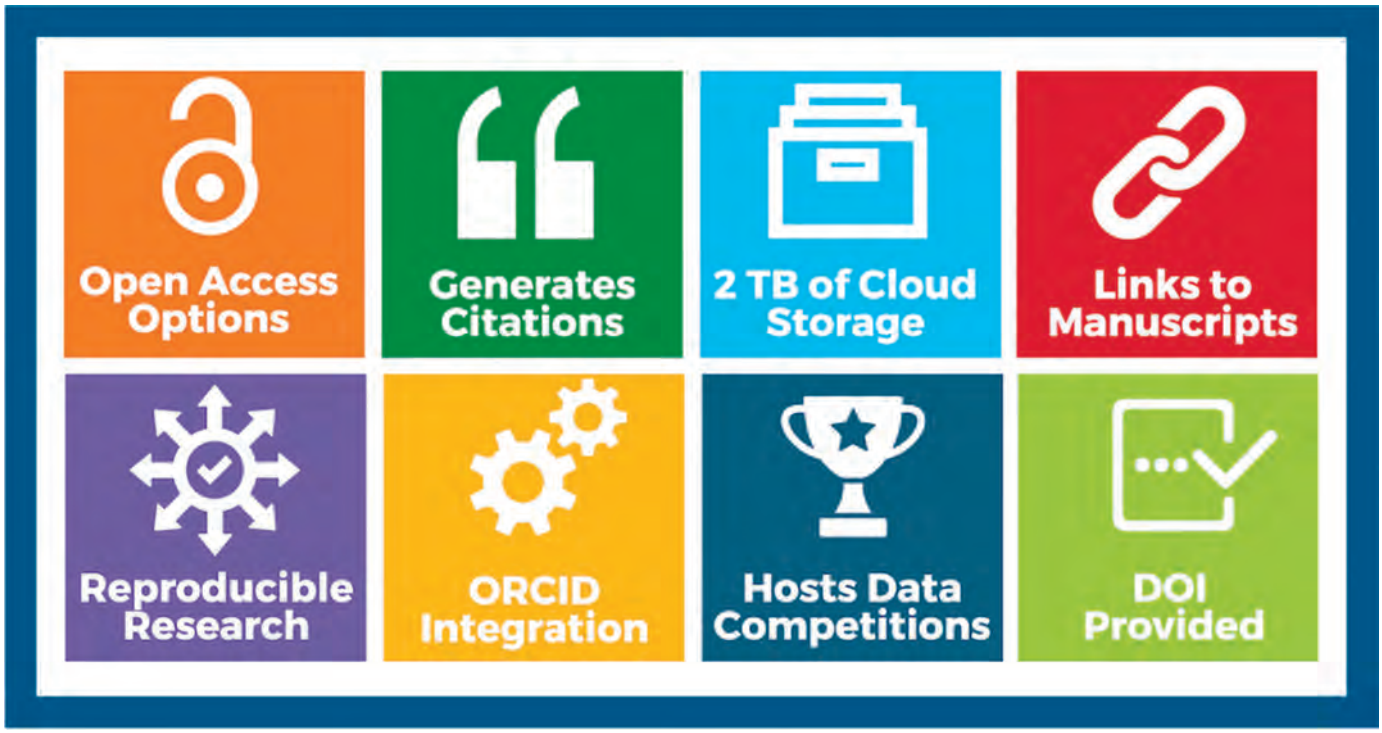


Figure 1. Key benefits offered to IEEE DataPort individual subscribers

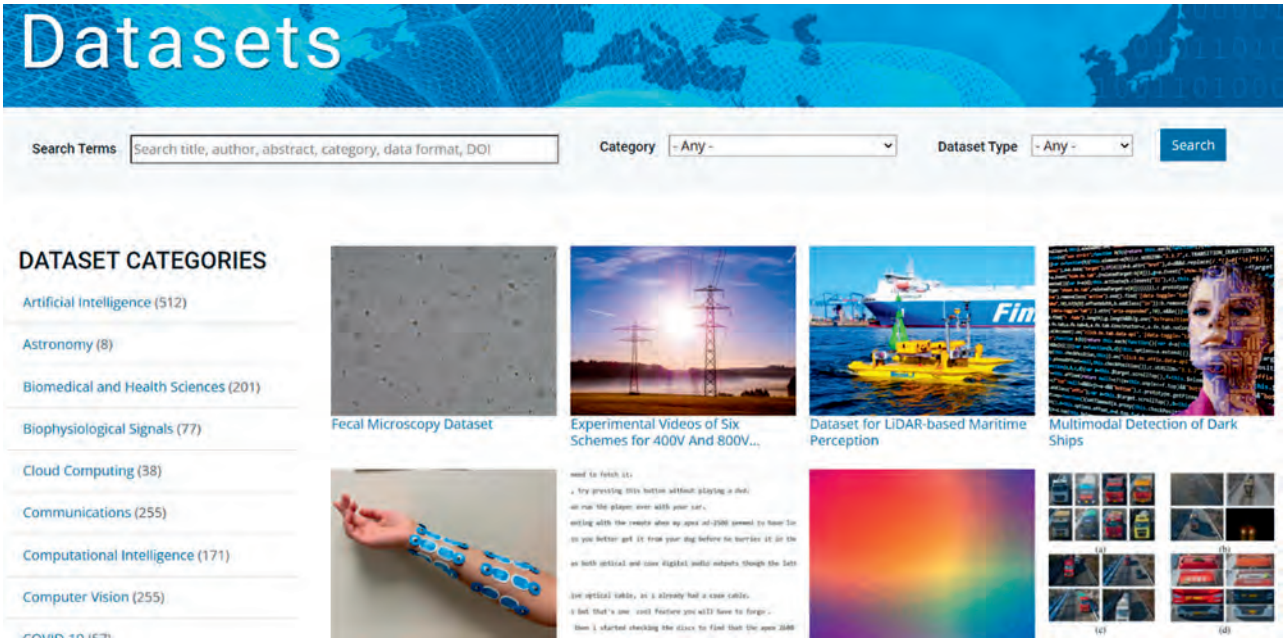


Figure 2. An example of the search functionality offered by IEEE DataPort

global technical community, or a specific set of participants, can then join the Data Competition and provide their specific analyses or make predictions based on the dataset.

Visit the IEEE DataPort at *https://ieee-dataport.org* and login to activate your free individual subscription and start taking advantage of all the platform has to offer.

Upcoming Events

of Interest to BTS Members

- **June 7–9, 2023** – BroadcastAsia 2023 - Singapore Expo; Singapore
- **June 14–16, 2023** – IEEE International Symposium on Broadband Multimedia Systems and Broadcasting; Beijing, China
- **Sept. 15–18, 2023** – IBC Show 2023 - Amsterdam RAI; Amsterdam, Netherlands
- **Oct. 16–19, 2023** – SMPTE Media Technology Summit – Loews Hollywood Hotel; Hollywood, California
- **Oct. 25–26, 2023** – NAB NY Show (co-located with AES convention) - Jacob Javits Center; New York City, New York
- **Jan. 9–12, 2024** – CES Show and Exhibition - Las Vegas Convention Center; Las Vegas, Nevada
- **Feb. 19–22, 2024** – HPA Tech Retreat - The Westin Mission Hills; Rancho Mirage, California
- **April 14–17, 2024** – NAB Show - Las Vegas Convention Center; Las Vegas, Nevada

(IMPORTANT NOTE: Due to the on-going global pandemic; all of the event dates and locations listed above are subject to change with little notice, with many events being cancelled, rescheduled or postponed. 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.

What's New

Broadcast Technology presents new product releases from broadcast equipment manufacturers

Thunderbolt Docking Stations

Sonnet Technologies has added to its product catalog of hard drive docking stations with the release of three new models for Thunderbolt drives. They are available with a large number of connectivity options along with a internal slot that allows installation of an M.2 NV/Me solid-state drive. One of the new docking station models build on the design of the company's Echo 11 Thunderbolt 4 models to add capability for direct HDMI display connectivity. Another of the new products features support for connecting as many as three 4K/60 HDMI or DisplayPort displays.

All of the new docking stations allow users to connect multiple peripherals to their laptop computers via a single cable linking the computer and docking station.

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

Dual Channel openGear Bidirectional Converter Card

Cobalt Digital's new Sapphire BIDI-2H2S converter card for openGear trays provides two channels of either HDMI-to-SDI or SDI-to-HDMI conversion, with each channel being independently configurable. Each conversion path is equipped with frame synchronization capability as well as full input and output audio crosspoints. Pre-path color correction is also available as an option.

Features of the new converter card include the ability to load and save custom card setting presets, instant "fallback" to original factory configuration, layered presets that allow changes to be invoked that are related to only a specific area such as audio routing, and remote control capability via the openGear DashBoard application or a dedicated remote control panel.

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

12G Routers

Blackmagic Design's three new Videohub 12G video routing switchers offer zero latency connection between sources and destinations, as well as a built-in front panel control of inputs and outputs. The new switchers are available in 10 x 10, 20 x 20, and 40 x 40 configurations and include an LCD display that displays both source labels and live from sources.

All three models feature reclocking of 12G SDI input signals, remote operation from Mac, Windows, and iPad devices running Videohub Master Control Pro and Smart Control Pro Software , Ethernet connectivity for operation from remote hardware- or software-based control panels, and labeling support for 13 popular languages.

For additional information, please visit Blackmagic Design at *www.blackmagicdesign.com*.

Cloud-Native Production Platform

Chyron's LIVE cloud-native production platform is ideal for sports production applications, as it provides users with an intuitive all-in-one user interface that's capable of switching as many as six video sources, as well as high-quality graphical overlays, creation of clips from live video sources, and instant replay (telestration). Also included is a built-in graphics package, a commentator mode of operation and a new MatchPad interface that specially designed for soccer match coverage applications.

The production platform's AI-based capabilities allow identification of significant plays and other events during a game and provides automated capture of game highlights. These AI-enabled features make it easy for a single operator to bring graphics, replays, multiple camera angles and other elements into a sports production. The LIVE platform is also accessible from almost anywhere, allowing multiple operators to collaborate as a team.

For additional information, please visit Chyron at *https://chyron.com*.

Hybrid IP Audio Monitoring

TSL's new MPA1-MIX-NET audio monitor provides a bridge between existing broadcast infrastructure and IP. The compact 1RU confidence monitoring and mixing device includes 1G AoIP connectivity that provides as many as 64 input channels, with an additional 64 channels available via an optional MADI small form-factor pluggable (SFP) input. The MPA1-MIX-NET also provides up to eight independent mixes and offers eight dedicated rotary controls for adjustment of source levels.

It features a front panel display of audio levels along with pan and balance information, acoustically-tuned loudspeaker, and two line-level analog balanced outputs.

For additional information, please visit TSL at *tslproducts.com*.

'Add-On' Functionality For PTZ Cameras

Canon U.S.A.'s new-developed "Add-On Applications System" for PTZ (pan/tilt/zoom) robotic cameras provides a number of new video production features and enhancements, features, including the ability to automatically track moving subjects and an "auto looping" function that allows users to program and automate repeated camera movements. The auto-tracking functionality is ideal for coverage of house of worship services and corporate event streaming, educational lectures, and corporate interviews, as it offers high-responsive full tracking of full body, upper torso, or head and torso movements of individuals.

The "Add-Ons" are available through a firmware update for Canon's model CR-N300, CR-N500, and CR-X300 PTZ cameras. Pricing and availability date information is available on the Canon website.

For additional information, please visit Canon U.S.A. at *www.usa.canon.com*.

Remote Production System

LiveU's new On-Site Production Solution provides an easy means for linkage of broadcast cameras to a production truck at sporting and other remote events. No cables or antennas are needed and there is no need for pre-sourced Internet access, as it utilizes bonded cellular linkage. System components consist of compact 5G 4K field units for transmitting video from multiple cameras and a mobile receiver that's located in the outside broadcast vehicle.

The On-Site Production Solution is simple to use, as it does not require complex and lengthy setups or navigation through remote venue IT protocols, and it taps Live Reliable Transport (LRT) technology to ensure low latency, high-quality and resilient connectivity.

For additional information, please visit LiveU at *www.liveu.tv*.

CALL FOR ABSTRACTS

June 30, 2023

BTS Graduate Student Workshop
September 7, 2023

IEEE Broadcast Technology Society's Education Committee is hosting the 2nd annual virtual BTS Graduate Workshop on September 7, 2023.

We invite Graduate Student members to present and highlight their work progress.

This workshop is a unique opportunity to share your ongoing work, receive feedback, and network with other student members and their supervisors.

Participation is open for BTS graduate student members and graduate students whose tutor is a BTS member and supports the submission.

Each student will be allotted 15 minutes to present the work.

All accepted presentations will be featured as a special article in one of the upcoming issues of the publication

IEEE Broadcast Technology.

Presenters will receive a certificate of participation.

This workshop is free of charge for BTS members.

Graduate students interested in participating must submit an abstract of at least 200 words.

Abstracts will be reviewed, and decisions made by the BTS Education Committee.

Click here to submit your Abstracts online

ABSTRACT DEADLINE June 30, 2023

BTS Education Committee Members

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Giuseppe Araniti
Pavlos Lazaridis
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Visit the BTS Resource Center

BTS PULSE Events Now Available for download

IEEE Broadcast Technology Society now offers a comprehensive on line Resource Center, providing a single location to access all available virtual content. The Resource Center is located on the home page of the BTS website, *resourcecenter.bts.ieee.org*. New content is added everyday.

The Resource Center houses the following virtual products by top industry experts, educators, innovators and influencer's;

- Webinars
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Visit today resourcecenter.bts.ieee.org

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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Broadcast Technology Publication
Editor James O'Neal

Best, Greg
gbconsulting54@gmail.com

Bouchard, Guy
Guy_Bouchard@ieee.org

DiLapi, Christine
cdilapi@allonscience.com

Fernandez, Marta
marta.fernandez@ehu.eus

Gomez_Barquero, David
dagobar@iteam.upv.es

Hayes, William T.
wt_hayes@ieee.org

Hirakawa, Shuji
shuji.hirakawa@ieee.org

Hogan, Ralph R.
rhogan@ieee.org

Husain, Samina
samina.h.husain@ieee.org

Luplow, Wayne
w.luplow@ieee.org

Murroni, Maurizio
murroni@diee.unica.it

O'Neal, James E.
BTSeditor@ieee.org
scm114@aol.com

Shulins, Paul
paulshulins@gmail.com

Siegler, Dave
david.siegler@outlook.com

Siebert, Peter
peter_siebert@ieee.org

Silliman, Thomas
tom@eriinc.com

Song, Jian
jsong@tsinghua.edu.cn

Stenberg, Jim
jim@jsengineer.com

Symes, Peter
p.d.symes@ieee.org

Weiss, S. Merrill
merrill@mwgrp.com

Weller, Robert
rweller@ieee.org

Wu, Yiyan
yiyan.wu@ieee.org

Zhang, Liang
liang.zhang.dr@ieee.org

Technical Community Program Specialist
Jennifer Barbato
Broadcast Technology Society
445 Hoes Lane
Piscataway, NJ USA 08854
tel: 732 562 3905
j.barbato@ieee.org
bt-pubs@ieee.org

Society Promotions & Marketing Program Manager
Margaux Toral
445 Hoes Lane
Piscataway, NJ 08854
tel: 732-981-3455
m.toral@ieee.org

Institute of Electrical and Electronics Engineers, Inc.
445 Hoes Lane
P.O. Box 1331
Piscataway, NJ 08854-1331

BTS Business

Web Site

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

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