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Ed Note

WELCOME TO THE third issue of *Church Sound* from the editors of *Live Sound International* and ProSoundWeb. As usual, you'll find that the focus is on both technical and non-technical topics.

For example, Andrew Stone gets things off to a great start with a discussion about "seeing the unseen" – in other words, anticipating problems before they occur, setting up processes to prevent avoidable mistakes, and so on. This is followed by an excellent overview from Mike Sessler with (experience-earned) ideas on presenting effective loudspeaker demonstrations for key church decision makers.

Also don't miss Chris Huff's helpful (and again, experience-earned) look at key things to keep handy in the live audio toolkit. Then there's veteran mix engineer Samantha Potter's keys to developing the "modern" church sound. I can go on and on, but you get the idea. The bottom line is that the path to success for folks working with audio at their churches involves both sides of the equation. Technical understanding is truly necessary, but that's only part of a bigger picture.

Also, and as always, I encourage you to take advantage of the Church Sound section of ProSoundWeb. There you'll find all of the articles from the first two editions of this publication in addition to more than 700 reference articles, free and available to anyone who visits, 24/7.

Further, expert advice regarding all aspects of church tech can be had by visiting the Church Sound forum on PSW. And on top of all that, many of our authors, who collectively bring more than 125 years of relevant experience to the table, also run blogs/websites devoted to sound for worship, and I encourage you to visit them as well.

I hope you enjoy and benefit from this third edition of *Church Sound*, and please don't hesitate to contact me with your thoughts and ideas via my e-mail address.

Keith Clark
Editor-in-Chief
LiveSound Internation/ProSoundWeb/Church Sound
kclark@livesoundint.com

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SEPTEMBER 2016

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111 Speen Street, Suite 200, Framingham, MA 01701
800.375.8015 | *www.livesoundint.com*

PUBLISHER Kevin McPherson, kmcpherson@ehpub.com

EDITOR-IN-CHIEF Keith Clark, kclark@livesoundint.com

SENIOR EDITOR M. Erik Matlock, ematlock@livesoundint.com

SENIOR CONTRIBUTING EDITOR Craig Leerman
cleerman@livesoundint.com

ART DIRECTOR Katie Stockham, kstockham@ehpub.com

CONTRIBUTORS Samantha Potter, Andrew Stone, Bruce Badger, Chris Huff, John Mills, Gary Zandstra, Mike Sessler, Mike Sokol, Curt Taipale

ProSoundWeb.com

EDITOR-IN-CHIEF Keith Clark, kclark@prosoundweb.com

SENIOR EDITOR M. Erik Matlock, ematlock@livesoundint.com

PRODUCT SPECIALIST Craig Leerman,
cleerman@prosoundweb.com

WEBMASTER Guy Caiola, gcaiola@ehpub.com

ASSOCIATE PUBLISHER Jeffrey Turner
jturner@livesoundint.com | 415.455.8301 | Fax: 801.640.1731

ASSOCIATE PUBLISHER ONLINE Mark Shemet
mshemet@prosoundweb.com | 603.532.4608 | Fax: 603.532.5855

AD PRODUCTION DIRECTOR Manuela Rosengard
mrosengard@ehpub.com | 508.663.1500 x226

AD PRODUCTION MANAGER Jason Litchfield
jlitchfield@ehpub.com | 508.663.1500 x252

JUNIOR PRODUCTION DESIGNER Amanda Winitzer
awinitzer@ehpub.com | 508.663.1500 x478

Circulation and Customer Service inquiries should be made to:
Live Sound Customer Service
EH PUBLISHING
Phone: 800-375-8015, ext 294
(Outside the U.S.: 508.663.1500 x294)
Fax: 508.663.1599
customerservice@livesoundint.com
111 Speen Street, Suite 200
Framingham, MA 01701

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On The Cover:
A new VUE Audiotechnik array and loudspeakers recently deployed at First Baptist Church Hendersonville in Tennessee, joined by church media team members (left to right) Chris Forte, Ben Swaby, John Hogan and Taylor Vlarik. (Photo by Chris Demonbreun)

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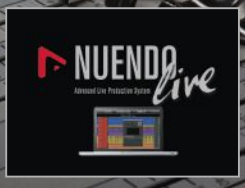

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THE POWER OF THE UNSEEN

Excelling at the invisible helps in building visible quality. ***by Andrew Stone***

In the world of live production, most have come to rely on their obvious senses when analyzing what's going on: How does the audio sound? Aren't the lights beautiful? Is the video style enhancing the vibe onstage? How does this song make me feel?

Although it's certainly gratifying and perhaps even fun to determine our success based on these mostly visible senses, I contend that the invisible side (read unseen), is far more important, and perhaps one of the most ignored. For me, this invisible side is comprised of systems, processes, maintenance, equipment, skillsets, and even attitude. These invisible elements are what comprise the basis for the visible, or tangible side, to come into existence in the first place.

We've spent many years at Church on the Move (COTM) establishing invisible procedures to deal with almost every situation we may encounter in a live production. Simple procedures; you know, like preparing for failure. Human, technical, act of God, whatever. But I thought we were supposed to avoid failure? How in the world does one prepare for failure when we're not supposed to fail? Become a fatalist? Adopt an overly morbid outlook? Not at all.

We've done it by staying cognizant of this one fact: Every single technician and every single piece of equipment *can* and *will* fail at some time. Although no one ever told me I wasn't allowed to fail, I've opted to spend our time developing ways to deal with failure accordingly. The crazy thing is that even though this is perhaps our biggest cornerstone tenant, it's completely invisible to almost everyone – because it's literally had to become a state of mind, not a tangible object.

FUNDAMENTAL MATTERS

Here's a good one: when mixing, how often does your audio engineer check a microphone before it goes live onstage? Our engineers do this more times than you can even imagine. I can't tell you how many times we've caught a problem and fixed it before anyone ever knew – all from exercising one of my obsessive compulsive habits of checking a mic a zillion times. And then checking it once more just to be safe. Again, a seemingly invisible system, but yet *so important* to the success of an event!

What about establishing paperwork to support your events? Input lists, stage plots, rigging plots, schedules? They might seem overkill or boring to some, but these can help relay pertinent information to how an event is going to function. Beyond that though, they create an invisible procedure that can set your team up for a win. A win that can be repeated consistently time and time again. All because someone took a few minutes to think through the plan thoroughly and commit it to paper. All that work and all those printed pages for a procedure that is completely invisible to the audience? You know it.

How about a gear maintenance schedule? This one is absolutely invisible – that is until something breaks… Taking time to routinely inspect your gear can allow you to find and fix a multitude of problems before they cause an interruption during an event. Numerous times, we've discovered potential failure points with gear that we were actively using and had "assumed" was working fine, all from employing a simple, boring, and *invisible* maintenance schedule.

PLANNING AHEAD

Here's another one: How neat and tidy are your spare parts and unused extra gear? Funny how quick this seemingly invisible part of the production world can become visible. I was at a church recently and couldn't find a working mic cable to

save my life. How they had working band inputs still baffles me. Implementing a plan to store and categorize unused gear sets you up to actually go with the flow when situations change unexpectedly.

Which of these would you rather do when a mic cable fails on stage: Walk calmly to the backstage storage closet, get another cable and switch it out and move on – or – race around, frantically tugging at a massive pile of old cables that were shoved underneath the audio console while praying to God to save you and hope that a decent cable magically appears? I'll be honest, at COTMProd, job longevity isn't often associated with the latter.

What about rigging? The mostly invisible world hanging above everyone's head comprised of shackles, span sets, chain hoists, cabling and the like. Is all of this equipment deployed correctly and safely for both stage personnel and talent as well as the audience in your room?

The crazy thing is that even though this is perhaps our biggest cornerstone tenant, it's completely invisible to almost everyone – because it's literally had to become a state of mind, not a tangible object.

Even though these parts are specifically designed to be remain invisible during an event, we still subject them to a very visible annual rigging inspection where every item is examined for strength, wear and tear, and safety compliance. Interestingly enough, *every* time we do this invisible task, we find something that would have eventually become a *very* visible problem if left unchecked.

So herein lies the simple point: excelling at the invisible side of what we do is one of the biggest ways we can build a quality visible side. As we serve the church and strive to make a difference, consider making the invisible parts of the job the most important and you may find that the visible side just got a heck of lot easier. CS

Andrew Stone *is the production manager and audio director at Church on the Move in Tulsa, OK. His 27 years of touring experience have brought a unique, and sometimes unorthodox, perspective to his approach towards production in the church. You can find him on Twitter (@stone_rocks), Instagram (cotmprod), and as a blog contributor on Seeds, COTM's free resource site (http://seeds.churchonthemove.com)*

THE GAME PLAN

Presenting a successful loudspeaker system demonstration.

by Mike Sessler

A few years back when I was the technical director at a church, we had the opportunity to demo a new loudspeaker system in our auditorium. The existing PA was not great; well let me rephrase that: It was a decent system that was completely wrong for the room while also being installed incorrectly.

Of the 12 boxes (six per side), eight were pointed at walls, not at people. That led to a highly reverberant sound field and minimal direct sound. Clarity was low, and we had to run music a lot louder than we should have to try to overcome the reverb.

I spent a lot of time thinking about how to demonstrate the benefits of a proper system to our church's leadership. I think this gets overlooked too often, and quite frankly, it's a flaw in our thinking. As humans, we naturally tend to think everyone is like us. It's a normal misconception. We assume that because we can obviously hear the difference between the old lousy-sounding PA and the new great-sounding one, that everyone else will be able to as well. The bad news: This ain't necessarily so.

PLAY MUSIC, BUT DON'T STOP THERE

Most loudspeaker demos I've been to consist of a select group of carefully chosen tracks that make the proposed system sound good. It's a valid test, but only for the engineers and musicians in the group. The average person will not likely be able to sort out the differences in loudspeakers – at least not on a conscious level.

We played music on both our existing system and the proposed one, and when I polled the audience, most said they really didn't hear much of a change. Yes, the new one sounded a little more clear, but it wasn't enough to make the sale.

One of the major issues in the room was comb filtering; in fact it was so bad that there were 12 to 18 dB variations between 2 to 4 kHz from seat to seat. I can hear the collective groan coming from you, who are informed readers. However, when I explained it to our leadership, here's what they heard: "Blah, blah, blah, 12-18 blah, blah, blah, blah…" It meant nothing to them, and thus needed to be demonstrated.

So we fired up some pink noise at a moderate level, played

it through the existing system, and I asked them to walk the room. Almost everyone could hear the sound changing dramatically as they walked down the center aisle and then over a row. In fact, I had them wobble back and forth along the center aisle only and could clearly see that most could hear what was happening.

Then when the pink noise was fed to the proposed PA, there was a collective response: "Ah, I get what you're saying. I don't understand it, but I can hear it." This was followed with an explanation of the implications of such varied listening experiences.

But even that wasn't enough. Simply pointing out a problem is generally not enough motivation for solving it. We have to dig deeper and find out what is causing pain for our leaders. And once we've identified the pain, it's time to provide a solution.

FIND THE PAIN POINTS

The message was the most important part of our services (not everyone's services, but it was the case with ours). And I knew speech in this room was terrible. But remember that

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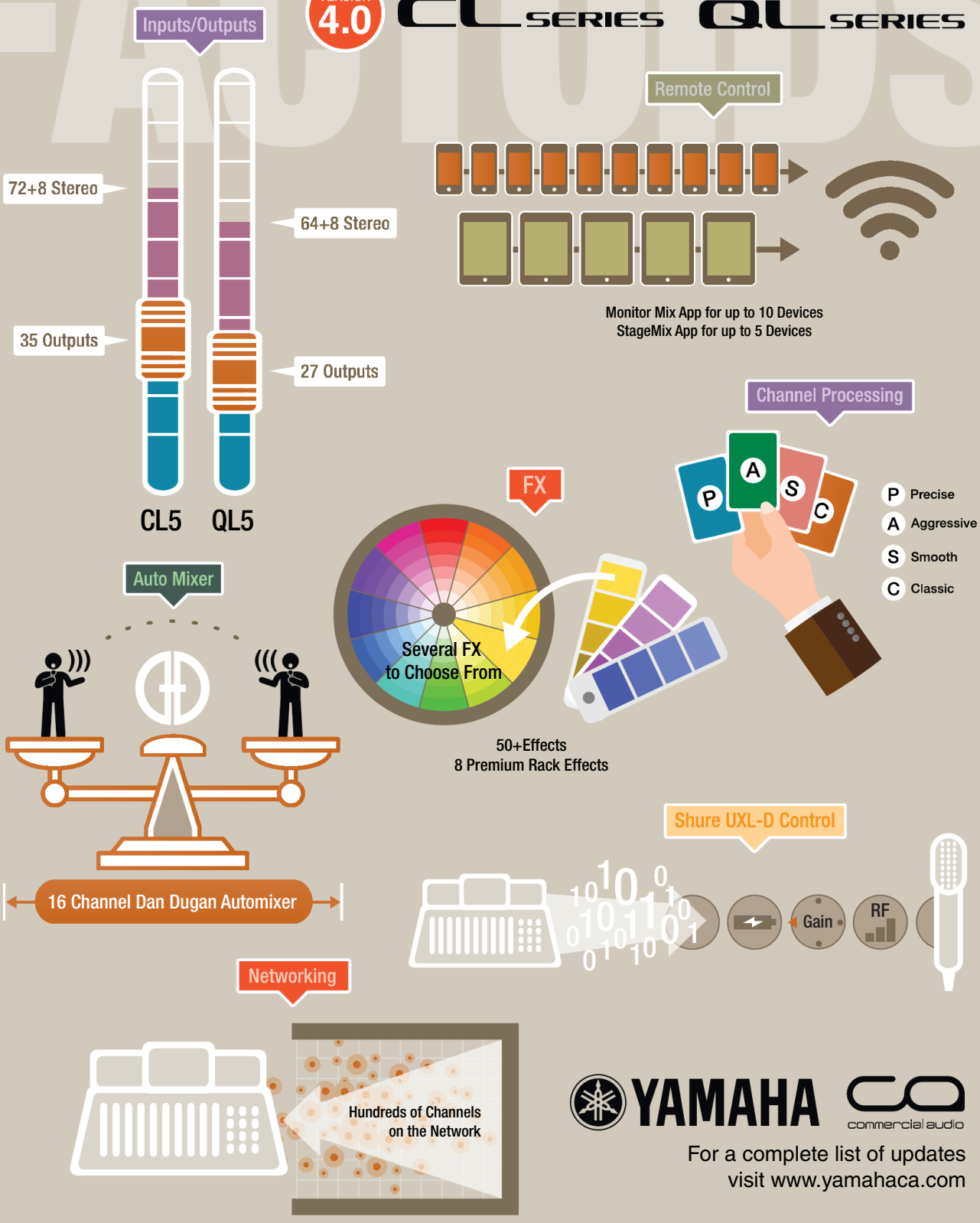

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almost everyone's point of reference is the room they're familiar with. They don't know any different and figure that's just how it is.

Of course, as people who are focused on sound, and some of us even trained as engineers, we can hear exactly what the problems are. But how do we explain it? Again, demonstrate.

So I played some tracks of our pastor teaching through the existing system, then switched to the proposed system. Because of the increased focus of his voice, there was another "Ah ha!" moment among them – you could almost see the room getting brighter as the light bulbs went on above their heads. But it still wasn't enough to make the sale.

I knew it was really hard for our pastor to preach in that room. He heard himself four times, which is exhausting. He may not have known it, but having to filter out that many reflections wears you out. I knew if we were going to have a chance at funding this project, he needed to be on board.

So I brought him to the platform, asked him to put on his microphone, and to begin speaking. We fed his message through the existing system and then switched to the demo rig. Within about six words, he stopped and said, "O.K., yeah, I hear that. That's a big difference. No wonder I'm so exhausted on Sundays!" He put it together on his own.

To be sure he understood, I explained what he was experiencing, and then added that it's just as exhausting for the congregation to have to filter out three extraneous copies of his voice over the course of 40 minutes. He definitely got that.

A proper system can help your church grow; leadership just needs help in understanding exactly why.

I also brought up the executive pastor, who sometimes did announcements. Even though he'd had three surgeries on his ears and therefore couldn't differentiate even with the previous demonstrations, when he spoke into the mic as I switched between systems, it took about four words before he said, "Oh, wow... I hear that. I didn't think I would, but I can really tell a difference." Finally, the light bulb had gone on for our least technical, least critical listener.

I then proceeded to work with some musicians to demonstrate what they needed to hear, and concluded by answering questions. Note the one question that didn't come up: "How much?" And that's just what I wanted.

It's best to have the proposed new loudspeaker system brought into your facility for demo purposes.

GETTING IT DONE

Understand that I'm not simply patting myself on the back here; all of the thought and work put into creating a demo that everyone would truly understand had paid off, and that's the point. In fact, each of our senior leaders thanked me for the time and effort, acknowledging that there was a significant difference. The new system was approved and it proved to be a *huge* upgrade.

So if you have the opportunity to do a loudspeaker demo, try to get the new system brought to your room for a direct A/B comparison while also figuring out what's needed so that the key decision makers will unequivocally hear the difference. They need to know it's not just complaints about some esoteric, subtle things that only the sound team can hear. A proper system can help your church grow; leadership just needs help in understanding exactly why. And it's our job to help them get it. CS

Mike Sessler *has been involved with church sound and live production for than 25 years, and is the author of the Church Tech Arts (churchtecharts.org) blog. Based in Nashville, he serves as project lead for CCI Solutions, which provides design-build production solutions for churches and other facilities.*

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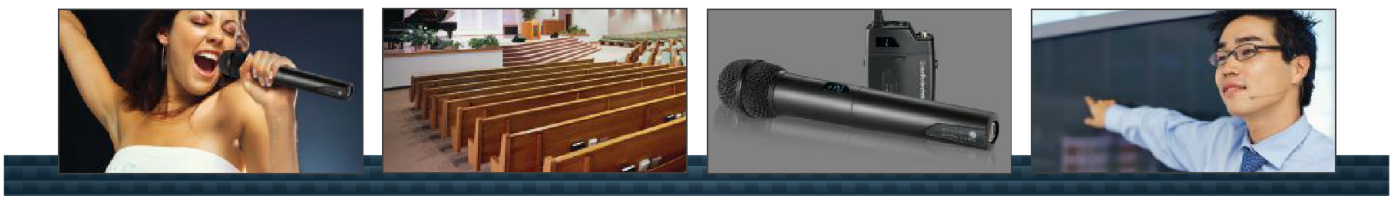

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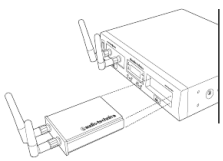

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NEVER-ENDING QUEST

The journey of church tech and AV integrator Tony Hill.

by M. Erik Matlock

Tony Hill at an Indianapolis church outfitted with a Behringer X32 console.

I first met Tony Hill while working with Chuck Colson's Prison Fellowship in the late 1990s. Not a typical "sound guy," he displayed a passion for the craft that seemed to fall second only to his passion for people. A minister in every sense of the word, with technical prowess to match.

Now the owner of AV systems firm Ears 2 Hear Audio in Indianapolis, he's never been content with his skill level, possessing a desire to continuously improve and move forward that's enabled him to branch out far beyond mixing Sunday morning worship services.

Originally, Hill entered the production world from the other side of the fence as a musician. From his high school marching and concert bands to years as a sax player, he developed his ears, always in search of better sound, within a bigger picture of a pursuit for quality in every endeavor.

MERGING INTERESTS

In the 1970s, Hill turned to recording as the next step in his development, purchasing an open reel 8-track tape recorder. "I went around offering to record bands for free," he notes. "I wanted to be better at it and used them for practice. They couldn't really complain about the quality since I wasn't charging them. It gave me an opportunity to practice and sometimes they got something good for free in return."

A bit later, his ministerial passions merged with his technical passions to serve within a local church. Like many other church techs who've found their place and calling, he began helping other ministries improve their events and services. And in that process of giving, he received even more in return.

"I was volunteering for the Billy Graham crusade in 1999, helping with the production team for the youth service," he explains. "It was there I met Bill Thrasher, the reverend's long-time front of house engineer. We became friends, and he became a mentor to me. To this day, I can call up Bill and pick his brain whenever I need some direction."

The affiliation with the Graham crusade led Hill to Colson's Prison Fellowship, with Capital AV of Washington D.C. managing the production for PF's Starting Line program, taking bands, singers, ministers, comedians and reformed ex-offenders inside the walls to encourage the inmates. Capital AV recruited sound techs from across the country for these events, with Hill proving a natural fit in that role.

"I had kept my day job (serving as a postal worker) and was working with PF on the weekends," he says. "By mid-2000, there was just too much going on and I had to make a choice. I told my wife I felt like I should leave the post office and go full-time with PF. She not only agreed, she told me that she felt like God told her that was coming a year earlier. So I made the change."

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A NEW DOOR OPENS

Hill and I were working together in September 2001, partnering with the Graham organization for a crusade running parallel with PF throughout California during the same week. But on September 11, everything changed.

As a result, our October dates were cancelled about a week before we were supposed to fly out. It was a hard season for all of us. The shock of everything that happened during that time basically put everyone's plans on hold and left everyone feeling uncertain as to what would happen next.

For Hill, it was especially devastating, having just given up his previous source of income to jump into production work full-time. However, not long after, he was contacted by pastor Ed Barnes of Spirit of Life Church in Indianapolis, who had a unique proposition.

"Basically, this pastor calls out of the blue and wants me to put together his new systems," Hill says, chuckling. "They had a small church and were building a larger one. We'd met before, but hadn't talked for about a year, and here he was on the phone, saying they were about to break ground and asking me to do all of the AV."

That opportunity not only locked in five years of consistent work, it enabled him to set things in motion that would eventually lead to opening a business of his own in the form of Ears2Hear Audio, based just outside of Indianapolis in Westfield, IN. And it also provided a platform to develop his skills in other areas, including acoustics, where he now holds a patent for a panel of his own design.

Hill at Lucas Oil Stadium in Indianapolis, where he's been involved in AV systems work.

"Pastor Barnes and the church not only paid for the equipment and installation, they paid me for the design time and even helped me get the patent for the custom acoustic panel design," Hill adds. "This is a church that really believes in being a blessing by blessing others. The relationship enabled me to build up my business by gaining additional training in sound and acoustics, in addition to working with their video systems."

WHAT'S HAPPENING NOW

To this day, the passion for a higher standard continues to push him farther into system design for churches needing the ability to grow. He offers some spe-

cific thoughts on the state of the house of worship market and the current technologies he views as game-changers.

"The digital console has transformed everything," Hill begins. "We don't need tons of gear and miles of copper wire to have a great system anymore. I can set up a system with only a Cat-5/Cat-6 cable and a small digital console that can do it all. All of the processing needed for most church sound systems is supplied in something as basic as a Behringer X32."

The latest wave of digital consoles also offers the opportunity for increased flexibility for growth and expansion, as well as improved performance with tighter budgets, he adds, pointing to in-ear monitoring, mobile device support, remote mixing, fully networked systems, and more. These advancements are, and will continue, enabling the local church to streamline processes, empower production abilities, and ultimately save money over the long run.

"With digital systems, I'm able to set up everything up and fine-tune it to the exact needs of a specific church," he says. "If there's an issue or an 'overly helpful volunteer' changing parameters, it can usually be fixed very quickly. In fact, most of the systems we're installing give us the ability to log in remotely and make changes as needed. That's a quick way to be a hero on a Sunday morning. It also saves time and money for simple changes without having to charge for a service call."

STAYING MINDFUL

Continuing our conversation, I asked Hill what he sees as the primary issue most churches face as a result of this technological development. "They're hurting themselves by not bringing in qualified technicians early in the process," he responds. "Just because there's a member of the congregation who knows something about sound doesn't make them qualified to design or install a system.

"Most volunteers aren't prepared to face the code and legal challenges if there's ever a problem," he continues. "Further, many churches don't understand the long-term commitment of investing in systems. It may be cheaper to do it yourself now, but what about a year from now?"

Just because there's a member of the congregation who knows something about sound doesn't make them qualified to design or install a system.

The changes have also altered the dynamic of tech staff and operators, he adds: "Digital consoles are computers. It's that simple. I find that the younger folks, the ones who have grown up with cell phones and computers, are much easier to train on new systems. But the older folks tend to have a better ear for mixing and a stronger work ethic. It's good to have both sides involved, as long as they remain aware that they need to perform as a team and work together."

It's just one insight in many that have been a long time in the making for Tony Hill, who after more than 40 years of work with audio, systems and music, remains on a never-ending quest to embrace technological changes and learn ever more. It's a quest many involved with church tech and production share, an unflinching pursuit of excellence. CS

Senior editor ***M. Erik Matlock*** *has worked in professional audio for more than 20 years in live, install, and recording, including time as a church tech and media director. Find out more about Ears2Hear Audio at* www.e2haudio.com.

SOLVING MYRIAD ISSUES

The advantages of earset and headworn microphones.

by Curt Taipale

A Countryman E6 earset microphone, providing high performance and low visibility.

Lapel (also commonly called lavalier) microphones have served churches and other audio applications admirably for decades. They've been a great tool and are often still preferred for a controlled sound environment like a video recording studio or TV newsroom. But for live sound applications, earset (a.k.a., earworn or headworn) mics have quickly found favor with church sound techs and pastors alike.

Think back with me for a moment. How did we start using lapel mics in the first place? And why do we need something better?

It began when churches grew to the size that they needed to amplify the pastor's voice so that all could hear the message. Early on, simply placing a mic at the podium allowed us to pick up the senior pastor as well as the song leader and others making announcements. But that didn't work very well for pastors who preferred to move around while delivering their message, so someone got the idea to strap a lanyard to a cabled mic that a pastor could hang around his neck.

It worked O.K., but of course was big and heavy and cumbersome. Manufacturers eventually developed smaller mics that could be clipped to a shirt, lapel or tie, but they were still connected to the sound system by a long cable. Wireless systems came along later, and in fact to this day some pastors prefer to use a cabled mic rather than risk the potential dropouts of going wireless.

ALL ABOUT THE GAIN

The lapel mic gave us a way to capture the natural sound of a pastor's voice with a device that's all but invisible. (Of course, the invisible part is not a technical issue, but often requested anyway.) So what's wrong with lapel mics?

Nothing, really. They do a reasonable job of achieving the desired goals and continue to be used today by several very high-profile pastors during live services. The downside the potential for problems with gain-before-feedback; that is, the voice can't be clearly heard due to other noise the mic is picking up. Turn up the gain on the mic, and everything it's picking up is amplified, not just the voice. And if the loudspeaker system and/or room acoustics are anything less than ideal, things can get even worse.

Further, when you watch a video of the message and compare that with the sound picked up by the lapel mic, you discover that each time the pastor turns his head away from the mic, the sound diminishes, often significantly. In other words, the level is inconsistent. Empirically, if you can't get a person's voice loud enough without putting the system into feedback, the cure is simply to either have the person talk louder and/or move the mic closer to the person's mouth (the source).

Some pastors simply aren't going to talk louder, no matter how often we remind them. So how could we move the lapel mic closer to the talker? We could encourage the pastor to position the mic higher on his tie. But place it too high and his chin shadows some of the high frequencies, making his voice sound muffled. He's probably not going to wear it in his hair, or attached to his eyeglasses. So where? Tape it to his cheek?

Actually, yes. The first time I saw this concept in use was during a theatrical performance of "The Phantom of the Opera" in New York City. The person playing the lead role had a miniature mic creatively placed on his cheek. Think about it. For years the sound techs in such productions would hide lapel mics in the hair, or in a hat or some other article of clothing that would position them closer to the mouths of the actors. Placing the mic on the cheek moved it to within an inch or two of the mouth. That was thinking out of the box.

IN WITH THE IN CROWD

O.K., perhaps your pastor isn't so dramatically inclined as to wear a mic taped to his cheek. So what else could solve the problem?

I know, do what Garth Brooks does! Strap a mic right in front of your mouth. Actually, there were a handful of early efforts at this concept, but Brooks – as well as Britney Spears and Janet Jackson – made the Crown CM311 an overnight success. It was big. It wasn't all that attractive. And it was hugely noticeable (good for Crown, not so good for the performer). But sonically, it worked great.

The key reason for the performance benefits of the CM311 is a "differoid" design. That unique approach makes it very effective at canceling other sounds (like rejecting the spill from stage monitors or picking up a clean vocal from a drummer while playing the drums). The result is very high gain-before-feedback. (Several years ago Crown was absorbed into the Harman group, with the remaining Crown mic models now offered through AKG.)

Subsequently, Countryman introduced the E6 "earset" mic, which started a revolution. It's not a differoid design like the CM311, but it's very small and very light while delivering very good gain-before-feedback. It allowed us to discretely place a high-quality miniature mic quite close to the sound source. Now, not only could we pick up the pastor's voice clearly and consistently with minimum feedback problems, but finally – finally – we could get the big solo during the drama to sound good without the actor having to grab a handheld mic.

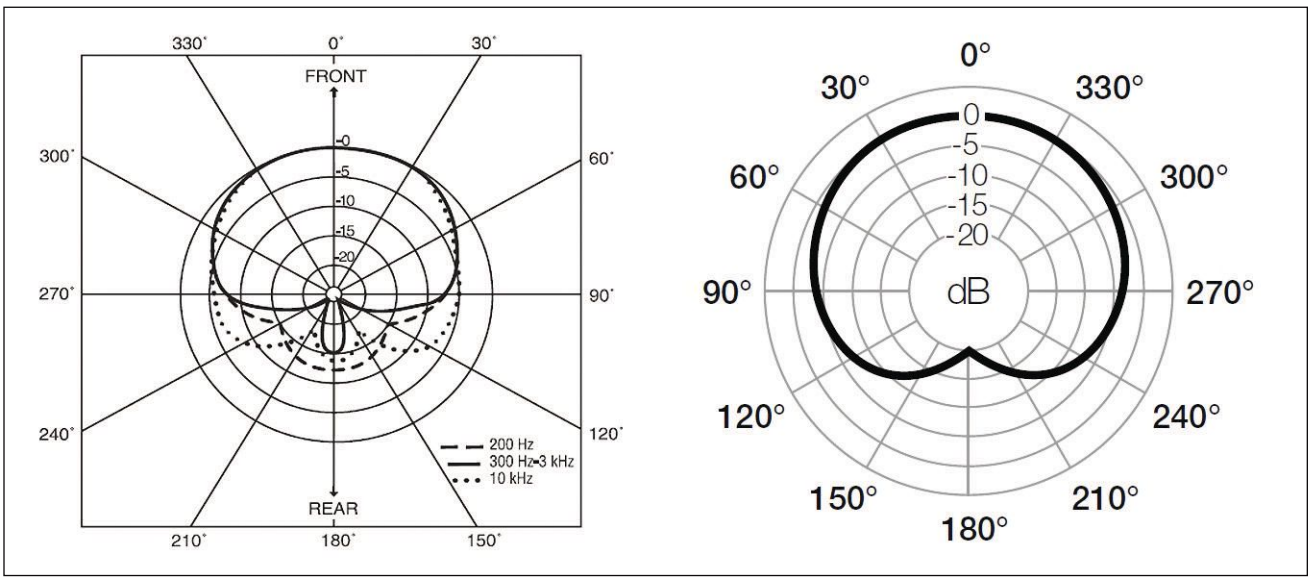
Garth Brooks outfitted with a Crown CM311, which he's still using for live shows after more than a decade.

ADDED CONTROL

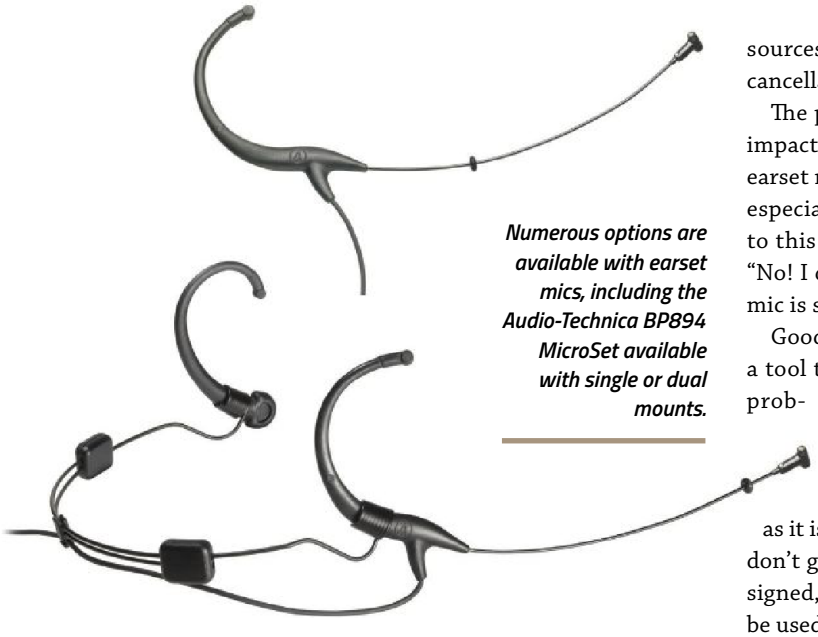
The first time I mixed the Dallas Christmas Festival at Prestonwood Baptist, I was delighted at how much control I had over the spoken drama parts and the sung vocal parts. We had E6 earsets on all of the actors with spoken parts or vocal solos.

In particular, there was a duet with Mary and Joseph singing towards each other.

Ordinarily with two actors wearing lapel mics and facing each other, either talking or singing a duet, I would have had to alternately turn off the mic that wasn't being used at the moment, constantly juggling the two parts, just to keep from hearing the interaction (phase cancellations) when both mics were open.



Polar patterns for two of the drivers of earset mic technology: AKG/Crown CM311 (left) and Countryman E6 (cardoid version at 1 kHz).



Numerous options are available with earset mics, including the Audio-Technica BP894 MicroSet available with single or dual mounts.

But by instead using earset mics on each of the actors, the amount of juggling – while still needed – isn't nearly as critical. In other words, putting earset mics on all of the actors doesn't make the phase cancellations disappear, but since the sound sources are so much closer to the mics, the amount of phase cancellations is significantly reduced.

The popularity of the CM311 had an unexpected negative impact on pastors when asked about the newer (far smaller) earset mics. They're now so tiny as to seem relatively invisible, especially from beyond about 30 feet from the platform. Yet to this day there are still pastors who will instantly cry out, "No! I don't want to look like Garth Brooks!" when an earset mic is suggested.

Goodness. Such fury over a seemingly simple request to use a tool that would immediately resolve the ongoing feedback problems. Shoot your sound techs in the foot, why don't you? It might hurt them less.

Of course, there are some who hold onto their love of the lapel mic. Actually, it's probably not so much love as it is disdain for how they'll look wearing an earset mic. And don't get me wrong; a high-quality lapel mic, fed to a well-designed, well-funded and properly installed sound system, can be used successfully without problems. But finding those three ingredients in many church sound systems isn't all that common.

The good news is that the pastors I've talked with who have embraced the earset mic tell me how wonderful the experience is for them, how they used to have to strain their

voice each time they preached, and how the earset has spared their vocal cords. Based on what we're hearing (pun intended), the popularity of these mics will simply continue to grow.

This also applies to headworn mics, which offer additional stability in placement.

The lines have blurred on this terminology, though. Manufacturers now seem to be settling on the term "earset" or "earworn" for a mic that clips around one ear, and the term "headworn" or "headset" for mics that clip around both ears.

ADVANTAGES & FACTORS

Regardless, it's not just the "new thing," but rather a tool that genuinely solves a myriad of technical issues that church sound techs have been chasing for years. It gives us a clean pickup of the pastor's voice, consistent sound character no matter how the talker moves their head, excellent gain-before-feedback, significantly reduced phase cancellation issues, and it's virtually invisible to most of the congregation. What's not to like?

Today, one can find earworn/headworn models from several different manufacturers, at retail prices varying from about $100 to $600. Most can also be wired to work with any major wireless microphone transmitter. Don't want to use wireless? Most models also connect via a standard mic cable. Further, some are available with an omnidirectional or cardioid pattern, and most can be ordered in tan, black or brown colors.

Finally, when comparing specifications of the mics, be sure to consider the maximum sound pressure level rating. Loud vocalists can distort in mics with a lower SPL rating. And make sure the mic comes with a detachable cable. If something is going to break, experience has shown that it will probably be the cable. So having a mic with an easily replaced cable is highly desirable. Otherwise, repair will involve sending the mic back to the manufacturer. CS

It's not just the "new thing," but rather a tool that genuinely solves a myriad of technical issues that church sound techs have been chasing for years.

Curt Taipale *of Taipale Media Systems heads up Church Soundcheck.com, a thriving community dedicated to helping technical worship personnel, as well as the Church Sound Boot Camp series of educational classes held regularly throughout the U.S.*

YOUR BEST FRIEND

Don't overlook the impact of high-pass filtering in your mixes.

by John Mills

A high-pass filter, or HPF, is exactly as it sounds. It's a filter on mixing consoles that allows only the higher frequencies pass. Sometimes it's also referred to as a low-cut filter for a similar reason, but whatever you call it, it's frequently the most overlooked tool in the sound engineer's arsenal.

Where It's Found. Some consoles/mixers are equipped with only a high-pass switch, which is fixed at a certain frequency, usually 80 or 100 Hz. Higher-end consoles include the most amazingly useful type — the coveted golden ticket, the end-all-be-all — the "variable high-pass filter."

The variable HPF is even more useful because it allows changing the frequency where the cut-off begins, or more importantly, where the lows no longer muddy up the bottom of the mix. But rest assured, I have a little trick those of you not yet blessed with a variable HPF.

Why We Need It. Well, simply put, the more low frequencies allowed into a mix, the more muddy or unintelligible it usually is.

For example, consider a violin. For the most part, the sound of this instrument is made up of mostly mid and high frequencies. So if we have four microphones on our violin section, we[re probably picking up a good deal of low-frequency content from the timpani, bass guitar, kick drum, and so on. The problem is that the leakage from the other instruments into our violin mics is out of time with any of the close mics on the low frequency instruments.

A brief trip back to physics class: Sound is made up of waves, waves take time to move through air, and low-frequency waves are longer than high-frequency waves. So if one mic hears two sound sources arriving at the mic at different times, the waves are out of sync. And when that happens, there are cancellations and/or additions. Therefore it's best to not have multiple mics picking up multiple instruments, especially if they have the same frequency content but are different distances from the source.

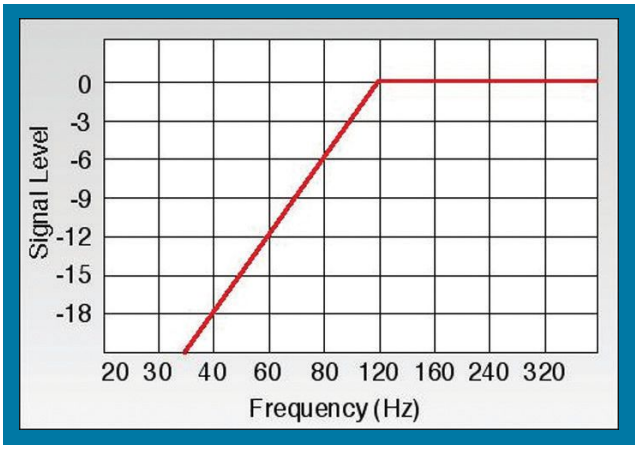
High-pass filtering built into a Yamaha MG Series console.

As noted, if the violin mics are picking up the bass guitar, it's safe to say that the low-frequency leakage of the bass into those mics is not "in time" with the actual bass input. This will result in some of the bass guitar sound being compromised because of the out of time (or out of phase) leakage into the violin mics.

What Do I Do With It? If you're lucky enough to have a variable HPF, the trick is to engage it, and (continuing with our example) while listening to the violins play, sweep their HPFs up until their lower notes can be heard to change. At that point, back it off just a little bit, and know that the bass guitar leakage has been eliminated from the violin channels.

Do you follow? By making the HPF higher, but not so high it altered the low notes of the violin, we've effectively eliminated any lower frequencies from leaking into those inputs and ultimately into our mix.

What If There's No Variable HPF Or There's Just A Fixed Frequency One? I



CREDIT: MIKE SESSLER, CHURCH TECH ARTS

An example of an HPF with a threshold frequency of 120 Hz, and a slope of 12 dB per octave (that is, at the frequency 1 octave below the threshold—60 Hz—the level will have been reduced by 12 dB).

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wish we all had unlimited budgets to buy the consoles that have this feature. But they can be expensive, and sadly, I know how that one goes.

But here's how to work around the limitation. Almost all consoles/mixers have at least an HPF switch that can be engaged. So engage it on all channels except for things like kick drum, bass, CD, video, and anything else that has the potential to make really low notes.

Next, use the low EQ facilities of the mixer to emulate what's done with a variable HPF. The low EQ knob on most of the consoles/mixers in this class provide what is called a shelving filter, which means everything below that frequency is attenuated similarly. So even though you can't sweep it up to hear the low notes cut off, you can still clean up a little more low-frequency leakage by adjusting this EQ knob down.

The approach is even similar to the variable HPF process. Listen to the instrument and have the musician play some of its lower notes. Turn down the low EQ until you hear a substantial change in the sound of the low notes. Then turn it back up just a notch. You've now cleaned up any leakage from those mics similar to how the folks with the variable HPFs are able to.

Why It Cleans Things Up. Actually, the issue isn't just about leakage; it's also about finding holes in the mix for instruments. If an acoustic guitar is to be placed in a contemporary mix with electric guitar, bass, and keys, then the low frequencies of the acoustic aren't really necessary.

That's not to say it should sound like a swarm of bees, but the bass and electric guitars are certainly more capable of providing low frequencies. So if the acoustic is also taking up that range in the mix, it is very likely that section of the frequency spectrum will easily get clogged up.

How Does It Help The System's Amplifiers And Loudspeakers? These components in our systems pretty much do what we tell them to do. So if there's a sloppy low and low mid section in the mix, they will reproduce it just as we mix it.

However, if we clean up the mix by eliminating conflicting and extraneous low and often low-mid frequency content, we not only get a cleaner mix, we actually allow our amplifiers and loudspeakers to run more efficiently since we're not asking them to reproduce content that isn't necessary. CS

A 20-year veteran of working live sound everywhere from churches to top touring artists such as Kenny Chesney, ***John Mills*** *is now the education & development manager for Morris Integration in Nashville.*

THE CAPABILITY QUESTION

Helping drummers understand their roll within the band and in worship.

by Bruce Badger

When mixing live church praise and worship bands, or any other band for that matter, it's the seasoned, tasteful and professional musicians that always make the sound tech's job easy and rewarding.

Their musical talents can enhance the entire worship set and they can make the sound tech's craft really look good to boot! A capable church musician who plays with feeling, self-awareness and controlled dynamics, not only enhances the worship experience for the entire church but also makes the sound tech's job far less stressful, and even at times, a pleasurable experience for sure.

On the other hand, a musician without control, feeling, or with limited self awareness can certainly diminish and even harm the overall worship band's contribution to a church service. These less experienced musicians may force the sound tech to have to "babysit" and fight to control the player's "donation" to the cause.

Many times techs need to over-compress/limit their signals, constantly "ride" their faders through the whole set, or just send them to the back of the mix. Moreover, when managing a busy or inexperienced player, the overall mix can suffer, i.e., taking away the sound tech's ability to focus on other instruments or vocals impacting the overall sound.

Enter church drummers… God love 'em. They have wonderful "A" personalities, and are typically high in energy, passion, drive and exuberance. However, that same energy and personality, when channeled through their instrument, can either add a spark and interject life into a song, or blow-up, derail or kill the flow of the music and Spirit in the music set.

Percussion instruments are powerful and the foundation of most songs; they can move a crowd and drive the energy of a service in a positive way or completely tangle up a moment. They're like TNT – the power can be strategically utilized for good purposes or just used to make a huge mess.

When drumming styles include bombastic eruptions, over the top, complicated drum fills, every snare hit a rim shot, loud bass drum beats during soft passages, or misplaced fills and accents, there can be real tension and distraction "in the house." Something has to give.

ANY GIVEN SUNDAY

I remember a time when during the music worship portion of the church service I was attending, all was really going quite well. An energetic song, well-inspired lyrics and a great arrangement were all clicking together. The congregation, along with me, seemed to be connecting with the song, the lyrical message, and the Spirit of worship in that moment.

However, all of a sudden, about halfway through one of the verses, the drummer cut loose into a fill with what I can only describe as an 8- to 12-count "eruption." He launched a very busy bass drum and tom spasm that sounded like the grand finale at a 4th of July fireworks show. While he certainly believed he was enhancing the moment, I (and possibly many others in that service), were instantly distracted away from the worship mindset.

The flow of the worship was somewhat derailed, at least for a moment or two. If a professional session drummer contributed a fill like that during a recording session, he or she would probably receive a quick "pack your stuff up – don't call us, we'll call you" moment.

I love the passion, energy and exuberance of church percussionists, but when their craft is not focused and controlled, the flow of the moment will soon be quenched.

In the same vein, at the end of many

church services, there's typically an altar call where people come forward to pray or reflect upon the sermon they just heard. Most times, the music starts off softly and gracefully for this part of the service. The music is designed to flow in like a misty fog, slowly building as people are processing and reflecting.

I can remember a time when I was at the altar feeling moved by the service, deep in prayer or reflection, when all of a sudden, a strong bass drum hit – through a hot open channel into a dual 18-inch subwoofer – went off like a cannon fired out of nowhere. BOOM, BOOM, BOOM… BOOM, BOOM, BOOM… The bubble was popped. Once I regained my composure, I thought, "Wow, where did that come from? Now, where was I? Oops…" I lost the thought or prayer – and just went back to my seat.

Albeit innocent in intent, the drummer did not have the self awareness to play a part that flowed with the moment. Light brush work on a tom may have been a far better way to ease into the song. Again, if this happened in a pro recording studio, a session drummer would have probably been directed to the exit sign. However, in the church, we don't direct anyone towards the exit sign; we must love, lead, mentor, and develop these important church musicians.

MENTORSHIP 101

As sound tech leaders, we're ultimately responsible for the audio quality of the service; to that end, we may also need to be proactive and mentor our musicians, both young and old. The process really is not that difficult – just a little investment in people is required.

Start with music directors – they have a lot to be thinking about during the service and may not even be aware of the opportunity for improvement in the percussion section. Offer to help mentor and get their blessing to proceed.

Then sponsor a few sessions with your drummers listening to music. Find some pro recordings where the drums and bass are really tight. Point out that most pro recordings have direct and precise drumming with very limited fills. Discuss with the group what "play like the record" really means. Ask them what, from each recording, they would like to incorporate into their own unique styles.

Help them to develop an appreciation of the "less is more" formula for success. Positive change will come; not overnight, but it will come.

Also, if possible, take them to a few popular Christian artist concerts and have them take notice of the location and the number of fills per song, the tightness between the bass guitar and the drums, and how the drumming energy rises and falls along with the dynamic energy level of the song, and so on.

Reinforce the message of the pros such as: "It's not the notes you play, it's the notes you don't play" (Miles Davis, 1926 – 1991). Help them to understand that the best live drummers out there are those who play the same live as if they were in the studio. When these concepts are understood and employed by the drummer, you'll be amazed how much the quality of the worship band, the worship experience and the mix all improve so dramatically!

Contrary to common logic, when playing clean, simple, and tight drumming in church, it may seem like nobody "will notice" the drummer, but on the contrary, it won't be long before everyone starts noticing. These are the drummers that get the call to play at regional events, youth rallies, conferences, and large community outreach events, and ultimately, they're also the musicians that get the call when recording projects begin.

In conclusion, we as sound techs wear many hats in our service to the church, but few things are as rewarding as mixing the worship set with quality musicianship, knowing that we had an active role in someone's growth and development in their craft as we grow and develop in ours.

Oh, by the way, if you know any Nashville session drummers, please invite them to church – we can use all we can get! CS

Discuss with the group what "play like the record" really means.

Bruce Badger *has worked in church media ministry since some time around the days of Moses. He is currently the general manager of iPRO AVL (Audio Visual & Lighting), a church AV integration team based in Chicago. He is also a church drummer.*

DESK ESSENTIALS

A primer on mixing console form and function. *by Craig Leerman*

A Lawo mc²36 digital console (top) and Yamaha PM5000 analog console offer an interesting contrast in large desks, yet in terms of mix capabilities, many of the functions remain the same.

At the heart of a sound reinforcement system is the mixing console, handling the routing, gain adjustments, balancing between inputs, EQ, and possibly some processing of the audio as well.

When it's a large analog console, invariably at least one person walks up to us at a gig to ask, "Do you know what all those knobs do?" Recently while freelancing a show outfitted with an unfamiliar digital board, I had to ask another audio tech for help in finding a parameter adjustment in the vast menu. "I know what all the knobs do," I explained. "I just don't know where in the menu to find them!"

While some older techs (like me) might get lost in the layers of digital, some younger techs get lost on the basic principles of consoles. Analog boards are a little easier to figure out because every adjustment had a dedicated knob, switch or fader. Learn one channel strip and one master output strip and you pretty much know the entire console. Digital consoles may have hidden features, such as a master aux pre/post switch I was looking for the other day along with additional processing like graphic EQs or FX units that can be "plugged in" and inserted where needed.

GETTING STARTED

Let's go through typical console routing, beginning at the channels. Input channels have a preamp and the volume adjustment on the preamp is usually labeled "gain" or "trim." This allows setting the input gain into the console for different microphone or line level sources.

Setting the gain too low sacrifices headroom in the console and increases the noise floor. Set it too high and the signal can overload, causing distortion. There may be an indicator LED or meter on the channel that can be used to set input gain. If not, solo the channel and use the main meters to get a good level. Most consoles include a pad switch that will reduce the level of a "hot" audio signal in this quest.

Condenser and tube mics – and some DI (direct) boxes – require phantom power to operate, and larger consoles may include individual channel switches to supply it. Smaller or older boards may offer phantom power for groups of channels, or even the entire console. Make sure phantom power is off when plugging in mics and DIs or the resulting "pop" could damage the mics as well as loudspeaker drivers.

Larger consoles incorporate a polarity switch for input channels. This may be labeled "flip" or marked as a "phase" switch. Let's go over the basics. A positive sound pressure on a mic should produce a positive voltage down the cable into the console. If you flip or invert an audio signal and add it back to the original non-inverted signal, there's disruptive cancellation in the signal.

A common example is a mic positioned above a snare drum – the first hit moves the drum head away from the mic, causing a negative pressure wave, but as the head rebounds back, it causes a positive pressure wave. Position a mic beneath the snare and the first hit causes both top and bottom drum heads to go toward the bottom mic, causing a positive pressure wave at the mic's diaphragm. Use both mics at the same time and some of the sound will cancel each other out. Reverse the bottom mic's polarity and a more rounded sound is captured.

Another use of a polarity switch can be with two kick drum mics or a trick that I use with a kick drum mic and a loud drum monitor. With the kick mic placed inside the drum shell, when the beater strikes, it produces a positive polarity, with the woofer in the drum monitor moving forward to reproduce the positive polarity signal.

But in reality, the drum head is moving away from the drummer, so the loudspeaker and drum head are moving out of polarity with each other. Flipping the polarity on the mic or loudspeaker box produces a more full kick sound at the drummer, usually enough to stop them from asking for more monitor volume (always a good thing in terms of feedback and in general).

Many consoles include direct output jacks and channel inserts for each channel. The direct outputs can be used to feed another console like a monitor desk or recording board, or they can be used to feed a multi-track recorder directly. Insert jacks are used to "loop" a processor into the signal chain. These are still popular on analog desks that don't have tons of processing on every channel.

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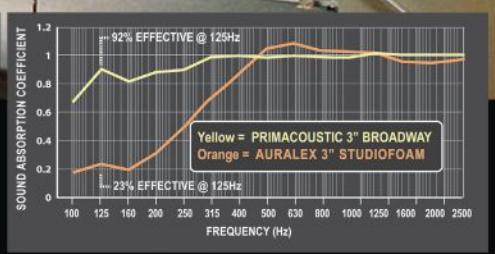

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The insert is usually a 1/4-inch TRS (Tip/Ring/Sleeve conductor) and a special insert cable that breaks out the TRS into two regular 1/4-inch plugs. One plug is connected to the Tip and is the send, while the other plug is connected to the Ring and is the return. Processing such as a compression, reverb, and delay units can be inserted into a channel, and the effects are then applied to only that input.

FINE TUNING

The next stop for the audio signal in a channel is usually the EQ section. This can be as simple as a bass and treble control with fixed center frequencies, or a multi-channel parametric EQ section that enables the user to choose a center frequency, boost or cut that frequency, and adjust the width of the boost or cut with a control often labeled "Q" or "Bandwidth."

Both larger analog and digital consoles may also offer pass filters, which pass audio above or below the selected frequency and roll off everything on the other side of the frequency. High-pass filters are great for removing low-end stage rumble that finds its way into vocal mics as well as for any low end sounds you don't want mics (i.e., drum overheads) to pick up and amplify.

Equalizing (EQing) an instrument or voice is usually a matter of taste, but there are a few tricks that I've found over the years that can help get a better sound out of the PA. The first is to remove stuff that does not need to be amplified, like the aforementioned rolling off of the low end of vocal mics with a high-pass filter. However, I don't stop there, also electing to get rid of the ultra-high end of many things onstage.

For example, I just mixed an Oktoberfest with a band that used a tuba for the bass parts. I know that a tuba does not reproduce harmonics past 4 to 6 kHz, so I rolled off everything above 6 kHz to eliminate the tuba mic from picking up the adjacent cymbals.

Another thing that EQ can be used for is making similar instruments sound slightly different so they can be better distinguished in the mix. Take two guitarists onstage, for instance. They might be playing similar guitars, amps, and even the same chords, so they're likely to sound pretty much the same in the PA. EQ each guitar a bit differently and there will be definition of each in the mix (and PA). They'll still sound like guitars, just not like each other.

Analog-style channel strip control on the new Allen & Heath GLD-80 Chrome Edition.

In the digital age, some functionality has moved to screens, as evidenced by the DiGiCo SD21.

Sometimes it's tough to exactly identify an offending frequency that is making something sound wrong. Working with parametric EQ during setup and/or sound check can help. Boost the signal with a very narrow bandwidth and sweep it around until the problem sounds even worse. Now that the problem frequency has been found, cut it until things sound better.

SUPPLEMENTAL FACILITIES

The subsequent destination is usually the auxiliary sends, referred to as aux sends or "auxes." Equipped with volume knobs, they can send the audio signal to a separate output. Depending on the console, some may be configured as pre fader (the channel fader), some as post fader, and some may have a pre/post switch to allow the user to configure the send as needed. Some consoles also allow users to configure the sends as pre EQ and post EQ, giving the user the option to have the channel EQ affect the send.

Normally, pre fader sends are used for stage monitors and feeds for recording, while post fader sends are commonly used to send a signal to effects processing like reverb and delay units, or to provide audio feeds at different locations. Most small consoles have mono aux send, larger consoles may offer stereo sends, complete with a pan control.

Some consoles may label some auxiliaries as FX or effects sends because they're intended for use with outboard processing and are configured post fader. Other boards may offer dedicated FX sends that feed the internal effects processing units.

Auxes are quite useful and may be used for feeding monitor mixes, recording feeds or sending audio to delay, fill, and subwoofer loudspeakers. Aux fed subwoofers are a very popular way of reducing low-end problems in sound systems. A typical PA system usually includes full range boxes and subs, with a crossover splitting the signal between the two. An open mic onstage can pick up low-end rumble, and this will be sent to both the tops and subs in the system. Hard "plosive" consonants from vocalists will also be sent to the subs, and all of this adds up to unwanted energy in the room.

Using a post fader (and usually post EQ) aux, only the chan-

nels that the engineer wants in the subs (such as kick drum, floor tom, bass guitar, low speaker on a Leslie, etc.) get sent to the subs. That open mic picking up low end rumble won't send the mush to the subs unless the engineer routs that signal with the channel aux send. Vocal plosives are reduced as well, with the subs only reproducing what is desired, not whatever leaks in.

ADDITIONAL CONTROL

Now we're moving along the channel strip to the pan control and group assignments. On a basic console, the pan control will route audio to both the left and right main outputs evenly when it's set in the center. Turning the knob to the left or right sends more audio in the direction of the turn and less to the other side.

The pan pot is my best friend at corporate gigs. A typical gig has full-range loudspeakers on stands to each side of the stage or by the walls of the room. The lectern is usually located off to one side of the stage, way closer to one of the loudspeakers. While I can ring out the mains to reduce the susceptibility of feedback, one of my basic approaches is to simply pan the lectern and presenter mics toward the loudspeaker that's further away. In smaller rooms, the audience still hears everything just fine, while the threat of feedback has been reduced.

Consoles with submaster groups offer group selection buttons near the pan knob. When groups are selected, the pan control will route the audio to the odd or even numbered groups, depending on the position of the knob. In the master section, the subgroups can then route the audio to the main left and right outputs or send the audio to independent group outputs.

Submasters are useful for grouping like instruments together, such as drums and guitars, providing an easy way to manage their volume. Submasters are also useful in setting up mixes for recording or sends to remote loudspeakers. You can also apply Processing such as reverb or compression can also be applied to a submaster group, giving, say, all background vocals the same verb by using the submaster insert points.

Solo and PFL buttons allow listening to a particular channel by itself or along with other soloed channels. PFL stands for Pre Fade Listen and as the name implies, you hear the channel before the fader. Solo (or less commonly called AFL or After Fade Listen) will take the channel's fader position into account, but many consoles label the PFL as solo.

Some consoles offer "mute" buttons while others offer "on" buttons, and they basically do the same thing in an opposite way. Engaging the mute button silences the channel (or sub-master or mains) that its assigned to. Pushing an on button unmutes the channel.

Larger consoles also have mute groups, which allow the user to assign different inputs and outputs to various groups and recall the mute settings at the touch of a single button. This comes in very handy if there are different musicians or different actors appearing onstage at various times. I used mute groups a lot when I mixed musical theater, placing all of the chorus mics on one group, and various actors on different groups. As the play went on, I would unmute groups of mics with the touch of a single button and not miss a beat.

The Yamaha TF1, a relatively recent introduction, provides a wealth of capability and options in a compact footprint.

REMOTE CONTROL

Our last stop along the chain is the channel fader that controls the master volume for the channel, and it affects all of the audio except pre fader sends. Larger analog and most digital consoles offer VCAs (Voltage Controlled Amplifiers), which are also called DCAs (Digital Controlled Amplifiers) in some digital models.

These controllers don't pass audio but instead remotely control the position of the channel faders. Submasters are great for grouping channels, but every time a channel is added to a subgroup, another gain stage is added, and every time a channel is added to more than one subgroup, there's an increase in volume.

VCAs work differently in that they remotely control just the channel's fader position, and more than one VCA can be assigned to the same channel. The user can group drums, drums and bass, entire band, and entire band with vocals on four different VCAs without adding any gain to the signal while also putting a large number of channel volumes under one finger. On digital consoles that have hidden channel layers, this is a great way to bring groups of inputs to a single layer.

Digital boards may offer additional processing like compression, noise gates, or even audio delay to a channel, as well as the ability to patch in additional processing. But no matter the size or style of console, the basics always remain the same, and by understanding the basics, you can usually get through a gig even if you're unfamiliar with the desk. CS

*Senior contributing editor **Craig Leerman** is the owner of Tech Works, a production company based in Las Vegas.*

THAT MODERN CHURCH SOUND

Tips for dialing it in, instrument by instrument.

by Samantha Potter

I've been to my fair share of church services, and more than my fair share of contemporary/modern church services. Some of the mixes I hear are fantastic! Some of them, however, are less than stellar.

I'd like to think I know it all, but know enough to understand that's completely not true. Certain mixes hit my ear different than others, and that's O.K. All I can offer is what I believe to be that modern, pop-y Christian mix. I need to say that my mixes are heavily influenced by gospel and R&B because these are the genres of music that I typically work with and listen to recreationally outside of the church.

VOCALS

Man oh man, can these things get buried. Vocals are the number one priority in all of music. If I can't understand your vocals, you're losing the entire message of the song. I understand that things happen, but this is a no-no for me. They should fit right on top, right in between any melody-carrying instruments.

I tend to cut out a lot of low end. Perhaps a lot more than others, but it's necessary to make plenty of space for instruments whose fundamental frequencies reside below 500 Hz. So I place a high-pass filter (HPF) at about 150 Hz and do a low-end cut at about 500 Hz to get rid of any boxiness.

I've also noticed I like the sound of a "notch-out" at about 1 kHz. In recent months I'm finding more and more "throatiness" in some of my vocalists and people speaking, likely because of the hot and humid weather we have in the Midwest. I find it fun to try opening it up a bit. Business first, though, as any problem frequencies get ousted, with attention also on the octaves just below and just above them.

GUITARS

I love a robust guitar sound, but what I don't love is over-amplification of electric guitars. There's a time and a place (read: solo) for strong loud guitars, but I don't consider it in contemporary Christian music. (I can already hear the crowds boo. I regret nothing.)

Now, if it's a pleasant acoustic guitar, go ahead and let it take center stage (aside from vocals – never, ever push the vocals away.) I like my acoustic guitars with just a little "meat" at around 250 to 300 Hz, and plenty of sparkly high end without getting too much fret noise. Once I notice the fret noise is really prevalent, I can't un-hear it.

The low end of guitars can tend to be a little tedious as I'm balancing it with the rest of the low end. I usually end up cutting at 400 or 500 Hz while still trying to keep that previously mentioned beef at 250 Hz. This is all a balancing act you may be familiar with.

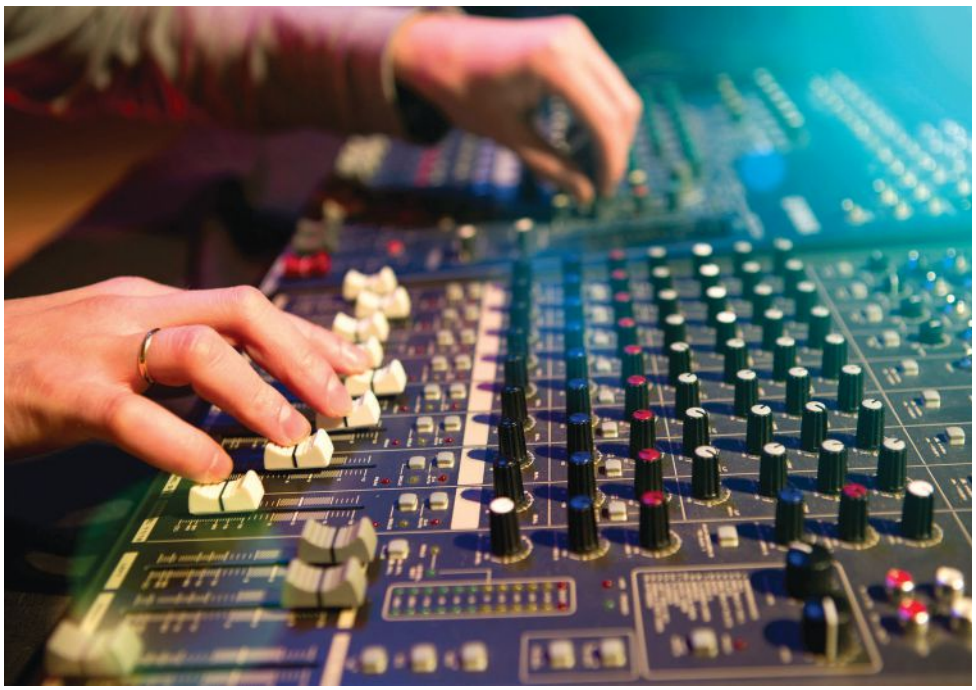
In general, though, I whole-heartedly believe that guitars can't always serve as the main instrument. They have their places and I love really ethereal licks, but this isn't a metal show and there are often many more instruments on stage that could use some love.

DRUMS

I consider drums to be the second most important piece of the band behind vocals. We all know how poorly some congregants keep the beat, so we need to make sure that a nice crisp clear drum set can be heard.

Kick and snare, most of the time, are vital. I prefer a very fat low end with a cracked snare. I boost the kick around 60 or 80 Hz depending on what the feel of the song is, and also boost just a tad at about 1 kHz to keep some of the pedal sound in.

On snare, I always prefer to have top and bottom miked.



If you just walked in off the street, could you understand what the vocalist was saying even if the words weren't onscreen?

The approach here is a boost at about 250 Hz or so with a cut at 500 Hz, which produces warmth. Then the bottom of the snare provides a sharp boost at 1 kHz to really give it a snappy, cracked sound. I typically blend the two sources, with slightly more top than bottom. Finally, I like toms present, round, and resonating, but not overwhelming, and I prefer cymbals to be bright, but not harsh.

I find a lot of churches use enclosures (i.e., a plexiglass shield around the drum kit), which adds a certain level of complexity to the mix. I love the isolation, but I really hate how "boxed in" it can sound. You have to fight that in almost every mix of your kit.

BASS

I love a smooth bass line. I'm a bassist and really enjoy when I can't pick out really weird sounding (or overpowering) bass in mixes. I had to accept it growing up playing the instrument, and we must accept it as sound engineers: bass shouldn't be the loudest instrument in the band.

And by that I mean a nice round low end (I hate the sound of frets on a bass. Any uprights or fretless out there?) with a HPF at 60 Hz with just enough finger noise around 2 kHz or so to distinguish accented notes without overpowering the kick, or worse, the vocals. The kick and bass should be working harmoniously, not stomping all over each other. Don't be afraid to use ducking to get them to behave.

KEYS

Pianos have been in churches for as long as both have been in existence. Nothing can replace a really incredible pianist. (I envy those who can "tickle the ivories.")

Usually, I don't do anything particular to keyboards and pianos because they were made to be left alone. That's not to say I don't slap on a HPF every now and again, but I do try to stay true to the piano and let it do it's thing. The only thing I can say is make sure I can hear it in the mix.

Everyone mixes differently, and every congregation likes its music differently. Because of the generation in which I grew up, my mixes tend to sound a lot funkier and modern than some generations before me. (I also consider myself one of the most conservative.)

Always be careful to take care of your ears. I know exactly when I start to reach the 95 dB point (if you can get your congregation to even accept levels that high) because I begin to get uncomfortable. It's actually been something I've been working on lately, sometimes my mixes are perhaps too quiet – a good problem to have if you ask me.

If you take one thing from this discussion, it's this: listen. Really listen. If you just walked in off the street, could you understand what the vocalist was saying even if the words weren't onscreen? Our job is a balancing act and when done right, it's incredible. CS

Samantha Potter *is an IT media supervisor and audio engineer for the largest Methodist Church in the U.S. and a production manager for Funk Syndicate in Kansas City. In addition, she's head of the Kansas City chapter for SoundGirls.org, where you can read more from her.*

BIG & FULL

Techniques and ideas for enhancing the sound of choirs.

by Gary Zandstra

Modern worship doesn't always call for a choir, but there are still many worship services where a choir is involved. They used to be the staple of the worship experience in most churches.

I grew up in a church where they were located in the "choir loft" for the whole service, singing all of the hymns with the rest of us as well as doing a special number or two themselves. This choir consisted of 40 to 50 members, accompanied by acoustic piano, and amplification was not a big issue.

As I entered adulthood I took a position as technical director at a mega church that boasted a 100-voice choir and full orchestra. With the orchestra, amplification of the choir was a necessity. It was during this time that I began working and experimenting with choir microphone techniques.

There's a treasure trove of information already available on ProSoundWeb about what type of mics to use, where to place them, the 3:1 rule, and so on. So rather than rehash these topics, instead I'll share some techniques that have proven successful.

AUGMENTATION

One of the things that I like to do is to stack the deck in my favor, and at the mega church, I did this by putting eight or 16 handheld mics on the best singers. I chose eight or 16 based on the number of channels I had available – and in a pinch, would settle for four.

The reason for the increments of four is simple. Most choir music is broken into four parts: soprano, alto, tenor and bass. Adding close-up individual mics enhances gain before feedback, and I also tried to apply them to the best singers. And, I sometimes applied some effects –primarily reverb – to the signal from these mics, which helped their input fit better with the overall choir sound.

COME TOGETHER

A worship leader that I worked with took out the choir section and instead used portable risers. When he first made the change I thought it was for flexibility of location for the choir, but he told me that was only an added benefit – the main reason was to get the choir members close together.

He would put the best singers in the center and then surround them with the rest of the choir using as few risers as possible. His premise (which worked) was that if the choir could hear each other better, they would sing better. Also, by putting the best singers in the center, the surrounding choir could hear them and rise to their level.

SPICE IT UP

This works on both stereo (multichannel) systems as well as mono systems. Use a very short decay on a reverb setting (1 to 1.5 seconds). I prefer a hall reverb on a choir, and also add a chorus effect. This makes a choir of 30 to 40 sound like a choir of 50 to 60.

In fact, sometimes I back off on the effect because it does not "look" natural – the sound is "bigger" than the group. As a result, caution should be used when implementing this technique. In addition, it can also greatly reduce gain before feedback, which is rarely to never a good thing with choirs.

BACKWARDS PAN

This only applies if you have a stereo or left, center, right main sound system: pan the mics to the opposite cluster. In other words, if you have two mics, pan the left one to the right cluster and vice versa. This helps gain before feedback because there's greater distance between the mic and the speaker. It also adds a fullness to the sound, particularly in front seating sections where the congregation hears both the acoustic and the reinforced choir sound.

By the way, combining these techniques can help improve your results. And if none of them produce the results you're seeking, you can always…

FAKE IT

I'm almost embarrassed to admit I've done this, because it's a bit deceptive: record the choir ahead of time and add them into the mix. Note, however, that this was our own choir and not "canned" split-track voices from a recording done in a professional studio.

I put a lot of the tracked vocals back in the choir monitor, rather than in the house system. Doing this not only made it sound a bit more natural, but it also helped the choir to sing much more confidently.

Choirs are always a challenge, so it helps to have few more tricks in your bag to make it work. And as always, try to take the time to experiment further (during rehearsals) to achieve an optimum result. CS

Gary Zandstra *has been involved with working with churches and in church production for more than 35 years, and is the founder of NemoSyn (nemosyn.com), which offers a multitrack recording device that gives sound techs the opportunity to practice their craft.*

DIY PRESS MULT

A simple (and inexpensive) way to provide audio feeds for video cameras and more. *by Mike Sokol*

As more churches add video to their worship services, there's an increasing need to send audio from the mixing console to the camera. But don't be tempted to just link the XLR line-level output of your console to the XLR inputs on the camera(s), because bad things can happen (as I'll detail here).

And yes, there's often need to feed the same audio to multiple cameras in different locations around the room. So how do we connect them all together?

It's done with something called a press mult, which is an audio distribution box that takes a single line-level input from the mixing console and creates multiple (mult) isolated XLR mic-level outputs for all the members of the press. (Get it? Press mult?)

While you may not be sending audio to the various alphabet networks (NBC, ABC, CBS, etc.), the exact same principal applies to distributing audio to the video cameras in a sanctuary. And yes, you'll probably want to send console audio to the video cameras at any special ceremonies or plays that also may be held at the church in addition to normal worship services.

COST VS BENEFIT

Quality press mult units, such as the Whirlwind PressMite, use battery or "wall-wart" power to create active isolation between a dozen outputs or more, as well as line-level thru and headphone amps. In all, the PressMite is a very sweet unit that I've used dozens of times.

Whirlwind PressMite, designed for press mult applications.

However, it and all other models of this type can be a little pricey, costing about $1,000. That might be a bit much if the primary applications consist only of feeding audio to a video camera for a local church play or for the visiting Bishop doing a ribbon-cutting ceremony for a building expansion. However, they're worth it if a church is adding video to a decent degree.

Press mults solve a lot of problems. Many video cameras don't like line-level signal shoved into their XLR jacks. And even if they have a 20 dB pad on the inputs, I've found that many pro cameras will still clip with a live-level signal approaching 0 dB VU.

Plus the switching power supplies for video cameras are notoriously sensitive to grounding, often feeding their power supply hash back into your own sound system or other cameras on the "mult" creating ground loop hum and hash. So there is really a need for transformer isolation on each XLR output, which should also be dropped to a signal level of -20 to -40 dBU.

ANOTHER WAY

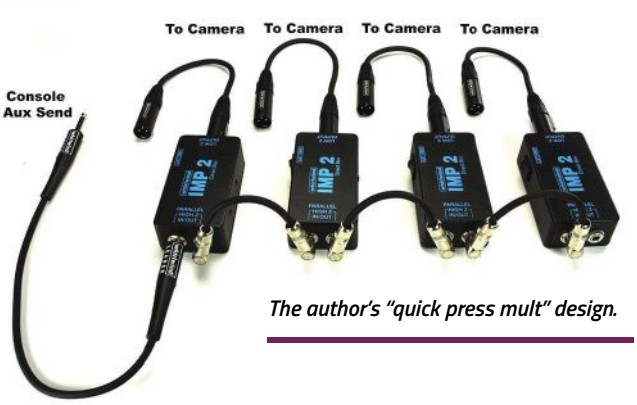
Don't fret if your church doesn't have $1,000 to spend for the few times a year that a press mult might be needed, or for that matter, for feeding console audio to one or two cameras every week. I figured out another solution some 30 years ago while doing a play where a video guy showed up and asked for an XLR

feed at the last minute. I tried coming out of the console's aux output with a line-level signal, but not only did his camera audio distort, his camera's switching power supply made my sound system hum and buzz.

So I had a brainstorm that a basic passive DI (direct) box hooked to an aux output of the console would provide the needed transformer isolation as well as the level drop. It worked perfectly that night, as well as on other gigs since then. Plus I figured out that multiple passive DI boxes can be linked together using TS (mono) cables to feed separate cameras. You can easily drive up to a dozen or more passive DIs such as the Whirlwind IMP2 without any problems.

So should you drop a grand on a "real" press mult? Yes, if you're doing a gig that requires meeting the spec of a tech rider. However, the alternative presented here will work perfectly for any gig where there's the need to send audio to a few cameras, or feed console audio to a camera for a one-off play or special ceremony.

And if nobody bothered to tell you that a press feed was required for the gig, just grab a passive DI box out of the equipment room and make a "quick press mult" in (literally) a minute. You'll meet the need and amaze your audio buddies at the same time! CS



The author's "quick press mult" design.

***Mike Sokol** is lead trainer for Live Sound Co. in Maryland, and lead writer of the Live Sound Advice blog. For more than a decade, he led the HOW-To workshops, teaching thousands of church sound techs, and he's also an adjunct professor at Shenandoah Conservatory in Winchester, VA.*

SURVIVAL TOOLS

Eight important things to include in the live audio toolbox. *by Chris Huff*

"Can you come to our church and run sound in a few weeks?" "Can you run sound for my band next weekend?" Work as an audio geek long enough and you'll get these questions plenty of times, usually followed by the statement, "Don't worry, we've got all the gear, you just need to show up." Danger, Will Robinson!

I've been in these situations and one thing's for sure: It's never as easy as it sounds. Standard equipment is lacking, or outdated at best, and waving a magic wand isn't an option. While I can't do miracles, taking the right tools has enabled me to survive such gigs.

1. Gaff Tape. It sticks to anything so it's great for securing cables to stages/floors, and it's easily removed. Gaff tape is not duct tape, which is the silver roll the drummer hands you when you ask, "Do you have any tape?"

I use gaff tape on just about anything except gym/basketball flooring, which can be hit or miss with any type of high-strength adhesive. I've seen it remove the oil gloss from these types of floors when pulled up. And, gaff tape is also great for volume critics (forget I said that).

2. Cable Tester. Never assume cables are good when doing a one-off gig. From personal experience, I know some musicians will use gear until it dies. If they have to flex a cable just right so it works, they'll do it.

Cable testers range in price based on brand and functionality. I have a Live Wire Solutions LWSCT tester that works with Speakon, XLR, RCA, MIDI, TRS, banana, and USB/FireWire cables.

Make sure to test all of the cables in use, and if one fails for any reason, even if it's only when twisted just right, replace it. Testing only takes a few minutes and may save you from a notable glitch and the embarrassment that goes with it.

3. Whirlwind QBox. Kent Morris, audio engineer extraordinaire, notes that he carries one for those times when he doesn't have any "helping hands" for line checks. This little box has a microphone, speaker, and test-tone generator, so performing a line check on all cables and audio sources is pretty easy.

Live Wire Solutions LWSCT tester.

For example, place it in front of a wired mic and then go to the console and check that the signal is being detected. Or plug it into the cable and talk into it, which sounds odd until you work with vocalists who insist on carrying their own mics and typically don't arrive until the last minute. (Not as uncommon as one might think.) The Qbox helps get the line check accomplished when you're the only one on the job.

4. Multimedia Passive DI (Direct) Box. These days, folks are connecting everything from iPhones to laptops to mixing consoles, but too often it's not being done correctly. The most common mistake I see is taking a stereo TRS and plugging it into a mono channel jack, with the assumption being that's all it takes – but the console expects a balanced mono signal.

As a result, the outcome varies. Some mixers are forgiving (I doubt intentionally) and they'll pass the audio without any problems. Other times, the mixer won't pass the audio or it will do some really funky signal level fluctuations so the volume goes up and down.

Carry a multi-media DI like the Radial ProAV1 that take a stereo signal and transforms it into a mono balanced signal. Another tip: Make sure the device is sending the strongest signal before touching the channel gain. This eliminates line noise problems. Also note that Radial recently introduced the BT-Pro, which uses Bluetooth technology to make the DI connection to the device.

Radial BT-Pro with Bluetooth technology.

5. Headphones. Never assume a venue or the band has headphones at front of house. And let's be honest, wouldn't you rather wear your own? Headphones are helpful for checking channel EQ and tracking down problems, and also when working in a noisy environment.

At one gig, the house loudspeakers were silent, and I couldn't tell if the problem was them, or the amplifiers, or the console routing. By plugging my headphones into the console, I was able to check the signal routing and solve the problem.

Traditional cans, in-ears, or ear-buds – it's up to personal preference. For mix work, go with a solid brand with high fidelity. And be aware of the frequency response of the headphones. For example, some might accentuate the low end too much. (Great bass sound! Yeah, whatever, mister marketing genius…)

6. Batteries. Never, ever assume a venue or band keeps spare batteries. Oh, it's their responsibility, but you're the one who'll be asked to solve the problem. I've had to make runs for batteries, for cables, and even for the band's dinner. Nothing like being in a long line at a sandwich shop and then telling them you have seven orders.

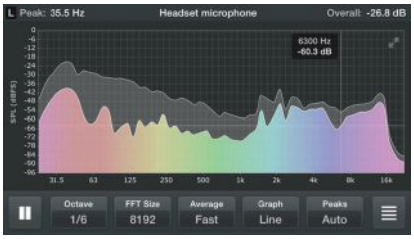
Carry a variety of batteries, including 9-volt, AA, and AAA. This takes care of wireless mics, guitar equipment, and any other common battery-powered audio gear. A useful tip: when replacing batteries, carry the new ones in the right pocket and the old ones in the left pocket. (Unless they're new 9-volts, which like to connect with car keys and warm up a pocket in a hurry.)

7. SPL Meter. Here we get on shaky ground. A variety of SPL metering apps are availavle for smartphones, but there are a few problems to be aware of. Some apps are limited to 100 dB, and some don't indicate if they're measuring dBA or dBC, let alone providing the sampling rate. One that does do these things is SPL Pro by Studio Six Digital.

The thing is, a smartphone isn't a sound meter, so results can vary. Some techs have told me that their phone metering is accurate, while others have said it isn't even close. I prefer a dedicated SPL meter because my phone has another job.

Whatever you choose, be consistent – use the same SPL meter every time so venue comparisons are spot on.

SPL Pro metering app from Studio Six Digital.



Spectrum Analyzer by ONYX Apps.

8. RTA. A real-time analyzer displays all detected audio frequencies. It's helpful to see the sounds of the room when it's empty to identify any possible problem areas, as well as to actually see the make-up of a mix. And particularly when working a new venue, you can see how the house EQ (the one locked behind the steel door) is affecting the sound.

RTA capability used to be offered only with high-end equipment, but thanks to app development, it's now available on the cheap. (I use the Spectrum Analyzer app.) Yes, these apps rely on the phone's mic, but MicW offers the i436 for iPhone and iPad. The i436 package includes an omnidirectional measurement mic as well as a cable, splitter, and storage tube for the mic, protecting it from damage when not in use. Also note that some digital consoles include an on-screen RTA that receives input from a measurement mic.

RTAs include various settings, such as for sampling rate and scale, which are important for viewing a useful chart. I use an FFT size of 4096, fast rate, and simple graphing.

The Take-Away. While it's helpful to have all of these tools on hand for working in different venues and gigs, it's also important that they be available at your usual workspace. Right? And before the complaints start about the price of gaff tape, trust me, it's money well spent. CS

Chris Huff *is a long-time practitioner of church sound and writes at Behind The Mixer (www.behindthemixer.com), covering topics ranging from audio fundamentals to dealing with musicians – and everything in between.*

WIRELESS OPTIONS

Are 2.4 GHz digital systems a viable alternative?

by Jim Lappin

Traditional analog FM (UHF and VHF) wireless systems have advantages – such as longer wavelengths (especially with VHF units) and, thus, a more robust signal – but the ongoing U.S. governmental "repacking" of the TV bands in which these systems operate has led to RF spectrum congestion, making it difficult in some areas to find enough open frequencies to operate wireless microphone systems. With another round of FCC repacking looming in 2016, 2.4 GHz digital wireless systems could be a viable option for many users, especially those without the aid of a dedicated tech team.

Some potential users harbor reservations about 2.4 GHz systems in WiFi-rich environments, in places where line-of-sight placement is problematic, and/or where multiple systems are required. Understandably, no one wants to settle for a limited-use system just so they can escape the overcrowding and regulatory uncertainty of the TV bands.

TECHNICAL FACTORS

UHF systems transmit shorter wavelengths than their VHF counterparts and so tend to have fewer problems with interference. Also, since the UHF spectrum is wider than that of VHF, there are more frequencies to choose from, making UHF a better choice when operating in an area where a lot of other wireless systems are present or when wanting to employ multiple systems.

This broad spectrum, paired with frequency-agile systems capable of tuning in anywhere from 10 to 100 channels (or up to 1,000 user-selectable frequencies), has made UHF wireless systems the standard for concert tours, theaters, megachurches and the like, any one of which might employ 50 or more channels of wireless.

To combat the challenges associated with operation in the higher-frequency UHF band, many UHF systems include diversity and companding technology to enhance their performance. Diversity systems employ two receiver paths in order to combat interference such as multi-path fading. The logic inside the receiver chooses the signal path with the least amount of interference.

Companding compresses the audio signal upon transmission and then restores it close to its original dynamic range in the receiver. But while this improves the system's overall performance, it can also introduce audio artifacts, and, since companding is typically optimized for a specific audio-frequency range, it can be unsuitable for wide-range sources such as bass guitars.

AVOIDING THE CROWD

But, again, the repacking and auctioning off of spectrum makes the use of UHF TV bands increasingly problematic. A congested UHF band will become even more crowded. Unlike traditional analog VHF and UHF wireless systems, some digital wireless systems operate outside the TV bands, so they avoid all of that congestion.

And while it is true that systems operating in the 2.4 GHz range have to compete with WiFi, microwave ovens and other activity, a digital system with frequency diversity may easily avoid interference by constantly monitoring the spectrum and switching to a better frequency when necessary. (Keep in mind that many 2.4 GHz systems don't operate with this frequency diversity; however, this widespread deficiency is a primary cause of disenchantment with 2.4 GHz wireless.) Plus, the digitally modulated signal of these systems removes the need for analog companding, so they can deliver uncompromised, full-bandwidth, high-fidelity audio.

Audio-Technica System 10 PRO digital wireless system.

These systems can also incorporate professional features without greatly increasing the cost or making then difficult to use. The new Audio-Technica System 10 PRO rack-mount digital wireless system, for example, offers the aforementioned advantages of a 2.4 GHz system, along with three levels of diversity assurance (the signal is sent on two dynamically allocated frequencies, in two time slots, from two antennas on both receiver and transmitter), allowing it to be taken anywhere, set up and turned on for faultless digital audio.

The System 10 PRO also offers two receiver units that can be removed from the chassis and mounted remotely via basic Category cable (Cat-5e, Cat-6, etc.), plus a unique linking function that allows up to five chassis (10 receiver units) to be synched for simultaneous use. CS

Jim Lappin *is product manager, wireless microphone systems, at Audio-Technica.*

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BIG MINISTRY INSIDE BIG SHOWS

Using tech to develop opportunities that can make a difference.

by M. Erik Matlock

Many years ago, we hosted a three-day worship arts conference. Not like the conferences I was paid to do, traveling around the country with large budgets and excessive amounts of gear.

This one confined me to my home church, with no budget and no warehouse full of touring grade audio toys. It would prove to be a challenge to my control-freak nature that served promoters and bands so well during my career.

Basically, this conference was about various forms of dancing, music and choreography. We used the main sanctuary stage for the opening night, and it also hosted group events to begin and end the event. Also in play were classrooms in three different buildings on the property, along with rooms at two other churches in our area. Shuttle vans ran all day. It ended up being a very complex event.

I agreed to assume responsible for the tech side, knowing that I needed to relax my "psychotic death grip" on productions. There were only four people on the tech crew, and since they were volunteers, I couldn't get all of them working at the same time. You know, they had jobs and families. So I needed to create another team.

Seeking eight more techs and a runner, I went to the youth group. There were a few that would do fine, but the others were going to need training. I talked to the ones I was hoping to get onboard, and also asked for some suggestions. It came together following some quick training.

Every tech was responsible for one room, each equipped a basic sound system, wireless headset, CD player, DI (direct) box and a line up front for another input. There was audio recording, and in some cases, video recording. The larger rooms also had an audience response microphone for questions. The techs were provided a written routine for things to do during and between classes.

The young lady who served as the runner went to each room and harvested the recordings, dropped off batteries, and made sure everyone had everything they needed. She also carried a radio to call me if there was an issue she couldn't handle, and we provided her with the same training as the others in case she needed to fill in. In short, this person proved to be a lifesaver on several occasions.

Another thing that helped tremendously was our relationship with a local music store, something all churches need to develop. In Macon, GA, our location, the folks at Bill Hardin Music went out of their way to help us. They've always been a huge supporter of local churches. We ended up short on wireless headsets, small loudspeakers and stands, and they saved our hide. (Thanks, Chuck.)

In the end, the conference was a huge success. The tech crew was great, and looking back, we accomplished much more than we planned to.

Several of those young people ended up staying with us as volunteers. Two of them went on to full-time careers in AV production. Some of the others are career musicians now, still involved in production. We also developed an even better relationship with the music store, and half of those young people worked there at one time or another.

Creating that team of volunteers opened career doors. Asking them for help also provided them opportunities that they might not have ever gotten otherwise.

The crazed megalomaniac within me will always want to be in complete control. But asking for help often benefits others more than ourselves. You never know what kind of opportunities you're creating for someone else; you never know how much they need to be involved in something. If you're determined to do it all yourself, you're missing out on things that may not happen any other way.

I think that's the big ministry within tech. Creating connections and relationships. It benefits everyone, often to a significant degree, to seek those opportunities. CS

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*Senior editor **M. Erik Matlock** has worked in professional audio for more than 20 years in live, install, and recording, including time as a church tech and media director.*

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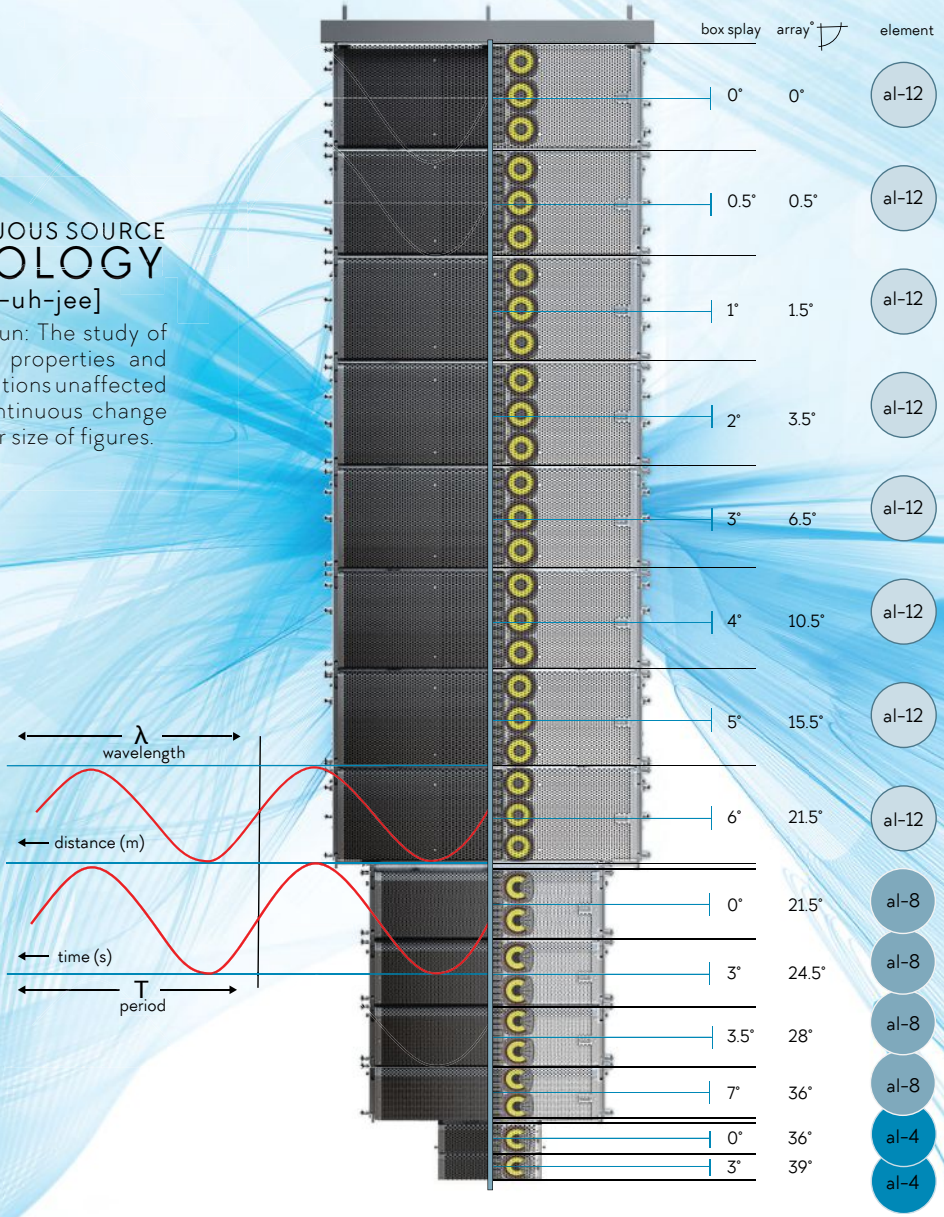

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