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Problem-solving After the Downbeat:

Troubling shooting live audio disaster on the fly

By Tim Dolbear, with Angela Dolbear

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Knowing your system and its signal chain can be the saving grace for both you and your job. Pushing faders and setting EQs is one thing, but when disaster strikes, you must know how to problem-solve your way out of any situation. I learned this lesson early and here is one time where it really saved me.

It was a beautiful summer evening in a city park occupied by approximately 2,500 people. A local country act was just taking the stage at the City of Whittier's summer concert series. I was working that night with Ross Miller of Miller Sound, the company that I had been engineering for the past five years. Up to this night, the outdoor concert series had been a very uneventful event, as far as the sound system was concerned.

One trick to this park was its layout. We were forced to mix from behind and to the side of the band, with myself at what should be the FOH position radioing in the information to Ross at the board. We also could hear a descent mix from the satellite speakers on the side of the stage used for the rap-around crowd at this park. This mixing inconvenience would prove to be in our favor this night, making our trips from the mixer's location to the stage seem next to nothing.

Sound check, that night had been, for the most part, as normal as the previous 60 other shows we had done at this park. The real work was finished and it was almost time to start talking about "what's to eat."

The Problem

By the chorus of the first song, we knew there was a serious problem: the vocals were distorted and the bottom end was about as clear as the air in the Los Angeles basin. By the second chorus, I would have killed for the clarity of an old Shure vocal master PA. We were in a serious situation. For the first time in my career, a band was going to be forced to stop due to the sound system. Sure, I've seen bands stop before for problems such as when a power breaker blew (not my department) or when the lighting rig went dark (not my department, either). On another occasion a few years back, a keyboard player accidentally pushed his keyboard rig off the front of the stage, bringing his solo to a smashing conclusion. Prior to that stunning display of musicianship, a band had a train wreck in the middle of a



song that was so bad even CNN had footage. But this time, when the band stopped they would be looking at me.

So where does one begin to find the culprit of such a major problem while the band is losing patience, the audience is looking on, and the guy who signs your check is apologizing to the Mayor for the poor sound system at his event?

The System

Before I go further, let me provide you with a short run-down of our system to help you follow along with the madness. The band was a four-piece band with drums, bass (D.I.), electric guitar, pedal steel, and three vocalists. For this show we were using a 24-channel BiAmp board with a BBE and a Behringer Feedback destroyer in the master insert. The master L+R outs fed a 6-channel Rane mixer splitter that fed the main speakers and two sets of satellite speakers (which are used to help coverage in this outdoor park where the audience spreads most of the way around the stage).

Only the mains are bi-amped using a Yorkville crossover feeding two 400watt amps, and the full range satellites share a 350watt stereo Soundcraft amp. There were various channels using a Presonus ACP-88 or DBX 266 compressors in their inserts. The two-channel monitor mix went out of the mixer and into a Sabine 2402 feedback reduction system, and out into a stereo 350watt per side Soundcraft amp feeding four monitors, two a side.

On top of all the things to consider, the AC that was being fed to us was "city power" from a box on the side of a restroom, 150 feet away. Here we did not have the ability to pull our own power source and there wasn't the choice of using generators. Our system was only given three 20 amp circuits and this band was forced to split a single 20-amp circuit among the three amplifiers on stage, two of which were tube amps. Many vendors from around town were at this park, and each drawing for the same power pole. We had had situations in the past at this park where the streetlights had turned on, and took the threshold of the area's power down a notch and turned our sound to mush.

Scary, eh?

Search for Solutions

After the seriousness of this situation had set in and we had quickly looked over the usual suspects, we needed to step back and ask ourselves a few questions to track down the problem.

What speakers had this distortion coming through them? Mains? Satellites? Monitors? Just the Left? The right? What type of distortion was this? Was it a blown tweeter on one of the mains? Could it be clipping distortion (for example, is it distorting only when a spike comes through from a snare drum being smacked)? Was it an all-over distortion when the levels start to climb? Was a power amp clipping? Was it just on the vocals, or other instruments too? Was the mix distorting or just elements in the mix, such as the bass guitar that was fed to us via the direct out of a SWR amp? Did a cable get kick or pulled and is now hanging out of the jack just slightly, causing a short? Was a bad cable reeking havoc on the phantom power? Was it as simple as a knob getting bumped on the Rane SM-6 splitter-mixer (our matrix section)? Or, are audio gremlins really to blame?!

Did something change since sound check? Something was different, but what? One thing was that the AC level had lowered due to vendors showing up and plugged in since the sound check. But we had dealt with this problem many times before. This was also a relatively small band. We were not stretching the system.

There is always the chance that the band "kicked it up a notch." Bands will often play quietly at sound check and step up in level when the show starts. Singing and playing softly is always something to watch out for in a situation like ours, where the band sound checks while people are already seated and watching. If the band had stepped up a notch at the start of the show, we most certainly could have a few channel input levels (gains) to bring down as well as the master level meters would be climbing.

Now, remember don't just look for clip lights on channels. When a band does step up in level, the things to look for are sometimes small and overlooked. If a channel steps up only a few db, the overall level may only come up slightly, and not really look to far off target. In our case, a level increase would have been absorbed by a compressor that is inserted into the channel inserts, making the compressor overworked and the master out levels only increase slightly.

Remember there is a difference between types of level meters. Here, level meters are RMS and don't show us the level of the peaks and spikes in the audio, just the average level. So if the "average" level is hitting the threshold of your signal chain, where are those peaks climbing to?

Elements unique to each channel can be effected with a wide range of results when a player on stage makes changes after the sound check is over. If a bass player decides to "kick it up a notch," his tweaking of his volume can effect the feed he is sending the board. It's the same with a singer that was soft during sound check and now has "stepped up to the mic" and in result is slamming your compressor. Feeding a compressor more signal can cause compression distortion when it starts to reduce the levels at a range it really can't handle. Most mid and low cost compressors can't handle large amounts of db reduction the way that some higher quality units can. Generally speaking, I know, so I'll just say, know what your dynamic units can and can't deal with.

Did someone change their EQ on their amp? That could send levels flying and frying. Most all musicians boost their EQ settings. So never ask musicians " did someone turn up?" Instead ask, "Who changed something? Anything?"

Yet another cause of the problem could be microphone placement. Sometimes you run into a situation where a microphone has been bumped and is sitting in a harsher and louder spot than where you had originally set the mic, which renders the original channel settings useless. This will set up a detrimental domino effect throughout your signal chain.

Here, though, all level meters were right on target, and from the looks of it, everything was fine. The compressors were compressing away and nothing had been bumped or boosted, bringing us back to the AC. One thing to remember is that when you run out of headroom from a low AC situation, the level meters on the board and amps may look fine, but your system will sound like the clip lights on every unit are flashing away. So, we never ruled out the AC that was fed to us, even long after we killed the satellites to conserve the AC's headroom.

We had to find out what was causing the distortion and fast. A check of the speakers had revealed that the distortion was coming from the mains and satellites. Judging from what the band told us, the monitors only had a little distortion, though they may have been hearing the house speakers, or the fact that we had a low-pass on the monitors at 7K that might have been hiding the harshness of the distortion. For the most part, we focused on the mains and the signal chain feeding them, since the monitors seemed fine to us after this quick walk of the system.

Desperate Measures in Desperate Times

It was time to start pulling units from the signal chain. After the first song had ended, we conversed quickly with the band while the lead vocalist interacted with the audience. His speech to the audience was clear and clean for the most part, pointing toward a headroom problem. We knew this park and we knew about the AC and the headroom distortion it could cause. But this was way beyond an AC headroom problem.

After he said a few words, he then paused for five seconds to give us the time we needed to make some changes. We bypassed the BBE and Behringer, by pulling the master insert. Yes, the levels changed a little and our signal path was no longer set to unity. Whatever. I wasn't worried about keeping the signal path pristine in regard to signal-to-noise ratios and all of the other small tweaks we are always so concerned about. Today was about just getting anything that wasn't distorted to come through. The master insert was out and there was no change.

Here is a good rule in a trouble-shooting situation: Never just use the "BYPASS" switch of a unit while trouble shooting. "BYPASS" might clear the signal but not isolate the ground or various output stages. We doubted that this was a hardware problem. A nugget of wisdom I swear by: "Cables are the root of all evil." Pulling a unit out of the signal chain both takes out the unit and bypasses possible bad cables. Always remove things completely out of the equation when problem solving.

We were frantically preparing for the next big signal chain switch along with trying other fixes during the second songs. We pulled the Presonus and DBX compressors from the channel inserts. Then, muted the overheads on the drums (SM98) and vocal mics (beta 87) during a musical section, and killed the phantom power to those channels. Nothing was helping and the distortion seemed to be getting worst.

Throughout this ordeal, there was a non-stop flow of audience members interrupting our frantic search for the source of this career-ending nightmare to tell us that the vocals are a little distorted. A little!? This country act was sounding like Motorhead playing "King of the Road" through an office intercom.

Next, we fixed our eyes on the Rane SM26 splitter mixer. We both doubted highly that the Rane was to blame. In our opinion, equipment made by Rane will be the only equipment left for cockroaches to play their music through after we are all long gone. But at the end of the second song, out it came. We plugged the mixer's main outs straight into the crossover for the mains. The next song started and there was still no change. The distortion was definitely getting worst.

Desperately, during, yes during, the third song, I took two new and fresh cables and unplugged the crossover's inputs and went straight into the amp feeding the EV mains. Yes, the sound cut out for a second, but you do whatever it takes. Still, no change...other than people telling me that they can't hear the singer. Note: we went from a full PA system down to a pair of EV1502 speakers at an outdoor park with 2,500 people. Now the main sound source at the park seemed to be the monitors.

Now What?

What next? Well, for the last 100+ shows we had dragged around a 16-channel Studiomaster board in a flight case, our "cause-ya-neva-no" mixer. Now it was time to pull the BiAmp board from the equation and see if dragging around this extra board had been worth it. During this third song, we readied it, placing this 16-channel board on top of one of the 20-space racks next to main mixer. The Studiomaster mixer had the same setup for outputs and power that the Bi-Amp board had. The plan called for me to repatch the board, set up the channels as best I could, and "guestimate" the fader levels, while Ross would replace the signal path for the monitors and main outs to the Rane splitter mixer, along with rehooking up the crossovers.

When the band finished their third song, we asked them to announce that they were going to pause while some technical problems were worked out. After what seemed like an hour, but was actually only a minute, we gave them the signal and they started the next song.

Perfect! Clear as a bell! Not my best mix, but hey, the distortion was gone, concluding the longest and most memorable 10 minutes I've ever worked.

Ross's ability to pull this small extra mixer out of nowhere made us the heroes, even though it was our system that had failed. Later we learned that the board had blown the output section and was dying a slow death. The monitors were not distorting. The band had not known that there was a serious problem until we alerted them to it. The majority of people there that day had no idea that an audio problem even existed.

In short...

Knowing how to trouble-shoot and then being prepared enough to handle anything made the difference. Approaching the situation calmly was the most important factor. You have to be able to step back and think through the process, and ask yourself the questions that help limit the possible causes. Or be ready to change your field of employment.

Tim Dolbear is a professional sound engineer/producer and performing songwriter, along with his wife Angela. They own and operate Eclectica Studios. More about them can be found at www.eclecticarecordings.com. Contact them at dlbmusic@eclecticarecordings.com
