

FILLING THE ROOM

THE ESSENTIAL ELEMENTS IN SPECIFYING A SOUND SYSTEM FOR A PERFORMANCE SPACE

by Steve Harvey

WHETHER YOU ARE OUTFITTING A NEW SPACE WITH A SOUND REINFORCEMENT SYSTEM OR UPGRADING AN EXISTING RIG, THE CONSULTANT IS GOING TO NEED TO KNOW TWO THINGS: USE AND CONSTRUCTION. BUDGET IS IMPORTANT, TOO, OF COURSE, BUT FOR ANY ROOM, WHETHER IT'S A HOUSE OF WORSHIP, A NIGHTCLUB, OR A COMMERCIAL SPACE, THE PRIMARY USE – SPEECH, MUSIC, OR A MIX – AND THE SIZE, LAYOUT, AND INTERIOR FINISHES WILL ALL DICTATE THE OPTIMUM SYSTEM.

According to Mick Hall, account manager at GC Pro's Tampa, FL location, "Before I even look at a room I'll talk to a client to determine their use and needs for the room. I always do an interview or at least a discovery with the customer to figure out exactly what it is they're expecting and what they're hoping to accomplish. That way, when I walk into the room I'm already analyzing, putting some parameters on what I'm looking at."

Jeff McLeod, managing director of Church Audio Video, a Proaudio.com company, in Fort Worth, TX, focuses on houses of worship in the North Texas region. "I use a document called a systems needs analysis," he reveals. "It's a four- or five-page survey that I have my customer fill out."

What is McLeod looking for initially? "I need to know the basic layout and dimensions of the room and what the surfaces are — the floor coverings, the wall coverings, the ceiling surfaces, the layout of the seating. The second thing that I need to know is what is their worship style? What is it now, and are they in transition?" Many of his customers, he explains, will buy a system with the expectation of repurposing it when they build a new church at a later date.

Expected coverage is also an important factor, says Hall. "Do they need it to cover a certain area more than others, or do they want uniform coverage throughout? Is it a multi-



JBL VRX932LA line arrays with JBL AM5212 large point source boxes for extreme side fill at Grace Bible Church, Sebring, FL.

purpose space? How flexible does the system need to be?"

He continues, "The initial qualification of what goes in a room is going to come from the customer's perception of what they need. It's GC Pro's or any consultant's job to interpret that and make it into the correct answer."

From experience, he says, "There are very few customers who have a realistic expectation about performance versus their budget. Knowing their expectations allows us at least to show them what is required."

In designing a system, Hall will often use the online apps that are typically made available by the speaker manufacturers, and then substantiate his recommendation with an EASE (Enhanced Acoustic Simulator for Engineers) model. McLeod favors an enhanced version, EASERA, and SysTune, from Renkus-Heinz. "We have pre-recorded impulses that we run through a system and use Earthworks measurement microphones and software to see where the nasties and the nodes are in the room," says McLeod.

WHICH BOX IS BEST?

There are three basic choices of speaker types for these spaces: line array, direct radiator, or a distributed system. "The room has to tell me what speaker system it needs; it comes back to physics," says McLeod, noting, "I generally only recommend line arrays where I need to be able to control vertical dispersion because of balconies or the long length of a room."

Distributed systems are an ideal solution in very reflective spaces, he continues. "I'm running into more and more houses of worship that are leaving the floors concrete and they have a lot of glass in the room. So I'm doing pendant distributed loudspeaker systems in more and more facilities. I can't fight physics, and if I have a forward-firing, two- or three-way, horn-loaded loudspeaker system and all it's going to see are hard surfaces, I'm going to get acoustic anomalies that I can't ever tame."

Whatever the speaker type, says Hall, he has a design best practice to which he likes to adhere: "Always use the smallest driver possible when designing a system that will

"Always use the smallest driver possible when designing a system that will still allow you to meet or exceed the required specs of the system."

still allow you to meet or exceed the required specs of the system. If you can get by with an 8-inch speaker, then don't put 15s in there." An eight-box line array with 8-inch speakers is not much bigger than a 2-x-15 box with a horn, he points out, "So really it's a matter of picking the right thing."

LINE ARRAYS

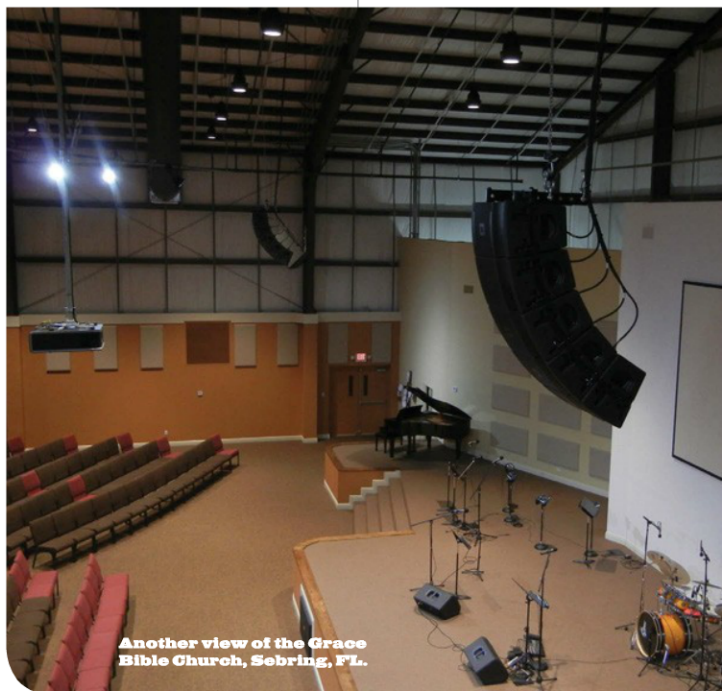
Line arrays certainly have a lot of things going for them. "In public speaking places such as churches or auditoriums, a line array usually gives you the best coverage and intelligibility because of the pattern control. Line arrays are best for uniform coverage of frequencies and volume through all areas of a room. They have controlled dispersion and directivity. You can very predictably focus a line array away from trouble areas, like reflective surfaces. You can shade them, so the people at the front don't get killed but the people at the back can still hear; that's a huge advantage."

Line arrays are ideal for handling a large vertical axis, simply by adding extra boxes and extra curve to the array. "For a given height you can determine the amount of coverage you can get front to back by curving the array more or less. That's a nice tunable aspect of the line array," says Hall.

That said, a line array is typically flown, which means that the space does need to have a minimum ceiling height. "The higher the ceiling the better suited a line array is. You need a 15- to 20-foot ceiling, ideally, just to get it up over the top of people's heads." But of course, he points out, "You need that to work with any speaker system."

One of the hardest rooms to design for is one with a ceiling that slopes down to the rear of the space. "You can't use a line array, you can't use a point-and-shoot box," says Hall. "And that's a really popular church model here in Florida, at least for the churches that were built 20 or 30 years ago. There's not a good way to cover that other than use ceiling speakers in the back."

As McLeod notes, "The challenge is that most line arrays, until you get four modules in the array, generally don't give the low-mid response that you want. You can't defy the laws of physics. If you want -10 or -15 dB down at 200 Hz and can live with that, fine, but there's some



Another view of the Grace Bible Church, Sebring, FL.



Bose FreeSpace DS 100E
small point source fill
system in the Islamic
Center of Hernando
County, Spring Hill, FL.

warmth there that you're typically going to want to capture."

In a room that is long and narrow and that has sufficient ceiling height, a single, centrally located line array cluster with narrow dispersion characteristics may be just the ticket. "We're creating a point-source using line array transducers instead of two- or three-way direct radiating boxes," he says.

Certain line arrays also work well if the room is wider than it is long, he continues. "I might use, for example, a QSC WideLine, whether it's the WideLine or the ILA [installation version], because that loudspeaker system has about the widest the horizontal coverage I've ever seen. You can get at least 120 degrees out of it. Sometimes I'll chose that system simply because I don't need eight cells for depth, but I can get a better solution by doing three or four cells and two stacks, and cover 180 degrees, 200 degrees, easily."

McLeod has also had success with a compact TOA box, the HX-5, that comprises four cells in an array and may be quickly adjusted to one of

four vertical dispersion angles. "You have to couple with a subwoofer, because it won't go below about 90 Hz, but it's a Swiss Army knife in

"Under-powering amps will blow up speakers more than overpowering; you don't want to ever clip an amp. If you hit the top of a speaker box before you hit the top of an amp, you're not going to send any square waves to the voice coil."

terms of giving amazing vocal clarity and punch. I've installed over 100 of them in churches in North Texas."

POINT AND SHOOT

Direct radiating boxes, also referred to as point-and-shoot boxes, are short throw, says Hall, which makes them ideal in certain applications where line arrays are not well suited. "They're best for rooms where you want sound concentrated in one area, but not another. You don't see a lot of line arrays installed in nightclubs, or even in multi-room convention centers where they have air walls that

close off. You need to be able to treat a certain space as an individual area. That's why they call them point-and-shoot — where you point them is where they're going to hit.

"If you're in a big nightclub, you're not going to want a line array because you just want to cover the dance floor. If it's a concert club and you have a bar off to the side or areas where there's seating where they want to talk, you may want conventional boxes." Direct radiating boxes are also very good for supplementing line arrays, for example, covering side seating areas beyond the main system's 180-degree coverage in front of the stage or platform.

Larger auditoriums might require under-balcony speakers to supplement the main system, but in houses of worship and similarly sized spaces, they are simply not necessary, believes Hall. "If you can see the line array from the back row, then you don't need under-balcony speakers. Generally, the more delay boxes you have, the more phasing issues you have, so I'm not a huge proponent."

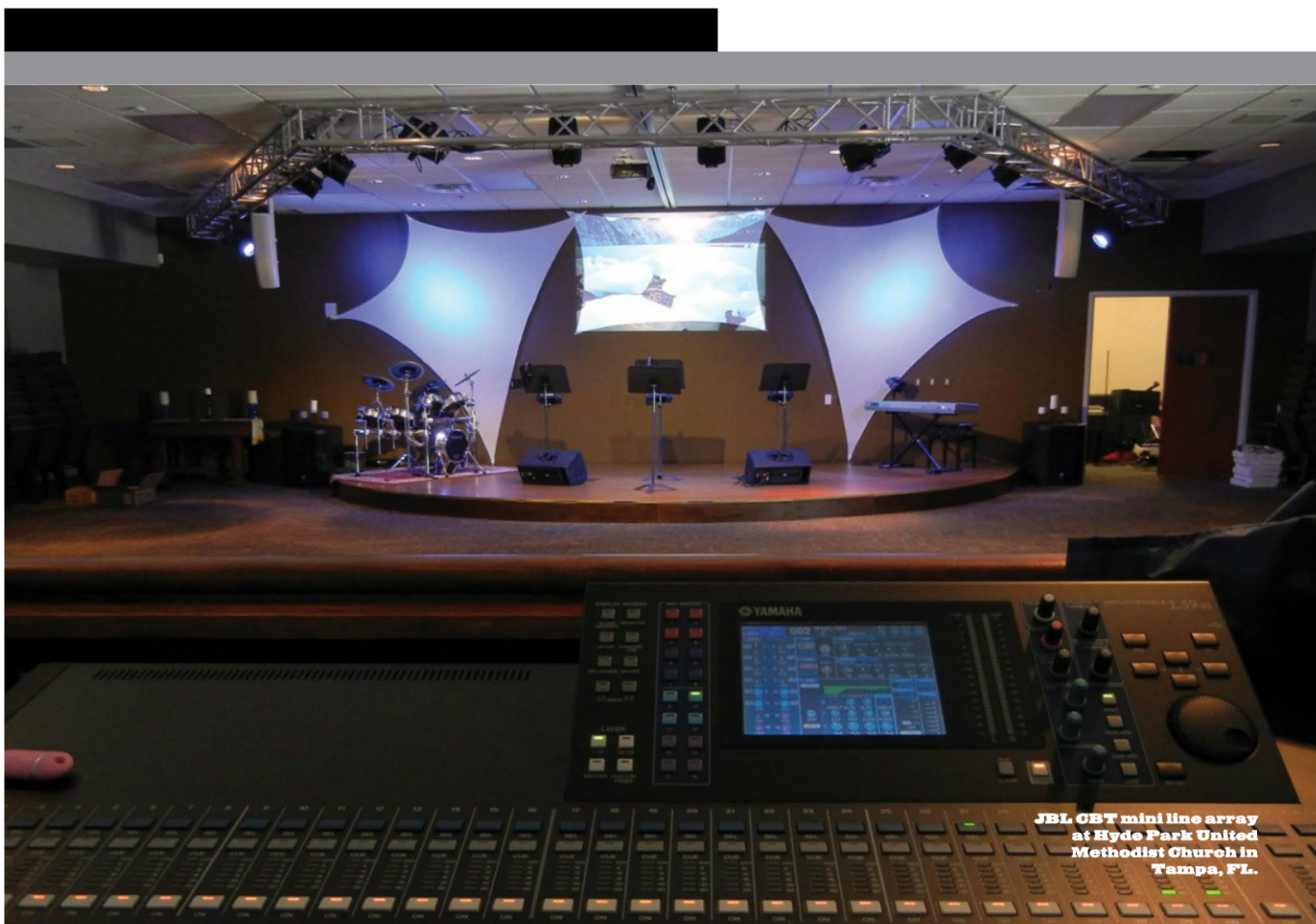
AESTHETICS

One factor that can be a challenge is aesthetics, says Hall. "Especially in churches and historical buildings, what does it have to look like? Sometimes people are very insistent that you can't see the speakers. That's a real problem for the audio designer; that's always the biggest thing to overcome."

In fact, almost any room will inevitably involve compromises that require modifications to the initial, ideal design. "If you have to compromise, whether it has to do with visuals or with budget, you still need to analyze the customer's concerns and needs. Then you're going to have to explain the trade-off involved in the compromise to make sure that the customer is aware that certain needs will not be met."

If the available budget will simply not cover the system that is required, Hall continues, "With churches especially, I'll tell them they need to get a capital stewardship and call me back in six months; you don't have enough money to make a drastic improvement in what you're doing. I'll tell them to live with the bad sound that they have for another six months."

In certain circumstances, he says, he will walk away



**JBL CST mini line array
at Hyde Park United
Methodist Church in
Tampa, FL.**

from a deal rather than compromise with a system design that will not be up to the challenge: “It’s against my principals to sell a client a system that’s solely based on budget or upon their expectations where I know it won’t fit their expectations or a minimum need.”

Aesthetics may be an overriding factor in some historical buildings, according to McLeod, where the system needs to be heard but not seen. “We just finished the First United Methodist Church of Lubbock. It’s on the national, Texas, and local historical registries. They have the largest diameter stained glass window in the United States, and the aesthetic of the system was the number one priority. We ended up installing K-array KK50 and KK100 miniature column arrays. We put 14 of them in the room.”

But the reverse can also be true: “In younger, cutting-edge congregations, where the ceilings are painted

black and they’ve got lots of lighting and big video screens, if they don’t see the loudspeaker systems they feel like they’re being cheated. They want the look of a rock concert.”

OTHER CONSIDERATIONS

The customer’s expectation of maximum sound pressure level or frequency response must also be considered, observes Hall. “I base my systems on continuous instead of peak power. If the customer wants 120 dB, you need to spec a speaker with a continuous value in that range. Then I use the peak value on the speakers to determine which amplifiers to use. If the peak is 2000 watts, as a rule I generally spec an amp that is 20 percent greater than that. Under-powering amps will blow up speakers more than overpowering; you don’t want to ever clip an amp. If you hit the top of a speaker box before you hit the top of an amp, you’re not going

to send any square waves to the voice coil.”

Another point in favor of line arrays is that a single box may not make the spec, but when you add six of them per side it likely exceeds the spec, he notes. “That’s one of the advantages of line arrays — a line array behaves like a single box without being a single box.”

The building and the electronics need to be considered in totality, according to McLeod. “One of my mottos is that the room is a part of the system,” he says. In some circumstances that may require the application of acoustical treatment to make the room “well.” “If it’s ‘sick,’ my first and foremost perspective is going to be to fix the room first. You can’t really be honest about putting a loudspeaker system in a space without realizing some of the pitfalls that are down the road if you don’t deal with that.”

During his 30 years in the business, McLeod has seen only four or five buildings constructed with acoustics in mind. As for the rest, certain spaces might sound great for speech or a singing congregation, “But the minute you put a rock ‘n’ roll combo in there and you start blaring out of loudspeakers, you’re dealing with the clash of speech intelligibility and music reproduction,” he observes. “That has always been the sound designer’s number one tension.” ■