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Building the big systems

Audio design considerations for performing arts centers

Photo courtesy of the Weidner Center for the Performing Arts

The Weidner Center in Green Bay must adapt its sound for a wide variety of performances. There's an art and a science to building a sound system that can handle that challenge.

by Wendy L. Ellis

The engulfing beat of a helicopter surrounds you. You can't help but look up and behind and all around for something you know isn't really there, but all of your senses tell you is about to land on your head. It's one of the defining moments of Miss Saigon, and anyone who has seen this musical knows just what an intense feeling that thrub, thrub, thrub of the imaginary rotors can bring.

Equally powerful, however, is the rich voice of a solo artist that rises from the stage to the farthest reaches of the auditorium, losing none of its intensity in the journey. The larger the venue, the more versatile its entertainment offerings and its audio system needs. Success can often be defined by what reaches the ears of the audience.

"Flexibility. That's a good theater sound system in one word," says Henry Lewis of Lewis Sound & Video in Waukesha, Wisconsin. "The requirements for Miss Saigon are certainly different from Prairie Home Companion, yet they might both be in the same center. You never know how the next production will place demands on the space."

That space can be a real challenge in venues like the Weidner Center at the University of Wisconsin Green Bay, which seats over 2000 people, or the Irvin Young Auditorium at UW-Whitewater, which is somewhat smaller. Weidner Center production manager Brock Neverman says every performer knows what he wants his show to sound like, and adapting to those demands is almost essential if performers and the audience are going to go home happy.

"The industry and theater in general want to have an in-your-face, TV-type presentation," says Neverman. "We do everything from Bill Cosby to Phantom of the Opera." Some performers want the space to be acoustically "dead" when they turn off everything but a single guitar. "The only sound they want to hear is what's coming out of their speakers," says Neverman. "They want to hear every sound only once." On the other hand, when the Green Bay Symphony performs, they want to fill the hall with music. "The symphony depends on the reverberation. They want the sound to bounce off the walls."

Concert hall components

"It puts extreme demands on a system to be top notch for everyone," says Dave Nees, technical director at the Young Auditorium at UW-Whitewater. With a seating capacity of 1300, the Auditorium leans heavily on the use of a central speaker cluster mounted over the proscenium. A smaller, similar cluster serves the balcony. "The balcony is a different acoustical environment," says Nees. "The walls are different, the ceiling is a different height, and all of that changes the acoustics."

Both clusters are controlled from a mixing board which is usually located at the back center of the main floor. "From there we are experiencing the same sound as the audience," says Nees. "The ideal location would be the middle of the auditorium but there's always a

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huge debate about that. Those are the top dollar seats and the best place for the audience to sit."

At the Weidner Center, left, center and right clusters make up the main speaker system with additional fills that cover the front of the stage. A rear speaker cluster carries the sound to the upper balcony. There are six three-ton moveable walls at the back of the stage and two down in front of the house that can be positioned to help with acoustics. More panels are stored above the stage and can be lowered into a horizontal position to form an angle, making the stage a funnel for sound.

Photo courtesy of the University of Wisconsin-Whitewater.

The Young Auditorium showing the proscenium speaker cluster and catwalks.

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"A lot of larger venues don't have what we have here," says Neverman. "The larger Broadway shows bring in their own audio systems and that's where we get complaints." Because he has recently upgraded to digital systems and newer speakers, Neverman estimates the Weidner now handles sound for about 90 percent of the shows that appear there. Many performers will tie in to the house system to enhance their own audio packages. "We recently had Kenny Rogers in here and he asked for copies of the audio system plans. He wants to build one like it in Branson."

Multiple systems

"At Weidner, we put a permanent FOH, or front of house, loudspeaker system where there will always be an audience," says Lewis. "We hid loudspeaker arrays and clusters behind scrims and in enclosed places. The FOH system can be quite large and by design it spills very little energy onto the stage." A second system is the FX monitor system, which provides onstage monitoring and various audio effects -such as the helicopter in Miss Saigon- using portable loudspeakers. "You never know where the system needs to be. Rock and roll acts want speakers at their feet. Dance programs want them off to the side." It has to be flexible, but it also has to be safe. Having speaker cords running across stage floors and stairways can be a problem. "It can be and has been done," says Lewis. "That's what black gaffers tape is all about. But the fewer cords the better." Lewis hid as many as 20 or 30 FX output jacks around the theater, in catwalks and loading bridges for versatility.

A third system is the BOH, or back of house system, which is primarily a one-way monitor for back stage production areas, dressing rooms and the green room. The BOH allows engineers to pipe the production to the back so everyone knows what's happening on stage. It also provides paging for stage crew and performers, and it can send pre-program music to the lobby area, carry chimes announcing the end of intermission, or provide other audio when the lobby becomes the venue for separate, smaller events.

A fourth, intercom system provides the running crew with two-way communications during a performance. With 2, 4 or 8 different channels, the stage manager, director, lighting and sound crews can discuss every facet of the technical operation via their headsets. These behind-the-scenes audio utility systems are as important to the success of a production as the front of house system.

Ears of experience

Designing a sound system like the one at Weidner or Young can be something of a challenge, but Lewis has become proficient on computerized three-dimensional modeling programs. He says EASE (Enhanced Acoustics Simulator for Engineers) can help him locate audio system design problems before they start, or reinforce what his already trained ear can tell him. "EASE is like a hammer," says Lewis. "It's only a tool and it doesn't tell you which end to hold on to or where to hit the nail. But it can certainly make things a little easier for you."

Lewis says the larger the venue, the more time consuming the simulation. He recently used EASE to simulate a very complex church building with curved surfaces, windows, and varying levels of seating. It took him 60 hours to input the necessary 4,544 points of reference and generate the drawing. "The first step is to create the vertexes and then create the faces between the vertexes," says Lewis. By inputting the type of material used in the floors and walls and ceilings, EASE automatically determines the acoustical qualities of each room."

What EASE doesn't do is determine which speakers to use. That's where a couple of decades of experience can come in handy. But once Lewis chooses components, he can input each speaker's bandwidth and dispersion angles and let EASE display the results. "You can position loudspeakers in the computer model and then tell the installer how to put the speaker in," says Lewis. "I haven't had to do any re-aiming in a long time."

Whatever technologies become available, Lewis, Neverman and Nees all agree that experience is invaluable. "It sounds good in here and people want to know how we did it," Neverman says. "I tell them 98% of what we do is by ear. That's one of the hardest things to master in this business. You can teach someone how and where to plug things in, but you can't teach someone to have a good ear."

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