

The Puzzle of PA for a Hall-in-the-Round

By: Alan Hardiman

How do you integrate a public address system into a concert hall in-the-round that isn't even built yet? This was a problem facing Engineering Harmonics, the Toronto consulting firm that worked on the performance sound, video, and communications systems of the \$304-million Metropolitan Kansas City Performing Arts Center, currently under construction. The job was to design a PA system capable of delivering highly intelligible, natural sound—primarily speech—to every seat in a stunningly beautiful hall designed primarily for acoustic, orchestral music. While this is never easy, considering the many reflective surfaces and intentionally long reverberation times inherent in all good concert halls, it becomes much more difficult to achieve in an “in-the-round” or “vineyard terrace” style room, especially one that isn't finished.

“Concert halls need public address systems that are separate from any music systems they may need,” said Engineering Harmonics' president and founder, Philip Giddings. “Music systems are always large and obtrusive, and, if they're hung in the middle of these beautiful, expensive environments, they can be eyesores. In-the-round concert halls are particularly difficult, and, in the new Metropolitan Kansas City Performing Arts Center, the ceiling slopes up and away, so there's nothing to install loudspeakers into.”

One key to solving the puzzle lay in finding an existing concert hall with a similar architectural design in which to test an innovative solution based on a configuration of Renkus-Heinz ICONYX digitally steerable array systems.

“We had achieved remarkable



intelligibility in the large reverberant space of Ottawa International Airport using these visually unobtrusive arrays, each of which is about 6' high and only 6" wide,” said Giddings. “We hit on the idea that if we were to arrange three of these arrays back to back in a circle, 120° apart, we could get the kind of coverage necessary for a hall-in-the-round. But we needed to test the idea in an environment similar to the Metropolitan Kansas City Performing Arts Center.” Luckily, Roy Thomson Hall in Toronto has similar features and challenges, and the hall's management graciously made the facility available for the test.

The circular configuration was flown about 30' above the stage floor, a fairly typical height that allows for clean sightlines and accommodates anticipated lighting angles. This was augmented for the test by two smaller Renkus-Heinz ICONYX arrays—one on either side of the stage—a Renkus-Heinz subwoofer on the

stage, and the built-in stage lip loudspeakers that are part of Roy Thomson Hall's permanent house system.

How did it sound? “There was very little discernable change in timbre where the coverage patterns overlapped between the three elements of the central cluster. Loudness was quite consistent across the overlap zone. All told, that part of the system was quite impressive,” said Robert Mahoney, a member of the team of acousticians for the Metropolitan Kansas City Performing Arts Center, who flew to Toronto for the test.

“With an open mic, there was plenty of gain before feedback,” said Mahoney. “The demonstration was interrupted by a tour group of about 100 students, who were addressed from the stage by one of the hall's managers. He used a stand mic and stood quite far from it, about 2-3m away. None of the acoustical drapes were exposed, so reverberant conditions in the lightly occupied hall were about as great

as they are likely to be. Wherever I listened—several levels of balcony and on the orchestra floor—the sound was very intelligible and quite natural.

“Listening in the upper side boxes, at a point about as high above the stage as the cluster itself, there was some obvious coloration, due to long-delayed reflections, probably from the far wall of the hall,” he continued. “But they were not nearly as strong as I feared they might be, and they did not degrade intelligibility much at all. Perhaps if we’d lowered the drapes or had time to pulse the room, we might have learned more.


“In conclusion, I think the slender central cluster idea is likely to work very well for us,” Mahoney said.

Each ICONYX array is comprised of two IC-8 enclosures, one mounted on top of the other, to provide sixteen 4" drivers on each of the three sides. The ICONYX system is unique in that each of the 16 discrete drivers in each array receives an

individually filtered and delayed signal, enabling the array to produce a specified vertical beam and steering angle. The control software, Beamware, also permits adjustment of the apparent acoustic centers without physically moving the array itself, in order to improve localization of the sound source. And, because of their small size, they can be moved in and out quickly and inexpensively.

What is significant about this process is that, given a client with a problem, Engineering Harmonics developed an original solution. They found an appropriate venue—another hall-in-the-round with similar features and challenges—for testing this solution, and brought in representatives from the client, the acoustician, and the manufacturer. They did the test, and conclusively demonstrated the efficacy of the solution. This method of approaching the problem is perhaps as noteworthy as the solution itself.

The Metropolitan Kansas City Performing Arts Center, designed by architect Moshe Safdie and Associates, is slated for completion early in 2008. The 360,000-sq.-ft. performing arts center will be home to the Kansas City Symphony, the Kansas City Ballet, the Lyric Opera, and other arts organizations. It will contain three performing spaces—a 2,200-seat ballet/opera house, a 1,350-seat concert hall, a 500-seat flexible theatre, and a 500-seat banquet facility with suites adjacent to the box seats—all spilling out into a central glass-encased lobby area and lush terraced gardens overlooking the city. The structure will also house theatre offices, a restaurant, and a café.

Engineering Harmonics is responsible for the performance sound systems, technical infrastructure, and systems to support broadcasting and recording, video, paging, intercom, hearing assistance, and surtitles. 

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