

19th Century Cathedral's Challenge

Blending style, intelligibility and
ease of use with modern technology

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SOUND & COMMUNICATIONS
COMMERCIAL AV TECHNOLOGY AND APPLICATION





By Dan Daley

Every building has a story, and houses of worship often have especially complex narratives. The Cathedral of St. John the Baptist, in Paterson NJ, is one of those. The church, which opened in 1870 to serve the rough-and-tumble Irish working community a dozen miles west of Manhattan NY, continues to be home to immigrant enclaves in the area, including Dominicans, Peruvians, Colombians, Mexicans, Hondurans and Puerto Ricans; in 2014, the city hosted the annual Statewide Hispanic Chamber of Commerce of New Jersey (SHCCNJ) convention. Over the course of its history, the space went from being the parish church to a true cathedral, seat of Bishop Arthur J. Serratelli, leader of the Diocese of Paterson.

St. John's sound system also has a narrative. It's been updated twice since 1996, and you could set your watch (or your calendar) by how it's gotten a new PA system every 11 years. There's nothing mystical about that, however; the most recent update to the cathedral's audio came last December, and it



A hybrid point-source/distributed-sound system provides the ability to use multiple wireless microphone systems throughout the worship space, which Catholic liturgies often require. Enhanced user comfort levels are achieved by reducing the "source speaker" delay effect by having local support speakers.

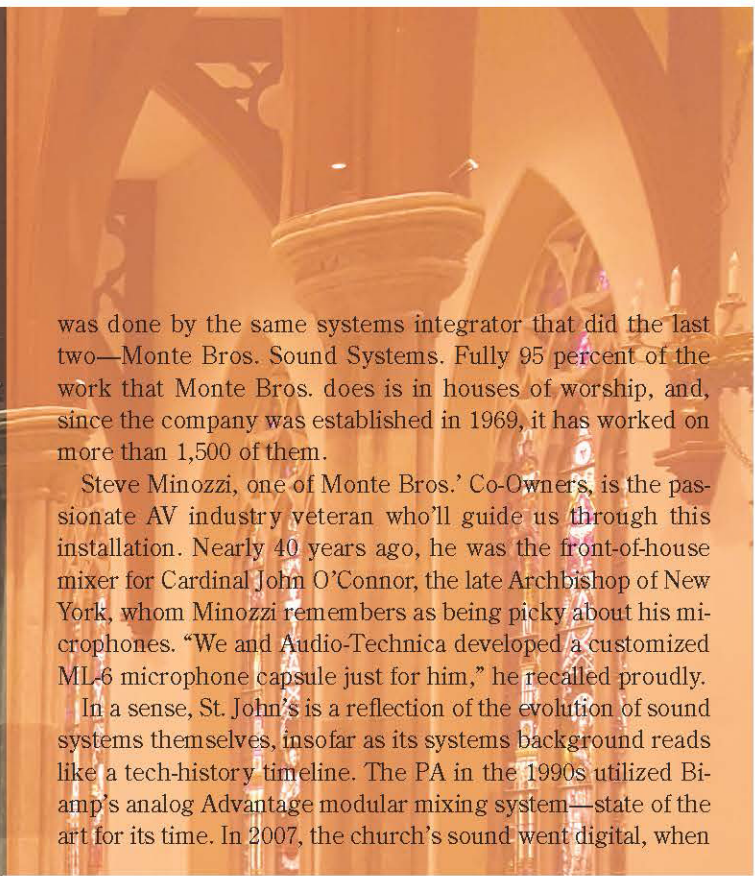


19th Century Cath

Blending style, intelligibility and



The use of compact speaker systems, with acoustical support from multiple concealed subwoofers, managed with DSP processors, delivers highly accurate spoken-word intelligibility in a worship space that has an average RT profile of 3.5sec.



was done by the same systems integrator that did the last two—Monte Bros. Sound Systems. Fully 95 percent of the work that Monte Bros. does is in houses of worship, and, since the company was established in 1969, it has worked on more than 1,500 of them.

Steve Minozzi, one of Monte Bros.' Co-Owners, is the passionate AV industry veteran who'll guide us through this installation. Nearly 40 years ago, he was the front-of-house mixer for Cardinal John O'Connor, the late Archbishop of New York, whom Minozzi remembers as being picky about his microphones. "We and Audio-Technica developed a customized ML-6 microphone capsule just for him," he recalled proudly.

In a sense, St. John's is a reflection of the evolution of sound systems themselves, insofar as its systems background reads like a tech-history timeline. The PA in the 1990s utilized Bi-amp's analog Advantage modular mixing system—state of the art for its time. In 2007, the church's sound went digital, when



The implementation of a hybrid point-source/distributed-speaker system in the cathedral's nave enables the sound system to operate automatically, without the need for user assessment of attendance and volume adjustments.

Cathedral's Challenge

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Monte Bros. used a Biamp Tesira audio server as the DSP hub for a new sound system. This time, the company chose to use Biamp's TesiraFORTÉ AVB AI networked DSP platform, which is paired with the integrator's own proprietary, cloud-based, network-control-system software through a Ubiquiti wireless-access portal, allowing the system to be remotely monitored, managed and troubleshooted via laptop, tablet or smartphone.

The purpose of St. John in the community, and its message, might not have

changed much over time, but its technology certainly has.

The Criteria

"We've had mostly the same criteria for our sound all along—just more so after the large-scale rehabilitation project of the interior and exterior of the cathedral that we've just finished," according to Dennis Rodano, who, since 2010, has been the Business and Facilities Project Manager for the Diocese of Paterson. He cited the need for the sound system to blend seamlessly into the

church's neo-Gothic style and décor (the church is in both the National and State Registers of Historic Places); the ability to be operated by church staff easily; and, perhaps most critically, that the system be exceptionally intelligible for spoken word. "All of these criteria were possible, and the new sound system achieves them," he said. "But they required effort."

For instance, acoustics are the traditional challenge for classical-style cathedral designs, which combine extensive tall, hard, reflective surfaces with copious open spaces—the perfect environment to propagate long reverb times that smear intelligibility. Minozzi, diocesan architect Rebeca Ruiz-Ulloa and outside architect Arthur John Sikula collaborated on a concept for the cathedral's new ceiling in which a combination of purlins, rafters and beams creates a coffered effect, essentially acting as a massive diffuser and, to a large extent, mitigating the interior reflections.

The design of the actual sound system itself is substantially different from the preceding one, but that, Rodano said, is because so, too, is the church; it underwent a major reorganization of its interior liturgical space. The aim of the revisions was to increase seating capacity and return the layout to a more traditional one, after elements such as the altar had been moved into the forward seating areas years earlier. "The organ and choir seating, which had been placed behind the altar in a prior project, are now back in their traditional liturgical location in the loft," Rodano explained.

Hybrid PA Design

In fact, the second set of columns ahead of the altar now holds a foundational part of the new PA system. Terra Speakers CAMM CA-43L columnar line-array speakers are the basis for what Minozzi described as a hybrid point-source/line-array distributed-system approach. Each column in the church's center section, including the two front columns to which the columnar line arrays are attached, also holds a pair of Terra Speakers CAMM DT-200 two-way speakers—30 in all—essentially creating zones within the church that provide even coverage in each zone. The sound seamlessly transitions from one zone to the next.

Diving into the technical specifics a bit more deeply, they are basically Haas Zones, based on the precedence effect. When a



sound is followed by another sound, separated by a sufficiently short time delay (*i.e.*, below the listener's echo threshold), listeners perceive a single, fused auditory image. The perceived spatial location is dominated by the location of the first-arriving sound; the lagging sound is suppressed by the first-arriving sound.

"We did this so that the volume of the system doesn't have to be adjusted to the size of the crowd," Minozzi explained. "And we time-align the speakers in each zone so that each seating area hears everything coherently."

Monte Bros. opted to use two CAMM CA-43L columnar line-array speakers to extend the sound into the chapel, which is sited perpendicular to the main church altar and nave, and which was also fully renovated as part of this six-year-long project. In addition, there are CAMM DTC-1 and CAMM DTW-1 recessed ceiling and wall speakers in the church narthex. Eight CAMM CAS-10 subwoofers are mounted in the lower ceiling area of the nave, held in place using custom brackets that, according to Minozzi, were required for liability reasons due to their height above the seating areas. "They really add a lot to the sound of the music without you realizing they're there," he said, adding that Hispanic-themed services add electrified and percussive instrumentation to the usual liturgical hymns heard in St. John's. All speakers are powered by a combination of Crest Audio, Crown and JBL amplifiers, located in racks in the church sacristy.

(For those unfamiliar with the Terra Speakers brand, the speakers' heritage dates back to legendary transducer developer Rudy Bozak, whose mid-century patented audiophile speaker design used very thin spun-aluminum cones, which took much of their strength from a curvilinear profile along the radius. The cone received a thin coating of latex in order to dampen the surface reflections that, otherwise, would occur on a metal surface that is vibrated rapidly. Bozak, Inc., underwent ownership and other changes in the 1980s and '90s, and several of the successor principals formed Terra Speakers in 1999. Monte Bros. uses the Terra Speakers brand extensively, Minozzi said, because the cones' innate engineered resistance to large changes in temperature and humidity



Monte Bros. Sound Systems
914.693.2600



The utilization of voice-lift sanctuary microphones with line cardioid polar patterns, and a 90-degree angle of acceptance at the high pulpit and cantor's lectern, provide accurate replication of spoken word and liturgical singing, with minimum ambient interference from the space's acoustics.



Wireless boundary microphones on the altar table provide excellent sound capture in this critical area of the church, while minimizing the presence of technology to maintain the interior aesthetic.



The ability to manage and control multiple independent speaker zones in the cathedral's sanctuary provides optimal and automatic performance of specific microphones. For instance, the speaker at the Bishop's cathedra is adjusted to reduce interaction with the Bishop's wireless lavalier microphone when speaking from that location.

make them well suited to house-of-worship applications.)

Plenum-rated, four-conductor IsoTech speaker cabling was used throughout, with each speaker home-run back to the processor and amplifiers to maintain the highest signal quality. That was labor intensive, Minozzi acknowledged, but the labor intensiveness was offset, to a considerable degree, due to cooperation by the electrical contractor on the project; they gave Monte Bros.' technicians access to their conduit under the church floor. "That was one of the benefits of doing such an

extensive renovation," Rodano added. Belden cabling connects all the wired microphones.

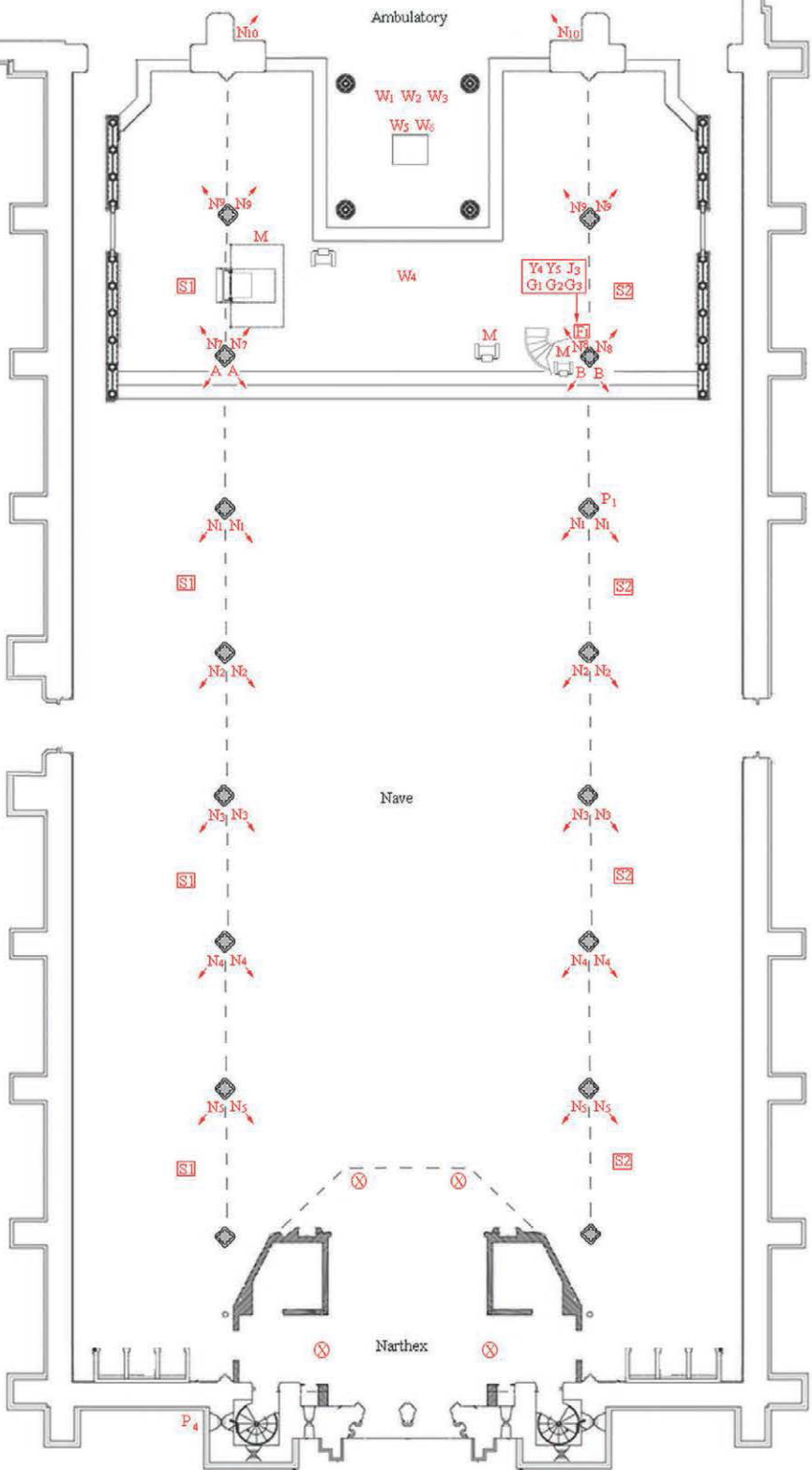
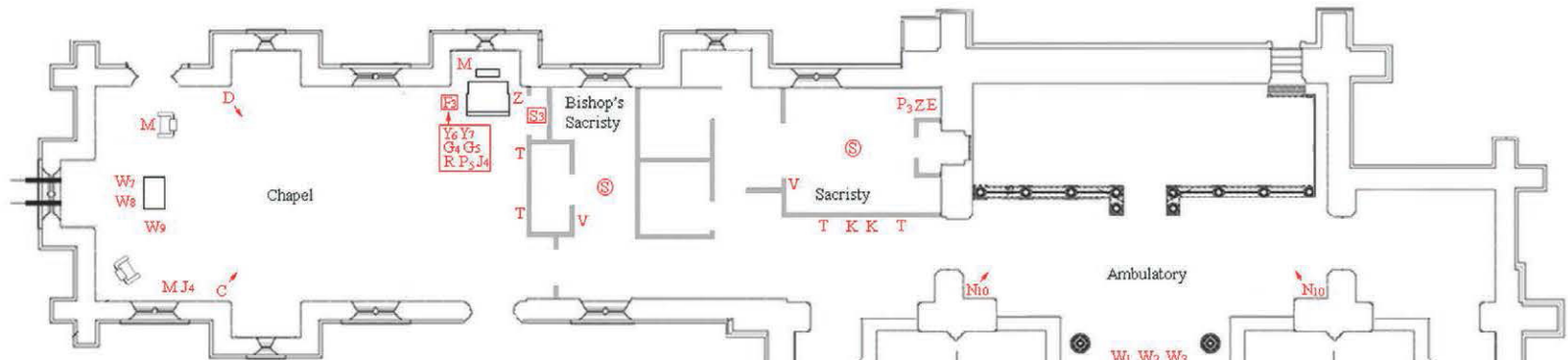
As part of the aesthetic component of the mandate, Terra Speakers took paint samples from the church and matched them for the loudspeaker cabinets and grilles. Low-profile gooseneck microphone stands are used on lecterns, and wireless Audio-Technica ATW-T1006 System 10 PRO boundary mics are used on the altar table. (Wireless systems, including four of Audio-Technica's Engineered Series wireless lavalier belt packs and two handheld mi-

crophones, are in the 600MHz range. They will be replaced by the latest-generation 500MHz units as soon as they become available later this year. This change is necessitated by the RF spectrum reallocation that took place last year.)

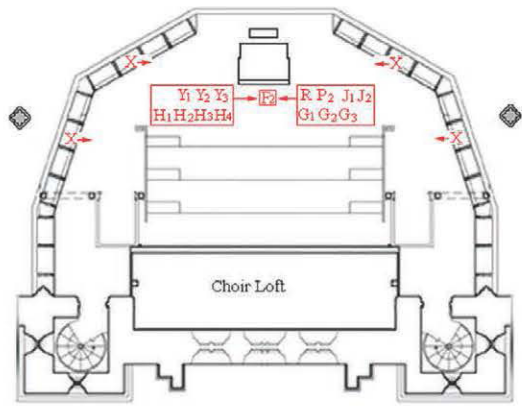
Minozzi was sure to address ease to use to ensure his client was satisfied. He said the Biamp TesiraFORTÉ AVB AI's implantation of AVB networking meant fewer components in the network—that makes for a simpler, more streamlined system design—and there are presets on the Biamp wall unit

controller panels. "Literally, anyone who needs to use the system can use the system," he affirmed. "It's that easy to operate. And we can monitor operation and performance ourselves from anywhere, anytime."

We started by discussing the need for the sound system to be exceptionally intelligible, and that's where we'll end. Rodano happily confirmed that the system performs flawlessly in that regard. "You can hear every word clearly," he stated. "And you can barely see that there's a PA system there." That's a great combination.



- E** = Electronics Rack Console
- Z** = Sound System Control Panels
- R** = Choir Microphone Control Panels
- M** = Microphone Inputs
- Y** = Choir Solo Microphone Inputs
- H** = Choir MicroBoom Microphone Inputs
- G** = Acoustic Guitar Inputs
- J** = Line Level Audio Inputs
- P** = Audio Recording Feeds
- W 1-2-3-7-8** = Wireless Beltpack Lavalier Microphone
- W 4-9** = Wireless Handheld Microphones
- W 5-6** = Wireless Altar Microphones (2.4g)
- T** = Wireless Antennas
- K** = Wireless Receivers (2.4g)
- ABCD** = Speakers
- N** = Speakers
- X** = Recessed Wall Speakers
- ⊗** = Recessed Ceiling Speakers
- S1 S2** = Subwoofers Recessed In Ceiling
- Ⓢ** = Recessed Ceiling Speakers
- V** = Speaker Volume Controls
- F1** = Recessed Floor Box with cable for future:
G 1-2-3 / J-3 / Y 4-5 / R
- F2** = Recessed Floor Box with these connections:
R / P2 / J 1-2 / Y 1-2-3 / H 1-2-3-4 / G 1-2-3
- F3** = Recessed Floor Box with these connections:
R / P5 / J4 / Y 6-7 / G 4-5



EQUIPMENT

- 1 Aphex DA-120 distribution amp
- 3 AtlasIED GD87W 8' coaxial in-ceiling speakers
- 5 Audio-Technica AT899 subminiature omnidirectional condenser lavalier mics
- 2 Audio-Technica ATW-A64P UHF powered dipole antennas
- 2 Audio-Technica ATW-DA49 UHF antenna distribution systems
- 1 Audio-Technica ATW-RC13 System 10 PRO receiver chassis
- 2 Audio-Technica ATW-RU13 System 10 PRO receiver units
- 2 Audio-Technica ATW-T1006 System 10 PRO boundary mics/transmitters
- 3 Audio-Technica ES915/ML MicroLine condenser adjustable-length gooseneck mics
- 3 Audio-Technica ES935 mics w/on/off switches
- 4 Audix MB1255 MicroBoom cardioid mics
- 3 Biamp Systems TEC-1 remote Ethernet devices
- 3 Biamp Systems TesiraFORTÉ AVB AI digital audio servers
- 1 Crest Audio Pro-LITE 2.0 power amp
- 1 Crown CDi 1000 2-channel power amp
- 1 Crown CT 4150 4-channel power amp
- 1 Crown CT 8150 8-channel power amp
- 1 JBL CSA 140Z audio amp
- 2 JBL CSA 180Z audio amps
- 6 Terra Speakers CMM CA-43L line-array speakers
- 9 Terra Speakers CMM CAS-10 subs
- 30 Terra Speakers CMM DT-200 2-way speakers
- 4 Terra Speakers CMM DTC-1 ceiling speakers
- 4 Terra Speakers CMM DTW-1 wall speakers
- 1 Ubiquiti Networks secured remote access system

List is edited from information supplied by Monte Bros. Sound Systems.



New technology has significantly reduced the rack space requirements for large sound systems. It provides the ability to access, monitor and service these sound systems remotely via the internet, ensuring minimal interruption and optimal performance.



www.montebros.com

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