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Sound Speech & Aesthetics

ST. FINBAR CATHOLIC CHURCH DOES IT ALL IN A HISTORIC BUILDING.

BY STEVE MINOZZI
MONTE BROS. SOUND SYSTEMS, INC.

The installation of sound systems in reverberant and aesthetic houses of worship is, and probably will always be, both acoustically and cosmetically challenging. Because few houses of worship have the same acoustical and logistical profile, each space must be treated as a specific and individual entity.

Metamorphosis

The metamorphosis of liturgical music programs in houses of worship has evolved to encompass a multitude of venues. This has expanded the need for sound systems to accommodate these changes acoustically, while continuing to provide speech intelligibility.

The restoration of the landmark Brooklyn NY St. Finbar Catholic Church features the return of the interior floor and seating plan done for a previous renovation in 1984 to the church's original 1912 design. The restoration project required a new sound system that would be cosmetically acceptable, with no compromise to acoustical and logistical performance, as well as superior speech intelligibility.

The goals of the pastor, Fr. Michael Gelfant, were to preserve the aesthetic beauty of this magnificent church and accurately replicate the intelligibility and acoustical quality of the spoken word, as well as all varieties of liturgical singing and music in the listening and performing areas of the worship space. In other words, Fr. Gelfant wanted a sound system that "looks good" and "sounds good."

The major challenges of "cosmetics vs. acoustical performance" would require technology that is now possible with the development of advanced DSP





St. Finbar is the Mother Church of Bensonhurst/Bath Beach, Brooklyn NY.

processors and Audio Video Bridging (AVB). Current DSP processors are at least four times more powerful and more easily expandable than their predecessors, providing the capability to design sound systems with a variety of cosmetically acceptable speakers that are acoustically and logistically managed with this new reservoir of DSP programming power.

Audio Video Bridging (AVB) technology has improved the synchronization, reliability and networking capability of multiple DSP processors, and eliminated the expense of third-party licensing and firmware to combine multiple DSP processors without additional fees and programming.

Ornate Design

The ornate design of St. Finbar Church would require small, acoustically competent speaker systems capable of producing full-range sound to replicate the spoken word and liturgical singing and music programs throughout the worship space. The planned sound system would feature two DSP processors with AVB technology programmed to accommodate and manage the voice lift and choir microphones, as well as electronic and acoustic instruments.

We programmed and installed password-protected remote digital control panels with default settings to return the sound system to normal operation after any possible user manipulation during special events. The ability to assign user passwords to these remote digital control panels prevents the unauthorized manipulation of the sound system, and still provides user-friendly local control of a multitude of features.

DSP software structures the firmware that resides in the DSP processor to operate the sound system, and can be remotely accessed via the internet for updates or changes in the future operation and configuration of the sound system.

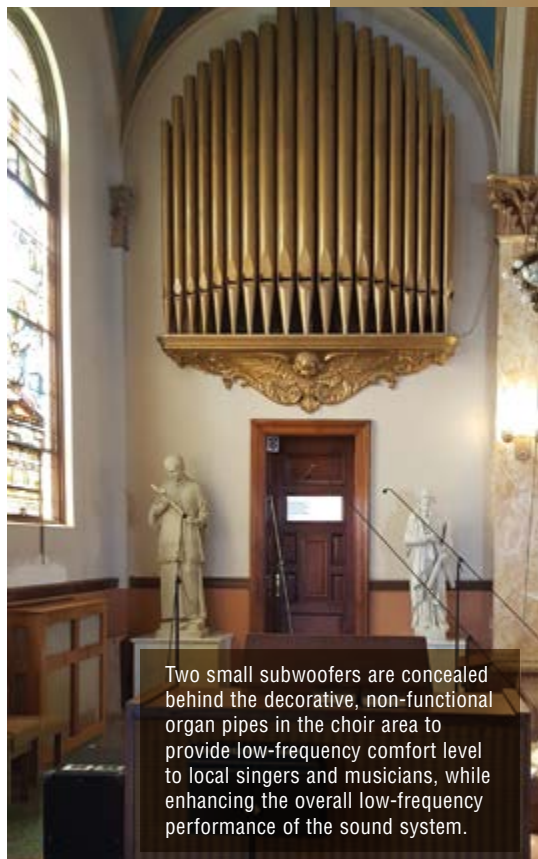
We installed a custom internet cloud that provides remote access to the sound system for emergency service and adjustments, routine maintenance and updates to the sound system to ensure quick and efficient service, as well as remote monitoring and control capability for special events. The cloud also provides a private VPN wireless network that is available for user-friendly laptop computers in the worship space.



Four independently powered line array source speakers are installed on the front columns of the transepts, cosmetically treated to blend with the environment.



Four independently powered support speakers were installed in the nave, custom painted and with custom grille cloths to blend with the environment.



Two small subwoofers are concealed behind the decorative, non-functional organ pipes in the choir area to provide low-frequency comfort level to local singers and musicians, while enhancing the overall low-frequency performance of the sound system.

We programmed password-protected surface-control software for the owner's laptop computers to access the VPN wireless network through the cloud. This allows for alternate and simultaneous manipulation of the sound system during special events and the capability to create "scenes" with multiple presets for special events that can be activated with a laptop computer or the local password-protected digital sound system control panels in the church.

Hybrid Sound System Design

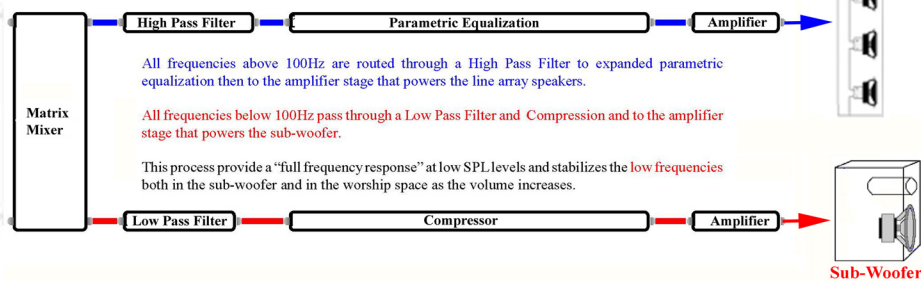
Hybrid sound system designs consist of source speakers with line array technology that have an extended cylindrical (high Q) wave form, support speakers with low Q waveforms and subwoofers that provide enhanced, but controlled, digitally managed low-frequency response for singing, acoustical and electronic musical instruments, and prerecorded audio. This format significantly reduces or eliminates the necessity of "manipulating the sound system" to accommodate a variety of attendees in the worship space. The sound is distributed throughout the listening areas with "digitally time-aligned" support speakers that create the "precedence effect." This occurs when two or more sound sources radiate identical or nearly identical complex signals; the listener hears a single image located at the nearer source.

Because frequencies below 100Hz tend to be more active in reverberant houses of worship, the necessity for acoustical consistency becomes a problem as the sound-pressure levels increase in the space. The establishment of discrete acoustical speaker zones controlled by a virtual matrix mix-

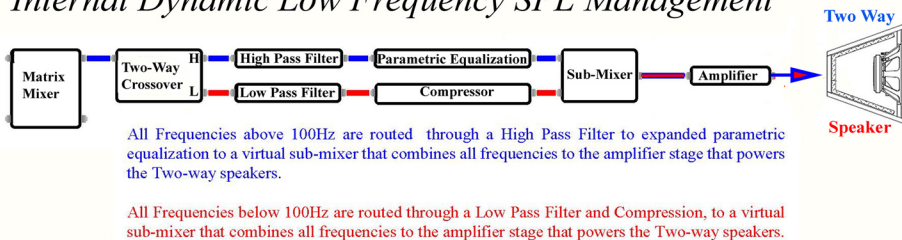
Equipment

- 2 Audio-Technica AT-899 lavalier mics
- 1 Audio-Technica ATW-DA49 wireless antenna distributor
- 1 Audio-Technica ATW-RC13 System 10 receiver chassis
- 1 Audio-Technica ATW-RU13 System 10 pro receiver
- 1 Audio-Technica ATW-T1006 System 10 boundary mic
- 3 Audio-Technica ES-915ml mics
- 2 Audio-Technica ESW T-411 wireless belt-pack transmitters
- 4 Audio-Technica ESW UHF ESW R-3100 wireless receivers
- 1 Audio-Technica ESW-T441 wireless handheld transmitter
- 2 Audix MB 1255 MicroBoom mics w/50" boom
- 2 Audix MB 1255 MicroBoom mics w/84" boom
- 2 Biamp TesiraFORTÉ AVB-AI DSP Processors
- 1 Biamp Tesira TEC-1s controller
- 4 CAMM CA-43L line array speakers
- 2 CAMM CAS-10 subwoofers
- 6 CAMM DT-1 monitor speakers
- 4 CAMM DT-200 2-way speakers
- 2 CAMM DTC-1 ceiling speakers
- 1 Crown ComTech DriveCore CT 475 4-channel amp
- 1 Crown ComTech DriveCore CT 8150 8-channel amp
- 1 Ubiquiti UniFi security router
- 1 Ubiquiti UniFi UA-8-150W 8-port switch
- 1 Ubiquiti UniFi UAP-AC-LR networks enterprise WiFi system

External Dynamic Low Frequency SPL Management



Internal Dynamic Low Frequency SPL Management



The two DSP processors are programmed with external and internal Dynamic Low Frequency SPL Management for the speakers in the church to digitally manage sound-pressure levels below 100Hz to enhance frequency response.

er accommodates the use of a variety of local microphones in close proximity to speakers, without acoustic feedback or phase cancellation.

The implementation of external and internal Dynamic Low Frequency SPL Management, programmed with a virtual matrix mixer and sub-mixers, enables controlled expansion of the low-frequency response of the line array "source speakers" and subwoofers in the transepts, and the small support speakers in the nave, by digitally managing the sound-pressure levels of frequencies below 100Hz to prevent unacceptable SPL levels of low frequencies inside the speaker cabinets as the volume increases.

Rise Time

The rise time of low frequencies in reverberant houses of worship is significantly faster than those of mid-range and high frequencies, and presents significant acoustical and intelligibility problems.

The combination of a hybrid distributed speaker system, enhanced with external and internal Dynamic Low Frequency SPL Management and Critical Zone Digital Delay Technology enables the implementation of smaller speakers in the worship space that are capable of providing and digitally managing low frequencies to enhance the music program while maintaining speech intelligibility.

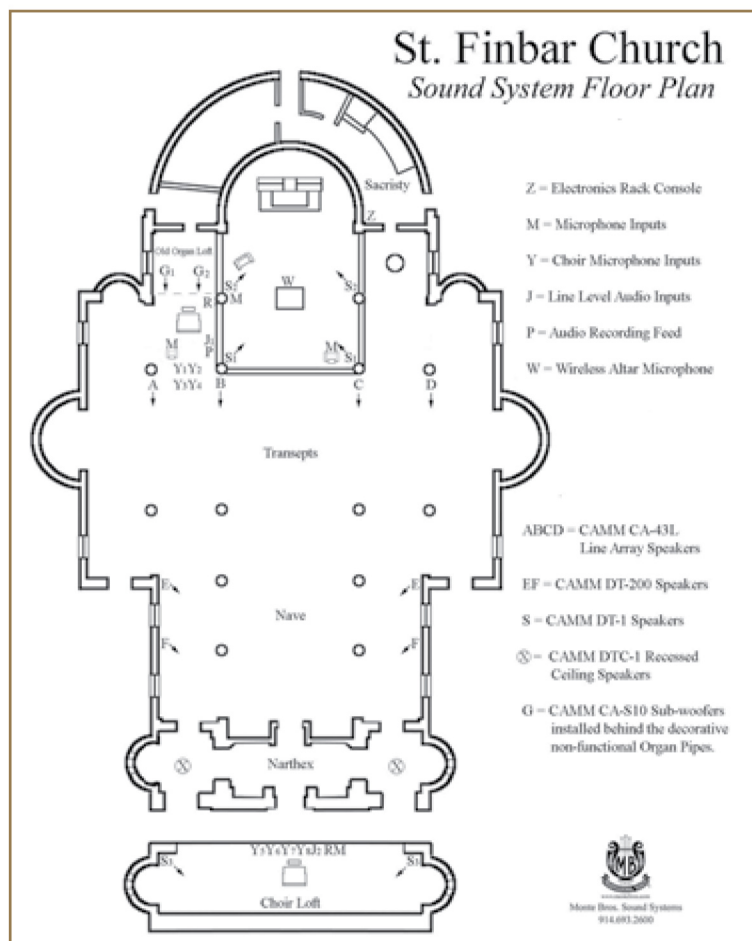
Four independently powered small line array source speakers installed on the front vertical columns of the transepts, custom painted and with custom-colored grille cloths, provide the "source" effect of this hybrid sound system. Strategically placed small subwoofers in the choir area enhance

and expand the low-frequency performance of the sound system. These independently powered small subwoofers are installed behind the decorative nonfunctional organ pipes in the sanctuary choir area to also provide low-frequency "comfort levels" to the singers and musicians.

External Dynamic Low Frequency SPL Management establishes a dynamic range for these subwoofers that feature a low-pass filter at 100Hz and a compressor limiter to control the sound-pressure levels inside the cabinets during increased volumes. The effect of digitally calibrated compression on frequencies below 100Hz provides an acoustically well managed sound system that does not require user manipulation to accommodate a variety of events and attendees in the worship space.

Internal Dynamic Low Frequency SPL Management, along with Critical Zone Digital Delay Technology for the precedence effect, regulates four independently powered support speakers on the side walls of the nave and provides optimal intelligibility

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during all levels of attendance.

The small support speakers are now capable of locally enhancing the low-frequency response of the sound system for singing, musical instruments and prerecorded music, without compromising the intelligibility of voice lift microphones that are individually programmed for limited participation in the expanded low-frequency enhancement of the sound system through the virtual matrix mixer.

A chronic problem inherent to providing local monitor speakers in specific areas of the worship space, such as the sanctuary and choir areas, involves the interaction of the “local microphones” in close proxim-

ity to the “local speaker.” Independently powered and digitally managed custom-painted monitor speakers in the sanctuary and choir loft, with an “independent mix” through a virtual matrix mixer, provide optimal performance without feedback.

The ability to digitally program multiple speaker zones through a virtual matrix mixer with specific equalization and signal processing contributes significantly to speech intelligibility, as well as accurate replication of liturgical singing and music throughout the church. It is equally important to enjoy the aesthetic beauty of a worship space while simultaneously enjoying the intelligibility and acoustical quality of

the spoken word, as well as liturgical singing and music that enhance the celebration of liturgies, concerts and special events for all in attendance.

The desire to hide speakers in houses of worship with challenging acoustics usually yield results that bring to mind the colloquialism, “If you can’t see them, you probably can’t hear them!” Significant developments in DSP processing, compact multichannel amplifiers and advanced speaker management design techniques allow for installation of smaller multiple subwoofers in multiple locations that are not visible to the congregation...and the good news is, “What you see is not only what you get!”



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