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HOUSE OF WORSHIP: TECHNOLOGY

REAL-TIME POPE:
Philadelphia's Cathedral Basilica Receives Audio & Video Upgrades For Pope Francis' Visit

HOUSE OF WORSHIP: TECHNOLOGY

Cathedral's Audio Requirements Presented Challenges

Cathedral Basilica Of Saints Peter And Paul Audio

Audio requirements presented challenges.

BY STEVE MINOZZI, MONTE BROS.

In mid-August, I received a call from Fr. Gerald Gill, the rector of the Cathedral Basilica of Saints Peter and Paul in Philadelphia, requesting an urgent meeting to discuss the design and installation of a new sound system in the largest Catholic church in Pennsylvania. This would be for a Papal Mass in six weeks that would be broadcast around the world.

Previous Experience

Having had the previous experience of designing and installing the sound system at St. Joseph's Seminary Chapel in the Archdiocese of New York that was used for a visit by Pope St. John Paul II in 1995, I knew what to do and what to expect.

Fr. Gill and I agreed that all necessary cable for the new sound system would be supplied and installed by the cathedral's electricians in compliance with cable installation documents and site supervision provided by Monte Bros. Monte Bros. was also charged with concurrently installing and calibrating all sound system components as a "parallel sound system" that would not interfere with the facility's daily operation and use of the current sound system.

I quickly located an old in-scale floorplan of the entire worship space, and created detailed worksheets for the cable installation documents, and for a master sound system floorplan that would illustrate the location of sound system components, mic/line inputs and speaker systems in all areas.

The Papal Mass was attended by cardinals, archbishops, bishops and hundreds of priests.

The chapel, which accommodates up to 500 people, was designed to accept audio from the cathedral sound system, and was used for overflow attendance at the Papal Mass.

A custom white altar microphone and two white boundary microphones were used at the high altar to accommodate the pope and concelebrating priests.

Technicians with laptop computers were in the cathedral and media room to monitor the Papal Mass and provide audio feeds to Vatican Radio and backup audio feeds to the media room.

There were three major challenges to the successful and timely completion of this project:

- **Acoustics:** A spectrum analysis of the worship space identified nine different acoustical zones that would require independent equalization, logistical management and multiple combinations of speakers to get the job done.
- **Logistics:** The existing sound system had to remain in use on a daily basis during the parallel installation of the new system. We had to accommodate a variety of scheduled events in both the cathedral and chapel, which would restrict our ability to proceed during those time periods.
- **Project Management:** An accelerated installation schedule would require the implementation of four project management teams that would operate concurrently and multilaterally, along with the cathedral electricians' cable installation team.

Installation Plan

We set up a detailed installation plan:

- **Design and Programming:** I quickly prepared sound system floorplans, schematics, equipment lists and DSP program files for the project management teams, as well as cable installation documents for the cathedral electricians. These were delivered via email to each team member.
- **Technology:** Jim Woodward, assisted

The electronics console was designed with additional space to accommodate preprogrammed DSP processors for the cathedral and chapel that could be quickly activated if necessary.

Equipment

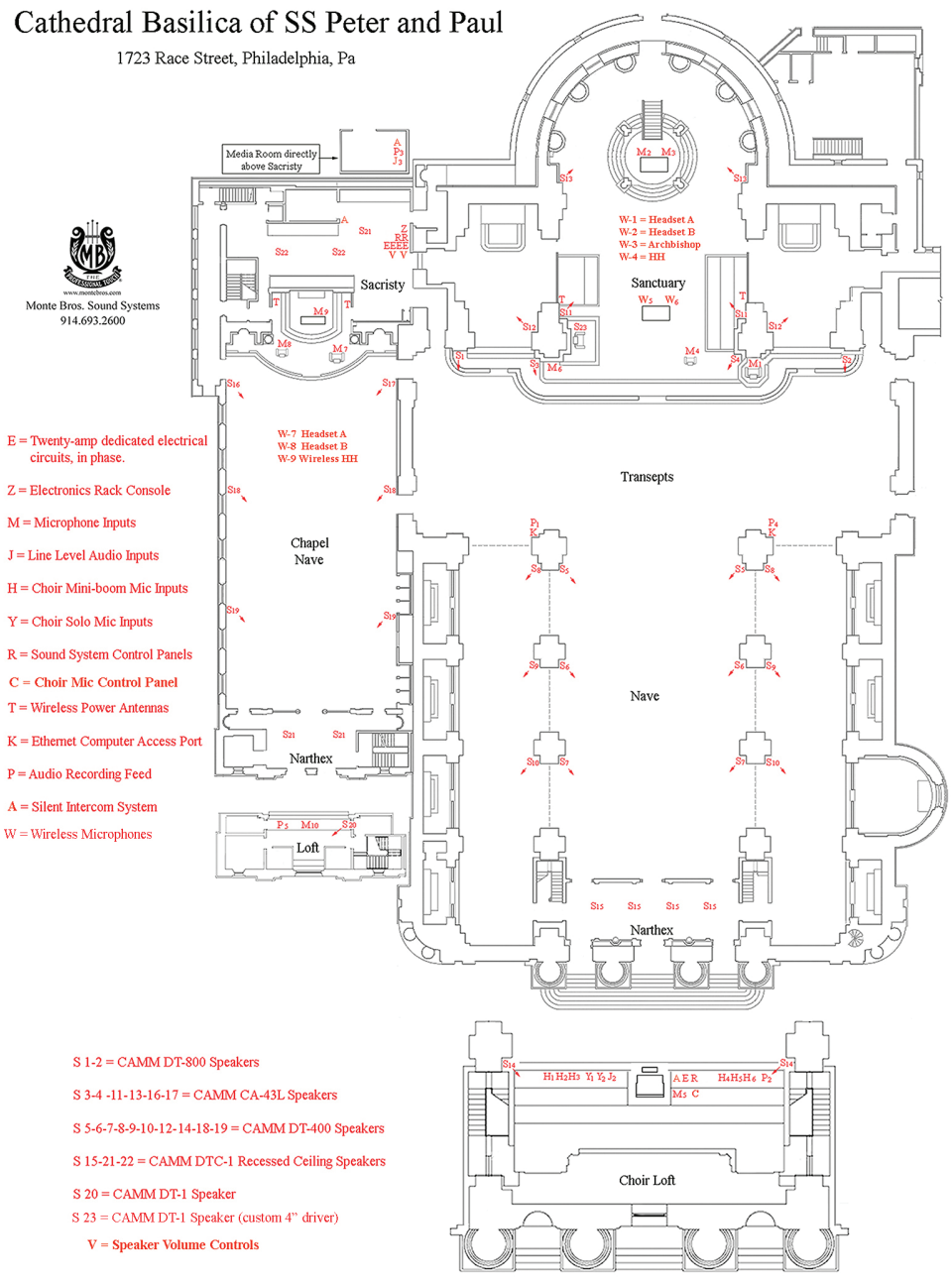
3 Aiphone 3-line silent intercoms
2 Aphex DA-120 distribution amps
5 Audio-Technica AT-894 headset mics
5 Audio-Technica ES-915/ML mics
4 Audio-Technica ES-935/ML mics w/on/off switch
3 Audio-Technica ES-961/W altar mics
2 Audio-Technica ESW-T441 handheld wireless mics
2 Audio-Technica AEW-DA6600 antenna distributors
1 Audio-Technica ATW-DA49 antenna distributor
1 Audio-Technica ATU-891 mic
6 Audio-Technica ESW UHF wireless receivers
5 Audio-Technica ESW-T411 belt-pack transmitters (switch)
2 Audio-Technica ESW-T412D wireless transmitters
6 Audix MB 1255 MicroBoom cardioid mics
3 Biamp Tesira Forte AVB-AI DSP processors
4 Biamp Tesira TEC-1S controllers
8 CAMM CA-43L line array speakers
2 CAMM DT-1 speakers
20 CAMM DT-400 speakers
2 CAMM DT-800 speakers
8 CAMM DTC-1 ceiling speakers
1 Crest CM-2204 amp
2 Crest CM-2208 amps
1 Crown CD1-1000 amp
1 Denon DN-F450R digital flash recorder
1 Galaxy PA6S powered monitor
1 Peavey IPR2-2000 amp
1 Penn-Elcom 6642BK console
1 Raxxess ER-16 console
1 Raxxess ER-20 console
1 TASCAM CD-200iL CD-iPod player
3 Whirlwind SPC-82P 8x16 mic splitters

CABLES

American Data Link multi-cables
Belden mic cables
Belden RG-8/U coax cables
Genesis Cat5 cables
Isotec speaker cables

List is edited from information supplied by Monte Bros.

The author used this in-scale floorplan of the worship space as a basis for other planning



by Bobby Scarano, would review all DSP program files and surface control software files. They would execute and monitor the accelerated acquisition of all custom and proprietary equipment for the new sound system, as well as handle and expand interaction with the new media room on the floor above the sacristy.

Woodward's team would also be responsible for interaction with the Secret Service and media broadcast organizations to ensure that there would be no conflict with the 600MHz wireless microphone backup systems for the Papal Mass.

- **Electronics, Microphones and Media Interface:** Tom Silliman's team would design and assemble the main and ancillary electronics rack consoles in the sacristy, along with temporary electronics consoles that could be transported quickly into the cathedral and chapel worship spaces for equalization of the nine acoustical zones in both areas, by using temporary cable runs to the speakers.

Silliman would synchronize and test the 24 mic/line cathedral audio feeds from the transformer-balanced mic/line splitters to the media room to ensure continuity, and for all hard-wired and wireless microphones, and line level audio inputs, in the cathedral and chapel.

More Installation Plans

- **Speaker Systems:** Julio Salazar's team would identify the optimal locations and focusing for all 41 speaker placements in the cathedral and chapel, and would manage the installation and positioning of the new speakers for optimal performance by temporarily relocating the existing speakers wherever necessary.

Salazar would oversee paint matching in the area of each of the speakers, to have them blend with their environment and to patch any holes left by the removal of the old speakers. He would also oversee the testing of all speaker cables installed by the cathedral electricians, in accordance with the sound system cable installation documents provided by Monte Bros.

- **Progress:** The collective progress of all levels of project management and the cable installation team would be monitored collectively by Monte Bros.' multilateral project management team, and evaluated each week to confirm that all project management teams were in compliance with the sound system and cable installation schedules.

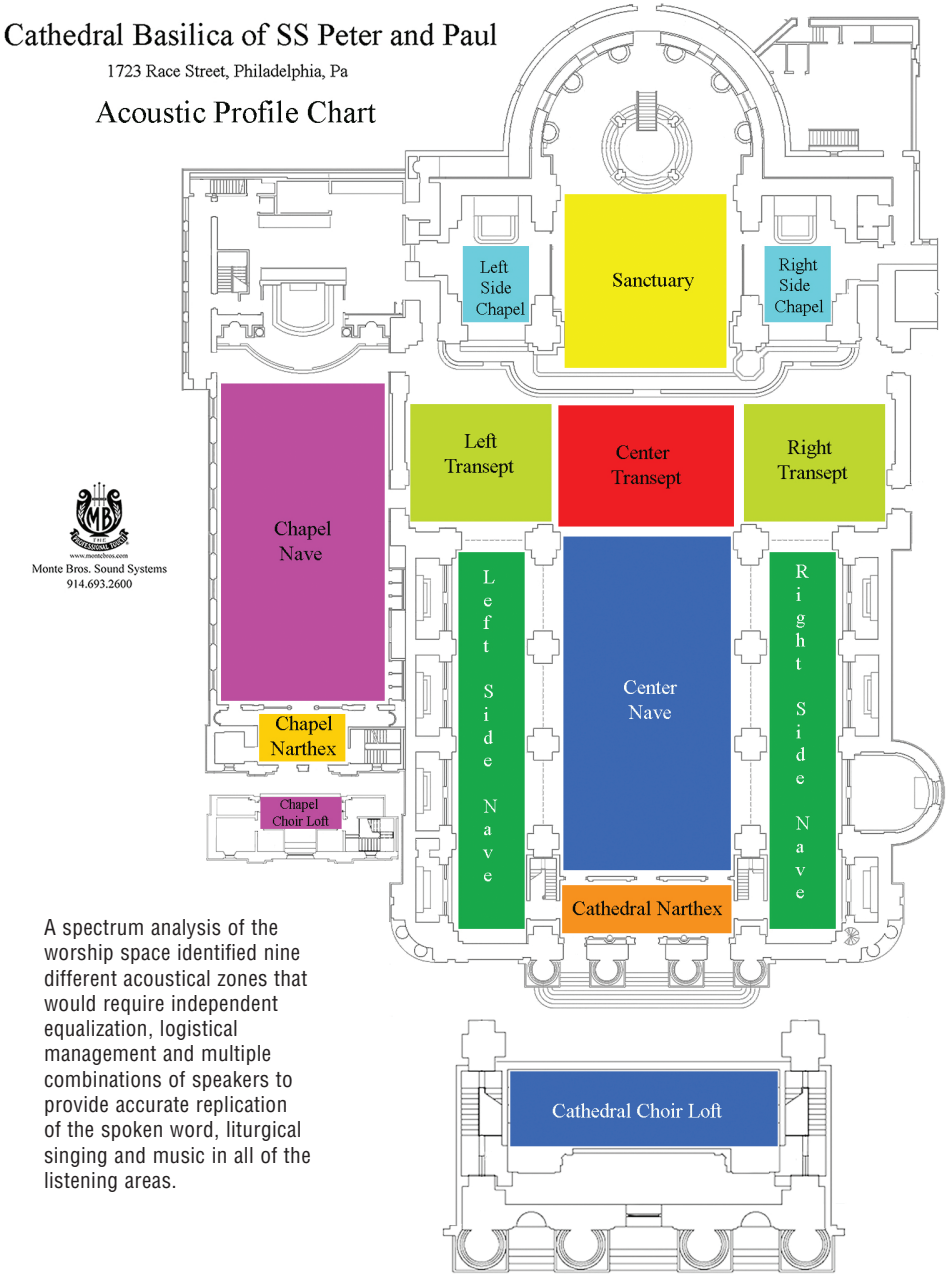
The new sound system was scheduled to be in full operation for final testing by the beginning of the sixth week of the project, which would culminate in the Papal Mass on Saturday, September 16 at 10:30am.

The biggest advance in technology since our last papal visit in 1995 proved to be the interaction and advantage of computer systems: software and the internet, in designing, installing and servicing our sound systems.

Over the last 10 years, Monte Bros. worked closely with Jerry Macon of Macon Systems to develop his DB Master client server relational database software to integrate and monitor all aspects of our business. This provided the ability to cross reference sound system schematics, floorplans, equipment and speaker designs in similar installations, to expedite the design of a sound system for this cathedral.

The ability of our technicians to remotely access information from our file servers in the field via their laptop computers and smartphones, and to operate the database system remotely to provide purchase orders for custom-fabricated equipment, significantly contributed to the timely success

documents, including the Acoustic Profile Chart, which documented nine different acoustical zones.



A spectrum analysis of the worship space identified nine different acoustical zones that would require independent equalization, logistical management and multiple combinations of speakers to provide accurate replication of the spoken word, liturgical singing and music in all of the listening areas.

of this project.

The expansion of this sound system to accommodate a Papal Mass, which may not happen again for many years, required a design approach that would maximize the assets of these additional features to enhance other special events in this worship space in the future.

Microphones

When Umberto Civitarese, the Technical Director of Vatican Radio, arrived at the Cathedral at 9:00am on the morning of the scheduled 10:30am Papal Mass to review the logistics and backup features of the sound system, we were ready for him. There was a hard-wired microphone on a stand that could be detached quickly and easily for the seminarian to hold for Pope Francis when he was speaking from the cathedra, along with an identical 24-inch handheld microphone on a wireless plug-on transmitter available as a backup.

There was a custom 24-inch white microphone and white base on the high altar for Pope Francis, as well as two white boundary microphones on the sides of the altar, to accommodate the concelebrating clergy. These could also be used as emergency backup microphones for Pope Francis.

Two additional 24-inch microphones with wireless plug-on transmitters on stands were used to accommodate the last-minute request for a deacon's microphone and a translator's microphone in the sanctuary, and for the final address to the Holy Father by Archbishop Chaput, in the sanctuary opposite the pope at the cathedra.

An 18-inch microphone on a base, with a wireless plug-on transmitter, was positioned on the floor of the high pulpit so it could be placed on the pulpit quickly, as an emergency backup.

Multiple Computers

Jim Woodward and I had multiple laptop computers with surface control software in the left transept to monitor and control the sound system, and provide an independent audio mix for the Vatican Radio digital recorder. Bobby Scarano had a laptop computer in the choir loft, with surface control software, to monitor and control the performance of the visiting choir and instruments. And Tom Silliman had a laptop computer in the media room, with surface control software, to provide an emergency audio feed to the media, in the event of any malfunction of the media-room mixing console.

Three identical DSP processors were programmed and installed into the electronics rack console in the sacristy. These could be switched in less than 60 seconds to replace any or all of the active DSP processors, along with backup amplification and wireless receivers and transmitters.

A temporary backup generator was installed to provide alternate electricity to the sound system and broadcast media room, to ensure uninterrupted performance of the live sound system and broadcast media feeds in the event of a power failure.

Fortunately, none of these backup systems had to be employed, but they were there if needed to ensure minimal interruption to the live audio for the Papal Mass and broadcast feeds to the media around the world.

The "longest hour" for Monte Bros. during the 1995 papal visit by Pope John Paul II at St. Joseph's Seminary Chapel in New York was truly the "longest hour-and-one-half" for Monte Bros. during the 2015 Papal Mass at the Cathedral Basilica of Saints Peter and Paul in Philadelphia.

As they say, "History repeats itself!"