

Sound System Assessments and Recommendations

**Messiah Episcopal Church
1631 Ford Parkway
St. Paul, MN 5511**



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Sanctuary:

Overview and Use

The worship band and hybrid pipe/electronic organ are located in the rear balcony of the sanctuary.

Additional speakers for the pipe organ are located at the front of the sanctuary. Traditional choir ensembles perform from the balcony as well. Preaching, reading, prayers, baptisms, and other worship events occur in the front of the sanctuary. The priest prefers using a wireless lapel mic to allow mobility during the worship service.

Occasionally, special music performance takes place at the front of the sanctuary- two examples are a youth band and AYPAs- KaRen group presentations.



Sound System Description

Three audio systems are in place. The **main system** has a 16 CH mixer that outputs to a main speaker in the center/ front of the sanctuary (unknown Mfr). The mixer also sends audio to speakers located in the rear balcony to deliver worship band sound to the congregation seating area. Vocals from the worship band are routed to the front speaker. Instruments are routed to the balcony “music” speakers. A **second monitor system** provides selected program through four “hot spot” monitors in the balcony. A **third sound system provides audio interpretation** of the content of the worship service. This system includes a mic, small mixer and an audio transmitter and wireless receiver system for individuals in the congregation to hear using ear sets.

The program output of the main system is intended to provide signal to the Gathering Space sound system and an audio feed is sent to a powered speaker in the vestibule at the rear of the sanctuary.

The output of the main system feeds the input of a personal computer for recording the service (Audacity Software) and the message is uploaded as an .mp3 to the church web site for listening via the church web site.

Notes from church staff or observations:

- Additional input channels are needed on the mixer.
- A solution for the occasional performance groups (music, drama) at the front of the sanctuary is needed (~ 12 input channels)
- The location of the mixing console doesn't allow the operator to hear the audio that is delivered to the congregation.
- The Interpreter system is located in a position where the interpreter's voice is heard by the full congregation.
- Feedback is occasionally a problem from the pulpit. The omni-directional conference room mic used at this location isn't able to provide enough gain in situations where voices are soft or the mic is obstructed by note pages, etc.

- Reading from the scriptures when the reader is away from the pulpit isn't adequately amplified.
- The monitor system for the band needs improvement.
- The current mixing console can't provide enough flexibility in routing to the headphone output for level-setting.
- Can the system benefit from a full-room EQ?
- Why do headphones fail every year or so?
- Sanctuary audio needs to be delivered to rooms in the lower level (nursery, adjacent room to nursery and lower level hallway area). A separate volume control for each of the rooms would be helpful.
- Additional vocal mics, stands and cables are needed.
- The wireless mics need to be analyzed for frequency range compatibility with new FCC regulations.

Assessment Visit Notes:

I verified operation of the various parts of the sound system. I played a variety of sound material through the monitor system, the music system (rear speakers) and the main sanctuary speaker system. I sent isolated audio tones from the lowest sounds we hear (30Hz) up to the highest sounds we can typically hear (16,000 to 18,000 Hz). I also sent test audio through the sound system (Pink Noise) and measured the efficiency of the sound system using a Real-Time Sound Analyzer. The sound through both the main sanctuary speaker and the rear music speaker was overly strong in the mid-range area of the sound spectrum and had diminished performance in the upper frequency ranges. In the recorded music that I sent through the system, these characteristics were evident as well- the crisp sounds of percussion and definition of words in vocals were diminished. Both speakers were capable of full-range reproduction.

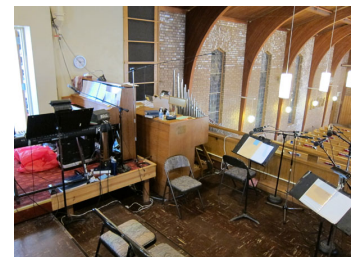
Recommendations

From the information that I gathered through our meeting and my assessment visit, I offer the following recommendations:

1. **Replace the Sanctuary Mixer-** Soundcraft GB2-24 (See Reference "A" in Appendix B) While the current mixer still has useful life, a new mixer will provide additional input channels that are needed as well as more flexibility in operation. The existing Mackie CFX20 mixer could be re-located to the Youth Loft to replace the Sound Tech Mixer in use there.
2. **Re-locate sound equipment to provide an improved mixing location for sound operators.**



The location of the existing mixer does not allow the operator to hear what that congregation is hearing in the sanctuary. The goal is to choose a position for the audio mixing location that allows the operator to hear the sound in the room from the perspective of the congregation so proper volume level adjustments, equalization and balance can be made to provide the highest quality sound for the congregation. A suggested location is the current location that is used for the Interpreter Sound System. This is at the front of the balcony and slightly west of center. To help the operator hear the sound from the music speakers behind the grille cloth panels at the left and right of the balcony, it is suggested that those speakers be relocated on a diagonal axis that will allow the operator to hear the sound at this new mixer location.



3. **Re-locate the Interpreter sound system** to the current location of the audio mixer in the upper part of the balcony. This would help prevent the speech from the interpreter from reaching the congregation, but could still allow the Interpreter to see most of the activity at the front of the sanctuary.

4. **Add system-wide Graphic Equalizers** to both the main sanctuary speaker and the “music” speaker portion of the audio system. This would allow the audio from existing speakers to be adjusted to provide an even sound across the listenable audio spectrum and improve the overall sound quality in the sanctuary. This equipment should be installed and adjusted through critical listening and the use of audio analysis equipment. It needs little additional adjustment following this initial set-up. (Reference B)

5. **Monitor System:** Since the acoustical value of the balcony area is pretty live, the use of the “Hot spot” monitor speakers that are currently in place is a viable solution. Re-positioning the “Music” speakers may provide some monitor signal that is useful for the worship band. Alternately, or as a supplement, an in-ear monitor system can be considered for members of the worship band. (Reference C)

6. **Replace the Omni-directional conference mic at the pulpit** with a conventional podium mic. This will prevent the occasional feedback problems while ensuring the mic will not be obscured by papers, texts, etc. The podium mic can have a shorter gooseneck so that proximity problems are avoided. (Reference D)

7. **Equipment for Performing Groups at the front** of the sanctuary:



We discussed the possibility of a portable mixer to be used at the front of the sanctuary to be used with performing groups in that location. Since space is tight in the pews and aisles I would suggest an alternative: Run twelve mic lines from the platform area to the new mixing location in the balcony. As needed, these mic lines can be plugged to available channels in the new audio mixer or a smaller auxiliary mixer could be used and connected to the main system for the sanctuary. The new mixing location would allow smooth operation and monitoring. The addition of one audio line to the platform

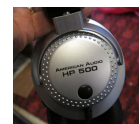
area would allow monitor speakers and amplifier to be run from the new mixing location. (Reference E & F)

8. **Wireless Mics and Frequency evaluation:**

Only the TOA wireless mic is broadcasting on the frequencies that have been re-allocated for emergency systems. (See appendix A: Wireless Microphone Frequency Restrictions). The other systems are OK.

9. **Headphone failure:**

I was not able to find information about the output level available at the headphone jack on the mixer. Clearly, the mixer can send a very strong signal to the headphones. I think the headphone failure comes from a higher level of sound being sent to the headphones than the phones can handle.



10. **Sanctuary Sound to Auxiliary spaces** (Office, Nursery, Children’s area, lower level):

By running an audio line from the mixer output to an input of the Gathering Space mixer/ amplifier, the sanctuary sound can be sent to these spaces. Volume controls in each room should be considered. (Reference G)

11. **Additional Mics and Stands**

Additional mics could be the Shure SM-58 for the worship band vocal needs. Purchase additional mics, stands and booms to support the typical programming needs. (Reference H, I, J, K)

Gathering Space:

Overview and Use

This sound system provides voice reinforcement for gatherings in this open area adjacent to the sanctuary. A projector and screen are available and the sound system can provide the sound that is part of media handled through the projector.



Sound System Description

A single TOA distribution amplifier/mixer is located in a storage room off the Gathering space. A wireless mic is used most often in this location. There is capability for using a wired mic and audio from media sources (DVD and Data projector)

The system is configured as a distribution system and speakers are located in the ceiling of the Gathering Space, in the adjacent office/ meeting/ reception room, in the lower level space below, and in the space adjacent to the current nursery.

Notes from church staff or observations:

- The system works well for the current use.
- The Sanctuary program audio should come to this amplifier/mixer to provide monitoring for children's church, nursery and parishioner entry through the Gathering space.
- Consider adding speaker volume controls in each room on the lower level for maximum flexibility.

Assessment Visit Notes:

The sound system operated well and provided quality sound for the needs the system is asked to perform (voice, media playback). The wireless mic receiver is located in an area that was not accessible, so assessment was not possible.

Recommendations

1. **Add an audio line from the sanctuary mixer** to one of the spare inputs on the mixer/ amplifier for this area to provide monitoring of the worship service in the sanctuary to the spaces served by this sound system.
2. **Add wall mount volume controls** for the speakers in the lower level hallway, and the nursery. Replace the knob for the speaker in room LL-102. This will allow proper listening levels in each of the rooms. (Reference E)
3. **Re-connect the speaker in the lower level hallway** (one of the wires at the speaker has been disconnected) and add a volume control.

Youth Loft:

Overview and Use

This room is a general gathering space as well as a room for youth programming and activities. The room has a stage installed and performance and presentations are often done from that area.

Sound System Description

The sound system includes a commercial TOA amplifier and TOA HX-5B speakers. A 12 channel mixer with snake to the platform area in the room handles mic and instrument inputs. The output of the mixer feeds an input on the TOA mixer/amplifier which drives the speakers as a mono signal.



Notes from church staff or observations:

- Location of speakers do not provide good coverage to west side of the room (with the lower ceiling)
- Since the sound system includes both the TOA mixer and 12 channel Sound Tech mixer, the operation can be confusing for some users.
- Consider providing a connection point at the platform area for computer audio to connect.
- Additional vocal mics, stands and cables are needed.

Assessment Visit Notes:

The sound system provides reasonable quality for voice and music applications. The sound coverage to the room is diminished in the west part of the room with the lower ceiling. The Sound Tech mixer has seen a useful life and has a variety of performance issues. Replacement should be considered. I agree that the operation of the system can be confusing for operators.

Recommendations

1. **Replace the Sound Tech mixer.** (The Mackie mixer from the sanctuary could be used if that mixer is replaced).
2. **Remove the TOA mixer/ amplifier and replace with a power amplifier** to receive the audio from the mixer and send to the speakers in the room. (The TOA mixer/ amplifier could be re-used in the Undercroft.) (Reference L)
3. **Move the two speaker arrays** to the center of the high part of the room and hang near the front of the stage. (See image). This will provide better coverage to the west part of the room and provide better feedback control from mics in the stage area.
4. **Dedicate one of the jacks in the snake box** at the stage area to receive **audio from the rolling media cart** that is available. (Provide necessary connector adapter or DI box).
5. Purchase **additional mics, stands and booms** to support the typical programming needs in the room. (Reference H, I, J, K)



Other spaces needing Sound System Support:

Overview and use

The **Undercroft** space below the sanctuary includes presentation or performances at various times through the year. The nature of the performances varies and the performance/ presentation area is most often located at the south end of the room. Currently, two speakers are hung from the ceiling at the south end of the room. These are used with portable sound components (Mics, Mixer, amplifier) when sound reinforcement is needed.

The **outdoor yard** space located east of the sanctuary is occasionally used for events and presentations requiring sound reinforcement. Portable sound systems/ equipment are set up to provide sound when needed.

Notes from church staff or observation:

- It was observed that there are three spaces where a portable sound system could be used: The front of the sanctuary for music and other performance groups, the undercroft for performance presentations and the outdoor yard space for performance and presentations in that area.
- The two logical speaker locations in the undercroft are 1.) ceiling mounted distributed speaker layout and 2.) a pair of speakers on stands or hung from the ceiling at each side of the presentation location, 3.) Speakers at 6 of the supporting columns.

Undercroft

Assessment Visit Notes:

The hard surfaces in the room actively reflect sound. This room could benefit from a distribution style sound system and ceiling mount speakers (10 ceiling speakers placed evenly through the space). The ceiling tiles likely would require ceiling speakers to be surface mounted. An alternate to ceiling mount speakers could be small speakers (70volt distribution style) at 6 of the supporting columns in the room.



Recommendations

1. Install ceiling or column-mount speakers

through the space and **install the TOA mixer/ amplifier** that is taken out of service in the Youth Loft as the permanent sound system components. (This mixer/ amp has up to 6 inputs and the inputs can be configured for either mic or auxiliary source inputs) (Reference M)

2. Install mic jacks in key locations in the room and wire to TOA Mixer/ amp.

Outdoor Yard

Recommendations

1. A **Portable Sound system** with ~ twelve channel powered mixer, speaker stands, speakers, microphone snake, and rolling cart is suggested. (Reference N, O, P, Q)

The monitor speakers from the sanctuary could be used as the main speakers for this system (Sanctuary- Recommendation Item #7). Microphones, stands and cables could be brought from other areas of the church for these occasional uses in the yard.

Appendix A: Wireless Microphone Frequency Restrictions

Messiah Episcopal Wireless Microphone Frequencies:

Sanctuary:

- Telex FMR 50. Frequency: 169.505 MHz
- AudioTechnica ATW R12 (3 units). Frequencies: 207.000, 193.000, 183.200
- TOA WT-S200 Frequency: 742-744MHz

Gathering Space:

The Wireless receiver in the Gathering Space was not accessible- perhaps it is installed above the suspended ceiling? Further research is needed! Use the information below to determine if it falls in allowable frequency range.

Wireless Microphones

Wireless microphones are used to transmit sound to an amplifier or recording device without need of a physical cable. Typical users include theaters, churches, schools, conference centers, theme parks and musicians and other performers.

Wireless Microphone Prohibitions:

The operation of wireless microphones and similar devices is prohibited from certain frequency bands for public safety reasons and commercial concerns. The sale of wireless microphones or similar devices intended for use in the United States in the 700 MHz Band was banned by the FCC in January 2010, and use of the devices in the 700 MHz Band was prohibited as of June 12, 2010. "Similar devices" include wireless intercoms, ear monitors, audio instrument links and cueing equipment.

The 700 MHz Band – between 698 and 806 MHz -- is now reserved for use only by public safety groups, such as police, fire and emergency services, and commercial providers of wireless broadband services. Use on broadcast bands outside of the 700 MHz Band was not affected by the ban, and can continue. Microphones and similar devices with cords are not affected by this prohibition.

- [Manufacturers and Equipment List](#): See if your model operates on the 700 MHz Band or request more information from the FCC's Consumer Center.
- [Frequently Asked Questions](#): Answers regarding the 700 MHz Band prohibition and compliance issues.
- [Related FCC Publications](#): Background on the ban.
- [Report Interference](#): How to report interference to devices operating on licensed 700 MHz spectrum.

Background

[Operation of Wireless Microphones in 700 MHz Band Prohibited After June 12, 2010 \(PDF format\)](#)

Fact Sheet: [Distribution, Sale and Use of Wireless Microphones Operating in the 700 MHz Band Prohibited \(PDF format\)](#)

[Frequently Asked Questions](#) about Wireless Microphones [\(PDF format\)](#)

Appendix B: Sound Equipment Information and Pricing estimates

The "Ref" (Reference) letter in column 1 corresponds to recommendations above.

Ref	Item	Quan	Model	Notes	URL Reference	Cost Estimate
A	Audio Mixer: Sanctuary	1	Soundcraft GB2-24		http://www.fullcompass.com/product/323484.html	\$1500.00
B	Graphic EQ- 1/3 Octave	2	Rane ME60S	This unit provides both EQs	http://www.fullcompass.com/product/343115.html	\$599
C	In-Ear Monitor System	1	Shure P2TR215CL \$599	plus 5 receivers P2R receiver- \$289	http://www.fullcompass.com/product/400137.html http://www.fullcompass.com/product/258479.html	\$2045
D	Microphone- Pulpit	1			http://www.fullcompass.com/product/285767.html	\$130
E	Power amp for monitor speakers	1	Crown XLS1500	2 Rack space.	http://www.fullcompass.com/search.php?search_simple=true&txtAll=Crown+xls1500	\$400.00
F	Floor Monitor speakers	2	Yamaha Club V Series SM12V	Includes pole mount for use as main spkrs	http://www.sweetwater.com/store/detail/SM12V/	\$350 each
G	Volume control for individual rooms	3	Atlas AT-35		http://www.mcmelectronics.com/product/555-7341	\$24 ea
H	Microphones Worship Band & Youth Loft	??	Shure SM58		http://pro-audio.musiciansfriend.com/product/Shure-SM58-Mic?sku=270101	\$99.00
I	Mic Stand	??	Atlas Black	MS-12CE Black	http://accessories.musiciansfriend.com/product/Atlas-MS12C-Round-Base-Mic-Stand?sku=450649	\$41.50 ea
J	Mic Boom	??	Hercules MB200B		http://accessories.musiciansfriend.com/product/Hercules-Stands-MB200B-Short-Telescoping-Boom?sku=453070	\$43.95 ea
K	Mic Cables	??	Horizon	25' Soldered Connectors	http://accessories.musiciansfriend.com/product/Horizon-Pro-LoZ-Microphone-Cable?sku=336520	\$32.00 ea
L	Power Amplifier	1	Crown XLS1500	2 Rack space	http://www.fullcompass.com/search.php?search_simple=true&txtAll=Crown+xls1500	\$400.00
M	Wall Mount Speaker	6	Atlas Sound SM42T Wall Mount Speaker	\$68.50 ea	http://www.fullcompass.com/product/244380.html	\$68.50 each
N	Portable Powered Mixer- 12 Chan 3 choices shown	1	Mackie PPM 1012 OR Yamaha EMX5014C Or Yamaha EMX5016CF	8 mic channels w/add'l line channels 16 channels	http://www.sweetwater.com/store/detail/PPM1012/ http://www.sweetwater.com/store/detail/EMX5014C/ http://www.sweetwater.com/store/detail/EMX5016CF	Mackie \$1100 Yamaha \$729 Yamaha \$1000
O	Speaker Stands	2	Pyle Pro Speaker Stand Kit		http://www.mcmelectronics.com/product/555-12905	\$80.00 ea
P	Mic Snake	1		12 chan	http://www.mcmelectronics.com/product/555-13871	\$119
Q	Speaker cables	2		75' with speakon connectors	http://www.mcmelectronics.com/product/24-12248	\$85 ea