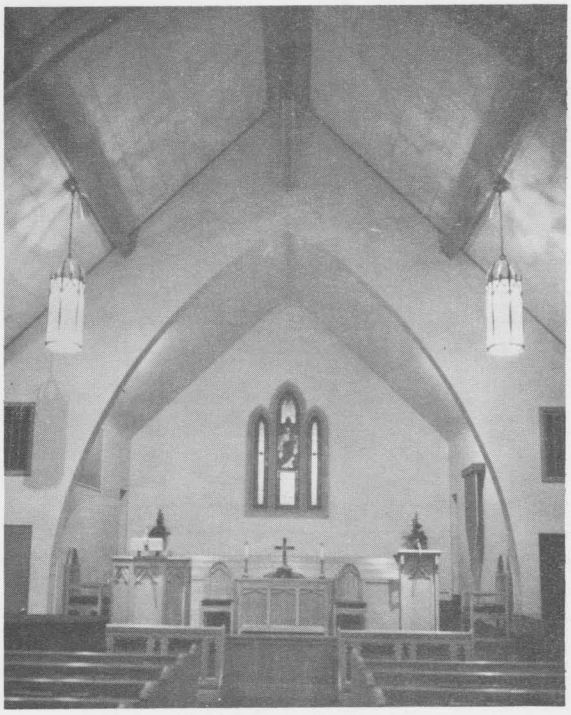
P. A. FACT SHEET NO. 8

SUBJECT:

CHURCH SANCTUARY

EVANSTON, ILLINOIS

Electro-Voice®



THE BACKGROUND

Acceptance of sound re-enforcement as an essential ingredient in religious services, is evidenced by a tremendous upsurge of interest in its use by churches of all denominations. Planning for new structures almost universally includes provisions for sound installations. In existing structures, authorities are re-evaluating the performance of their systems and planning replacement or modernization. Trends indicate that, in the years ahead, near perfection in the performance of the church sound system will be a basic requirement.

While specific performance standards have not yet been established, it is possible to outline, in general terms, the criteria by which the performance of a church sound re-enforcement system may be judged. The objective is apparent in the answers to two questions. (1) The worshiper in any seat should reply "yes" when asked whether he was able to hear every part of the service clearly, and (2) the most desired answer to the query, "How do you like our new sound system?" would be, "What sound system?" A high degree of intelligibility, then, is a must-in every seating position. Extreme uniformity of dispersion - without "coloration" of any kind - is essential. Great precision in the projection of sound at the appropriate loudness into the desired areas and minimum "spill over" in areas where it is not desired, with essentially flat frequency response (of the total system, including microphones, amplifiers, speakers, and the room itself) is the basic method. Skillful control of these elements can produce the ideal result - a congregation that is unaware of the fact that sound re-enforcement is being employed, and a congregation that is aware only of undistracted and fully-satisfying participation in the service.

In the Roman Catholic Church, recent liturgical changes, such as the use of the English language in the Mass, has brought into focus the need for effective sound re-enforcement and the need for specific information on equipment and techniques.

THE PROBLEM

Two separate, but related, problems must be resolved if a satisfactory installation is to result. (1) The selection of microphones and loudspeakers, and (2) placement of this equipment. Generally, the following rules will be applicable in the selection of sound re-enforcement equipment.

THE SOLUTION

Unidirectional microphones (cardioid polar pattern) should be used in all positions. Omnidirectional microphones should be avoided. One exception can be made: if the rest of the installation is exceptionally good, a lavalier microphone may be successfully used by the Priest. Too often, however, a careful evaluation will show that a fixed unidirectional microphone, properly placed, is superior. The cardioid microphone, with its inherent ability to reject unwanted sounds from certain directions, will enhance the naturalness of the overall sound, and, at the same time, offer a material aid in the prevention of feedback. The use of one omnidirectional microphone in a system will result in overall performance no better than the result obtained by the use of all omnidirectional microphones, even if all the remaining microphones are unidirectional.

A directional speaker system capable of precise dispersion of sound is a must. A single directional speaker, such as a Line Radiator, when properly placed, will produce the necessary uniformity of sound dispersion and yet maintain the illusion of sound originating from its visual source. Multiple speaker locations or distributed systems, though sometimes necessary because of special conditions, are at best compromises and should be avoided whenever possible.

In theory, the ideal frequency response curve for the total sound system should be essentially flat. (Figure 1) Some listener preference tests indicate, however, that a slope of approximately 10 db between 1 kc and 10 kc is acceptable and, in some cases, actually preferred. (Figure 2) The measured response of a large volume of space, such as is represented by the typical church sanctuary, is likely to show an undesirable accentuation between 100 cps and 700 cps. (Figure 3). Compensation by reduction of low frequency response of the speaker system (and microphones). (Figure 4) so that overall system response is more nearly similar to that shown in figures 1 or 2, can greatly enhance the sound

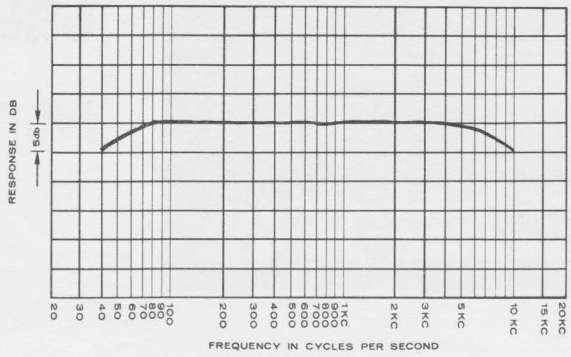


FIGURE 1

FIGURE 2

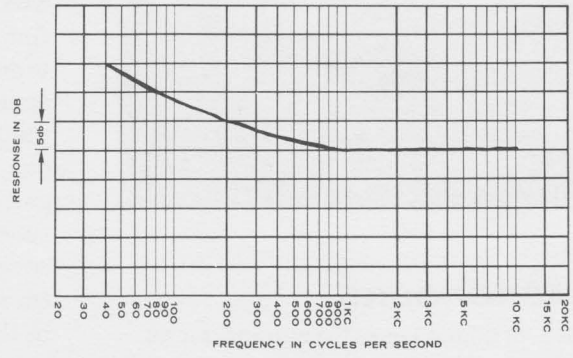


FIGURE 3

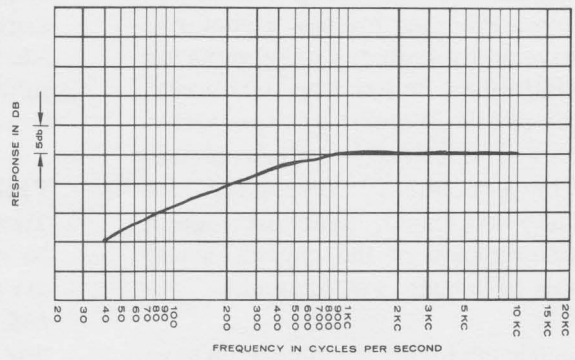


FIGURE 4

naturalness of the system, and at the same time aid in the control of feedback.

The traditional arrangement of the altar area (in the Roman Catholic Church) is shown in Figure 5. Here, the Celebrant normally faces the wall and away from the congregation. Here also, the microphones are normally distant from loudspeaker locations and few feedback problems exist, even though the speakers may be nearly on the principal axis of the microphones. Normally the portions of the Mass that originate from the pulpit present no major problems since the Celebrant is relatively close to the microphone while the loudspeaker locations are off the main axis of the microphone.

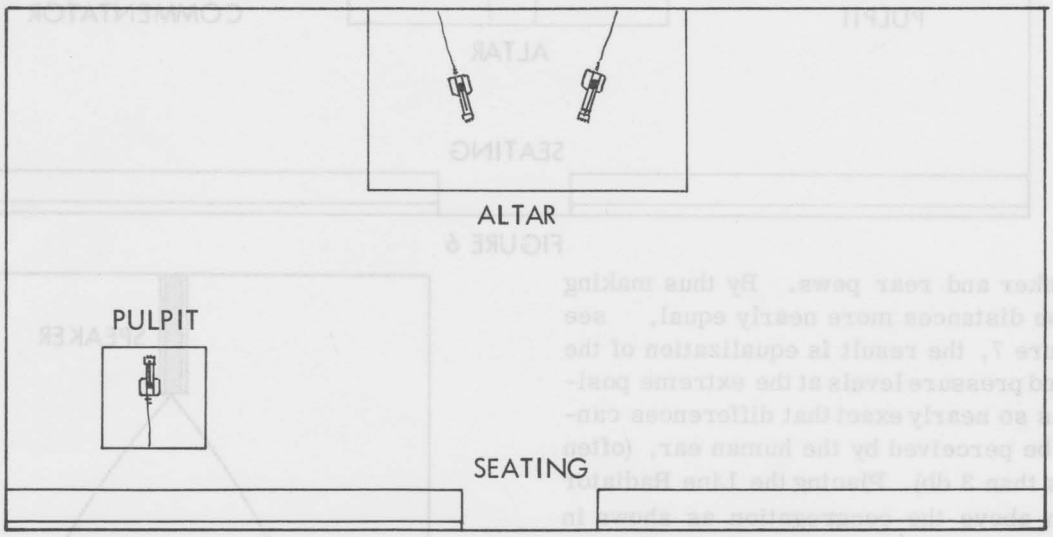


FIGURE 5 TRADITIONAL ARRANGEMENT

The new liturgy calls for a probable relocation of the altar, and introduction of new microphone locations, as shown in Figure 6. Now, the microphones are much nearer to the congregation and the loudspeaker locations. Proper selection and placement of the microphones is critical. The new E-V model 676 cardioid dynamic has proven to be very effective in recent actual installations. Its small size, extremely smooth response, bass attenuation (down 5 or 10 db at 100 cps), and the constant directional characteristic achieved through the CV-D principle, produce results unmatched by any other microphone. The model 676 is available in gold, chrome, or gray finish. Normally, two model 676 microphones, spaced about eighteen inches apart, and angled approximately thirty-degrees outward from the altar, provide very uniform pickup for all portions of the ritual originating at the altar. 676 units at the pulpit, Commentator's position, and President's chair will normally fulfill microphone requirements.

A major advancement in precise sound coverage resulted from the development of the Electro-Voice Line Radiator concept. Horizontal dispersion of 160 degrees and vertical dispersion of 60-degrees (25 watt LR4A, 50 watt LR7) or the 30-degree vertical dispersion (25 watt LR4S) for more difficult situations, accomplish several important objectives. The wide horizontal dispersion reduces installation costs by necessitating the use of only a single unit, whereas two or more of the other types would be required. The 60-degree vertical dispersion of the curved LR4A or LR7 permits installation high above the seating area (25 to 50 feet is desirable), thus, at once, removing the speaker system from the visual field of the worshiper and also equalizing the distance ratio between the loudspeaker and front pews, and the loud-

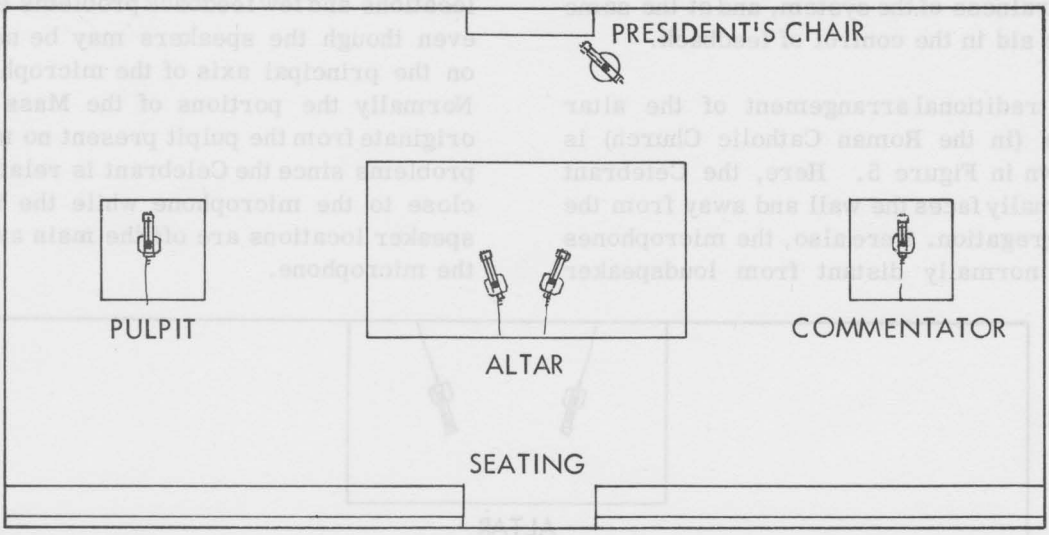


FIGURE 6

speaker and rear pews. By thus making these distances more nearly equal, see Figure 7, the result is equalization of the sound pressure levels at the extreme positions so nearly exact that differences cannot be perceived by the human ear, (often less than 3 db). Placing the Line Radiator high above the congregation as shown in Figure 7, also creates the ideal relationship between microphones and loudspeaker. Here, a minimum of sound is projected to the microphone positions greatly reducing the tendency of the system to feed back.

Although many changes are requiring immediate attention to sound systems in the Catholic Churches, very similar needs do exist in religious structures of all denominations.

The following case history is typical of many church sound re-enforcement problems, and further illustrates the points discussed above. A member of the board of the Lutheran Church in Evanston, contacted an Electro-Voice engineer for help with their sound problem. The recommended installation was made and the letter that follows describes the results. (See photo and sketches of installation.)

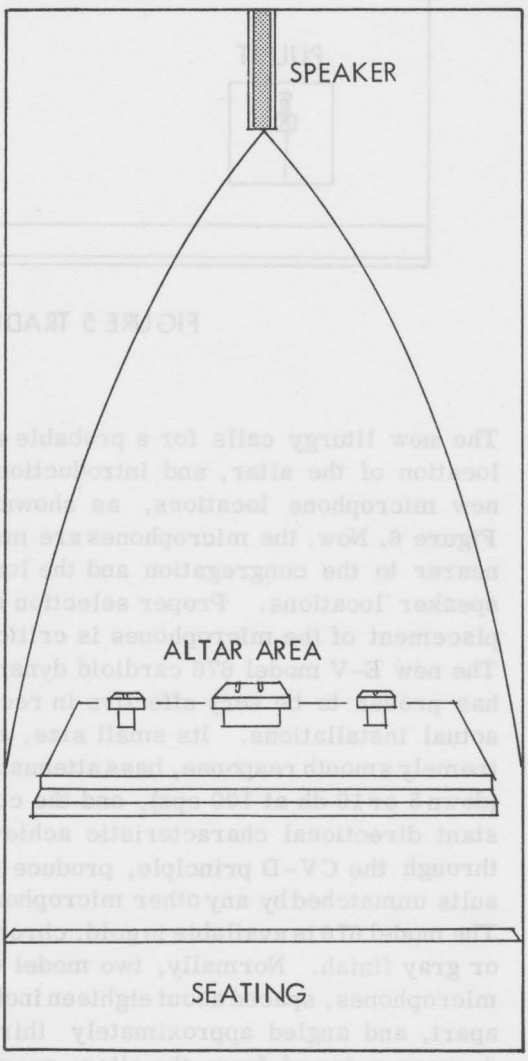


FIGURE 7

IMMANUEL LUTHERAN CHURCH

SHERMAN AVE. AT LAKE STREET
EVANSTON, ILLINOIS
NOAH M. INBODY, PASTOR
PHONES: CHURCH, DA 8-7930
PARSONAGE, UN 4-8784

Electro-Voice Inc.
Buchanan, Mich.

Dear Mr. Franklin,

Immanual Lutheran Church of Evanston, Illinois has had a problem hearing the pastor beyond the center row of seats and especially in the rear of the church, particularly if its pastor or speaker of the day had a soft voice. In addition, the church is near the elevated transportation lines and when a train would pass by, the pastor's words would be drowned out during that period of time.

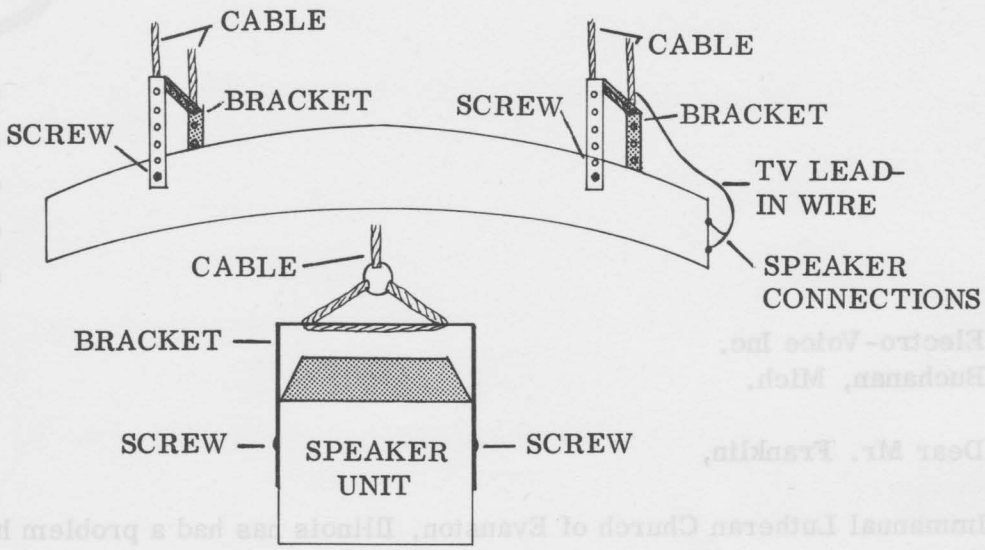
The ceiling of the auditorium of the church is 40 feet high at its highest point and is of a domed type. The acoustics are poor. It was difficult to understand all the words of even a good strong voiced speaker in the rear pews.

We tried many amplification systems to no avail. Finally we tried an Electro-Voice speaker unit in the window area on either side of the church in front of the pulpit, but the sound from it always detracted from the person doing the speaking, for it was obvious where the sound was coming from and people were torn between listening to the words as they came from the P.A. system and those they could hear from the Pastor.

Finally, an engineer from Electro-Voice came to the church and, after study, make suggestions for an ideal installation. He suggested that an Electro-Voice curved Line Radiator LR4A speaker unit be mounted 10 to 12 feet in front of the pulpit and at the very highest peak of the dome of the church with the speaker unit slanted at about a 45-degree angle so that the center line of the unit was directed to the rear pews.

This was done. Access to the dome peak was made through the crawl space above the ceiling. Special 1/4-inch telephone company bits were used to drill through the plaster. Two holes were drilled at the peak line about 12-inches apart. Directly above the holes small pulley wheels were mounted to the rafters and two 1/8-inch steel mesh cables were lowered through the pulleys and holes to the floor of the church.

The mounting brackets that came with the speaker unit were mounted on the speaker as follows:



Only one screw was attached to each side of the speaker unit so that the hangers would pivot when the speaker unit was drawn up to the ceiling or dome. In this way the cables could be drawn up or let down individually in order to get the proper angle or incline of the speaker unit. Heavy twin lead TV antenna wire was connected to the terminals of the speaker unit then taped to the top of the unit and finally to the front wire cable. It then followed the cable and was pulled up with the cable through the hole in the dome or ceiling and then, with the cables, through a series of insulated guides down to the amplifier. Sufficient cable and twin lead connector wire was used so that the speaker unit could be let up or down at will should it ever be necessary to repair or adjust the unit at some future time. Anchors were made at an easily accessible spot for the cable wires.

We then connected the twin lead wire to a new 50-watt amplifier. An Electro-Voice 649B lavalier microphone was then connected to the amplifier and the whole unit was then balanced and checked out for proper amplifier settings.

Suffice to say, the installation was a complete success. The sound is perfect and one cannot even tell that there is an amplification system at work. It is very natural in tone and the speaker unit in no way betrays the fact than an amplifier is being used. The lavalier mike works very well, particularly with a little practice for it allows complete mobility.

Respectfully submitted,

Harold V. Hayward

IMMANUEL LUTHERAN CHURCH, EVANSTON, ILLINOIS