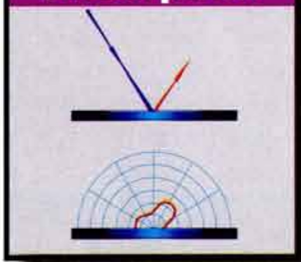
Acoustics for the Church Studio

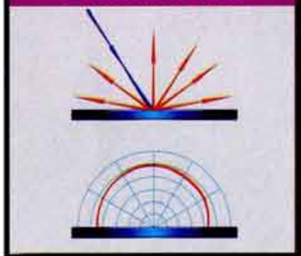
by Nick Colleran

At a time when many churches are considering building a recording studio, it is helpful to recall a time when the church *was* the recording studio.

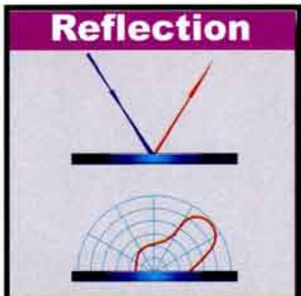
Absorption



Diffusion



Reflection



Some churches have become full time recording venues such as Columbia's 30th Street Studio "C" also known as "The Church" in New York City. (For a sound example, recall Simon and Garfunkel's "Bridge Over Troubled Water".)

If the sanctuary sounds good, so will its recording. If there are obstacles, the room can be made to work with a good knowledge of equipment and acoustics. Major acoustical improvements can be achieved with minor enhancements.

First, it is good to define what is being recorded. Is it to be a performance (live) or a production? In a live case, performers need to be comfortable and the engineer must be ready to record even on the first run through. The space should feel correct for the subject of the session.

EQ WON'T DO

Room acoustics cannot be corrected with electronics, although a good room can be improved with them. If a sound encounters a room boundary or flat surface halfway through it's cycle, the incoming peak high pressure is reflected back to meet the following low pressure trough of its cycle and cancels to zero. Boosting the signal will also boost the cancellation and still sum to zero. Moving the source or the microphone will correct this condition or create a new tonality, as different frequencies are affected as a function of wavelength and distance.

Microphones and their placement will interact with the room for good or bad. The best (most expensive) mic is not always the appropriate one for the job. A full range, large diaphragm condenser type may capture not only the full range of the instrument but the extraneous noises of the room, including rumble. A microphone that doesn't respond to unwanted noise eliminates an acoustic problem without requiring construction.

A microphone set on figure "8" polar pattern will often reject more unwanted side noise than a traditional cardioid. When using a cardioid pattern to record an instrumental soloist or singer, it helps to have an anechoic area behind the performer so that the microphone only "sees" (hears) the performer and not the extraneous room reflections. Opposite of what is sometimes seen and said, placing acoustical absorption at the rear of a cardioid microphone will usually wreck its polar pattern and rear sound rejection since it relies on rear ports to create the out-of-phase components necessary to eliminate pick-up from behind the microphone.

The acoustic needs for large group recording and worship service are often very much the same. If the recording is a performance, players and microphones should be placed as they will be in the stereo field on the recording. In that way any acoustical leakage will enhance rather than detract. Natural delays, so far, achieve more complex relationships than artificial digital ones and help the ear determine position more so than a panned mono signal with no spatial cues. Timing is everything in controlling the bleed, but done well, yields a superior spatial effect.

Acoustical treatments for a good sanctuary sound include a reasonable reverberation time, perhaps 1.5 seconds. Rear wall diffusion will retain the warmth of a good reverb time but disburse the reflected energy more evenly throughout the sanctuary. It also eliminates the annoying affect of forced tempos created from back wall reflection.

"Church" acoustical panels on commercial studio wall.

Pop rock or Contemporary Christian music usually benefit from a dryer acoustical environment, especially where instruments will be processed after the session. Recording closer to the sound absorbing panels of the sanctuary will allow some of this and can be enhanced with padded partitions separating the instruments. These dividers should be large enough to block the lowest notes that may escape around the edges by flanking. The length of the wave relative to the size of the barrier will determine the lowest frequencies to be blocked. Overdubs in a room with both diffusion and absorption will allow a variety of acoustical coloration when combined with varied microphone placement.

Solving one acoustical problem will often reveal, or create, another. Sealing a room to eliminate outside noise (and neighbor complaints) will allow hidden noises to be unmasked. At the same time, a tightly sealed room will tend to lose bass response as their longer waves have no room to develop and cancel as they fold back on themselves in the newly confined space.

Control rooms are most often smaller than is optimum, no matter if the music is from a performance or a contemporary record production. Bass trapping has become an essential feature for accurate monitoring. Traps can be made in many configurations: panels across room corners, curved surfaces with hollow cavities (polycylindricals), or suspended plywood with layers of absorption. Some devices such as foam corner traps may be called bass traps but are really broad band absorbers that are even more effective at removing the high frequencies along with the bass.

It is important to hear what you have recorded in order to decide if it is good or bad. Are you hearing the record or the room? In the early days, engineers and producers would carry wide range electrostatic headphones to foreign control rooms to assure that they could trust the recording. Today there is general consensus on control room acoustics. Suitable sound can be achieved with readily available acoustical materials, or common items with additional labor. The considerations are control or elimination of first reflections, diffusion of the rear sound field, bass trapping and a uniform response throughout the room (or at least in the mixing position).

Making the room essentially anechoic from the sound source to the ear allows evaluation of the recording without coloration from early reflections. Items that achieve this are light, porous and have cavities to absorb sound. Examples include fiberglass, foam, rock wool, sofas, pillows and heavy curtains.

Once sound passes the ear, diffusion will keep the room sounding live and large without flutters and slap-back reflections. Typical diffusers are binary arrays, quadratics, pyramids, bookcases with odd sized books, and wood shingles. Another diffuser, that serves double-duty as a bass trap, is the polycylindrical. These can be bought or built to size which determines the center frequency of the bell curve of absorption. For example, 2' X 4' yields 125 Hz.

Creating a temporary recording space on-the-spot may be accomplished with acoustical foam mounted on stands. Although often unsuitable for permanent installation due to building codes, acoustical foam is highly efficient for reflection control. Similarly, molded plastic diffusers can provide extra scattering where needed. One of several commercially available kits can provide enough of each item to tweak the space. Close monitoring combined with a little extra acoustical help may be all that is needed.

The control room serves to monitor and evaluate the recording and for this reason is it is critical that it be uniform and accurate. Unfortunately a makeshift room will not often have the dimensions of the common pre-designed spaces offered by acoustical suppliers. For that reason, it is best to understand and apply acoustical principles, listen to familiar records and trust your ears to evaluate the space. ◆

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