

## Acoustics in Houses of Worship

### Application Note 0802

- 1) Introduction: Houses of worship have several acoustic requirements:
  - a. They should provide optimum spoken word clarity.
  - b. They should have natural ambience for congregational singing.
  - c. They should have low background noise.
  - d. They should have high quality sound reinforcement.

MSR offers several solutions for the above criteria.

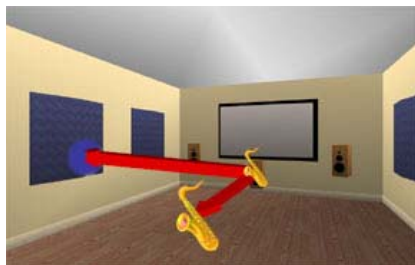
- 2) Spoken Word Clarity: Several items affect speech clarity. These include speaker and microphone quality; sound system design, installation, and calibration; and sound reflections, echoes, and reverberation. The latter group is very often addressed far too late in the construction process, usually after the sound system has been installed and the congregation notices poor speech intelligibility and sound clarity.

A room with hard surfaces will reflect sound, much like a mirror reflects light. Some sound reflection is good for a sense of presence, but too much of it reduces clarity and creates listener fatigue. Typical assembly rooms have between 3 and 6 seconds of sound decay time, because the sound waves bounce around the hard surfaces in the space. This is much too long for clarity and comfort. A good target time is 1 second.

Sound reflections and echoes should be reduced and controlled. Absorption and scattering are two strategies for reducing echoes and reflections. In either case, the solutions consist of surface treatments applied to the walls.



Sounds reflect off walls.



Absorption removes reflections.



Scattering breaks up reflections.

Figure 1: Absorption and scattering treatments to reduce sound reflections

Acoustic treatment should typically cover between 20 and 30 percent of the wall surfaces, depending on the room's size, shape, and existing conditions. Treatments are available from MSR in a wide variety of forms, sizes and colors.



Figure 2: Sound absorbing panels and example installation

- 3) Natural Ambience for Congregational Singing: For members of a congregation to enjoy singing together, it is important for the room to enhance their sonic ambience. This requirement can sometimes conflict with the need for speech clarity, since ambience is created through lengthy reverberation times. However, judicious use of sound scattering treatments can bridge the gap between the two needs. Scattering units have several forms and sizes:



Figure 3: Sound scattering panels and example installation

- 4) Noise Control: There are several sources of noise in a room. The most common is the heating, cooling, and ventilation system. The mechanical noise generated by the air handlers can be reduced by using suspension systems.



Figure 4: Air handler suspension system

The noise generated by the fans and the air rushing through ducts can be reduced by the use of duct silencers. Silencers can also reduce the sound bleed-through between rooms serviced by the same HVAC system.



Figure 5: An inline duct silencer

Silencers can easily be retrofitted into an existing duct system. MSR has several models of suspension and silencer systems available to fit your needs.

- 5) High Quality Sound Reinforcement: MSR can assist in the design and tuning of high quality sound systems. Its sister company, Performance Media Industries (PMI) has years of experience engineering and calibrating AV systems. PMI can be contracted to consult on any aspect of a system in order to maximize its potential.