An Interdenominational Worship Space:

The MIT Chapel, Cambridge, Massachusetts

The MIT Chapel has the reputation of superb acoustics for music, the best in Cambridge, Massachusetts. While it cannot accommodate a symphony orchestra and maximum seated capacity is about seventy-five, it has excellent acoustics for everything from classical string quartets and vocal recitals to organ concerts. Piano recitals suffer from a bit too much reverberation if the program is not carefully chosen. It is regularly used for Catholic Masses, occasionally for Protestant services, and for Jewish and other weddings. On occasion, it is used for music recordings. How is it possible that a round room, one of the worst basic forms in terms of exaggerated normal-mode resonances and extreme focusing effects, has such a fine reputation for music acoustics?

Figure 1: Chapel Exterior A moat surrounds the circular, drum-like building, and glass reveals surrounding the interior allow light reflected from the water to penetrate the interior. Architects; Eero Saarinen and Associates. Acoustics: Richard Bolt and Bob Newman, with assistance by William Cavanaugh, W. Ranger Farrell, and Jack Purcell. Photo by Morten M. Lund.

The answer is the undulation of the interior wall, which is not circular, but has non-regular waves built into it, shown in Figure 2. This undulation removes both the focusing effects and spreads normal -mode resonances, assuring reasonable uniformity of reverberant energy. In addition, the ceiling is a downward -facing truncated cone, further diffusing reflected sound energy. The limited sound absorbing treatment on the lower part of the wall prevents unmanageable reverberation when the room is nearly empty, and the empty mid-frequency reverberation time is 3.2 seconds. The fixed absorption is largely masked by the edge effect of audience absorption when the room is filled. The reverberation time in the occupied room is 2.0 seconds at mid-frequencies, with a moderate bass rise.

Figure 2: The Chapel Interior, Left: View of the Serpentine, Photo by Daderot at Wikipedia modified by D. L. Klepper. **Right:** Note two acoustical features: the undulations of the walls and openings in the brick wall, behind which is a 50mm glass fiber sound-absorbing treatment.

The organ is very basic, only twelve stops on two manuals and pedal, with only flutes and principles, no reeds, strings, or mutation stops or swell-box. Early period music, Bach and his predecessors, are performed authentically, and other organ music requires some reinterpretation. All Bach's organ music, Trio Sonatas to the Passacaglia and Fuge, can sound beautiful on this organ in this space.

Reference: W. J. Cavanuagh and R. Newman, "Design for Hearing," *Progressive Architecture*, May, 1959.

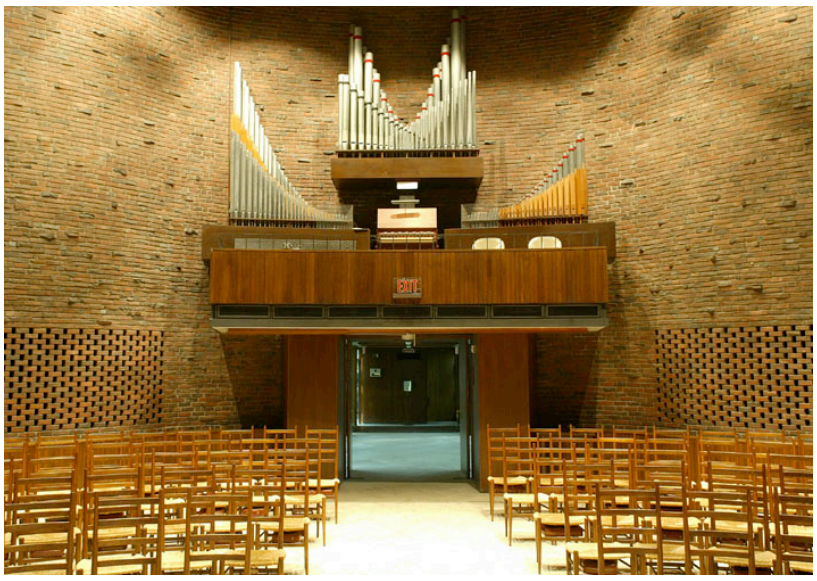

Figure 3: Interior, Rear View, Holtkamp Organ, Photo by Morten M. Lund.