CLAYTON ACOUSTICS GROUP

Acoustics and Sound System Consulting for Houses of Worship and the Performing Arts

CLAYTON ACOUSTICS GROUP is an acoustics consulting firm specializing in projects for houses of worship, serving congregations across the spectrum of Christian and Jewish denominations. Our projects include new construction, renovations and historic restorations, and we are equally at home in a small parish church, neighborhood synagogue or large city cathedral.

Successful worship spaces share highly-valued qualities such as clarity for intelligible speech, reverberance for liturgical music, responsiveness for congregational participation, and low background noise for enhancement of all sounds. We offer a full scope of architectural acoustics consulting services, including room interior acoustic design, sound isolation, mechanical equipment noise and vibration control, speech- and music-reinforcement sound system design and pipe organ acoustics.

Bringing both music and speech to life in a worship space is an exciting challenge, and our passion.

DESIGN PHILOSOPHY FOR HOUSES OF WORSHIP

Clayton Acoustics Group’s design philosophy and consulting practice are acoustics-centered and engineering-based—the natural room acoustics and sound system must fully be part of the architectural design, and selection of materials and equipment must serve this goal exclusively. We support the theory that acoustics is architecture, as well as the equally important corollary audio is acoustics, and always look for simple, flexible and elegant solutions which meet our clients’ needs.

Many of our projects are houses of worship, with a clear emphasis on churches and synagogues having traditional liturgies and strong music programs. We most often serve those congregations which wish to retain or even enhance the natural worship-space acoustics and may also require a high quality speech-reinforcement sound system to provide excellent speech intelligibility. We also help our clients with a variety of organ-related acoustics issues.

A reverberant synagogue or church is often a very complex acoustical space which must reconcile a distinct conflict of uses, needing to simultaneously be a music room and a lecture hall. Choral and organ music, as well as congregational singing and responses, are typically well supported by the natural acoustics of a responsive and reverberant worship space. Sermons, prayers and scripture readings are best served by a space with little reverberance which favors clarity of the spoken word. Our preferred design approach is to preserve those qualities of natural acoustics which are already good and enhance those which need improvement, and then specify a high quality speech-reinforcement sound system capable of providing excellent speech intelligibility.

Noise in a worship space—even the background hum of traffic or whir of machinery—can be a potent enemy of speech and music. Any amount of background noise reduces speech intelligibility and music clarity, masking nuance of the spoken word and subtlety of a musical phrase. We advocate strongly for elimination of noise in the worship space, whether from environmental sources outside the building or mechanical systems inside.

Many worship buildings, old and new, can be challenging spaces in which to achieve the right acoustical balance between music and speech requirements. A practical and sensitive design based upon solid acoustics principles, with careful attention to detail and thoroughness of purpose, can achieve excellent results.

CONSULTING PRACTICE

As specialist acoustics consultants Clayton Acoustics Group brings considerable “value-added” services to every project. Our goal is to identify and design the best solution to meet the users’ needs, within the owner’s budget, and then see the project through to proper completion.

Architectural acoustics consulting for houses of worship typically includes room interior acoustics, sound-isolation, mechanical equipment noise and vibration control, and a speech-reinforcement sound system. We view these four disciplines as highly connected parts of a whole, as they are interrelated in complex ways and all are of critical importance to the success of a high-quality worship space project.

For all projects we assemble an appropriate “project team” with just the right mix of specialist consultants to address the particular needs of each client. It is our standard practice to work vigorously for the full integration of all acoustics requirements into the architectural and liturgical fabric of each building design.

A cooperative and professional working style between consultants, engineers and architect during design, and later with the contractors during installation, helps ensure the success of any project.
Clayton Acoustics Group is an independent professional consulting firm which works only for facility owners or other design professionals. We are consultants and designers, not contractors, installers or equipment resellers. We do not have financial or business interests in the product manufacturing companies or contracting firms we may recommend. This independence allows us the necessary freedom to best represent the needs of our clients throughout a project.

For each and every project Clayton Acoustics Group brings its considerable experience and singular expertise in the highly-specialized area of worship-space acoustics fully to bear on the concept, design and implementation.

**DESIGN & CONSULTING SERVICES**

For a house of worship project having critical music and speech requirements, the specialist acoustic consultant should initially take a leading role with the architect, engineers, liturgical consultant and organ builder in design of the worship space to ensure acoustical excellence.

It is essential that strong criteria and guidelines be established for room acoustics, sound isolation, and noise and vibration control from the very beginning of the project. For these disciplines a large share of our value to the client and design team is usually realized in the early phases of design. Once these important goals are set, and the design lead moves to the architectural and engineering teams, concepts are developed into construction details and finally the bid documents are prepared.

Sound system design follows a similar but more involved and concentrated path throughout the project. Our usual work plan begins with concepts and guidelines, followed by a significant engineering and documentation effort, continuing with supervision during installation, and concluding with hands-on consultant tuning of the completed system.

We participate fully in all phases of our projects: programming, design, documentation, bidding, construction administration and on-site commissioning.

**ACOUSTICS TECHNOLOGY**

Clayton Acoustics Group has invested heavily in hardware and software technology in order to give its staff the necessary tools to work on the cutting edge of architectural acoustics. We use 2D and 3D CAD drafting to produce all our drawings, plus we use computer modeling extensively for design and prediction of room acoustics as well as loudspeaker and audio system performance. A portable “acoustics field-measurement lab” supports all our on-site work.

**SELECTED PROJECTS FOR HOUSES OF WORSHIP**

- Church of the Redeemer (Episcopal), Chestnut Hill MA
- Congregation Beth Sholom (Orthodox), Lawrence NY
- St. Paul’s Episcopal Church, Rock Creek Parish, Washington DC
- Church of the Holy Cross (Roman Catholic), New York NY
- The Hampton Synagogue (Orthodox), Westhampton Beach NY
- Cathedral of Christ the King (Roman Catholic), Atlanta GA
- Temple Emanu-El (Reform), New York NY
- St. James-the-Less Episcopal Church, Scarsdale NY
- Congregation Shearith Israel (Orthodox), New York NY
- First Presbyterian Church, New Bern NC
- St. Martin-in-the-Fields Episcopal Church, Philadelphia PA
- Congregation Agudas Achim (Conservative), Austin TX
- Cathedral of St. John the Baptist (Roman Catholic), Savannah GA
- First Church of Christ Scientist, Greenwich CT
- Christ Church Cathedral (Episcopal), Louisville KY
- St. John’s Seminary Chapel (Roman Catholic), Brighton MA
- Presbyterian Church of Chestnut Hill, Philadelphia PA
- West Market Street United Methodist Church, Greensboro NC
- St. James’s Episcopal Church, Richmond VA
- Park Avenue Synagogue (Conservative), New York NY

**CONTACT INFORMATION**

We are always delighted to talk to prospective clients about their acoustics needs and project goals. Please contact:

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Nave and Sanctuary – Renewed in Historical Style

Computer Model to Evaluate Direct Sound & Early Reflections from High Pulpit to Listeners in the Nave

Computer Model for Speech-Reinforcement Sound System Loudspeaker Design

St. Paul’s Episcopal Church
Rock Creek Parish
Washington, DC

Founded in 1712, St. Paul’s Church is the oldest congregation in the District of Columbia. On the occasion of their 290th anniversary the parish undertook the delicate work of a historically-informed renewal, reordering and infrastructure upgrade of their church building. Victorian era renovations were stripped away, uncovering a simpler interior more in keeping with the Georgian-style building. The result is a fine balance between historic-styled furnishings and the modern liturgical needs of the Anglican church.

We were given a challenging goal: ensure that the already good musical acoustics were not harmed by the renovation, enhance chancel acoustics for the choir and new Dobson pipe organ (2004), and also improve intelligibility of the spoken word. We embraced the congregation’s desire to open up the enclosed chancel into a new chapel and a new multipurpose side aisle. This proved to be a win-win solution: the church is visually larger and more engaging as well as acoustically more spacious and reverberant. Choir and organ sound easily projects into the nave directly through the chancel arch and also through side archways providing early lateral reflections essential for the congregation’s sense of musical warmth and envelopment. Musical acoustics were previously judged to be fairly good and are now just superb.

The new “wineglass” high pulpit and tester (a suspended canopy) on the front nave wall proved quite a challenge as we designed an effective but unobtrusive speech-reinforcement loudspeaker system. Preliminary computer models showed the ideal loudspeaker height would be in conflict with the pulpit and tester—clearly, the loudspeaker had to move. Our solution was custom “steerable line-array” loudspeakers which precisely cover nave pews from positions high on the front nave wall. Amplified sound of talkers’ voices is synchronized with the natural sound through an innovative DSP-based “level-delay-mixing matrix” and individually routed to all seating areas through loudspeakers in the nave, sanctuary, chapel and side aisle. Sophisticated computer modeling and digital-audio technology gave us the tools to design a very high quality speech-reinforcement sound system in the reverberance of St. Paul’s Church without the need to modify the natural acoustics, and with minimal visual impact.

Noise control and sound isolation advice was also provided for the existing HVAC system.
THE CHURCH OF THE REDEEMER
CHESTNUT HILL, MA

Completed in 1915, this is the largest and perhaps finest parish church by the renowned British-American architect, Henry Vaughan. Inside the late Decorated Gothic style building can be found one of Vaughan’s most majestic spatial compositions—a four-bay nave joins a two-bay chancel beneath an unbroken vaulted ceiling, leading the eye and spirit inexorably to the altar and east window. Wide stone arches line the nave, opening into tall side aisles, increasing both visual and aural spaciousness. Originally, the natural acoustics of this church was unsurpassed in its support of the rich Anglican liturgy. Yet, within a few years of construction, thick sound-absorbing “pegboard” tile was added to the ceiling vaults, presumably to improve intelligibility of the spoken word. While this “acoustic deadening” of the church may have been considered a success at the time, it also spoiled the fine musical acoustics with equal effectiveness. Chancel tile was removed in the 1970s as part of an earlier organ project, and in 1989 a fine Noack pipe organ was built within these acoustic limitations. As part of a modest building renovation in 2004, we guided the church toward an authentic “acoustic restoration.” Ceiling tile, carpet, tapestries and pew cushions are all gone, and Henry Vaughan’s splendid Church of the Redeemer sings once again!

CHURCH OF ST. JAMES THE LESS
SCARSDALE, NY

The original Victorian Gothic church on this tranquil site comprised part of the present nave, plus a small chancel and sanctuary which are no longer extant. In the 1920s a stone crossing, transepts and larger chancel were appended to an enlarged nave, all designed by architect Hobart Brown Upjohn, grandson of Richard Upjohn, the celebrated architect of Trinity Church, Wall Street, in New York City. The 1946 Aeolian-Skinner pipe organ—much altered over ensuing decades—is installed in a single small chamber on the Gospel (left) side of the chancel, with the organ console in a tiny chamber-level alcove just across the chancel. This ineffective arrangement is far less than ideal for organist, choir and congregation. We made a detailed acoustical survey of the church in order to evaluate the effectiveness of current and proposed organ chamber locations. Using our computer-audio studio and acoustical analysis software we simulated several “virtual” configurations of organ divisions in the church, measured at a variety of listener positions.
St. James's Episcopal Church
Richmond, VA
Built in the Georgian style and patterned after St. Martin-in-the-Fields, London, this early-20th century church was destroyed by fire in 1994 and rebuilt in 1997. Responsive natural acoustics of the original church were enhanced in the new building to support a new pipe organ by C.B. Fisk (1998), resulting in challenging speech acoustics. A new approach to speech reinforcement sound system design was needed. In order to retrofit a historic-styled sanctuary with modern-day audio equipment, we recommended a new loudspeaker technology: digitally-controlled, steerable line-array loudspeakers (only the second such installation in the United States). Each loudspeaker has separate “sound lobes” aimed down to the main floor and up to the wraparound balcony. Mounted on pilasters on the front nave wall adjacent to the pulpit and lectern, and decorated to match surrounding architectural details, the loudspeakers are nearly invisible, yet the spoken word reaches every listener.

St. Martin-in-the-Fields Episcopal Church
Philadelphia, PA
Upgrade and renewal of this late-19th century Victorian-gothic church sanctuary included removal of white paint applied in the 1940s, exposing decorative glazed brick walls and returning this intimate space to its original beauty. We designed a new speech-reinforcement sound system to replace a long series of unsuccessful systems which had not met the needs of the congregation. Steerable line-array loudspeakers are mounted on the transept front walls, displaced from the pulpit and lectern at the chancel arch. Not ideally located for listeners in the nave, these loudspeaker positions were requested by the architect and church on the basis of appearance, requiring supplementary loudspeakers for the chancel, transepts and rear nave. A digital-audio signal processor is configured with an innovative “level-delay-mixing matrix,” providing listeners with simultaneous “location imaging” of talkers at left, center and right.