thinking sound Meyer Sound

Behind the Innovations

Meyer Sound Realizes a New Vision for Multipurpose Venues with Pearson Theatre

Meyer Sound has long been known not simply as a source of top-quality products for sound reinforcement, but also as a resource for information and training that has dramatically influenced the overall quality and professionalism of the sound reproduction field over the last quarter-century. The company has been conducting high-level professional seminars since 1984, including worldwide training sessions since the 1990s. But until recently Meyer Sound had no facility of its own in which it could host training and informational events and demonstrate the capabilities and operation of its products. With the recent completion of the Pearson Theatre at the company's Berkeley, Calif., headquarters, these goals and more have been realized in an environment exemplifying Meyer Sound's signature attributes: technical innovation, uncompromising quality, and harmonious design.

Meyer Sound's Pearson Theatre

The theatre was named for the late Don Pearson, a sound reinforcement pioneer whose history with Meyer Sound dated back to the company's founding. Co-founder of Ultra Sound (now Pro Media/ Ultra Sound), Pearson was devoted to the betterment of live sound and the diffusion of good technical information towards that end. These values led him to join Meyer Sound's staff as a technical seminar instructor for the last year-and-a-half of his life. They also made it an appropriate gesture to name the venue in his memory.

The initial concept for the 1,500-square-foot theatre, built in the last undeveloped section of the company's original production area, was driven by Meyer Sound's need for an in-house presentation venue. "The main thing that we wanted was a working space both for our classes, where we teach about sound reinforcement, measurement, and rigging, and for demonstrating how our speakers work in a credible venue," explains company founder and CEO John Meyer. That meant creating the appropriate acoustical and audience environments and also installing the right equipment for presentation and control of audio and visual media.

The theatre was also intended to be a laboratory venue for the ongoing research activities that drive Meyer Sound's patented advances. To that end, the space needed to be designed for flexibility, supporting the ability to house nearly any conventional or experimental sound system configuration.

As project planning progressed, the company's goals expanded to include the idea that the room should embody John Meyer's vision of multipurpose venues, in which ground-up attention to acoustical isolation, acoustical coupling (where desirable), surface treatment, and loudspeaker placement yields a space that achieves versatility and sonic performance far beyond the norm, and where electronic room enhancement allows a single space to be optimized for a wide variety of uses.

With these ideas in mind, owners John and Helen Meyer collaborated with project architects Marcy Wong and Donn Logan, Meyer Sound staff scientist Roger Schwenke, and the company's technical support manager, John Monitto, to shape a facility that is at once a practical solution to Meyer Sound's own needs and a groundbreaking showplace for innovative theatre design. Acoustician Sam Berkow also contributed to the effort, providing input in the early stages of design. To ensure that the demonstration of Meyer's ideas was not only convincing but also provided a practical model for real-world situations, the design would be created with an eye towards scalability to larger spaces, and would utilize off-the-shelf materials wherever possible. Veteran Plant Superintendent Gary Robinson played a critical role in overseeing an often complex construction project the design of which was being continuously refined.

The resulting room is centered around a main bleacher that provides seating for approximately 60, facing a floor-level demonstration area with an instructor's desk. The room features an adjustable-format projection screen on the front wall and a soundproof control and projection booth centered at the top rear.

Ambitious Plans on an Aggressive Schedule

The theatre under construction, summer 2004.

Planning for the Pearson Theatre began in earnest in early 2004. Meyer Sound was slated to host a technical tour of its factory for attendees of the 117th Audio Engineering Society (AES) convention that was coming to San Francisco that October, and the company was also in its 25th year of business. A major event was planned, combining the AES tours, advance demonstrations of new products, and an anniversary celebration for 400 guests. With that, plans for the theatre acquired new urgency, with an accelerated timetable for design and construction. This resulted in an unusual scenario where multiple sub-contractors worked in the theatre simultaneously around the clock in order to implement daily changes in a collaborative manner.

One of the few certainties at this early stage was the theatre's location, which was to be in a then-underutilized section of the building that had held Meyer Sound's manufacturing operations since 1983. "The building is in a fairly spare industrial zone," Wong observes, "so part of our goal was to immerse visitors into the audio possibilities of the company's products within an alluring architectural context that belied the outside surroundings."

About 1500 square feet of the 19-foot tall space was chosen for conversion into the new theatre itself. The remainder of the space was reserved for a display gallery that would also double as the theatre's entrance foyer.

It was clear from the start that the shell of the building would require substantial preparation before construction of the room itself could begin. Given the time crunch, it was crucial to complete this preparatory work as soon as possible. That meant that the design team was immediately faced with the fundamental issue of isolation, ensuring that the finished space would keep out noise, such as trucks on the street adjacent to the theatre's West wall, while also containing sound generated within.

One possible solution was to take a page from typical recording studio design, cutting the concrete to create a slab that was isolated from the rest of the building. But this procedure, which is in any case expensive, difficult, and time-consuming, was rendered impractical by the high water table at the location, less than a mile from the San Francisco Bay.

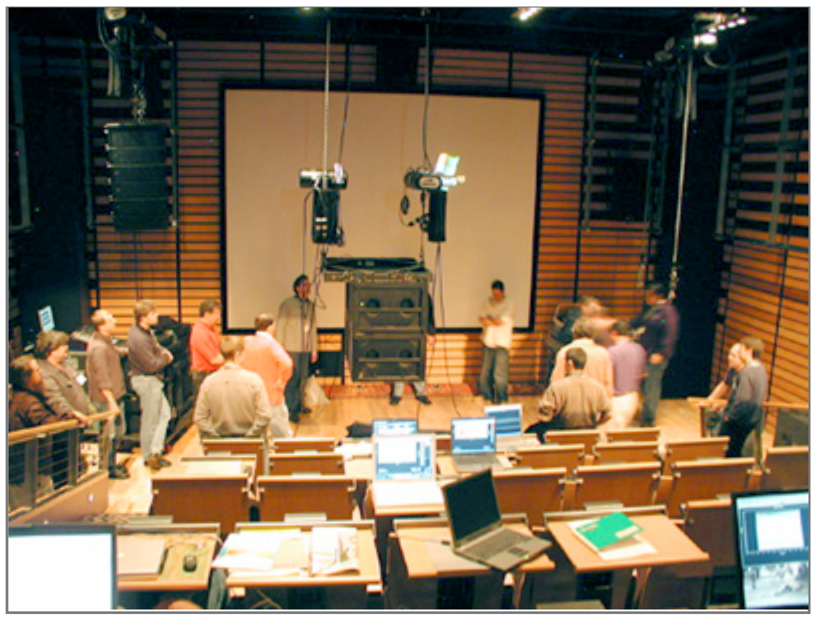
It was decided instead to create a floating room-within-a-room, leaving the entire interior structure having no contact with the outer shell. This meant that the slab would have to be completely covered with 1.3 inch thick layer of rubber that would isolate the concrete from the subfloor and the bottom plates of the walls. Every connection between the building and the room would require isolation with rubber, including the attachment of each wall's top plate to the roof. The stud wall would also be isolated from the outer concrete wall by about 2 inches of airspace, and connected to the concrete wall with kinetic sway braces using neoprene pads to maintain isolation.

With the isolation approach decided, it was possible to get to work even as other requirements for the new room were still being fleshed out. Before applying the rubber, the concrete floor was sealed four times, and a calcium chloride moisture test was used to confirm that the sealing was successful. The floor was also leveled to within about an eighth of an inch from front to back, a difference that would be imperceptible to anyone other than the project's carpenters. And two massive U-shaped steel beams were erected at the front of the theatre and anchored in the foundation to support the rigging of large loudspeaker arrays.

To avoid reducing the room's volume to the point where it would be difficult to obtain favorable low-frequency reverberation time, a contractor was found who was able to mount an isolated ceiling directly off of the roof. Preparation involved significant roof reinforcement, with all of the beams in the area sistered (doubled-up) to support the added weight of the ceiling as well as of the air conditioning unit for the theatre.

Traveling the Road from Vision to Design

As preparatory work progressed, the planning team continued the process of turning general goals into specific design requirements. The root motivation for the project was to provide Meyer Sound with a facility of its own in which to conduct its high-level professional seminars. The project coincided with an increased commitment to the company's education program, exemplified by the hiring of Gavin Canaan to manage global growth and the addition of staff trainers—including Don Pearson. As the seminars themselves were devoted to Meyer Sound's innovations in sound reproduction, it seemed appropriate that the theatre in which they were held be innovative as well.



A training seminar being held in the Pearson Theatre.

Several requirements flowed directly from the theatre's training mission. "The vision I gave to (architects) Donn (Logan) and Marcy (Wong)," says Meyer, "was that I wanted a space somewhat like a lecture hall, with good visibility to the stage area, but also including a small balcony so that when we demo loudspeakers people can walk around and hear the coverage area. I also wanted an enclosed projection booth to contain the noise of the video equipment."

It was decided that a seating riser rake of 15 degrees should be sufficient to allow unimpeded sight lines to both the projection screen and the instructor's desk, which would offer full control of the room's AV and lighting systems. "Marcy [Wong] and I designed the AV and lighting systems in conjunction with theater consultants Auererbach and Associates," Monitto says. "Our goal was to make the space versatile while also simple to control so that presenters, instructors, and meeting hosts could use the room effectively."

Another training-driven decision was that every seat would have laptop accomodations such as a fold-away desk-top, AC power, and Internet access via Ethernet. Both the seats themselves and the entire environment were to be conducive to long hours of intensive concentration. "People are seated there for six or seven hours a day over two or three days," Meyer says. "It had to be comfortable."

Training was also a factor in defining the target range for reverberation time. "We weren't going for acoustics appropriate to chamber music," Meyer says. "The reverb time was designed to provide good natural speech intelligibility. To get that, it would be more live than a recording studio, but not as live as a concert hall or opera house."

Reverberation time was also influenced by the fact that the theatre would be used for seminars on room tuning with the SIM audio analyzer system. If the room was too dry, there would be little acoustical behavior to measure and tune for. So 750 ms was settled on as the target overall decay time, with low-frequency decay "tilting up" to 900 ms.

While training served as the base-line application for defining the room's physical acoustics, the goal of creating a multi-purpose venue was by no means abandoned. Instead, the theatre has become a showcase for the effectiveness of virtual acoustic optimization via electronic room-enhancement.

"In most multi-purpose rooms," Meyer explains, "they'll design the reverberation time to be somewhere in the middle between speech and symphony, which winds up not being very satisfactory for anything. On the other hand, if you adjust acoustics passively by doing things like pulling down curtains and opening up big chambers, it makes a hall prohibitively expensive to build. One of the things we wanted to do with our theatre was to demonstrate cost-effective solutions, and it's much more economical to build a room for speech, which works well for movies, and then use electronics to create alternative acoustic environments for music."

Meyer has been interested in the possibilities of electronic room-enhancement systems since attending a Philips demonstration in the 1970s, but it wasn't until recently that the required computing power became affordable enough to make the idea feasible. The theatre project created an imperative to find the most effective solution, which turned out to be the VRAS variable room acoustic system integrated into the LCS Series Matrix3 modular mixing/processing engine from LCS Audio (which was ultimately acquired by Meyer Sound in November 2005).

Rather than adding reverb to program material through a PA, VRAS is independent of sound reinforcement, using a dedicated system of microphones, processing, and loudspeakers to change the theatre's early reflections and overall reverberation time and strength. VRAS allows the theatre to be optimized for chamber music, a cappella, or any other applications that benefit from an environment that is more "live" than the speech scenario that defined the room's physical acoustics.

A Real-World Venue for Real Credibility

The theatre seen from the top of the riser, projection booth on right.

Along with the quality of the sound experience, Meyer also wanted to insure that the aesthetics of the theatre reflect the synthesis of technical creativity and visual design excellence that is embodied in the company's products. "John and Helen called for an architectural environment that complements the sound experience, that projects the company's quest for innovation, and that yields an aesthetic which is simultaneously warm, high-tech, harmonious, and sleek," Wong recalls.

In addition to these requirements for the "feel" of the room, it had to be capable of demonstrating—without compromise—a variety of loudspeaker setups covering a wide range of different types of events, not simply for training purposes but also to showcase Meyer Sound products in a real-world context.

"To achieve legitimacy," Meyer says, "the space has to be visually and sonically correct. So we wanted an environment that customers from a theatre or other aesthetically pleasing space would feel is comparable to their own. If you show a speaker in either a warehouse or, at the other extreme, an anechoic chamber, the customer has to use sonic and visual imagination to get a sense of how it might look and sound in their own space. So we hired architects who have worked in theatre, and we asked them for a facility that would give our clients a true sense of how our equipment would perform in a real contexts."

Another advantage of approaching the theatre as a real-world environment was the invaluable first-hand experience the company could gain through creating and operating its own venue. Putting itself in the shoes of its clients would give Meyer Sound added insight into the challenges its customers face, as well as the added credibility that comes from addressing the market from a shared perspective.

"We wanted to deal with all the real issues of a theatre: isolation, transformers, a grid, theatre lights, hum and noise," Meyer says. "We wanted to show that we understand all those problems, so that when we discuss these things we wouldn't just be talking about them in theory, but instead would have actually lived through them."

A realistic setting was also crucial in furthering Meyer Sound's research activities, which have been an integral element of the company's success since its founding. Meyer Sound conducts its own ongoing experiments in audio as well as providing support to selected efforts underway in places such as the Center for New Media and Technology at the University of California, Berkeley. The theatre offered an opportunity to enhance and expand these research activities. To support that role, the noise-floor requirements were defined as less than 30 NCB (air conditioning on), and the infrastructure (grids, power and network connections) to support up to 600 self-powered loudspeakers was distributed throughout the room.

Experimentation turned out to be important not only as an activity that the room was required to support, but also as an influence on the design of the room itself. At the time the room design was developed, John Meyer had recently participated in an episode of the Discovery Channel's *Mythbusters* TV series that explored the physiological effects of high-level exposure to low frequencies, and had also recently helped add subwoofers to the Pacific Film Archive theatre in Berkeley for a showing of the 1977 film Rollercoaster, which employed the Sensurround subsonic technique. So the question of how audiences experience low frequencies was much on his mind.

"In a lot of the subwoofer experiments we had done in the past," Meyer says, "we kept adding more and more power to get the lows louder and louder. But that didn't seem to be the answer. So we wanted to try a different approach, with less emphasis on making it loud and more energy going into the physical feeling."

This experimental urge dovetailed nicely with the decision to create a floating room-within-a-room, because this approach to achieving isolation also allows a room to be moved by structure-borne energy from subwoofers. So Meyer saw the theatre as an opportunity to explore the enhancement of low frequencies through a combination of approaches, harnessing subwoofer energy transmitted through both the air and the structure to create a sensory experience that more fully supports on-screen depiction of low-frequency events.

Informed by this list of varied requirements, the design and construction process yielded a space that is at once functional and attactive, and that offers a practical example of how superior performance can be built into today's multipurpose venues. John Meyer, Monitto, and Schwenke worked closely with Wong and Logan throughout to handle all of the various challenges that arose.

Vigilance and Measurement: Two Keys to Room Tuning

John Meyer confers with Gary Robinson, Meyer Sound's project manager for building the theatre.

Construction on the theatre began in earnest in July 2004, with a mandate to be up and running less than four months later at the end of October. The tight schedule was exacerbated by the fact that the vibration-transmitting potential of every mechanical connection had to be damped with rubber. Schwenke remembers preaching the gospel of isolation to everyone involved in the construction.

"If you bang a tuning fork and listen to it in the air you hardly hear anything," Schwenke says. "But if you do the same thing and touch it to a table, it's really loud, even though the surface area of that contact is tiny. So I had a tuning fork that I carried around to emphasize that if you have just one bolt that connects directly to that concrete, it's like a short-circuit for the vibrations."

As Meyer Sound's resident acoustician, Schwenke was also heavily involved in determining the desired reverberation characteristics and insuring that these requirements were achieved. As construction progressed, Schwenke often came in at night to take acoustical measurements, monitoring changes caused by the materials—sheetrock, plywood, fiberglass insulation, etc.—installed during the day. By assessing the acoustical impact and correlating results with the desired reverb times at different frequencies, Schwenke was able to suggest construction changes "on the fly" as needed to stay on target.

"I think the process of measuring as you're going along is the key," Meyer says, "because you don't know in advance how much absorption you're going to get when you're using materials like sheetrock instead of concrete. It's not something that's studied all the time, because most people don't use sheetrock as a low-frequency absorber, and the way it behaves also depends on things like if you stagger the joints. So the only way you can do it is to roughly model it, then do it and see how much absorption you're getting with each layer you put up. We kept modeling, measuring, and correcting all the time, and it was those measurements that actually kept us on track."

The eventual result was that the back wall received two-inch deep fiberglass to provide low frequency absorption. On the side walls, meanwhile, fiberglass was used in varying thicknesses, positioned so as to minimize combing from side wall reflections. More fiberglass was used toward the front of the room than the back, and more was used at audience level than up toward the ceiling. Small amounts of insulation were also used on the front wall behind the loudspeakers.

As the interior neared completion, the fine-tuning of decay time was accomplished by adjusting the wall treatment, which is horizontal slats of clear (knot-free) Douglas Fir overlaid on sound-absorbing fiberglass that is held by a hidden wall grid and covered with black fabric. This design facilitates continued acoustic flexibility as desired in the future, and also creates a visually striking effect in the finished room.

The attention to acoustics was rewarded with a space that allows a presenter to be heard easily throughout the house when speaking without amplification, yet maintains intelligibility when loaded with the full-throttle power of today's epic movie mixes. "It ended up being quite successful to modify the absorption depending on what Roger (Schwenke) found each day," Meyer says. "We ended up with a very nice, even sound."

Making the Riser a Moving Experience

Physically, the central feature of the room is the seating riser, which rests on a one-inch subfloor of 12-ply Finnish birch (the same wood used to make Meyer Sound loudspeaker cabinets) that sits on top of the layer of rubber that covers the slab. Areas of the floor not covered by the riser are topped with a tough inch-thick floor of end-grain fir, bonded to the birch with fiberglass and urethane.

Building the riser. Note all wood construction.

The seating riser is constructed from wood rather than concrete, allowing it to couple with the floor and transmit structure-borne low frequencies to the seats from two stacks of four Meyer Sound X-800 studio subwoofers positioned in the room's front corners. Each X-800 is rated for a peak output of 136 dB SPL and an operating frequency range down to 20 Hz, and corner-loading increases their acoustical gain by 18 dB. Powering these loudspeakers alone required upgrading the audio isolation power transformer to provide the additional 20 kW needed to shake the room at 20 Hz.

The result is a visceral low-end experience achieved by transmitting bass through both the riser and the air, validating John Meyer's approach to enhancing the audience experience of bass frequencies. "People see these huge stacks of subwoofers, and they think that the level will be excessive," Meyer says. "But it's not, because a lot of the energy of the subwoofers is moved to mechanical energy through the structure, so you don't overwhelm the ears. You don't necessarily notice that you are 'feeling' the sound, but the structural energy makes things more realistic because it becomes part of the overall sensation, allowing the body to contribute to the experience."

The success of Meyer's experiment in low frequency transmission means that the decision to float the theatre's wooden structure contributes significantly to its ability to provide a truly immersive experience. But Meyer is careful to point out that there is no floating sensation when simply walking on either the floor or the riser. "There's enough mass so that it doesn't feel spongy, it feels solid and real," he says. "I conveyed to the consultants that it shouldn't draw everyone's attention when someone gets up to leave. Of course, compared to the way these things are normally built, we used twice as much mass and wood."

The riser also features upholstered seats that exhibit the same absorption when empty as when occupied. Each seat offers its occupant a retractable desktop, duplex AC power outlets, and an Ethernet jack for connection to the Internet, making it easy for attendees to use laptop computers. This is especially important for training on Meyer Sound MAPP Online acoustical prediction software, which uses an Internet-enabled client-server system. The theatre has a dedicated T1 line and router so that it is entirely isolated from the company's network. There is also wireless Internet access (802.11g) in the room.

Technical Infrastructure: Comprehensive and Advanced

Looking up the riser towards the booth. Surround speakers are in the rear corners.

The center rear section of the riser is occupied by the theatre's soundproof control and projection booth. The booth, which is the heart of the theatre's advanced technical infrastructure, is situated directly above the under-riser space that houses the theatre's breaker panels, dimmer controls, and motor controls (for speaker rigging).

The booth is fully equipped for events including presentations and lectures, training, research, cinema screenings, teleconferencing, and product demonstrations. Because the theatre was conceived as an ongoing project that would allow continued evolution, additional potential uses such as film mixing may be implemented in the future.

The booth's two video playback machines — D-VHS, and DVD — are switched into a Faroudja DVP-1080 video processor that feeds a 5300 lumen Sanyo PLV-HD10 projector. The projector is factory-modified to run at 1080p/60fps, allowing it to comfortably accommodate input from instructors' laptops.

The projector's high-definition output is displayed on a 14-by-10.5-foot Stewart screen with multiple masking settings for various aspect ratios from 4:3 (standard television) on up to 2.35:1 (CinemaScope). The projector inputs also include RGB via three inputs for guest computers near the instructor's table at the front of the room. The table features an AMX touch panel control system from which a presenter can drive the audio, video, conferencing, and lighting systems. The touch control system is also used in the control booth.

For audio, the LCS Matrix3 system is used to handle mixing, routing, and equalization, while multichannel decoding is performed by a Dolby DP564. The Matrix3 system contains two fully loaded LX-300 card frames under the control of a CueConsole control surface. The setup allows mixing from practically anywhere in the house utilizing Ethernet or Wi-Fi.

To distribute audio to the loudspeaker positions, signals are routed from four patch bays through Belden 1800 series cable (rated for analog or AES/EBU digital) to connection plates at distributed locations throughout the ceiling and each of the walls. The panels provide connections not only for audio but also for data and isolated-ground AC power.

The distributed connection plates allow easy setup of Meyer Sound's self-powered loudspeakers anywhere on the four-foot square grids of steel Uni-strut and pipe that project from portions of the ceiling and four walls. "It's a very flexible research space," Meyer says. "We can address up to 600 speakers if we want to do surround sound experiments with a lot of density."

An additional 32 lines of mic- or line-level I/O are available on the front wall, from where they may be routed to any loudspeakers that are rigged either on the steel U beams or anywhere else in the room. The beams are equipped to allow up to six tons of loudspeakers to be flown using six one-ton hoist motors, each of which is fitted with a Vishay

Celtron STC S-type strain-gage load cell that reports the supported weight with half-pound resolution. A Rice Lake Weighing Systems 920i programmable indicator monitors the load cells and displays the loads.

While the possibilities for loudspeaker configuration are essentially unlimited, the room's standard configuration is for 5.1 channel theatrical playback. Meyer Sound CQ-1 wide-coverage main loudspeakers are installed for the five main channels. The front loudspeakers are positioned to avoid the high-frequency filtering effect that typically results from placement behind the screen, making the space more suitable for applications such as live music. To maintain dialog imaging at screen level, the center CQ-1 mounted above the screen is complemented by an M1D ultra-compact curvilinear array loudspeaker mounted below the screen.

With the design and construction process now behind him, Meyer feels that the completed theatre validates his vision of a multipurpose venue that fulfills all of its goals — in this case: supporting training, supplying a visceral low-end experience, providing an effective research space, and acting as a real-world venue for demonstrations and functions — without having to compromise performance in any one application to achieve another. As such, the Pearson Theatre serves as precisely the example Meyer wanted to present in the hopes of influencing the conception and design of new facilities, large and small.

"Anyone building a facility today—colleges, high schools, corporations, theatre owners—should be thinking in terms of something that's multipurpose," he says. "Our theatre shows that you can have a space that can look nice and sound great for lectures, films, presentations, and live music. And it also lets us show movie people that sound can really be an integral element that enhances the film."

Since the Pearson Theatre's October 2004 debut, a steady stream of prominent audio and film industry guests has visited to experience the room's excellent acoustics and powerful low-frequency response, and a popular series of movie screenings has been established for friends, clients, and staff. Potential customers, meanwhile, have been exposed to the power and quality of the company's loudspeaker products, and attendees of Meyer Sound seminars (including several given by Don Pearson himself) have honed their skills in a comfortable, convenient setting that is at once real-world and state-of-the-art. From every angle, the Pearson Theatre has exceeded its design goals, and stands as a model of a new, higher standard in multipurpose theatre design.