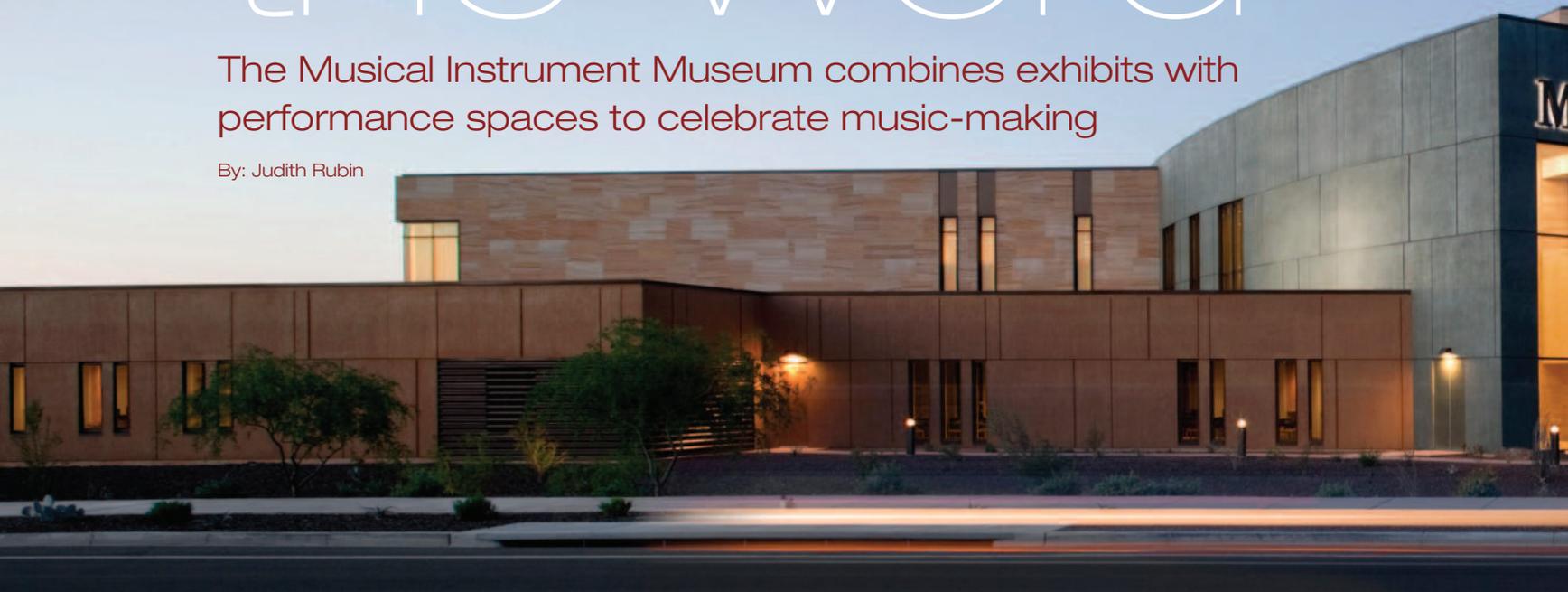# MIM's the word

The Musical Instrument Museum combines exhibits with performance spaces to celebrate music-making

By: Judith Rubin

The piano on which John Lennon wrote "Imagine," the guitar on which Eric Clapton wrote "Layla," and the first Steinway piano ever made are part of the collection, but the new $250-million Musical Instrument Museum (MIM), open since April 2010 in Phoenix, Arizona, isn't just another tribute to Baby Boomer culture or Western chromatic music. MIM collects and displays musical instruments and artifacts—more than 10,000 instruments in some 75,000 sq. ft. of exhibit space—from every country in the world, and lets guests have up-close, multi-media interactions with those instruments, represented in the context of their cultures of origin.

Guests at the official groundbreaking on the 20-acre campus in February 2008 left with special MIM-exclusive plush dogs provided by Target. The founder of MIM, former Target CEO Bob Ulrich, wasn't shy about drawing on his business network, reports Mark McCauley, MIM's director of technology. "We got the incalculable value in expertise of people who came in to advise us from Target through Bob Ulrich. They brought fresh ideas and approaches that are reflected in the design from exhibits to architecture, from security to marketing to infrastructure, the performance space, gift store, dining, and more."

The design/build approach

McCauley joined the team two days before groundbreaking. "It's been a fun rollercoaster," he says. "When I started, the planned size was around 100,000 sq. ft. and we ended up at about 190,000 sq. ft." (The initial collections goal of 5,000 instruments was rapidly overshot, and, by the opening, the number was about 14,000.) "Ulrich's vision and the project grew as we filled out our team," notes McCauley, "and we had to go to a pretty rapid design/build philosophy with a close interface between the museum team and the outside providers. This spurred us to be very careful in selecting vendors. They had to wear some pretty diverse hats."

The design/build approach applied primarily to the exhibit areas and not the theatre, which had to proceed

along a more traditional path, and two design teams formed, with some overlap. The building was designed by RSP Architects Ltd. (Ted David, lead architect), with Rich Varda serving as the owner's architect. Under contract to RSP, acoustics throughout were handled by Shen Milsom Wilke (SMW), who also provided technical infrastructure design and AV design consulting in the exhibit areas, while Auerbach Pollock Friedlander (APF) served as theatre and audio-video design consultant for the 299-seat music theatre. The AV integrator was Sound Image. Other major players included Sennheiser (guidePORT wireless audio systems for the exhibit areas), NEC (exhibit monitors), ETC (theatre lighting equipment, including dimmers and control), Stage Technologies (automated theatre rigging), and Crestron (control systems in all parts of the building). Additional suppliers included Lutron (lighting products in the exhibit areas), CE Labs (solid state playback devices), Cisco (IT cabling), Carousel (digital signage), Panasonic, BSS, and Pook Diemont & Ohl. The general contractor was Ryan Companies Inc.

Exhibit areas

The L-shaped, two-story building is distinguished by El Rio, a long, narrow atrium that ties together the exhibit areas, café, and other spaces. "They wanted the space to be open and flowing," says SMW's Erik Ryerson, project manager for acoustics. Highly sound-absorptive acoustic ceiling tile was used to control noise buildup in this open space, especially at the entrance, where, he adds, "you want some degree of liveliness, but not so much as to overwhelm program material that's being heard in the exhibit areas."

Integrated with more than 3,000 instruments on display are some 300 NEC monitors of varying sizes, with wireless audio delivered by the Sennheiser GuidePORT system. MIM's GuidePORT infrastructure is able to accommodate simultaneous use by 1,800 visitors. Each and every guest gets a pocket-sized receiver and headphones with his or her ticket purchase as standard equipment for the museum experience. The audio sets have just four buttons, for power, volume, and mute. "You set and forget

Inside the museum's sun-filled lobby.

and start experiencing things," says McCauley. Audio is broadcast over 300 wireless transmitter zones in strategically placed bases throughout the museum. Each zone has its own radio mini-broadcast. As a visitors moves through the building, guidePORT detects his or her position and introduces the appropriate sound or media feed to accompany the specific exhibit her or she is viewing. An identifier built into each receiver uses a combination of RFID and magnetic field-based technology to track location and automatically switch frequencies. The receivers have a range of action between approximately 5'-10', and auto fade in/fade out. Audio is delivered concurrently, so museum attendees can share simultaneous experiences. If there is an unexpected power outage, the system automatically continues from the same location once power is restored. Robert Genereux, guidePORT business director of Sennheiser, was a key player in the installation of the audio guide system.

The headsets minimized the need for acoustical treatment in most exhibit spaces, except those areas where people would remove their headphones to listen to a performance. The Experience Gallery, a separate area where guests can play instruments themselves, is sound-isolated with double walls and acoustical treatment of ceiling and ducts. SMW also provided general design input to minimize noise and vibration from the HVAC systems.

Gallagher & Associates was brought in to work with the MIM team to develop the flow of the exhibits and to design the display system (including graphic design) for the main exhibits. "We developed the floor plans for how the various regions and countries would be organized, including the audio zones," says project director Bruce Lightbody. "The biggest challenge was to arrange the respective displays for an even distribution of audio and video experience without creating overlaps of audio or empty zones. Given how extensive audio is in this museum, it was like solving a puzzle—moving pieces around until everything fit just right."

Gallagher designed the exhibit system of platforms, display walls, graphic rails, and other elements as well as the overall graphic design for all the exhibits along with templates for the museum team to use. Working with the curators, the Gallagher team designed and documented all the instrument layouts—and, given that there are thousands of instruments, this was no small task. They also designed the orientation gallery on the first floor and the themed areas that are sprinkled about the second floor regions, such as the steel drum workshop. As part of the design for the display system, Gallagher developed the necessary housings, wire chases, access panels, and other infrastructure components for the various audio and video equipment that needed to be located at the

platforms. The engineering for the overall audio and video systems was handled by the museum team working with their own consultants. Key individuals for Gallagher on this project were, in addition to Lightbody: Patrick Gallagher (principal in charge), Jennifer Sparrow (exhibit designer), Tina Besa (graphic designer), and Kyra Bowling (project manager).

Sound systems to support announcements, classrooms, intercoms and paging, performance areas, and background music incorporate a variety of speakers and placements. Ryerson says, "There are a lot of traditional ceiling-mounted speakers. In El Rio and lobby areas, we had to incorporate a line-array design, discreetly tucked under the edge of the balcony. The outside wall has a lot of glass. The array let us point sound where we wanted it and minimize reflection.

"Each museum space has its own node of the sound system," notes Ryerson. "You can join it all up or break it all apart. You can also transmit from the auditorium and use the exhibit areas as overflow. They all are capable of talking to each other so can be centrally managed with the Crestron control system." Crestron control panels are installed in each of the three ad-hoc performance spaces, and the eight data closets distributed throughout the facility. For additional flexibility, SMW provided a conference room on wheels: a portable cart with a small video projector, remote control, PC input jack, built in Blu-ray player, tabletop audio conferencing, and microphones.

"My mandate within my group is I want 99.99% up-time," says McCauley. "We have had no failure on any of our major AV systems in galleries that we could not troubleshoot and get back up within 10-15 minutes." Operations for the museum are scripted. "There are no buttons to push in the morning when you walk in," says McCauley. "At 8:30am, the systems turn themselves on."

Unified IT cabling
Outside the theatre, the museum infrastructure consists of more 500,000' of Ethernet cable to support MIM's data and AV needs. Managing the team that provided this was the responsibility of Randy Tritz, director of Shen Milsom Wilke's Chicago office, who says, "It is a luxury of new construction to be able to design the infrastructure around a unified cable plant—to accommodate voice, data, and AV with a ubiquitous structure design. It allows you to reduce the total amount of cable in the facility—comparatively—and to significantly compress the amount of conduit and pathways involved."

Tritz named another advantage of the unified system: "The building is better able to adapt over multiple generations of equipment. Most products these days are designed as a network node with an IP address. Unplug one, and plug in another—you're less dependent on an installer to put in a new cable. It plays into installation,

operations, maintenance, and security. If there is a problem with the network inside the building and their network management folks need to access from outside, they can do that. More importantly, if there's a problem with a node of AV or paging or something, you don't need to necessarily deploy staff to the location—it can be handled remotely from within an office in the building, or from home on a handheld. Some owners prefer to have their own staff triage the initial problem. And, in the case of MIM, the museum experience space is changing all the time. Setting up a new presentation with this system is a matter of hours, rather than weeks."

The unified approach also allowed building and exhibit hall construction to move forward without impinging on or rushing exhibit design. McCauley notes: "Above the ceiling we have consolidation boxes. These boxes sit in the middle of 30' x 30' grids, and all this cabling runs to them. A patch point above the ceiling allows us to expand or distribute easily in any direction. This gave us a very flexible solution to the unknown quantity of where these walls were ultimately going to go, and how to get wiring to them."

Tritz's team was on board with the design/build process. "Working from our bid specs, the museum managed the integrators. We helped them review bid responses and made recommendations, and they did a fine job."

Theatre lighting, rigging and acoustics
The 299-seat MIM Music Theatre is a luxurious jewel box with 42"-wide aisles, 22"-wide seats, and a steeply raked floor, with each row of upholstered seats rising 12" above the one in front, so that audience members
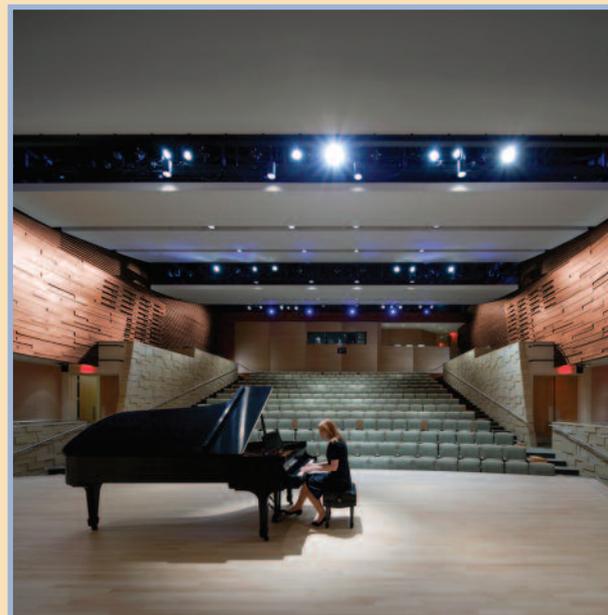
The 299-seat theatre features 42"-wide aisle, 22"-wide seats, and a steeply raked floor, for good sightlines.

can see and hear everything. Wheelchair accessibility is provided at a center cross aisle and at the rear of the room. Theatre support spaces include several meeting rooms, a green room, and, at the rear of the hall, a control booth and small recording studio (which is currently being converted to house an audio mix suite in support of a webcasting system).

APF provided theatre design, including seating configuration, theatrical lighting design, theatrical automated rigging design, variable acoustic system, and audio-video system design, working closely with RSP Architects, SMW, and other team members. "The design intent was to craft a space with exceptional acoustics for performances highlighting instruments from the museum's collection, as well as providing a venue for concerts featuring guest artists," remarks Steve Pollock, design principal with APF.

Part of the design brief was to conceal gear as much as possible and retain the wood aesthetic. "It's a highly integrated room," says Steve Pollock. "You walk in and have no idea how much is really there. The variable acoustics work nicely and are more or less concealed from the audience. This is also true for the lighting catwalks and slots overhead, which allow the lighting to illuminate the performers while concealing the fixtures themselves. You can see them from the stage, but they are hidden from the audience. It takes effort to manage the design and functionality of a space when the client doesn't want to see equipment exposed in front of the truly exceptional architecture."

Tom Neville adds, "You walk in and see only a few lighting fixtures, yet actually many more are there. The speakers are also hidden from view. Our biggest challenge

An electronic music exhibit.

The Guitar Gallery.

The APF team also included Tom Neville, (principal in charge), Kenneth Fause (AV design principal), Robert Hill (principal project manager and lighting systems designer) and Vene Garcia (audio-video systems designer). Sunni Fass is artistic and managing director for the MIM Music Theatre and James Book serves as its technical director.

As with many such projects today, the theatre was designed to be multi-purpose, and the desired range of purposes grew over the course of production. This called for a menu of adjustable acoustical treatments and sound reinforcement designed by Erik Ryerson and his SMW team, including Thomas Rafferty and Jerome Smith, to accommodate all possibilities and support speech intelligibility along with multiple styles of music and performance configurations.

was to reinforce elegance and simplicity of the theatre without a technical overlay. The carefully managed team coordination ensured the best possible design solutions to this end."

"RSP was the glue that joined us together," remarks Ryerson, citing RSP partner in charge, Jeremy Mayberg, and lead designer Ted Davis.

The lighting package is primarily ETC equipment, including 180 ETC 2.4kW Sensor SineWave dimmers, selected to keep ambient noise levels from dimmed fixtures to an absolute minimum. Four Sensor SW+24 SineWave dimmer racks, four Sensor CEM+ control electronics modules, an ETC SmartSwitch SS-241P 24 single-pole DMX-controlled relay panel, four ETC Net3 two-port DMX tour nodes, and one ETC Net3 full-function

node, an ETC Ion Control console with submaster wing in the control booth, and an ETC Unison Paradigm architectural system flesh out for the system components for production house and work lighting control.

The theatre is equipped with five automated lighting battens, four of which are used to maintain house light fixtures and the other for over-stage theatrical lighting. "The Paradigm lets the end-user program the desired lighting cues and capture them in the preset station," says Neville. "We initially set up a few basic cues for immediate use until the technicians could customize their own desired presets."

Under contract to Ryan, Stage Technologies Inc. fulfilled APF's spec to manufacture and install automated rigging equipment: five BT250 winches, which fly custom architectural lighting battens with

Drapes were supplied by Acoustacorp. Using the grooved wood product Decoustics Quadrillo, SMW treated the rear wall with a repeating convex-patterned surface to scatter sound waves and prevent distinct echo patterns. The ceiling has a series of sound reflective clouds, made of chips board, to help project sound waves into the audience. "They have a certain bow to them, and an upward stepping motion follows the rake of the seating to achieve uniform coverage," says Ryerson.

To help design the acoustics as well as the sound system, SMW enlisted a 3D acoustic modeling program running AMFG Technologies' EASE software (distributed in the US by Renkus Heinz).

"Even with a sound system engaged, you still want a good room shape," notes Ryerson, "and it's ever more

An exhibit on China's Beijing opera.

cable reels, and 16 sliding, floor-to-ceiling acoustic panels that slide on ADC tracks. Justin White was project manager for Stage Technologies. "It was a lovely job and something out of the ordinary for us--instead of flying people, we are flying lighting in this gorgeous theatre," says Gemma Guy, general manager of the Las Vegas office. Bronx-based Pook Diemont & Ohl provided seven custom color wool serge acoustic banners varying in length from 8' to 16'.

A set of sliding acoustical panels placed on the rear side walls are manually adjusted by a rigging control system provided by Stage Technologies. A set of removable, retractable drapes is located at the front of the hall. Additional drapery that mimics the look of wood can be lowered in front of the acoustical shell onstage.

critical for unamplified music. Some of the shaping of the stage walls behind the musicians has been done so that the musicians can hear themselves well and communicate aurally, especially in an ensemble. We specified upholstered seating to ensure a uniform acoustic environment even if the hall is not completely filled. The stage walls have a convex pattern and the traditional fan shape to help project sound. The side walls have a degree of texturing to them; the front side wood walls also do to some extent, as well as the tile walls that project out slightly on the lower rear wall. When sound waves in certain frequency ranges hit them, they will be scattered or diffused, to avoid unwanted sound reflection patterns, echoes, and flutters. The diffusion also helps create a sense of envelopment."

The theatre itself is sound-isolated by virtue of being surrounded by buffer rooms, and having masonry walls with an inner layer of gypsum board that is decoupled from the masonry. Ryerson points out that, given the museum's location in a secluded area of desert not adjacent to a highway exit, there are no significant exterior noises to wall off, but, as a matter of good design practice and to guard against future possibilities, "we provided the layer." All doors are fully gasketed and sound-rated, with sound lock vestibule entrances. The air handler is off to the side of the theatre, separated by buffer spaces and fitted with a special low-noise fan. Sound attenuation devices in the ductwork prevent fan noise, and the duct distribution and sizing are designed to prevent noise pickup from air flow velocity. "We worked with the electrical engineer [Michaud Cooley Erickson and LSW Engineers] to choose quieter devices and isolate correctly, not just for airborne noise but also vibration," says Ryerson. The control room and recording booth are isolated by a sound-rated glass assembly and have sound-absorptive material on most surfaces.

Theatre AV

Shortly after opening, MIM installed in the theatre a flown audio system designed by its technical manager, James Book, consisting of two arrays of Tannoy VNet DR 15, VQNet 60, and VQNet DF 85 each. The arrays are self-powered, with user-controllable DSP on board for system alignment processing. Audio to the arrays is managed by a Meyer Galileo 616. The arrays can be removed in less than 15 minutes for strictly acoustic concerts, using custom-designed carts that allow the array to remain intact.

A concealed system is in place and is used for announcements during unreinforced concerts. It features two (left/right) Meyer Sound CQ-2 loudspeakers supple-

mented by five Meyer MM-4XP for front fills. The speakers are hidden behind cloth that matches the surrounding wood surface. The stage monitors are six Meyer UPJuniors. Digital signal processing for this system is supplied by a pair of BSS BLU-160 processors. The Avid/Digidesign Venue D-Show System mixing console is positioned at the rear of the house.

The visual presentation system includes a large motorized projection screen from Stewart Filmscreen, concealed in the ceiling architecture; a high-definition Panasonic PT-DZ12000U video projector; and a Panasonic AV-HS450 signal switching/management system, which input interfaces in analog or digital signal formats. The video show support system includes a color camera feeding color video monitors at the stage manager position, the Green Room, the dressing rooms, and the technical services offices. Video capture and production in the theatre are done with three robotic high-definition cameras, a high-definition video production switcher, four AJA Ki Pro recorders used for isolated camera signal ingest, various picture quality and content monitors, and related sync, timing, and terminal equipment. "As the project moved along," remarks Neville, "the technology for HD and digital processing became cheaper, and we were able to get higher-quality equipment as the pricing structure changed."

A small recording studio is currently being converted to house an audio mix suite in support of the museum's webcasting system; it is due to be commissioned at the end of May. The system includes a digital audio workstation with an Avid/Digidesign ProTools with C24 control surface interface, which will be used to mix outbound audio. The audio is delivered to ProTools via Digilink from an Avid Venue console.

The story of MIM's creation is of a state-of-the-art project put together by a top-functioning team performing smoothly from top to bottom. There were pluses to it being a brand-new undertaking: "No pre-existing political environment to circumnavigate," notes Tritz.

"Bob Ulrich was an active participant in all the design," says Tom Neville. "We had meetings at an early stage where he sat down and said, 'Tell me where the gotchas are,' and we went through the list of things that usually cause grief. Ryan Companies was conscientious as well. A general contractor who takes the trouble to really understand the process of creating a theatre can later take credit for there being no ductwork running through the catwalks, etc. Rather than trying to find a way around all the 'thou shalt nots,' general contractors who succeed at this project type recognize them as an exciting challenge that can open up new markets for them." 🔊

Attendees take advantage of the Sennheiser GuidePORT system.

Photo: MIM/Bill Timmerman

Copyright **Lighting&Sound America**

March 2011

www.lightingandsoundamerica.com