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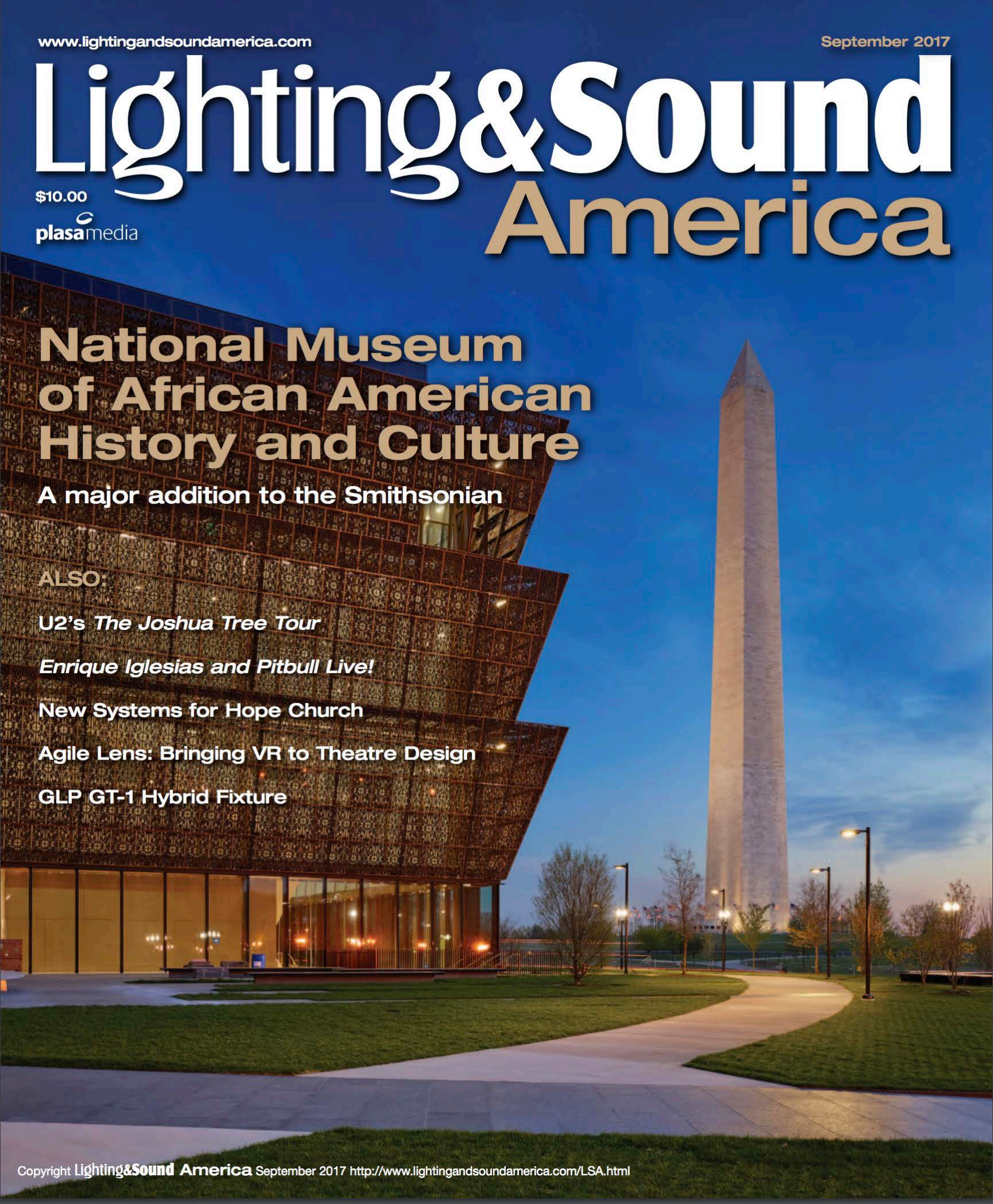

National Museum of African American History and Culture

A major addition to the Smithsonian

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The Oprah Winfrey Theater

The Oprah Winfrey Theater at NMAAHC is located below ground, opening directly into Concourse C of the History Galleries. The main theatre entrance is off the main lobby, down a great circular steel staircase.

The 355-seat theatre was designed to support a broad range of uses. According to Keith Madden, the theatre director, the possibilities include events, symposia, curator talks, conferences, corporate meetings and presentations, awards ceremonies, live theatrical performances, dance, live music (from jazz to string ensembles), feature films, documentaries, archival media in a variety of formats, and other special programming. The theatre also functions as a recording and broadcast location. There are many tie-ins with exhibition content and mission-relevant material and with the Smithsonian Channel.

Naturally, the Oprah Winfrey Theater hosted many NMAAHC opening day festivities, concerts, and lectures. Peter Rosenbaum, who headed the team for theatre consultant Fisher Dachs Associates, notes that the venue was prioritized for early completion, in order to be ready for these.

Aesthetically, the theatre interior echoes architectural themes that characterize the rest of the building, with panels utilizing the decorative corona motif. “It’s a jewel box of a space,” Rosenbaum says.

“People kind of gasp when they walk in,” Madden says, who has been on staff at multiple Smithsonian museums since 1996. “It’s not ostentatious, just gorgeous.”

Shen Milsom & Wilke, LLC (SM&W) was the acoustician on the project. The ETC theatrical lighting system was installed by Barbizon Lighting, and the rigging was installed by SECOA, per Fisher Dachs specifications. Clarke Construction subsidiary S2N was charged with implementing the AV install.

In and out of the booth

The theatre has a proscenium stage; it and the auditorium are 50' wide; the stage is about 23' deep and the room 90' long, with ceiling height ranging 23' – 27'. (Harlequin Floors supplied Cascade Marley floor in black for dance performances.) There is a small backstage corridor for talent and stage management, equipped with video and audio outputs and monitors, company switch, and lighting panels. Also backstage are two storage closets and four green rooms and dressing rooms, connected by a Clear-Com communications system. The back-of-house area connects directly to the building’s loading dock.

The AV design has gone through some stages. Madden, who came onboard in August 2016 while construction was still underway, helped steer equipment decisions to support the desired range of capabilities. The theatre is set up for Dolby 5.1 cinema audio and 35mm and 16mm film, as well as DCI-compliant digital cinema projection. The equipment supports video switching, camera control, recording, and webcast.

In August 2017, a new, retractable Stewart SnoMatte 36'-wide perforated cinema screen was rigged further downstage to accommodate new cinema audio amplifiers and speaker arrays behind the screen. Equipped with quick disconnects, these four-way speaker arrays with QSC mid, high, and very high horns and a pair of JBL pattern control bass cabinets for left-center-right channels are each mounted to Genie Lift carts. “They can be wheeled on- and offstage as needed and raised to the proper height for optimal cinema sound coverage,” Madden says. A manually operated side masking system was also rigged and installed in front of the screen, to allow clean masking for all projection formats, along with an upstage heavy fabric traveler that closes behind the cinema speakers to provide a light and sound baffle. “This new system provides a world-class cinema experience and supplements the live sound and PA system,” Madden says.

At mezzanine level is the three-room booth, with one room dedicated to lighting and video production, one to projection, and one to audio. In the first room lives an ETC Ion lighting control console. In the middle room are a Christie 4K digital cinema projector and two Kinoton FP 38-E film projectors. These top-of-the-line Kinoton products are no longer manufactured and were acquired used. “They run actual film,” Madden says—whose experience includes years as an IMAX projectionist and certified service technician—“including 35/16 archival prints, reel-to-reel, and most other film formats, including 70mm. The ‘E’ stands for electronic; the projector uses a servo motor and controller to precisely pull down the film, giving a very steady image and allowing adjustment to any frame rate,

The theatre is designed to handle a broad array of events.

easily. Film is coming back." Madden, who also worked on the recent 70mm feature film releases of *The Hateful Eight* and *Dunkirk*, also provides his services as an install technician, technical representative, and often projectionist to the Sundance Film Festival, CinemaCon, Turner Classic Movies Festival, AFI, Toronto International Film Festival, and Tribeca Film Festival, among others.

In the third room of the booth, audio racks and control include a Midas Pro 2 audio console. All processing is by Biamp. "It can be stand-alone or switch to sound console; turn on your mic and the Biamp just kicks in, with auto mixing capability," Madden says. "Up here in a soundproof booth is not the best place for a sound console during live events, so we bring it down to the middle of the house and set it up on a table in one of two live mixing positions. We recently added a digitally addressable Midas DL252 stage box that we can wheel around, and get 64 channels of audio in and 16 out."

There are four Panasonic remote-control studio cameras with tilt/zoom, motorized heads controllable from the booth. A Grass Valley digital recorder/player can play back digital video files and uncompressed video. Also featured is a broadcast-style Ross crossover video switcher.

Renkus-Heinz short-throw and long-throw speakers and subwoofers, plus JBL surround speakers, are positioned in a left-center-right formation in the ceiling of the proscenium, delivering sound through openings in the drywall on the steel-beam structure, hidden behind black fabric and four flat acoustic clouds angled down toward the audience. "The design was for an acoustically transparent

Photos: Alan Karchmer/NMAAHC

The architect specified a silver palette for the theatre's interior; the customized seats are by Series Seating.

auditorium, with the long-throw reaching most of the house and the short-throw covering the first few rows," Madden says. This system was augmented recently as described above.

In addition to Rosenbaum, the Fisher Dachs team included theatrical lighting designer Jon Sivell, and rigging designers Joe Mobilia and Scott Madaski. Their scope covered planning and design of the theatre, back-of-house spaces, seating and sightlines, rigging, lighting, stage machinery, and variable acoustics. They interfaced with the NMAAHC architectural team to ensure the functionality of the spaces, as well as the AV and acoustics specialists.

Fisher Dachs design tools included a proprietary software package to establish and optimize seating and sightline layouts for the theatre's range of uses within the constraints of the architecture. "One of the great challenges of being underground was that we had to meet certain building elevations and study the relationships between the various floor levels to create appropriate sightlines for the range of activities, to maximize the audience experience and make the room feel intimate no matter what was going on—dance, music, film, theatre, or lectures," Rosenbaum says.

Lighting, rigging, and control

The theatrical lighting package for the Oprah Winfrey Theater includes 192 circuits of ETC Sensor dimmers and 48 SmartSwitch relay circuits for theatrical lighting, ETC Unison 277V dimming for architectural lighting with Paradigm controls, and an ETC Ion 2000 theatrical control

Photos: Alan Karchmer/NMAAHC

console with fader wing, RVI, and RFR remote and custom ETC faceplates for power and data distribution.

The fixture inventory consists of 112 ETC Source Fours in various models and degree sizes, five Philips Vari-Lite VL1100TSD units, along with assorted fixture accessories and hardware from City Theatrical and cable inventory from Lex Products.

Ten self-climbing hoists (four front-of-house electrics, five onstage electrics, and one cyc batten), engineered, and supplied by SECOA, take the place of a traditional lighting grid. The system employs triangular trusses about 50' long, with 12" sides. Motors inside the trusses connect to a rotating line shaft. The truss lifts itself up and down via integral cables on winches. "There is no need to set up a ladder to get to the lighting equipment—it comes to you rather than you going to it, allowing for staff to quickly and easily maintain all the lighting within the theatre," Rosenbaum says. "These motorized lighting battens are able to reach across the entire audience seating area and allow staff to quickly and easily maintain all the lighting within the theatre without resorting to ladders. It's a relatively new approach that has proven very successful in dealing with overhead lighting. Rather than a stage tower, there is a stage loft that has all the rigging overhead. There is also a series of dead-hung pipe across the stage for general purpose use. The rigging control system is interconnected to the house lighting and AV control so the variable acoustics banners can be raised and lowered from the booth."

Sparkle in the room

As the architect wanted a silver-themed palette throughout the room, the Fisher Dachs team mocked up the house curtain as a translucent fabric of metal threads (Rose Brand Duet fabric in the color Steel). The initial design had the curtain rise into the ceiling to be concealed there. Ultimately, there was less clear height above the stage than anticipated; in addition, the curtain had to be backed with more layers of fabric, which resulted in a deeper curtain stack than originally planned. Rather than disappear entirely, when retracted the curtain forms a valance across the entire room, a serendipitous result that harmonizes pleasingly with the silver corona panels.

The architect also wanted silver highlights in the seating. "We spent quite a bit of time designing these customized chairs made by Series Seating," Rosenbaum says. "We went through many iterations to combine fabric and silver laminates for just the right amount of sparkle in the room." The room meets code for wheelchair access and has six wheelchair places and some with removable seats up front, and at the cross-aisle.

Acoustics

Motorized battens of sound-absorptive material (wool fabric banners made by acouStaCorp) live inside the back and side theatre walls and can be raised and lowered to tune the room using established presets or as needed. Fisher Dachs designed the system in accordance with performance criteria that SM&W provided.

"The reverberation time for speech intelligibility—for instance, to show a movie—is diametrically opposed to what you need for a concert," says Julie E. Fischer INCE, LEED AP BD+C, associate principal, Shen Milsom & Wilke. "The hidden curtains in the walls lower down and raise up to adjust it. We did quite a bit of testing to determine how the curtains would be affected inside the walls, behind the ornate screens. The screens are backed by a speaker cloth material that allows sound to pass through. Behind the acoustic curtains is diffusive CMU [concrete masonry unit], which is used to break up sound—it allows a longer reverb time while breaking up echoes, which is good for symphonic music. In general, you build for long reverberation and then adjust for short reverberation."

"This worked beautifully for symphonic ensembles from the US Army 'Pershing's Own,' which performed pieces from four African-American composers, and then later jazz performances, including legend Randy Weston with his quartet," Madden says.

In addition to collaborating with Fisher Dachs, Shen Milsom & Wilke interfaced with the architects, structural engineers, and mechanical engineers to fulfill its job scope. The location of the theatre in the center of the building, with MEP systems directly below and the central lobby area above, called for a box-within-a-box sound isolation system. The space was provided with a floating floor slab—a separate pour of concrete decoupled from the rest of the structure. The walls of the theatre are also completely separate. The noise above the theatre was a big concern. "If you have someone rolling a cart, or heel-click noise, or a school group running across, you don't want to hear any of that," Fischer says. The theatre's sound barrier ceiling uses multiple layers of drywall, hung on isolation hangers. As the theatre is fed with ductwork hung from the slab structure above, special care was taken with how the mechanical equipment was hung. "If it is rigidly attached, you 'short-circuit' the isolation," he adds.

Other low-noise measures include the use of sound attenuators, very large ducts, and acoustically rated doors. The control booth is separated by glass, which is angled so as not to create an echo down into the seating area; a floating floor in the projection booth keeps it quiet.

Shen Milsom & Wilke built a digital model using CATT software to test the different finish types—CMU, curtains, drywall, floor treatments, etc.—and get the desired reverberation times.—**Judith Rubin**