

Vegas baby! It's all about the spectacle

A block away from the Strip and connecting directly to The Venetian Expo, the 5.7 million cubic feet MSG Sphere is a \$2.3 billion high-tech arena in Las Vegas. **Clive Couldwell** looks into the megabuild of the decade.

The Sphere is a signature project for James L. Dolan who you might know oversees a family empire that includes Madison Square Garden, Radio City Music Hall, the Knicks, and the Rangers.

However, unless you've been hiding yourself away in that old air raid shelter in the garden for the last 12 months, the Sphere represents a new, completely immersive and visually powerful

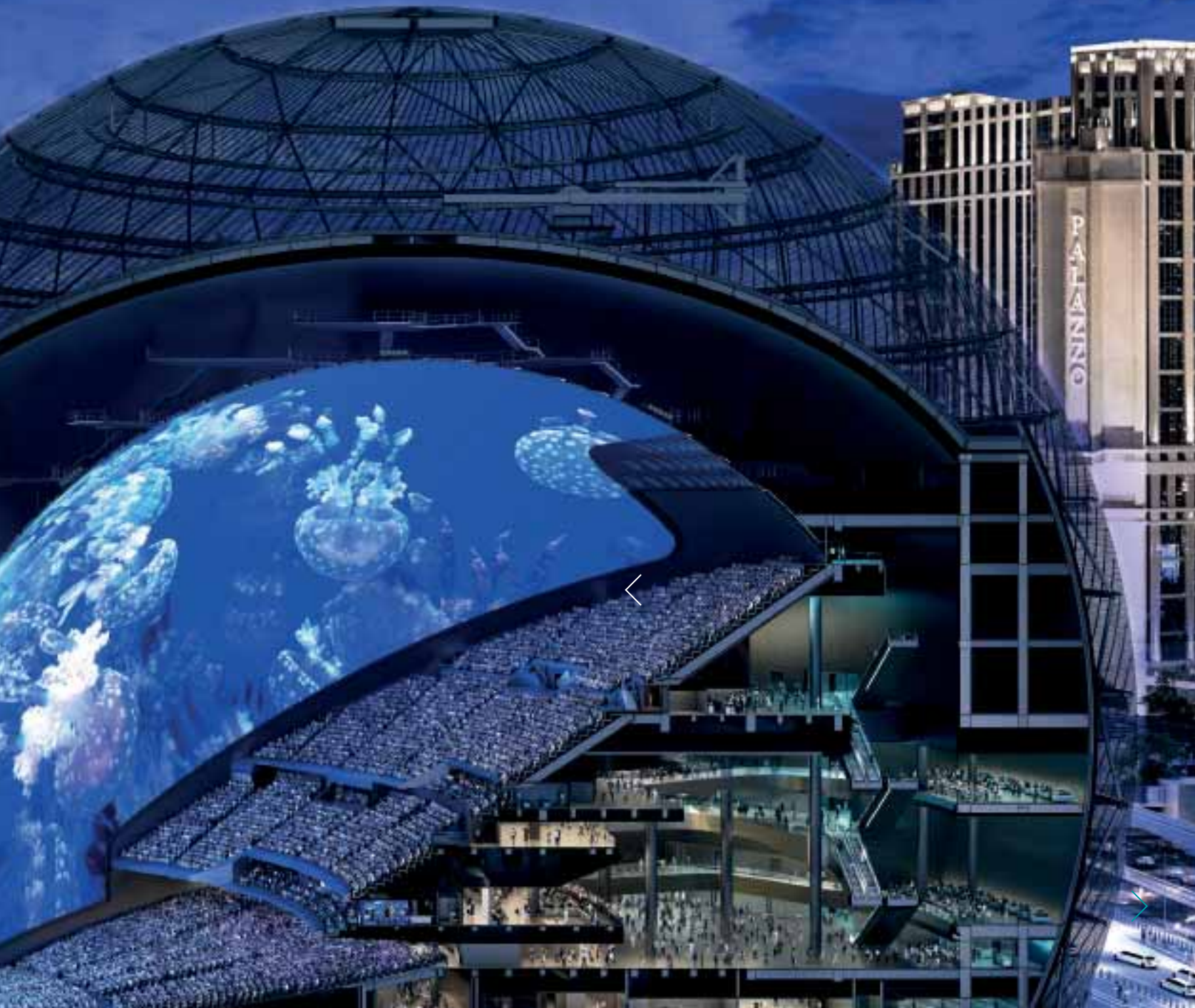
entertainment experience which features a 161,400 cubic metre Atrium and an auditorium that is home to 17,600 seats and a 14,860 square metre LED screen that wraps up, over and around the audience.

7thSense has worked with MSG on the speed, image quality, and integrity needed to render content. Powersoft's technology is integrated within the venue's 10,000 haptic seats and part of the venue's Sphere Immersive Sound (SIS) - developed in partnership with Holoplott and specifically



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7thSense



SPHERE ENTERTAINMENT

developed for the Sphere's unique curved interior.

SIS uses 167,000 speakers to direct sound to the audience like a laser beam, and with nearly the same precision. It not only delivers delay-free and echo-free sound to all seats, but it can also create wholly immersive 3D audio by placing a sound in any position in 3D space.

Traditional loudspeaker technology in large-scale venues can deliver audio quality that diminishes as distance from the speakers increases because of the uncontrolled nature of sound wave propagation. Holoplot's 3D beamforming technology uses software algorithms to create highly controlled, and more efficient soundwaves than conventional speakers, the company claims, so that levels and quality remain consistent from point of origin to

destination – even over large distances.

For example, the system could deliver an entirely different soundtrack, in various languages, to different positions in the theatre. So, within a small group of seats, one viewer can listen to a French soundtrack while the neighbouring viewer hears English – both in perfect sync with the picture.

Other firsts

The 54,000 sq metre fully programmable LED exterior exterior of Sphere – the Exosphere – is the world's largest LED screen, comprising about 1.2 million LED pucks.

Sphere's interior LED display plane and the Exosphere use Hitachi Vantara data processing software to stream high-resolution immersive

content.

According to Alex Luthwaite, senior vice-president of show systems technology at Sphere Entertainment, other firsts include streaming immersive, high-resolution video content on a scale that has never been done before.

Hitachi Vantara has also partnered with Sphere to produce the same capabilities at Sphere Studios' Big Dome, a 2,600 square metre, 8,000 square ft, 30-metre-high custom geodesic dome in Burbank, California with a quarter-sized version of the screen at the Sphere in Las Vegas.

(Big Dome serves as a specialised screening, production facility, and lab for the Sphere Studios team to develop original content exclusively for the Sphere.)

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So, is this transformational?

Is the Sphere changing our perception of what AV technologies can do? Well, according to Powersoft's sales and business development director, Luca Giorgi it's creating an experience that involves all the senses (well, at least four of them), considering that at the Sphere you could also experience smell and wind during a performance. "I do think that the change of perception is more related to the simultaneous combination of these senses than to audio visual technologies. However, in order to achieve this astonishing result, technologies are key – super high-definition video, multi-channel audio with granular control at the single transducer level, wavefield synthesis software capable of projecting sound objects everywhere in the available space, plus customised content able to really emphasise the emotional elements of the experience," says Giorgi.

"The Exosphere sets a new bar for placemaking, not only with the notion of video wrapping the building with video, but also the shape of the building itself which stands out in its visual uniqueness in a cityscape of unique buildings," adds Eric Cantrell, 7thSense's vice-president of marketing.

MSG contacted Powersoft initially at PL+S in Frankfurt in 2017. "We provided them with support during the evolution of the project up to the final definition of the specs, and then with Holoplot a

year later when MSG introduced them to us, and we started working on the integration of power electronics into the X1," says Giorgi.

"There are multiple challenges associated with the size of the complete system. One is the pressure to design products where efficiency is a main driver. Another has been reliability where fixing possible problems would be very critical and expensive.

"If we add to these challenges the fact that the main production phases happened during Covid and a supply chain shortage, the picture was quite daunting. But we were able to overcome all challenges and deliver," he says.

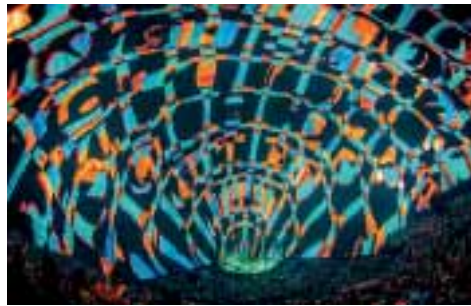
Geometry challenges

The geometry of the concave spherical display necessitated the Sphere's LED panels having different shapes, with pixels removed. "This posed a challenge on the media side of things, since a coherent image cannot be sent to the tiles, as information would be dropped where those missing pixels are in the media but not on the display," says 7thSense's Cantrell. "Re-mapping was required to put the correct media pixel in the right place in the video signal to make it appear at the right place on the display.

"This would be particularly challenging when working with live inputs, such as cameras or generative input, for example if an Esports event



▲ Above and next page: Phish kicks off its four-night run...



As the rock band jammed, the Sphere's screens became an art show.

were to take place in the venue. The remapping must be done in realtime, in sync across dozens of pixel processors to avoid latency and image tearing where different sections of the wall meet," he adds.

Large displays require higher frame rates than smaller displays because motion from frame to frame is smoother and less jarring to viewers. It was decided early on that image quality was very important, so 12 bit, 4:4:4 colour was the design standard, with 4K sections of LED running at 60

frames per second to make the images as close to reality as possible for the audience, according to Cantrell.

"There are significant challenges with transmitting that much video information over HDMI or DisplayPort and routing those signals to all endpoints that would need them. A network based uncompressed video stream using SMPTE ST 2110 offered the most flexibility, reliability, and redundancy. That decision was not without its own



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challenges though, as the size of the wall required dozens of 4K signals to be displayed in sync. This affects everything from the playback through pixel processing, and the network transport of huge amounts of information in a stable, predictable way," he says.

At the outset of the project, though the specification for the format existed, there were no products that supported 4K 12 bit 4:4:4 at 60 frames per second over ST 2110, not even test equipment. 7thSense worked with a manufacturer of ST 2110 analysis tools to expand their products to include this high-end format so it could validate the products they were building were functioning per the specification. "These tools have proven extremely useful not only for product development but also during on-site deployment and system commissioning," he says.

Logistical server challenges

The workflow for playing back different segments of a complete film across dozens of servers is a logistical challenge for loading the correct media on to the correct servers. 7thSense developed a workflow for media servers to play films directly from a central Network Attached Storage (NAS) cluster where all the media for the venue is stored. This required additional high-speed networking between the NAS cluster and the media servers, separate from the high-speed network handling the ST 2110 video streams.

"System reliability and uptime is of utmost importance in a venue like the Sphere, so there was a requirement to have multiple layers of redundancy to handle technical hiccups at any

stage along the signal chain," says Cantrell. "The storage drives in the NAS are configured in a RAID array, providing data redundancy. The NAS and ST 2110 networks are actually two parallel networks each, which allow for partial or complete failover between networks if timely and complete data is not received on the primary network.

"Each media server and pixel processor is connected to both networks for redundancy across the system. The LED panels are fed from two different pixel processors simultaneously and switch over if there is signal trouble on the primary processor," he says. "There are also banks of spare playback media servers, generative media servers, and pixel processors, all able to be switched to via the show control system or automatically on signal loss. All media servers and pixel processors use redundant power supplies as well."

Next steps

The 'big' official announcement that Sphere Entertainment Co had acquired full ownership of Holoplot has been a dramatic development in the story of the Sphere and for the pro audio industry. Sphere Entertainment Co plans to add new audio capabilities beyond the already astonishing audio system inside the Sphere. Executive chairman and CEO James Dolan said an audio component would make the Exosphere even more attractive to advertisers.

He also spoke enthusiastically about Holoplot's patented technology which he referred to as "beamforming sound", in relation to the building of Spheres in markets outside the US. "You really can't build a Sphere without a beamforming

"You really can't build a Sphere without a beamforming component to it. The sound does not work unless you have that technology."

**James Dolan,
Sphere Entertainment Co**

component to it. The sound does not work unless you have that technology. So we're very happy to be able to acquire this technology and acquire the company. We see it doing great things for us."

Holoplot's future direction

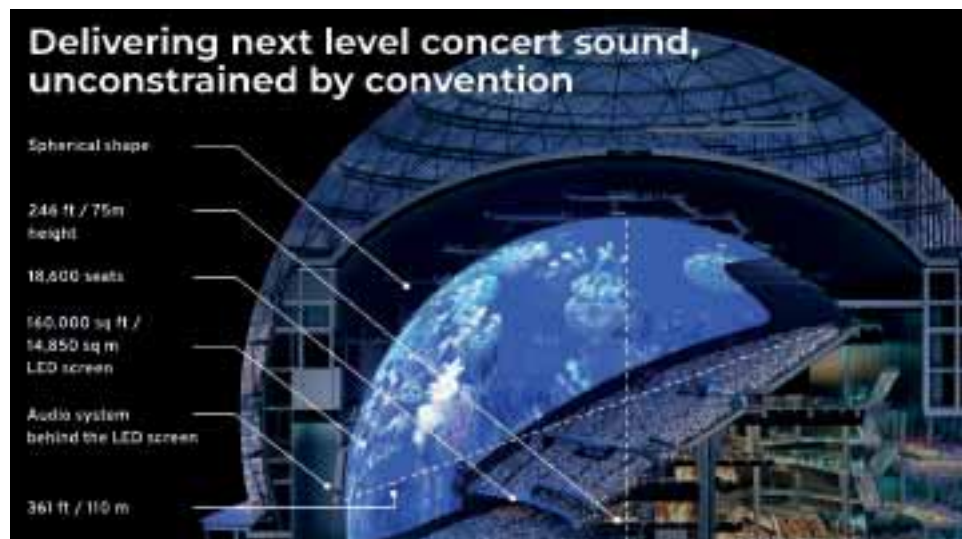
Now, however, Holoplot is well placed to continue its development of audio technology for the Exosphere and new Sphere venues outside the US, as a wholly owned subsidiary of Sphere Entertainment Co - obviously. And the company is not just a provider of technology for the Sphere but has notable installations elsewhere, including in Africa's largest mosque, the Misr Masjid outside Cairo, Egypt and in London's Lightroom digital art gallery which is this month hosting immersive listening parties for a new album by Billie Eilish.

The company also has a distinctive approach to the audio market, arguing that current audio market segmentation with separate products for a wide range of verticals is outdated, as multi-purpose venues proliferate, and that its software-enabled audio technology provides a better approach.

Adds former Holoplot CEO, Roman Sick who stepped down after eight years in charge, while remaining as an advisor to the company:

"We have worked alongside the Sphere team for many years developing our technology, and together we have forever changed the live sound experience," said Sick, who didn't just pilot the company through its technology development phase but through the pandemic and the supply chain crisis among other challenges.

"As a result of this transaction, Holoplot can accelerate its mission to bring its technologies to more applications and markets, and continue to push audio innovation to new bounds." ■



Capturing the Sound of Sphere.