orbicular fascination

eric loader • stadia
moving heads

STADIA

Introduced by Scott Willsallen, Audio Director and Sound Designer at Auditoria, Australia.

Flying in to an unfamiliar city for the first time is so much more interesting if it's on a clear day and the flight path takes you for a brief scenic tour. At 1,000 metres above the ground, it's difficult to make out much of the detail other than suburban areas, parklands and business precincts. However one type of building has the scale and shape that makes it easy to spot, the stadium.

On my first trip to Dublin, Ireland, a few weeks ago, my flight landed around noon on a cool clear day. It's a beautiful city from the air, lots of green, lots of water, but from this altitude, houses look like houses, buildings look like buildings. Then Croke Park stadium comes into view and its size and shape are familiar enough to us all, to know what it is and what happens in there.

Stadium, from Stadion, was the Greek measure of the length of a running race; either 185-metres or 192-metres depending on what you read. The length of the race determined the geometry of the venues and a breathtaking example of such geometry is the host venue for the 1896 Olympic Games, the Panathenaic Stadium in Athens.

Zoom ahead to today, where 19 year-olds are paid millions to skillfully kick a ball around, venue geometry has changed to keep up with the popularity of football and other rectangular pitch sports.

Those venues lucky enough to also host cricket, are faced with the difficult challenge of providing an engaging audience experience for both oval and rectangular fields of play. This challenge has seen some very clever engineering feats such as ANZ Stadium in Sydney with its moving stands; 1,500 tonnes of reinforced concrete gently moving 15-metres closer to the sideline for rectangular sports, and retreating for cricket and AFL (an odd sport involving kicking, lots of kicking).

A TOUGH JOB

I've spent quite a bit of time on sporting events over the years, and witnessed the evolution of how sport is presented to the live and television audiences. In Australia, the various sporting codes make a special effort to add an entertainment package to major events, such as grand finals and international fixtures. These packages have involved everything from helicopters to hovercrafts, international bands and folk heroes.

In recent years entertainment packages have become part of most typical club games to make more of an occasion of every game. In addition to specific pre-match entertainment, the presentation of the sport itself has also evolved.

Sports presentation is of real importance to sporting clubs in creating culture and brand. It is the coordination and delivery of the event information to the live audience. Using music, commentary, replays and video packages, sports presentation aims to build the drama before and during an event.

The combined growth of both sports presentation and entertainment has seen venues upgrade their facilities, with the addition of LED screens and audio systems to provide a better audience experience.

Possibly the toughest job for the management team of a stadium is making the business sustainable and profitable, particularly with such high maintenance costs and relatively few events. Venues compete for business and work hard to provide facilities that meet the diverse range of requirements of their clients.

A stadium with higher performance and more flexible facilities have an advantage, as it can fill the quiet periods between seasons with other events. Ultimately the venue that can provide efficiency, scalability, flexibility and an excellent fan experience will succeed.

WHAT'S SOUND GOT TO DO WITH IT?

The fan experience consists of many things but the two most significant are what they see and what they hear. In my experience, historically most regular stadium punters will expect the audio in a stadium to be bad. The typical experience is low intelligibility and narrow bandwidth.

We are finally in a situation where the audience is expecting high performance sound, the sporting codes and stadium hirers are expecting and will make use of high performance sound. It's time the performance criteria of stadium audio systems increased to meet these demands and provide stadium operators with the right facilities to compete.

My process of designing an audio system for a stadium begins with the loudspeaker system, mainly because this system will require the greatest coordination effort with the architect and the electrical, structural and mechanical consultants.

The loudspeaker system sketch design is simply an exercise in geometry using the building plans to determine the approximate number of loudspeaker clusters / arrays and section drawings to assess the vertical requirements for each array. This process is repeated for every loudspeaker product that I am considering for the project, to yield a rough starting point for the detailed design.

The designer must have a strong understanding of the performance characteristics of the products under consideration, and understand how the various products in an array will interact. I'm not just referring to the nominal dispersion of a product; it's about understanding the fundamentals of waveguides, direct radiators and the complex interaction of multiple sources.

The designer should be able to imagine the three-dimensional coverage of each array and how that will work in the venue geometry. In my case, this is a process of becoming comfortable with the design of each array, and if it doesn't feel right, I know I've made an error and must keep working on it.

Once I'm comfortable with the individual array design, then the interaction between multiple arrays is considered. This process leads to modifications to the horizontal details of each array to increase or reduce interactions in the horizontal plane.

Once each design has passed the comfort test, it is then modelled using EASE software. The building model should be as detailed as it needs to be; that means that all surfaces of acoustical significance are included and all other details are excluded. The loudspeaker system designs are precisely added to the model and saved as a unique file for ongoing calculations, simulations and editing.

The modelling will answer any question you ask of it, however errors can be made when the wrong questions are asked or simply not enough questions are asked. Third-octave band coverage mapping is interesting, but is only the first stage in what must be a multi-stage modelling process to understand the performance of the system. The time domain should receive as much, if not more attention than the frequency domain.

This long and detailed process reduces the number of designs down to only those manufacturers which have a set of products that match the venue geometry and deliver the required performance at the right price. There are various methods to reach the final decision; my preferred is a listening test and physical inspection in the venue whereby the venue staff can get involved in the decision.

The control system design is typically in two parts: the bowl system, which has a mixing console, and the back-of-house and ticketing systems, which are automated. The bowl system is simplistic when compared to the back-of-house system. The mixing console(s) connect to a digital audio network - be it Dante, Optocore, Ethersound or another - that connects to the amplifiers, either directly or via conversion to AES or analogue.

Most loudspeaker systems use DSP within the amplifiers, so DSP within the signal transport for the bowl system is less important, but can be handy, especially if the proprietary amplification does not allow for user EQ.

There is some I/O and DSP in the control room to interface with the stadium video systems and the media, as well as some clever routing and distribution for the corporate boxes. This is an area where there are quite a few alternatives to consider. The important factors beyond functionality are redundancy and sound quality.

An 80,000 seat stadium must be agile in terms of scale to provide a good experience for a 40,000 or 30,000 capacity event. The audio system design must support this agility and provide operational modes that deactivate the parts of the system that are not needed, without sacrificing the performance.

Muting unrequired loudspeakers will likely improve the intelligibility due to the reduced reverberation, however the reduced number of sources will affect the dispersion characteristics of each array. This must be understood in the design process and optimised during the commissioning of the system.

Don't underestimate the requirements of the mixing console and the announcer microphone(s). In the right hands these two items can make the difference between average and amazing, intelligible and engaging.

The available dynamic range in a stadium is quite narrow, juggling poorly mixed

video packages with announcements and a noisy audience is difficult, high quality compression and EQ is vital, be it outboard, built-in or plug-in.

THE FUTURE

Over the last decade my profession has taken me to loads of stadia all over the world; some of which had just been completed, some recently refurbished. Most of the installed systems I come across seem to be designed to meet a performance expectation which is best described as suitable for speech and low level music.

This level of performance is not what current and future sports presentation require, nor does it consider how the audio system can support the diversification of the venue in its ability to host non-sport events.

The audience expectation has grown, the performance expectation of stadium hirers has increased, stadium operators need high performance and flexible facilities to compete, and it's time stadium audio systems caught up.

In June 2013, I completed the upgrade of the Sydney 2000 Olympic Games Stadium, now known as ANZ Stadium. The project ignored the accepted standards for stadium audio performance, and aimed to raise the bar both locally and internationally.

The audience experience has improved dramatically from multiple complaints every event to positive comments about the sound. Event producers responsible for sports presentation and game-day entertainment have increased their programs to make better use of the system and deliver a more engaging experience.

The audio system is one of the many elements of stadium technology. It is not something that belongs buried within the electrical specification for a new stadium construction project, it belongs on the same page as the LED screens, WiFi connectivity and all other elements of the fan experience.

The world is serious about an engaging and exciting fan experience, sound owns a large percentage of creating that experience, and it is time the audio system designs responded to this.

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