When it opened in 1999, the Millennium Stadium set new standards for sporting venue design and construction in the UK. Now, 11 years later it has been given a technology upgrade.

A new Millennium

It's been more than a decade since Cardiff was blessed with the opening of its new stadium and things have moved on a little technology-wise since then. Technologies such as digital signage and LED information displays have matured considerably, and new standards governing the performance of life safety systems have arrived.

In addition, expectations of sound quality from PA systems have risen dramatically. All of this added up to a need for the Welsh Rugby Union (WRU) to give its home-base a serious technological face lift.

The three million pound project contained three key elements. First was the installation of a brand new network infrastructure and site-wide display system.

The second element was a total overall of the venue's PA / VA system. This was designed by Vaughan Sound Installations, and installed by the PAI Group, both based in Wales.

The final part was the installation of a pair of 90 square metre Daktronics LED screens in the stadium roof, upgrading the existing display system to deliver HD content.

Cisco Gold Partner CAE Group was selected as the main IT contractor for the project and replaced first the existing large LED displays. This necessitated the construction of a new steelwork mounting gantry in the roof of the stadium.

Secondly a new fibre, data and power cabling infrastructure was required. Over 75,000 metres of cable were laid within the stadium to cover all possible corners and screen positions. This was carefully integrated into the existing infrastructure of the stadium by CAE.

Finally over 450 large LCD displays and media players were installed throughout the site.

To meet the considerable challenges involved in mounting these screens in a variety of locations, CAE partnered with Unicol. The company designed and manufactured a bespoke solution to house the Cisco 4305G digital media player, as well as a LCD100PRO 40N or 52N display in a single unit.

Unicol also provided outdoor enclosures for both sizes of display, with built-in temperature control. Heating elements were included for icy evenings, with ventilation and dust filtration also included.

The software and networking elements of the new display system come from Cisco. The Millennium Stadium is the first European implementation of the company's StadiumVision solution.

Tech-Spec

Video

Cisco 4305G media players, LCD100PRO 40N, 52N displays

Daktronics DVX LED display units

Unicol bespoke brackets

It includes a full HD production studio able to deal with OB and HD signal feeds, two independent live streaming video channels for in house broadcasts, five external video feeds and a full suite of editing tools for applications such as graphic overlays and action replays. The system allows full zone control over all the various LCD panels.

Millennium Stadium IT manager, Craig Phillips, said: "In just one month we have gone from handful of CRT screen TVs to having a fully interactive system that will give supporters up-to-the-minute information during the game, wherever they are in the stadium."

On the audio front, the existing solution was based on Community cabinets and horns, paired with Crest amplifiers.

Community's UK distributor CUK Audio was approached by Vaughan Sound to supply a new proposal for an upgraded system.

Stuart Thomson, the company's managing director explained the background, and the new approach: "The system originally operated on the basis of Community coaxial horns, chosen for their massive pattern control (obviously important in reverberant spaces) and extremely high efficiency. Amplification was a big issue back in 1999 where amps that could be fault monitored and produce upwards of 3000W simply were not available.

"The backbone of the system was Community M4 coax's, utilising the M4 mid range driver. The coaxial horn systems were originally configured with passive crossovers (externally mounted in weatherised boxes). Whilst these performed a crossover function they failed to accurately time align the drivers.

"The system was in extreme need of Biamping, corrected aiming, accurate time alignments and re-amplification. Then to take the system to more of a full range entertainment system LF reinforcement needed to be added. This needed to have the ability to extend up to 250Hz to meet the LF limit of the M4 Coax system, whilst adding controlled LF reinforcement. The solution we arrived at was the Community R6 Basshorn, loaded with six 12" drivers.

"We carried out an acoustic study of the stadium looking at the existing system and working closely with Vaughan Sound to ensure the client received the system they needed, on time and on budget. CUK Audio established that the addition of a 18 x R6 Basshorns was required, in conjunction with bi-amping the Community Coax systems and re-powering the main parts of the system, subs, and under-balcony (Community W2 2V8).

"The R6 Basshorns are powered with Powersoft K20 and K10 amplifiers, while the main part of the system - the Community M4 Coaxes- is now bi-amped using individual processing outputs from the BSS SoundWeb BLU's, to Powersoft Duecanali 5205 and Powersoft Duecanali 3904 amplifiers.

"The under balcony area has been supplemented with four additional Community W2 2V8's – taking the total to 44. 32 of these speakers are on their own home run and are thus powered by Powersoft LQ2804's. In some of the areas cabling required two speakers per channel and these are powered from Powersoft Q4002s."

Whilst CUK were looking at system improvements, the PAI Group team had another challenge on its hands. Almost no electronic drawings or diagrams of the original wiring system existed. A major challenge was to verify the old drawings, by testing each line, before converting them into a digital format.

Line status monitoring is also now a key component of a safety system. To this end, PAI also installed new Baldwin Boxall line monitoring equipment, and in the cases where multiple lines are fed off a single amplifier, IKON AVS impedance monitoring units were used.

Once the upgrade was complete, leading electro-acoustic consultant Peter Mapp was brought in by the PAI Group to independently check the speech intelligibility of the new system.

The audiovisual system received its first major test in February 2011, when it was employed for the home game between Wales and Australia.

Tech-Spec

Audio

Baldwin Boxall line monitoring untis

Community R6 Basshorn, W2 2V8 cabinets

Ikon AVS ECM Impedance monitoring units

Powersoft K20. K10, Duecanali 5204, Duecanali 3904, LQ2804 amplification.