The system had to be commissioned at least two months before the opening ceremony

The SEA spectacular

When the SEA Games returned to Singapore after a 22 year gap, a weight of expectation was on the technical team as well as the athletes, writes **Barney Jameson**

EVERY MAJOR SPORTING EVENT BRINGS WITH IT ALMOST as much anticipation for its opening ceremony as the competition that follows. Such was the case when the South East Asian Games, or SEA Games, returned to Singapore in 2015, marking the city state's fourth time as host of the event. Adding an extra layer of pressure, however, was the fact that 22 years had passed since the last time the SEA Games arrived in Singapore's former National Stadium. Over more than two decades, much has changed for the Games and for Singapore itself – even the venue has been transformed from the old stadium to the new Singapore Sports Hub. When the time came for the opening ceremony to begin, a weight of expectation hung heavy in the air.

That same pressure applied to the technical systems in use throughout the event. Some 40,000 people gathered for the opening ceremony, in which more than 5,000 performers and volunteers participated. Highlights included a new world-record for multimedia projection – for visuals alone the event drew on 160 Christie 20K Roadster projectors plus almost 500 BMFL fixtures from Robe, supplied by Showtec Communications Pte Ltd. Similarly impressive was the dual redundant Optocore fibre ring set up by The Show Company.

For the event's sound reinforcement, meanwhile, the choice of system proved a major coup for French manufacturer Nexo, whose flagship STM series was entrusted with one of the highest profile events taking place in Singapore's 50th year.

Again, the suggestion was made by The Show Company, a long-term user of the French brand having initially used PS15 enclosures in 1996 before progressing on to Alphas, Geo S, Geo-T, Geo-D, and the CD sub-bass series. Much more recently, in December 2014, the company took delivery of its STM inventory and immediately debuted it on Singapore's ZoukOut Moon Stage rave party. It was also in December 2014 when The Show Company approached Shah Tahir, the sound designer from the SEA Games committee and consultant for the opening ceremony, to suggest STM for the Games.

Part of the reason was the late 2014 arrival of the M28 multi-

The positioning of the STM arrays was strictly limited

purpose 'omni' module, which allowed The Show Company to propose a complete system solution and arrange a demo for the committee. To ensure it was a success, Nexo's David Hochstenbach and Nicolas Kirsch assisted The Show Company design team of Desmond Fong (project director), Jon Sim (audio project manager/chief systems engineer), and Jerome Soh (chief field engineer RF systems).

Crucially, at the beginning of the design phase The Show Company had to contend with the acoustic challenges of the stadium, particularly its domed roof. The team used Nexo's NS-1 software to determine the best speaker locations, and Mr Kirsch confirms that the exercise was well worth it. 'The sound

was clear and detailed even though that huge dome shaped roof gives a seven second reverb time,' he reports.

From this point, it was up to Jon Sim, head of audio at The Show Company, assisted by Australia-based Mark Bollenberg, an STM expert described by Nexo as 'an NS-1 genius'. Together they worked on design options to match the specification given by the SEA Games consultant, ultimately producing plans that exceeded the performance specification while keeping in check the weight and size limitations, as well as adding options to reduce equipment whilst maintaining SPL.

Not everyone was immediately convinced – Mr Tahir, in particular, was sceptical before the demo changed his mind and the decision was made to opt for Mr Sim and Mr Bollenberg's more compact option, prioritising clarity, coverage and weight.

So began the not inconsiderable challenge of building the system. The Show Company provided an overall design involving 10 flown clusters and 16 ground-stacks (12 of which addressed front of house while four were in-fill), with PS series speakers for holding areas.

Looked at in detail, the flown clusters each comprised nine STM M46 main elements plus nine B112 bass enclosures, four S118 subs and two Nexo Universal Amp Racks (NUAR), both of which were flown behind the clusters to keep cabling short and lightweight. These covered the top two tiers of seating and the VIP balconies. The ground-stacks boasted three M28 mains, two B112 bass enclosures and two S118 subs to cover the first tier seating, offering the same performance but with more vertical splay.

For monitoring, six additional ground-stacks were deployed, each with two M46 mains and two S118 subs, intended for fold-back in case performers' IEM systems failed. Finally, PS10R2 delays were located at the outmost second tier seats of the North and South stands, covering the upper rows. More PS15s were deployed for 'blind spot' areas under balconies, while 30 PS15–R2s were located in the tunnels leading to the field.

A significant challenge was the limitation of where the clusters could be positioned. Reasons included a weight limit on the

roof that stressed each cluster had to be less than two tonnes, including motors and 60m chains. Additionally, for safety, the weight of each cluster had to be distributed across three rigging points (two at the rear and one at the front). Lighting trusses also had to be accommodated while sightlines had to be kept clear.

'We were given fixed rigging points due to the roof's loading, which didn't work in favour of flying arrays,' explains Jon Sim. Indeed, the only feasible location for the STM clusters was above the general gridline, at approximately 44m. 'The points were situated on a straight horizontal beam, making it difficult to adjust vertical tilt angles and horizontal aiming. After much research, we managed to offset our rig points on the straight beam to allow us fixed horizontal angles and also to solve our array tilt angle.'

This meant aiming distances of 55m to 60m maximum, with a vertical splay of 55-degrees per flown cluster, and 40m to 50m with 15- to 20-degrees per ground-stack. It was therefore critical to have sufficient HF power and waveguide control to more than line source (55-degrees). 'With its 10-degree opening and four HF drivers per cab, STM was the best choice around to meet these specifications,' reasons Mr Kirsch. 'It could open very wide (vertically) without breaking the line source control.'


Two Nexo Universal Amp Racks (NUAR) were flown behind each array to reduce cabling length and weight

first but, he reflects, made absolute sense. In the drive to reduce weight, The Show Company wanted to rely on STM's lightweight bumper instead of the full-blown rigging hardware which uses separate NUAR bumpers

Seats in the first tier were covered by ground-stacks with three M28 mains, two B112 bass enclosures and two S118 subs
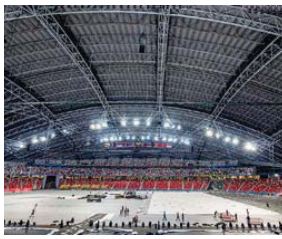
Preparing the enormous Singapore Sports Hub stadium for the Games

powers on ground level.

The creation of the dual redundant fibre network, through which all audio signals in the stadium were routed, required The Show Company to substantially invest in Optocore. It added to its existing inventory with eight X6R-FX-8AE/8LO converters plus three X6R-FX-16MI, two X6R-TP-16MI and five X6R-TP-16LO interfaces with a central DD8RP repeater, all purchased through local distributor Total Solution Marketing.

'Optocore is a very stable and easily expandable system – ideal for large scale deployment such as this,' explains Mr Sim. 'The scale and the importance of the audio support for the games made it mandatory to have a large dual redundant ring

system as nothing is allowed to fail.' All 18 devices were connected in the loop, including 11 X6R-FX devices set in 11 locations throughout the stadium. Six of the X6R-FXs were located in the control room, receiving AES3 signals from Dolby Lake rack processors and analogue signals from a back-up Dolby Lake rack. Both racks were fed by Avid Profiles. 'Signals were then distributed through the network to all locations, and then we just picked up the AES3 signals and analogue signals to the amplifiers,' Mr Sim continues.

Jon Sim and The Show Company's team were duly impressed with the STM system and how it performed. 'Overall we were very happy with the results of the system. We had plenty of headroom in the system and the direct sound clarity is amazing even with a reverberation time of seven seconds.'

But the challenge was not only technical – it was also logistical. To bring so many systems together, additional inventory had to be shipped in from outside Singapore, while the set-up requirements were to provide and commission the sound system at least two months before the opening ceremony, giving the performers ample time to rehearse. The Show Company was able to provide 48 M46 systems (a total of 144 modules) and 24 M28 systems (totalling 48 modules), but that

Approximately 40,000 people gathered for the spectacular opening ceremony

The scale of the system's success can be measured in numbers – in the vertical field from the ground to the top of the highest bleacher, the SPL change was +/- 1.5dB, and in the horizontal field, walking across the stadium at a low, medium or even at the highest level, the overlap gave nearly flat +/- 0.5dB variations. The only area off the direct sound field was located at the far-end of the second level bleachers, where two PS10R2 cabinets were used to aid HF clarity.

System management and monitoring was done via Nexo's ES Monitor interface, with clusters arranged in groups, allowing Mr Sim to keep an eye on all the NXAMPs from his sound control room on Level Five of the stadium. The requirement to have NUARs flown with the clusters was a surprise at

for individual flying. However, after a round of idea sharing and concept discussions at the local level, The Show Company suggested a new concept, encouraging Nexo's R&D department to develop a 'rear extension bar' addition for the standard lightweight bumper. The bar provides an anchor point for flying two NUAR racks at the back of the cluster, side by side, and after testing the design was approved and manufactured to order. It has now become a standard offering within the STM family.

The NUARs themselves were fitted with NXAES104 cards, thus allowing the integration of AES/EBU signals into the amps and control signals via Ethernet through the Optocore network. The flown racks were specially configured so they would have control of individual amplifier

Nearly 500 Robe BMFL fixtures were used for the opening ceremony

A dual redundant Optocore fibre ring was provided for networking

was still short of the 320 modules required. The answer came by way of an introduction to Engineering Impact Ltd, Nexo's STM partner in Hong Kong, and the two companies quickly agreed to cooperate. Within weeks, the 36 additional M46 systems were en-route.

That's just one example of the deep cooperation and teamwork that went into the technical success of the 2015 South East Asian Games, an event of which all concerned are now rightly proud. More than two decades of development and change may have passed between Singapore's hosting of the SEA Games, but the determination of everyone involved to stage the best show possible remained the same.

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