Stadium Australia

Stadium Australia will be the focus of entire world when the Olympics come to Sydney in 2000, and thankfully the sound for the venue was given high priority. Christopher Holder spoke to The PA People's Chris Dodds about his $3.5 million sound installation.

Over 107,000 people packed into Stadium Australia for the recent Bledisloe Cup rugby match between Australia and New Zealand. There are few sporting events that evoke more passion. Forget about England v Scotland in the World Cup soccer semi finals (too many tartan skirts and exposed beer bellies), forget about the Superbowl (too many pom poms and hotdogs), forget about the America's Cup (too many winged keels and blazers) the Bledisloe Cup has a gladiatorial rawness that makes any other contest look like a CWA bridge club meeting.

It was a monumental night in many respects. A record crowd was in attendance and Australia rubbed the All Blacks' noses in the turf with a record victory.

The evening also marked another significant step in the Olympic stadium's coming of age. The eyes of the nation (and a good part of the rugby playing world!) were on Stadium Australia, and it came up trumps.

Getting in and out of the venue was painless, the view from all seats was good and unobstructed, the beer was nicely chilled, and the sound? The sound was something else. I think we all take for granted that in large stadium events the sound is all about compromises. Coverage, intelligibility, power, are all compromised by the inherently difficult nature of the large space. My praise of the system that night is almost without qualification, the PA was highly intelligible, there was virtually no huge delay problems (all the sound I heard came from the two nearest speakers and nothing arrived half a second later from the other side of the park), and the coverage was very uniform as I wondered around the stands. All the compromises that we to take for granted as being part of

the stadium experience seemed eerily absent. I say eerie because the bi-product of the clarity is a strange isolation. A try is scored, 100,000 people rise as one in rowdy homage to the scorer, but you find that the only cheering you hear is from the portion of the stand that you see around you. This takes some getting used to, but clearly represents the way of the future for stadiums as a modern entertainment venue.

Christopher Holder: Chris, I was quite impressed by the lack of messy delays and reflections in the audio while at the rugby. What's that due to?

Chris Dodds: Acoustically it's a very controlled space compared to many other stadia. Much of that is due to the roof that concaves up in the East and West Stands. An open roof propagates the sound out, while here the concave roof allows the sound to go up the back of the stands and dissipate within that space. The roof goes up a long way and a lot of the energy is trapped. Anything that does go up into the roof and reflects, will reflect back into the stand, it doesn't reflect out on to the ground – whether it's crowd noise or the PA.

CH: So there aren't any clever construction tricks, or space age materials, it's all down to the architecture?

CD: That's mostly right. But as far as materials go, the roof is a polycarbonate sandwich, basically a honeycomb polycarbonate, which is reasonably transmissive of low frequencies, which helps, but quite reflective at high frequencies. But ultimately it's more about the geometry than acoustic treatments.

CH: But the controlled nature of the space must have given you great encouragement when you were doing your modelling of the system?

CD: It's a remarkably forgiving acoustic space, and it's very well designed architecturally too – I don't know how much of that was good luck or good management, but, acoustically it's a remarkably good space. I mean, if you sit in the East Stand with that stand's sound on only, then turn the West Stand's system on, you hardly hear it, nothing. It meant that with careful design we were able to achieve great coverage – the result was a variation of less than 2dB over the entire stadium. As far as intelligibility goes, there were a few small 'worst case' pockets which were down to an STI [Speech Transmission Index] figure of around 0.47, but the vast majority of seating was between 0.55 to 0.63. In a space like this, those figures are unheard of, it's just mind bogglingly good. I should stress that those figures are measured, not predicted.

CH: Okay, let's get down to nitty gritty, what speakers have you put in here?

CD: The speakers are all Bose. In back-of-house [all the function rooms, public concourses, corporate boxes, etc.] there's Model 8 and Model 32 ceiling speakers. There's Model 25 small cab speakers, and there are Model 502A, which is commonly called the Banana Box, in large acoustic volume paging spaces, and they also serve as under balcony fills on the East and West stands. In all there's 1600 speakers in back-of-house. For front-of-house (inside the main stadium area) there's Bose 402s around the balcony and on the North and South stands. The rest of the cabs are LT9702, LT4402 and LT3202 which are all horn loaded mid/high cabs, and the 502BE bass cabs. All of the bass cabs are in directional arrays. [See diagram for a typical cluster configuration.]

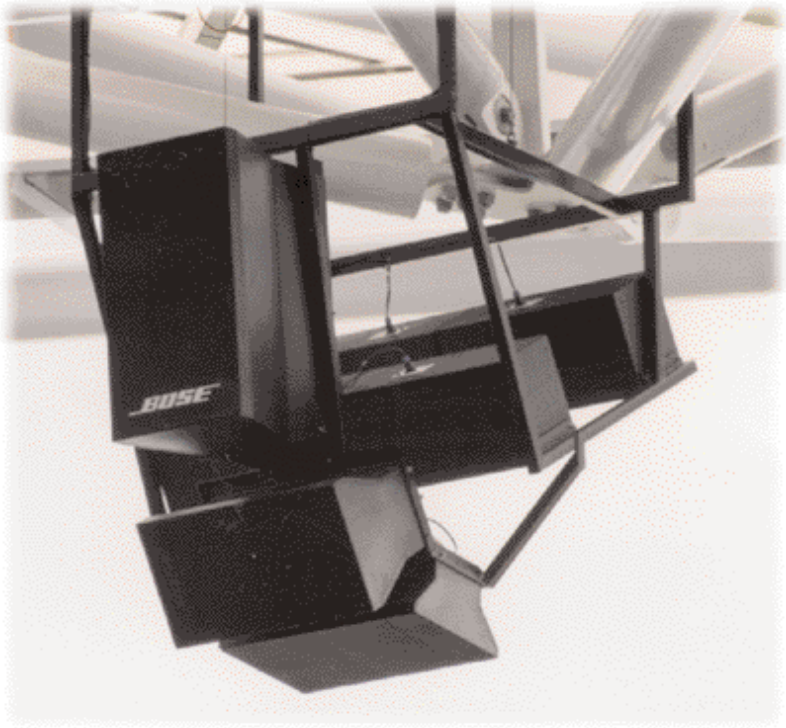
CH: Bass directional arrays? How does that work?

CD: I think the only way I can answer that is, yes it does work. We're not letting all the tricks out of the bag, but if you physically look at them, they are arrays which are digitally controlled, and it achieves the goal. So all the bass cabs are beam steered, they're all pointing at seats with something like a 12dB front to back ratio at 125Hz. So it's just as directional, if not more directional than a horn loaded cabinet.

CH: Why did you spec Bose?

CD: The primary reason why The PA People corporately specify Bose is, a) it's a good product, and b) the design development tools Bose has brought to their package, give us a level of certainty in design unmatched by any other manufacturer. Bose's Modeller, (the acoustic modelling tool), and Auditioner, (their auralisation tool), in our opinion are a significant level above any comparable tools – particularly in their ability to predict the reverberant field, which after all is the real field. Sure, other people make good speakers, but they're a lot harder to use than the Bose products and a lot harder to actually know what result you're going to achieve. For example, the correlation between predicted and actual perfor-

The PA People's Chris Dodds at the control room's Soundcraft K3 console.



A look at a typical seven-speaker cluster in the East and West Stands. Refer to the CAD diagram opposite for the cluster's specifications. Photo courtesy of Bose's Brian Chilcott.

mance for this system showed that we exceeded our coverage predictions – which shows Bose are relatively conservative – and as far as intelligibility, we were pretty much on the money.

CH: What have you got powering the Bose speakers?

CD: We're using 56 Crown CT Series amps for back-of-house, and 94 MA series amps for front-of-house. There are four different amps in the CT range and they're purely selected by the number of speakers that they're powering. Same applies to the MA range, there's three amps in that range, and we just match them to the right size cab. The amp racks are located in four points around the ground.

CH: Those are the new Crown amps with the DSP card slots aren't they?

CD: Yes, the new USP2 modules. Each module provides eight bands of filter, as well as delay, compression, and load monitoring within the amplifier.

CH: So what do you see as being the principal advantages of having that functionality in the amp rather than in the control room?

CD: The dimensions of the system is one benefit. If you've got 160 amplifiers, like we do here, and you needed separate processors on every channel, then you'd have a system that generates 320 outputs. As it is we have a system that generates 60 outputs, so that's a significant benefit. Also the way we've implemented the system using Cobranet, we have several levels of functionality that you wouldn't get – or would be very expensive to get – using a centrally located process system.

CH: Cobranet is a fairly recent technology, what exactly is it about?

CD: Cobranet is a proprietary digital audio protocol from a company called Peak Audio in the US, who are licensing it to a number of vendors, including both Peavey and Crown. It's becoming a standard for distributing audio via ethernet, where we can distribute 64 channels of 20kbit audio over a standard 100baseT ethernet connection. Rane are about to release some Cobranet stuff, QSC have got it. It's a pretty exciting mechanism.

We can use Cobranet to easily reconfigure the system amp by amp, zone by zone. It allows us to have a virtual network, which is a significant benefit. But to use the protocol in the exact manner that we wanted, we needed the back-of-house amps to have Cobranet going straight into them. So, in co-operation with Crown, we developed our own interface to do that.

CH: We're heading into system control territory here. Perhaps we should discuss the control issues?

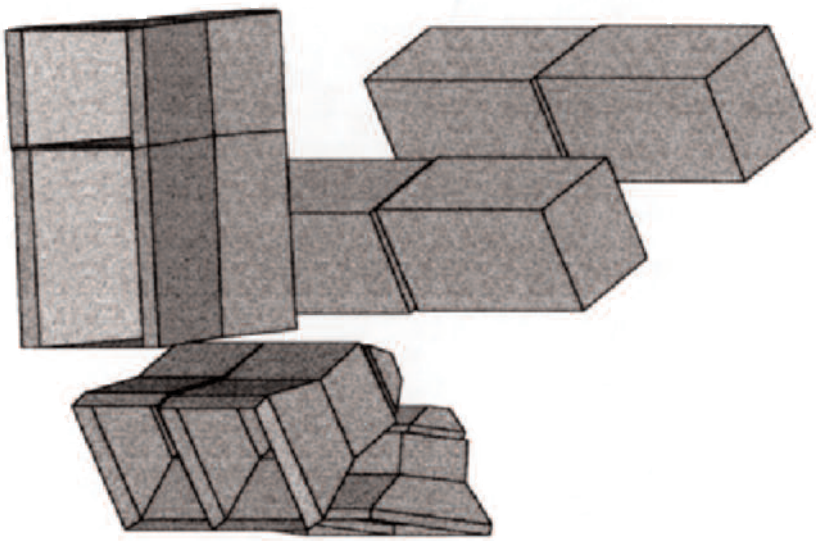
CD: From a control perspective, the system is split into two halves. The first half is a fairly standard but comprehensive analogue front end, the second half is where we believe the smarts are – the control system is what makes the thing tick.

Looking at the analogue side, there are copper tie lines from eight major positions around the field – four corners of the stadium, plus four in-field pits under the turf. Each of those has 12 mic lines on a multi-pin connector and six XLR lines, they all come up and terminate at the patchbay in the control room. Then there are other dedicated positions – like the media boxes, television boxes, press split positions, the OB control room, TV screen control room, Telstra termination room – where there are also cables. They either come up as undedicated tie lines, or they come up as dedicated feeds. The patchbay is comprehensive, with all of the control room's Soundcraft K3 I/Os on there, and all the insertable effects units. The system is designed so that if you strip the patchbay, the system will still work. We've also got almost every conceivable playback device in here, and a good array of processors and effects – you should be able to come in here and not have to bring anything.

CH: Sounds like you've got the front end covered extremely well…

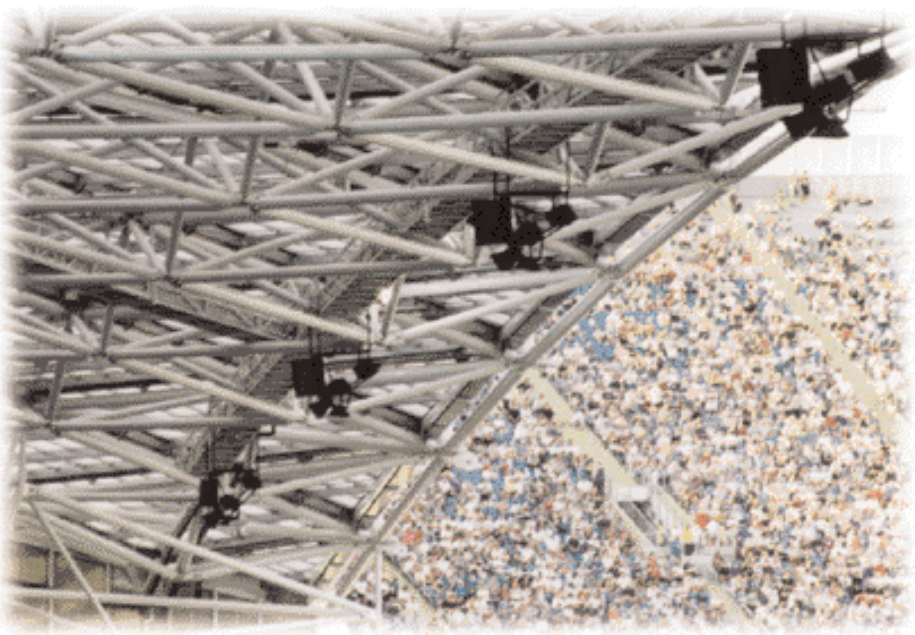
CD: Yes, which brings us to the control system. It takes crowd mics, paging mics, background music sources from the desk, and so on, and routes and manages them throughout the site.

The actual audio processing box is a Peavey Media Matrix, while the amp control system is Crown's IQ. Both



There are twenty clusters distributed along the main front gantry of the East and West Stands. A typical cluster comprises a steel frame loaded with a Bose LT3202 mid/high cabinet, a Bose LT4402 mid/high cabinet, a Bose LT9702 mid/high cabinet and four Bose 502BE bass cabinets. The cluster is supported by two Demag DS1 wire rope winches.

systems have their own dedicated PC interface, and we have our own software which controls those two systems plus the paging stations and all the ancillary hardware. So, from an engineering setup perspective you're using the relevant native application – whether it be ours for the paging stations, Media Matrix for the routing, or Crown IQ for the amps – but from an operational perspective you have a single user interface which addresses all three as separate pieces of hardware. In our opinion, this was the clue to making the system uniquely versatile and friendly.



The leading edge of the roof of both the East and West Stands is above the front row of the seating, which provides an ideal position for the seven-speaker clusters. Photo: Brian Chilcott.

CH: Is there much of an overlap between the roles of the Crown IQ control software and Media Matrix?

CD: The Media Matrix's primary function is as a router, with some basic dynamics and ducking functions. All the processing which relates to where the speakers are and the delays, that's done in the amps via the USP2 modules.

CH: So going back to Cobranet and your interface modifications, how did all this fit in?

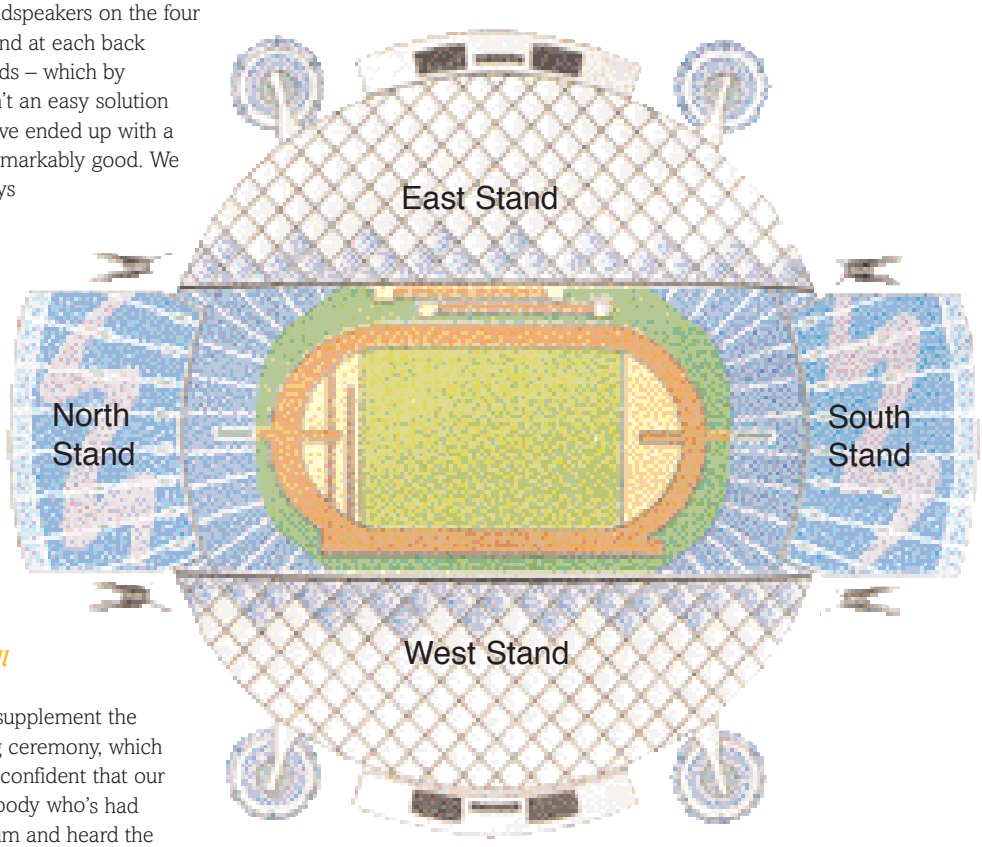
CD: The latest version of Media Matrix has Cobranet as an option. So the actual Media Matrix box itself has a number of RJ45 connectors on the back and not the traditional BOB (breakout box) interface. Then Peavey has their Cobranet to Audio box, which they call CAB, which we use to get the inputs into the system and the outputs to the analogue amps. As well as that we go directly to the back-of-house amplifiers with a Cobranet interface in the actual amp we were talking about earlier. This modification is basically a daughterboard for the Crown USP module. It's fair to say that these amps here are the first in the world to have direct Cobranet interfacing, the only ones at this stage…

CH: Can you tell me about any innovative solutions you had to make with the installation of the cabinets into the stadium, or did the architecture and construction make life easy for you?

CD: There are certainly some innovative solutions in the coverage of the end zones. The East and West Stands were easier, they have roofs with leading edges which are basically above the front row of seats, and as such were a perfect location to put loudspeakers in those stands. The roof concaves upwards, which means that those speakers which are on the leading edge can't 'see' the back rows of seats, so there's a supplementary row of delay

speakers half way up the roof. But primarily the East and West Stands were good spaces to work with. The end zones, however, are temporary structures without roofs and caused us a few headaches. We were instructed that there should be no obstruction in front of those stands which put an end to our initial proposal of stringing a catenary cable in front of each stand and having a centrally located point source of speakers – which sonically would have been a superb solution.

So after evaluating and modelling many options, we put the loudspeakers on the four lighting towers that stand at each back corner of the two stands – which by anyone's analysis wasn't an easy solution to implement. But, we've ended up with a solution that sounds remarkably good. We use beam steered arrays of low frequency cabs, which keeps the low energy where we want it, and propagating down onto the people and not washing across them, so to speak. The mid/high cabs are in the same pattern. It's a weird looking array of loudspeakers.



CH: So how do you think the Olympic opening ceremony will sound?

CD: They're going to supplement the system for the opening ceremony, which is appropriate, but I'm confident that our part will perform. Anybody who's had cause to use the stadium and heard the system before and during an event, have all been very happy. The sound guys from the Denver Broncos when they were in town couldn't believe the quality of the sound. We are confident that what's here is as good as anything in the world.