

# Lighting & Sound INTERNATIONAL

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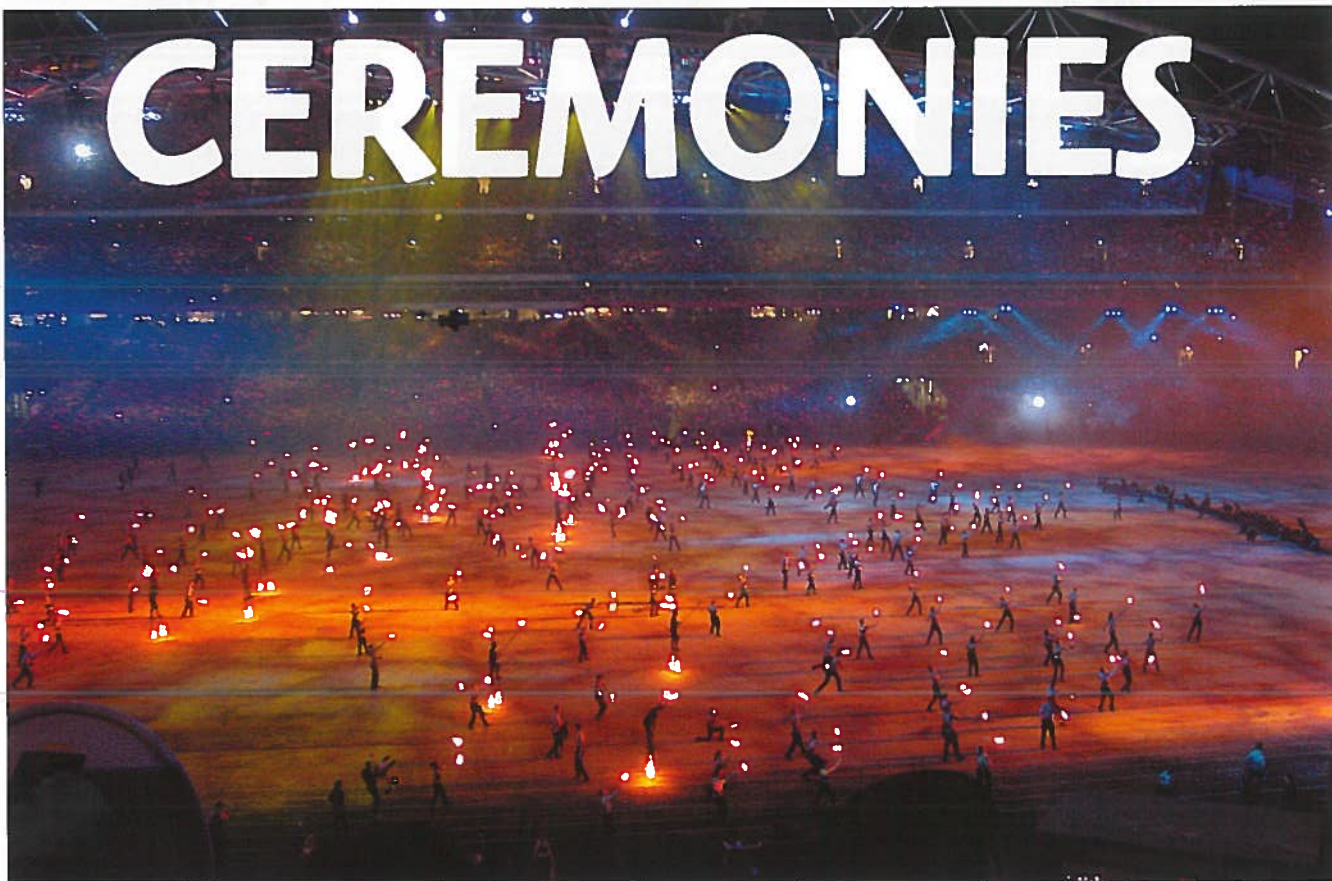
## AES 2000

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# CEREMONIES



**W**hatever else you may have to say about



the opening ceremony of the XVIIth Olympiad in Sydney, you have to admit it was big, bold, and well-crafted. While your personal preferences may not run to hundreds of building workers tap-dancing on checker-plate, bush rangers with pyrotechnic muskets, or ballet performed by an assortment of giant glowing sea creatures, there was little evidence of the show being constrained by the production facilities of an athletics stadium.

The opening ceremony saw a cast of 13,500 people and 120 horses performing on a painted floor cloth which covered the entire field of play - some 20,000sq.m (five acres). While around 110,000 punters saw it live in the stadium, an estimated 3.5 billion more watched the ceremony on television - a big house for a one night stand that took four years to produce. Never before in Australia has such a large production organisation been assembled. Special dispensation had to be sought from the extraordinarily tight (paranoid?) Olympic security administration in order to avert the confiscation of the hundreds of Leatherman multitools being worn by the crews!

## LIGHTING

Early in the planning stages for the Sydney Olympics, Ric Birch, director of ceremonies, took the controversial decision to stage the ceremonies in darkness, to enable a theatrical level of control over the look and the

*Andy Ciddor joins the technical crews for the spectacular Opening and Closing Ceremonies at the recent Sydney Olympics*

atmosphere. This was the first, and quite possibly only, time that an Olympics opening ceremony has been performed after sunset. (US television network NBC had originally requested that the ceremony be held at 10am Sydney time, to coincide with evening peak viewing time on the US East Coast.) The upshot of Birch's decision was that between the stage lighting design and the audience and architectural lighting for television, the rig became the largest lighting system ever assembled.

Although the majority of the audience would watch via television, Birch elected to employ a theatre lighting designer because he considered the ceremonies to be large stage shows. Freelance designer John Rayment (see Profile this issue) was engaged around 18 months before the Olympics, to design the opening and closing of both the Olympic and the Paralympic games. Rayment is known for his many years as resident lighting designer for the Sydney Dance Company and freelance designs for such companies as the Australian Ballet, Sydney Theatre Company and the Australian Opera.

Rohan Thornton, one of Australia's most experienced live television lighting directors, was brought in to the Ceremonies team in early

2000. His role was as a liaison with the television production team, and to provide the ambience for the television broadcast, by lighting the audience, the stadium, and the surrounding precinct. Once the TV cameras were in the venue for rehearsals, Thornton's duties expanded to include the unenviable task of mediating between the broadcast engineers' desire for more light and less contrast, and Rayment's theatrical atmospherics.

As the complexity of the plot became clear during rehearsals at the disused Schofields aerodrome, another freelance lighting designer, Trudy Dalglish, was co-opted to the team, to plot and call the cues for the 26 followspots (these were 18 2k and eight 4k Lycian Xenons). The 30 spot operators would gather before dark each evening for a briefing from Dalglish, before dispersing to their eyries in the distant corners of the stadium.

Prior to commencing the lighting design, Rayment went to Europe and the USA to talk with equipment manufacturers and suppliers, to ascertain what was available and what might become available for the Olympics. He was specifically looking for a high-output, narrow-angle robotic spot, to deal with the long throws in the stadium. High End Systems offered to produce a higher output version of their Cyberlight for the project, and thus the Cyberlight Turbo was born: 300 of them featured as the main robotic spots in Rayment's final design. Rayment then drew up a lighting plan and equipment specification to be put up for public tender.

The contract to supply, install and operate the lighting rig went





Right, the Turbo version of High End's Cyberlight, 300 of which were in the spec

Centre, one of the seven Wholehog desks deployed across the stadium

Bottom, audio director Bruce Jackson front-of-house



to Bytecraft, an Australian company well known in Europe and Asia as a developer and manufacturer of lighting control and scenery automation systems. The company had previously been consultants to the producers, from as far back as the design phase of the Olympic stadium, to ensure that adequate power, cabling, suspension and communications infrastructure would be available for the ceremonies. Bytecraft had recognised from the outset that it was unlikely to be able to source the entire rig either from its own constantly working production stock. Stephen Found, lighting producer for the Olympic ceremonies, and one of the founders of Bytecraft, brokered an international network of partnerships to provide the equipment and support necessary to implement Rayment and Thornton's designs.

This consisted of Bytecraft who provided the system and network design, installation, co-ordination, management, crewing, operation and maintenance. They also supplied the dimmers, some of the conventional luminaires and some of the power cabling and distribution. Procon Multimedia of Germany supplied the majority of luminaires, dousers, colour scrollers, truss, chain motors, the majority of the power distribution, DMX distribution, power and DMX cabling, and associated infrastructure. Strand Lighting in the UK provided 550i consoles and the Shownet DMX data distribution system. High End Systems of Austin, Texas, developed the Cyberlight Turbo and also provided the Wholehog consoles, operator training, and two of the operators. The UK's Light & Sound Design (now LSD/Fourth Phase) supplied consultancy services, whilst CAST Lighting of Canada provided WYSIWYG visualisation software and one of the Wholehog operators.

The lighting rig consisted of 1,628 luminaires consuming around 3.3 Megawatts of power. There were 658 conventional luminaires including 112 ACLs, 100 4kW HMI Pars with dousers (60 also fitted with colour scrollers),

60 Par 64s, 48 four-way groundrow floods, 92 KinoFlo tubes and 36 eight-light minibrutes. Robotic instruments included 300 HES Cyberlight Turbos, 40 HES Cyberlights, 136 HES Studio Beam PCs, 132 HES Studio Colors, 84 CityColors and 16 CityBeams from Italian manufacturer Studio Due, 48 7k Space Cannon Ireos Pros and 28 2k Space Canon Easy 2000s.

Controlling these 14,208 channels across 35 universes of DMX, necessitated seven

Wholehog 2 desks (plus seven back-ups) for the stage and arena, a 3,000-channel Strand 550i (plus tracking back-up) for audience

lighting, and another Wholehog 2 (plus back-up) for searchlights on the roof and exterior of the stadium. With extremely limited time scheduled to be available in the stadium for plotting, the seven mainstage Wholehogs were set up in a room off-site, with a network of WYSIWYG computers.

This allowed the board operators to familiarise themselves with the design, and Rayment to pre-plot the palettes, and even some of the states, that would be refined at the stadium once the rig was in the air. The WYSIWYG software was configured to let each operator look at their own output, that of any other console, or the composite result of the 12,000-odd control channels in that system.

All DMX data was distributed over a Strand Lighting Shownet which enables up to 36 streams of DMX to be moved over a 10Mbps Ethernet network. As almost all trunk runs within the stadium exceeded the 100m limit of Ethernet over Category 5 data

cable, data was transmitted via optical fibres which had been installed in the stadium on Bytecraft's advice. Network manager Murray Taylor deployed 25 Strand SN103 4-stream DMX input/output nodes. In the control area there were nine SN103s configured for DMX input, and in locations throughout the stadium, from behind the stage, to the gantries under the roof truss, 16 SN103s were configured as DMX outputs.

The fit-up was conducted over a period of six weeks, with schedules having to fit around rugby matches and other events in the stadium,

until the venue was finally handed over to Olympic Coordination Authority a mere two weeks from the opening ceremony. Lighting technical manager Paul Rigby and crew supervisor Niki Koumos split the venue and the 60-strong rigging crew, into four zones, each with its own crew under a crew chief. In order to give approximately balanced loads to the crews, the North section included the stage, the torrent and the (now infamous) cauldron. The South sector included all of the audience lighting for the television coverage, whilst the East and West sectors each consisted of a series of trusses, along virtually the full length of the arena.

If numbers like nine console operators, 106 lighting crew, 4,500amps per phase of mains, 57 mains feeds into 207 distribution boards, or 3,615 power and 2,519 DMX cables, don't quite give you a feel for the scale of the rig,

think about this one: it took just over two hours for the show crew to power up the rig for each run.

#### PROJECTION

Amongst the more striking images from the Opening ceremony, are

those of an inconceivably-large white flag, being passed down, hand to hand, from the top of the southern stand, onto the field of play. There it was held aloft by all of the athletes and officials participating in the Olympics. As the flag moved down towards the arena, images of athletes were projected on to it from four 7kW Xenon ETC PIGI scrolling image projectors on the roof of the eastern stand. When the flag was in position on the field of play, an image of the white dove of peace (mandatory for an Olympic opening ceremony) filled the flag. This image, and that of the Olympic rings, which appeared a few minutes later, were projected from another six 7kW PIGI projectors, located in the east and west roof gantries, on either side of the field of play. The projectors, control systems, and all image preparation were supplied by a Sydney-based company, The Electric Canvas.

All four projectors throwing the images of athletes, projected the same keystone-adjusted image, overlaid to produce sufficient intensity for the television cameras. They were synchronised via a local RS422 network by a single operator with a notebook computer. The six projectors on the gantries each projected a separate keystone-adjusted section of the final image, with sufficient overlap for an apparently seamless join. They were computer synchronised on their own RS442 network, which utilised spare optical fibres, originally installed for the sound and lighting networks, to carry the data the several hundred metres between gantries. Focus alignment on the flag was extremely difficult, due to the absence







Left and inset, scenes from the closing ceremony. Bottom, the complex audio patch set-up in one of the control rooms



from the rehearsals of the 10,000 flag-holding athletes. The Electric Canvas crew overcame this problem with a golf buggy equipped with a 1.2m x 2.4m sheet of plywood, mounted at flag height. By carefully driving the buggy along the image overlap points, the positioning and focusing of the projectors could be slowly completed, in between the plotting of lighting cues.

For the closing ceremony, The Electric Canvas projected a wide range of images onto the 10 visible, pentagonal faces of a dodecahedron, a task involving extremely critical projector location, alignment, image manipulation and masking. The alignment was performed by placing a white, masked-out sheet, in the gate of each projector while it was still switched off. The image of the dodecahedron was then aligned with the mask, in effect, using the projector as a plate camera.

#### AERIAL EFFECTS

The Olympic stadium, as with most arenas, is singularly lacking in flying facilities, a fact that Ric Birch did not allow to deter the creative teams. In particular, director/choreographer Meryl Tankard and designer Dan Potra used flying to great effect in the Deep Sea Dreaming sequence, where illuminated sea creatures of all sorts appeared to fill the entire volume of the stadium. Aerial effects manager Richard Hartman, with his team of riggers, engineers and technicians, started in April 2000, with a single proof-of-concept line spanning the arena, between the roof trusses. As these trusses had been designed to carry a vertical load, considerable testing and measurement work was carried out by engineering consultants Sinclair Knight Merz, to establish permissible horizontal loads for a flying system.



The production system consisted of 10 catenary wires suspended east to west across the arena. Nine of these lines were fitted with two winches, lift and traverse, to provide both vertical and horizontal movement for a single pick-up. These were used for the majority of flying effects for the Hero Girl, the sea creatures, and the flaming Ned Kellys. The tenth line was fitted with nine pick-ups on a single winch to carry the Wandjina backcloth in the Awakening segment. The Siemens motor controllers on the winches were driven by a controller from APC Technology in Adelaide.

Extraordinary safety precautions were required to fly performers on this hybrid theatrical, industrial and commercial system. In addition to spotters with E-stops watching each line, there were two independent overtravel cut-off systems and a three metre slow-travel creep zone at the top of the lift lines. Each line also had independent electrical, hydraulic and resistive braking systems. As a final precaution, there

were rescue teams on the roof, on standby to lower in any performer who may have been stuck in the air as a result of a winch malfunction.

#### SOUND

The audio director for the ceremonies was Bruce Jackson, an expatriate Australian. He is regarded as a guru by many in the live sound business for his stadium and arena work with such immortals as Elvis, Bruce Springsteen and Barbara Streisand. Jackson was approached by Ric Birch some two years before the Olympics, and although they had some preliminary discussions, the process began to take shape in June of 1999 at the Olympic Stadium. To assist with the process of selecting an audio

contractor, Jackson and Birch arranged for a shoot-out at the stadium, in which Australia's major sound production companies demonstrated the PA systems that they had to offer. To the surprise of many in the industry, Jackson selected Norwest Productions, not only for the quality of the Eastern Acoustic Works (EAW) system that they presented, but most particularly for their ability to supply the necessary infrastructure to support their system.

Matching the approach that Bytecraft had taken with the lighting system, Jackson sought partnerships to provide two key components for the project: a means of distributing audio signals around a venue as large as the stadium, and a system for the production and replay of the recorded elements of the production.

Jackson was considering using Klotz Digital's VADIS optical fibre-based distribution and processing system, but wanted to test it under live conditions. The opportunity arose on Barbara Streisand's Australian tour in March 2000, when the backing choir was too large to fit into the Sydney Football Stadium for the performance. Jackson placed them in the nearby Sydney Cricket Ground and connected them into the mix via the VADIS. This enabled him to evaluate in the field, the quality and reliability of the fibre optic links.

The 12-card frame VADIS system used for the Olympic Stadium was configured as a variable level cross-point matrix, to route all microphone inputs, replay sends and outputs, between the control rooms, the stage and the various FOH and foldback speaker locations, scattered throughout the venue. Monitor engineer Ian Shapcott was impressed to receive such unusually clean replay feeds that he could push his monitor levels without fear of distortion. An additional card frame was installed in the nearby International Broadcast Centre. This gave broadcast audio producer Colin Stevenson and his team, splits of all signals, including mic inputs and the 12 AES stereo feeds from the hard-disk replays.

Australian digital audio pioneer, Fairlight ESP, was approached to support the Olympics project with a digital recording system. Fairlight not only supplied its new Merlin 48-track hard



disk recording system for recording the music, but also supplied three MFX3+ Workstation/Replay systems, together with Steve Logan as operator and editor. One MFX3+ was used as the main replay source, a second as its mirrored, jam-sync'd back-up, whilst the third was used for wild, spot effects. The effects MFX3+ was also loaded with a full copy of all other material, to act as a second level of back-up for replays.

Full advantage was taken of the capabilities offered by the Fairlight multitrack hard-disk replays. Not only was there a full stereo mix laid down for each segment, but all of the stems and effects for the mix were available on separate tracks. This enabled Jackson to re-balance the mix during production, or if necessary, edit the stems directly. Taking matters a step further, Jackson had Steve Logan on the MF3X+ machines and John Simpson on the back-up Midas Heritage 3000, working as an on-site production studio.

Whilst every live act was fully mic'd, there were also studio recorded versions of each act and all of the theme music for the ceremony. The Aboriginal music was recorded at communities throughout the country, and some rock and techno tracks were recorded at the artists' preferred studios. However, the vast majority of the music was recorded by Studios 301, headed by senior recording engineer Richard Lush. As the replays were to be used for both live and broadcast sound, Lush laid the reverb on to separate tracks, allowing it to be used for rehearsals and broadcast, but not for FOH. All sessions were recorded by Steve Logan on the Fairlight Merlin, with a Fairlight MFX3+ as a back-up.

With most of the performance occurring in the centre of the arena, Jackson chose this as the point of origin for all PA delays. The main stadium FOH sound was provided by 23 pairs of EAW KF 860 (60° x 30°) and EAW KF861 (90° x 30°) tri-amplified virtual line array speakers, powered by Crest 8001 and CA9 amps. To provide coverage for the un-roofed Northern and Southern grandstands, roof trusses at the ends of the East and West stands were rigged with 24 EAW KF750s (35° x 35°) tri-amplified, three-way boxes in four clusters, each two-wide and three-deep. Coverage for the upper ends of the East and West stands was augmented by a further 32 EAW KF750s, flown as 16 clusters, each of two boxes on their sides. The flown KF750s were powered by Crown



*Above, the flamboyance of the closing ceremony*



*Left, the spot crew*

VZ5002 and VZ2402 amplifiers, with Pip II interfaces to the Crown IQ network.

The second ring of delay utilised the existing house system - five Bose 9702s per side, to cover the upper seating banks. A third ring of delay, seven Zeck Vector T3s per side, was rigged in to provide coverage of the very last rows of seats at the tops of the main stands. Due to the shape of the stadium, the location of the seating and the available rigging points to fly boxes, every overhead box had its own delay and EQ settings. Front-of-house was mixed by Steve Law on the main Midas Heritage 3000 /48, with a Mackie CFX20 as a sidecar.

Although the recorded tracks were used during the performance, the Sydney Symphony Orchestra, who were also performing live, were fully mic'd as a further precaution against system failures. The Audio Technica microphones used included 4050s, 4051s, 4047s, 4041s and 3525s. The lectern microphone used for the official speeches was actually a cluster of three miniature Countrymen microphones (two cardioid and one omni). As an additional back-up, the speakers were also wearing radio lapel mics. All radio microphones were Shure Bros U1 bodypacks, with Beta 87 capsules. Peter Twarz, on sabbatical from Australia's Shure distributor, Jands Electronics, looked after the fixed end of all wireless devices, handling mic receivers and in-ear monitor (IEM) transmitters. Doc Wood (an Emergency Room doctor in his spare time) handled the moving end of the wireless devices: the microphone transmitters and the IEM receivers.

Foldback for the thousands of performers and athletes was from 12 EAW KF755 downfill boxes, sitting directly on the ground, behind FOH boxes. Over the five levels of stage there were 20 EAW SM200iH wedges and eight Zeck Vector T3s, many of them either under grilles or set in to the stage structure. Solo performers and the eight conductors were supplied with wireless IEMs, predominantly Shure PSM 600s and PSM 700s, although slightly slimmer Sennheiser IEMs were used to fit under costumes.

## COMMUNICATIONS

On a production with a crew numbering in the thousands and a cast 10 times that size, effective and reliable communications are an absolute minimum requirement.

Acknowledging that experience with communications on this scale is not easy to find, Ric Birch had planned from the outset to hire in one of the most experienced communications management teams in the world. Communications director, Larry Estrin and communications manager, Peter Erskine, have been dealing with very large productions, and Olympic Games in particular, for a long time. The system that they specified was based around a ClearCom Compact 72 Matrix system.

Estrin had originally sought radio spectrum allocations for 16 simplex radio channels and one trunking channel for two-way radio use. However, as the rehearsals progressed, the ceremonies team eventually came to use 700 two-way handsets on 17 simplex and four repeater channels (allocated in the 450MHz military band to avoid possible interference), together with 22 trunking channels.

The wired communication system consisted of 22 matrix stations and 18 distinct talkback loops. Cast calls were vastly simplified when the comms team, "borrowed" the unused mono program feed which is reticulated to virtually every space in the stadium. In many cases it was simply a matter of switching existing speakers over from the stereo to the mono feed. In-ear monitors were amongst the most arduous of the communications responsibilities, simply because of their numbers. Nearly 3,000 FM wireless receivers were used by the cast for either program or cueing feeds. Every horse rider, tap-dancer and dance captain had an IEM. Erskine recalls the day in the rehearsal venue, when IEMs were first issued to the 700 tap-dancers from the Eternity segment. The FM transmitter technician started playing the rehearsal tape through the transmitter to set-up his levels. Eerily, in total silence, 700 enthusiastic young tap dancers began to dance.

