

# Lighting & Sound international

Aug-Sept 2012

entertainment, presentation, installation

plasa media

www.lsonline.co.uk

LSi Exclusive!

## Isles of Wonder

Behind the production of the Opening Ceremony  
of the London 2012 Olympic Games . . .

Also Inside:



**PLASA Highlights**

What you won't want to miss . . .



**Accidental Pioneers**

The Green Hippo speaks!



**TF: Luminaire Focus**

Clay Paky's Alpha Spot QWO 800



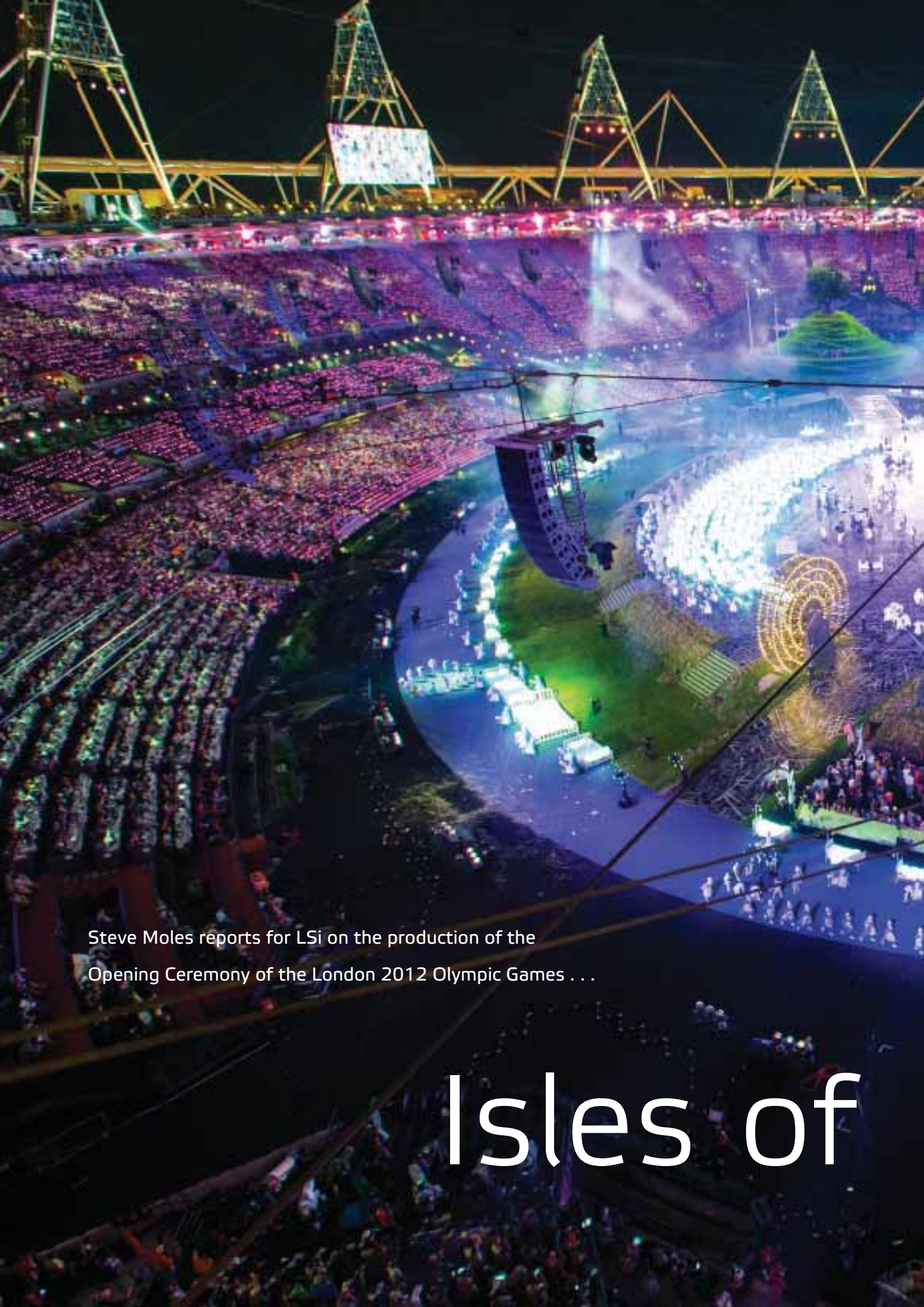
**Minority Report**

South Africa's Industry Women

**PLUS!**

- New Sound for the Olivier Theatre
- Funktion-One at 20
- Coca-Cola Soundscape at the Olympic Park
- One Extraordinary & Unusual Day for the London 2012 Festival
- Interview: Trond Lutdal of Scandinavia's Eastvab
- Theatres Trust Conference 2012
- Blackout in Profile
- NiteLites: True North

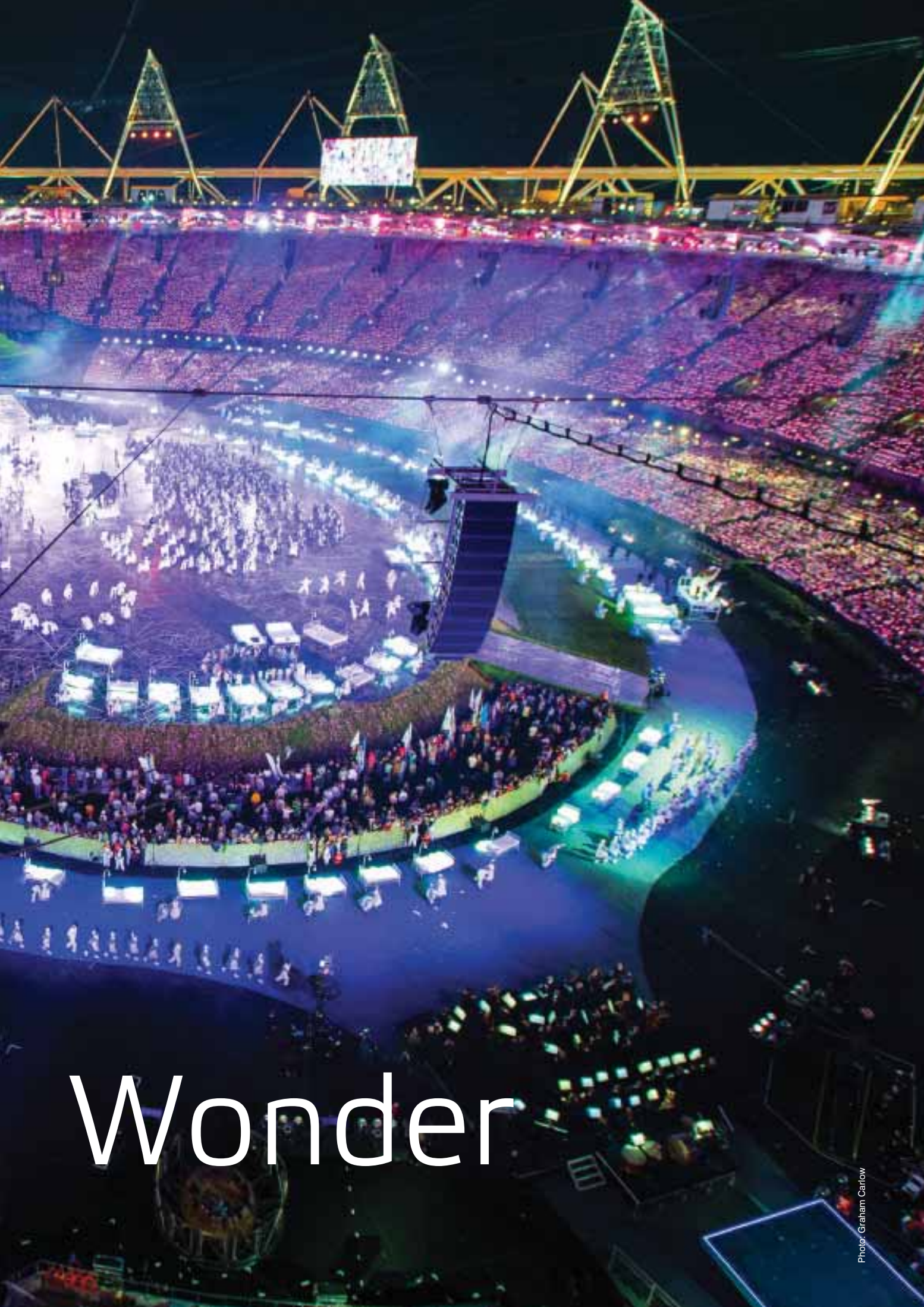




Steve Moles reports for LSi on the production of the  
Opening Ceremony of the London 2012 Olympic Games . . .

# Isles of





# Wonder



Photo: Ian MacNicol/Getty Images



The Opening Ceremony of the London 2012 Olympic Games required the expertise of many people, working in the closest cooperation. The show production elements were many, varied and complex, and despite the high level of experience of many of those involved, the sheer scale of the production meant that, in many cases, they were breaking new ground together.

This was a richly varied piece of entertainment - punctuated by technically brilliant, jaw-dropping set-pieces: the towering chimneys of the Industrial Revolution, the flaming Olympic Rings, the audience turned into an LED screen - and the extreme beauty of the unique Olympic Cauldron.

Perhaps the greatest legacy for the UK's event production industry stems from the unprecedented focus on sustainability and safety, which clearly left a positive impression on all those involved. Led by Piers Shepperd and the technical operations team, this policy has meant that service providers who were already leaders in their respective fields now have an added dimension of experience, and a redefined attitude to safety and sustainability.

These event production specialists have pulled off the biggest show on Earth in the safest and most environmentally sensitive manner yet possible. The bar has been raised and those standards can now be built on by future hosts of major events.

Our thanks are due to London 2012 Ceremonies Technical Director Piers Shepperd, Head of Ceremonies Martin Green and Executive Producer Catherine Ugwu, for their agreement and accommodation in allowing LSi to document the technical aspects of this historic event.

Thanks also to Steve Moles: what follows is his account of the contributions of just some of those responsible. While we could not hope to include every element of this production, and although our allowance does not extend to coverage of the other Ceremonies, we hope we have been able to highlight the Opening Ceremony's most remarkable elements. And we hope that this report - by far the largest ever featured in LSi - will serve as a record of what was achieved by the event production industry for London 2012.

**Lee Baldock - editor, LSi**

## Quick Reference Guide

Introduction	54	Audio & Comms	72
Video	59	Rigging, Staging & Scenic	80
Lighting	66	Special Effects	92

## Words by Steve Moles

**18 May 2012 at 5.00pm: I'm standing in the Olympic Stadium in Stratford, East London, and what do I see? Technical director for the Opening Ceremony, Piers Shepperd, is at the side of the running track stood over two large plan-view drawings of the stadium. He is surrounded by a small crowd of people who, like himself, are all wearing three-point PPE. They have assembled from every corner of the building, the project leaders for all departments - staging, effects, rigging, lighting et al. It's 10 weeks to the Opening Ceremony.**

The meeting, it transpires, is a procedural. Since coming on-site, the Ceremonies team meets every day at this time, and all department heads announce what areas of the building they will be working in the next day and what they will be doing; the actions are graphically marked onto the wipe-clean surfaces of the plans. They also report any safety concerns that have arisen that day - even slight infringements of established rules - and express any predicted safety awareness required the next day.

Since I first began tracking this story I have heard many rumours about safety procedures at the stadium, and not a few grumbings about how petty it all is. That's not what I heard on this day: in fact, it all seemed matter-of-fact and business-like - 'this is what's wrong and it's no big deal to fix it' was the prevailing sense. Yes, there may be the odd malcontent, and frustration is inevitable, but the fact remains - everyone has embraced the discipline, and having now spoken to so many of those involved, I know there's not one who hasn't admitted that their working practice is all the better for it.

Before you embark upon the meat of this article I must make something clear. The scale and scope of the Opening Ceremony alone is so vast it would not be possible to list all those involved: time pressures, manufacturing capacity, specific skill applications, have all forced sub-contracts, and sub-sub-contracts, that have inevitably involved just about every entertainment and production company in the British Isles - and more than a few beyond.

Shepperd cited over 500 companies, from supplier of the real grass on the stage (Filmscapes), to the striker for the bell, a mighty Hammer of Thor contraption (a cooperative effort between Stage Technologies and The Cumbria Clock Company). For the many of you who will be disappointed, apologies: perhaps we can make amends by pointing to the three stage crew companies, without whom none of you would have been able to achieve what you did: Gallowglass, Show Force Services and

Showstars. Well done to all of them and their employees who rarely, if ever, receive a mention.

In terms of content, I will assume everyone watched the Opening on TV and therefore not describe the narrative. Nor do we expect you to plough through the whole of this article; rather you should all pick and choose your areas of interest.

However, there is a common thread throughout focused on a couple of issues common to all contractors and imposed by the ethos applied to London 2012: Sustainability and Health & Safety are embedded.

It was my observation that those involved managed to address the two issues with good grace and if that was coloured initially by scepticism and cynicism, most emerged with something of value that they didn't possess before. Sustainability is an issue that will rumble before us for many decades; more contentious is health & safety. Historically, we as an industry have taken the utmost care of our people, long before legislation appeared, so some might feel burdened by the imposition of rules and regulations - but they all shrugged their shoulders and got on with it.

Whatever the rights and wrongs and whatever the cost, one life saved will always be worth it. The 2012 Opening Ceremony has proved one thing: like the Jubilee celebrations just weeks earlier, the UK is exceptionally gifted in the creative *milieu* and can produce something truly magnificent and of pan-global appeal. We have also assembled a huge mass of people and engaged them to the extreme in the presentation of sensational theatre - and no-one has died in the making. That is a noble achievement, one completed by apparently mundane adherence to bureaucratic regulation. Read through the sections of your particular expertise and you will find some of the 'hows' and 'whys' - which you may be able to apply to your own work.

Finally, I have to take my hat off to Piers Shepperd: in discussing LSI's access to the Opening, he said: "I want you to look at the failures as well as the successes," - and then quoted an example of where an aspiration to utilise decking made from recyclable materials proved a non-starter. "The point is, we've learned some important lessons from the failures: knowing them will enable people to address such issues in different ways next time they arise." Nobility aside, this is what everyone in the entertainment sector needs to hear.

I refer to Shepperd frequently throughout the text; this is often for convenience, I could have used the anonymous 'Ceremonies Technical', but personality drives production. Think of Shepperd as a collective noun for all the Ceremonies team: in particular I would like to single out the following technical managers: Jeremy Lloyd -

**". . . everyone has embraced the discipline, and having now spoken to so many of those involved, I know there's not one who hasn't admitted that their working practice is all the better for it."**

## London 2012 Ceremonies Production Team:

### Technical Executive

Piers Shepperd - Technical Director  
Andrew Morgan - Senior Administrator  
Elena Dogani - Production Coordinator  
Ross Nicholson - Production Assistant

### Aerial & Special Projects

James Lee - Technical Manager, Aerial & Special Projects  
Glenn Bolton - Senior Production Manager, Capital Works & Special Projects  
Luke Mills - Production Manager, Pyro, Flame & SFX  
Edwin Samkin - Deputy Production Manager, Pyro, Flame & SFX  
Sammy Samkin - Production Manager, Fireworks  
Nick Porter - Deputy Production Manager, Aerialist Training  
Paul English - Deputy Production Manager, Show Vehicles  
Anna Cox - Assistant manager, Special Projects  
Emma Neilson - Production Coordinator

### Audio, Comms & Broadcast

Chris Ekers - Senior Production Manager, Audio & Comms  
James Breward - Deputy Production Manager, Comms, CCTV & Mass Cast IEM  
Alison Dale - Deputy Production Manager, Principal Performer IEM & Wireless Mics  
Trevor Beck - Audio Playback  
Richard Sharratt - Audio FOH  
Hannah Charlesworth - Deputy Production Manager, Backline  
Steve Watson - Audio Monitor Engineer  
Steve Williams - Audio Broadcast Systems Engineer  
Andy Rose - Audio Broadcast Sound Supervisor

### Lighting, AV & Power

Nick Jones - Technical Manager, Lighting, AV & Power  
Andy Loveday - Senior Production Manager, Lighting  
Ben Pitts - Production Manager, Lighting Set LX  
Dan Sloane - Production Manager, Video & LED Screens  
Tim Routledge - Senior Lighting Operator  
Andrew Voller - Lighting Operator  
Pryderi Baskerville - Lighting Operator  
Lee Threlfall - Set Lighting Production LX  
Dave Bartlett - Project Manager, Pixels  
Mike Dawes - Deputy Project Manager, Pixels

### Staging & Scenic

Jeremy Lloyd - Technical Design & Staging Manager  
Nigel Mousley - Senior Production Manager  
Steve Richards - Senior Production Manager, FOP  
Chris Clay, Dave Williams - Production Managers  
Kieran McGivern - Deputy Production Manager  
Scott Seaton - Deputy Production Manager, FOP  
Jack Willis - Deputy Production Manager, FOP  
Lianne Bruce - Production Coordinator  
Johanna Eaden - Production Assistant  
Tom White - CAD Manager  
Andrew Bailey, Ben O'Neill, Philip Wilding - CAD Operators  
Moose Curtis, Magnus Harding, Kevin Jones - Staging Crew Chiefs  
Peter English - Head Carpenter  
Dario Fusco, Gibson Arpino, Chris Aram, Jem Nicholson - Carpenters  
Phil Perry - Staging Crew Chief, Rehearsal Venue  
Ray Bogle - Field of Play Crew Chief

continues on p60>

"The biggest thing we did for production was getting all the senior people in early on . . ."

- Piers Shepperd, Technical Director



Photo: Graham Carlow

Technical Design and Staging; James Lee - Aerial & Closing Ceremonies; Nick Jones - Lighting AV & Power; Scott Buchanan - Services and Special Projects; Ted Irwin - Scenery & Props; and Chris Ekers - Senior Production Manager for Audio & Comms.

There is one final, and I believe crucial focus, one which Shepperd was perhaps too modest to mention, but which was stated by Dave Keighley from ELP. He said: "What has been best . . . is the way Piers and the team at L2012C have been honest and up-front. His approach has been transparent - we're all in his confidence. Many of us have worked on big, national projects before, and usually the pervasive air of secrecy leads to a situation where you are only briefed on your own small contribution; the absence of the big picture makes the job more difficult than it should be. Piers and his team led from the front and told us all the full scope: that's great for anticipating and solving problems, but there's something more than that.

"We all know we're working to a common goal, but when you know exactly what that common goal is, it's very motivating. I think that is why everybody has taken the whole issue of sustainability and worked with it instead of against it. Taking all personnel through the SPA Safety Pass Alliance, the Stadium familiarisation session, the Olympic Park induction - and, for many, the Roof induction where we have to learn the latch-way system and develop 'at height' rescue training - that has all been very time-consuming and costly. LOCOG paid for some of that; we as suppliers funded some ourselves. There's no doubt of the benefit to all involved."

Keighley was not alone. I spoke to many who placed great value on being given 'the big picture'.

## Production Notes: Piers Shepperd



Photo: Steve Moles

Piers Shepperd, technical director for the Ceremonies, discusses his approach to the production, the over-riding emphasis on sustainability and safety, and the extraordinary commitment and cohesion that was required from all the contractors involved . . .

### Big Picture Planning

"The biggest thing we did for production was getting all the senior people in early on," Shepperd says. "Even before we had decided the tendering process, we invited all those prepared to bid and asked them for their proposals for infrastructure essentials."

There was obviously a lot of agreement, and certain common ideas were implemented, even if those particular companies either decided in the end not to tender, which some did, or were simply unsuccessful. "A good example is the black steel rail along the front edge of the entire upper grandstand.

A typical position to rig lights or projectors, we had the construction company install this 4" box steel, with standard 2" pipe below for C-hooks, and with a cable tray along the support struts that attach it to the concrete front edge.



INTRODUCING ARCS® WIDE AND ARCS® FOCUS...



TREAT YOURSELF



L-ACOUSTICS WST® technology is now packaged in two enclosures perfectly arrayable into a constant curvature line source with no destructive interference typical of trapezoidal cabinets. Treat yourself to just one pair, first. And as your appetite for coverage grows, you can come back for seconds, thirds, or more, adding slice by slice, until you're sound-full. Serve your audience the legendary L-ACOUSTICS sonic signature and rider friendliness. The icing: the price is tailored to medium-sized productions. They say you can't have your sound budget and your acoustic system, too. We say you can. **Give it a taste at [www.l-acoustics.com](http://www.l-acoustics.com)**

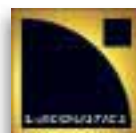


Photo: Steve Moles



Above: 'Landscape video' - Tait Technologies' Pixel Tablet creations turned the audience sections of the stadium into part of the visual backdrop to the event.

"Normally you'd see that rigged as small Trilite-type truss off the grandstand rail, and not look particularly attractive; this, on the other hand, can stay in forever, barely impacts on the construction costs, and will be used again and again when events are stage here. Doing stuff like that is not difficult, you just need thinking and planning ahead."

Technical op's also purchased some small winches, so all lights and heavy equipment are lifted locally into place, not heaved up by stage hands and ropes.

"We also called together all tendering parties about the imperatives of health and safety and sustainability, and asked them how we can help. Yes, I think everyone responded with a groan - but actually they have all risen really well to the challenge and I think learned some useful applications from it."

That statement was vindicated by many - Steve Lutley from Delta was typical: "I've written many risk assessments in my time and going through the rigorous process demanded for this event I realise where I have overlooked things. That's been very positive learning for me."

### Boyle's Broadcast

Shepperd also comments on Danny Boyle's approach to the show: "Because Danny Boyle has the film maker's eye for a picture, it was decided early on that he would produce the broadcast feed for the Opening Ceremony; that in turn led us to take possession of the whole process. Here you

see, two months out from the actual event, we're flying a cameraman off the cable-net system; this is to practice and make sure we have the best position, to provide that dramatic opening shot for the event."

"We've brought in CTVOB to handle the broadcast of the Opening: as I said, it gives Boyle greater control - us too. We also have control of broadcast sound with our own truck." (The Broadcast mix for all Ceremonies is delivered by Delta Media's mobile broadcast unit for worldwide distribution.)

"Decisions on broadcast audio are always late, we've seen this at Doha and the Asian Games - 'you don't need to worry about that' - and then at the last minute they panic, which is expensive. By taking that function in-house it becomes a managed cost and it's done comfortably within the production, because it's planned."

### Node Point Housings

"Normally node points for lighting, sound and video systems are temporarily created in the public spaces beneath grandstands, and isolated by Harris fencing. We've had special rooms built," - often, it must be said, above other facilities such as baby changing stations, so not too accessible - "but we put double doors at the end and fork-lifted all the gear up to them."

I'd be surprised if these rooms are removed; they will make a useful legacy for the stadium, especially for future events. I visited the cast monitor and audio patching facility, where Andy Marsh from Norwest was

installing. What did he think of them? "Bloody good mate!" was the verdict.

"By commencing load-in really early we have a situation where people work 8-hour shifts for three months rather than hectic shifts in the last few weeks," says Shepperd.

### Contractor Flexibility

Six cabinets of L-Acoustics Kudo were rigged off the tension-ring at either end months ahead of the main system going in. "Rather than have to drag them up the Tor, this is easier, and demonstrates something typical of all contractors: Delta saw the concept as making things safer and easier, and so gifted the speakers early. That cooperative 'give and take' comes from involving people in the whole process so they understand the big picture and contribute effectively.

"You see the same thing from Unusual Rigging - they've brought in the hoists for lights and video and rigged them early because they can, and have them available. We actually scheduled PRG to come in half a day behind Unusual and follow them around the stadium; instead we see they're taking advantage and rigging trusses now while they are in the cable-laying stage around the stadium; it takes the pressure off the load-in schedule. We issued the contract to Unusual last July so they had plenty of time to schedule the equipment; that's part of the reason they were confident in putting the motors in early."

### Power Planning

"Aggreko have done a fantastic job," says Shepperd, "the cable runs are a thing of beauty. For routing through the stadium we had Nick Jones working 18 months ahead to negotiate the routes and building adjustments that we would need, and rooms for electronics. Back then we didn't know what would be needed, but made a best guess. We've moved some non-show-critical elements off generated power and used the house supply. Everything in the show matters, but if the paddles, for example, were to fail through electrical problems, it wouldn't stop the show running."

"Power-wise we've made a saving through our managed approach: we initially calculated an 18MW pull, but we have reduced that to 11MW. One of the main reasons is planning: for example, it's easier to have all the cables laid, as we have here, and then have it all running as the production comes in - but that means having all the generators idling most of the time. A scheduled approach allows us for most of the fit-up to run off just one generator."

**"Power-wise we've made a saving through our managed approach: we initially calculated an 18MW pull, but we have reduced that to 11MW."**

- Piers Shepperd, technical director



## Backstage - In-house Wood Shop

"For all that inter alia power, the unexpected bits and bobs that aren't so much part of the show but more the backstage function, such as workshops, we've brought in Pete Wills. Pete English is head carpenter across all four ceremonies, and Terry Hubble is our machinery quartermaster. We have a dedicated wood shop, so when those little things pop up - typically it's for video, a little riser here, or a door there - we do it in-house. Much easier and cheaper than commissioning someone off-site to do it and then go through the rigmarole of bringing it in through the security checks process. Also much faster. We have four full-time carpenters for add-ons: the wood shop is shared as a base for on-site fabrication by Stage One and Show Canada."

## VIDEO

### Tait Tech's 'Landscape Video'

Tait Technologies brings two elements to the Opening ceremony; the application of video pixels across the audience; and the highly theatrical application of LEDs to the NHS sequence. It's worth a look at both, as each has something to offer those creative types hungry for media on which to experiment. And on that score, it is also worth noting that like so many contractors involved in the Ceremonial side of the Games and Paralympics, Tait Tech provides other equally eye-catching devices that unfortunately lay outside the remit of this article.

"The principal item is the Pixel Tablet," began Carol Scott, director of sales and marketing at Tait, "and we also provide the beds and LED duvets and pillows for the NHS scene." All the oversized duvets and pillows for the beds were manufactured by ShowTex, using more than 2500 meters of its flame-retardant Spinnaker fabric - a lightweight, translucent cloth.

Scott continues: "We were first approached by Danny Boyle two years ago: he was investigating different technologies, LED video being one of them. What we've developed with the Pixel Tablet system is what we refer to as 'landscape video': video emerges from its two dimensional world to become three dimensional, and the audience becomes integrated into the show itself. It's designed to work in any venue, so this is very much an item that will become part of our rental portfolio."

Before you even contemplate this as a rental item, it's worth confronting the logistics of this undertaking. "There are 70,500 seats and we provide an LED Tablet for every seat. They're all linked to a central feed via a coiled cable at the seat, down into a branch line that we install along each row. The Tablet head contains nine RGB LED clusters in a 3 x 3 configuration."

The logistical challenges don't end there. "We had just 14 weeks from the signing of the contract to arriving on-site and commencing installation," said Scott. The lead time is typical for a rapidly evolving creative event; the experience was common to many of the contractors on the Opening Ceremony project. Nevertheless, it is remarkable how Tait went from design, through commissioning to delivery in such short order.

"In conjunction with the recently-opened Tait China facility," Scott revealed, "XL Video China was also instrumental in the process - they helped in the sourcing of the plastic Tablets and holders from China."

Tait focussed on cable infrastructure initially, this being the most time-consuming part of the installation, thus giving more time for the development on-site, and the manufacturing of the LED Tablets themselves. "It took me some time to map out the seating for cable runs," explained Tait Tech's project manager on site, Stef Vanbesien. A phlegmatic and doughty Belgian, Vanbesien is one of those guys who is undaunted by considerations of scale and rapidly approaching deadlines.

"I divided the stadium into 56 sections and counted every seat in each block. The rows are irregular. In fact, if memory serves, just two blocks are identical in the whole stadium."



## Get your wings!

MA onPC command wing – the sophisticated yet affordable extension for grandMA2 onPC

- Perfect solution for flexible and mobile programming
- Look and feel as known from grandMA2 consoles
- 2,048 parameters on-board
- Expandable by an MA 2Port Node onPC/onPC PRO
- Light, handy & rock solid: extra small housing and just 6kg
- Plug and play via USB: simply connect to your notebook
- Fully integrated into the grandMA2 system

The brand new MA onPC command wing is the perfect solution if you are working as a lighting professional all over the world, running a small club or theatre, want to join the huge grandMA2 family or simply look for a smart backup or preprogramming solution.

So – get your wings!



Brand new MA onPC command wing – simply connect to your notebook running grandMA2 onPC via USB



Exclusive Distributor for UK and Ireland:

Ambersphere Solutions Ltd  
Tel: +44(0) 20 8992 6369  
info@ambersphere.co.uk • www.ambersphere.co.uk

Photo: Graham Carlow



Photo: Steve Moles

Left: Beds from the NHS sequence.

Above: Tait Technologies' project manager, Stefan Vanbesien.

## Production Team, cont:

Mike Grove - Stage Manager (Main Stage)  
Rasti Bartek, Aran Chadwick, Glyn Trippick  
- Consultant Engineers  
Richard Bentley, John Prentice - CAD Consultants

### Technical Services

Scott Buchanan - Technical Manager,  
Technical Services & Special Projects  
Annette Stock - Production Manager,  
Schedule, Crew & Contractors  
Jess Noakes - Production Coordinator  
Dave Wilkie - Production Manager, Plant & AP  
Matthew Beardsley - Production Coordinator, Crew  
& Logistics  
Terry Hubble - Production Staff Quartermaster  
Laura Lloyd, Grant Peters, Kate Ramsey  
- Production Staff Runners

### Workshop & Props

Ted Irwin - Technical Manager  
Dan Shipton - Production Manager, Props  
Sally Christopher - Production Coordinator, Props  
Pam Nichol - Deputy Production Manager,  
Props/Rehearsals  
Rhiannon Newman-Brown - Production  
Coordinator, Workshop  
Eric Hickmott - Production Manager, Workshop  
Nick Bloom - Deputy Production Manager, Carpentry  
Jo Cole - Deputy Production Manager Props, Crew &  
Volunteer Chief  
Sherri Hazzard - Deputy Workshop Manager, Props  
Sean Flynn - Production Coordinator Props  
Mark Moore - Deputy Production Manager,  
Metal Fabrication  
Will Sumpter - Deputy Workshop Manager, Props  
Steve Dart, John McGarrigle - Props, LX  
John Pratt - Workshop Coordinator / Buyer  
Dave Blacker - Props Coordinator /  
Crew & Volunteer Chief  
Tanya Bond - Props Buyer  
Stephen Jeffrey - Crew & Volunteer Chief  
Sarah Whiting - Workshop Volunteer Coordinator  
Krissy Lee - Technical Assistant

### Internship Placements

Laura Rixon, Chris Tani

"Even for seventy thousand seats it's relatively fast with quite a small team of people. The Tait manufacturing process was managed from my seat-plan, so each week a truck arrives on site with a complete kit of parts - the root-and-branch cable infrastructure, everything needed to mount to seating and rows securely - and the mains, signal and driver hub for each section. The kit contained everything we could do in one week with a team of four Tait technicians and eight stage hands."

By the time cabling was completed, the Tablets arrived, packaged in similar-sized weekly chunks. "With the cabling and drivers already in place we could immediately run signal, so as we went round and installed the Tablets we were simultaneously in system test mode. The whole process was very smooth and efficient."

Vanbesien referred to testing as 'gardening': "We're doing the weeding, pulling out one or two temperamental Tablets." In amongst the bank of approximately 10,000 Tablets I saw when I visited, just one failed. Vanbesien's team completed the installation to fully operational status in just 18 days: that's 370km of mains and data, and 13km of custom-built cable trays - not to mention over 70,000 Tablets and their holders.

It should also be noted that for the Olympics the Tablet system was installed semi-permanently, in that it would reside in the stadium for almost three months and thus required more stringent, durable cable management. System developer and Tait Technologies CEO Frederic Opsomer explained: "The system we have developed is intended for touring. In that respect the cabling, signal and mains distro', and Tablets could be installed to a stadium in a matter of two or three days." Knowing parent company Tait Towers' reputation for packaging complex touring systems, that's an assertion not to be dismissed lightly.

Frederic Opsomer visited the installation mid-June, and I asked him about the sustainability issue and how that integrated into development. He explained: "With the emphasis the Olympics placed upon us, all new products needed to have an afterlife, so we have designed something that can, and will, be used many times. From my perspective, developing a disposable alternative doesn't really make sense; besides the waste, the effort involved is enormous."

And just how did he arrive at the nine-pixel Tablet? "It's a combination of different considerations; physical size of the Tablet, budget, and total pixel amount for the stadium. We defined the pixel distance as 50mm, that's between two pixels on the Tablet. The distance relative between the left edges of two adjacent seats (where the Tablets are mounted) is 500mm. That gives the ratio of empty space to pixels (24 million virtual) and we're left with approximately 600,000 pixels: that's nine pixels per Tablet for just over 70,000 seats."

Vanbesien said the cabling infrastructure is some 370km: what are the implications for signal loss over distance? "The backbone is the Barco FLX system; they provide the DX700 processor, 58 FLX controllers, and 450 FLX hubs. There are some 3,400 converters placed at the end of each row. Data is managed by breaking down into sectors; the sectors are determined by cable run limits. We experimented again and again and found that the maximum limit for data is 60 metres.

"The seating design of the stadium is fortuitous; although the seating blocks are irregular, they are essentially of similar size, as they are in most modern stadiums. We found that if we mounted a central rack directly to the underside of each seating block, as physically close to destination as possible without actually placing it in the seats, then we could reach every seat in the block in under 60 metres. So every sector in the stadium is independently controlled. The Tablets are IP65-rated, as well as being EC and EMC compliant. The EMC testing was long, and the component development that came out of that process took longer than the installation here."



“... with an image 300m wide, a disturbance of, say, half a metre is insignificant, but if that were to occur at every seating block - well, it's not clear how that might look.”

- Frederic Opsomer, Tait Technologies

The Tablets slip-mount to a plastic holder attached to the profile structure at the base of each seat. “We actually developed four different types of temporary holders for the Tablets,” said Scott, “a main fitting for most seats, plus one for the end-on position, which is something specific to the cameras, one for the media tribune, and one for the disabled members of the audience. The plastic is recyclable but we have designed the holder so that the bottom section that attaches to the seat profiles can be detached and replaced with a unit designed to fit any seating profile or mounting bracket, so the unit can work in any environment.”

Justine Catterall, head of audio-visual for L2012C, curated the stunning content, which runs from The Avolites Media/Immersive Ai Infinity Server (see below). “The guys from Immersive did the pixel-mapping,” explained Scott. “Dave Green from Avolites Media used a 3D model of the stadium to define target

coordinates. At this scale and density, each LED is HD mapped; as far as we know this is the most complex video-mapping ever attempted.”

Opsomer singled out Ai Infinity as “one of only two existing systems capable of mapping on such a scale. We chose Ai because of the Avolites connection and the strength and confidence in support that brought with it.”

While perhaps not quite so jaw-dropping, the beds and pillow LED devices had their own challenges - and a rather charming sustainability outcome. “About 300 single and 20 double beds are pushed around in choreographed fashion by NHS volunteers,” explained Scott. “The duvets on the beds have a total of 15km of self-powered LED in them, and the pillows are also LED; the rechargeable battery pack is in the bedframe, though some of the pillows are

independently powered so that kids can pillow-fight with them. Knowing we would have 320 beds at the end of the event, we contacted Charlie Hernandez at the ‘Just a bunch of roadies’ charity and he has placed them with Project Cure: thanks to the generosity of Rock-It Cargo, who provide all transport for free, they're all destined to end up in hospitals in Tunisia.”

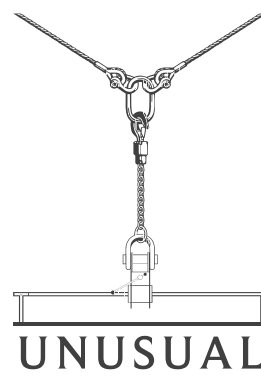
The duvets to some degree, and the pillows certainly, come in for some rough treatment? “The wiring is critical,” said Opsomer, “the LEDs are mounted to a flexible PCB, some 12km of them; such flexible PCBs have existed for about 10 years now. We vary the intensity and colour using pulse width modulation: this reduces power consumption by a factor of about 75% and means that battery life is good, without needing something the size of a family car.”

[www.taittechnologies.com](http://www.taittechnologies.com)

Photo: EYE R8 Productions



Photo: The 5th Estate



From stage engineering and rigging for productions such as *The Phantom of the Opera UK Tour* to developing systems for and ensuring the safety of the performers for *One Extraordinary Day* – our name says it all.

Distributor for  
Liftket :: Prolite :: Doughty :: Kinesys

+44 (0)1604 830083  
sales@unusual.co.uk  
[www.unusual.co.uk](http://www.unusual.co.uk)



Photo: Graham Carlow



## Creative Technology

For Creative Technology, the redoubtable Scott Burges oversaw the Ceremonies installation with Nick Whitehead as project manager. The Opening Ceremony commitment also consumed Anthony 'Bez' Bezancon as project engineer.

Burges began with some perspective of CT's role in the Opening - broadly two parts.

"Danny Boyle has made a couple of films that we'll be showing as part of the opening ceremony. There are four big LED screens up on the stadium roof - that's all Spider 30 - and even now we have all that side of things pretty nailed down," (this was 2 April).

"Hamish Hamilton is in charge of the broadcast mix; downstream from him, Matt Ascombe will feed the LED screen mix when not used as part of the show."

"Then there's the house in the middle. It has only recently become taller and now has a roof; originally we factored in 16 of the new Panasonic PT-DZ21K projectors. When the house was physically enlarged in mid-April we were then obliged to wait for content providers Fifty Nine Productions to complete that redevelopment process in terms of projected image upon the house, to know exactly how many more projectors we would need to cover these new elements."

Fifty Nine were engaged by Boyle for, "their reputation of edginess," said Burges. "The content mapping has inevitably upped the projector count and there are now 17 projectors in portrait orientation on the house, plus three landscapes, and another eight on the stadium roof which also target the house."

There is, of course, the issue of using new technology: an increase from 16 to 28 total projectors might not sound significant, but as Panasonic only commenced production runs of the new projector as it was launched at ISE in January, there was always the fear that they wouldn't be able to deliver these

required quantities. "Thankfully, they stepped up to the plate and we have all that we need," said Burges.

The projectors are mainly mounted to the house bar that has been installed as part of the construction process along the front edge of the balcony, as used by the lighting systems. "This is a useful mount but a vulnerable position, out from the protection of the stadium roof, so we had special weather-proof covers made by Delstar," said Burges.

"That highlights one of the other great features of the new Panasonic projectors: not only do you have a 20kW projector that runs off a 13A plug, they also run significantly cooler than an equivalent Xenon powered projector. That lower heat output means the rain protection can be designed in a lot closer to the machine, just a 200mm gap, and so provide much better protection. You can't guard against horizontal rain unless you're prepared to spend thousands on air-conditioned housing - but practically speaking, this is as good as it gets."

"Because the house is no longer a square, but a T-shape, it necessitated putting projectors on the roof. The big consideration for them is positioning. There's a lot of stuff flown on the Stage One cable-net system that moves and will interfere with the projected image. The roof also flexes by up to 150mm under load; obviously, with the weight of flown objects changing the flex, this will affect focus and target. There's no solution to the factor of roof deflection; the fact remains that when the cable-net system is carrying heavy loads we can expect deflection - but we can still cover what needs to be covered.

"Fifty Nine tweak their content: the trick is to make the coverage more generalised and less critical. For example, don't project a small defined object such as the chimney on the house, instead make it just a part of the overall image. That way it always appears present, if perhaps a little out of

Left: House projections by Creative Technology, projectors by Panasonic.

position: but at the range those seated will view from, it will barely notice."

Back in April, load-in for CT hadn't commenced: when it came, it was surprisingly short. "The main installation work for us didn't begin until 25 May when we installed all the control and replay systems and media servers," says Burges. "The LED and projectors went in around the same time. Cabling-wise there wasn't much advance cabling benefit for our purposes - the mains was laid in to where we needed it ahead of our arrival; we added a bit of local distribution when we brought in our hardware. Signal management was all laid in by us at the same time; our fibre network, double redundant, is simple, quick and easy."

Burges mentioned that the LED screen install was 'nailed down', but of course it wasn't straightforward. "Steve Porter at Unusual determined that because the LED screens sit above much of the various roof cable systems, it had to be part-assembled on platforms built out in the seating; hung in two halves, then completed in mid-air. That's the easy bit from our point of view."

Porter would beg to differ, as you can read elsewhere: this was a very tricky procedure for Unusual riggers and CT techs alike; add in some nice wind and rain to slow things down, and suddenly assembling 150 square metres of nine ton screen 150ft above ground takes on a whole new dimension.

"The control system kept us planning as the needs constantly changed. For example, what Kim Gavin has created for the Closing looks really stunning, but required us to accommodate his needs during the late May load-in. Content-wise, originally we would use 10 Catalysts; the new house roof added to that."

Back in April Burgess was quite concerned, and for reasons outside his control. "It appears Apple are going to stop making the Mac Pro that the Catalysts run on. Now our Cat' count has increased to 10, with 10 back-ups for main projector content, then four more with four back-ups for the Spider screens on the roof."

Did they secure enough Mac Pros? "We now have all the Mac Pros left in the UK. I'm thinking of renting some market stall space outside Stratford Westgate after the games and auction them off," he joked. "The LED takes all the artwork content - that is the *created* content - and they will also show parts of the broadcast, especially the protocol sections. The projectors all work for the show on the field of play."



**"The biggest gain is the new Panasonic projector. We calculated from estimated usage that the savings from using these compared to an equivalent number of Xenon projectors of comparable output is 4.2 tons of carbon dioxide."**

- Scott Burges, Creative Technology

For CT, outside their embedded company policy on recycling, they also had another significant sustainability gain. "The biggest gain is the new Panasonic projector. We calculated from estimated usage that the savings from using these compared to an equivalent number of Xenon projectors of comparable output is 4.2 tons of carbon dioxide. The Panasonic uses 10 Amps; an equivalent 20K projector uses around 20 Amps. The other great thing about the Panasonic is the multiple bulbs instead of a single Xenon source, which means if you lose a bulb, your image just gets fractionally dimmer, you don't lose the whole thing. The Panasonic also has stunning Warping software to line-up the projectors - fast, easy, and very powerful, it made set-up a whole lot faster."

Burges made it all sound everyday, and quite possibly it was compared to what CT was contending with elsewhere in the Park. In fact, the curious thing about interviewing Burges during equipment load in - just as the

Biblical-scale deluge swept Britain and the ladies got their frocks wet at Ascot - was the sanguine nature of his replies. For all the stress in his voice you'd have thought he was supervising the installation of a 50"

Plasma at his local pub.

[www.ctlondon.com](http://www.ctlondon.com)

#### Immersive & Avolites Media

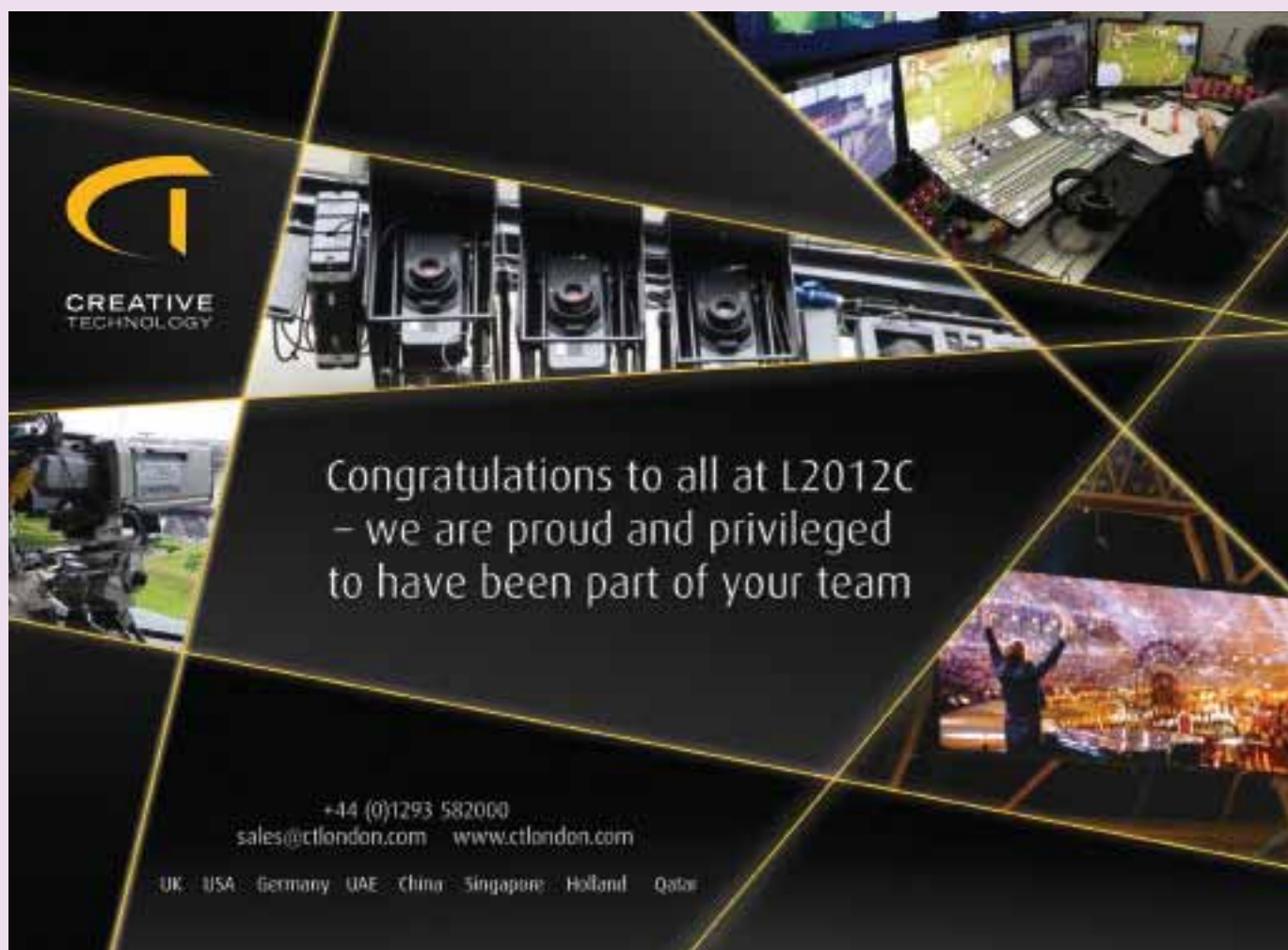
The delineation of roles and responsibilities on this project were clarified by Mark Calvert, MD at Immersive.

"Immersive has been involved in this project for two years. During that time, we sold the intellectual property of the Ai Infinity Server to Avolites Media. Now, Avolites Media build the hardware, including the Sapphire Media Controllers, and sell them to Immersive for distribution. Immersive in turn supplies the systems to Tait Technologies and Creative Technology: this manufacturing is something that is core to Avolites' business and they're very good at it. Immersive remain engaged

to deliver the service side of the 2012 contract - project pre-production, show programming, on-site installation and on-site technical staff throughout the four ceremonies."

It should also be noted that Dave Green now works for Avolites Media as Lead Developer, though he remains a shareholder and is active in the Immersive business on special projects such as 2012. Immersive, meanwhile, is now refocussed onto its core business of designing installations and animation. They remain a distributor for the Ai System.

I asked Green how the landscape video format will work with 70,000 audience members all holding Tait Technologies' Pixel Tablets in their hands? He explains: "The issue is really this, with an image 300m wide, a disturbance of, say, half a metre is insignificant, but if that were to occur at every seating block - well, it's not clear how that might look."

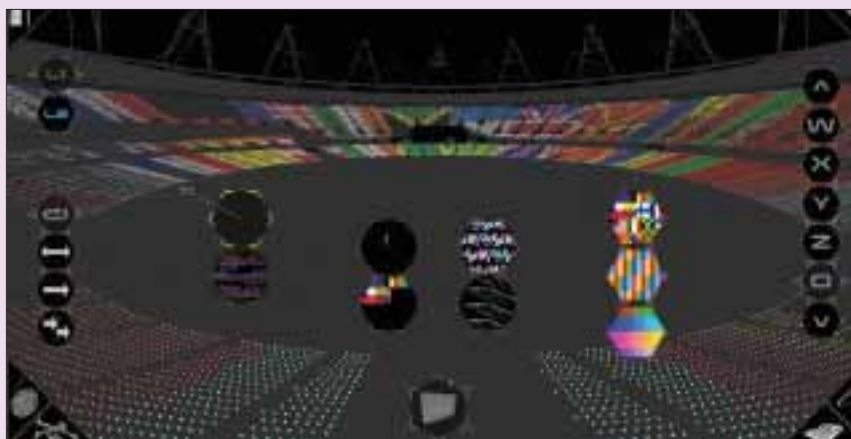


**CREATIVE TECHNOLOGY**

**Congratulations to all at L2012C  
- we are proud and privileged  
to have been part of your team**

+44 (0)1293 582000  
sales@ctlondon.com www.ctlondon.com

UK USA Germany UAE China Singapore Holland Qatar



Screen capture of the Ai Infinity media server control interface (courtesy of Immersive Ltd).

way it's transferred to screen. Taking the means to do that in-house makes for better control and a more coherent approach to the whole thing."

"It's never been done before - by us, or in this way for the Olympics," said Bill Morris, international business director for CTVOB. "That said, we've known and worked with Danny Boyle's nominated director, Hamish Hamilton, for 15 years or so. I think LOCOG's choice to go with this approach is a compliment to Danny."

The logic is compelling, if you accept 'the vision thing' - and Boyle certainly appears to have created and marshalled an inspired vision - then you have to accept that part of that vision is derived from a man with a cinematic perspective: *ergo*, directing the camera's eye view devolves from that vision.

"Danny came up with a wonderful idea, but typically movie-makers are not expert at multi-camera shoots; Hamish has worked on lots of big events and has that expertise, it was he who brought us on board to deliver a high end independent system. Our resources allowed us to build a system bespoke to the creative and artistic elements of the event. What I should make clear is that our remit ends at the artistic element of the opening: the official opening, the athletes' parade and the lighting of the cauldron - although that's still not totally decided - is handled by OBS, the Olympic Broadcast Service, as it is at all Olympic Games. These are different parts of a whole event, so the lines between them are slightly blurred: our Ceremonies system will offer shots to the OBS, for example. Cumulatively, the level of resources in and around the stadium is enormous, many hundreds of cameras, and it's the same with OB trucks."

"CTVOB will bring in 40 cameras and install two full broadcast galleries, one in the north vomitory, the other out in the Ceremonies storage compound immediately outside the stadium." (The second gallery for the inevitable redundancy.) "There is no single point of failure in the system - everything is backed-up somewhere. We have engaged specialist camera operators, HD operators and a fly pack engineering operation as well, all linked to produce an array of output options. OBS will take a definitive cut from us, delivered by diverse routes. A couple of our cameramen will be flown from the cable-net system. There are two hydraulic lift cameras, a couple of aviation cams and a large number of radio cameras as well as cabled cams. The RF cameras are working in a well-packed bandwidth - there are other cameras in the same part of the spectrum, and that bandwidth is surrounded by numerous other users, so we are concerned about interference. Britain has one of the

This is the essential dilemma of the eye/brain mechanism that allows large-scale video to work. As Frederic Opsomer describes elsewhere, the ratio between actual Tait Pixels and virtual pixels (i.e. those created by the eye/brain mechanism) is quite large.

Green continues: "I'm under the impression that every sector has what we can call a seat chaperone - someone to choreograph the audience. Nevertheless, the impact of audience movement upon the resultant image is an unknown. We've had a trial with 200 people in a sector, but that doesn't really tell us what will happen across the whole stadium. With the Tait Pixel Tablets in their holders the rectilinear structure is secure and, I must say, looks absolutely breathtaking. The Ai Server can remap something even of this scale in real-time - at 1920 by 1080 the resolution is not that great - so at whatever the frame rate is, say 60fps, Ai could compensate for audience movement if that degrades the image. Unfortunately, no control system yet exists that can accurately report the coordinates of 76,000 paddles in 3D space."

"We had been thinking about landscape video for some time at a conceptual level; but when we first started talking to Frederic about this project two years ago it was obvious he'd got stuck into the practical dimensions already. While we'd contemplated perhaps an RF system for controlling the audience pixels, he had gone the cable route. It's more laborious but bypasses RF issues.

"We started our mapping process a couple of months out. It takes approximately two weeks' constant work, but spreading this way makes it more bearable and allows other projects to run simultaneously. We can actually map pretty accurately: we know where the Tablets will physically be positioned in their wands. The projected image is two-dimensional but we do wrap to the 3D of the stadium to decide how that image is placed. Although when you get down to seat detail architects' drawings aren't always accurate to what the builders put in, we did allow another two weeks, once the Tait system was fully installed, to make adjustments. We map to an accuracy of

1cm, and human visual tolerance across an image 300m wide is approaching 20cm."

"In essence, Crystal CG produce the opening ceremony video content under the direction of the ceremonies team, who then hand it over to Immersive for loading into Ai. Above Crystal sits Fifty Nine Productions to provide the conceptual direction. Having mapped the stadium, we give all those involved in the creative process a CSV file with the exact pixel locations. That allows them to understand the destination image and get a feel for the stadium. The 3D Live visualiser in the Ai software means they can see, in pre-production, how any given moving image works. That's a very big consideration when you're sat in a studio somewhere working on a 17" monitor: producing a running man, for example, might look good on that screen, but that's no good if when you transpose it to the stadium system he runs around the whole surface in one or two seconds - the image would be unreadable."

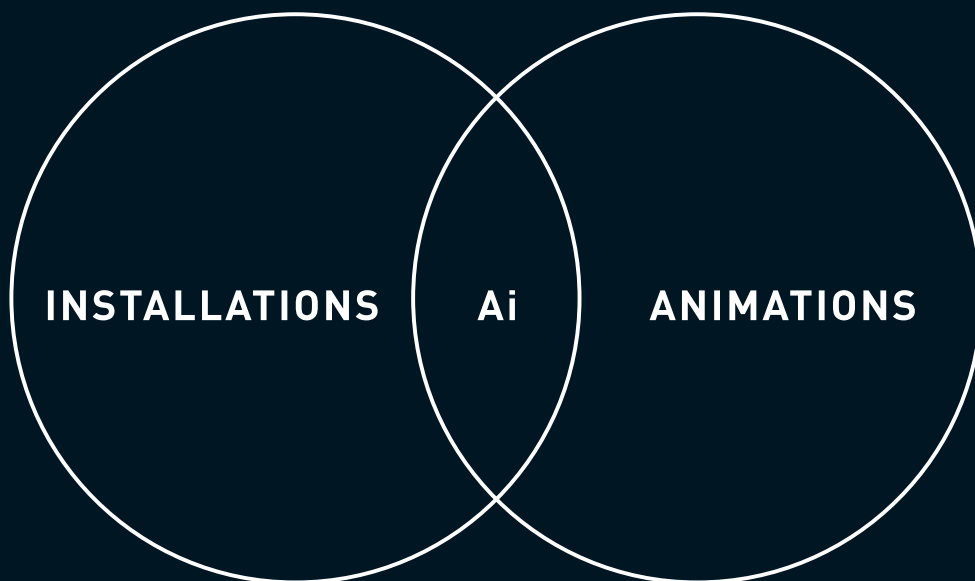
"Just one Ai Infinity, with back-up, delivers the mapping that drives the Tait Tablets; the other 28 Ai Servers on site are being used, or as back-up, by Creative Technology variously for the video projectors and content playback onto the stadium LED screens."

Readers should understand that the need for such a quantity of Ai Servers for CT's purposes is not for the Opening Ceremony alone; there is heavy demand downstream in the other Ceremonies. "One of the key features of the Ai, the real-time mapping, was one of the determining factors in us being selected, not least to sustain projection upon the video elements of the closing ceremony and Paralympic ceremonies," says Green. [www.avolitesmedia.com](http://www.avolitesmedia.com) [www.immersive.eu](http://www.immersive.eu)

### Broadcast: CTVOB

Once again, Piers Shepperd drew attention to a peculiar aspect of this particular production. "We have taken the whole aspect of the broadcast of the cultural segments of the Opening in-house: it makes sense for an event conceived by a film director, that he should control the





Stage Design / Installation Design / 3D Animation and Film /  
Production Management / Ai Technicians / Ai distributors

**[www.immersive.eu](http://www.immersive.eu)**

Photo: Graham Carlow



Left: The firework finale over the Olympic Stadium.

Below: The stage build in progress, June 2012.

most limited bands for these camera systems in the world. With our 11 RF cameras and a total 35 in the stadium, it's tight - especially with HD: space is swallowed very quickly."

"In terms of sustainability - I'm the first to admit that we can't do without electricity, but over the last few years we have reduced our power demands through advancing technology. Despite moving to HD, which you might imagine would increase draw, the refinements in technology have reduced power usage. Add in the replacement of CRT monitors with segmented LCD screens and system-to-system our power draw has reduced by approximately 45% in recent years. However, we are making an offset investment, planting a small copse of 50 trees at our home base; and as procedure we have almost totally eliminated PVC from our operation. You may think that's a small gesture, but when you're laying 250km of cable, replacing plastic cable wraps with sisal ties is a big deal.

"The process of adhering to the Ceremonies' sustainability ethos has certainly forged a change in people's awareness: recycling was already in our business plan, but this has made us look at that again and become more committed. Changing habitual forms of working is difficult: this common goal has brought it into focus."

[www.ctvob.co.uk](http://www.ctvob.co.uk)

## LIGHTING

### Patrick Woodroffe: Sustainability in Mind

On a project of this scale, just how does a lighting designer square the circle of designing for spectacle while addressing the issue of sustainability?

Patrick Woodroffe says: "In the end, we have to conform to certain fixed criteria. You do have to light the entrance of the athletes, the arrival of the heads of state and all the other 'protocol' moments to a particular lux level; there are only so many ways you can achieve that. We've minimised our use of incandescent lamps - it's mainly high output moving lights - and we've used LED wherever we can.

"The fact remains, you do need the big lamps - but having said that, we're using far fewer fixtures than we might have done - certainly a lot fewer than were used in Beijing [5,000] - but the lights we have selected are the best in the world. Choice of instruments is a key factor. In terms of attitude and commitment, we're all party to it," he says, referring to the safety and sustainability issues. "Sometimes it seems unnecessarily bureaucratic, but there's nothing that has passed that hasn't been without some benefit - and where we've had a choice to err on the side of caution, we've done so."

"The lighting design was approached in two distinct sections; there is what we refer to as a generic system; this system does the lion's share of the work and is common to all four events," - these being the Openings and Closings of both the Games and the Paralympics. "Then there are the specials: each show has its own particular elements that require additional or different lighting. And, of course, things get added, even at the eleventh hour - a back-drop here, or whatever.

"With the Specials and add-ons, we do get the chance to choose how we respond - so, for example, if the lighting of a particular piece of scenery or special effect can be achieved using, say, a huge bank of Molefays with colour changers, or VL3500s, then we'll take the 3500s - a more sophisticated light, equal or better impact, and much less power. These decisions don't come about simply because we have a finite budget, but you can't start adding generators at this stage, so power consumption dictates the more sustainable route.

"Both PRG and ELP have been very good to us in that they have left in a lot of lighting that was only originally spec'd for the Opening Ceremony and allowed us to use it for the shows that follow. And they've been generous with support and generous with manpower."

"Our approach to the whole project is based on the four shows. The main opening is a real piece of theatre - very dramatic with actors and performers; I believe what Danny Boyle has done here has never been done before with an Olympics opening, in that much of what the audience sees is akin to watching a film. I suggested to him that we would light his show as you might light a movie for the cameras, with the big difference being that, rather than being just out of shot, our lights would always be visible and be part of the whole composition."

"The closing, by Kim Gavin is much more like a big rock-and-roll circus. This is where we will show off the system, and the lighting and effects will be very present. That's also true of the opening for the Paras, though that show is more considered and intellectual than the Olympics Closing."

"And, finally, the closing Paralympics ceremony is more in the vein of Mad Max with music composed by Coldplay; the drama will unfold in an almost anarchistic fashion - unrestrained and chaotic!"

So our lighting has to serve all four of these masters. To do that you really need the best

Photo: Steve Moles







# DIGICO

# UK Sales Network

Vision, expertise and understanding from the best in the UK



Unit 3, Pitkerro Park,  
West Pitkerro Industrial Estate,  
Dundee, DD5 3RU  
Phone: 01382 818513  
Email: [enquiries@apexacoustics.com](mailto:enquiries@apexacoustics.com)



**DIGICO**  
Manufacturing  
Made in the UK



Unit 101, Phoenix Close Ind. Estate  
Phoenix Close, Heywood, OL10 2JG  
Phone: 01706 363400  
Email: [sales@wigwam.co.uk](mailto:sales@wigwam.co.uk)  
[www.wigwam.co.uk](http://www.wigwam.co.uk)



Third Way, Avonmouth,  
Bristol, BS11 9YL  
Phone: 0844 870 0077  
Email: [sales@stage-electrics.co.uk](mailto:sales@stage-electrics.co.uk)  
[www.stage-electrics.co.uk](http://www.stage-electrics.co.uk)



Burnt Meadow House,  
North Moons Moat,  
Redditch, B98 9PA  
Phone: 01527 528822  
Email: [sales@sseaudio.com](mailto:sales@sseaudio.com)  
[www.sseaudiogroup.com](http://www.sseaudiogroup.com)



Unit 6, Bush Industrial Estate,  
Station Road, London, N19 5UN  
Phone: 020 7281 7574  
Email: [sales@autograph.co.uk](mailto:sales@autograph.co.uk)  
[www.autograph.co.uk](http://www.autograph.co.uk)

**Greater London**

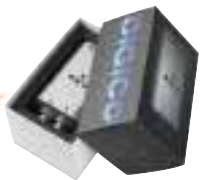


Broadcast Specialist  
73-75 Scrubs Lane,  
London, NW10 6QU  
Phone: 020 8962 5000  
Email: [digico@hhb.co.uk](mailto:digico@hhb.co.uk)  
Web: [www.hhb.co.uk](http://www.hhb.co.uk)



**Head Office**  
Unit 10, Silverglade Business Park,  
Leatherhead Road,  
Chessington, Surrey, KT9 2QL  
Phone: 01372 845600  
[www.digico.biz](http://www.digico.biz)

**ib**  
2012



### WIN A CLEVER UB MADI AT IBC

We're giving away four clever UB MADIs at IBC (one each on the first four days). UB MADI offers 48 channels of MADI to USB2 for MAC or PC and is compatible with almost any DAW. Just drop by our stand before 4pm each day for a chance to win.

**7th - 11th SEPTEMBER 2012**  
**Hall 8. Stand B16**



# DIGICO

[www.digico.biz](http://www.digico.biz)

Photos: Steve Moles



Above, left to right (and facing page):

PRG lighting crew chief Rich Gorrod (right) with Mark England.

One of the Clay Paky Sharpys in the Robe LightDomes which topped the stadium floodlight 'paddles'.

Two views of the steel lighting rail with cable tray installed along the upper grandstand front.

instruments - lights with beautiful shuttering and framing capabilities; lights with the ability to enhance the beauty of the show and, at the same time, address those protocol moments and ensure they are evenly lit."

Challenges? "For both the Opening Ceremonies we have all the time in the world to develop and programme the shows, but the Closings will be a real challenge. We come in at midnight and then must be ready for a soundcheck by 2.00pm, just 14 hours later; that will be hairy. But with the time advantage at the Opening we will have used that time and learned a lot, and if we see the need we can at least sneak in a couple of nights in that first six weeks to have a quick look at the other three shows and so stay ahead of the game."

Woodroffe, ever the diplomat, shared the credits. "In the early stages of the design process, as I was finding my feet, I discreetly got in touch with Bob Dickinson who lit Atlanta, Athens and Vancouver. There are very few people who do this sort of thing and he has been very gracious with advice and direction. I also asked Al Gurdon if he would join our team as a consultant to help with the TV broadcast aspect. He's one of the very best there is and understands both lighting and camera so well. He has a great eye but he also understands the technicalities of the craft - for example, what is required as the show progresses and we transit from daylight to darkness."

Woodroffe's programming team is a mixed bag in terms of skills - a reflection of the unusual demands of the project? "Exactly so. Tim Routledge I've been working with for several years. He designed the control system and it's he who fits it all together. He also has the rock-and-roll perspective of large events. That skill sits very comfortably with our other programmers - Andy Voller, who is there for his theatrical experience, which is ideal for the strong dramatic content present in all the shows. And then Pryd Baskerville for all the weird bits and pieces. They spend a week in Wysiwyg setting out all the fundamentals, group selects, and

"... we have used a lot of LED wherever possible - we have some 400 GLP units, for example - and we also have lots of Clay Paky Sharpys: both are very efficient... But then there are things that, at present, have no alternative..."

- Rich Gorrod, PRG

probably establish rough focusses. When you have 350 VL3500 Wash, they take some time to focus - roughing them in ahead of time will be a big help. Then we're on-site for a week from 26 June programming, then rehearsing up to the night."

Last but not least: Woodroffe's associate lighting designer Adam Bassett is a key part of the design team - both creatively and logistically, along with other long-time members of Woodroffe's team, lighting directors, Miriam Evans and Terry Cook.

**Rich Gorrod, PRG Lighting crew chief**  
I spoke to Richard Gorrod, PRG's Head of Event Services and project manager for the Opening Ceremony, several times before and during fit-up. Even as load-in commenced, the scope of his terrain was still expanding.

As lighting designer Patrick Woodroffe points out elsewhere, what could be got in during this long and protracted first fit-up needed to embrace, wherever possible, the needs of the other ceremonies. So Gorrod was mastering one giant system in two main elements - that for the show, and that for the 'protocol' moments (the athletes' parade, for example) - and then adding in the augmented system requirements for the three other ceremonies: there simply wouldn't be time later. Despite all this, Gorrod was never less than courteous, and generally always chirpy: he's not the most sought-after lighting crew chief for nothing.

Gorrod says: "We tested our control set-up off-site at PRG East Molesey, where we set up the complete system, multiple desks [the show used two VL676 and a GrandMA2, plus spares for each], dimmers, and two thousand feet of fibre network. That was reassuring for the operators Tim Routledge, Andy Voller, the main programmers, and Pryd Baskerville who programmes the weird bits and pieces. The operators had two weeks' Wysiwyg programming at Molesey."

Of the load-in schedule, he says: "First we did a small lay-in of cable (16 April) that was buried by the set on the field; then main cable laying began on 21 May and the lights start getting hung on 3 June. We've left the lights till last so the rental impact is left off the budget as long as possible: when you've got 450 VLs hanging off the balcony rail, it soon mounts up."

I asked him if the sustainability issues had affected the way he'd approached this project? He said: "It has and it hasn't. There are inevitably the compromises forced between system and budget - we have used a lot of LED wherever possible - we have some 400 GLP units, for example - and we also have lots of Clay Paky Sharpys [these using 189W Platinum 5R discharge lamps]: both are very efficient in terms of energy consumed. But then there are things that, at present, have no alternative - for example, there are 450 bars of ACLs and some 800 1200W moving heads."



What about the general principal unearthed by L2012C during the long planning phase last year - the idea of staggering lamp ignition to spread the heavy firing load? "In fact it's something we've been doing with big systems for some time. To some extent, a group of lamps does that automatically; they all fire within a couple of seconds, but not all at the same time. With a big installation like this we break it down into sections, so if you've got 400 lamps you'll bring them online in sections of maybe 100 at a time.

"Of greater concern is the huge amount of mains cable: because of the stadium design the generators are miles away. Yesterday [18 May] I was looking at maybe 100 drums of mains, each 250 metres of 240sq.mm Powerlock cable; there's a team of some 20-30 guys just pulling power cable. The voltage drop over long runs is not a major concern for the equipment - we've just done a big job in Mexico where we had lamps down a road a mile long; the most remote were getting 180V and the spec' says they will tolerate as low as 160V."

"In terms of scheduling we go in a couple of weeks early, just to lay in our cables and dimmers ahead of fitting lamps. The basic premise is that if something should take a day to do, then we allow two days. And, in terms of workload, people on site do not work more than a maximum 11 hours in one stint, generally less. It takes about 45



Photo: Steve Moles

minutes to get on site: it's rather like checking in for a flight at a busy airport. After that, you're on a bus to the stadium where you have to change from Stadium Pass to Load-In Pass to commence work. The health and safety on site is well implemented: some may find it onerous, but there's nothing that can't be worked with."

"The Stadium design leaves a bit to be desired," Gorrod adds: "Apart from the remote position of the generators there are issues concerning staging special events - it's not as if they didn't know there would be a huge, spectacular Opening Ceremony. There is a lot done well, but there are things

that - had a few people from the production industry been consulted by the lead architects right at the beginning - could have been done so much better. I expect to see people with drills and pneumatic hammers knocking holes in the walls of 30-year old stadiums to create cable runs, but not in something that's just been built . . . No doubt it's a money issue."

The following month, when the lights were installed, Gorrod told me: "The Bad Boys are mounted on the trusses which hang off the catwalk at the roof perimeter's inner edge. Once up there, the trusses are dead end and the hoists re-used at the other end of the



**AVOLITES**

**TOUCH THE FUTURE**



Photo by Antonio Pagano

Titan Mobile



Sapphire Touch



Tiger Touch



**Ai MEDIA CONTROL**

**DEFINING THE FUTURE**



4K Media Server

**AVOLITES MEDIA**

**plasa2012**  
9 - 12 SEPTEMBER 2012 / EARLS COURT

Find us in Hall 1 stands F18 and G15 + Join the Avo Afterparty 2012, Monday 10th Sept

Avolites Media: T: +44 (0) 208 965 8522  
E: sales@avolitesmedia.com  
W: www.avolitesmedia.com

Avolites Head Office: T: +44 (0) 208 965 8522  
E: avosales@avolites.com  
W: www.avolites.com

Distribution USA: T: (518) 251 3302  
E: sales@creativestagelighting.com  
W: www.creativestagelighting.com

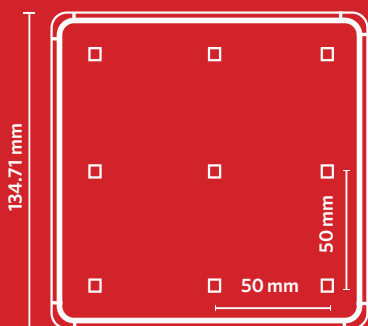
Avolites Media: T: +44 (0) 208 965 8522  
E: sales@avolitesmedia.com  
W: www.avolitesmedia.com

# LANDSCAPE VIDEO

► ENGULF YOUR STADIUM WITH MOVING IMAGES



## THE PIXEL TABLET



► 0.5kg ► RGB ► IP65

Utilizing TAIT's pixel tablet technology, recent ceremonies for world class sporting events have successfully transformed stadiums into three dimensional video screens; incorporating the audience into the screen. Included in TAIT's rental fleet the pixel tablet system can be designed for any size or shape for use both indoors and outdoors.

The units are configurable; to be hand held, inserted in holders for use in any environment or attached to webbing to clad building facades—the possibilities are endless.

The arrival of the pixel tablet system means that video screens are no longer confined to two dimensional environments opening up unlimited opportunities in both live events and architectural settings by creating a blank canvas to enhance event communication.

**TAIT**  
MAKING THE IMPOSSIBLE

+1 717 626 4569 [www.taittechnologies.com](http://www.taittechnologies.com)

► UNITED STATES ► UNITED KINGDOM ► BELGIUM ► CHINA ► JAPAN





Photo: Jamie Squire/Getty Images

The view from above: The stadium roof colour-washed by Philips Arena Vision fixtures with Syncrolite's Arena Colour colour-changers.

stadium. The only way to service them is to harness and drop below the catwalk. The PA pods have the Best Boys - a lighter version with better optics; a pair of VL300s is mounted above."

"The Robe LightDomes are great - they have a 16A supply for the lamp within that switches on only after the dome has inflated; then there's a UPS which keeps the inflation fans running for 15 minutes after the lamps have powered down. There's a single Sharpys at the top of each stadium paddle [floodlight tower] top with a Robe Dome."

"There are 112 joins in the stadium roof fabric, at each join is a short scaffold pipe near the rear of the roof, standing off from back wall by two or three metres. Each pipe has a four-lamp bar of PAR64 ACLs, two GLPs and two Sharpys. They're powered in sets of eight pipes from the dimmers above. I don't think PRG has any more bars of ACLs left in Europe or the UK."

Gorrod manages from the top: "It's just better if one person looks at the whole picture, especially with control infrastructure; then I have people like Mark England and Aidan McCabe to whom I devolve responsibility. It's a proven package - in terms of scale this is no different to Super Bowl or Abu Dhabi."

[www.prg.com](http://www.prg.com)

## ELP & Syncrolite

Although the provision of two pieces of technology amongst the blizzard of kit that is applied to the Opening Ceremony might seem insignificant, the addition of Syncrolites has its own story to tell. Not the

least of which is the rigging thereof, which provides a clear example of what the rigging teams had to contend with.

Dave Keighley from ELP explains: "The main lighting tender was split: schedule B included the Syncrolites and Arena Colours - the roof system. ELP acted as Syncrolite's agent . . . we guided the tender process. We were lucky to win, though we believe the Syncrolite is far and away the best light of this type for the large-scale performance they wish to achieve."

"As a lighting contract, although it was tendered separately, we still work alongside PRG, the main contractor. We're providing 40 Syncrolites and 56 Arena Colours," - essentially a Phillips Arena Vision with Syncrolite colour changer.

There are 14 lighting masts around the stadium: their distinctive triangular structure distances them from the more traditional single-stick mast and gives the stadium a more stylish appearance. The truss-mounted Syncrolites for each mast fit immediately below the paddle of the event floodlighting, with a pod of Arenas attached to the back of each paddle to light the stadium roof for the aerial camera shots; the Syncrolites pick up action on the field.

Keighley says: "We coordinate with Unusual to get the lamps in position: we hang them to truss, which Unusual then lifts into place. It sounds simple but, as with so many things in a complex event, it's not. Last October we looked at each position. The first thing to consider is the cable-net that circles the field-side roof edge: stood off some 30

metres, it's the suspension system for the flown line array PAs. The ring attaches to the tension ring of the roof proper beneath each of the paddles, so for that reason alone the trusses for our equipment have to be raised in two sections, and then assembled in the air above the catenary."

"Then there's the Stage One cable-net system for the effects and scenic elements flown above the field. You get the picture: each tower has its own obstacles and although Steve Porter from URC, who leads the rigging project, has come up with some slick solutions, each is inevitably slow and awkward. For us, the important consideration is the impact this will have on servicing: once the lights are in place they're there for three months. Bulb life is OK, and there's a gap between the Olympics and Paralympics, but if we had to lower in a Syncrolite, you can imagine the difficulties involved. Each lamp weighs 250lb (113kg) - not bad for a 7kW Xenon automated searchlight, but still not a simple operation."

The xenon Syncrolites produce 350,000 lumens: compare that to a PRG BadBoy, currently the most powerful mainstream moving spot light for concert work, at 48,000 lumens - and you get some measure of their capability.

Keighley adds: "The Arena Colours have a Syncrolite colour changer and douser on the front; the lamp itself is a regular 5 degree reflector. The scrolling colour cross-fade effect can also be varied by a diffuser lens that can widen the beam angle. So, in effect, they become an enormous dichro' colour mixing washlight - and a pretty unique one at that."

Photo: Graham Carlow



Above: An ETC Eos triggered video for the Pixel Tablets, the high level screens and the projection onto the house, via the Avolites Media Ai Infinity and Catalyst media servers respectively.

"The Syncro SXL is about as sophisticated as you can get. Compared to the latest LED light it looks a bit agricultural, but there isn't an LED in the world with anything like this intensity: at this range they'll provide a big boost." Olaf 'Pud' Pötcher is the Syncro' veteran; Jonathan Wood has comparable experience with the Arenas.

Conditions will be tough for the equipment: "There are stresses and strains - they're 160ft in the air for months and nothing that moves can be 100% weatherproof. A fifty-mile-an-hour wind will stress the yoke."

"All our guys have to undergo a rope access course to focus the lights, though we calculated that primary focus can be achieved in advance. The Arenas have a quadrant angle gauge, so once we fly the first paddle set and get it how we want, we can then pre-set all the others as they attach to the trusses before they are raised into place.

"For power, we provide a small distribution on the truss; the main feed is in place ready for us at each tower. There is a perimeter catwalk on the roof and there are cabins for electronics; the ballasts will go there. The cabins will be packed with dimmers, amplifiers and other equipment. The cables we lay on the paddle trusses; mains and DMX will include spares for redundancy, though once they're in place we're not expecting problems. There is also a catwalk deck below each paddle so access to the fitted lights is not so onerous."

On the issue of sustainability, Keighley says: "There are two things; yes you can't do much about the power consumed by a big beast like a Syncro', but on all other aspects L2012C have really raised the bar - and from our perspective have set a new Gold Standard in aspects of training, health and safety. I'd like to think future Olympics will adhere to that. Initially it looked a nightmare, but actually the industry has matured and taken it on, rather than kick against it. That was good to see.

"On the wider issue - look at the legacy of the Olympic park. Five years ago this was a lunar landscape of post-industrial dereliction: the transformation is remarkable."  
[www.elp.tv](http://www.elp.tv)

"L2012C have . . .  
set a new  
Gold Standard in  
aspects of training,  
health and safety. I'd like  
to think  
future Olympics will  
adhere to that."  
- Dave Keighley, ELP

## AUDIO & COMMS

### Bobby Aitken: sound designer

Bobby Aitken is credited as the sound designer for the four Olympic Ceremonies. Scott Willsallen is systems designer, responsible for design and implementation of the technology. Willsallen is well known for his work on major international events, while Aitken is best known for his award-winning designs for West End musicals.

Aitken says: "Scott Willsallen and I got together about 14 months ago and started to ask the big questions . . . we arrived together at a position where we specified five system proposals - L-Acoustics, Meyer, Martin, d&b audiotechnik and Clairs. Any one of those

would have done a good job; we've ended up with the L-Acoustics V-DOSC system and it sounds good. In the end it was the audio consortium led by Delta Sound that took the project. That group of companies - Norwest, Autograph, Britannia Row and Delta - has proved a very potent combination. It's been really good to observe how well they've all worked together - there are no egos going on down there . . . and they all seem to be having a good time doing it."

The absence of a roof out far in advance of the first audience rows appears, on the face of it, a problem for any system designer approaching this project. Aitken says: "Aesthetically the stadium looks great - pleasing, comfortable and open; but yes, that entailed a reduced roof cover. On the plus side, the great thing is we've ended up with the cable-net ring, which proved to be entirely to our advantage. The PA is now suspended in true free space - a good 25m of free air before sound is even in under the roof. The other thing - and this was quite unexpected - is that, bizarrely, the stadium is acoustically quite dry."

This is one of the stadium's most remarkable characteristics. Presumably the reduced roof cover is one of the major contributing factors, but also of note are the plastic seats; for much of the stadium these are not hard, single-layer, but hollow and softer plastic than we're accustomed to seeing. So certainly for rehearsals with no audience, the potential absorption is greater than you might expect.

There is an enormous amount of PA in the stadium, more than anyone's ever seen on an Olympic show before. Aitken explains: "I have to rely upon Scott's experience for that judgement - he has, quite simply, done more ceremony-type events than anyone I know. It's extremely hard to judge the amount of sound pressure you need to put into a venue this size - and we were briefed to achieve the high nineties. What we actually have is about +6dB above that if we need it."

We might characterise Aitken's and Willsallen's input to design as being dramatic and technical respectively. I asked Aitken if he had been able to achieve the sort of imaging effects that he likes to apply to his theatre work. "The system is configured, left/right, left/right, all the way around, so there is no spatial consideration, no aural cues that can lead the audience to focus say on a specific dramatic event at the north end of the stadium. It's very 2D in that respect, but to do otherwise is just far too complex and equipment-heavy."

You do have a large 'field of play' system as well, so could you pull the image down if you chose? "There are far greater demands than that which led us to ignore that potential; we have concentrated more on keeping it well balanced up."



**"It's been really good to observe how well they've all worked together - there are no egos going on down there . . . and they all seem to be having a good time doing it."**

- Bobby Aitken, sound designer

Despite all that, there is, it transpires, one quite magical moment where Aitken and Willsallen felt compelled to introduce some sound image manipulation to the event. "The huge bell - that really is an iconic moment and it has to be heard correctly. Yes, the bell is loud enough for the audience to hear throughout the stadium, but it needs that lift of maybe 6-8dB to make the impact more profound. Choosing the microphone proved a trial: I think we tried just about everything in existence that made any sense, and in the end we've settled on the good old SM57. But getting that high impact sound to run from point of origin to the opposite north end of the stadium - an audio distance of roughly half a second - has been challenging.

"We've stretched the Optocore system to develop a new signal path that takes the signal along the stadium: it works, and it works well, I'm pleased to say. That's pretty staggering when you consider the sheer amount of data that's already flying around that system - quite mind-boggling really. It's one of those things where you can have a chat where you think,

'yeah, that sounds like a good idea; shouldn't be too hard'. Then you engage with it the next day and what sounds easy in principal is fiendishly hard to implement. I have to say, from that perspective, Scott and his team are pretty special."

Also coming in for praise from Aitken is the creative director himself, Danny Boyle. Aitken says: "Danny is pretty special; he's constantly taking some very big decisions but I have no qualm in putting all my faith in him. An inspirational man."

### The Audio Consortium

If you never saw a wide shot long enough to count them all, there are a whopping 22 hangs of V-DOSC PA suspended from the stadium cable-ring. The cable-ring is distinct from the cable-net scenic ballet system supplied by Stage One (see elsewhere). This ring is a highly tensioned catenary circle stood 30m off from, and parallel to, the stadium roof, installed solely to support the PA and lighting pods.

The truth is, the architectural design did not thrust the roof far enough out from the audience to accommodate the physical distance required by your typical line array to cover the audience. Yes, you could have installed more hangs at short range direct from the roof, but then you get into enormous amounts of weight: think double the number of cabinets.

I heard one or two bleats about how the roof falls short - not, it must be said from audio guys, but it's worth observing the following: if you have ever worked big spectaculars in stadia, either rock concerts or events like this, then you will be all too aware of the effect a roof imposes on the psyche of the audience. Well-covered stadia where the roof extends well out beyond the seating - those found in the sunnier regions of the USA, for example - tend to feel more enclosed and claustrophobic; they can also feel much smaller than their 70,000 capacity would have you believe. Not so with this stadium: the more open roof gives the space an expansive atmosphere: this is an altogether



## Power Steering<sup>2</sup>

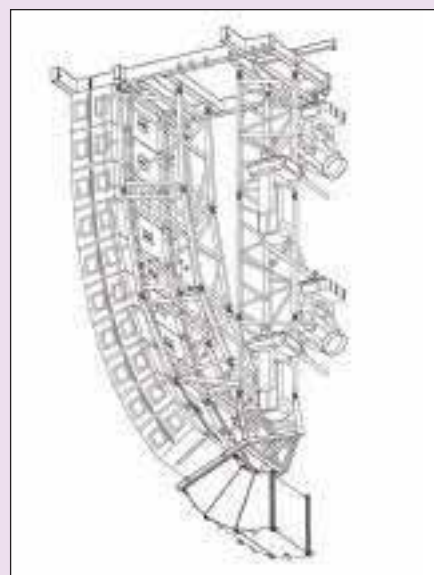
The **IC<sup>2</sup>** is breakthrough technology integrates Renkus-Heinz's acclaimed digital beam steering into a powerful and versatile point source design.

Four 8-inch low frequency Neodymium transducers and 1-inch Titanium Nitride-coated HF drivers offer high SPL point source performance, while individual steering control of each driver gives the **IC<sup>2</sup>** unrivalled vertical pattern control for maximum intelligibility, even in the most reverberant spaces.

**ICOMEX** DIGITALLY STEERABLE LINE ARRAY LOUDSPEAKERS

**plasa2012** the way  
Exhibition & Pavilion  
9-10 SOUTHMAN ROAD, HEBBLE COUNTRY Stand # 1-F9

Photo: Graham Carlow



Above, left: The PA and lighting pods, designed by Jeremy Lloyd, carry the L-Acoustics PA line arrays and moving head projectors on a rigid flying frame. Above, right: the Pod on the drawing board.

grander venue, as befits the stature of the event - and a very positive influence on the audience.

"The vastness of the system is linked together using Optocore," began Steve Lutley, Delta Sound's project manager for the Opening. Delta is the lead contractor, with Norwest, Autograph and Brit Row all providing support in the form of equipment to varying degrees: Norwest also provides personnel.

Lutley continues: "We use all 24 nodes available with the Optocore system, and squeeze in others to feed lighting control, mosh-pit etc, using Optocore's SANE protocol and a Cat 5 connection. The system runs round the field of play up to control areas for lights, show control, sound, monitors and audio patch - then up to the roof for the PA.

"For the concert-style live performances, the artists' own engineers will be here, but Richard Sharratt runs the main board.

"Each line array is 10 V-DOSC with a pair (or on the West side three) L-Acoustic ARCS hung sideways beneath. Jeremy Lloyd, in Piers' operations team, has designed a fantastic pod that allows us to pick-up the whole line complete, including flying frame, from three points of the cable-net system (see elsewhere). That triangulation allows us to manoeuvre each PA and position it precisely onto the main cable-ring. Of course, it's not quite so simple: every hang of 10 weighs down on the ring and deflects it cumulatively, altering trim height, but there is no building structure to reflect sound above the top row of seats, so we have a little latitude to over-shoot above. Nevertheless, it was tricky getting each hang correctly aligned." After a test hang in April, the team allowed 13 days to get the whole system up and trimmed.

"There are 14 amplifier positions on the roof - so many LA8s that L-Acoustics had to do some tests to make sure we could run that many together. The cable looms to the speakers run along the spoke wires supporting the main catenary ring, and are then lowered down: a man on a cherry-picker hooks them up."

**"Choosing the microphone proved a trial: I think we tried just about everything in existence that made any sense, and in the end we've settled on the good old SM57."**

**- Bobby Aitken, sound designer**

The cable runs are all made up for this event: 50m long, all have 4mm conductors to reduce voltage loss. The amplifiers are all in weather-protected cabins on gantry platforms installed above the roof.

"The track-side system is 22 stacks of four L-Acoustics Kudo with four SB28 Subs laid flat. We provided a small amount of pitch fill coverage for the athletes and performers - some small RCF speakers. There is further PA - the two mosh-pit areas to north and south ends for the concert performers have some local cover from powered 108s and some single 18"s to liven them up. All the signal processing is handled by Dolby Lakes, an enormous amount, which is where Norwest's specialisation on these types of events pays dividends: they shipped most of them over for us. The Lakes give us the instant analogue back-up should the digital network fail. Yes, believe it or not, there is a ring of copper analogue linking everything together, 25 pairs to every point. Scott Willsallen drew up the technical design for the system, Bobby Aitken the audio system design."

"The microphones are also backed in the same way, so, for example, the podium mic is passively split to A&D and also has an RF TX back-up. Although much of the Opening Ceremony is playback, with three live acts it still warrants a DiGiCo SD7 each for monitors, front-of-house and broadcast mix. And, of course, there is a back-up for each one. For the live performances it's all the usual mics we know and love. For the bell, we initially tried a DPA up inside and it nearly blew our heads off, we also tried Schoeps and Rode - well practically everything, actually. In the end I think we'll use an SM57." I doubt there's an audio man in the country who wouldn't say 'cheers' to that.

"Radio mics are all Shure's Axient system; the IEMs are Sennheiser G3, and all run on rechargeable batteries. Delta provides two levels of professional IEM; Riedel provides



Photo: Steve Moles

Andy Marsh (left) of Norwest Productions with Steve Lutley of Delta Sound.





# SMALL SIZE. HUGE PRESENCE.

Photo Credit 2me Studios

Photo Credit Joby Benoit



**"The VL440 Spot has everything that you love in a VARI-LITE luminaire; the color mixing, the gobos, the speed, but now it's all in a smaller size."** LD Ryan Murphy - *Andrew Bird Tour*

**"The VL880 Spot has definitely inherited the blood from a great family of products, all in a compact body with loads of creative possibilities."** Mak Kwok-Fai - *Hong Kong Ballet*

**"The VL880 Spots were perfect because of their wide color palette and quick gobo movements. They really gave the room the pop it needed."** LD Rachel Miller - *American Idol After-Party*

**"The VLX3 Wash is powerful and consistent with broad colors and a fantastic zoom."**  
LD Mike Swinford - *Big & Rich Xtreme Muzik Tour*

To find out how the **VLX3 LED Wash**, **VL440**, **VL770**, and **VL880 Spot** luminaires can impact your design, go to **[www.vari-lite.com](http://www.vari-lite.com)**

**PHILIPS**

**VARI\*LTE**



**plasa2012**  
9 - 12 SEPTEMBER 2012 / EARLS COURT

See us at **PLASA**  
Earls Court 1-F50

Photo: Steve Moles



Left: 22 L-Acoustics V-DOSC hangs are suspended around the stadium via the radial cable-net system.

"He did all the spectrum planning and entered into that work well over a year in advance. The computer control offered by the Shure and Sennheiser systems puts us ahead of the game, but Steve Cauldwell has developed custom RF amplifiers and uses a lot of different antenna systems to sustain the redundancy aspect."

- Steve Lutley,  
Delta Sound

the enormous third-level system for the huge cast of performers. We have 350 sets of level two G2 system operating over eight channels for principal cast, aerialists and the like, and then eight transmitters and 15 sets of PSM1000."

For all the advance planning involved in such projects, the implementation comes relatively late. Lutley himself only started on the project in January. I'd also like to point out that just as Lutley engaged with the project he broke his jaw, which made the LSi interview process less than comfortable: Delta is fortunate to have such a stoical man as Lutley.

He says: "Andy Marsh and the team from Norwest arrived at the beginning of May." This timing is typical of the way L2012C has determined not to have people falling over one another to get the job done in a hurry and is no doubt a major contributory factor to the event's success. "We did all the planning, drawing upon Norwest's prior knowledge and experience, shipping equipment straight from the events in Doha at the end of last year, though some of the Lake units came from Australia.

"I also went out to Doha at the time to take a look at how Norwest runs its operations. One of the things we decided from that visit was to have Norwest put all their gear into typical 2m tall installation racks." These racks were located in the dedicated cabins built on the main pedestrian concourse, which are referenced elsewhere.

"Norwest has a lot of infrastructure stuff we simply don't hold," continued Lutley. "The holding area for the main cast, for example - they provided an extensive 100V line system for that. They also had most of the fibre needed for the Optocore twin redundant loop. The rough division of labour is Delta do what's in the air, Norwest do what's on the ground, Autograph do FOH, Delta do monitors. For us, the advantage of Norwest's assistance is they know what's coming.

They've been the ideal partner for us; no other company has this type of resource and experience in Olympic Ceremonies, making our collaboration a good move all round. We have taken care of a majority of the pre-production, but the knowledge of exactly how the show runs from 'show control' is all part of their concept."

"In terms of sustainability there are limits to what we can achieve: volume equals power, though our working practices have been modified and the advice from L2012C has been very useful on that score. But adherence to health and safety was very instructive - in some ways beyond our normal commitment. Risk assessment for this far exceeded the parameters we normally work to, and that's something we will take with us for future contracts. Dealing with equipment specifically, learning how to back-up the Optocore systems has been a learning curve. DiGiCo, Shure and L-Acoustics did a lot of that back-up planning for us. Also, the detail supplied to us by Ceremonies has been extremely useful. Having done the Commonwealth Games in Manchester a few years ago, I can say the in-depth steerage has been really useful."

RF technology, Lutley reported, is overseen by Steve Cauldwell: "He did all the spectrum planning and entered into that work well over a year in advance. The computer control offered by the Shure and Sennheiser systems puts us ahead of the game, but Steve has developed custom RF amplifiers and uses a lot of different antenna systems to sustain the redundancy aspect."

I asked Andy Marsh, Norwest's lead man on site, for a thumbnail sketch of the company. "Back in Australia we don't primarily do concert touring, though we do some. Day to day we do a lot of TV, especially live to broadcast, particularly sport. We're starting to push into theatre. In terms of equipment we have a lot of V-DOSC and Kudo, Milo from Meyer, and from Adamson we have Y10 and Y18 and are buying into Energia. We also have a base in Auckland, New Zealand, where we have EV X Array. In Australia we have bases in Melbourne, Brisbane, Sydney and Perth. Because of our experience with these large international events we have worked with Optocore throughout to develop their system capabilities."

Despite the depth of experience, Marsh was impressed with the London set-up: "This is by far the biggest speaker system I've ever seen; even Norwest couldn't have done it on their own. And this is the most technical



**"This is by far the biggest speaker system I've ever seen;  
even Norwest couldn't have done it on their own."**

**- Andy Marsh, Norwest Productions**

support we've ever had," which says reams for the focus of expertise available in the UK.

Piers Shepperd commented on the many and diverse strengths of the Delta-assembled consortium: "Delta did well to involve Norwest and the others in their tendering team as it brought them lots of Ceremonies credibility. I see they've been working pretty well together."

That might sound an obvious thing to say, so I asked Paul Keating to expand on the consortium response to the 'many and diverse'. He says: "Having lost the Athens bid at the last hurdle back in 2004, we were determined to be involved in one Olympic Opening Ceremony during our careers, so we started work on London two years out. Building a consortium is all about filling in the missing pieces. Two years ago, Chris Kennedy from Norwest and I met at PLASA. We discussed how we could and should work together to bring great experience and credibility to the London Olympics.

"Ever since Sydney in 2000, Norwest and Scott Willsallen of Auditoria have developed a huge amount of IP, investment and delivery experience. I don't believe there is anybody in the world with more Olympic experience and this scale of delivery. Once Bobby Aitken had been appointed as sound designer, it was logical to have the inclusion and support of Autograph - they offered an entirely different skill-set from Norwest and ourselves but most importantly, they gave Bobby a level of technical comfort.

"The inclusion of Britannia Row was predicated by the closing ceremony being mainly a multiple artist line-up which made them the logical choice. Although this has changed a little from the original plans, Brit Row has remained a significant contributor: we have about 72 of their V-DOSC cabinets in the stadium. As for providing systems for the other venues, their involvement in terms of planning, design and equipment supply has been of great value."

Of the immense stadium PA, Keating says: "Of the loudspeakers within the Stadium, apart from the Brit Row contribution, the rest are from our rental stock, supplemented by AED. You might be surprised to learn there are none from Norwest, apart from 88 Kudo that came direct from the Doha games last December. It would have been nonsense, not to mention the carbon footprint that shipping so many boxes around the world from Australia would have created. So Norwest applied their network expertise, particularly with Optocore, where they are, without question, world leaders.

"Consultant Scott Willsallen has delivered a complex control network designed around Optocore and Dolby Lake. They also carry the extensive analogue redundant back-up required. So for us, as the lead contractor, our other partners formed a great fit, namely large-scale delivery, theatrical and concert expertise. As companies, we also have cultural similarities - essential if we're all to work happily and effectively together.



**the fabric and structure  
of your event**

**The largest supplier of drapes and rigging**

**London**

T +44 (0)20 8687 8400  
F +44 (0)20 8687 8500  
E [sales@blackout-ltd.com](mailto:sales@blackout-ltd.com)

**Paris**

T +33 (0) 1 40 11 50 50  
F +33 (0) 1 49 48 16 24  
E [info@blackout.fr](mailto:info@blackout.fr)

**BLACKOUT**



search for 'blackoutltd'

hire ■ installation ■ sale  
[www.blackout-ltd.com](http://www.blackout-ltd.com)

**Le Mark**

**When Our Time Came  
We Laid It Right..**

30 Years of constant support and award winning innovation  
culminating in the printing & installation of Harmony high gloss.  
The world's largest consecutive patterned vinyl stadium floor.

Performance Floors    Tripline Safety    Printed Flooring

Proud Suppliers To The Entertainment Industry

[www.lemarkfloors.com](http://www.lemarkfloors.com)

Photo: Graham Carlow



Each of the performers had in-ear communications.

"Scott agreed this was the biggest system he's ever seen on an Opening Ceremony. He and Bobby have worked well together. Bobby brings the theatrical expertise to what is ultimately a creatively driven show - after all that's what the UK is famous for. We may not be capable of assembling 10,000 drummers in a coordinated routine, but we do know how to create something magical. In that respect I think London has stepped out of the mould."

What of manufacturer support? One imagines they jumped to the task? "More than you might imagine. Of course, being in London there is a geographical advantage that for many manufacturers we are on the doorstep, unlike in Beijing. As far as I'm concerned, this is without doubt the largest PA system ever assembled for one of these events; there are 280 L-Acoustics LA8s - no-one has put so many on a single network before. Christian Heil at L-Acoustics literally had new amplifiers unpacked from their cardboard boxes at the factory, until they were able to build a test network of 300 to satisfy themselves technically: that's just one example of great support. Shure have been the same with their Axient system: having the RF flexibility is key, especially in a complex RF environment.

"DiGiCo, in their own inimitable way, have been hugely supportive: by Closing Ceremony there will be a total of nine DiGiCo consoles in the stadium."

This is clearly a significant contract for Delta, and one that places the company under certain stresses: what will be the benefits downstream of the Olympics? "In terms of process we have learned much, having gone

through a lengthy tendering and contract procedure. We planned well in advance; relatively speaking, we've made low investment in equipment for the Stadium. Conversely, we have invested heavily for the systems at other venues: there are a staggering 500 separate PA systems across all the Olympic venues, so we've spent heavily in the areas of communications, amplifiers and speakers for some of those, investing in Clear-Com, EM Acoustics, d&b audiotechnik, L-Acoustics, plus Yamaha and DiGiCo desks, and our own stock of Optocore - thanks to what we've learned from Norwest. With the added support of Brit Row and Dimension Audio, we are collectively covering some 40 venues. In that respect, the Stadium system has proved comparatively quite easy!"

"Another strength of the consortium approach is that our partners have been able to invest in the equipment that suits their business model, so Norwest have more Optocore and infrastructure, whilst Autograph have a fleet of new DiGiCo SD7s which, I have no doubt, will be re-deployed onto the next West End musical within weeks of the Olympics closing."

"Next time something on this scale comes along, it will be easier. We set out to develop relationships and combine our skills for future events. The world is now a much smaller place and London has proved that it's been a success: we've worked well together. That will be the legacy of 2012."

[www.deltasound.co.uk](http://www.deltasound.co.uk)  
[www.autograph.co.uk](http://www.autograph.co.uk)  
[www.britanniarow.com](http://www.britanniarow.com)  
[www.norwestproductions.com](http://www.norwestproductions.com)  
[www.auditoria.com.au](http://www.auditoria.com.au)

## Riedel: Comms

The comms system supplied by Riedel was by definition immense and complex. That said, their project manager Barbara Walker had its complete image firmly planted in her mind: "It consists of four parts: three comms and one CCTV system, forming an integrated infrastructure that also enables communication between the three comms systems."

She explains: "The first area is the RF network, which is quantified as providing all RF comms for 1,170 users: this comprises all transmitters, antennae, filters and combing systems, and all user hardware (e.g. Motorola hand and headsets). Second is what's called the 'Mass Cast' system - a large, five-channel FM-based IEM system for the massed performers - some 14,500 users in total. Four channels are used for cast, stage managers and choreographers; the fifth channel is a spare.

"The third element is the main comms system over a wired infrastructure, connecting stage manager stations and conventional headsets as well as belt-packs comms. With the Riedel Artist system as the foundation, this provides the primary communications between all the production departments, show callers, SMs, all the automation and motion controllers, sound engineers, lighting and video techs."

Of the system's complexity, Walker says: "The hardest part is determining the programming, as to who can access who." Not unnaturally, Riedel has been planning and preparing this for over a year, but in terms of laying infrastructure, work did not begin until Friday 11 May, as with most other contractors. Walker says: "Programming commenced the first week in June, with the full system implemented by rehearsals on 18 June."

With experience of a large number of world-class events, many of the Riedel team are veterans. The core team is just 16 members, with a large helping hand from stage crew for cable running, and volunteers who manage the multiple FM receivers and earpieces for the Mass Cast.

"A lot of the physical work is in running the hundreds of kilometres of XLR cable and the Fibre rings," says Walker. "MediorNet is used to manage and distribute the signal; a lot of the time in the six-week period is spent in

"We may not be capable of assembling 10,000 drummers in a coordinated routine, but we do know how to create something magical.

In that respect I think London has stepped out of the mould."

- Paul Keating, Delta Sound



# AXIENT



plasa2012

9 - 12 SEPTEMBER 2012 / EARLS COURT

VISIT US ON STAND 1-E34

## Axient Wireless Management Network Ultimate Wireless Control

Introducing the Axient Wireless Management Network from Shure.  
Ultimate control for the world's most extreme RF challenges.  
From the people who define Legendary Performance.

**SHURE**<sup>®</sup>  
LEGENDARY  
PERFORMANCE<sup>™</sup>

[www.axient.net](http://www.axient.net)

[www.shure.co.uk](http://www.shure.co.uk)

© 2012 Shure Incorporated

Photo: Graham Carlow



Left: The convincing brick chimneys which rose from the ground were inflatables from Airworks.

testing and proofing, followed by customisation dictated by merging and refining the needs of the various departments."

James 'Brew' Breward is the deputy production manager for comms for L2012C: it was he who designed the root-and-branch master plan for the comms system. "And it's that plan that pre-determines to a great extent the programming requirements and system design supplied by Riedel to support the Ceremonies Communications requirements," says Walker.

"The Mass cast system is a straightforward transmission system. Riedel can add as many additional headsets as required, but because L2012C has planned so well and they're very mindful of wastage, the profligacy seen at previous large-scale events has been avoided. Elsewhere, the system is designed for double redundancy, and taking the Opening Ceremony as the largest demand placed upon the overall comms infrastructure, by adding a leeway of +10% capacity so that all eventualities are covered, we accommodate growth.

"Of course, +10% is not quite that simple: previous experience in other Olympics has shown that the tendency to grow is generally restricted to certain areas - that is, some departments always tend to have unpredictable additional needs. So in that respect some parts of the system might accommodate a +25% in usage, others hardly any increase above what was planned. That's why flexibility at the design phase is critical and why experience within the team is invaluable."

"The FM comms offer high quality audio with an earpiece providing a really musical response. All Cast members keep their own ear-pieces. This gives them responsibility for maintaining them - though spare units are, of course, available - and it also overcomes considerations of hygiene. The receivers are managed by Riedel, so the cast members just turn up and plug in.

"L2012C has arranged a unique deal with the battery provider to keep the packs on fresh cells, with a dedicated recycling programme in place. Combined with the robust casing of the receivers, everything is set to function properly. The 55-60FM frequencies in London are really well managed for this event, so that no interference occurs between various broadcasters, LOCOG and Ofcom.

"... we have been at great pains to make sure none of the underlying support structure becomes visible when lit - from any viewpoint."

- Howard Eaton, HELL

"With the RF system, the biggest challenge is getting proper coverage in new and unexplored buildings, but the situation in London was very fortunate. The design of the stadium is geared towards RF transmission, resulting in very few dead-spots and cancellation areas to address. For providing a secure and thorough service, Riedel always has at least two team members assigned to any area of the system development and implementation, providing any support needed. All Riedel equipment will be reused after the Games as regular Riedel rental stock to be installed at upcoming big events or Riedel's day-to-day rental business," says Walker.

[www.riedel.net](http://www.riedel.net)

## RIGGING, STAGING & SCENIC

### Olympic Rings forged in HELL

A name familiar to many LSi readers, the contribution of Howard Eaton Lighting Ltd (HELL) is as enigmatic as the man himself. After the lighting of the Olympic flame, perhaps the next most iconic moment of the Opening - and one woven neatly into the industrial tableau - was the fiery appearance of the Olympic rings: these were built by HELL.

"The rings are formed from fibre glass-clad steel frame trusses which are built in-house," explained Eaton. "Seven 90kg segments form each 12m diameter circle. Attention is focussed on the centre ring, which is 'forged' from molten steel during the industrial revolution scene: the other four rings are already flown above and concealed on the stadium roof.

"The visual aim was to produce an effect that mimicked the pouring of molten steel from a giant industrial cauldron, along a channel and into the former of the centre ring. Artem provided the pyrotechnic accompaniment that recreates the smoke and sparks that would occur in a real forging process - we create the illusion of flowing metal using LEDs. Each ring has RGB LED coverage on all faces, with the centre forged ring and trough having additional amber LED strips. The additional Amber obviously provides a powerful authentic colourisation of the molten metal; then it's just a matter of controlling the LED sequence to advance the light/molten-metal in a realistic way. The LEDs allow for advances of 75mm a time so from the spectators' perspective, it looks remarkably fluid."

The flying of the forged ring to join the other four is part of Stage One's Qmotion remit. "It was tricky getting them to hang in position to accurately reproduce one of the most recognisable symbols in the world - the Olympic rings," says Eaton. "From our perspective the rings also have to look good individually and it took time to work out how to support the moulded fibreglass we use to form the ring's outer surface. This has to provide the correct opacity so that people don't see the LEDs. The moulding mustn't be too dense to cut down the light output, and we have been at great pains to make sure none of the underlying support structure becomes visible when lit - from any viewpoint. The results on camera were very effective." Then there's the mounting structure for pyro - "nearly a thousand holes and supports in which to mount them."



Last year Eaton was shown Danny Boyle's concept movie that unfolds the basic narrative; he too valued being given the bigger picture. "For us it's very helpful to know what's happening, especially immediately before and after the section in which we are involved."

What about the sustainability elements?

"Fairly straightforward for us. After the games the steel frames go straight to be melted down, the fibreglass is stripped for recycling, and all the PSUs, LEDS and DMX drivers come back into stock. That would be typical of most jobs we do, but there is one element that we may have done differently in the past: the rings had to be load-tested - normally, we would rent some weights, but instead of driving large quantities of pig iron around we used bags of gravel, which we've now donated to somebody's driveway. The other thing is scale: we do lots of work like this but not on this scale. There are, for example, some 6,000 ways of DMX drivers: that's not technically challenging, but it does make you think about your manufacturing processes more closely. In that respect, we have certainly learned a lot".

[www.howardeaton.co.uk](http://www.howardeaton.co.uk)

#### Airworks Rise to the Challenge

Although most viewers from within our industry will have realised that the seven

chimneys of the Industrial Revolution sequence were inflatables, they will also have been startled by the manner of their erection. In every sense of the word, this was tumescence personified; but just how do you get a 30m tall and 4m circumference fabric chimney to rise so solidly and majestically?

"The chimneys are almost as wide at the top as they are at the bottom, that makes them more vulnerable to wind," explained Bart Maes of Airworks BV in Holland. "Our assignment was that the chimneys should rise smoothly and without bending; to appear as if they were solid objects rising straight from below ground. The attachment to the cable-net system is just one half of the solution; below the chimney and within the fabric are eight cables equally spaced around the perimeter. The cables are attached at the bottom to a 7.5kW electric motor via a sophisticated winch and clutch system. The pressure on the cables is maintained by the clutch at 80kg per cable - a total 640kg constant. That maintains the rigidity; it's an all-new system developed specifically for this event, though we had done something similar with a small tower which I was able to demonstrate when we came to the stadium to pitch for the work last year."

That solves the wind shear problem, no bending chimneys here, but the chimneys appeared to rise as a solid, as if they were already totally inflated and taut? "With any inflatable, when you add air pressure the natural thing is for the thickest part to inflate first. So one metre below stage we have a system of eight skis to push against the inside of the fabric - that way the visible part, starting from the top, is smooth and already fully stretched. The skis are pneumatically operated and are designed to perform the same role when the chimneys come down. Between the skis and the clutch-tensioned cables, the chimney always appears solid and smooth."

The result is a visual eye-popper and one of the more startling elements of the rural-to-industrial transformation, but it's hard to see where sustainability can be accommodated. "We, in the obvious sense, will re-use all our hardware, the pumps and blowers. But at a fundamental level inflatable scenery is far more sustainable than any other scenic form. To make something like these chimneys any other way would require maybe ten times as much material. The object itself will initially join our rental stock, but even when we eventually dispose of it, the fabric represents a far smaller amount of waste than solid scenery."

## impression<sup>&</sup> X4

### HIGHLIGHTS

- Powerful and compact ◀
- 19 RGBW LEDs ◀
- Zoom 7-50 degree ◀
- Fast and precise movement ◀
- No light spill ◀
- Narrow beam effect ◀
- Weight only 7 kg ◀



impression<sup>&</sup>  
Spot

impression<sup>&</sup>  
Wash

"The Wash One is a real all-rounder, you can use it to create crunchy beam colours, but also clearly-selected areas on the stage can be illuminated."

Jerry Appelt (Light Designer)

"In a nutshell, the two lamps are compact, powerful and extremely flexible — and thus are made for such a job."

Thomas Gerdon (Set Designer - MayDay 2012)

plasa2012  
9 - 12 SEPTEMBER 2012 / EARLS COURT  
STAND 1 - F8

Facebook logo: Become a fan  
[facebook.com/GLP.German.Light.Products](https://www.facebook.com/GLP.German.Light.Products)

[www.glp.de](http://www.glp.de)

"The other thing is space and transport: as I explained, we came to the stadium to make a demonstration of our capabilities. In fact, I brought enough examples of our work to fill one third of the stadium field of play - and I managed to bring all that equipment over from Holland in a van, not even a truck."

[www.airworks.nl](http://www.airworks.nl)

### Scenic effects from Artem

A company more accustomed to providing scenery and effects for the movie industry, Artem is in many ways entirely suited to bringing Danny Boyle's creative muse to realisation. In short order, they provided for the Opening Ceremony all the smoke and steam effects from the houses and industrial buildings; the cottage and the Barratt-style house; the four large puppets and beds, plus the 14 trampoline beds from the NHS scene; 50 flaming bikes; and the naughty child carriage.

At the time of writing, Artem was also engaged with several equally diverse projects for the other Ceremonies. "A lot of this is new to us," began Mike Kelt from Artem, "but then so often, what we get asked to do is new. The inflatable puppets - and something in the Closing of which I can't tell you - are both large inflatables. Normally, we would sub-contract these out to the many firms who regularly deal with such things; but no-one out there seemed to be prepared to break with their traditional approach and try and engage with the more proscriptive demands of Danny's design, so we brought it in-house.

"Needless to say, we had to learn a great deal; the crucial thing was the accuracy of the skin. We employed costume makers in the end, people who can work very accurately to a detailed pattern, which is what we provided for them. It's an exacting standard, especially for an inflatable figure, but by taking it in-house at least we have control and can think around the inevitable problems that crop up. That's one of the strengths of the company - we have a large variety of well-developed skills in-house and when problems occur we'll all look at them to arrive at a solution. We've also learned some new lighting techniques in producing the molten metal effect for the crucible: that tongue of fire is basically LEDs embedded in silicone, but writing the DMX sequence - for the effect to convince visually - took us some time." An aspect shared with Howard Eaton (see elsewhere).

"The other unusual experience for us is engaging with other scenery makers: in movies we tend to either make the whole thing, or what we do make is self-contained; here we worked hand-in-glove with people like Howard Eaton."

"In terms of sustainability, yes we have had a regular recycling policy for materials for some time. Like many, we sort our steel and non-ferrous metal; but the bureaucracy of the tender requirements has proved a shaping process for our business; it has brought us to a point where we are the most sustainable in approach we've ever been. The paperwork has been unbelievably onerous."

Kelt is not alone: every contractor drew attention to the bureaucracy burden. "And I question the validity of it; who in the end will look at it all? But take PVC, for example - effectively a banned substance from the event, yet the inflatable for the closing ceremony is designed as transparent. There's only one skin that can do that and it's PVC - so you either scrap the transparent element, or accept the compromise. As it happens, and after scouring the globe, we have found someone who can recycle the PVC skin."

**". . . the bureaucracy of  
the tender requirements  
has proved a shaping  
process for our  
business; it has brought  
us to a point where  
we are the most  
sustainable in approach  
we've ever been."**

**- Mike Kelt,  
Artem**

Artem engaged with many challenges. The Barratt house is too large to enter complete through the vomitory, so it comes in two floors and clips together, but is eventually flown up onto the stadium roof, "so it had to be light but strong enough to stand weather. We developed the clips ourselves - you don't want the house disassembling as it flies up."

There were others - the baby's head, for example. The important thing is to recognise that the approach is the key: "In many ways we had an advantage in that we talk the

language of film, and we are well used to being given a small piece of paper with a sketch and few notes on it. We'll also go back to the conceptual people and negotiate alternatives, as in 'if you do it like this you get the same effect, but in less complicated fashion'."

In actuality, of course, that's no different from the many scenic builders in the concert and special events industry. It would be nice to think that these two schools of creative engineering might find mutual benefit from having all taken part in such an event as this. [www.artem.com](http://www.artem.com)

### Le Mark takes to the floor

Thanks to the persistent if unwanted attention of the national press, one of the more recognisable features of the Opening Ceremony was the vast stage floor presenting a striking bird's eye-view of the River Thames snaking through London. Various options had been considered - including painting the stage decking - but most were simply not durable enough to cope with the rigours of six weeks of rehearsals and production work.

Cambridgeshire-based Le Mark had been working with the Ceremonies team for some time, providing samples of specialist flooring and running printing tests. In early May, as many companies were already loading in, Le Mark was given the go-ahead to source, print and install 7,500sq.m of Le Mark Harmony gloss flooring.

"We first devised a print schedule," explained project manager Dave Cartwright. "Even with the modification of specialist machines running round-the-clock shifts, we initially calculated printing would take five weeks." That's four hundred and forty rolls of 13m x 1.5m rolls of flooring, "plus all the extra cut-outs and specials that would be needed. We eventually squeezed it down to three-and-a-half weeks."

Working in Adobe Illustrator, Cartwright overlaid the graphic on a plan of the stage with all its trapdoors, ramps, rakes and other obstacles, and split the design into separate logical pieces - almost 800 in all. The area was divided into coloured zones, with each piece given an ID colour-coding, duplicated on the packaging.

The flooring was to be laid onto the wooden sub-stage decks with permanent adhesive - leaving very little room for error. This proved to be Cartwright's biggest challenge, not least because of the weather. "Le Mark had sourced a specialist adhesive which met all of LOCOG's environmental requirements - and those for floor adhesives in general. The advantage was it could be sprayed on: not only would this be quicker to apply, it would also form a thinner film which would cure more quickly. It was water-based - the



WORLD LEADER IN AUTOMATED XENON LIGHTING

# SYNCROLITE SXL

350,000 Lumens

Standard with OmniColor™ -  
DichroFlexHT™ color mixing system

Triple Scroll

Seamless CYMRGBOV Dichroic Color  
Mixing/Crossfade

Unprecedented Flat Fields

Proprietary FP Gobos™, VFL  
Lenses™ and FX Engines

10°, 20° and 30° film for variable  
output

Variable collimated spot to  
20° flood

540° pan and 270° tilt

Douser/Strobe



*"Uber Powerful,  
Incredibly Bright,  
Affordable and Versatile,  
Unlimited Possibilities"*

[www.syncrolite.com](http://www.syncrolite.com)



SYNCROLITE™  
ENTERTAINMENT TECHNOLOGY

Photos: Steve Moles



Above: Stage preparations - with Show Canada's stage structure, Le Mark's flooring, one of the Rings and the various traps and ramps all visible.



Above, right: The Tor and its tree. Below: The steelwork inside the Tor.

manufacturer included the encouraging caveat that the adhesive should not be used outdoors."

Needless to say, they started laying just as the summer deluge arrived. "Trying to find time where the wooden floor was dry enough because it had stopped raining for long enough to spray the adhesive, get the floor stuck down and cured before it started to rain again, was another interesting challenge." I believe that is what King Canute said as he contemplated the incoming tide.

"Everybody we spoke to, from the initial concept onwards, said it can't be done. You always know you're on to something good when everyone says that . . . and you think, actually, we know it can be done - it just hasn't been done before."

The installation was completed, on time, on 18 June and last time I looked it was coping admirably with the elements, as well as the daily trampling of crew, performers and animals over the lengthy rehearsal period. "Even with all this excessive rain, the seams remain rock-solid," says Cartwright.

[www.lemark.co.uk](http://www.lemark.co.uk)

### Souvenir Scenic: The tree on the Tor

It's not often I get to write about a tree, but this one is a beauty. If nothing else, you have to take your hat off to the 600,000 leaves - all hand-painted.

"It's not quite like that," explained Simon Kenny of Souvenir Scenic Studios. "Artificial leaves have come a long way since I started back in the early eighties: these days they look and feel incredibly realistic, but for their intended use the sprays of leaves - 60 leaves to a spray - come painted on one side only; for most applications that's all you'll need. But one of the first things we thought about was that this is going to be seen in close-up on HD TV, so treating the backs of the leaves was essential."

The giant oak tree that stands atop the Tor is built by Souvenir. It's 10m tall and has a similar circumference, so it looks the part. "Painting the leaves was troublesome," Kenny continued. "You can't spray them in batches - they end up stuck together. In the end, we found hand-painting was the only way." Sixty leaves to a spray; ten thousand sprays.

"The tree structure is composed of a central truck with a removable crown of four main branches. We scanned the model which had been sculpted by Jacqueline Pyle, then imported it into RhinoCAD. It's an aluminium skeleton which is then filled and covered with a two-part foam, then carved to tree form. Finally, it's coated with two layers of fibre glass, which is what gives it strength. We assessed the coatings to ensure the tree would sway realistically in the wind.

"To mould a bark form into the fibre glass would have proved expensive and time consuming, so we used an industrial product more normally used for encapsulating asbestos, called Idendum. It's like an acrylic form of Artex - we spread it

onto muslin, leave it to dry, peel it off and apply it to the branches. The limbs attach with tapering chords; steel stirrups are wrapped to the branches and fibre-glassed in; a mini cable-net in the foliage canopy allows for the tree, when it's lowered back onto the Tor, to be positioned accurately, not just plonked down.

"The tree is secured to the Tor from within: four yacht-type ropes and cleats make it strong but quickly releasable should safety require. As it's lifted, a three metre root ball drops from underneath: this is familiar territory for us - a simple scenic technique using paper rope. The tree is wind rated to 20m/sec. Will Bowen was our structural designer, and Gavin Sadler the structural engineer. Under them was a team of five engineers, five glassers and 10 props people. For our own peace of mind we built a scaffold and assembled the tree ahead of load-in."

Did the sheer scale of this project impart any new lessons? "We do a lot of trees, mainly for theatre but fashion shows as well; this tree is the combination of several techniques we've used in those applications, but this is the first time we've used those techniques all together. We did a big one for the RSC for their Christmas show, *Robin Hood*, and got to test this method."

"In terms of sustainability the scenic industry has traditionally been terrible, but that's changing and the process of going into this project has certainly moved our thinking. We now have a Sustainability Policy and have won recycling awards. For the tree specifically, the trunk will be sent to Germany where it will be granulated and recycled. The limbs and leaves will all remain in our stock as they are very reusable. There is no doubt that embedding recycling into the scenic world will be the law in the not-too-distant future, so this has been a very positive experience for us."

[www.souvenir.co.uk](http://www.souvenir.co.uk)



Photo: Ben Delfont



## Stage One: Industrial Creations

There are three fundamental contributions from Stage One; the cable-net flying system, driven using Qmotion; the complete show automation system, again driven by Qmotion; and many of the major scenic elements that erupt from below stage - not least the flaming cauldron, affectionately known as Betty (named after the executive producer's dog). I was fortunate enough to tour all of this while in fabrication at their Tockwith base in Yorkshire some months ahead of the Opening, guided by the certain hand of Jim Tinsley, technical director for Stage One. We began, prosaically enough, at the waterwheel.

"The Water Wheel," Tinsley explained, "is ten meters in diameter. For most of the time it sits as a bare-axle device buried below stage; raised above stage on twin scissor lifts, the paddle segments are inserted by ceremonies performers, and the wheel is complete in just six minutes."

Tinsley is familiar with every aspect of the job. He provides the primary engineering drive, though a raft of significant individuals beneath him provides the varied expertise - CAD, engineering, design and realisation - that makes this work. Such is the level of automation that Stage One employs in its manufacturing these days that the company is almost exclusively a tight coterie of experts.

"The waterwheel construction is typical of what we see in modern aerospace engineering: instead of rivets and bolts, the whole thing is held together using a lot of glue. The structure is mainly aluminium, so it's easily recycled afterwards - the metal value more than justifies the small amount of energy used to recycle. Each segment is locked in place using a simple toggle clamp,

similar to the coffin-locks used in the US; it's a piece of rock and roll technology that works well, providing accurate location and structural locking in one action.

"Precise assembly is aided by machined tapering spigots; remember the wheel is assembled by volunteer 'performers', not regular stage crew, so the process needs to be as fail-proof as possible. Although real water passes the race beneath the wheel, it is driven mechanically."

The five beam engines that Stage One also provides are likewise aluminium structures; they too rise on scissor lifts and although they look like forged steel they are, for the most part, clever paintwork. "Each device is rotated or nods via concealed chain drives," says Tinsley.

"These days we handle all elements of construction in-house; we avoid using sub-contractors and have had this policy for the last three years. This is particularly advantageous on a job like this where boundaries move up until the last minute, but more generally it means we control the whole process and thus manage not just delivery schedules, but also engineering quality and uniformity.

"Stage One at Tockwith now occupies two and a half large aircraft hangars, approximately 75,000sq.ft. We have five-axis CNC machines, laser cutters, lathes and milling machines - we even design and build our own hydraulic rams, like the custom units on Betty. Of course, the more complex elements - the machines we build like the hydraulic rams - are devices we use again and again. The ram designs are of a type, scaled up and down to certain sizes, power, length and capacity; refurbishment of stop valves and testing in-house makes them future-proof.

"The most difficult thing is the balance judgement: 'what can we practically reuse', against 'what do we make new?' Because we design and own all the components in something like a hydraulic system, including all the electronic pump control and motion control gear, we know it intimately and can reasonably predict the point of failure; add in a leeway and for most uses you can for practical purposes eliminate failure. Reliability of hydraulic pumps is better than you might imagine: we have two on this show that we used for the opening of Athens eight years ago, as well as a few from the Commonwealth and Asian Games since then. They are long-lived because relative to those in commercial usage, ours have an easy life. But we still strip the pump head and service every time. Even hydraulic oil is reused or recycled - companies like Shell now recognise this and work with us so the oil can be tested and filtered. This is not nice stuff to dispose of, so their help is much appreciated.

"We provide ten hydraulic lifts for this show; some of the larger elements, like the inflatable chimneys also rise out from the stage via ram-driven chain drives - and the inflation process is aided by our flying winches pulling the chimney tops from above. The thing is, the frames for the chimney bases are custom-built to fit in the stage, but the mechanical elements - lifts and drives - are all from reusable stock. The most tricky frame was that used for the giant bellows that feeds the beam engine; not only does this emulate the motion of the real thing, but prior to its appearance above stage, it has to support the weight of large Shire horses from the pastoral opening scene: that meant the bellows had to be made stronger and consequently heavier for our machines to make the bellows appear to pump."

## OPTOCORE networks your Clear-Com and RTS intercom systems

### X6R-FX-INTERCOM

- 8 Matrix ports for Clear-Com or RTS intercom systems with OPTOCORE and SANE
- Four wire audio and serial ports that can be routed through OPTOCORE and SANE networks

### V3R-FX-INTERCOM

- 4 Matrix ports for Clear-Com or RTS intercom systems with OPTOCORE and SANE
- Four wire audio and serial ports that can be routed through OPTOCORE and SANE networks



**BroadMan**  
Broadcast Manufacturer

Now available

- HD/ 3G SDI video solutions please visit:  
[www.broaman.com](http://www.broaman.com)

Please visit us at IBC Hall 8 stand C94 from 7th to 11th September

**OPTOCORE**

[www.optocore.com](http://www.optocore.com)

Photos: Graham Carlow



Designed by Thomas Heatherwick and built by Stage One, the Olympic Cauldron (known as 'Betty') became one of the iconic images of the Games.

## The Cauldron

"The cauldron, or Betty as we call her, is the gas cauldron for the Olympic Flame and is one of the most unusual devices we have ever built. It's designed by Thomas Heatherwick, the genius behind the British Pavilion at Shanghai World Expo; it's something from which we've derived the most pleasure and the greatest headaches.

"It has 204 flower stems, one for each participating country, and each has a unique custom-designed 'petal', which is carried by each national team leader and then fitted to the stem top."

Betty is re-configured between Olympic and Paralympic events, so the number of flower stems varies with the number of participating countries.

"The stems rise to the vertical once each petal has been fitted and lit. The physical look is similar to a composite flower head, say a dandelion, and the proximity of over 200 gas-lit petals gives the ball of flame we all see. I said Heatherwick is a genius, and he is: his attention to detail is absolute - he aims for perfection and achieves it. Does that really give me a headache? No, because when you challenge him on anything, even what you may believe is the most rational objection, he is able to justify it and you're compelled: you just think 'Yes, of course'."

Betty is 18.5m in diameter and sat within her trolley and main lift housing weighs a total 35

tons. Betty herself weighs 16 tons. Tinsley says: "The trick to Betty was getting her out of the garage where she's parked below stage. The aperture is just 6m wide - and there is, as you can imagine, an awful lot going on down there."

So here you have the crux of Betty's complexity: the stems are up to 9m long, each a custom-made tapering steel tube, with a custom petal on the end. We will get to just how unique the petals are: for now, suffice to say that the petal sizes vary to a great degree.

Tinsley says: "Every stem has to fold to fit in the garage, and don't forget each stem has to house a separate gas feed and electric igniters. The stems are arranged and fitted to concentric rings, 10 rings in total, alternating - half of which remain static, half move. Each stem has a push-rod fitted between it and a static ring so as the active rings move vertically the push-rods lever up each stem. Betty wheels out of the garage into her raising frame, temporary decks are removed and the stems mechanically unfold to create the circular disposition. Then she rises and is re-decked around and below. It all sounds a bit Heath Robinson and in a way it is - even Heatherwick used that word - but it works and looks beautiful: Heatherwick has provided the detail to the very last pip."

This single, complex device (and believe me, there's more complexity yet to be revealed) is illustrative of Stage One's capabilities. The company has invested heavily in CNC machinery: "The investment is significant," says Tinsley. "These machines cost a minimum of six figures, but the gains in certainty of production and the time benefit in machining and manpower is a saving of the order of 50%. In general, we go for the flat-pack approach: we use automation to turn out a kit of parts, and the teams build from the kits. There are no errors because the machines are all programmed from a single, coherent drawing."

Of the petals, Tinsley explains: "The 3D modelling of the petals is done in stages.

**"It all sounds a bit Heath Robinson and in a way it is - even Heatherwick used that word - but it works and looks beautiful: Heatherwick has provided the detail to the very last pip."**

**- Jim Tinsley,  
Stage One**



Manchester

Athens

Turin

Doha

Melbourne

Rio

Beijing

Vancouver

Delhi

London &gt;

Automation. Engineering. Scenery. Interpretation. > Few people can honestly say they've made incredible things happen. But we've been doing it every day for over 30 years. And although we create extraordinary spectacles, we're very down-to-earth people. We pride ourselves on being level-headed problem solvers and our clients come to us because they like to work with practical, unflappable specialists who can think on their feet. We're a team of more than 80 experts with diverse skills and we spend our lives bringing creative ideas to life. Sometimes we adapt tried and tested solutions, other times we pioneer something that's never been seen before. What we always do is bring cutting edge innovation, hard-headed pragmatism, vast experience and massive enthusiasm to every job.

Photo: Steve Moles



One of the beam engines for the Industrial Revolution sequence, provided by Stage One.

We take Heatherwick's drawings and from them create a simple MDF model. In essence, we pre-cut a series of contoured flat pieces, glue them together, and then a final machining to create the MDF petal former. It's like a shoe last that bespoke cobblers use. The tricky bit is working out the shape of the cut sheet of Copper required to be beaten into the shape for each petal last.

"There is just a one millimetre tolerance to the finished petal thickness. With six panel beaters working, it takes roughly eight hours to beat one petal into shape. Then there's further work to polish them, then fit the collar that locates and locks them to the gas burner at the tip of each stem."

At this point one begins to feel a little overwhelmed by Heatherwick's detail. Tinsley says: "There are three complete sets of petals - over 600 individually beaten panels in all. One set is a trial set that will be used in rehearsals and allow us to fine-tune any design flaws: don't forget all 200 petals have to rise as a mass and intermingle in the vertical, and each single flame has also to mingle to form the mightier whole flame.

"The other two sets are the actual Olympic set and the Paralympics set. Every petal is also engraved with the name of the competing country that will carry the petal into the stadium, and each country will be given their unique petal after the games. That's one of the nicest aspects of the design: even if a country wins no medals at all, they go home with something exquisitely beautiful and unique."

The petals are returned to Stage One for cleaning and polishing before dispatch to each country, as the three-week burn will obviously tarnish the petals.

"Why did we go the route of the panel beaters? Well, we did try what's called spray transfer, almost like spray painting the copper into shape. But it was so obviously a machine-made process that the hand beaten version was the only way to go."

Expensive, certainly, but this hand-wrought process was a universally agreed consensus. Speaking to Piers Shepperd months before the Opening, the ethos was clear. He said: "So much of the ceremony is focussed on the authentic voice of the country's transformation from agrarian settlement through industrialisation to modern technological society. The petals are a powerful symbol of the artisanal skills that founded the industrial revolution. All the principal people in the creative team looked at the two versions and there was no doubt in our minds." A decision that will certainly impact on the recipient nations as they take these beautifully crafted objects home.

But petal detail doesn't end with panel beating. Neil Franklin at Stage One was responsible for the engraving of the national names - a process of Sisyphean devilment. "The first question you have to ask is what country has the longest name. That might lead you to place their name on the largest petal, but the petals have to emerge in fixed order . . . so the petals are affixed to the stems in that order. We have also encountered some late additions to the Paralympics, this is the Games where the Paralympics comes of age, with 174 countries competing. The petals for the Para's also affix in reverse order, from the inner ring outwards."

"Choosing Font type was a huge discussion and eventually we settled on Futura. The font has to be distorted in etching, so when the petal is viewed from front edge on, the scripted words are clear and appear consistent." (Think of the distorted

perspective used to apply advertising to sports pitches for television cameras, except with the petals the surface is 3D, not flat like a sports field).

"Mapping each petal has been incredibly time-consuming but it will provide a gorgeous legacy for each nation. In keeping with the hand-made ethos, although the etching is by machine the resultant script is then worn to a Hallmark finish. The nine metre long petal-stems have also been worked, they are Zinc-plated, then dyed black, then lacquered on top. We were fortunate in discovering one firm in Walthamstow, the Premier Plating Works, that could do it. Sadly, as with the panel beaters - a small specialist firm called Contour Autocraft in the East Midlands, which normally makes replacement body panels for vintage Jaguar cars like the XK50 - these are all fading skills. Heatherwick's ideas are unfettered by considerations of budget, to allow the greatest artistic freedom. Nevertheless, the budget is managed, in that he will be presented with options to achieve a certain goal. Thankfully, we have been able to give him most of what he wanted."

[www.stageone.co.uk](http://www.stageone.co.uk)

## Unusual Rigging

Steve Porter, project manager for Unusual Rigging gives an overview of the key elements of the company's role . . .

"In total we will rig around 300 hoists, although most of them are removed before the event, and most equipment it dead hung. Things like the trusses for the Syncrolites and LED screens fly and split to pass the PA cable-net, then re-join above; that's all rope access work and it's worse for some than others, as they also have to pass the followspot cabins on the roof: these have a peak that protrudes and requires a second split-and-pass. The LED screens are the most awkward - 19m by 8m structures: we



## Cable-net explained

In basic terms, there are three cable-nets:

First is the Radial (Automation) cable-net, by Stage One. This is a dynamic system, with 14 radial cables terminating at a central hub; there are two traversing winch trolleys on each radial.

Second is the Catenary (Automation) cable-net - also by Stage One. Again a dynamic system, it has catenaries running the length of stadium, from north to south, with two traversing winch trolleys on each catenary.

Third is the Tension Ring cable-net - a structural device for the suspension of audio and lighting. A static system, it is a circumferential tension ring suspended on 56 radial cables.

Watsons, the principal construction company, erected the teepee steel frames on the roof from which Stage One's cable-net is rigged.



Photo: Steve Moles



assemble them on platforms, float them, split them, lift above the ring, and reassemble. They are stealth-type screens and have a blackout covering behind which, if the wind gets up, can be drawn open; so they're not a simple structure. Each one weighs about nine tons and requires two teams to rig.

"For the PA and light pods, the lifting frame that Jeremy Lloyd in the Ceremonies technical team has designed is pretty slick. Built by Sheet Fabs, the pods are a lift-and-fix kit that works. The big thing is the roof ring they attach to. Rasti Bartek from Buro Happold has done all the calculations for the roof - the three cable-nets, the other loads up on top of the roof, all of it.

"Personally, I find the main catenary for the PA staggering. The cable is 65mm thick, the spokes to the roof are 25mm, all wound and then installed by a cable car company [Pfeifer]. It ends up with 22 pods of 2.5 tons each: the tension on the spoke cables, without load, is between 6 to 8 tons." Why the difference? "Because the stadium is an ellipse, the self-weight of the cable ring causes a deflection across the long to short sides of the ellipse; it might surprise you to learn that when all the PA and lighting is hung and deadened off to the main cable, some pods we calculated will be 1.1 metres higher than others. Overall, the roof proper will deflect between 400 and 600mm."



Photo: Steve Moles

**Around 300 hoists were employed by Unusual Rigging.**

In case you're interested, the catenaries of the Stage One system that span the full width of the stadium have a 26 ton pull merely to support their self-weight. Is it necessary to load up on opposing sides to even the load? "No, we're told we can load up any way we want - it doesn't need to be symmetrical. The only pain is getting the PA trimmed properly, but we have turn-buckles on the frames, so even when dead hung there is still some adjustment - maybe two inches." Over a 50m throw that should be more than enough if the PA is already in the fundamentally correct position. "The cable deflections under total load have been predetermined by Rasti. You know I do a lot of work for Unusual with Imagination, so I've done some pretty big stuff in my time - but this is a different scale: just amazing."

Asked about the project and the issues involved, Unusual's Alan Jacobi said: "We are honoured and very pleased to be doing this, and grateful we've had the opportunity to work on such a great event for the country. With regard to sustainability, that comes down to the individual in the end; anyone of any intelligence knows they have to be more sensible in what they eat, wear or drive. Unusual took that on board long before the Olympics. We already have a well-embedded zero-waste-to-landfill policy: we recycle everything we can - oil, paper, batteries.

"At a more logistical level, for this event we consolidate transport trips to minimise impact - a little tricky to manage with the Olympics, as the truck you booked through security can turn out to be too small, as the requirements remain quite fluid right up to the last minute - but we're probably better at it than most, because we do it all the time. Overall, when it came to the tendering process where we had to consider areas such as diversity, race and sustainability, it has made us re-examine those things. In that respect, we've become even more critical of what we do and how we think about ourselves as a company. We are stricter with ourselves."

"It has seen us make a massive investment at a time when perhaps we shouldn't - in simple

# WISH YOU WERE HERE

QUANTUM SPECIAL EFFECTS HAVE BEEN HAVING A TRULY EXCEPTIONAL YEAR SUPPLYING THE BIGGEST AND BEST EVENTS ACROSS THE WORLD. IF YOU WANT US TO BRING OUR EXPERTISE TO YOUR PROJECT, SIMPLY GET IN CONTACT AND WE'LL DO THE REST

WWW.Q-SFX.COM  
INFO@Q-SFX.COM  
+44 1225 708 144

PHOTO: ANDY WILTSHIRE

Photos: Steve Moles



Jean Francois (left) and Paul Charlebois of Show Canada.



terms, probably in excess of 500 hoists, equivalent amounts of truss, and steels. When we tendered for all this and just how much Olympic-specific work we would take on, we were adamant that it make no impact on our day-to-day business. What has been unexpected is that our day-to-day business has seen a dramatic and unpredicted upturn that, perversely, is in no way connected to the so-called 'Olympic effect' - just one of those peculiar coincidences."

I asked Jacobi if being given insight to the full production helps? "Because our work is so critical to any production we are accustomed to seeing the big picture from the start. As others have said, sometimes when just parts are viewed in isolation you wonder if there is any point to it, or where's the message? It's simple - it's The Olympics - and so, from the outset, we know the outline script, and the fact that it's written with a cohesive and coherent narrative is good for everyone because it's very motivational: everyone knows and understands the purpose."

[www.unusual.co.uk](http://www.unusual.co.uk)

### Show Canada on the Big Stage

Provider of the massive staging that concealed the complex machinery of the opening, Show Canada designed a decking system for precisely this type of event. I spoke to their project manager, Paul Charlebois.

"The Show Canada stage is founded upon a super unit decking system, roughly 40ft by 8ft," - in reality it's 39' by 7'6", but allow the joins and you have the measure of it. "What makes it challenging is that we have a two-week build to get it into the stadium, then the whole lot has to come out in 48 hours, in time for the first athletics event. We've put in around 90,000 square feet - that's most of the field of play, about 300 panels plus ramps and other custom pieces.

"The crane method for erection has been worked out in conjunction with Ceremonies (L2012C). The steel sections we've fabricated would, in North America, travel on flat-bed trailers and we could off-load and

build a stage using a forklift: for this, we've shipped them across in open-top sea containers, so there's no other way to get the parts out except by crane, even if we wanted. Once you've lifted the part with a crane you might as well keep it on the hook to put it in place.

"The ramps are pretty customised and the main decks vary in that the stage is actually rolling hills, so stage height is across four main levels. That variance is all taken care of in the adjustable support legs we designed; the slopes conform to two degrees."

The legs are comparable to Acrow props, as used in the building industry. "They are placed every 10 feet along the ledgers and we were able to produce just two sizes of leg to provide all the support height variations the stage needed. The stage super-deck was designed for the show; we'd never produced anything on this scale before, although we'd done something similar for the Vancouver Winter Olympics a few years back."

## The Stage Platform & The Tor

The Show Canada platform, despite its strength and inherent weight, could easily slide given that 10,000 athletes will be on it at one stage and they may begin to sway as one (not so unusual). So the stage is anchored through the turf by substantial 'platypus' anchors. "This has its own advantages," says Piers Shepperd, "it takes much less steel to build the stage, so a far more open structure beneath makes operating complex scenic elements less troublesome, and you end up with less gross stage weight."

The Tor structure, which will weigh tens of tons, extends into the seated grandstand, so extensive reinforcement work was done below the stand to support a weight for which it was never intended. "We even had to go through the podium floor by hand and jack-hammer, and then pour new reinforced slabs for some of the additional support legs - things no-one will ever see," said Shepperd.

"It's the dynamic load that's significant," said Jeremy Lloyd. "As with the main stage, it's the people upon the Tor moving rhythmically that could be dangerous, like the three hundred marching miners."

Shepperd continues: "The Canadians had a more old-fashioned handling regime for their stage, which we have reviewed and up-rated for H&S. All the decks arrive in sea containers with soft roofs. Normally they use ladders alongside to strip the roof off: we provide scissor lifts - much safer and easier, and no slower. When the panel superstructure is craned into place, a person is needed above deck level to finesse the fitting. A fall arrest is attached to the crane mast head, so that person, should the panel not locate properly and fall, is secure. It might not be far to fall, but far enough at eight feet, and the panel structure is very heavy were you to fall beneath it."



Photo: Steve Moles



# ROBIN<sup>®</sup> MMX Series

## THE WORLD'S MOST EFFICIENT MOVING HEAD SERIES !

### SMALLER, LIGHTER, BRIGHTER, ENERGY EFFICIENT

#### ROBIN<sup>®</sup> MMX Spot

- ✓ World's most efficient moving head spot
- ✓ Total light output **26,141 lumen**
- ✓ Unprecedented lighting **efficiency 47.5%**
- ✓ **Over-performing any 1200Watt spot fixture**
- ✓ Innovative Dual Graphic Wheel and Remote Hot-Spot Control

#### ROBIN<sup>®</sup> MMX WashBeam

- ✓ **Wash & Beam - 2 fixtures in 1**
- ✓ Innovative **internal Barn Doors and Remote Hot-Spot Control**
- ✓ Sophisticated optical system with zoom range **2,5°-60°**
- ✓ 6 rotating gobos for **Mid-Air effects**



VISIT US AT PLASA 2012  
LONDON | EARLS COURT | BOOTH F47 | 9 - 12 SEPTEMBER 2012



## WE CHALLENGE YOU TO FIND LIGHTER, BRIGHTER, FASTER, MORE EFFICIENT MOVING HEADS IN THEIR CLASS

THINK OF THE  
CONSIDER **FUTURE  
NATURE**

**ROBE<sup>®</sup>**  
www.robe.cz

**Head office:** ROBE lighting s. r. o. | Házovice 2090 | 756 61 Rožnov pod Radhoštěm | Czech Republic | Tel.: +420 571 751 500 | Fax: +420 571 751 515 | E-mail: robe@robe.cz  
**Factory:** ROBE lighting s. r. o. | Palackého 416 | 757 01 Valašské Meziříčí | Czech Republic | Tel.: +420 571 751 500 | Fax: +420 571 751 515 | E-mail: robe@robe.cz | **UK:** ROBE UK Ltd. | Northampton, UK | Tel.: 01604 741000 | E-mail: info@robeuk.com | **America:** ROBE Lighting Inc. | 12349SW 53<sup>rd</sup> Street, Suite 202 | Cooper City | FL, USA | Tel.: +1 954 680 1901 | E-mail: info@robelighting.com  
**South-East Asia:** ROBE S.E.A. | Singapore | Tel.: +65 8118 6665 | E-mail: info@robe-sea.com | **United Arab Emirates:** Makateb Business Centre | Makeen Tower, Corner of 9th and 10th Street Abu Dhabi | UAE | Tel.: +971 2 657 3461 | E-mail: info@robe-me.com | **Russia and CIS:** Taganskaya str. 26 - 1 - 72 | 109004 Moscow | Russia | Tel.: +7 495 504 9569 | E-mail: info@roberussia.com  
**Central and South America:** Galicia 1200 ap 303 | 1100 Montevideo | Uruguay | Tel.: +5982 2900 67 47 | Email: info@robecea.com

Charlebois says: "The big stage takes some considerable loads, not least the Shire horses, so we designed it with that in mind. You could build the whole stage structure with the sort of modular scaffolding systems we're all accustomed to using," (think Layher or Quickform), "but at key points it would need to be incredibly dense. More generally, you just wouldn't achieve the open, easy-access structure we have below deck."

Readers should check Show Canada's website: this is not just a staging company, they produce effects machinery in much the same way that Stage One does in the UK: "We have worked with Stage One before - we've done a fair bit together, in fact - so working with them is easy and we're happy to do it. Even outside the decking system we've built for this, the main steels, the heavy duty 'I' beams beneath the Tor, all come from our stock, cut to length, but any scrap gets recycled. I'd say more than 90% of the steel we're using here is reused. Even the spiral staircases, which no one will see, that allow access up through the Tor, come from an old project we did. Funny thing is, they fit almost perfectly - we had to add a little platform exit at the top, and two steps up at the bottom. The great thing is the spiral really helps with the headroom inside the Tor."

Show Canada fabricated the entire Tor substructure steel in Canada, and examination inside shows that it fit perfectly: there's not an on-site cut-and-weld scar visible.

So how will they get it out so fast? "Well, we won't be loading it back into open-top sea containers - instead we'll tear down straight onto flat-beds and ferry it out to a holding area. That also makes practical sense; there is a possible call on this equipment for the other three ceremony events."

Continuing on the sustainability theme, Charlebois says: "In many ways we were already up to speed with recycling wherever possible within our organisation, and with health and safety, we always work through the safest operation in our method statements. What's required in these method statements for the UK is a bit more thorough than what's asked for in North America, but mostly it's similar to what we do elsewhere."

"What's different is the risk assessment: what the UK asks for is, to our mind, the proper approach and I'm pleased to say North America is slowly coming on board. But there are some frustrations: there is no height limit applied to risk, so even if you're six inches off the ground, you still have to assess it. And ladders: it seems no-one wants to see ladders used anywhere, but sometimes that's the only method; you can't always get a cherry-picker into the position you want."

As it happens, Charlebois has installed two cherry-pickers into the Tor, for exactly this

reason. "We used them and built the Tor around their position, we can't get them out; having them inside made sense with the load-out being so time-critical."

"In terms of assembling the decking system, the idea of supporting the personnel who work up on the incomplete structure from a fall-arrest device attached to the crane tip - we like that. It's very workable as they guide in decks and ledgers."

Show Canada began cutting steel on 26 January and were shipping across by 10 April. While Paul Charlebois managed the project as a whole, from manufacture through to delivery of the finished stage at the stadium, Jean Francois was the company's installation director on site. [www.show-canada.com](http://www.show-canada.com)

## SPECIAL EFFECTS

### Kimbolton Fireworks

Kimbolton's Daryl Fleming said: "Besides the main firework display, we provide three 'buttons' for the major moments; one for when HRH the Queen opens the Games, another for the confetti drop, and the third to provide a spectacular pyro accompaniment to a headline act during their chorus. The finale will last 1.5 to 2 minutes, with the reveal of the Orbit included. We have 124 firing positions around the stadium roof, a 90-second intense pyro display is pretty amazing in terms of scale. Of course, it's a one-shot effect and although Danny Boyle did visit a couple of our displays, most recently the New Year's Eve event in London, he graciously said 'I'm not going to tell you how to put on a show'."

"Nevertheless, we have a 3D software that enables us to present a good simulation; primarily it's intended to plot firing positions; ShowSim allows us to share our vision." It's easy to overlook that pyro experts do, in fact, have a clear idea of how a display will unfold, just that it's not that easy to convey in words, "and, of course, we never get a chance to rehearse, so inevitably it's all done on trust. The simulator is excellent for working out the speed and spread of a chase, as we did around the stadium roof; that's an 880m perimeter, too fast or too slow and it just won't look right; the detonations are timed down to 100th of a second. These are the details that occupy my mind."

Sustainability seems an inappropriate subject for pyrotechnics, but are there areas where considerations can be made? "We make a considerable quantity of fireworks at our own facility, so they're not being transported halfway round the world. More importantly, we are engaged in the early stages of changing the chemistry, developing colours that allow us to use chemicals which are more environmentally

friendly. We have already removed plastics from all our products and replaced them with cardboard, though that was more a health and safety consideration when we did it - better that pieces of soft cardboard fall from the sky than bits of hard and sharp plastic."

"The extensive brief and outline of how the show would unfold given to us by Danny Boyle has proved very useful for us. Because pyro is hazardous, we are generally located well away from everyone else. We do run stuff around the roof, for example, but we find all the other contractors are very sensitive to our needs and where we run cables, nobody else does. Knowing the show narrative from Danny's outline was also very useful from the creative perspective of the display; in that sense LOCOG, Ceremonies and everyone involved has been very supportive."

[www.kimboltonfireworks.co.uk](http://www.kimboltonfireworks.co.uk)

### FCT Flames: Keeping the fire alight

More than most companies mentioned in this article, the activities of FCT Flames are not typical content for LSi magazine. Yet the fact they contributed so fundamentally to the central focus of the entire opening event surely qualifies them. With their head office in Adelaide, South Australia, they will also be an unfamiliar name to most readers. I spoke to their project manager, Andy Brown.

"FCT Flames has been involved in flame features for many years but our first major event on the world stage was the 2000 Sydney Olympics. Since then, we've been involved in many other games throughout the world at Olympic level, and regional level events such as the Asian and Pan American Games."

It seems somewhat fatuous to pose the 'sustainability question' to a company with a speciality in burning gas, but as we'll also discover with the pyrotechnic contributors, sustainability permeates the most unlikely of places. It's apparent from Brown's reply that his personal commitment extends beyond the issue of FCT.

"Sustainability is obviously a main factor, not only of the Games, but for the future of the planet. With FCT Flames' contribution to the Games being the supply of the burner and its control system, that's what should to be considered here. We have spent a fair amount of effort to ensure that the parts were not unique for this event and can be utilised on future projects; that was if they were not able to be returned after use by rental agreement or similar. So our focus was to start with rental options as a priority by not introducing new parts that had to be made specifically for us to use at this event. Failing that, we had to select items that were usable by FCT group on future projects."



# Source Four LED

ETC's latest layer of light

WINNER OF THE ABTT 2012  
LIGHTING PRODUCT OF THE YEAR AWARD



An LED profile spot that's worthy of the stage  
[www.layersoflight.com](http://www.layersoflight.com)

Stop by PLASA to have a look  
Earls Court, London  
9-12 September, Stand 1-G39

Photo: Ala Lloyd



The reputation of FCT is founded on burner design, they have a track record for producing very effective and visible burners that work in a variety of climates, hot and dry, humid and tropical, cold and wet. Even so, contending with Heatherwick's unique cauldron design brought its challenges.

"The burner and its control system were the scope of FCT Flames supply, but as in any Games application, without a feature to display the flame it might not look that impressive. Here we worked closely with Stage One Creative Services, and this has seen a new partnership grow. The team at Stage One have been great to work with; they're friendly, enthusiastic, quick to respond, and very accommodating of the different time zones when communicating. They also appreciated the significance of our burner constraints - not only the size, shape and weight, but also the inclusion of gas pipes and electrical cables - into their rendition of Heatherwick's masterpiece. The path of integrating the burner and its control system into the automated petalated bowl of the final product was negotiated and navigated with great care from both sides of the world; the attention to detail was immense. In managing that process we've had a few visits to Stage One, along with emails, phone calls, sending samples between us, and weekly conference project meeting to monitor and manage various activities."

Unlike most Games' cauldrons, the London Games saw a defined ignition sequence: this was a major contribution to the drama of the occasion and thus required some close attention. "The electrical tender that resides below stage alongside Betty, as Stage One has named the cauldron, is our control centre. Each of the 204 burners has an individual burner controller, signal and ignition, and are continually monitored. We have developed a control program for the lighting sequence which not only includes the sequence for lighting, but also the

monitoring for flame presence and re-light if required. As you can imagine, if the wrong burner lights at the wrong time it will be clearly visible during the lighting display. The flame is the life or breath of the Olympic spirit and must be kept alight at all times until the close of the Games, so we've integrated an LPG (liquid petroleum gas) back-up system in the event of mains gas failure to keep part of the flame lit."

As Stage One pointed out, it was not possible to test the cauldron till on-site rehearsals began; when asked ahead of time what he thought about that, Brown was unflappable. "Working on high visibility projects like the 2012 Olympics has been very exciting. You're always aware of only having one shot, so it has been important to keep great communications and working relationships with the whole LOCOG team to ensure the success of the project."

Brown concluded with the comment that defines perhaps the hardest aspect of working on these projects. "At the same time we've had to keep the grand plan under wraps so it is not revealed to the world before the opening night." He was not alone. [www.fctflames.com](http://www.fctflames.com)

### Quantum Special Effects

**Shaun Barnett is managing director and SFX designer for Quantum Special Effects.**

"We supply and fit the waterfall cascade effect on the flown Olympic rings. As well as spark-producing devices firing as the rings moved and merged, we fire 92 thirty-second gold falls and 45 twenty-second silver falls on each ring. We buy all our pyrotechnics from US manufacturers: RES supplied the silver falls; all the rest were from Ultratec. Ultratec has gone a long way to be green, and to our knowledge they are the first to remove many of the noxious by-products of the burn.

"Howard Eaton's cladding for the rings accommodates our pyros securely, using an R clip, the holes for each stick are countersunk into the fibreglass. The ring ignition system is self-contained and battery powered within the ring, we fire them remotely using a wireless system. Traditionally the pyros would be linked by bell-wire, but we use a three core 1.5mm/sq TRS, a more durable and re-usable product. The Galaxis wireless firing system we use has been adopted pretty universally across the industry: it's well-proven, safe and reliable. That said, we are obliged to build in redundancy, so there are two wireless trigger systems operating on different frequencies.

"We have other involvements in the effects of the opening. 'Smoke-filled bubbles' is literally that, we have developed our own machines that can produce a smoke-filled bubble up to half a metre in diameter. The large flame effects you see are also ours. Again, this is a system we built; the Spitfire flame system uses a liquid fuel which, unlike Propane, is heavier than air and therefore much less susceptible to wind. It also burns extremely hot; we believe every spectator in the stadium will feel the heat as they fire; there are just 12 of them positioned in the meadows around the stage.

"Finally the 'shock tubes' - the concept is that they recreate the impression of electricity flashing down a wire. You will see them for the world-wide-web sequence, to evoke the world's first ever transmission of data from the house. They are a simple mono-filament type line, hollow and internally coated with powdered aluminium; they burn at 2,000 feet per second and we're bundling something approaching 4km into a 70m braid to produce that pronounced pulse. We have actually spent a lot of our own money developing this - far more than the revenue from the event - but we believe it's a unique product."

[www.q-sfx.com](http://www.q-sfx.com)

THE END