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360% for 360°

Steve Moles reports on U2's latest touring extravaganza

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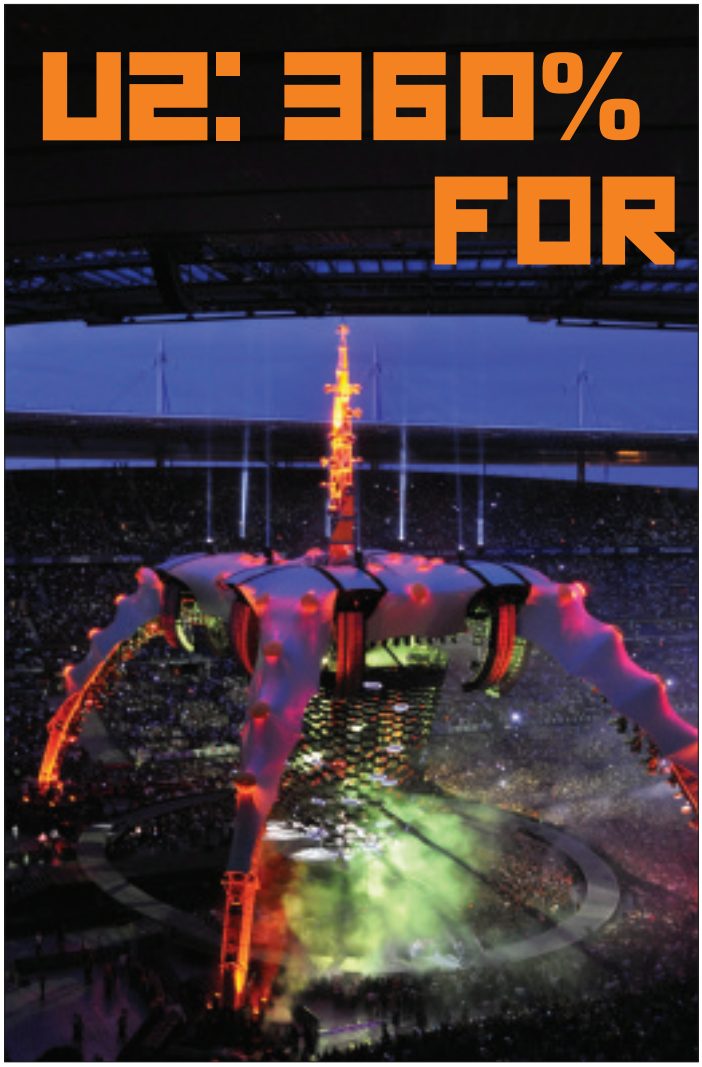
"The mind boggles. You might carry 120,000lb of equipment for a major show - we've got four times that. That's the commitment to 360, and it takes 360% from everyone to make it work."

Jake Berry, production director

Continued >>>

U2: 360% FOR 360°



Steve Moles reports from the Stade de France, Paris . . .

The U2 360° tour lays down a gauntlet for the industry. This show, just three gigs in when I saw it in Paris, displays absolute maturity of design, thought through in every detail. Not just the major disciplines - sound, light, video and staging - but even the less glamorous details - barriers, decking and power.

To view this show is to be overwhelmed. There can be hardly a member of the audience who hasn't seen the structure beforehand somewhere on the Internet, yet the first sight of what Bono calls "our Space Station" still takes your breath away.

I had thought to compare the show's grandeur to an Olympic opening ceremony, but that's an unrealistic comparison: this is an entirely different context, and it can be compared to nothing. Frankly, we've never seen anything like it. It is a towering achievement for the band, Willie Williams, Mark Fisher, Frederic Opsomer, Jake Berry and every single contractor involved. All are to be congratulated.

360° in broad brush strokes . . .

The four legs of the 'Space Station' or 'Claw' structure span an area roughly one third of a soccer pitch and support over 160 tonnes of equipment. There are three of these structures, leap-frogging from venue to venue. The universal show, common to every venue, currently takes 42 hours to load in. That will shorten, but at this early stage on the tour, it's tough as hell.

The LED screen you see hung within is - in true U2 fashion - an entirely new development, matching a totally flexible pixel system to a transformable structure. Jaw-dropping to view in motion, staggering in its engineering complexity, it is the perfect counterweight to the Claw's massive presence. The stage below, ringed like Saturn, is dwarfed by comparison, yet is larger than any stage set ever toured by a rock band.

The PA, effectively two stadium systems, breaks new ground by resolving a dilemma; how do you fly line arrays side-by-side without seriously compromising the sound field? Lighting features just one type of moving light; is physically never closer than 30 metres from its target zone on mainstage, yet embraces every corner of the stadium.

All these major elements conspire to produce a show that engages every audience member directly, no matter how remote - the '360' ethos; there is not a bad seat in the house. Frankly, the nosebleeds are in many ways the best place to be to view the full majesty of the show. This is the towering achievement of Williams' conceit; it's his major collaborator Mark Fisher who best describes the evolution that followed William's original idea.

360° Crew Credits:

Production Director: Jake Berry

Tour Director: Craig Evans

Show Designer/Director: Willie Williams

Production Architect/Designer: Mark Fisher

Video screen concept: Frederic Opsomer

Video screen kinetic design: Chuck Hoberman

Video screen technical manager: Richard Hartman

FOH Audio Director: Joe O'Herlihy

Video Director: Tom Krueger

Lighting Director: Ethan Weber

Lighting Associate: Alexander Murphy

Lights Crew Chief: Nick Barton

Sound Crew Chief: Jo Ravitch

StageCo Crew Chief: Johan 'Bellekes' Van Espen

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Mark Fisher of Stufish: The Architect

The structure permeates every conversation you have with this production team, and every story embellishes the previous one, so I was extremely grateful to Mark Fisher for presenting the most coherent and sober assessment of its evolution.

"The Space Station has its basic story in New Zealand," begins Fisher. "We were at the end of the *Vertigo* tour and Willie Williams had the inspiration. We had played arenas in the round during the tour and the question was, how to do it in stadiums? Willie's insight was to make the structure much bigger, so the audience were inside it. As an example he presented us with a picture of the Theme Restaurant at LAX. He showed it to Hedwig [de Meyer of Stageco] and Jake [Berry, production director] and both nodded 'yes'. I sketched off that picture something rather different."

The Theme restaurant is straight off the pages of 1950s sci-fi. It is, upon closer examination, a pair of arches, an architectural device as old and strong as history itself. "But our structure is a truncated arch, with the top removed; the points where the 'hips' are, where the arch tops off, you get huge forces to resolve," explains Fisher.

Fisher worked backwards from the practical considerations of touring to determine the critical engineering of the structure: "We knew to sketch the trusses to one half the size of what will go in a container [45ft sea container]. Then we chose a tube size that would work. The truss also had to be big enough to walk in and store equipment; more than 50% of the truss floor is used."

Engineers among you will see immediately that forces at the top, once managed, are then transmitted down the legs to the ground.

Stageco's solution there (see elsewhere) is more mundane, but no less effective.

"That West Coast Modernism was part of Willie's early vision, so it was fixed from the onset that it would be smooth skinned. At first it was conceived as a hard skin, though it was in the back of my mind to do it tensile; besides, hard covers just took up too much space for transport," continues Fisher.

Fisher's elegant solution for the skin was the 'Polyps' (see photos): the orange domes push out from the surface, providing a tensioning force to the skin in all directions, but the unbroken smooth surface is lost. Fisher says: "Presenting the idea to the band did distance us from the original idea." A potentially contentious moment, I ventured? "I wasn't nervous. The band wanted to be able to say it looks like something: with such things you have to consider it like

a journey where your job is to make sure all the travellers are comfortable. We ended up with something that is not a copy."

He adds: "It's a very collegiate process and we all have to be comfortable. They, the band, have never back-tracked, and we needed the time that allowed."

It's not uncommon for clients (fickle rock stars) on evolving projects such as this to frequently back-track: 'Let's look at that another way,' they might say, to avoid making a decision. U2's willingness to progress allowed enough time to solve the immense logistical and engineering challenges ahead. From the many conversations I had it's all too apparent that, had they blinked, we would not be seeing this today.

Fisher continues: "Next came video. Initially, the idea was to project upon the audience, maybe 48 large format projectors. That came from what Willie had done so beautifully on the *Elevation* tour. Apropos of nothing I sketched the video screens used indoors for *Vertigo*; you may recall the Mi-Spheres were invented for that tour? I sketched a cube of those video balls above the stage; Adrian Mudd, who does all the animation at Stufish said immediately, 'that isn't going to work because you'll never know its 3D'. He was right - we all went to Fred Opsomer's warehouse to look at a mock-up, and it didn't." (Opsomer is a blue sky thinker in the video world: see elsewhere for his contribution.) "So next I sketched 2D roll-up screens under the legs."

In view of what's hanging above stage now, a 2D solution sounds a poor substitute: fortunately, Fisher was busy with two other projects that influenced him heavily. "One, I was working in China with Fred Opsomer to do the floor of the Birds Nest", for the Beijing Olympics opening ceremony. "And secondly I was working on expanding/contracting screens for a building in Las Vegas for Steve Wynn. Chuck Hoberman was involved," Hoberman specialises in transformational structures. "So, over a few beers in a bar in China, I mentioned Hoberman to Fred."

From this came the expanding, inverted, cone-shaped screen. "Chuck made a proposal to Fred, I did the cone, and things then fell into place fairly quickly. By March 2008 we had the CAD renderings, and the dimensions of those original CAD models are pretty much within a metre of what we have now. This was fed out to Stageco; trucking estimates were made - that's when we did the tensile cladding - and by the end of April, early May 2008, we had the complete proposal in place. Then the band went on holiday and it wasn't until the first of September that Willie got acceptance."

Richard Hartman: The Practical Engineer

"The screen is the project of Innovative Design, Frederic Opsomer's company, but there were many other people involved, myself included. There are 477,000 pixels individually placed," says Hartman. Each pixel is mounted in groups to a tile; either triangular or square, multiples of these two tile shapes form the slightly flattened hexagonals that make the screen. These in turn mount to a lattice of pantographs that expand to form the inverted cone basket shape you see in various stages in the photos. Compressed, the screen is 7 metres deep; extended 22m.

"Hoberman Associates in New York have built a reputation for conceiving transformable structures; it was they that conceived the Iris device you will have seen used for the Winter Olympics in Utah 2002. The engineering on the scissors/pantographs was verified by Buro Happold; it's a very complex structure mechanically, as I'll explain. But to continue the history, the pixels are Frederic's design;

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Compressed (left), the screen is 7 metres deep; extended (right) 22m.

he developed them for Barco. They differ from other products in that the circuit boards live separately from the pixel cluster."

Hartman is routinely engaged by Opsomer to make his creations tourable in a practical sense, the weather being one of the major considerations. "We have already experienced a problem with weather in Milan, but not too serious," said Hartman. The second show of the tour, Milan was everyone's first move as the opening show was staged at the rehearsal venue - so a hell of a place to encounter the first problem. "We had two rainstorms, the first very heavy but vertical, the sort of rain you get in Singapore during the rainy season. That we survived. The second was accompanied by high winds. We have rain proofing in the trusses where the main screen electronics live; the vulnerable point proved to be the exhaust fan ports: fine when they were running, but when we switched off overnight the wind was strong enough to push the flaps, this in turn led to six racks flooding. However, we stripped them out, dried them off, and to our amazement the whole lot worked again, so no damage done."

Having worked with Hartman myself in '89/90 I can vouch that this man is unfazed by adversity. He may sound a little off-hand, but the fact is he's one of those people with two brains: one thinks laterally and solves problems by approaching them from unexpected angles, the other is entirely rational and rolls up it's metaphorical sleeves when the going gets tough - just one reason why Opsomer has engaged his services since '92.

Screen Load-In & Assembly

Since rehearsals drew to close in Barcelona, rumours have been circulating the industry that the screen is the biggest, slowest problem for load-in. Look at it closely and immediately the difficulties are apparent. It's not just an inverted cone with the tip cut off, it's also an ellipse in plan view, mimicking the shape of the stage, rather than a simple circle. As a 3D structure that's complex enough - add the ability to expand and a whole bunch of conflicting forces begin to weigh upon it.

"The screen modules weigh about 400kg each," Hartman began. "They cannot be manhandled. We examined two routes to mounting them; a modified powered pallet truck or a counterbalanced machine handling-device; the sort of thing you see in automobile factories for assembly line workers to precisely manage heavy parts placements, like lowering the engine into the bay. I would have gone for the latter,

because it gives the human direct control, it's natural and intuitive. With a forklift you have to shift the load right a bit, up a bit, tilt a bit, out a bit, down a bit, just to locate the screen module in what would be, for a hand-manipulated motion, one single, fluid movement. But U2 has employed powered pallet trucks before on tour so they're a known quantity. The trucks are Italian; we had them modified in Belgium. The trucks perform all the motions described above and have side shift."

"There are 24 columns of scissor mechanisms, with 19 modules in each column (5, 5, 5 & 4 in A, B, C, & D tiers respectively). To assemble we first hang the centre front and back panel, then four pallet trucks work outward in each direction from them."

It's tricky: no two panels are the same and the scissor arms are different lengths. It locks together with pit pins; Hartman introduced a small hand-operated pin extractor to shave seconds off the load-out regime. "We're getting faster, it's a matter of learning to drive the pallet trucks, and the guys are getting better already." Nine hours is assembly time, Hartman expects it to reduce to at least eight before long.

"Frederic got in touch with Hoberman's after Mark Fisher suggested them to him. Innovative Design drew it up and applied the roadworthy aspects to the electronics. It's 52 tonnes in total, including the drive racks above and the custom truss from which it hangs."

The whole assembly - truss, rigging and screen - is entirely self-contained, hanging from wire winches, so the screen complete, in whatever state of extension or contraction, can be lowered or raised. "There are 40 chain hoists [Kinesys Evo - a mix of 1 and 2 tonnes] powering the extension movement, eight large drum winches for raising and lowering the whole structure," says Hartman. "The structure is tiered, four layers with A at the top, D the lower section. For various complex reasons the C tier hangs from 1 tonne motors. One of the critical areas is when contracting the scissor joints, it's vital that one tier doesn't rise quicker than any other and take on the load of the tier above.

"The 2 tonnes are in sets of eight per tier; the 1 tonnes hang in intermediate positions, 16 of them. The algorithms to shift this thing are complex to say the least. We also have protection codes in the Kinesys commander [K2-3D software] to prevent the overload potential. The drum winches are, of course, also on load-sensors: the inner four winches, those physically closest across the narrow sides of the ellipse, carry more than the outer ones. If you look to the top of the screen you'll see it's actually saddle-shaped in the horizontal plane, again that's for reasons of movement; the fact that it extends makes that top edge shape advantageous.

"In the short time we've been using it we've been able to relax some of the sensing limits. It was always envisaged there'd be some adjustment, so we started with extreme limitation and as we learn how it behaves we're able to adjust the tolerances on moves," said Hartman.

I spoke briefly to Raffaele 'Raff' Buono who controls it: he's sanguine about the complexity of the beast: "The Kinesys K2 is just following a chart," (of plotted coordinates that have already been calculated. Hobermans provided a spreadsheet to import directly to K2.) "It works fine, though like everyone else when we first encountered it in test, rigged at the Sportpaleis in Antwerp, it looked scary."

It also makes a pretty appalling noise when you shift it, but who cares? The important thing is that K2 provides millimetre accuracy, and Kinesys developed sophisticated algorithms to keep the real-world hoist control matched to Hoberman's calculated chart.

"Then there's alignment cones and hub stabilisers on the scissors," continued Hartman. I'm not going to go into the full description, but

consider this about scissor mechanisms and you'll get an idea of the challenges. Think of those joke extending devices with a boxing glove on the end, so beloved of cartoonists: the multiple scissor joints facilitate extension, but laterally they are inherently weak - extended with the scissors flat in the vertical plane, no problem, but with the scissors flat to horizontal, the tip will droop. The cone shape of the screen tends to want to bow out or in for the same reason. These are difficult forces to imagine. Fully extend the screen, place an indestructible balloon inside the cone and inflate, the sides of the cone would bow out. Got that; now think about the electronic circuit boards and the tile-mounted pixels beyond them that have to live upon the surface of this unstable mechanism.

"We allowed 2mm of clearance between the electronics and the mechanics," said Hartman nonchalantly. Yes, and there are little tiny wires in there between the electronics and pixels. Oh, and of course the tiles have to remain horizontally aligned throughout expansion and contraction. Who'd want to solve these problems? That's what Hobermans and Innovative Design have achieved.

Nick Barton: Lighting Crew Chief

Lights are mounted all over the Station, and most of the control electronics is sited in the Stageco main trusses above: not quite your normal stadium rig? "It's been well thought out," says Nick Barton. "There are two lifts to take stuff up into the octagon that forms the structural hub of the beast. We have dimmers and distro' up there. Yes, dimmers - the spine is full of DWEs and there are lots of bulkhead lights. Everything has to go up in order, there's no space up there to swap stuff around.

"Putting the eight Big Lites on the roof is one of the most time-consuming jobs, here we had a 40m jib crane, which meant moving it five times to get the lights up there: with a 52m jib you can do it from two positions. It took Blaine Dracup five hours in total."

"Andy Beller looks after the Spine," (built by Brilliant Stages, it's more commonly referred to as the 'cigar'). "It's assembled top down, and hoisted up into position." In fact it climbs itself, getting re-rigged as it passes the upper limits of the Station so that a good 20m protrudes above the Station. "That goes on while the screen is constructed around it, so you can imagine the restrictions that places on everything: Andy has smoke machines, Bad Boys, bulkhead lights, DWEs, bloody big ripple lights built by Specialz, Sodium floods, and a bunch of Atomic strobes to fit in and on it."

This spine lighting system is architectural in function, it's the sheer horsepower of the PRG Bad Boys, DWEs and the 6kW MSR Ripple lights developed specifically for Williams by Specialz that make it work. A huge, decorative indulgence, it's one of the elements that make 360° such a great show for every seat in the house.

Barton continues: "Alex Murphy calls the spots and runs all the deck LED clusters. A Belgian company made the U2be [pronounced 'you tube'; they may live to regret that name] colour changing LEDs in the Polyps which Alex also runs."

The Polyps themselves are from Steel Monkey; the U2bes were developed in the US by 1212-Studio. "There are LEDs in everything, all over the decks, the bridges, even in the handrails of the bridges. Andy uses a PRG M-Box Extreme media server to run the LEDs."

Just two of the PRG Bad Boys in situ at the Stade de France.

Top: Ethan Weber.
Above: Alex Murphy.

Ethan Weber: Lighting Director & Alex Murphy: Followspots

Ethan Weber runs the show for Williams: "I worked with Willie on the band's 3D video, and we got on, so here I am." An understated explanation; if you take Weber's proven track record running shows for the likes of Patrick Woodroffe on the Rolling Stones, then "we got on" alludes to an intense level of collusion required on mammoth projects.

Weber has two grandMA full-size consoles, while Murphy has two GrandMA Lites for the LEDs. "I'm now down to 21 followspots", Murphy interjected. Spots are a mix of Strong Gladiators in the house, and Lycians hung beneath the Station's legs. They did number 25 in all, but the tally proved unnecessary and was reduced. "Willie and video cannot stand hard edges," continued Murphy. "All the spots are used as key light, very tight. The Gladiators have sighting devices because they're so remote."

Followspots, because of the imposed key light regime, were used sparingly, but very effectively, you'd think 21 would be a blast but it was a relief to see that Bono wasn't (photographically speaking) six stops hotter than the stage around him, and the stylised video images looked gritty, super real and great because of it.

Murphy adds: "We're always trying for head and shoulders: with three Lycians in each leg of the structure I can always call spots opposite the camera position, but we do have to be careful of flare-out if it spills into the lens." Remember that the band are moving around 360° and you'll immediately recognise this is more a ballet of moving objects than mere spot calling. Murphy and Tom Krueger the video director skilfully move their respective operators into the line of action whilst simultaneously tracking the band members. It's a tour de force of technical choreography.

As with all aspects of this show, the PRG-supplied lighting rig is unique, if only for the Bad Boys. These large format moving lights, launched at PLASA 08, are the only moving heads on stage - 196 of them. A breathtaking decision by Williams, it was not taken without careful consideration: "We managed to stage a field test at Wembley Stadium during the PLASA Show," explained Robin Wain, PRG's tireless client manager for most of their major European tours. "Willie saw enough to order them then, 240 initially, later reduced to 196; manufacturing really pulled out the stops to get these made in time."

(Incidentally, those furthest from the stage receive wireless DMX signals via City Theatrical's new ShowDMX system (*see Technical Focus, L&SI June 2009*): PRG deployed four

Jake Berry . . .

• There are three truck-loads of Mojo Barrier on the tour: "One section is silver. It's the Patrick Jordan memorial barrier that we carry in memory of him," said Berry. Jordan, a popular figure in the live events industry and the MD of Mojo, died suddenly in April at just 44 years of age.

• "That piece arrived from the States just as we loaded in to Paris," said Berry pointing to the rear curved ramp that completes the ring of the B stage, "so we stuck it in straight away to give the band something new to play with." That's a telling statement: Berry and his team had just suffered two major downpours in Milan, only their second show of the tour and their first load in/out gig. By his own admission, "we were overwhelmed by it." Yet he chose to add the extra parts from Tait's on the first day in Paris, when it would be less pressured had it been done for the second show. It's decisions like that, which qualify Berry's nom de guerre of Mr Showbiz. "I'm also sending Fisher away, so he can't keep adding things," Berry added, with a laugh.

Charming Security . . .

• Scott Nichols of Sequel Tours handles all security. This charming man from Michigan made a major responsibility look very comfortable. He also made a lowly hack from England, figuratively speaking a fly on the hide of an elephant, extremely welcome. There is no substitute for ease of access; without his co-operation much of this report would not have been possible.

Audio . . .

• There are two racks adjacent to Joe O'Herlihy's matched pair of DiGiCo SD7s. Rack one has a pair of Manley Vox Boxes (Bono & back-up), two Avalon 737sps (for Edge), and two Summit Audio DCL200s (guitars). Rack two has effects: 2 x TC2290 Dynamic Digital Delay, 2 x Yamaha SPX1000 multi effects processor, an Eventide H3500 harmoniser, a Lexicon PCM70 digital effects processor, and a spare DCL200.

• i-DL speakers are the delay units for this show, a compact I5 to look at them; Ravitch says they're a new product from Clair Brothers.

• Joe Ravitch on DiGiCo's SD7. "No, DiGiCo haven't built a fully submersible SD7 - yet." A sharp reflection on the appalling rainstorms endured in Milan for the previous show, but it raised the question, has he asked them? He wouldn't be drawn. Ravitch's maniacal laugh has finally been attenuated; maybe it was the exhaustion of the tour, maybe age. It was a blessing.

Medialon V5

• A redundant Medialon's Show Control System, Manager V5, is behind the stage in charge of the control of the video playback. The Medialon Manager V5 is slaved to the MIDI cues and controls the media servers and video processors for a perfect synchronization of the video, sound and light. This Medialon system for the tour is designed and deployed by XL Video. Technical director Richard Burford says: "Medialon Manager V5 enables us to very quickly create a customized interface for the show operators."

SHoW DMX transmitters in rack-mount panels and eight SHoW DMX receivers in outdoor rated enclosures.)

The Bad Boys performed a remarkable service. Weber said: "Even at the kind of ranges we're shooting - the closest lamps are around 80 feet away - we can still narrow the beam down on the band to pin-point sharpness. I don't know any other lamp that can do that." Does anyone?

Frederic Opsomer: Video Screen Development

"When Willie first showed me a sketch of the Claw he asked me to think about it; what can we do with this? I had always had a dream about an expanding video screen, like on the screen of your PC, where you can grab the corner of a window, click and drag and expand it to fill the screen. So some time a lot later I'm in a bar in China with Mark Fisher when he told me about Jack Hoberman."

"I met with Hoberman and we agreed to set up a project." Fisher revealed Opsomer funded this development himself. "I was committed to developing a standard commercial product for Barco (the single plug-in FLX 24 Pixel as used here). It's intended for installed use on buildings or other large structures. Then at our second meeting Willie called, so we set about designing how this would work for U2, we looked at putting it around the legs, but finally settled on the centre cone. Eventually it came to a meeting between us all - Willie, Mark Fisher, myself, Hedwig, Jake; 'do we all believe this is possible?' was the question.

"There are two factors really, time and money. It was March '06; we got the go ahead in September." Mark Fisher's account (above) also mentioned this hiatus, and not without good reason: time was tight. "We had a schedule and we delivered to it, the screen went into the Sportpaleis in May '09 for testing." Barco must think themselves blessed to have a developer with such commercial awareness.

But was the U2 screen the sole impetus for the new Barco FLX LED pixel? "The way I see screens going, they will become more and more integrated into set pieces and structures. If you look at the cost of a screen and the mechanics, it's roughly between 80/20 and 70/30 cost split, with the higher costs being the electronics, so you have to recoup the development costs on the electronics somehow, hence the commercial product."

It should be emphasised that Opsomer's Innovative Design is directly connected to Barco in these commercial developments. "Every tour is a different sculpture, so you want a reusable pixel," Opsomer continued. "The pixels in these panels are 25mm apart approximately, but this pitch does vary panel to panel," but not as you'd notice. "Yes the processor has to know where every pixel is, at the front end Smasher [Stefaan "Smasher" Desmedt, video technical director] uses a D3, a powerful computer that will install 3D volumes in space." (Readers may recall this controller appearing on the Marco Borsato show last year, used for real-time mapping of video images in three dimensions. See L&SI December 2008.)

"Would I do anything different with hindsight? Technically, not really. Next we will look at making the scissors in carbon fibre, but I had just two days to

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decide that one, and we already knew aluminium engineering and what was possible. There just wasn't the time then to learn all that about fibre."

Watching it work, there is something surreal about this screen; it makes me think of René Magritte (Google his picture 'Carte Blanche' for an example of what I mean). Hobermans have enabled a magical transformational structure, but it would be true to say the screen's real magic lays in its application. It's here we're presented with transformational images. Especially when expanded, images pass like ciphers through our field of vision, at times they can appear to be free floating, transported upon the rays of light emanating from within the cone. It's as close as you can get to hallucinating without pharmaceuticals. A remarkable feat of presentation and undoubtedly the living, breathing device that makes the structure above so much more than some static monster.

Joe O'Herlihy: That U2 Sound

Any sound person worth their salt will immediately be struck by the photos showing the Clair Global PA in all its mighty glory. 'Line arrays side by side', you'll ask yourself, 'can that be right?'. Well, it is and it works. They've come up with a radical approach, though personally I believe the reason it works is more complex than they are admitting . . .

With 31 years at the helm as front-of-house mixer for U2, Joe O'Herlihy is to our world as famous as Bono, so he was the man to ask: what's happening here? "Some of the main PA is there for a physical, visual reason, to look in scale with the whole thing," he explained - a marvellously self-effacing and informative admission: the PA had to look big, anything less would have appeared ridiculous. Again, it's a statement that underscores the fully integrated approach this show has received from all contractors, including Clair Global.

I asked O'Herlihy how the switch into stadium 360° format had altered his approach to getting the U2 signature sound? "It's a huge functional departure, and it's involved a year and half's work of preparation, implementing design, maintaining the criteria. This is done under an inclusive work ethic, design is integrated into every element; the goal is to not lose the sonic uniqueness that is a U2 show. When you look at the main system and its mirror pointing to the back, there's two line arrays side by side. Everybody knows you can't do that. So we came up with the idea of splitting the signal. My biggest fear was not getting the U2 power alley - the big volumes of sound the tried-and-tested Clair Brothers S4 produces. That fantastic energy is a lot harder to achieve with line arrays."

"So the only program information going to the onstage line array is Bono Vocals and The Edge: the outer array is bass and drums. When you do that, your SPL increases somewhere between 3 and 6dB in terms of power to the system. So you get incredible clarity and definition. In the middle of last year we put this system design into various stadium diagrams and EASE modelled it to check how it would function; we used the Stade de France and Wembley as starting blocks."

The acoustic modelling was effective: the two small delay towers at the Paris show were there to fill the back pitch area and just the first few rows of the first tier; the main system carried the long (and it is very long) throw to the upper tiers and nosebleeds and was not found wanting.

"Then there's the inner ring, what I call the turbo Club", he means the audience sandwiched between main stage and outer ring. "There are BT218s under main stage with the FF2s on top to pull the image down to crowd level. Then there's the B stage ring with

72 paired S4 subs below it; that's just to get sub energy onto the stadium floor." (By 'paired' O'Herlihy means arrayed in pairs for cardioid propagation: see Joe Ravitch.)

Subs in three positions - flown above, main-stage under, and outer ring: in terms of horsepower it's immense and the potential for enormous peaks and troughs is equally huge. The complexity of time alignment to steer and manage the low end is easy to imagine; but yet again it's an essential job that takes time to get right - a commodity in short supply on this tour.

"We took the system into the Toronto Skydome for a complete simulation to figure how it would work and particularly to figure a method that would stop the B stage Sub ring emissions travelling all over the stage. Historically, we've always had problems with Sub energy, particularly around 160Hz, being transmitted through the stage. We looked at treating the stage acoustically - we had Tait Towers install a hard face panel between each BT218; there's also what you might call a floating floor in the sub-deck beneath the stage proper; both have acoustic treatment - and there are bass traps under stage as well. It's now a lot nicer for the 15 people working below."

(Dallas Schoo, Edge's guitar tech', disputed that. "Still rattles my teeth as much as it ever did," he said. But he's barely 15ft (4.5m) from the nearest BT218.)

Above: Two views of the Clair Brothers arrays (left and right), and the two DiGiCo SD7s at front-of-house (centre).

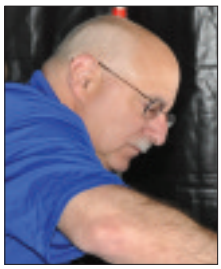
"It has helped in every way," O'Herlihy continued, "the band benefit, and mic'ing is easier. Larry has a new kit from Yamaha - long, deep shells and different wood: I'm able to get the best sound off the kit I can, really natural, great sonic value."

Then O'Herlihy made a very telling statement. "Bono has wanted to do this for 25 years. The wonderful thing is we were able to know what the complexity was before we got into it." He means problem solving in advance, things like EASE modelling - a technological advance not available when O'Herlihy started touring with U2 all those years ago - and the fact that the band must have put their hands in their pockets to pay for the practical trials. With PA, and in particular its rigging, there's no way Stageco could have built this structure without a firm picture of where the PA would hang, and how much of it.

On the Vertigo tour, O'Herlihy had a pair of DiGiCo D5s out front: now he's moved up to their new SD7 console. "The concept of the way we figured the mix structure is the heart of what the desk brings. The matrices on board means I can manipulate audio destinations in any shape or form I wish. And it's a cleaner, more efficient delivery. Five years ago I just wouldn't have been able to do this. And in terms of what the SD7 can do, it's not just a five-year advance in development; to me it's a lifetime of design, comparatively it's a great leap forward. This desk could have 10, maybe 15

years ahead of it. I spent time with Webby [Dave Webster], Bob Doyle and James Gordon at DiGiCo, and they listened. It gives me the flexibility to do absolutely anything within the 360° configuration - take a channel and put it anywhere - and nothing is a struggle."

If you consider the eight flown PA locations plus what's on the stadium floor, the zoning alone is by definition complex. O'Herlihy is using the SD7s to mix sound in the air, rather than at the desk: how exciting must that be?



Joe Ravitch: Clair Global Crew Chief

Joe Ravitch is O'Herlihy's long-serving Clair Global crew chief, front-of-house baby-sitter and system tech. I asked him to expand on the split feed PA and how the system works in practice. "At rehearsals in Barcelona we SMAARTed every inch of Camp Nou. What we have is like four arena systems combined, front, back and two sides. The basic presets are now firm, so we don't have to mess with them, and the PA will hang every gig in exactly the same position relative to the stage, so the only variable is the building. We have taken PDFs and CAD drawings of every stadium and come up with a High and Low building setting." (High/low grandstands, so gigs like Sheffield Don Valley, for example, with relatively low grandstands, will see the top cabs rigged anyway. Remember, the PA's physical presence is part of the show aesthetic.)

"It's not a situation where you can adjust the PA every day like you would on other tours. Just the size is immense. Originally they thought we'd put our amp racks in the Octagon grid of the Structure. I never thought that was going to happen, the speaker cabinets alone weigh too much. So when they said 'Oh, we're 28,000lb overweight', we put the amps down at the bottom of each leg, four carts each leg." (The amp racks all live and travel within 8ft x 4ft carts.) "All digitally driven over AES, there is also an analogue back-up. There are two DiGiCo stage racks - one takes 40 inputs and 7 AES outs, the other 40 ins and 7 Analogue outs, so each Structure leg has multiple feeds, and just two fibre lines to FOH, dual redundancy as you'd expect."

"Under stage are BT218 Subs stood on end with an FF2 for front-fill on top of each, as Joe said. The B stage outer ring has a cardioid arrangement of S4 Subs, paired inner to outer below the deck, 4ft (1.2m) apart. Each pair is on 30ft (9.1m) centres to the next, the inside ring being 4.5ms delayed and out of phase for the cardioid effect. They're all driven by Powersoft K10s - everything else is off Lab.gruppen." The Labs are a mix of PLM10000Qs and PLM14000Q: both models have integral Lake processing, a feature to be especially valued with a complex system set-up like this.

And the two line-array trick? "The onstage column takes Bono and Edge, the offstage column takes bass and drums, as do the flown [I5B] Subs. It's a trick that gives us tons of headroom and reduces distortion because line to line, you're not asking the speakers to do too many things at once."

I'm uneasy with the last part of that statement, not asking the speakers to do too many things at once, but maybe Clair's don't want to let the cat out the bag. To me that added clarity had a natural sound, almost like being in a small club, hearing the band perform acoustically. The results are there for all to hear - Bono's vocal was more distinct than I've ever heard, and the Edge could at times decapitate.

This configuration works and it has implications for every audio rental company in the market. U2 may have used a large amount of PA but the delays were tiny, just there to lift the mids and highs to the lower seats at the far end of the stadium where the curve of the

main stage arrays precluded the coupling needed to reach those seats. If the concept gains traction (a popular expression on this tour of experimentation) then we could all soon be seeing paired line array PA systems as a real benefit for managing audio at stadium gigs. In arenas it's not so certain because of cost; the issue of vertical coverage dictates lines of a certain length, nominally 12-14 cabinets is typical. Hang two arrays of such length each side of stage and you'd far exceed the power required for an arena-sized room, but apply the split signal method and the benefits of clarity may become persuasive.

Dave Skaff: Monitors & Vibes

There are three monitor men on this tour, all now ensconced below the main stage tail that leads to the (relatively speaking) backstage area. Previously they were directly below the main performance area, but the relocation affords them more space to work. The site is remote from the band, but with being onstage an impossibility, this is as good as it gets.

Dave Skaff explained how it all works and the division of labour. "Taits weatherised the decking above, and installed a drainage system that keeps our area secure and dry," he began. "The XL Video camera team supplies the vital visual link to the artists. We just take what we're given - the drums has a fixed camera, the other three feeds from FOH are a little trickier." Each of the three monitor consoles sports a wide screen video monitor with four split-screen images.

"There's a guy on the video crew who tries to give us all the four band members in shot; it's not always possible. Niall Slevin mixes for The Edge. Alistair McMillan is mixing Bono; both use a DiGiCo SD7. I have a Digidesign Profile for everything else - drums, bass and keyboards." Terry Lawless on Keys resides below stage, just downstage of Dallas, Edge's guitar tech.

"Alistair makes a multi-track recording, in fact there are four multi-tracks running, two from Alistair, one as an archive; I do one for myself as a tool for work; and FOH do their own thing as well. It's nice to have that library; for example, do I need to use processing on that new mic? It's a question I can easily answer. Monitor-wise on hardwired I've got Larry, Terry Lawless on Keys, and the drum tech' Sam O'Sullivan; they're all driven by Lab.gruppen, limited of course. There are two feeds to the drummer, the second for subs. In total we have around 60 pairs of in-ears including all the back-ups, tech feeds, and ourselves below stage - all Sennheiser G2 system. The vocal mics are all Shure wireless Beta 58s. There's also a song where Bono sings through what looks like a B52 hoop mounted hanging from a wire that he swings on. The look's important but it would have been a disaster for a vocal mic, so we popped an SM98 capsule in there and it works great."

Dallas Schoo: Guitar tech to The Edge, and repository of arcane U2 lore . . .

The aesthetic of the show has forced the back line tech's into awkward and restrictive spaces; for such a vulnerable job position - this band are nothing if not demanding of their crew - it's one area of the production that's tough for them, as Edge's guitar tech' Dallas explained. "From my position beneath the stage I needed direct line of sight of Edge's pedal board. Winky [James Fairorth] at Tait Towers saw the problem immediately he came to rehearsals; he's had built for me a step up to a downstage facing slot window onto the stage floor. I can't see Edge when he goes off around the stage, but the pedal board is right there."

Dallas has worked for Edge since 1983 and quickly learned the key to a long and successful career. He has meticulously maintained a record of Edge's every effect and guitar setting as used live at every gig since 1985, "Eight volumes of it: It's all there, I put it all on computer a few years ago." Why is it so important? "Because Bono might say to Edge, what was that sound you had for such-and-such a song when we played Vienna in 1991? I have to look that up, and I've got about five seconds to do it."

Dallas is flanked by Edge's effects rack: "This is the first time it's ever been below stage, so it's more important than ever that I get it right." He admitted that for many of such calls he already knows the answer off the top of his head, "but there's always one that comes out of nowhere".

Then there's the space issue: "This is the smallest amount of real-estate I've worked in since we played clubs." It is remarkably tight where Dallas works, but then Edge uses a lot of guitars so a lot of the cramp is from parking space. "Winky had all the changes made for me that make this workable, they cut the side wall off the staircase so I can jump onto it from here and be onstage that little bit faster." I lost count of the guitars down there; Dallas said he makes something like 43 guitar changes for this show in Paris.

Stage set: Main elements

Camera tracks and cable management

There are camera tracks affixed just below the deck on the outside edge of the main stage and B stage ring; the track also doubles for cable management for the cameras. The outside edge of main stage also carries a comparable tracking device that carries the power and control for moving each of the two bridges. I spoke to Jeremy Lloyd at Stufish who was heavily involved with Mark Fisher in this production. "The camera track is an amazing piece of work on its own. It's very tight in there, in terms of geometry it's a very good use of space, and the clever part is just how quick and easy it is to install."

I asked Matt Hales (*pictured left*), Tait's project manager for the stage set, to give me a guided tour. "It's Harken track, a sailing product," Hales began, (some readers may have come across Harken at the ABTT Theatre Show in London in June). "It looks like a tab track, but is designed to take bearing pressures in all three dimensions."

The runners on the rib track have a ball-bearing race that fully encloses the rib (*see photo, page 78*), lubricating pressure from any direction, making them ideally smooth whatever load is placed upon them - in this instance camera cables. The Harken is enclosed in an outer track; a linear cage frame raceway that provides the runway for the wheel dollies that carry the heavier loads of cameras and elsewhere the bridge electronics. Both the wheel race and rib track have carefully engineered joints that overlap in a way that prevents any pair of bearings or wheels from crossing a join at the same time as any other pair, further minimising the possibility of jarring.

Mark Cruikshank operates camera 4 on the B stage. "On a normal tour my camera would be on a typical track and pipe dolly on the

360 Crew, continued . . .

Stage Manager: Rocko Reedy
Assistant Stage Manager: George Reeves
Production Coordinator: Helen Campbell
Prod Coordinator: Jessica Berry
Tour Coordinator: Alison Larkin
Lighting (Temp Crew Chief through Paris): Rodney Clay
System Crew Chief: Craig Hancock
Lights - Dimmers/Distro: Mick Stowe
Lights - General/Mains: Stuart Lee
Lights - Hi Platforms: Russell 'Bits' Lyons
Lights - Moving Lights: Andrew Beller, Blaine Dracup, Jake Sullivan
Lights: Chris Keene, Jessica LaPoint, Alison Triplett, Gareth Morgan, Christopher Davis
Video Technical Director: Stefaan "Smasher" Desmedt
Video content producer: Sam Pattinson
Video content: Catherine Owens
Video Engineer: Bob Larkin
Video Engineer: Myway Marain
LED Tech/Crew Chief: Patrick Van Steelant
LED Techs: Jan Bonny, Jeroen Mahieu
Camera Operators: Mark Cruikshank, Gordon Davies, Luke Levitt, Eoin McLoughlin
Video: Olivier Clybow, Tobias Kokemper, Frederik Gomaere, Jan Paulsen
Head Rigger: Todd Mauger
Riggers: Scott Fremgen, Robert Slepicka, Dion Pearce
Carpenters: Flory Turner, AJ Rankin, Gino Cardelli, Johnny Gonzalez Mendez, Andrew Johnstone, Hajime "Haji" Minatodani, Jesse Thayer, Appy Thörig, "Sox" Shewmake
Automation: Raffaele Buono, Jack Richard, Timothy Woo
Crew Chief & Drum Tech: Sam O'Sullivan
Edge Guitars: Dallas Schoo
Keyboards: Terry Lawless
Adam Clayton Guitar Tech: Stuart Morgan
Electronics Wizard: Colm 'Rab' McAllister
Bono Guitar Tech: Phil Docherty
Monitor Engineers: David Skaff, Niall Slevin, Alistair McMillian
Consultant: Robbie Adams
Sound Crew: Ben Blocker, Dave Coyle, Hannes Dander, Thomas 'Duds' Ford, Chris Fulton, Kelsey Gingrich, Pascal Harlaut, Joel Merrill, Jason O'Dell, Vincent Perreux, Jennifer Smola
Crew Chief CAT Power: Jon Boss
CAT Power crew: Dennis Crespo, Jason McCabe, Erich Nemier, Michael Tagliabue,Francsisco Reyes, Jimmy Angerami
IT: Joshua Kapellen
Frequencies: Joshua Flower
Health and Safety: Dave Wilke
Ambiance Director: James Jacques
Ambiance Asst.: Mark Caldwell
Tour Accountant: Ian Jeffery
Security Director: Scott Nichols
Personal Chef - Sweet Chili: Sandy Hylton
Catering: Steve Quinn, Franca Geppert, Joshua Ireland, Courtney Keene, Tai Lopez, Lindsay McGoran, Rob Mullen, Natalie Parkinson, Chris Ricalis, Christian Streppel, Marisa Zoccolan

Blue Steel
Site Coordinator: Toby Fleming
StageCo Crew Chief: Johan 'Bellekes' Van Espen

Red Steel
Site Coordinator: Robert Hale
StageCo Crew Chief: Patrick Martens

Green Steel
Site Coordinator: Seth Goldstein
StageCo Crew Chief: Hendrik Verdeyen

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floor," he said. "There is a positive advantage having the Tait system along the edge of stage, for one it exactly follows the curve of the stage, which is a big plus when you're following an artist. And it gains ground because there's nothing cluttering up the floor."

That may seem an obvious statement, but with so much of the audience within the confines of the performance area, not having floor-laid camera track eliminates another security barrier issue and keeps the audience closer to the band and in a coherent mass. Use dollies and a lot of the band's hopes for an inclusive 360° audience would have been dashed.

Does the track eliminate camera shake? "Not entirely, there's still a little shake, especially when the bridges are moving, but Tait's have come up with a shock-mount suspension system for the camera - a bit like a sleep comfort bed, pocket springing - and that dampens the shake a lot. We also have gyroscopic stabilisation on the Televator cameras."

The Bridges

"The bridges are driven at both ends," explained Hales. "The difficulty is that the main stage and B stage are both ellipses, but for reasons of perspective they're not regular or parallel to one another; there's actually four different arcs. So the bridges have to deal with expanding and contracting gaps between the two stages as they track around. The inner and outer bridge ends have to travel at variable speeds to keep the bridge in line."

One of the bridge drives.

There's just nothing simple about this show: what Tait's has done to overcome this inconsistency is typical of their ingenuity, in that they've made something very tricky look easy. "The off-stage end is friction driven, a big drive wheel pushes it along the B Stage deck. Within the Harken we've added a rack and pinion that simply drives an incremental encoder to provide positional information to the motion control system. The onstage end has a drive unit that connects directly to another rack and pinion; the two drives then cross-reference one another as they progress around the perimeter; the outer speeding up or slowing down accordingly. If the bridge lags for any reason - catches a dislodged flightcase from the tight storage areas below stage, for example - once it goes 20 inches out of square it shuts down."

And if you're wondering about the expanding and contracting gap between stages, the bridges sit upon free-wheeling double casters, that's a centre pivoted triangular plate, with three further centre pivoted wheels, one at each corner, below it, so the whole thing is free floating.

Stage Assembly

"In order - we build the B stage for the video crew, then the upstage end of main stage," explained Hales. The Mainstage is a lollypop in plan view, an elliptical lolly with a stem that runs to backstage. "That is where monitor world lives, so they can get set up as soon as it's built. Every part of this stage is on wheels; everything." In itself this would be normal, every arena tour these days builds the stage out in the house while the rigging goes up, and then rolls into place later, but consider this statement from Tait's James 'Winky' Fairorth: "The B stage alone has more deck sections than the whole of the stage for the last Rolling Stones tour. The main stage is over 4,000 square feet. It's the biggest thing we've ever done, yet it looks small." Look at any photo and you'll gain some perspective, the main stage is just over 25 metres at its widest, yet looks tiny in this context.

"We zero the main stage off the pylon" (the cigar-shaped vertical truss at the centre of the mains structure above) "then we use a laser distance finder mounted to the monitor shelf that surrounds the stage to fine-tune the position to known points off the main structure."

At its most distant, it's just over 43ft (13m) to the inner edge of the B stage. During the show it's not till you see Edge and Bono walk along them, and how long that takes, that you start to get some perspective on just how massive this thing is. As for the cigar built by Brilliant Stages, assembly of this elegant piece is described elsewhere, but note should be made that Brilliant have - in the fashion of this show - produced an integrated, coherent object; everything about it, the way the Bad Boys, DWEs and Ripple Lights fit, the Brilliant designed rain hats for the Bad Boys - all are of a piece. As such it's functional without compromise to its elegance.

Tom Krueger: Video Director

The inclusion of a dedicated video director is quite a departure for Williams compared to his previous two touring concepts for this band; but it's a welcome one. "My main goal is to make the band look as good as they can." Krueger has adopted a single point Key light approach, putting the band into sharp relief. "It's very challenging in 360, the wild card elements are the band and where they go. Keying from one side allows me to shoot from the dark side." Yes, it sounds like a quote from *Star Wars*, but putting sci-fi firmly aside, there is a true filmic element to Krueger's work.

"Yes it's in high contrast, but only in benefit to the artist - it's much more dramatic. I love the way it highlights their movement. Bono's gestures and the way he moves are a huge part of his performance; edge light brings emphasis. Doing the show in 360, I have to hand it to the band, they really go the extra 10 miles for the camera system, because they can't physically be everywhere at once in 360."

Krueger is relatively new to the job, he only recently met the band as Director of Photography for their 3D movie, but this is a slightly different metier being totally live. "For this I have 13 cameras," that's a lot of operators and equipment, I interject. "I would have to say Jake Berry has been very helpful in realising the camera system. It's a lot more demanding in terms of quantity and quality; these rail cameras by Tait's are very sophisticated; and I do see the difference in the image. Most vulnerable is centre stage camera on B; it has a longer lens and has to move more and faster to keep with the band; the addition of gyros has helped, that's a 10,000 dollar item."

Tom Mauger: Head Rigger (has the whole world on his shoulders)

"This is great, I've got a 160 tonnes to hang up each show, hooks the size of my head, seven and eight tonne wire winches - how lucky am I?" Mauger's irrepressible enthusiasm for the scale of rigging is infectious. "The Kinesys system is great; I've never seen anything that sophisticated before. It takes someone liker Raff' Buono to run automation like that."

If you've read of the screen, or the bridges, or considered the PA system and everything else that's hanging up there, then this is rigging on a huge scale with some extraordinary motion control; Mauger and Buono bear enormous responsibilities, yet in their own enigmatic ways, each makes light of their work. This is big work, seldom acknowledged.

Hence the reference to Berry's support; as has been hinted several times in this piece, Berry will consistently go that extra mile if he thinks it contributes positively to the show. "The thing about the rail cameras is they provide about 80% of our show; cameras one and two on the Main stage are getting images just not seen before. I've looked at all their previous DVDs and what we have here is the band looking their most flattering and heroic."

And what does Krueger think of the screen? "It's far better than I thought it would be; even when open, fully extended, it's a better image than I thought. The cameras are standard definition; the screen doesn't demand higher resolution. I find the band very exciting to watch, to anticipate what they're going to do. As they refine their show we refine the cameras so I can better emphasise what they're trying to communicate. We're learning how best to capture that now. One thing I should mention is Smasher, (Stefaan "Smasher" Desmedt, credited as Video Technical Director); he's working beside me out front with the D3. It's great for me to watch Smasher come into his own, pushing the button, to watch him refine his own choreography as he takes what I give him and makes it work on the screen. I can't emphasise that enough - he makes it work."

Johan 'Bellekes' Van Espen: Space Station builder, Stageco

Bellekes, as he is known to everyone, is one of three team leaders for Stageco, the demands of this tour dictating that three complete steel structure systems leapfrog around Europe. Looks like a tough job. "We allow a little headroom, there's maybe 170 tonnes of production loaded up there. We have 38 trucks of our own for the steel and sub stage, 20 crew plus 10 drivers who rig.

"The set-up is simple but lengthy. First we build the octagon, that's the ring of large trusses that form the top of the structure. Then, at

the four corners of the octagon where the legs attach, we build eight standard Stageco roofing towers in four pairs, two either side of where each leg will stand: these we call 'portal towers'. It means that as we add the leg sections to the structure we can make a synchronised, controlled lift of the whole thing. In build terms, putting up eight towers is like building for a regular stadium show, just to get the structure up. You couldn't do it with cranes - there aren't enough venues where you can get that many cranes in for a start, and it wouldn't be safe to try and raise it on four cranes. Once it's up you have to dismantle the eight Stageco towers, only to have to put them up again for the load-out. Each main leg has a load capacity of some 70 tonnes."

The legs taper down to ground level, where they join to a fairly hefty ground block: even so the load transfer down to the leg must place enormous pressure at the base of the tower, how is that managed? "We have very big base plates, 6m by 6m, then we have Dywidag links diagonally across to stabilise between towers."

Dywidags resemble lengths of steel reinforcement, the sort of steel you'd see being wired into frameworks for say, the construction of a Motorway bridge. These particular items are about 30-40mm in diameter, have a coarse thread on them, and span across the base area with a turn-buckle type device to tighten and load. "We fit these when the whole structure is still hanging off the eight Stageco towers, before we lower it to the ground. In total it's about 42 hours to put up, but that's broken over a longer period, slightly less to get it out. It's new, it's a challenge and we're enjoying it."

Bellekes is typical of the Stageco mentality, his response to the structure is measured: to him it's an engineering job, nothing more and nothing less.

The structure is of course, prone to natural forces, wind being the major one. "We have slosher tanks up there to dampen movement, one in each corner. They hold 1500kg of water; each tank is compartmentalised so the water moves in measured fashion." Slosher tanks are a simple, tried-and-tested method for stabilising significantly heavy structures.

Tour vendors:

Primary Steelwork Fabrication: StageCo
Main Stage, "B" Stage and Bridge Fabrication: Tait Towers
Video Screen Fabrication: Innovative Designs
Video Screen Truss Fabrication: Wi Creations
Video Screen Automation: Kinesys Projects Limited
Membrane Fabrication: Architen Landrell Associates
Polyp Mushrooms: Steel Monkey Engineering
Motion Control System Design: Kinesys
Cigar/Pylon/Spire: Brilliant Stages
PA System: Clair Brothers
Lighting System: PRG
Video System: XL Video

Jake Berry: Master of Ceremonies & Production Director

When I arrived on the first show day in Paris, everyone I spoke with mentioned the Hungarian team that pulls the cables up inside the legs. It's not hard to see why this falls to a special team: lighting alone has 400A three-phase supplies up three of the legs, audio has a ton of signal cable

running between amp-racks at tower bases up to the PA; but that still leaves the question, how did a team of Hungarians cop for the job?

"The question was how long would it take to get the cables up and down the legs?" replied Jake Berry. "We knew we'd get local crew to do it, but until we got to Barcelona for rehearsals we didn't know just how tough a job it would be. We quickly decided we needed our own team to do it and someone suggested the local stage crew out of Budapest. I called them up and we have 12 of them with us and they've proved an absolute God-send."

There was no shortage of production crew people willing to endorse Berry's statement: Nick Barton for PRG was typical: "They're absolutely brilliant, it's a lot to haul up and yet when they're done they just get stuck in and help with everything else." Being married myself to a Hungarian, I can only agree - marvellous people.

"They deal with every cable you can name," said Berry. "In that one decision we took away a headache that in turn left people free to be focused on what we pay them for, their technology. They're brilliant; I take six of them and do the back line, and it's great because I don't have to watch them, it's not like a bunch of locals asking for guitar picks or drum sticks."

The fact that Berry supervises the back-line load-in caught my attention: on Saturday 11 July (show-day one in Paris) I'd spoken briefly to him and he told me, "We started load-in 3am yesterday." Berry hadn't left the building since; his assistant production coordinator Helen Campbell told me he'd slept a few hours on a first-aid gurney. Yet just a few hours later that day I saw him backstage organising the strip-out of opening act Kaiser Chief's stage gear during changeover. The following day I caught him helping to load the Kaisers' truck: shouldn't he be in the office resting?

"Yes, every team has a leader but that's what we are, a team and I like to be amongst them." Look closely at the photo of him sat between Opsomer and Fisher and you'll see a man smiling, but you can also see the fatigue of long days and heavy responsibilities: he is a remarkable man with an insatiable appetite to make this work.

"You look at our show here; at a minimum we've got at least two of everything, two PAs, two camera systems, double the normal number of followspots. Our B stage has more decks than Bridges to Babylon [Rolling Stones] - shit keeps coming!" He refers to the endless procession of equipment loading in. What's his measure of the logistical challenge?

"The first two moves have been f***ing overwhelming. My lead truck driver now travels on the bus with the crew because he has so much to keep on top of he doesn't have time to drive the truck." And the secret to managing such an unbridled beast? "Getting people involved: I wouldn't tell Willie Williams what lights to use, or Joe Ravitch and Clair Brothers what PA to put in. When

Bono came to us four years ago and said, can we play stadiums in the round? I thought, yes, a roof in the middle of the pitch with a few runways - not this! The commitment of the vendors has been unbeatable, Brilliant, PRG, Barco, Taits - everyone: but Stageco especially. I don't think there's another company would have done it, or even could have."

Just how much kit is there? "The mind boggles, you might carry 120,000lb of equipment for a major show, we've got four times that. That's the commitment to 360, and it takes 360% from everyone to make it work. I knew we were in for a hard start when I found myself eating lunch in the sunshine at Barcelona during load-out, the day after the show. The thing about this production is problems compound very quickly, one thing slows you down half an hour and half a day later you've lost six hours. I initially thought '36-hour set-up? no problem'. But we even take three truck-loads of Mojo Barriers and our own stadium flooring [from Germany-based EPS AG] with us, three sets of 6,000sq.m. More work, yes, but another God-send because you know what you're going to get and you can rely on it. If we'd allowed the local promoter to put down plywood in Barcelona we'd still be loading out now."

And what is it that keeps Berry motoring along? "I've lived the dream for 30 years - and now I'm seeing something different. It's a huge thrill when you see the show happening." Different, and has that changed his approach? "Process is no different to other productions, just more of it. We deliberately said no to 150-tonne cranes because it would have severely reduced the number of venues where we could play; the Nou Camp in Barcelona, for example. Yes, we could have done the Olympic stadium, but Nou Camp was better for vibe, and a better stadium," especially since Berry paid for the roadways in to be tarmac'd. "You pay for that vibe, no one relished playing there. But it was the best place for the show." Now there's a statement to savour - 'the best place for the show' - and that's the thought Berry keeps closest to his heart.

Conclusion

I've heard it said by many who should know better; that we'll never see it's like again. Well maybe not precisely, but don't be surprised if this scale of presentation is repeated somewhere, sometime. You only have to study the grosser indulgences of the Roman Empire to know that the thirst for ever-greater spectacle was never quenched. Such is the complexion of a decadent society, and the West is nothing if not decadent - ask Bono.

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