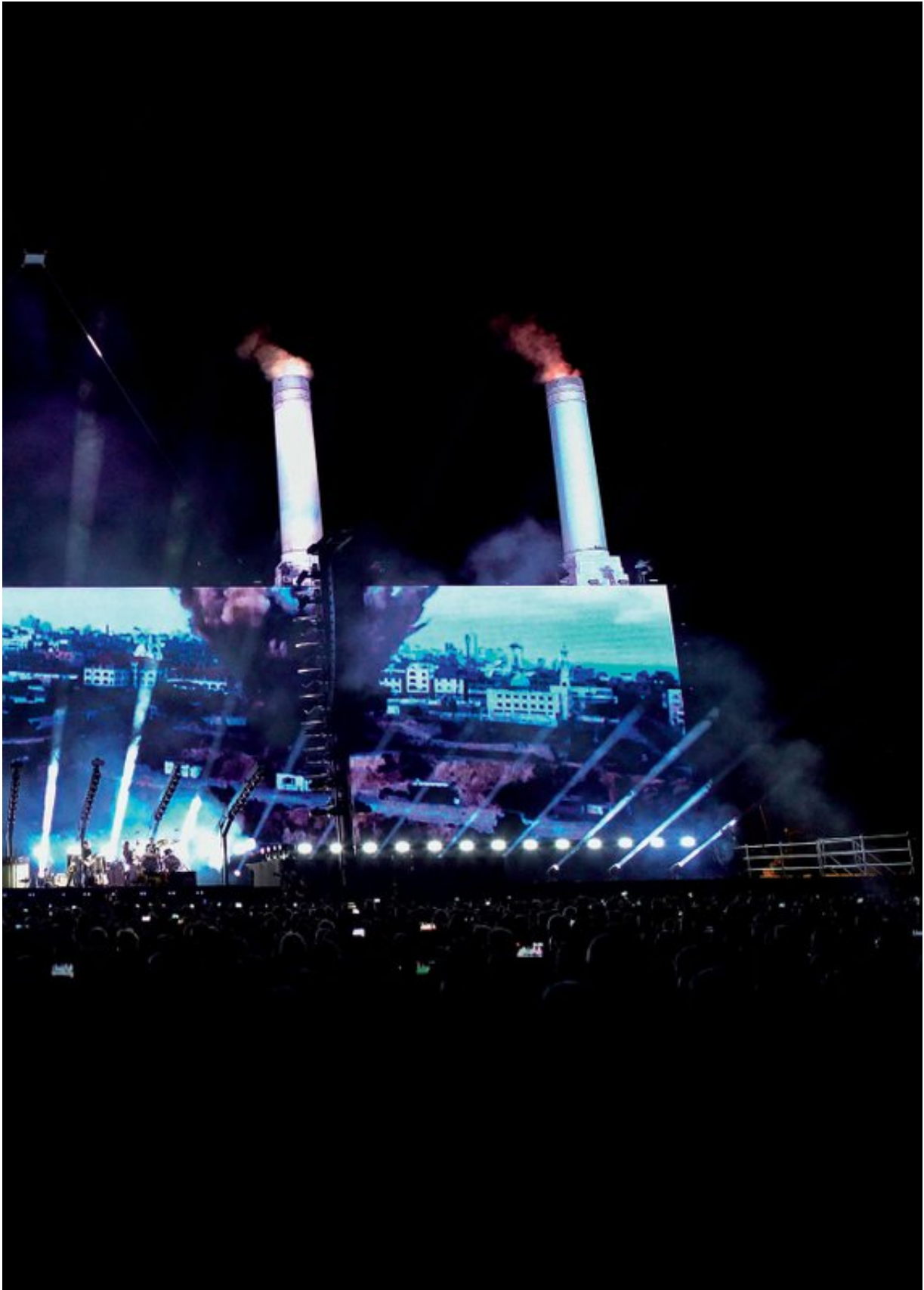


Roger Waters: Us + Them

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ROGER WATERS: US + THEM

“To be part of the realisation of his vision over the course of almost the last 20 years has been a huge honour and privilege which will never be equalled.” Richard Turner, Video Director



PRODUCTION PROFILE

The latest Roger Waters' touring spectacular, Us + Them, - named after the 1973 Pink Floyd song that featured on The Dark Side of the Moon - played in arenas around the globe before evolving into a huge outdoor production, which came to monumental fruition in Italy. TPI's Kel Murray visits Rome's Circo Massimo for the technically ambitious, theatrical gig, which was staged in monumentally historic grounds...



ROGER WATERS

There are few British rock legends who rose to fame in the '60s and continue to tour today, let alone with the magnitude and stamina of Roger Waters. Following an indoor arena tour which started in North America, the production then headed to Europe, via NZ And Australia, for the Lucca Summer Festival before upscaling further for Rome's Circo Massimo (Circus Maximus) and its audience of 65,000 fans. The outcome did not only deliver awe-inspiring technology in a

juxtaposing event space, but was a team effort - delivered seamlessly in 36°C heat - led by a hearty dose of calmness and clarity.

TPi began the story with the man at the top, Chris Kansy. "I've been a Production Manager since the late '80s, but I actually wasn't aspiring towards the role at all. I was working for Joan Jett and The Blackhearts, doing club shows as their guitar tech, when one day their Tour Manager said "Chris, you're the Production Manager now. I told him that I didn't know what that meant!

"Essentially, I became a Production Manager before I even knew what one was." Ah, the 80s. Where rock 'n' roll dreams were plucked out of thin air and thrown at full speed into a guessing game of how to tour. "I worked with the support acts for Metallica and Mötley Crüe under Jake Berry, so I learnt how other people did the job, and kind of figured out my own style." When production managing a gig of this size, and of this calibre - not to mention in said testing weather conditions - experience must go a hell of a long way? "Yes..." he continued. "Although, I'm still trying to figure things out!" he laughed. "Roger hadn't toured in a long time when plans for a live production of The Dark Side of the Moon were talked about 12 years ago, and that's when we began working together. It was supposed to be a 6-week tour and ended up going for 2 years. He's always in demand.

"Andrew Zweck, Roger's Tour Manager & Director, called me once again and said 'I think we're going to tour The Wall next. A lot of the old crew came together; (the late) Mark Fisher, Marc Brickman and a lot of the people who originally worked on The Wall. We figured out how to produce it for touring - as the original was almost an installation - but with the help of our vendors and the genius of

Mark Fisher from Stufish, we did 220 shows over 3 years with that production."

Waters' insatiable appetite for performing live continues, and before long, an appearance at Desert Trip was secured. Across 2 weekends in California, Waters joined the likes of The Rolling Stones, The Who, Paul McCartney, Bob Dylan and Neil Young for an unbelievable line up of legendary acts. The festival also birthed the creative and technical designs for Us + Them as a full-scale touring production, which officially began on 21 May 2017 and will end on 9 Dec this year. Kansy continued: "We did the Desert Trip show in the fall and then went into rehearsals for Us + Them in the spring of 2017. We've now done 130-plus shows in just over a year," he enthused.

Vendor wise, Kansy has used many of the same companies during the course of his career. "Roger is a very loyal person, and of course we have to make sure all is fair, but our vendors like working with us and they know it's a big chunk of touring work when they get the call, so they each come to the table with a viable option.

"Economics drive a tour, and if it's not affordable, you can't do it. For example, Clair Global has worked with Roger forever with that 'surround sound' ethos that he uses. I've personally done almost 500 shows with him, and it doesn't matter where we are or what we're doing, Clair deliver the surround sound he wants."

The Italian shows are a litmus test for the upcoming South American tour, which is an outdoor affair. "The arena shows we've done have meant we've used surrounds, front end and control packages all from Clair. Here, this is a much, much bigger site and we weren't touring with enough surround sound, so we've also employed the services of Britannia Row Productions, now part of Clair, to do

surround sound and delays with L-Acoustics.

Another long-serving vendor is Strictly FX. "They have always done our pyrotechnics and now, our lasers. Lighting and video wise, some have come and gone here and there because of companies being bought out etc. Phil Mercer, who was originally with XL Video, and then PRG XL Video, has now started Universal Pixels, so that relationship is still going strong no matter who he's with.

"We are using Upstaging for the first time lighting wise, and the reasons for that were comfort and quality of equipment. Upstaging is probably one of the best lighting companies in the world, certainly in North America, and is right up there with Neg Earth in Europe. For Rome, we're

"Animals is a dystopian view of society, and the lyrics are oddly relevant in today's climate..."

Sean Evans, Creative Director

38

not using an Upstaging lighting system as the one we brought over from America is designed to solely do the arena show, as oppose to an open-air show. Therefore, we invited Neg Earth to come do the Italian shows before we go back into arenas with Upstaging, Neg Earth will also do all the open air shows in South America. It works out well because Neg Earth and Upstaging have always had a very friendly working-relationship.

"My relationship with trucking goes way back; I've been using TransAm in Europe and Upstaging in North America since I was a kid!" he smiled. "We know how each other think, we know how each

other work and we know how to produce good work together. Trucking is the most expensive thing we do in our industry, especially on large-scale projects like this; the miles we put in is incredible, so you need to have someone on your side. TransAm were the leaders in the sense that they said "our drivers are part of the team, so our drivers will load the trucks as part of the crew". And I love that train of thought; most trucking companies are doing that now, and following TransAm's lead. Bussing wise, in Europe, Beat The Street and now their other company, Phoenix Bussing, I've used for a long time too. I don't think there's another company that competes with the quality of the equipment they have, or the attitude of their drivers - being a bus driver can be a thankless job, but I see the true value of having a good bus driver on your tour."

The Roman show's other suppliers include Airworks, Mobile Airships and Wlcreations, which has engineered and fabricated several key, bespoke pieces, The Appointment Group and Rock-It Cargo and Premier Aviation.

So, during the 30-year career that Kansy never intended to indulge in when re-stringing Joan Jett's guitar, is there much left to learn? "Every day is a school day; I'm not just learning from experience, I'm learning from some of the young people in this industry too. The younger people coming in are a whole new, stronger breed. I came up in this industry using rotary dial phones and pencils and paper - that's how I did my work. Now, young production and stage managers all have CAD drawing skills and a different frame of mind. I'm teaching them valuable communication skills though; showing them the way to go into all productions, is to consider them as families who each have different ways of doing things, but need to remain as a strong unit. The way I like to do things is to be very calm; you won't hear any yelling on our floor.

"I like the fact there's a great level of respect for each other and that everybody helps each department; sound crew push wardrobe cases, video folks push PA boxes, lighting guys wrap steel. Everybody out here is incredibly close and wants to be there for each other, and I do my best to breed that atmosphere and show that to the younger crew. I put my stopwatch away a long time ago on load-out. Do I pay attention to how long it's taking? Of course, but we're not out there rushing and trying to be the fastest; I don't think it's safe and I don't think it's a healthy environment because it breeds discord. Seeing the next generation work so hard before my eyes is very impressive, and I'm very proud of our team of here, running this amazing show."

PRODUCTION DESIGN Working closely with Waters is Creative Director Sean Evans (known as Dead Skin Boy) and Production Designer, Jeremy Lloyd of Wonder Works. Evans began working with Waters in 2005, when the pair worked on the star's Opera, Ira. He began: "The Desert Trip set list was a chronological walk through Pink Floyd's history. Not every song from every album could be part of the set but it felt very natural. Animals is a dystopian view of society, and the lyrics are oddly relevant in today's climate. At the time we were building the show,

ROGER WATERS



it was election season, and Trump was gaining ground. It was outrageous! How could he even be a consideration? One weekend I was at the studio mucking around with what to do visually for the song Pigs, and tried a quick pass at making the whole thing about Trump, and about what fake he is. We didn't think he'd actually win..." he said, with a remittance of disbelief.

"Around the time of Desert Trip, Roger was confirming that he would

do another arena tour, and was to call it Us + Them, based on the classic song title. The tour was to have a very strong political message, and given the success of the staging, and the relevance of the songs from Animals, we decided to figure out a way to pull off a large replica of Battersea Power Station indoors. For the indoor arena, chimneys above the roof wouldn't work because of height restrictions. I have long liked the idea of doing stage designs that make arenas feel small and envelope the crowd, and I was after a design that would feature large amount of video screens too - why not fly them above the audience? Jeremy Lloyd and I kicked that around for a bunch of weeks, and came up with the design of 2 sets: 180ft of screens segmented into 20ft sections. We weren't sure how to make it actually work, but TAIT sent through some new technology that they were working on called Rollios, and it was serendipitous - exactly what we needed.

"The indoor design was stunning, and the show works very well. But, the Rollios are basically large sails and therefore can't be used outside. So, we circled back to the design we had made for Desert Trip, and refined it further to have a simpler roof to feature the silhouette of the factory building when the chimneys were deployed. We had a few opportunities in Europe to test out the staging in Paris and twice in Italy. It was a bit hectic as we were shifting from an arena show to a stadium show without any rehearsals, but we pulled it off and the show in Rome was mind-blowing. I

was very pleased!" He added.

Evans furthered that the ideologies behind the strong political message were to essentially: "Stop killing each other and remember your humanity as the person over there is just like you. Resist tyrants! Different portions of the show get into different specifics -

for example, the dig at Trump in Pigs, needed to stay in. The ending of the song has a long instrumental section where we turn off most of the production, everything goes dark except some white lights on the band, and only damning quotes from Trump are visible on the screens. It's hard to imagine that the President of the USA has actually said these things but we keep updating the quotes, because he keeps saying things that are more and more insane!

"There's also a thread of a refugee woman and her child that runs throughout - it starts and ends the show, and is featured in the song The Last Refugee - and Wait for Her, when it's performed. This bit of film was one of the last to come together when we were building the show. I had seen a photo of an old man sitting in his destroyed house in Syria listening to an old turntable. It's an incredible photo, I found it very moving. For the longest time, our rough cut of the show just had a long slow zoom out of this photo. When it came time to make it into material for our show, it needed to fit with the lyrics a bit more, so the man was changed into a woman with a child, and the story was elaborated - she was a dancer, she's lost everything, is her child now dead?"

"Working with Roger is always positive, he likes big ideas, and I like that those ideas get to be ones with strong messaging. I also grew up as a fan of Pink Floyd, so the songs we are working with have been some of my favourites for my whole life. It's quite an honour!"

Masterminding not only designing parts of the show, but ensuring it all

40

ROGER WATERS

fits together, from the intricacies of the delay towers to the huge set pieces, it's akin to a very technical Lego set. But far prettier. Lloyd told TPi: "There's quite a lot of bespoke stuff on this show, mainly from Wlcreations, which makes things somewhat interesting."

A pair of elegant 15.5m high circular PA towers grace the stage, complete with integral tracking systems on the onstage side for the rigging of 10 moving light fixtures, and on the downstage side for the sound cluster's wind brace. The second Wlcreations object is an industrial style stage roof - or 'roofette' as it's known on the tour - comprising a set of imposing cantilevered steel beams which can be fitted with clear roof skins in case of rain. The third area in which Wlcreations is involved is a truss and beam rigging system, devised to securely rig and retain in place the impressive 65m-wide upstage LED screen. Wlcreations's Account and Project Manager, Koen Peeters, oversaw these elements, after being approached by Lloyd.

Lloyd continued: "The PA masts had to be very compact for airfreighting. We wanted something quite slender in front of the LED screen because the whole design premise was to not have a standard 4 poster roof; we wanted the LED to stand proud, all on its own, in such a big outdoor space. Particularly for the Battersea Power Station gag - when 4 bespoke chimney pieces are revealed - all the motors live on the floor so that the cables and motors don't ruin sightlines.

The set is built on some major scaffolding structures, primarily because once the show moves into South America to further iconic outdoor venues, a roof system would be far too expensive to freight and truck around. "It's been done, but I don't think it makes a lot of sense, certainly not for us, so the decision was made very early on in this design that everything should mount onto scaffolding. That in

itself is a bit of a challenge because you get different scaffolding in every place you turn up in!

“WIcreations built the roofette similar in style to the Genesis one we did in 2007 - which has since been re-used for ELO. This time, we designed our own, slender roof. It has Martin by Harman MAC Auras mounted directly onto the roof without clamps - they’ve got a special little bracket with

internal wiring so you can actually plug the lamps directly into sockets on the roof, again allowing that feature to be both minimal and lightweight. “For the video screen, because we want the top of the video to look like the top of the set, there isn’t any rigging above it. The LED screen header bars are on the back of the screen (as opposed to the usual position on top) and all the motors for the video live on the floor in dollies. The motor dollies are rolled in, attached to the structure at stage level, the motor hook is connected to a lifting cable that runs over a head block and the other end of the cable is connected to the LED header bar, once all connections are made the LED screen can be lifted.

“Our chimneys have been made by Airworks and Eventions. When they come out during the show, they’re 12m above the LED screen, and from the top of the chimney to the floor, there’s a height of around 28m. They’re totally stable in the wind that’s kind of the point; you can’t have an inflatable piece blowing over and looking like a big of a bouncy castle, you need to have a solid-looking setting to create the iconic Battersea structure.

Airworks’ Matthew Whitehead took up the story. “We were approached by Jeremy Lloyd who we had worked with on the London Olympics opening ceremony. We were originally going to

make some replica inflatables from early pink Floyd tours, but the design soon changed to a recreation of the Animals cover. We had made the rising chimneys for the Olympic opening, so we were confident we could reproduce the effect. However, this time without any rigging was going to be a challenge. We used a mast system raised from below to push the chimneys up.

“The chimneys are inflatable, and made with a complex mechanism to ensure they raise elegantly, and do not give any hint of fabric. They took 4 months to design and build. It wouldn’t have been possible to pass the chimneys through the structure as easily if they had been made of hard scenic, a far larger and more complex scaffold would have been needed. The fact that they were inflatable, saved not only on truck space - when deflated all the components of the chimneys fit in a single truck - but on installation time and weight within the structure as well. The engineering

42



ROGER WATERS

for the project was designed, developed and constructed together with Peter McKenzie, formerly at Eventions and now with his own company Qnetik. We built the London Chimneys together with him

in 2012. The mechanism is complex, with an aluminium mast that pushes the chimneys up, frictions skis that smooth the fabric, variable speed blowers to ensure constant airflow as the chimneys rise, and multiple guide cables to combat the influence of side winds. Custom lighting units and smoke machines were also fitted in the top."

Whitehead also mentioned that the team were very proud to be able to contribute to a show of this calibre: "Working for such a highly respected artist, and with such a talented team was a real honour, and the effect is one of the best shows we have worked on."

Airworks also created a smaller chimney effects for the arena show, at approximately 40% scale. The outdoor design utilised 4 e-Gear 800kg 1m/s BVG-C1 winches, 4 e-Gear Custom Waterproof 9Kw drives with extra I/O for Pneumatic control with feedback, Fan Control and DMX, 2 e-Gear Distro-4 and an e-Gear 25 Operating Console.

Regardless of this show's challenges, Lloyd, who worked on The Wall's production design with Mark Fisher, is happy to be back in the Waters camp. "It's so nice to come back to it again and it's a very enjoyable thing to do for a job!" he exclaimed. "I enjoy working with the team here. It's a really nice working relationship between Sean Evans and I, because we get on so well. I think when you're around like-minded individuals and everyone has the common goal of trying to achieve such a tourable, cool-looking set, you find ways to make it all work," concluded Lloyd.

LED WALL RIGGING Video and visuals have always been an essential part of Roger Waters' live shows which are a cerebral mix of music, activism and thoughtprovoking juxtapositions. The 64.5m-

wide x 12m-high video wall from

43

ROGER WATERS



Universal Pixels is built in situ in 7.5m wide sections. Each section is guided into place via 2 vertical beams that are attached to the upstage scaffolding structure, which is locally supplied to the tour's spec. The Wlcreations team come to site and prepare the trussing supports with integrated diverter beams, then fly the completed truss in sections on top of the scaff wall. Each screen section has several carrier wagons rolling along the vertical tracks, allowing the screen to be built from the ground up.

This methodology ensures that each 7.5m wide x 12m high section - and indeed the whole screen - is held firmly in place and wind-braced right from the start of the build process to the final moments

of dismantling during the get out. This minimises the risk that the screen sections can rapidly turn into giant sails if the wind gets up.

WIcreations' new proprietary MCA automation system controls the 18 motion hoists used for the LED screen rigging. There are another 15 moving light brackets attached along the top edge of the screen to which 15 more Robe BMFL Spots are attached, with 43 SGM Q7 blinders along the top and an additional 43 along the bottom of the LED surface.

SCREEN SCENES Phil Mercer of video vendor Universal Pixels - or UP as they're affectionately known, has been involved with Roger Waters' live performances since The Dark Side of the Moon toured in 1996. Mercer was a part of the innovative touring video team at XL Video, and later PRG XL Video, before flying solo to form his own company. Something he says he had no experience in doing, but was an important move never the less, not just for himself, but for the industry as a whole, the recent spate of mergers has dramatically reduced the choice of video suppliers. Mercer took up the story: "I left PRG XL Video when Desert Trip was happening, and my last show was actually a Roger Waters gig, funnily enough. When it came to this production, the tour originated in North America and we weren't involved at the very start, but were brought in at a later date to improve what had already been started. Our first gig with the tour was in Auckland in January. I got the call from Chris and set about shipping 3 containers of LED out to the other side of the world. All the same batch, all the same quality," he confirmed. The chosen LED tile? infiLED's ER5. Not typical in concert touring, but perfect for the job.

"Then of course, there's the huge projection element: the cameras, the PPU, and the interfacing. When it all came together, and I saw it

for the first time, I was just stood there thinking "that's all ours!" he laughed.

"Everything in my peripheral vision belonged to UP. It was honestly amazing to know you're a part of that.

"Some of the excitement on this tour is knowing that Chris has a very good crew out with him. For the show in Rome, we had 15 video crew, but generally speaking for the arena tour, it's around 9, which tells you how much video gear we've got out on the outdoor shows.

"We were literally starting out with the company and working on this amazing tour. There was only 4 of us at Universal Pixels at the start of 2018, but we're all very committed to the projects we undertake, and we were all fully behind this one. From a Production Manager's POV, there was a massive risk in getting us in for the job, as we were replacing the biggest touring video company in the world. We were very aware of the responsibilities we had in front of us.

"There are some big benefits to having a small company do a job like this though; the kit we've bought is very small in comparison to some gear out there. The Italian shows have a huge screen, but it actually has a small footprint because infiLED is a very high resolution, yet compact product. We first made an investment in it for Depeche Mode's Global Spirit tour, and one of our aims when we set up the company was to get a large inventory of the same LED product because large format shows like this need to look perfect. We bought the 5mm infiLED tiles, which are very high res, maybe higher res than the tour initially wanted, but because we believe the products will stay current for longer, we thought this was the right product for the job - and it's paid off."

Head of Engineering at infiLED, Si Jones was on-site: "As always with our displays, and events of this nature, content is key. We were blown away by the whole production and the way the show captured the crowd. The music and atmosphere, supported by incredible content on such a significant display screen, just created an amazing all-round experience."

UK CEO, David DaCosta, added: "Manufacturing, designing and putting on a spectacular show like a Roger Waters production is a collaboration with a number of organisations, without who it could never be a great success. At the end of the day, content is king, and it is the content that the audience gets to see so we were just thrilled to be a part of such a special project."

Mercer continued: "We've put the screen with Brompton Technology processing, for the best quality picture possible. I think Brompton is the best there is out there. Obviously, everyone has their own ideas of

46

ROGER WATERS

what they like, but we try to do things differently and not have the same inventory as other companies. The Polecam camera system we're using is an example of that; you get unique shots in a show that you wouldn't get using any other camera. You'd never get a normal size camera in live music concert parameters the way they do. Their products are used in televised Premier League Football games, so it's designed for really clever broadcast angles, but turns out that it's a great tool for live music; I've no doubt our Polecam system will be in use a lot in the future.

"This whole job has been a massive vote of confidence in what we chose to do. We took a huge risk in starting up, because nothing is guaranteed; nothing comes on a plate in this industry, yet I think it shows that people do have faith in us, in the value of their relationship with our team, and that means we've started out on the right foot."

Universal Pixels supplied an impressive 775sqm of InfiLED ER5 LED screen (configured as a single 64.5m/10,836 pixels wide x 12m/2,016 pixels high screen) with Brompton Technology SX40 Tessera Processing & 23 Touring Frames, 12 30k & 2 20k Panasonic Laser Projectors, a 5 Camera HD PPU and a 15-strong video crew to deliver what can only be described as the highest resolution touring LED screen to date – 21.8 million pixels. Pixel wrangling and motion tracking is courtesy of VYV Albion and Photon media servers.

DIRECTING THE MASTERPIECE "The Italian shows reflect a gigantic cinema scope look throughout the gig, and Roger loves a big, impactful design, so that's what we set about doing. How do you jazz up such a mammoth video screen? Well, by turning the set into Battersea Power Station, of course!" joked Richard Turner of Lucky Frog, Us + Them Video Director. "We regard the chimneys and the rig as a whole canvas yet Circus Maximus is the entire space we're able to use, such as allowing laser beams for the prism gag which expands from the stage to become a part of the set above the audience's heads. Sean Evans' creative design is incredible, and Jeremy Lloyd has led the technical side in such a clever way. It's pretty spectacular. As a Video Director, working with this amount of screen is unparalleled," Turner mused.

"A significant element of the Rome show was the projection mapping onto the 4 chimney breasts. Turner continued: "We are

already carrying enough VYV technology to deal with the arena show, with its 21 projectors covering 17 roller screens and 4 indoor chimneys, as well as providing performer (and pig!) tracking information to lighting. That all has to be repurposed for the outdoor projection task, changing lenses and angles of all cameras and projectors. Not an insignificant task, but one seamlessly managed by Lucky Frogs' Photon touring specialist Ellie Clement not once but several times (back and forth from arena mode) as the schedule demanded. To rig and align 14 projectors onto multiple 3d objects in a single overnight period is a proposal I would have laughed at until meeting

VYV 5 years ago.

"Fortunately for us, Photon has evolved SLAC for projector calibration. The way Photon SLAC (Structured Light Automated Calibration) works is by having a dedicated Optitrack IR camera per projector (or stack of projectors) That IR camera in greyscale mode sees the stepping stripes of structured light generated by the Photon calibration process as point reflections from retro-reflective tape on the strings of 4 VYV coppernic balls we hang, as part of the load in process, between each projector merge zone between roller screen. Each ball is a custom-made ping pong ball size sphere of translucent plastic containing a number of IR LED's. Each sphere emitting its own programmed unique numerical ID code at up to 240 FPS. The fact we have 2 parallel lines of screens 2.5m apart down the length of the arena means we have an almost perfect constellation of 18 hanging strings to calibrate the IR cameras in the first place.

"'Constellation' is a key word here, as it alludes to the celestial sphere. When we look at the starry sky we are effectively seeing a

“flat” representation of a MASSIVELY 3d universe. One point of a constellation could be a neighbouring star; another could be a galaxy forming out of the big bang an unimaginable distance away. The 2d representation of the 3d coppernic constellation from each camera or projectors PointOfView is how Photons math works out where and what shape each camera or projector pyramid is.

“The tracking cameras which cover the stage for performer tracking [Waters has infrared LEDs embedded in his IEMs] are the start point of the REALLY clever maths worked out by VYV’s research fellow in multidimensional maths Dr Gilles-Philippe Paille. By using the known ID’s of 6 measured coppernic points embedded in the stage the IR camera calibration can start work. An iterative algorithm compares the second image of the coppernics from each camera (that can see all 6 known points) to the known 3d model of those points within Photon to define each of those camera pyramids. At that point any unknown target ID is also calculated and positioned within the 3d scene so that cameras that can’t see all 6 known points can also join in the party. That process works down the room until all 50 or so camera pyramids are calibrated perfectly in the 3d scene. In less than a minute.

“SLAC then means we can have those 21 arena projectors all volumetrically calibrated generally within 40 minutes.

“Volumetrically” is the key difference with the VYV way, and fundamentally different to the traditional preset focus world. It means that Photons multidimensional maths not only works out the 6 DOF [the 6 DegreesOfFreedom are XYZ position and XYZ rotation] position of the projector lens, it also takes into account other parameters such as aspect ratio, lens shift and distortion etc to build a very accurate model of the lens pyramid shape as well as its position in space. This means that as long as we know where an

object is within that cone and its shape we can hit with it pixel accuracy. Even if it's

48

ROGER WATERS

moving, like the roller screens that invariably flap around in the air handling breeze of most modern arenas. We have copernics at either end of the bottom pipes to facilitate this tracking. It's another bit of magic that no-one would notice until it's not happening, the fact that the image 'sticks' to the screen surface as it moves.

"We then needed to apply that to the outdoor show. Big problem, no roof to hang our constellation from. For this, we employed another unique Photon feature – RealTime calibration and invent another calibration process. With Photon, once the projector calibration camera and projector are calibrated together those pyramids are locked together. So, as long as the camera lens, projector lens and projector optical block all maintain exactly the same relationship and we know where the camera pyramid is we also know where the projector pyramid is, and therefore can hit with projected UV mapped content any known object within that pyramid incredibly accurately. We didn't have a technology problem, it was an "applying technology to reality" problem. So we turned, with just enough time, to our favourite "reality mongerer".

Peter McKenzie at Qnetik to help us invent some solutions. Between us we came up with weatherproof 'steam punk' housings for each projector (to obviate the need for giant projector towers), lens clamps

to attach optitrack cameras to projector lenses and last but not least

'CarbonCubicConstructions. The CCC's are each effectively 3 2m a side cubes made of carbon fibre tubes joined together to give an extremely rigid (to cope with wind outdoors) constellation on either side of the stage under the LED. Each corner has a known coppernic ball. Big rigid known volumes that fit into a 2m x 0.75 x 0.5m roadcase.

"The night before we point each projector a CCC, calibrate, then use the super smooth pan and tilt mechanism on the housing to point at where the chimney is going to be. There are also - inevitably! - coppernics buried in each chimney to tell us where they are, so as they rise spectacularly at the start of the second half the UV mapped content sticks to the chimneys. Because we're hitting each chimney from separate projection positions we achieve greater than 180-degree coverage so all the audience sees is projected upon.

"The last 2 weeks of this first Europe leg were certainly the hardest period of my life. You can't not have scary moments when you're putting this much technology together!" He noted. "But it all worked and that's down to everybody's precise pre-planning and teamwork. It's a very complex matter!" he confirmed.

"Would it be possible to calibrate in other ways? I don't know... but I





ROGER WATERS

certainly wouldn't like to try it without Photon! At our BST show in Hyde Park we had the additional problem of the foliage around and above the stage that is the festival design, which meant the 'onstage' projectors had to go on the roof upstage of the foliage pointing up at crazy angles. There was some doubt about being to get all the targets in the appropriate place (we ended up craning the CCC's onto the top of the LED between the chimneys), so we thought we'd better try a manual calibration, which involve manually positioning the projector within the Photon 3D scene and fiddling the 6 DOF and lens shift etc. At those angles almost impossible from FOH so the team rigged robocams from projectors positions so we could see from the projector POV. After 2 hours the next night of trying I gave up with the roof projectors, maybe 6 hours a projector

would do it. The angles were so steep tiny adjustments made such a massive difference, and those adjustments fought each other. Possible with much longer throws, but i'm sure we would run out of time with a single night of darkness."

In total, there are 11 VYV media servers: 4 off 8 output servers driving projection system, one doing the LED and then the appropriate backups and Albion controllers arranged as a Projection group and LED group to split load and content storage. The show is almost entirely programmed, with pretty much every cut of every camera heading in an evolving

direction. How does the VD sum up the most challenging role of his career to date? "Fucking great - it's as simple as that. If you work in projection and video, who on earth could ever ask for more? This rig is like a great big toy... every day I feel as though Roger has let us play with his huge train set. To be part of the realisation of his vision over the course of almost the last 20 years has been a huge honour and privilege which will never be equalled."

LIGHTING "It's a lot of fun working with Roger and Sean; this creative camp is obviously a fantastic experience to be a part of," began LD, Pryderi Baskerville. "You could say Roger pretty much invented this idea of the rock concert theatre spectacle so it's extremely exciting to be involved with such an artist, and this team.

"When you're looking at the design for the Italian shows, it's an evolution of what we'd been touring from our arena run. From a design point of view, it's extremely collaborative - we all work together very closely in the initial impetus; with the creative drive coming from Roger and Sean. Roger is so passionate about what he does, and that extends to the staging of his music and the way he

wants to convey his message to his audience. "Obviously, the biggest thing we're dealing with is the screen; it's the one

Technical design from concept to reality

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51

ROGER WATERS

defining message that gives you effectively the primary visual stimulus, and the content is amazing too. The content Sean and Roger have created really is breath-taking.



“In order to complement this, the lighting is theatrical, for want of a better word. Obviously, my first point is to make sure everyone is lit, but the lighting is there to enhance, support, and respond to the content - and the narrative - as a whole. And providing a big impact when required.”

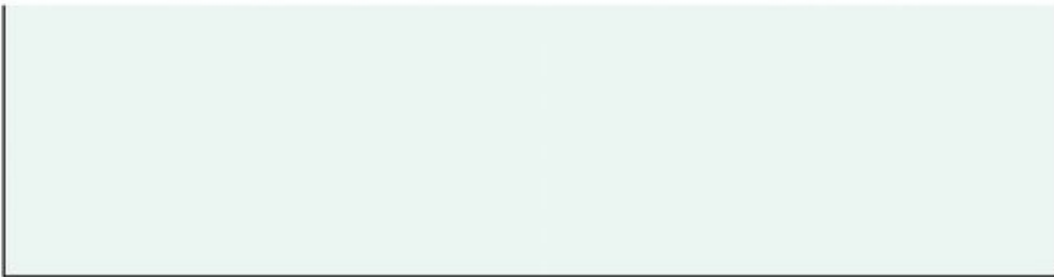
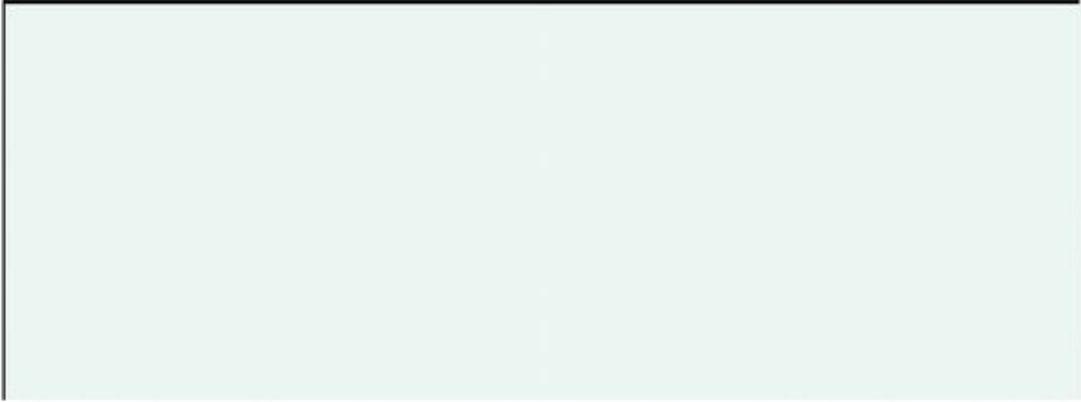
On stage, there are 7 identical cantilevered heavy-duty steel roof beams which mark out the 18m-wide x 12m deep stage space which constitutes the band performance area, all keeping with the

industrial vibe of the overall stage design. Variants on this theme have been a characteristic of Roger Waters' live looks over the years. Each of the roof beams feature 8 integral Martin by Harman MAC Aura LED washes and all the cabling required which is enclosed in the beams. The Auras plug in with a short 25cm tail maintaining the tidy, high-quality finish prevalent throughout the whole stage area.

The roof beams are pinned to a sub-frame structure below stage that hold them rigid and rock solidly in place. On the end of each roof arm is an SGM Q7 LED strobe. Fixture wise, the entire lighting rig consists primarily of Robe BMFL WashBeams, SGM Q7's and Martin by Harman MAC Aura XBs, and is supplemented by GLP impression X4 Bar 20's and TMB Solaris Flare Q+. At Circo Massimo, 15 BMFL WashBeams were placed along the top of the LED wall and mounted on custom fabricated brackets.

A further 20 BMFL WashBeams (10 SL, 10 SR) were mounted on a custom fabricated track in both PA Masts. Known affectionately as the aforementioned on stage 'Tormentors.' A total of 20 BMFL WashBeams (10 SL, 10 SR) are placed in Tyler GT Truss on the offstage side of the LED Wall – the offstage Tormentors. The Robe preference doesn't stop there: 22 BMFL WashBeams are on the







52

ROGER WATERS







Michael Hartle, Laser Tech; Production Manager, Chris Kansy; Lighting Designer, Pryderi Baskerville; Shawn Jacobs, Infialtables Guru; Production Designer, Jeremy Lloyd; Video Director, Richard Turner.

upstage floor, with 8 BMFL WashBeams (4 per side) on the side bunkers. Another 8 BMFL WashBeams are used at FOH as followspots and for key band lighting, and finally in the Robe arsenal, 4 BMFL WashBeams at FOH - floor mounted - to light the

tethered pig (more of this later!) as it's walked around the stadium floor and into the crowd.

There is a total of 56 MAC Aura XBs in the bespoke roof structure; 7 spans that run downstage to upstage with 8 fixtures in each. There is an SGM Q7 mounted at the end of each roof span - 7 in total, and 85 Q7's mounted on the LED wall - 43 on top, 42 on the bottom edge.

A further 52 SGM Q7's are distributed onto the FOH and PA delay towers, each 0.5m diameter, and matt black coated round steel tubes, for a fully streamlined and modern aesthetic. The PA rigging cradles holding the slimline Clair Global line arrays which are rigged to the towers via an i-beam hoist system. The hoists are at the base of the tower and the arrays are built and raised up until complete, then an adjustable stabilising arm is attached to a trolley riding up the mast while the whole assembly is flown up to trim height.

Another 1-tonne hoist is attached to the base of the tower with its steel travelling up the offstage side of the mast, hoisting a stack of 10 Robe BMFL moving lights up along the integrated PA mast track. Individual transparent rain shields offer clean-looking and effective weather protection for the moving lights. When in position, these form a perfect perpendicular line of downstage lights each side. There is also 17 GLP X4 Bar 20's deployed onto the downstage edge of the stage.

Then, 10 Solaris Flare Q+ are situated behind the backline. In addition, the Italian shows require some practical elements: 16 chimney warning beacons (red LEDs), with 4 placed per chimney; 4 custom RGBW LED fixtures - 1 per chimney - to accent the smoke; 4 Viper smoke machines - 1 per chimney; 4 MDG The One machines

for atmospheric Haze; 2 Viper NT smoke machines. Additionally, there are also 12 rotating beacons on the downstage edge for the Battersea Powerstation deployment.

Baskerville continued: "Despite the amount of gear we have up there, it's a really clean looking show. A great deal of thought has been given to integrating the lighting system with the screen and set elements, and to make it as unobtrusive as possible.

The reason I chose the BMFL Washbeam as my main fixture is that I find them brighter than the BMFL Spot (which is used on the arena show), really punchy, their colour temperature is great - capable of delivering both a

hard-edged beam and a wash, so they're really good for multi-use. The Q7's can be used as strobes and blinders.

Baskerville served as the Lighting Director as well as the lighting programmer, operating the show each night. "I'm running the show too, probably because I'm a control freak!" he joked. "I've used several consoles over the course of my career but for me, the MA Lighting grandMA2 is the most stable console for this type of show and for the nature of work I'm doing. If you're gardening, you don't use a spade for everything, but it's whatever makes you feel confident in the job, and for me, that's MA. If you get to know a console well enough, your muscle memory is so good that you're able to stop thinking about what you're physically doing and able to think about what you're trying to achieve instead." Baskerville's MA2 is running software version 3.3.4.3.

SPECIAL EFFECTS With the video and lighting in check, the show can really come into its own with some unique special effects. Creative Director Sean Evans added: "The 'Eclipse' - the laser

pyramid that forms towards the end of the show. Again, first seen as Desert Trip. I wanted to end the show with something that was three-fold: an ecstatic, positive moment for the crowd that was based in Floyd's iconography, something that people would want to photograph, and something that could be seen for miles. The crowd wasn't expecting a 50ft tall pyramid to materialise over their heads and it looked great in Rome."

The gag involved a variety of lasers on the downstage edge of the stage and in the audience where the prism could take shape. Production Designer Jeremy Lloyd added: "Of course, we have to stop the beams just shooting off into the sky from the top of the prism, so we've got 4 masts, 2 up-stage behind the LED screen and 2 FOH on the delay towers, connected to the masts are small 6.5mm steel wire ropes these create an 'X' in the centre of which is a square metal plate suspended over the audience which is the beam blocker for the lasers. That's another Wlcreations bespoke piece. It's one of those things that I think will have the audience questioning throughout the show, until right at the end. It's a really simple effect but it's very creative effective, it's a nice moment to watch."

The lasers and special effects were supplied by Strictly FX. The plethora of gear included the array of laser systems on the whole tour, ranging from 6W through 24W, with the smaller wattage lasers being replaced for the

54

ROGER WATERS

outdoor shows for more powerful systems when the atmosphere can't be controlled as accurately. The company also provided an

Estop and control system that allowed the various ops to comfortably handle the physically spread out show.

Michael Hartle, Laser Technician, told TPi: "The Dark Side of the Moon cover appears for the song eclipse and the laser pyramid covers 80ft by 80ft, which is pretty amazing to watch unfold." Hartle, who is running the gag using Pangolin Beyond software, continued: "Roger is such a legend. For me, it's like being working for one of my heroes. To be part of such iconic imagery in a live show is crazy. I was born in 1972 and The Dark Side of the Moon came out that year and became one of biggest selling albums of all time, and become a favourite of mine. To be here, creating this effect, is something I'm proud to be a part of."

Lloyd also concluded by saying pulling off the prism gag in Italy was a mean feat. "Italy is so strict when it comes to event like this. It's probably one of the most challenging places in Europe to do a show, from a health and safety legislation point of view. We have to ensure everything we build is fully engineered, that we've got all the documentation and engineering analysis and that our safety people have been in to collate the information on laser. We're using The Event Safety Shop (TESS) for this, and they deal with all the different departments for our local promoter who in turn deals with the relevant authorities."

Elsewhere in the special effects realm of Us + them, Strictly FX deployed mines and comets in height ranges of 200ft – 275ft. FireOne was used for control. Strictly also added to the show's haze effects, utilising 6 Haze Base Tours and 4 Viper Foggers. Pyrotechnic Shooter, Reid Nofsinger, is manning the explosives. "Everything I deal with is white because that's how Roger likes it; it looks striking and a bit unusual for pyro. It all happens in the last

12 seconds of this show so it's like the icing on the cake."

The final shot of the show has 60, 275ft white comets with a pixie dust tail shooting up into the sky, creating quite a scene. Ending up 30m in the air, the special effects moment is certainly an engaging part of the show. "When you're told 'just go crazy' and you're in charge of pyro, it's a pretty good feeling!" he laughed.

Us + Them also contains some iconic physical special effects. Enter Shawn Jacobs, Inflatables Technician, of Mobile Airships AKA The Blimp Guys. He's the man behind the iconic flying pig, and the other inflatable gags throughout the show. He said: "I began touring with Roger in 2006. I was flying around a little remote controlled blimp for hockey and basketball games just a part time job. Roger Waters bought one of the 'blimps' and needed someone to go on tour. That was my introduction to touring! In a dark twist, the inflatable pig gets torn apart by the audience once it's set out into the wild during the show. "Sean Evans designed one side of the pig, but the other side is blank because depending on what country we're in, I spray paint it whatever says 'Stay Human' in the local language." There was also a chrome orb led by Jacobs, manufactured by Netherlandsbased Airworks. Measuring in at 5m in diameter.

SURROUND SOUND AUDIO Veteran FOH Engineer, Jon Lemon, had a somewhat unexpected entrance to the tour. "I'd just come back from doing some promo shows with Lana Del Rey in America and the UK, and I'd literally been back home in Australia for less than 24 hours. I think it was 18 in fact, when my phone goes off in the middle of the night. I wouldn't usually pick up, but I saw that it was Shaun Clair. The engineer they had out, Trip Khalaf, had to leave, and had asked for me to take over. I said sure, when do you want me to start... he



ROGER WATERS

FOH Engineer, Jon Lemon with his DiGiCo SD5.

said can you fly tonight. I needed to do my laundry first, so I said I'll do it, but I'll have to fly tomorrow! It was pretty easy to slot in as I'd worked with Roger and many of the production crew before and everyone was so supportive, but it wasn't easy missing all the rehearsals trying to pull everything together quickly!" he noted.

"Matt Napier, on monitors, had a DiGiCo SD7 with him, and as I use DiGiCo too, I could start working out exactly what was going on from his show sessions and the recorded shows. I jumped in at the deep end about 6 shows in. I actually started out for the first two months of the tour using Trip's gear, which was 2 old Midas XL4 consoles and a Yamaha PM5D. When we had a 3-week break in the schedule, I said I thought I could make it better if I swapped out both my consoles and the PA we were using. Trip always likes using analogue and he really likes the Clair i5D PA, which is a fine PA, sure, but the newer Clair Cohesion CO12 was much more my kind of thing. I specified a DiGiCo SD5 for my desk, because it was clear to me that as the show was so theatrical, I might need 10 or 20 scenes for one song...which I could only do in the digital world.

"In saying that, I've got quite a lot of outboard analogue gear because I was slightly nervous of taking it from full analogue to full digital without keeping some of the warmth or familiarity Roger would know and love. In this time, I went to Rock Litz and set up a CO12 pa and surround system. Our playback guy, Mike McKnight came and checked all of the surround effects etc. which turned out great. It was the right thing to do; it modernised the show in many

ways and I haven't looked back since changing out the kit."

Lemon noted that mixing this show is a lot of fun: "Roger is so receptive to input, along with the band, we just keep chipping away and changing things all the time and make the show better and better.

Clair Global couldn't have been more helpful in facilitating all the changes I requested. They just made it happen and understood what I wanted to do. It is a big thing on a tour of this size, to change everything out, but they were wonderfully supportive.

"Along with the PA change, I got Dean Mizzi in as my Systems Engineer. I'd done my research and he was regarded very highly. Everybody I spoke to from around the world who had worked with him, said that I'd get on really well with him. It was sort of like 'you're both Australian, nerdy guys!' Dean and I have spent a long time discussing and experimenting how to achieve the most consistent result with the surrounds indoors. Now the question has been; how we're going to get that to translate for the largest outdoor gigs. We had to work out how to time them and confine them to create the same experience for each zone of the audience in a large area. For the outdoor surrounds, we weren't touring enough CO10 to do it entirely, so we chose one of my other favourite PA's - the L-Acoustics K2. I think it's a really good box, and luckily for me, now that Clair Global and Brit Row are one incredible touring entity, we could advance book a lot of K2 for these Italian shows.

"With our tight schedule, we decided to get Josh Lloyd from Britannia Row involved as our advance man. Between Dean and Josh; Dean knows L-Acoustics products really well, and having Josh Lloyd on board it made it so great."

Lemon explained that he chose the SD5 because it, "always feels like a faster engine when being networked to Soundgrids". The number of macros was also a bonus: "It's a simple layout for a console in this kind of theatrical come rock show. I needed speed. I wanted to keep the analogue sound as

57

ROGER WATERS



SFX Shooter, Reid Nofsinger; Monitor World L-R: Eric Piontkowski, Stage Manager; Dean Mizzi, Crew Chief / System Engineer; Richard Burke, Monitor Tech; Matt Napier, Monitor Engineer; Alex McCormack, PA Tech; Nicole Wakefield, Stage Tech; Tim Joyce, Surround System Engineer; Cesar Lopez, Surround PA Tech and Tristan Robbins – PA Tech.

I mix through a lot of groups. I always use Waves NLS on there to give it a little bit of texture before it hits all the other analogue stuff I carry. I need all the outputs for right surround, rear surround, left surround etc, and have all those effects at my fingertips. One of the things that keeps coming up talking to many of the promoters was having a really big sounding mix without the volume. We rarely go over 100db, yet everybody talks about how big this show sounds, and that's down to using chains of compression and limiting correctly, plus a great pa!

"Many sound engineers who I highly respect have come along to this show and complimented us on the audio which has allowed me to feel very proud of my team. I guess that's what happens when you work with a great production, Roger and Chris Kansy have put together a pretty amazing bunch of people, and I'm glad to be part of it."

For microphone duties, it's a Shure SM58 for vocals. Lemon stated: "Roger has always used this, and I still like the sound of them, so it's easy to employ them on all 9 of the vocalists." Elsewhere, the mic choices are varied; Heil PR48's, Neumann 184's and 103's, Shure SM57's to name a few.

Highly-praised System Engineer, Dean Mizzi, joined the conversation: "We're touring the CO-10 boxes as part of our arena system, but as mentioned, for the outdoor shows and all factors involved, it made sense that we employed a K2 supplementary system from Brit Row. We needed a large box count to do the Italian outdoor shows properly, and having access to the L-Acoustics inventory of Brit Row just down the road, made it an easy solution. Josh was integral in advancing the installation of the surround towers and infrastructure for these outdoor shows. The arena

system is CO-12 on the front end, and CO-10 as the surround system. The outdoor show is kind of an extension of what we're doing in the arena, but in an even less controlled environment! Here in Rome, with the length and shape of the field, we've added a whole other level of complication!" he laughed. "Especially given that it's an asymmetrical venue. It gets really tricky as 1 side of the venue is completely different to the other. The biggest challenge with the surround stuff is that there is a lot of content that is played in unison with the main system, so it's hard to achieve a somewhat timealigned PA."

Mizzi also noted the kind of responsibility the audio team has: "Roger has the vision. He sat and worked with producers initially to develop this show and surround content we're using now, and continues to adjust and improve content almost daily. We have the task of doing justice to that vision, and creating the same experience for each audience area in the environment we're working in. There has been some fairly unconventional methods used to tune and time align these large systems, to say the least! This camp has an incredible sense of community, and that support makes it so much easier to work in."

The touring inventory comprises of 72 Clair Cohesion CO-12's, 48 CO-10's, 12 CO-8's, 24 CP218 Subs, 54 Lab Gruppen PLM20000Q amplifiers

and Shure Wireless RX/TX. The stadium configuration in Rome comprised (per side) a main hang of 16 Deep CO-12's, a side hang of 16 deep CO-12's, ground sub array of 24 CP218's, 12 CO-8's for front fill and surrounds of L-Acoustics 72 K2 boxes and 48 Clair CO-10's.

Mike McKnight, Audio PlayBack Tech, joined the Roger Waters camp in 2009 for The Wall tour. "I jumped at the chance, and am very happy to still be a part of Roger's tours. During pre-production, I work closely with Roger, the video department and the drummer to get the music together so that they can begin to work on the visuals. There are a lot of decisions that have to be made in pre-production on the tempo maps and arrangements because once they're set and the visuals are rendered, it's extremely timeconsuming to change the visuals to match the music. Therefore, we need be somewhat done with the basic arrangements. Endings and transitions between songs are an evolving thing that we deal with during the rehearsal period."

McKnight uses MOTU Digital Performer for any the additional surround sound effects and surround sound music, as well as the click tracks and time code. "I send time code to the audio, video and automation departments as they each depend on time code for their automation. The band hears a click track that they play to so that the music is always in sync with the visuals."

McKnight utilises 2 Apple Mac Minis for playback, a 3rd MBP to record the shows, MOTU interfaces for MADI and analogue ins and outs, and Digital Performer for the software.

MONITORING A LEGEND In monitor world, it's down to engineer Matt Napier to mix the talent. "The Wall monitoring duties were looked after by the late, great Ian Newton. They were big shoes to fill, and it was an honour to be asked. I had worked with Mike McKnight many years ago on a Madonna tour, and we had kept in touch, so when Roger was looking for someone for Desert Trip in 2016, Mike put my name in the hat."

As mentioned by Lemon, Napier's desk of choice is a DiGiCo SD7. "I have a close relationship with DiGiCo; I've been a fan of theirs since they first started out. I keep playing with other consoles, out of curiosity, but for these large-scale shows, there isn't really anything else that comes close. They're reliable - I've done well over 1,000 shows on SD7's and only ever had one incident that scared me, which was resolved in minutes - so I like those odds! They are ergonomic and fast to work on which is essential for monitor mixing. They sound great, they handle a huge audio count and the back-up service from DiGiCo is second to none."

Napier is using over 100 snapshots all fired from SMPTE timecode. 130 input channels, 37 output busses, 7 stereo and 3 mono groups, 32 x 14 Matrix, 24 Control Groups and 15 internal FX Engines. Then there are the external 'toys'. "I use a Lexicon 480L. It's ancient but the Random Hall verb is superb for IEMs. My favourite live vocal chain is in-line with Roger's vocals

58



ROGER WATERS

Dean Mizzi, System Engineer; SFX Shooter, Reid Nofsinger; The trucking team.

before they hit my desk. It's an XL42 with an Empirical Labs Distressor inserted. It's a great setup that can be tailored for any singer, and it gives me the ability to grab something quickly that isn't affected by scene changes. I also have another distressor inserted over Roger's Bass and a couple of AI Smart C2 Compressors for bus compression on Rogers Mix.

"We are using SMPTE quite extensively. The band are fully live but they are locked to click as the whole show is designed as a cinematic experience, locked to the visuals. The surround system is fed with discreet sound effects from Mike at playback. Because of this, SMPTE is constantly running so I can utilise this to fire my snapshots. Some snapshots will be full recall, but others will just do very specific rides. With 10 musicians on stage it allows me to give

each musician an unprecedented amount of attention and care to their mix whilst still being predominately focused on Roger's Mix. Roger is treated as a FOH mix on my desk; he runs off the master bus and I utilise control groups and bus groups to really keep his mix tight and album like.

"These musicians are all top of their game, and expect a lot of attention paid to their mixes. This is where the multiple snapshots per song really come into its own," he added. IEM-wise, there are 20 channels of Sennheiser 2000, and all musicians are on Jerry Harvey Audio JH Roxanne in-ears. "It's a great combination; the 2000 is a very musical IEM and the Roxannes are a great product, ideally suited for stage use."

There are also some wedges dotted about the stage, to add "a bit of weight and also to have some ambience on stage for when the children join us for Happiest Days / Another Brick in The Wall. I also gave Jon Carin, the keyboard player a pair of L-Acoustics 108P's, there's a few Clair 12AM's and our drummer has a Clair CP118 which works great in this application. Napier is also mixing 8 channels of Sennheiser Instrument systems and 6 channels of the new Shure Axient Digital."

The engineer also looked after the tour's rather tricky RF. And then there was RF in an ancient part of Rome, which was a whole new challenge. "We had over 40 channels of RF squeezed into DTV guard bands, crammed into just 3 8Mhz TV channels that were clear of local interference!" he said.

"Clair Global have been amazing throughout everything. We have a top-class crew and Rich Burke and Nicole Wakefield who have been looking after the stage end with me, are absolute stars! Greg Hall

and Britt Natale

at Clair Global have put un-real hours into this show, and made sure from the first conversation we had, to the support us with everything we need. Dean Mizzi is a great Crew Chief and System Engineer too; the show really wouldn't happen without him. He deserves some kind of un-sung hero award!" he concluded.

Lemon also praised their vendors: "I've worked on and off with Britannia Row since 1988, and with Clair since around 1995. They both always had great service, but now seeing it today with Troy and Shaun Clair, Bryan Grant and Mike Low from Brit Row, watching the development of the companies as a sound engineer has been spectacular. It gives you great flexibility as an engineer because they can just facilitate your choices. I think them joining forces is a really positive move. To me, with how perfectly this tour worked, it feels like they've always been one company. That's why for us, this whole tour has been able to work so smoothly." TPI Photos: Kate Izor (all show shots) & TPI . www.rogerwaters.com
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60