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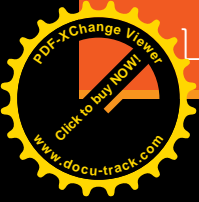
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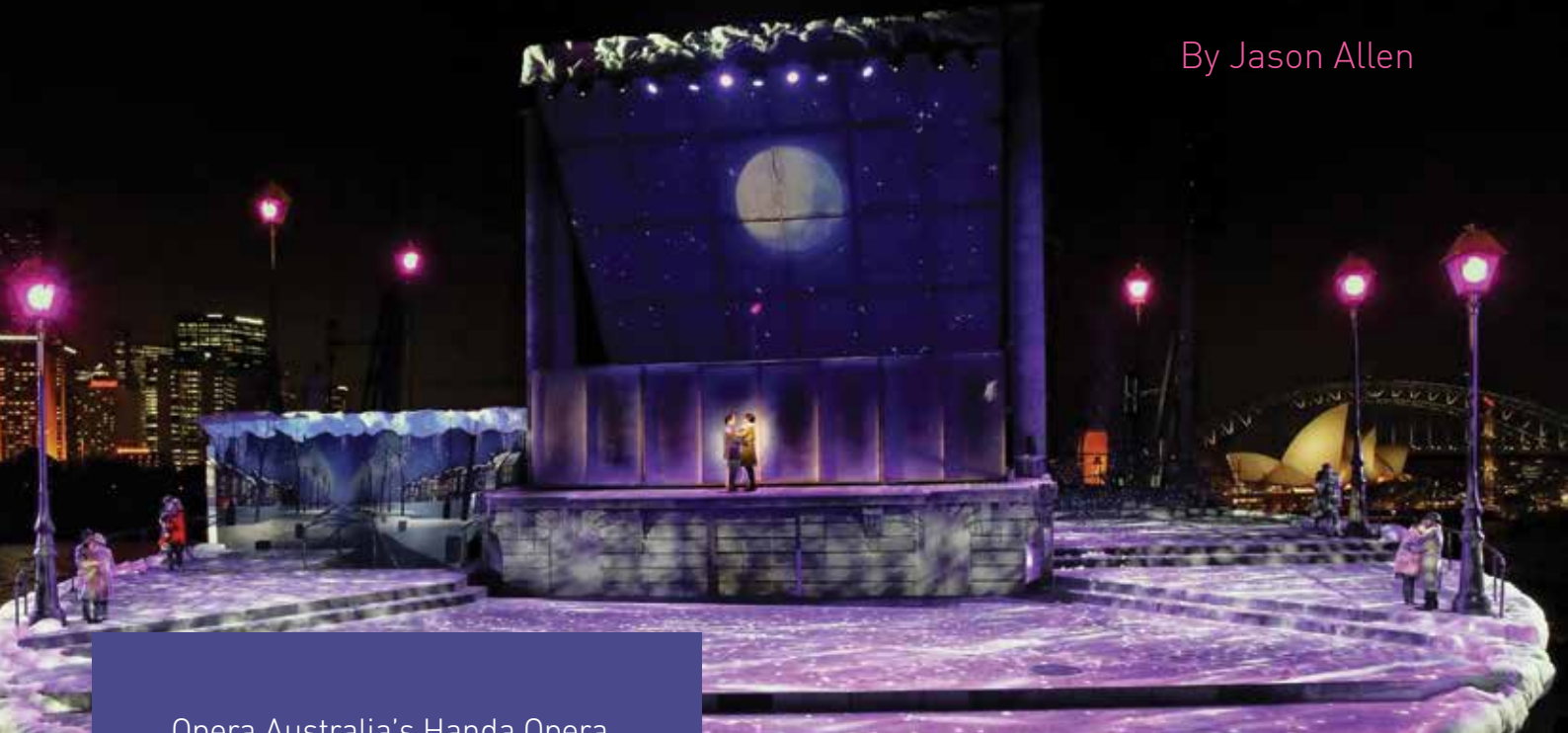




Track The Light Fantastic

Radio Tracking on *La Boheme*

By Jason Allen



>> Ho-Yoon Chung and Iulia Maria Dan*

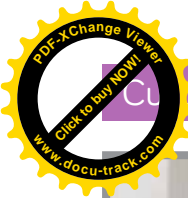
Opera Australia's Handa Opera on Sydney Harbour is always breathtaking, and it takes an army of technicians to handle the complex lighting, sound, and effects infrastructure it needs. In a trial of a new system for OA, this year they employed a Zactrack radio tracking system to partially automate the lighting rig, with spectacular results...

Zactrack is a simple yet powerful system in which small radio transmitters called tags are carried by performers or attached to set elements that beam their coordinates in x-y-z format to a control system (see in-depth Zactrack feature on page 20 for a full-run down). "OA had been looking at Zactrack, and they asked if I was interested in doing a trial on this show," said lighting designer Matthew Marshall. "I've always wanted to do back follow-spots, but never had the budget, so that capability alone plus solving some tricky problems with moving elements made it worth pursuing. We're using it in key moments, but in the end we've used it a lot more than I thought we would."

Fixtures on La Boheme automated with Zactrack include Martin Mac III Profiles, Claypaky Alpha 1500s, Claypaky Sharpies, and Martin Mac Auras. "Normally we have two follow-spots," added Matthew, "but we've replaced them with Zactrack. There's some effects in the show that are only possible with Zactrack. One of the briefs was to be spectacular, and I realised tracking could help us achieve that. We use it in subtle ways as well. For example, in Act Three there's back follow-spot moments where the leads are followed from upstage. It's a beautiful look you can't normally do unless you have two people in harnesses all night standing-by."



Matthew Marshall >>



Custom Parameters

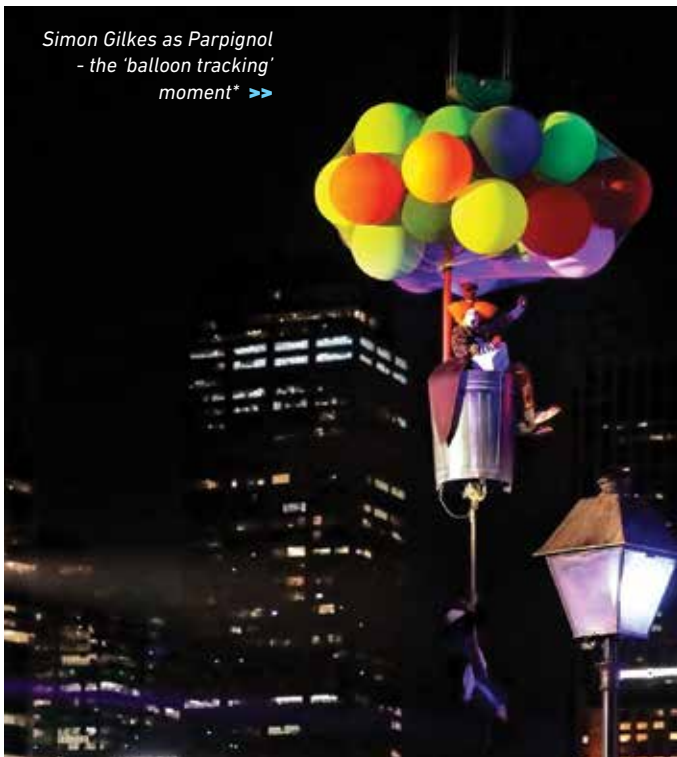


Peter Rubie >>

Working closely with Matthew was Peter Rubie, lighting programmer tasked with getting their GrandMA2, the fixtures and Zactrack to play nice with each other. "For each fixture that can be controlled via Zactrack, I've built a custom fixture profile," Peter illustrated. "We've expanded each profile to include parameters just for Zactrack,

like tag number assignment. As soon as we change the tag number, all the lights assigned change to following that tag. We can offset the x-y-z coordinate values as well. Zactrack centres the light on the performer, but sometimes we want to light from the waist up, or a do headshot, so we change the z offset by 80 centimetres or so. During the moment when there's a performer flown with balloons above them, we offset the z value by a metre to hit the balloons above the performer's tag. It also means we can use one Zactrack transmitter and light multiple targets."

"We've also incorporated other assignments like mode channels that determine what happens if the fixture loses the transmitter," continued Peter. "There's a perimeter defined around the stage, and if a performer leaves the stage and we forget to fade a light out in a cue, Zactrack will fade it out for us. The GrandMA2 is doing a lot of work in taking information from the console, sending it to the Zactrack server, and then getting it back. We send out our data on a lot of different universes, Zactrack listens to that, takes control of all the parameters it needs, and sends the changed data back to us, while passing through everything it doesn't need. The reason we don't go straight out of the desk is so we can keep control of both Zactrack and all of our fixtures."



Simon Gilkes as Parpignol - the 'balloon tracking' moment* >>



1. Julie Lea Goodwin and John Bolton Wood*
2. Julie Lea Goodwin in the dress that acts a mirror ball!*
3. Nick Bojdok



Precision Effects

The effect on the show is quite subtle overall, giving the impression that they have a lot of very well-rehearsed domies. "So much of lighting design is about focussing attention down to fine details," observed Peter. "It's such a huge stage; if you have to wash the whole thing to cover faces, you lose so much of the atmosphere. Having more control and more options is really good - there's a moment where we track a car, and we use framing shutters to shape the light into a box that's the shape of the car, so it's not just this big circle hitting the rest of the stage. With precise fixtures like the Sharpies we punch a whole lot of light onto one performer's reflective dress, and she lights up like a mirror ball. Half way through that scene, she does a throwing gesture, and we change the tag assignment and so all the beams instantly all track to another performer."

It's not just the lighting crew who are benefitting from Zactrack's tracking data - scenic video projections are using it to stay focussed too. "We've got three 32K Barco laser projectors on different parts of the scenery being driven by main and backup disguise servers," said Nick Bojdok, Technical Manager for video provider Big Picture. "Some of the scenery is movable, and we've got Zactrack transmitters mounted on them. Zactrack is giving us PosiStageNet data to track them up and down stage, and the disguise changes its mapping. It's simple, and it gets rid of any discrepancies in positioning."



Sound Spatialisation

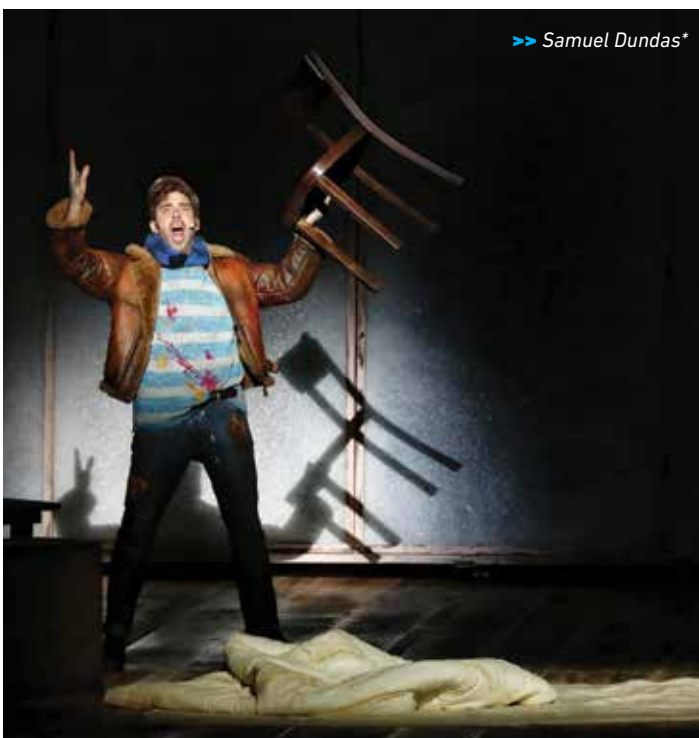
Meanwhile, sound designer and FOH mixer Tony David Cray is eyeing the data output by Zactrack for future use by the sound system. "This year, we're just monitoring. Next year we're adding it to the mix," he confirmed. "There's an unreleased kit from DiGiCo that can take OSC data that Zactrack outputs. Panning is only one part of it; we're looking at putting in a spatialisation engine. That science is maturing. Barco's IOSONO has wavefield synthesis, but comes with processing delay that is a sum of the width of the system, so when we used it on Carmen here at Handa Opera on Sydney Harbour, we had a large delay on the system due to the size of the auditorium. But d&b audiotechnik's Soundscape and L-Acoustic's L-ISA take a different approach, and their processing delay is down to milliseconds."

Tony is excited by the technical change heralded by 3D audio.

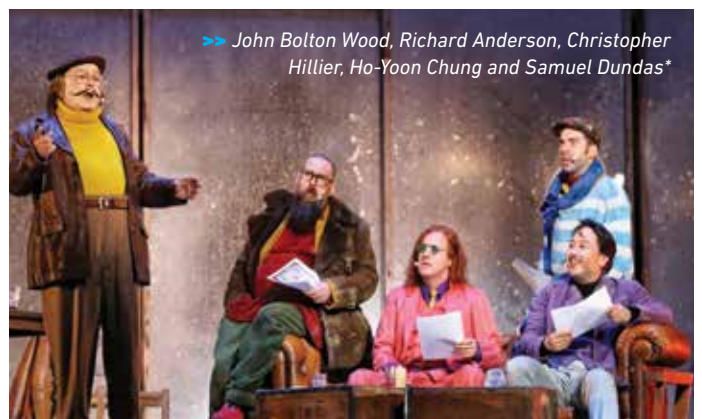


>> Tony David Cray

"Companies that will survive this change will be the ones that are open to it," he predicted. "I can sit here and write a programme in Max MSP and say, well, for this show I don't always want the actors to come from where they are tracking on stage. Sometimes it's like a film mix, where for a big aria, you want them front and centre sound-wise, even though they might be on the far end of the stage. We're anticipating writing software that sits between tracking systems and the desk, then feeds it to a spatialisation engine."



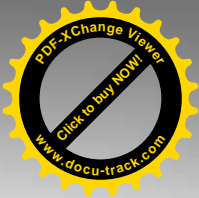
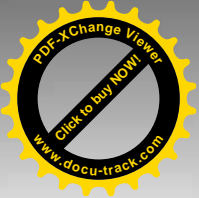
>> Samuel Dundas*



>> John Bolton Wood, Richard Anderson, Christopher Hillier, Ho-Yoon Chung and Samuel Dundas*



>> Ho-Yoon Chung and Iulia Maria Dan*



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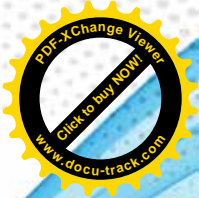
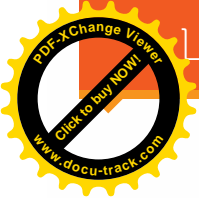
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ZACTRACK

How It Works



>> Paul Roch with the CORE tablet interface

With a gig as globally prestigious as Handa Opera on Sydney Harbour, and Opera Australia sizing up the tech for future use, Zactrack CEO Werner Petricek and Project Manager Paul Roch were on-hand in Sydney to make sure the OA's techs had all the guidance they needed. We talked to them in detail about the system...



>> Werner Petricek with a Zactrack tag

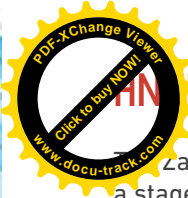
Zactrack's transmitters, known as tags, are small rectangular boxes that transmit ultra wide-band radio in the 3-4GHz range. They're low powered, and are in a license-free band with little or nothing else in it in all major markets, including the EU, USA, Australia, and Japan. They're ideally placed high on the performer, under the costume. As it's not line-of-sight like an infra-red system, it can be hidden anywhere except behind significant amounts of metal, which interferes with radio.

The tags run on a rechargeable lithium battery, with a recharging station capable of charging 30 tags at once. The largest amount of tags Zactrack have used on one show is 53, but the system could use more if necessary.

GET ON TRACK

"Zactrack is one of the oldest companies doing tracking," explained Werner. "We've been active since 2005, and have been doing large touring shows since 2009. Tracking itself is tricky, and took us some time to get it to this level where it's now applicable to 90% of situations, and easy for designers to implement. When we started out, we underestimated the amount of math we needed to cope with. We learnt our lessons, and now we have a different idea of how tracking on stages works."

"We divide the task of tracking into three distinct processes," continued Werner. "Creating and receiving the positioning data, doing the math that calculates all of the parameters, and lastly, communications and control. Only when all three parts are right does it work. Every section takes time; calculation time and computing time. It's a lot of prediction mathematics to know where the performer will move next so you can get the light ahead of them, sometimes up to half a second ahead."



ANCHORS AWAY

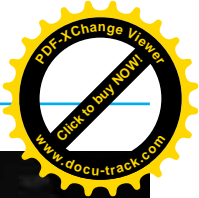
Zactrack system's antennas are called anchors. "On a stage production, we typically use a minimum of ten anchors," Werner elaborated. "Having more anchors doesn't make the data more accurate, it's about getting total coverage of complex spaces. For BMW, we once tracked cars through tunnels, and we used 28 anchors. In an open field, six would likely be enough."

Setting up the Zactrack system for lighting tracking is a three-step process – mount, measure, and align. After the anchors have been mounted in the space, their positions are measured using a Leica Disto S910 laser device connected to the same WiFi network as the processor, from a defined zero point on stage. Each anchor has a yellow dot, and the laser is shone onto to each dot to confirm to the system the anchor's position in 3D space.



← Leica Disto S910

Zactrack anchor rigged at the rear of the seating area ▼



ON THE NETWORK

▶▶ Zactrack puck, tag charger, and tags



▶▶ Zactrack tablet interface



The next step is using the ingenious sensor puck – a small puck with a light sensor built in. Pucks are positioned at four points on the stage where the 3D coordinates are known. They are activated and connected to the Zactracks WiFi network, and each light shone onto the puck four times, taking five to 10 seconds per light. The Zactrack CORE software can then calculate everything it needs to know from that data.

The heavy lifting is done in the Zactrack CORE computer. "It receives the x-y-z coordinates, which are accurate down to plus or minus 5 centimetres," Werner stated. "CORE then does the calculations to get the correct pan and tilt angle of the lighting fixture. To calculate that, it needs to know where the light is and the orientation of the light. From that, it can calculate every position in 3D. On the output side, we support any kind of lighting protocol; ArtNet, DMX, sACN, OSC or whatever else you want. We take the info from the console and can control any moving light on the market. We have found that the accuracy of fixtures varies from manufacturer to manufacturer, and the speed of the fixture is an issue if the performer is moving quickly and stopping fast."

TOUR-PROOF

Werner believes Zactrack is now mature enough for use in almost all production situations. "With new technology, there's always fear and uncertainty," he mused. "We learned there's a difference between having a working piece of technology and it be suitable for use on tour. Tours need to

run for six months, load in and out in 10 hours, and not take too long to align the lights. We can get these systems aligned in around an hour. Zactrack is tour-proof, accurate and fast enough to do lighting, robust enough for bad conditions, works in the dark, and works in the sun."