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Coachella Valley Music and Arts Festival 2012

1- The Main Stage amidst the Coachella 2012 scene

TAMING THE ELEMENTS
INSIDE THE SOUND DESIGN FOR THE 2012 COACHELLA FESTIVAL

Designing a sound reinforcement system for a large-scale music festival is a complex process, with the 2012 Coachella Valley Music and Arts Festival, held this year in Indio, California, serving as an instructive case study.

Once again, the festival relied on Rat Sound Systems of Camarillo, California, to provide systems for all five stages. The L-shaped configuration of the stages, combined with the wide range of music styles performing at the festival, created a number of unique sound design challenges, including controlling sound bleed from one stage to another, tailored spatial coverage, and frequency control over extreme temperature ranges – in excess of 100 degrees Fahrenheit in the afternoon, and as much as a 50 degree temperature drop in the evening.

Rat Sound's experience combined with L-ACOUSTICS line arrays and sound design tools proved a great match in overcoming these challenges to deliver quality concert audio to more than 650,000 who attended Coachella over two weekends, as well as the Stagecoach Country Music Festival on a third consecutive weekend.

Virtual Optimization

The use of L-ACOUSTICS' proprietary modeling software, SOUNDVISION, as well as LA NETWORK MANAGER 2.0, were of considerable benefit from the outset of the design process. SOUNDVISION allows multiple system designs to be considered at the same time, which lets the system engineer present different options to the production beforehand

This is especially useful thanks to the delay mode in SOUNDVISION, because the delay times can be calculated with high accuracy ahead of load-in. As many shows don't usually allow enough time to time align and tune a complex system like the one for the Coachella Main Stage, having the ability to prealign the system is a large time saver and allows for virtual troubleshooting before any equipment is in place.

In addition, NETWORK MANAGER 2.0 allows a system to be easily designed ahead of load-in and match the offline design to the physical units onsite. Further, as parts of the system come online, they can be synchronized instantly without having to rebuild the layout.

After several years of using L-ACOUSTICS V-DOSC line arrays for the main stage, in 2009 Rat Sound first deployed its then-new K1 arrays. That practice continued this year, with left-right arrays each comprised (top to bottom) of eight K1-SB subs, 12 K1 full-range elements, and three smaller KARA elements for down fill.

The K1 array installation proved simple and fast, with the ability to control both the vertical angle and horizontal angle. The K1-SB/K1 arrays were suspended from three points per side, two of which utilized the Delta Plate for azimuth control (pan/yaw). The Delta Plate accommodates micro adjustments in the horizontal aiming of the array to compensate for any discrepancies in the rigging points as well as to provide more uniform coverage.

The Main Stage side arrays were asymmetric to avoid impacting the adjacent Outdoor Theater Stage. The left side array consisted of 12 KUDO elements, while the right side array, almost directly facing the Outdoor Theater Stage, included nine KUDO used with narrow 50-degree louvers in order to provide accurate spatial coverage and avoid interference.

> "THE L-SHAPED CONFIGURATION OF THE STAGES, COMBINED WITH THE WIDE RANGE OF MUSIC STYLES PERFORMING AT THE FESTIVAL, CREATED A NUMBER OF UNIQUE SOUND DESIGN CHALLENGES, INCLUDING CONTROLLING SOUND BLEED FROM ONE STAGE TO ANOTHER, TAILORED SPATIAL COVERAGE, AND FREQUENCY CONTROL OVER EXTREME TEMPERATURE RANGES"

2- Grace Potter and the Nocturnals on the Main Stage at Coachella 2012

Scaling The System

As many as nine delay towers, each with six V-DOSC, were distributed throughout the Main Stage audience area to tailor coverage depending on crowd size and time of day. V-DOSC served as an appropriate delay system in this configuration as the 70-degree (-3 dB) horizontal dispersion pattern allowed for maximum coverage with minimal overlap between arrays. An LA-RAK amplifier/processing package at each tower kept loudspeaker runs as short as

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possible, with only a single drive line and one network cable per tower required.

The use of a larger quantity of smaller delay towers allowed the system to scale nicely depending on the crowd size, without affecting the tonality in the desired audience area. For small crowds of less than 10,000 people, it was possible to utilize just the main system in the afternoon, then scale it up for crowds of over 80,000 people with just the click of a mouse.

In addition, front fill was supported by six ARCS II enclosures distributed along the front of the main stage. A set of 36 SB28 subwoofers satisfied low end requirements.

3- One of the K1 arrays at the Main Stage

At the nearby Outdoor Theater Stage, the main arrays each consisted of eight K1 and three dV-DOSC per side, joined by 16 SB28 subwoofers and four ARCS II for front fill. The delay approach was similar to the main stage, with 36 V-DOSC enclosures on six towers distributed throughout the coverage area.

The Sahara Tent, which predominantly featured electronic music artists, was outfitted with K1 this year as well, with 16 enclosures set up for L/R with a complement of 24 V-DOSC and 12 ARCS used around the tent to provide a surround effect. The system was completed with as many as 48 subs that kept the packed crowd bouncing. Finally, the Gobi Tent was supplied with a KUDO rig, while the Mojave Tent rocked with a V-DOSC/ dV-DOSC combination, along with six SB28 subwoofers per side.

All systems were controlled and powered by LA8 amplified controllers, which simplify implementation. The ability to distribute DSP to each loudspeaker location decreased the number of drive lines required and added a significant amount of processing flexibility.

To best protect the LA8s from the sun, rain and general chaos that are common to outdoor festivals, the amplified controllers were located below the stage and housed in a total of six LA-RAK touring racks, with three LA8s in each rack. Only six drive lines and a single network line were required to distribute audio and control all 144 channels of DSP/amplification for the Main Stage system.

Theory & Reality

In the mid afternoon, it becomes impractical to extend the coverage of the main arrays to the full field from the stage because the loss of highfrequency energy due to air absorption becomes insurmountable. For instance, in typical valley weather conditions in April (86 degrees for an average high, with 30 percent humidity), the loss of energy in the HF domain due to air absorption is approximately 17 dB at 100 meters (330 feet), and approximately 35 dB at 200 meters (660 feet). And often, the local weather conditions far exceed the average; in fact, it's not uncommon to see 104 degrees and as low as ten percent humidity.

SOUNDVISION allows users to model the impact of air absorption depending on the atmospheric conditions, and this year, it led to the following configuration of the Main Stage delay towers: the first row of three towers was placed

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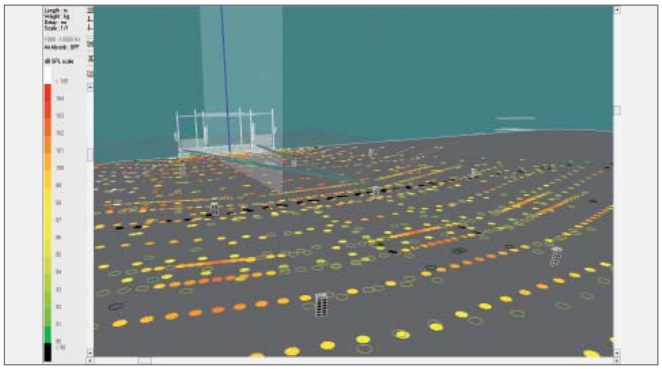

4- A Soundvision screen capture of the delay design for the Main Stage

approximately 275 feet from the front of the stage, with the second and third rows at approximately 450 and 625 feet, respectively. This extended coverage well beyond 850 feet while keeping a consistent tonality and mitigating the loss of SPL.

A challenge presented by modern line arrays is keeping tonal balance consistent. Generally speaking, moving from the front of the coverage area to the back, sound can be "thin," and impact lost. This is the nature of line source propagation, which is not typically an issue in an arena or theater, where the differential in listener distance from the first to the last row is between four to six times. On the other hand, a festival system "thins" more due to lower array trim height and the larger distance of the differential from the closest listener to the furthest, which is generally greater than ten times.

5- Two of the V-DOSC delay arrays to support the Main Stage system

An effective way to mitigate the problem is to extend the array to better throw LF to the back of the audience coverage area, and to reduce the LF content in the front of the audience area. Due to the air absorption, it doesn't make practical sense to do this with full-range enclosures because the loss over distance would result in a very dull sound.

This is why the K1-SB was placed above the K1 in the arrays for the Main Stage. In this configuration, the LF of the array is extended in length (but not the HF), and it is possible to attain a tonal differential that has less than 6 dB of variation between LF and HF.

The differential in air absorption experienced across the audience in such a dry and hot environment is also significant. Utilization of the FIR (linear phase) EQ in the LA8 allows for a differential EQ in the HF, which takes into account the air absorption and proximity of the array across the large audience differential. Combination of physical modification of the array with the K1-SB and electronic modification, such as the FIR EQ, allow for the most consistent results to date.

Under Control

A new concern at Coachella this year was noise pollution in the surrounding residential areas. The use of cardioid subwoofer arrays reduced the rearward sound pressure level 12 dB from the traditional omni configuration.

As important as rejection behind the array is, the loss of sub energy in front is equally (if not more) important because low-frequency energy is often the most expensive to produce, move and power. The loss of energy forward due to the cardioid configuration was less than 1 dB compared to a traditional configuration.

Further, the directivity of K1 arrays provides significant rejection across all frequencies outside of the desired coverage area due to their proprietary Wavefront Sculpture Technology (WST). Rejection outside the listening area is at least 12 dB down as compared to the desired coverage area, and often much greater.

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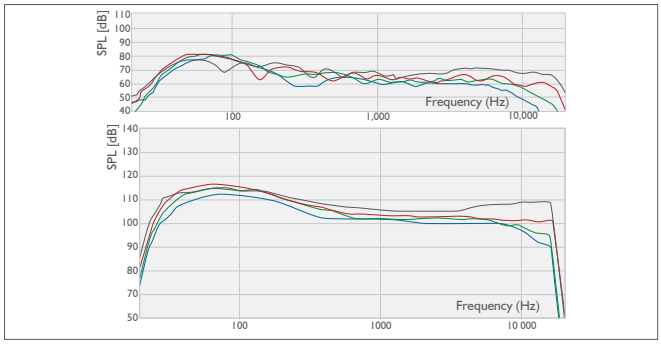
6- The Main Stage



7- Measured and on-axis frequency response for the Main Stage arrays

The difference between front of house at the Main Stage and the closest residential area was always at least 25 dB, and often much more. The SPL measured offsite only exceeded 85 dB for a total three minutes and 17 seconds at the closest measurement location for the entire festival.

Sherif el Barbari, System Designer and Engineer for Radiohead, which performed at the festival, shares his experience with the Main Stage system. "The first show was generally difficult to get a grip on because of the tough weather conditions. Even the audience couldn't really get into the vibe, I thought. California and freezing cold just don't work.

"Nevertheless, after adjusting for the change in humidity and temperature, we managed to achieve a very satisfactory result. When the show started, I'd say we were already at 95 percent of our target and it ended up being among the best sounding shows of the tour. A big thumbs up to the Rat team in supplying us, and every artist on the bill, with a perfectly set up system."

For Kevan Wilkins of Goldenvoice, who served as Onsite Production Manager for Coachella 2012, the system designs were paramount to the overall success of the festival. "From a production standpoint, sound system design and power are the two most important line items. I believe that this year's festival, which featured 140 artists, five stages, two weekends and zero complaints, speaks volumes about the sound and performance of the systems that Rat Sound used, and the level of professional service they provide."

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