AN INTRODUCTION TO SLIM ARRAY TECHNOLOGY

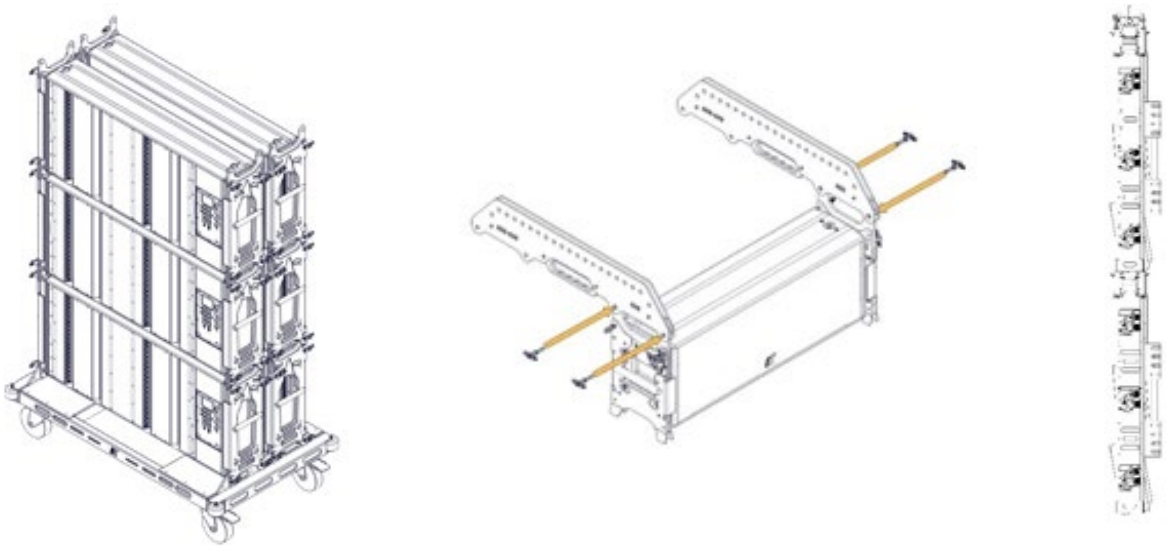
K-array began in 2005 in live sound and installation. After experiencing the usual challenges that most rental companies faced of high costs associated with loading time and transporting heavy speakers, the company founders set out to develop a better way of operating. Their results were revolutionary and, quite literally, out-of-the-box designs.

The KH4 was developed to overcome these problems with over 4,000 W of onboard power, yet weighing around 100lbs and measuring only 6" deep. It was the first slim array technology speaker.

Quick to assemble and deploy, easy to transport and delivering extremely high SPL with unprecedented quality for a wide variety of performance types and venue configurations, the flagship series helped establish K-array as a manufacturer of innovative pro audio solutions.

Since then, K-array has maintained its reputation in the industry for revolutionary design by developing the next generation of touring systems – the Concert Series – and the top-of-the-line Firenze Systems, which include K-array's distinctive Slim Array Technology (SAT).

Just by looking at their compact profile, it's apparent that SAT-featured products, such as the KH2, KH3, KH5, KH7 and KH8, are lightweight solutions which save space along with transportation costs, but users of the systems also enjoy little effort and time in setup and takedown and minimal visual impact on the venue.



The practicality of transporting, the ease of assembly and the overall minimal footprint of the cluster are some of the advantages offered by SAT technology..

While these are significant benefits, the main advantage of SAT is that the compact design allows for a better impulse response with respect to a diffuser with a voluminous box and controls the horizontal directivity even at medium-low frequencies where traditional line arrays elements tend to be nearly omni-directional.

THE CHALLENGE

The figure below shows a typical configuration of a live event in which a stereo PA system is mounted. As mentioned, traditional line arrays have a low directivity on the horizontal plane below a certain frequency. The angle of the horizontal coverage, often greater than 180°, is very broad in the low frequency. Consequently, a large amount of energy is sent to center stage, the area where the orchestra is located, the front of the stage and towards the side walls.

This results in numerous complications:

- The emission of low frequency energy on the stage calls for an increased volume level of the monitors for the musicians, which consequently deteriorates the signal-to-noise ratio of the microphones and increases the difficulty in feedback management.
- Similarly, the excess energy in the medium-low frequencies in the front rows leads to the need for very powerful front fill systems to ensure sufficient definition. Front fill systems driven at very high volumes worsen the definition of the sound on stage and further complicate the microphone placement.
- The large amount of energy directed towards the center stage creates a big problem when there is an orchestra. The amount of gain available before triggering the feedback is greatly reduced, making it difficult to pickup the sound of instruments like the strings and piano.
- The energy dispersed in the direction perpendicular to the array leads to an increase in reverberation in closed environments, such as theaters and auditoriums where PA systems are often installed in proximity to the walls.

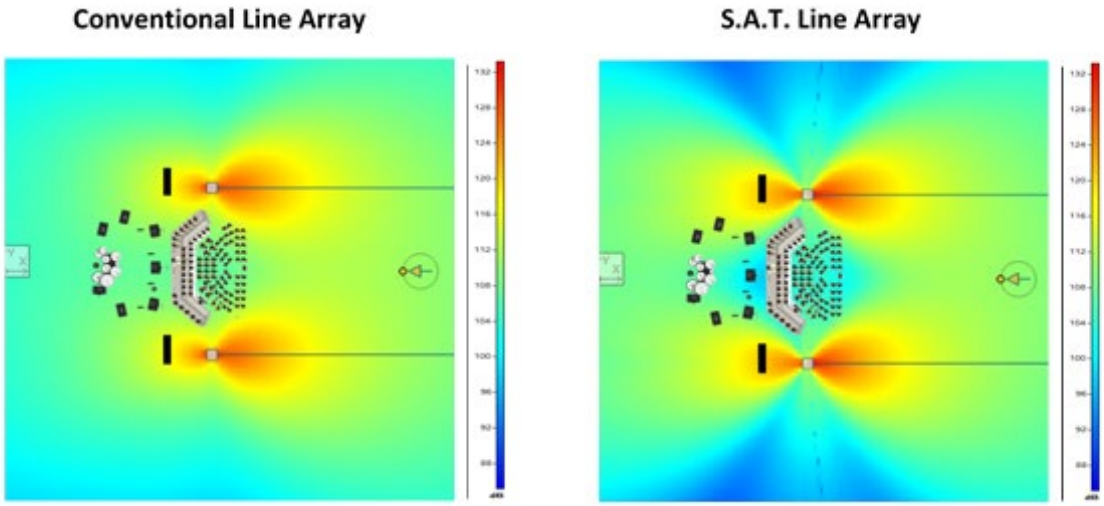
Typical configuration of a live event in which a stereo PA system is mounted

THE SOLUTION

This is where SAT comes in to save the day.

In the initial developmental stages, the starting point was a sound baffle configuration. The natural energy dispersion of the acoustic baffle has a dipole characteristic or, in other words, a figure 8 dispersion. This seems to be a viable solution that can address the problem of minimizing the energy sent to the center stage, front stage and side walls. The drawback is that there is a strong emission in the rear of the system. In order to address this issue, the S.A.T. speakers have been mechanically designed to reduce and absorb sound emissions from the back panel. The resulting directivity does not manifest a figure 8, but looks more similar to a hyper-cardioid figure. This preserves the desired directivity and produces minimal back emissions.

The following figure is a comparison of the horizontal dispersion of a standard 4-m long line array and a SAT system of the same length, consisting of 6 KH8 units per side. The use of the SAT system results in a reduction of sound pressure levels in the area occupied by the orchestra, at the front of the stage and on the side walls at an average of 12 dB in the medium-low range.

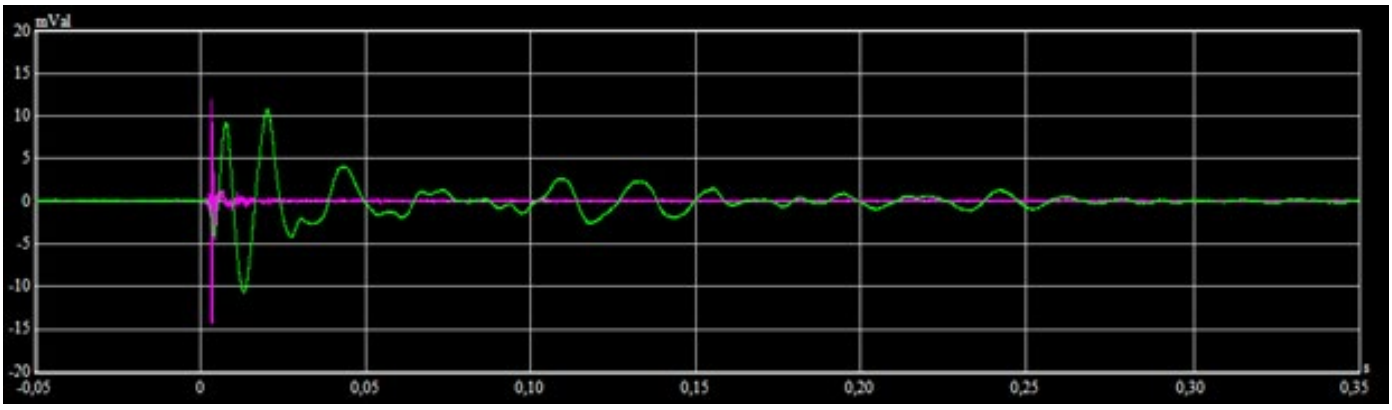


Comparison of the energy distribution of a traditional PA system and a SAT system consisting of 6 KH8 units per side. The simulation shows the SPL values in a third octave band centered at 200 Hz.

IMPULSE RESPONSE

The control of the directivity on the horizontal plane is not the only benefit of a diffuser devoid of a bulky box. Another advantage of SAT is a better impulse response than that of a conventional line array element.

In truth, a direct-radiating bass reflex box uses a resonant air volume that tends to reduce the definition in the low-mid range and does not allow the correct reproduction of fast transients. Instead, SAT's compact design allows sound to exit instantaneously without resonance, generating a significant amount of sound pressure in the low and low-mid range with a fast transient response.



Bass reflex S.A.T.

CONCLUSION

The hyper-cardioid dispersion in the low frequencies and an extremely fast impulse response are the true advantages of slim array speakers. The combination of these two factors leads to a significantly better acoustic outcome with respect to the traditional line array elements, particularly in terms of sound definition and noise pollution outside the desired audience areas.

Additionally, the compactness of the speakers benefits the user through the practicality in transporting, the ease of assembly and the overall minimal footprint of the cluster which leads to an optimization of space, time and, therefore, total incurred costs for the management of these systems.