Line Array Round Up

Recent months have seen an explosion of new line array systems. Christopher Holder stacks them up for a closer look, and lines up discussions with an array of men who had a hand in their design.

AudioTechnology has devoted quite a few column inches to the subject of line arrays, probably more than might seem warranted given that line array systems in Australia are rare as hen's teeth. But I believe the renaissance and refining of line array technologies represents the most exciting development in sound reinforcement for quite some time, and it does us no harm to be as informed as possible. It's well known that L-Acoustics, a small company based in a farmhouse outside Paris, made the 'big boys' sit up and take notice with their V-DOSC system. The likes of EAW, Apogee Sound, Meyer, JBL, and EV eventually found the clamour from their loyal customers for a similar system too great to ignore. They hit the drafting boards with a vengeance and have all emerged with competing products, and they all have their own take on what a line array should be.

If you want to know more about the theory behind line arrays and the sonic qualities they exhibit, then you could do worse than look at AudioTechnology Issue 11 where our 'Line Arrays Explained' article lays down some of the ground work. But just to briefly recap here's a few things to remember.

The usual suspects: (Left to right) The EV X-Line, JBL VerTec, L-Acoustics V-DOSC and Meyer Sound M3D systems lined up for a shoot out at an undisclosed US location. An interesting session to have attended, no doubt.

The Story So Far

The theory behind line arrays has been around a long time – papers on the subject were published at least as far back as the '30s.

Line array-type speaker systems were very prevalent in the '60s and '70s. The weren't big or sophisticated but certainly ruled the roost before horn-loaded technology took over.

Dr. Christian Heil of L-Acoustics revisited the theory in the '80s, building prototype speaker systems that evolved into what we now know as V-DOSC.

Line Arrays first hit Australia again when Norwest Productions took an EAW KF860 rig out with Jimmy Barnes.

A line array system should be thought of as one large speaker, only broken up into individual cabinets (or 'elements') for the sake of portability. In other words, don't think of a line array cabinet in the same way as you'd think of a conventional box – use a line array cab in isolation and the results will be inferior to a conventional cab.

If you build a line array that is big enough and with the drivers closely spaced enough, you will have a highly directional and controllable sound over a large frequency spectrum, with excellent uniformity of sound from front to back.

The closer you come to having a true line source array and the longer the arrays is, the closer the array comes to emitting sound 'cylindrically' rather than 'spherically'. In practice, this means that you have a longer throw than conventional rig, and greater pattern control (fewer boxes required, less spill on stage and onto reflective walls etc).

Who's right, who's wrong?

As mentioned, L-Acoustics kicked off the line array renaissance with V-DOSC. And, undeniably they have a very good system indeed. But the theory behind the way V-DOSC works isn't completely beyond debate (as you will read later). Naturally, whatever the 'whys and wherefores', the proof of a good system is in the using. Time will tell as to which of the new line arrays are considered 'top flight', but, as is presently the case with conventional speaker systems, there will not be a clear winner in all regards. After all, there's more than sonic considerations at stake, there's also ease of rigging, weight/size issues, brand loyalty, and the price for heaven's sake.

It's also worth noting that the systems I've outlined here are available to anyone who has the cash. Meanwhile, L-Acoustics works under a 'V-DOSC Partner' arrangement, where each territory has only one source from which to hire a V-DOSC system – ie. even if you waved a suitcase full of money at L-Acoustics they will point you to the Australian V-DOSC Partner, Jands Production Services. Similarly, the other notable omission in this list is Clair Brothers' i4 line array system. This is a Clair proprietary system designed and manufactured for themselves and their affiliates (again, JPS in Australia) so you can't buy the system for yourself, for love or money.

The article concludes with a synopsis of the competing line array systems. I've tried to outline how each system differentiates itself in this increasingly crowded market. Also I've interviewed key people from each of the manufacturers to learn more. The gentlemen involved (in no particular order) are: David Scheirman, Director of Tour Sound for JBL; Kenton Forsythe, Executive Vice President of Engineering and co-founder of EAW; Ken DeLoria, President of

Apogee Sound; John Meyer, CEO of Meyer Sound; and Mike O'Neill, Chief of Engineering at ElectroVoice. A significant quorum of industry heavyweight I'm sure you'll agree... so, let the discussions begin!

Long Time in Replying

For starters I asked 'the panel' why it took so long for the industry to reply to L-Acoustics challenge. In V-DOSC, here was a system that had obvious advantages, but it has taken the best part of 10 years to produce viable alternatives. Admittedly, around four years ago, EAW and Apogee Sound produced line array systems, but neither company were entirely satisfied with the results and have subsequently superseded those efforts with superior systems. So why has it taken so long? I think JBL's David Scheirman encapsulated the general response best.

David Scheirman, JBL: Well, if you know your history you'll see that line arrays from the likes of Bozac, EV, University, Altec, and JBL were the primary way of presenting public address (mainly for vocalists with musical groups) in the '60s. That trend peaked in the early '70s. That said, the limits of the line array column-type speakers became quite obvious in the early '70s. Many of the groups that began touring then, like Grand Funk Railroad, Iron Butterfly, Vanilla Fudge, or Three Dog Night, soon realised that systems for rock music in larger venues needed more acoustical power. From there, horn technology kicked off, with cinema-type multicells proliferating, and that steered the development of most portable sound reinforcement for the next 20 years. Vendors like EAW, Meyer, and Turbosound all brought modular three-way horn-loaded enclosures to market, so that by the mid '80s, to the mid '90s that was the dominant paradigm – and the poor line array got left behind in the dust. Well, around 1990 L-Acoustics' Dr. Heil began in earnest his evangelistic decade-long drive to have line source arrays considered again – which resulted in a successful product, particularly in Europe.

In answer to your question 'why did JBL come out after the fact?', I think whenever there's a paradigm shift in technology, the larger organisations will see whether it's a fad or a trend. So, in one sense, you could say that V-DOSC (as an early, single brand) was a fad, while array systems in general (offered by a growing number of professional manufacturers) are an industry trend. So the early innovator, L-Acoustics, has done a very good job of reminding the broader industry of the benefits of line array technology.

CH: But V-DOSC represents a marked improvement on the line arrays of the '60s and '70s. It's a different animal. Would you say the recent crop of line arrays are inherently better than conventional systems?

David Scheirman: I'd say, in general, a properly deployed line array system will offer smoother coverage in the horizontal plane and predictable coverage in the vertical plane. Therefore, from the front row to the back row of the audience you can predict what your sound reinforcement results will be and you can mechanically deploy it to guarantee those results.

CH: So that's a 'yes' then?

David Scheirman: Yes, I'd say so – if predictability and smoothness of coverage is better than unpredictability and spotty coverage, then I would agree.

CH: So, even though you are observing a product come onto the market that you would identify as being innovative, JBL still needed to be 'asked' by its customers for a JBL equivalent?

David Scheirman: JBL provide products customers want to buy. and it's the market that's saying, 'we're interested in line array systems' – it's not JBL or Meyer, or EAW, or anyone else who are trying to push that system format on the market place. We are simply providing alternatives to the single source monopoly of the original purveyor of large format, high power, modular line array system – L-Acoustics.

If you're looking for a parallel, then go back to the late '60s, and look at what happened in the UK. Back then you had two primary brands, in WEM and Court Acoustics, ruling the roost. Their speaker columns were being used for every rock 'n' roll gig under the sun. If you went to a Rolling Stones concert or a Beatles concert in the middle of the '60s you typically saw

> *"That was our design criteria: to try to meet those user requests for incremental improvements, both mechanically and acoustically"*

David Scheirman, KBL's Director of Tour Sound.

> *"the early worry was: 'would [the M3D] get the sound and the power and the punch [of the MSL4]?'. But... we've achieved that"*

John Meyer, CEO of Meyer Sound.

> *"Apogee has approached its line array development with a careful view towards minimising distortion"*

Ken DeLoria, President of Apogee Sound.

> *"We eliminated some of the difficulties of the KF860 and came up with a package that is much smaller, easier to use, and actually higher in output"*

Kenton Forsythe, EAW's Executive Vice President of Engineering.

> *"We were looking for better horizontal control over a wider band, and we were looking for a better stereo image"*

Mike O'Neill, EV's Chief of Engineering.

column-type speakers, early line array systems, in use. Then, when Iron Butterfly trucked a big Altec-Lansing and RCA horn-loaded cinema-type system over to the UK for the first time (for use at the Royal Albert Hall) that was a revelation, and changed the direction throughout the UK and Europe. So you had Court and Dave Martin going right to work on their own competitive options so 'these darn American horn-loaded systems' wouldn't take over their franchise as providers of sound systems.

So this is the same situation in reverse. Here's a European large-scale column speaker which a certain segment of the market appreciates. So what we did at JBL was to say, 'we understand line arrays, we have a great wealth of knowledge from decades ago and we can give the customers what they want'. I mean, we can go all the way back to acoustical pioneers in the 1930's like Leo Beranek, Harry Olson, and Ian Wolfe and moving up through the 1950's and 60's with researchers like Dave Klepper and John Hilliard, and you can find a tremendous body of knowledge that describes these systems, and how they will behave. So if you then map that knowledge to modern components – which obviously didn't exist when these acoustical pioneers did their research in the 1930s and '40s – yes, you have a whole different animal.

The HF Summation Conundrum

For driver coupling, or summation, to occur the string of drivers you see for each frequency band in an array must be placed close enough together. The minimum distance required between each driver is dependent on how short the audio wavelengths the speaker produces. For very high frequencies it becomes almost a physical impossibility to get those drivers close enough – the wavelengths are simply too short. To combat this problem, L-Acoustics developed their DOSC waveguide (or lens) which is designed to produce a flat, phase coherent ribbon of sound – thus it was now possible to place the mouth of each lens close enough together and allow summation to occur. The DOSC waveguide is patented and L-Acoustics claim that it is a unique geometric shape that allows for the ribbon of sound to be produced – their rationale is: 'you don't have the shape, you don't have summation; you don't have the patent, so you don't have HF summation'. Competing manufacturers have either chosen to ignore this point, use more conventional horns, or develop something of their own to have a crack at this flat ribbon of sound nirvana. Alternatively, John Meyer of Meyer Sound, contends that summation of audio (of any kind) is pure fiction (see box item).

Mike O'Neill, EV: What's clever about Christian Heil's design is the use of a long HF slot, which means that there's very little gap between it and the adjacent box above and below it – I think that's the key over and above any horn or waveguide geometry. The hybrid that we have in our box is an alternative approach (the Hydra plane wave generator). That technology dates back to circa 1949 – nothing particularly revolutionary about it but it does a very similar job.

Kenton Forsythe, EAW: Within one element those DOSC waveguides work fine, and I think it produces something very close to a flat ribbon when you stack them one on top of each other to create a vertical line source – with no arc. Of all the systems, that's probably the closest. The trouble is, if you want a really uniform back-to-front coverage you have to curve your array, or else you're limiting your application to a fairly long throw condition.

With the KF760 line array we focussed on keeping the spacing between HF point sources constant – if you don't, you start to create interference effects. The KF760 maintains the internal spacing and the spacing between cabinets. The result is a line source which is very seamless at very high frequencies. It's a very smooth sound.

Saying that, the 760s are not perfect, but they're perfect up to around 12k – and then they have a few problems above that. But 12k was deemed to be an acceptable high frequency limit. A lot better than interference starting at 6k, which is a lot more common out there.

Ken DeLoria, Apogee Sound: I'd tend to agree. What L-Acoustics have, I believe, is less about the DOSC waveguide and more about placing the high frequency devices close enough together. For

Summation in a Line Array? John Meyer Says 'No'.

John Meyer, Meyer Sound: I have nothing against what L-Acoustics has done, all I'm saying is that V-DOSC has been presented more in a marketing way than a scientific way.

There's a real misconception that somehow line arrays do something different to the sound than regular speakers do. The idea that these waves from adjoining line array elements somehow join together and form a common wave... that's just completely not true. Sound does not do this, sound from two source simply passes through each other. Which is unlike the way water behaves, because water is non-linear. If you drop two stones into water, you get a third wave. This just does not happen with sound until you get to like 180, 190dB SPL – ie. in shock wave situations. So the idea of these things magically joining at the mouth just doesn't happen. It's just a complete marketing ploy to try to give people the idea that there is something different going on. Personally I don't like telling people that something is working the way that it isn't because sooner or later they'll figure it out, and then they just don't like you anymore!

'So if sound from two sources pass through each other, completely, what's going on in a line array – it's more than just a bunch of drivers flapping away,' you might say, and, of course, you'd be right.

If you stack up, say, 10 five-inch drivers on top of each other, and turn them all on, the result seems to be more directional than a single driver – you go above and below the field and the sound disappears. But the reason it's gone is because those drivers cancel out anything other than what's on the forward direction. In other words, if you start with one five-inch driver, and you put another one above it, on axis you would hear a doubling of energy (6dB gain) while as you go off axis you hear some comb filtering – there'd be some cancellation at certain frequencies. So if you added two more of these five-inch drivers on top of the previous two, it would go up another 6dB on axis, but you find in the vertical plane the combing would be more serious – more frequencies would be cancelling. As you keep adding elements in the line array the off-axis combing becomes more and more severe. So it isn't like these drivers are mysteriously becoming more and more directional, or that the array is taking on a life of its own – the directionality is caused by off-axis cancellation.

This same phenomenon would occur in the high frequency range if only you could get the drivers small enough and close enough together. But you can't, so that's why we've all gone for the highly directional HF horn approach.

So even if you could make a theoretically perfect high frequency line array – with an infinite number of infinitely small omnidirectional drivers, all spaced infinitely close together – you're still not going to see any summation. The advantage you would have is you can choose a new direction for that sound by electronically steering it. By feeding the drivers different delay times you can choose any angle in the vertical domain you want the thing to go, and that's how the military does it. But once you use horns and you make the speaker directional, you're stuck with physically having to bend the array to point the sound in another direction.

So these systems are a hybrid of array and horn technology. It doesn't mean that they don't work or they're not practical or they're not useful, it just means that it's been conveyed more in a marketing way than a purely scientific way.

Mike O'Neill, EV's Chief of Engineering.

John Meyer, CEO of Meyer Sound.

Kenton Forsythe, EAW's Executive Vice President of Engineering.

Ken DeLoria, President of Apogee Sound.

David Scheirman, JBL's Director of Tour Sound.

> "The cylindrical wave thing is a lovely concept for people to latch onto, but it doesn't happen at all."

> "None of us are building true line arrays, we're building hybrid low frequency line arrays combined with high frequency directional horn-loaded systems."

> "I don't think there's a magic bullet that's going to cover every type of job. Line arrays are going to be part of our future... but certainly not an exclusive part."

> "You've got to have enough speakers, you've got to have them located in the right place, and you've got to have them focussed properly. It's crucial."

> "Is [the DOSC waveguide] the only way to construct a line array system to give correct summation of high frequencies...? Absolutely not."

example, in early versions of our large-scale ALA9 line array cabinet, we had two HF devices in them. But the cabinet was quite large and the HF devices were around six inches apart. The results were absolutely disastrous. So we then changed the design to include three HF devices (so within the enclosure the HF devices are virtually touching each other) and we only have a 1.5-inch inter-cabinet spacing of devices. And the results are spectacular. There's a certain amount of measurable interference in the 15 or 16k range but it's relatively small, and below that, to around 13 or 14k, it is so smooth. So if you turn a single cab on, measure the results, store it... then turn the second cabinet on... it looks like the trace on your analyser has been elevated electrically, as opposed to there being another acoustic source added in. The summation is incredible.

David Scheirman, JBL: To Dr. Heil's credit he's done a good job at finding a way to differentiate his product in the market (with the DOSC waveguide) and, via a patent, protect the mechanical structure of one part of the system. As far as it being some 'secret ingredient', you can draw parallels to when Turbosound released their mid range device. Your readers may recall that in the early '80s, when Tony Andrews, and John Newsham and the R&D team at Turbosound created the Turbo-Mid Device, there was a period of three to four years before manufacturers like EAW, Meyer and others realised what was going on; what was and wasn't really patent-protected... and what may or may not really be necessary to get similar acoustical results and musical quality. So the patented HF device in the V-DOSC system works very well. But is that the only way to construct a line array system to give correct summation of high frequencies in multiple vertical stacked adjacent boxes? Absolutely not.

John Meyer, Meyer Sound: The whole idea that V-DOSC somehow achieves high frequency summation is simply not true. The truth is, all any of us are doing, is building very directional high frequency designs. Which is why you have to curve the array, because when it's directional like that it's not steerable – you can't electronically steer it – you can only electronically steer things that are omnidirectional.

This is a trap people fall into. They get hold of a system, are told it's a true line source array, they look into the theory and think: 'it says here that I can electronically steer a true line array'. They go away and try, and the results are terrible. I've heard it done, it's awful. L-Acoustics doesn't try to electronically steer V-DOSC because Christian Heil is more scientific than that. It's been some of the more amateur companies that have tried to put these horns into stadiums and steer them and it just turns into a big mess.

In reality, when you make the high frequency cover five degrees in the vertical plane and 90 degrees in the horizontal, you have something that is no different to any other horn geometry. In other words, the high frequency that the V-DOSC creates is no different than if you create it off a ribbon. In fact, we built a ribbon driver to prove this. It just creates a very highly directional sound.

So none of us are building true line arrays, we're building hybrid low frequency line arrays combined with high frequency directional horn-loaded systems. (See box for more.)

Cylindrical Wavefront – Fact or Fiction?

A theoretically perfect line array produces a cylindrical wavefront. 'What's that then?', you may well ask. Well, sound emitted from the array resembles a cheese wedge of sound rather than something closer to a segment of a sphere. A cylindrical wavefront is rather good, because the sound remains very phase coherent, and, the nature of the cylindrical polar pattern means your sound attenuates at a much slower rate. But do the current crop of line arrays produce anything that resembles a cylindrical wavefront, or is it just a theoretical ideal?

Mike O'Neill, EV: The thing you have to remember is: the minute you take anybody's line array and arc it (ie. if you don't have the front of the array flat), there is no cylindrical wave anyway – it's remains spherically divergent. So you step back and say, 'alright, well, if that's true then how come this still works better?'. And the answer goes back to the fundamental concept, if I can cram enough devices in together, and make the radiation apertures of those devices very close together, then I'm going to have less comb filtering. And that's the real key to anybody's line array.

The cylindrical wave thing is a lovely concept for people to latch onto, but it doesn't happen at all – it's still a spherically diverging wavefront, particularly the minute you put any arc at all on the array.

John Meyer, Meyer Sound: For an array to have any chance of producing a cylindrical wavefront, it needs to be very, very long. Cylindrical waves are a theoretical concept based on an infinitely long array. The military literally draw mile-long line arrays in the ocean behind destroyers looking for submarines, I mean, they have to be really long to start to work. Most cylindrical waves are created off power lines that are miles and miles long, and often you get cylindrical waves that seem to come off of long lines of traffic on freeways. But something that's 10, 20, or 30 feet long doesn't seem to create much of a cylindrical wave, they're just not long enough.

Not For Every Application?

A line array's very defined coverage pattern is both its biggest strength, and possibly its biggest weakness. A line array needs to be aimed very carefully, otherwise you're likely to miss whole sections of your audience almost entirely. Furthermore, most manufacturers recommend a bare minimum of four elements in an array, but preferably eight to begin to squeeze any of the 'good stuff' from an array. Hence, line arrays aren't going to be perfect for every application. Or are they...?

David Scheirman, JBL: Will line arrays completely supersede conventional systems? Well that's up to the market – I think neither you or I can predict the answer to that. Just like if you were Rudy Bozak heading up a manufacturing company whose gear is being used to do sound for top touring groups like Peter, Paul & Mary and Herb Alpert, and you were the top name in speaker columns in about 1966... what if someone asked you, 'would horn-loaded technology replace your speaker columns...?'.

CH: Granted, but a critical mass of line array elements is required to have something that actually functions as a line array. If I'm a smaller operator that needs a system that can be split up and used in a variety of applications, I'd being going for a conventional rig, surely?

David Scheirman, JBL: Well, that depends upon the application. We're seeing a shift in North America towards more and more sound designers going for a distributed model – smaller arrays positioned around the listening area – rather than these monolithic main left/right arrays. So you might see a group of three or four VerTec enclosures, in a dozen or more locations – it can make significant sense.

CH: Even though you're sacrificing a lot of the 'good stuff' you get in larger arrays.

David Scheirman, JBL: Directionality increases at lower frequencies the more elements you couple together. If you have a 12- or 16-box array you're going to have better pattern control and predictable directivity down to a much lower frequencies than if you have a four-box array. So, yes. But then the same is true of traditional three-way horn-loaded boxes. As you combine those as multiples in an array, you have frequency dependent characteristics that begin to develop. Both types of systems (line arrays and traditional fan-shaped arrays of multiway boxes) have their advantages and with both types of systems you can find some less than optimal conditions.

John Meyer, Meyer Sound: I'd say right now, line arrays fit 20 percent of the jobs we do. There isn't anything magic about line arrays. Currently all you hear is, 'oh it's got to be a line array', like somehow the sound coming out of a line array will be better than the sound coming from other systems... but that's just marketing stuff.

I've been to shows where they've used two line array columns and they've covered the down area (where the mixing position is) and there's nothing for the balcony – the whole balcony was just completely weak. That's not a good design, and a line array isn't going to magically make it sound any good. I've been to other shows where they're putting line array clusters in the ceiling and aiming them down at the audience. Doing that doesn't necessarily make it sound like it's coming from the stage – it sounds like the band's coming out of the ceiling, and people don't like that!

I've always been of the opinion that you can't just fly something and go backstage and get drunk. This is not the business we're in. You need to make sure that you're covering the audience with the power and the quality that they're looking for. I'm not saying there hasn't been some wonderful shows with line arrays, I'm just saying a good show isn't somehow inherent within a line array system.

Kenton Forsythe, EAW: It's a set of trade offs. We tried to design the KF760 system so that it would purposely service a broad spectrum of venues. The KF761 was part of that strategy – it's a shorter throw or wider vertical coverage cabinet, and we really see proper arrays using a 760/761 combination.

Every design has its own limitations and merits as to how it's going to be used. I don't think there's a magic bullet that's going to cover every type of job. Line arrays are going to be part of our future – they may well become an overwhelming part of our future – but certainly not an exclusive part of it.

Ken DeLoria, Apogee Sound: Line arrays are highly directional and they're not forgiving. If you go into a theatre, for example, and you need 70 degree coverage from the top row of the balcony all the way down to the first row of the floor, and you've got seven cabs angled at 10 degrees each, (which is what our boxes do when they're 'tight packed') then you're going to get coverage. But if you go in with six cabinets, because that's all you've got, you are going to be seriously missing a section of the seating. And, when I say 'missing', I mean really missing. You've got to have enough speakers, you've got to have them located in the right place, and you've got to have them focussed properly. And whether you're doing a rental job, or a permanent install, you've got to have enough time to adjust the array... it's crucial.

Mike O'Neill, EV: We've made a point of going out to our customers and saying, 'just because you have a line array doesn't mean you throw away your conventional systems'. It's interesting, when I'm at trade shows, where there are a lot of line arrays, I'll get a lot of touring companies coming in and getting pretty steamed up, as though we're forcing them to ditch their existing stock. And I'm very quick to say 'no, no, no, there are places where conventional PAs work better, just like there are places where line arrays work better'. So what we're saying is, 'look, you can combine these if you pay attention to what you're doing, you can combine line arrays and conventional boxes...'

What's Going On?

RBI, Hydra, Broadband-Q, REM, WST, WaveFormer... good grief. All of the players are quite naturally trying to mark out their turf with proprietary 'smarts' that set them apart – so much so, it's practically impossible to determine whether anyone actually has the wood over another in the technology department.

Line arrays have been very successful in The States, if our spokesmen are to be believed. JBL have already sold 'over 1,000 VT4889s' in the last 12 months, EV are still trying to keep up with demand for their X-Line, etc etc. In Australia, the situation will naturally be a bit different. The systems are expensive, and the large-scale models we've mostly looked at are

primarily designed for big-time touring applications – something we don't have as much use for in Oz.

Saying that, this is only the tip of the iceberg, and I predict that it will be the next ensuing wave of smaller-format line arrays that will get the most sales in this country. Out with Singin' in the Rain, Jands Production Services have a system comprised only of the smaller dV-DOSC elements, Apogee Sound have had 'enormous success' with their smaller ALA3 and ALA5 cabs in the theatres and churches of America... and I can see this trend carrying on in the install and theatre markets of Australia.

This article is big enough as it is, and I still haven't covered many other areas of interest, such as sub woofers in the system designs, or line array signal processing, amplifiers, software etc etc.

But I hope this has kicked off a certain degree of thought and maybe some debate. Send me an email if you've got something to say, I'd like to hear it (chris@alchemedia.com.au).

The Contenders...

Manufacturer: JBL
System: VerTec
Models: VT4889
Drivers: 3 x 1.5-inch, 4 x 8-inch, 2 x 15-inch
Element weight: 69kg
Maximum array length: 16 at a 7:1 design factor
Where It's different: JBL probably has the deepest pockets when it comes to developing new drivers and use of new materials, and they've come up with something that is genuinely innovative.

Saying that, VerTec, on the face of it, looks remarkably like V-DOSC, but great emphasis has been placed on cabinet weight, and power. To address the problems of high frequency summation, JBL has developed their WaveFormer waveguide. Also JBL's RBI (Radiation Boundary Integrator) is a component that 'covers' the midrange units, and aims to negate any intermodulation distortion (between the HF and midrange units).

Rigging/Trucking: VerTec is lightweight, which is a good start, and uses a high tensile strength aluminium 'Array Frame' combined with sliding steel-alloy hinge bars to make box angle adjustments. All the required hanging hardware for each box travels with the enclosure. Meanwhile, the VerTec Line Array Calculator (an Excel file) offers a software indication of predicted system performance. Each cabinet is fitted with a dolly board that doubles as a protective grille cover for easy trucking.

Contact: Jands Electronics (02) 9582 0909
Website: www.jblpro.com

More On Why VerTec is Different

David Scheirman, JBL: Mechanically VerTec looks similar to V-DOSC but there are some major differences.

Firstly, you have the increased output potential and greater dynamic headroom of each individual enclosure due to the high-powered components, and therefore the composite array. Each VerTec enclosure is has 4 to 5dB more output potential than a V-DOSC enclosure, for example. And these aren't sales claims, these are just objective measurements – there's simply more drivers in each box, with greater power-handling capacity than the competition.

The second major difference is in terms of the weight of the individual enclosure. VerTec weighs about 72kg. The V-DOSC weighs about 107kg, while our other competitors are often even heavier.

The RBI (Radiation Boundary Integrator) is also important. It's a slotted plate that covers the eight-inch mid cones, and it minimises the amount of DSP pain that you have to go through, because it helps the midrange cones behave more like the HF aperture. Also it gives the HF aperture a smooth surface to radiate past without the disruptive and vibrating cone surfaces interfering. Because of the RBI we have a significant and measurable decrease in the intermodulation distortion in the mid/high section of the VerTec compared to the competing projects.

I think, all up, we paid close attention to what pro customers have said they want to see improved in earlier line array systems. Invariably the comments were the same, 'we want more output', 'we want lower distortion', and 'we want lighter weight'. That was our design criteria: to try to meet those user requests for incremental improvements, mechanically and acoustically.

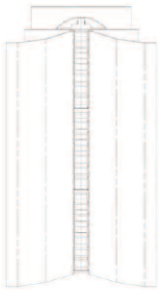
Manufacturer: ElectroVoice
System: X-Line
Models: Xvls, Xvlt, Xfil, Xsub
Drivers: (Xvls/Xvlt) 3 x 3-inch, 2 x 8-inch, 2 x 15-inch
Element weight: 117kg
Maximum array length: 14 at an 8:1 hang ratio
Where It's Different: EV figure that having the HF section placed between the midrange units (where the midrange units effectively create a 90 degree horn) creates problems in the midrange – they calculate that the small space created by the HF section gives rise to off-axis nulls in the midrange. So they've moved the HF section to one side. For the high end, EV has developed Hydra, a 'vertical plane wave generator', which is coupled to a waveguide – the result is a 'uniform phase over the entire vertical plane of the waveguide'.
Rigging/Trucking: Up to four Xvls cabs can be dropped onto one dolly and raised or lowered in a single cell. The idea is you don't have to lay all the cabs out on the floor and hoist them up that way, but simply raise the array up and add cabs to the base of the array as needed. Having four Xvls cabs to a dolly should make carting the system around easier – although, the trapezoidal cabs each need their own dolly. But EV has given much thought to transport configurations, consult their website for examples.

Contact: Telex Australia (02) 9648 3455
Website: www.electrovoice.com

More On Why X-Line is Different

Mike O'Neill, EV: When you look at a trend towards a new product like we've seen with V-DOSC, the typical corporate response is: 'it's no good', and you go away and find reasons why that's the case. But the fact of the matter is, it is good. Every other manufacturer, who said, 'gee, we have line arrays too', but did not do them as well as V-DOSC, realised we really had two choices to

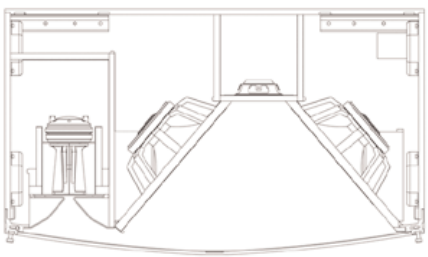
make: do we want to make a product like that? Or do we want to bring something additional to the party? And the latter was our approach – we were looking for better horizontal control over a wider band, and we were looking for a better stereo image.



V-DOSC has its two woofers on the outside of each element, which represented a horizontal array in the cabinet itself, with the consequent narrowing you get horizontally. Likewise the midrange driver either side of their waveguide represented a horizontal array where you start to get horizontal narrowing below 1kHz – you can hear that in a lot of arrays. But this mid range frequency band is critical to vocal intelligibility, so our approach was to take the HF out of the centre so all the vocals, fundamental material, don't have a piece of plumbing in the centre of it (see below). Taking that out, we can turn the midrange into one source rather than a source on the left of the HF and a source on the right. Also by doing that we can get a pattern without horizontal lobing associated with it.

Sure, by taking the HF device and placing it to one side you do get cabinet asymmetry about the centre axis, but we were happy to allow that because it cleaned up the lobing and you had a much more consistent stereo field as a result.

The other thing with our mid/bass configuration is that our midrange drivers are effectively coupled to a short horn, and that gave us a couple of octaves more horizontal control. With other line arrays, as you go down lower in frequency the horizontal pattern begins to widen out – so when you're doing indoor shows you're going to get more reflection off boundaries. We avoid that.



Manufacturer: EAW
System: KF760 Series
Models: KF760, KF761
Drivers: 2 x 2-inch units, 2 x 8-inch, 2 x 12-inch
Element weight: 91kg
Maximum array length: 16
Where it's Different: EAW has gone to great pains to make the KF760 exceptionally easy to set up – physically, as well as requiring virtually no signal processing or amplifier adjustments. The KF760 series doesn't use any direct radiating drivers whatsoever. But having low frequency horns usually means a more unwieldy cabinet dimensions. EAW have rather cleverly used their bent horn technology – cutting down on cabinet size and increasing LF output efficiency. Good horizontal pattern control is achieved in the low/mids by the 760's wide horn mouth.
Rigging/Trucking: There are only three splay angles engineered into the rigging of the KF760s (where you change the splay on the rear, so the fronts of the enclosures are always tight packed). The 760 caster pallet is designed to carry four enclosures. Which means, once the top enclosures of the array are rigged, you can add up to four 760s at a time.

Contact: Production Audio Services (03) 9415 1585
Website: www.eaw.com

More On Why EAW's KF760 is different

Kenton Forsythe, EAW: We took a slightly different approach to some of the other line arrays out there. We already had our experience with the 860 line array which we released around four years ago, and we applied what we'd learnt from our work on that. The 860 adhered more to the EAW philosophy of horn loading, wide bandwidth pattern control. But, they were also quite big and heavy. One of the big attractions of the V-DOSC cabinets is not necessarily how well they work but how easily people can plug and play them – it's a rectangular box, you lift them up, put some signal in, and you've got something that will work for you. I think one of the down sides of V-DOSC has been their output capability and variations in coverage as a function of frequency – which is just inherent in having components with defined spacing to them, as opposed to a horn load situation. So we kept coming back to the 860 approach in terms of large mouth, mid-range horns for pattern control.

In the process, we eliminated some of the difficulties of the 860 and came up with a package that is much smaller, much easier to use and actually higher in output – mainly due to the component updates. One of the fundamental differences is that the low frequency section of the 760 is actually a horn load, which you might think is actually quite difficult in that package. But we've done a lot of work researching the modelling of the horn conditions, which allowed us to come up with a dedicated horn/driver match that provided strong output in multiples to well below 60Hz. You wouldn't confuse it with a sub woofer, but these systems are almost always used with sub woofers.

Manufacturer: Meyer Sound
System: M3D
Models: M3D, M3D-Sub
Drivers: 2 x HF units, 4 x 15-inch (2 forward facing/2 rear facing)
Element weight: 177kg
Maximum array length: 16 at a 7:1 hang ratio
Where it's Different: For starters, like other current Meyer designs, the M3D is self-powered – with some 4500w of power on board. Meyer also employs their proprietary cardioid bass technology which greatly reduces LF energy emitted to the rear of the cabinet. The M3D is a two-way design, with the two forward-facing 15-inch speakers taking care of the lows and mids. Meyer uses a complex crossover technique such that in the lowest frequencies both drivers combine, while in the mids the crossover feeds only one of the drivers. Meyer developed the new MS-15 driver to

ensure the system's power handling matched their more efficient horn-loaded systems, like the MSL4. The M3D employs their REM (Ribbon Emulation Manifold) to feed a constant-Q horn from two Meyer manufactured compression drivers.

Rigging/Trucking: Because of the on-board amplification the M3D is considerably heavier than its competition. There again, Meyer aficionados are more than familiar with Meyer's extra weight, but appreciate the advantages of the powered design.

Contact: Meyer Sound Australia (07) 3252 4433
Website: www.meyersound.com

More On Why M3D is Different

John Meyer, Meyer Sound: Because of the new crossover arrangement, we built a special high-powered 15-inch driver. These new drivers are designed to take twice as much power because we knew the drivers would be functioning on their own more (due to the crossover arrangement), and more would be asked of them as a result. We can have 1200w go into each driver and they can take 300w continuously.

The other reason for building these drivers with high power handling was we didn't want to horn load them. Horns are more efficient than direct radiators, about twice as efficient, but to use the MSL4 or MSL6 horns would have made the M3D too bulky. But, there again, the general perception is that horns sound better, or at least different, than direct radiators. This is generally due to the horn's phase characteristics, or where the sound comes out. In other words, when you put a pulse into a horn-loaded speaker system, you don't get a pulse out, you get things emerging at different times depending on what frequency it is. So we've done a lot of phase correction in the M3D to make sure that all the frequencies come out together – this is something our competitors don't do.

A lot of the early worry was, 'would we be able to get the sort of transient response that people got from the MSL4s, would they get that sound and the power and the punch?'. But it seems as though we've achieved that, so we feel pretty good that we don't have to use horns to get a horn-like sound.

We don't use the V-DOSC waveguide method for the highs. That horn is too long and the sound stays in the there too long as a result. You wind up with a lot of distortion and having to build a three-way system to combat it. Our horn is much shorter and we don't have to use as many crossovers.

Manufacturer: Apogee Sound
System: ALA Series
Models: ALA3, ALA5, ALA9
Drivers: (ALA9) 3 x 2-inch units, 2 x 10-inch, 2 x 15-inch
Element weight: (ALA9) 100kg

Maximum array length: 16 at 11:1 hang ratio
Where it's Different: Apogee Sound use horns for their high and mid drivers, and offer 60 degree or 90 degree horizontal dispersion alternatives. Apogee Sound keep HF driver spacing to a minimum by using very thin board on their enclosure's top and bottom, combined with a good degree of internal bracing for rigidity. The Apogee Sound way has always been about paying careful attention to driver materials, and horn characteristics, to keep distortion to a minimum – this holds true in the ALA Series.

Rigging/Trucking: Apogee's Ken DeLoria informs me that the system, "goes together on the ground very quickly, it uses steel plate to join the boxes, there are no hinges or cables. Two guys can put up a two tonne system in seven or eight minutes."

Contact: CMI (03) 9315 2244
Website: www.apogeesound.com

More On Why the ALA Series is Different

Ken DeLoria, Apogee Sound: Apogee has approached its line array development with a careful view towards minimising distortion. We've exhaustively studied what happens to distortion when you have three speakers versus six versus nine, etc. Each time we reached a point where we felt we could characterise the polar response of a particular line array configuration and the frequency and phase response, we would then also characterise distortion. We observed some interesting things. As you add more enclosures, distortion does increase more with line arrays than it does with conventional speakers, but not so radically that it threatened to abort to the project. We did see distortion somewhat in the low end, but definitely in the mid range, where it was very much dependent on the size and type of drivers – it seems some driver compositions are very friendly towards being used in a line and others not so friendly. The horns definitely have a great bearing on distortion as well. Some horns would provide excellent acoustic addition and would not increase the distortion over a single driver by any significant amount . Others would sum well power-wise but distortion would go up dramatically. So we steered away from horns that created that behaviour.