MARTIN AUDIO
LONDON

MLA

MULTI-CELLULAR LOUDSPEAKER ARRAY

Martin Audio has a rich history, pioneering high-efficiency touring sound systems since the 1970's.

The new MLA™ Multi-cellular Loudspeaker Array combines our design heritage with leading-edge research and ground-breaking technologies. MLA delivers a dramatically increased level of performance and consistency of audience coverage compared to conventional touring arrays.

Introducing MLA…the new standard in touring sound.

MARTIN AUDIO
LONDON

LEGENDARY SOUND
FROM THE BEGINNING

Martin Audio's speaker systems first took to the road with the likes of ELP, Supertramp and Pink Floyd in the early 70's. These early systems combined all-horn design with vertical arrays, and still serve to inform our designs today.

In the eighties this reputation was maintained with the F2 two-box touring system. The F2 remained true to the principle of vertical-in-line columns whilst also being flown – no mean achievement at the time.

The Wavefront W8C/WSX system entered service in 1996. In this system, the traditionally used large-format compression driver was replaced with a combination of a 6½" cone upper-mid and smaller 1" compression driver. This arrangement overcame the power and distortion limitations of large format compression drivers and remains a cornerstone of our design philosophy today.

In 2002 Martin Audio introduced the W8L line array. The latest version of this – the W8L Longbow – has brought a new level of powerful performance to arenas and festivals worldwide.

Our 35 years of touring experience and the latest research tools have now been brought together in our latest touring system – the MLA.

M

MARTIN AUDIO
L O N D O N

![Martin Audio London logo]

MARTIN AUDIO
L O N D O N
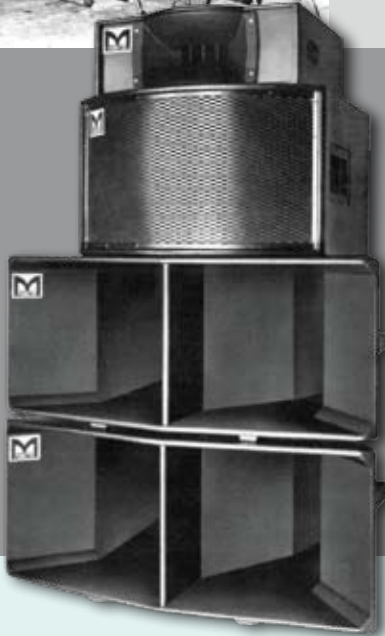
1971
Martin Audio founded
in Covent Garden,
London

1973
Martin 2-way bin and horn
system for Pink Floyd
"Dark Side of the Moon"
concerts, Earls Court,
London

1978
Martin 3-way modular
system introduced

1987
F2 system
introduced featuring
"rack-mount" mid
and high modules

1996
Wavefront W8C introduced
- used 6½" cone + 1"
compression driver in place
of large-format HF driver

2002
Martin Audio W8L
touring line array
introduced

2008
W8L Longbow
upgrade specified for
Glastonbury pyramid
stage

DESIGN BACKGROUND
WHAT ISSUES DOES MLA ADDRESS?

Over the last decade, line arrays have become the touring standard. Acoustic models unavailable to early designers have shown that line arrays are much more complex than first thought. This can contribute to inconsistent results in use and set-up difficulties.

▲ Plot showing SPL and frequency response variations over distance

Inconsistency Issues

- Gig-to-gig inconsistency on tour – results on some nights are better than others.

- The frequency response can vary at different points in the audience.

- Sound levels can vary, depending on the distance from the array.

Set-up Issues

There is often little time between getting the system rigged and the sound check. Even if time is available, the system tech has, up to now, been given inadequate tools for array design. This is why large preset libraries, arrived at by trial-and-error, have emerged for different array configurations and venues.

At best, these are near-fit approximations which can't cater for all eventualities. A set of look-up tables like this is not a 21st century solution.

PRESET LIST

4 BOXES FLOWN LOW CURVATURE
4 BOXES FLOWN HIGH CURVATURE
4 BOXES FLOWN 50M COVERAGE, WE REALLY NEED MORE BOXES!
4 BOXES GROUND STACKED

6 BOXES FLOWN LOW CURVATURE
6 BOXES FLOWN HIGH CURVATURE
6 BOXES FLOWN 75M COVERAGE (TOLD YOU WE NEED MORE BOXES)
6 BOXES GROUND STACKED

8 BOXES FLOWN LOW CURVATURE
8 BOXES FLOWN HIGH CURVATURE
8 BOXES FLOWN 50M COVERAGE
8 BOXES CREW TOO TIRED TO CARE

10 BOXES VENUE NEEDS 12 BUT TWO BOXES FELL OFF THE LOADING BAY
10 BOXES BAND WANTS TO SEE LOADS OF PA BUT VENUE ONLY 15m DEEP
10 BOXES OUTDOORS NICE AND SUNNY
10 BOXES OUTDOORS THERE COULD BE SNOW ON THE WAY!

12 BOXES ROWS 15-23 DONT LIKE MUCH TOP END
12 BOXES ROWS 15-23 LIKE LOTS OF TOP END
12 BOXES OUTDOORS AND (GET THIS) SHOOTING OVER A 50m LAKE
AND SO ON
AND SO ON
AND SO ON
AND SO ON

MLA SYSTEM
## HOW DOES MLA ADDRESS THESE ISSUES?

MLA solves both consistency and set-up issues by a combination of unique optimisation software and cellular array design – enabling the sound engineer's exact mix to be delivered throughout the audience with a degree of precision, consistency and repeatability not previously possible.

With MLA, audience position and venue criteria are used as a basis for intelligent optimisation of up to 144 individual acoustic cells within the array. Everything is done from an audience perspective. Firstly, the software calculates what acoustic source is required to deliver a consistent frequency response and SPL over the audience. Secondly, the software configures an MLA array that can generate this source. In mathematical terms this is an "inverse problem" that we solve using numerical optimisation within the software.

Having so many individually driven and optimised cells available massively increases the resolution of the array – resulting in a much more consistent frequency response and level throughout a venue compared to previous touring technologies.

At the heart of the MLA optimisation process is the most accurate acoustic model of array behaviour within the industry to date.
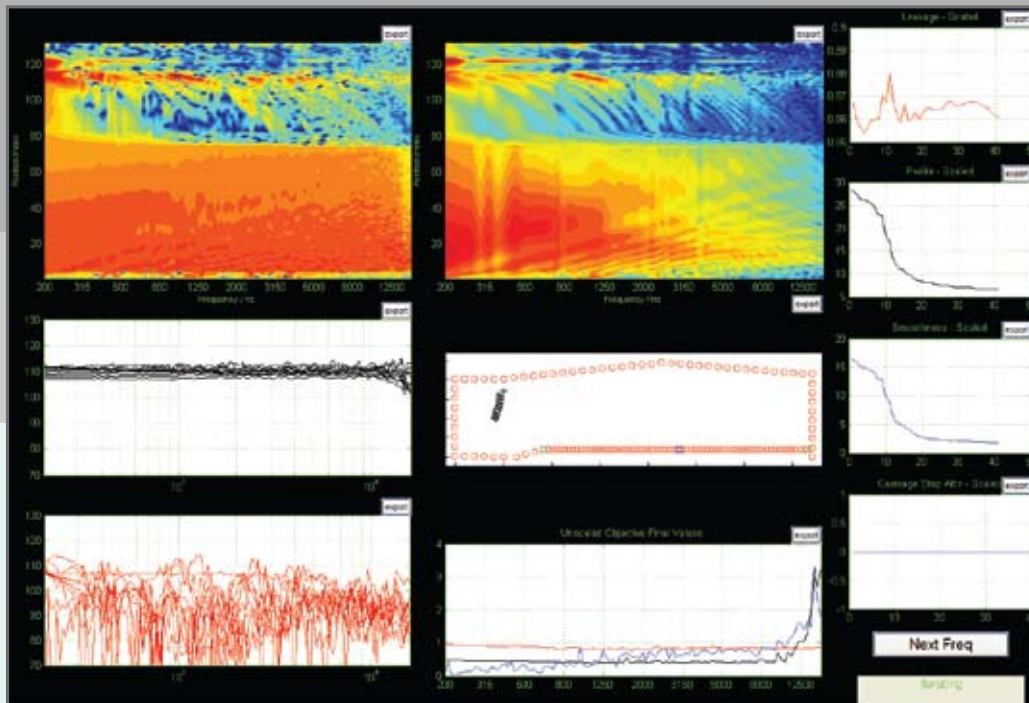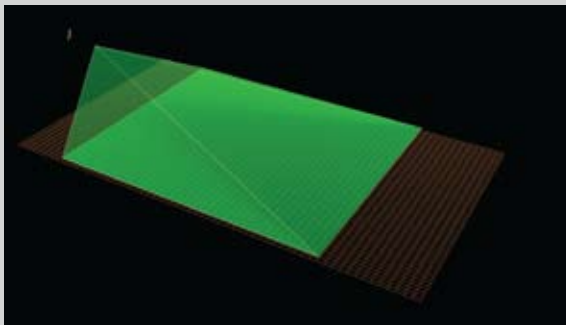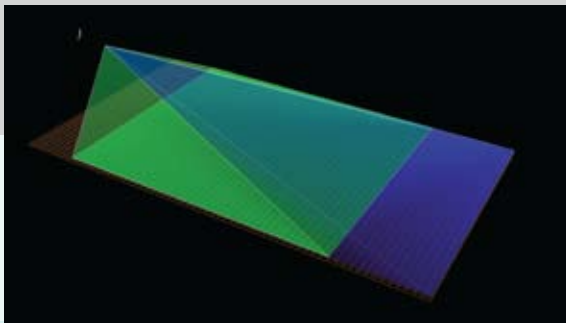
◀ Matlab® acoustic simulation

▶ Unique drive signal for each cell
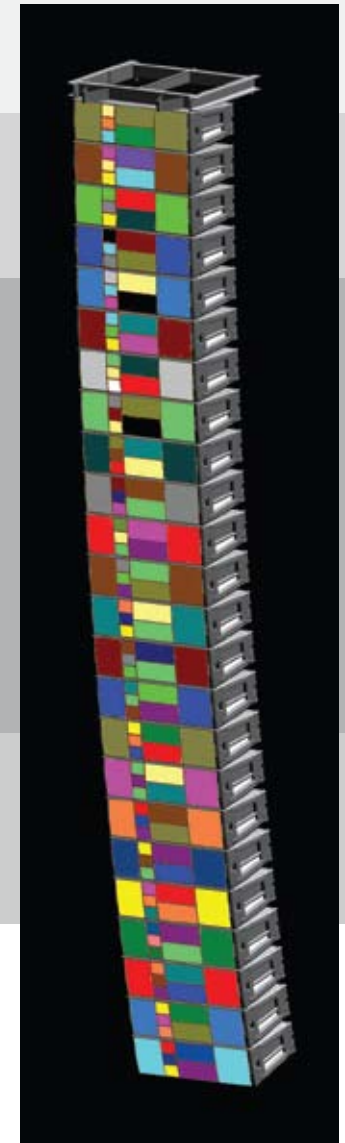
DESIGN BACKGROUND
BEYOND LINE ARRAY

▲ Native array coverage

▲ Coverage extended electronically

Whilst MLA shares physical aspects of a line array in terms of its touring-friendly format and articulated hanging architecture, it does not fully share early line array designers' declared goal of producing flat, isophasic, vertical wavefronts. Early touring line arrays were usually driven by the same audio signal throughout – i.e. 1 zone systems. Today, touring line arrays tend to be driven in 3 or 4 stepped zones to which increasing level and HF EQ is applied at the top of the array to compensate for increasing air absorption losses with distance. Simple zoning like this is too coarse to reproduce the engineer's desired balance and level throughout a large venue. In contrast, MLA has 72 individual HF cells, each automatically EQ and level optimised for the audience profile. MLA has 24 times more HF control resolution than a 3-zone line array.

Also, as a "fly-by-wire" system, with so many individually driven and optimised cells under software control, MLA's vertical coverage pattern can be adjusted electronically in real time to cope with changing environmental conditions and last-minute changes in rigging height. So, if coverage cuts off too early or extends too far, it can be changed in-situ via the optimisation software.
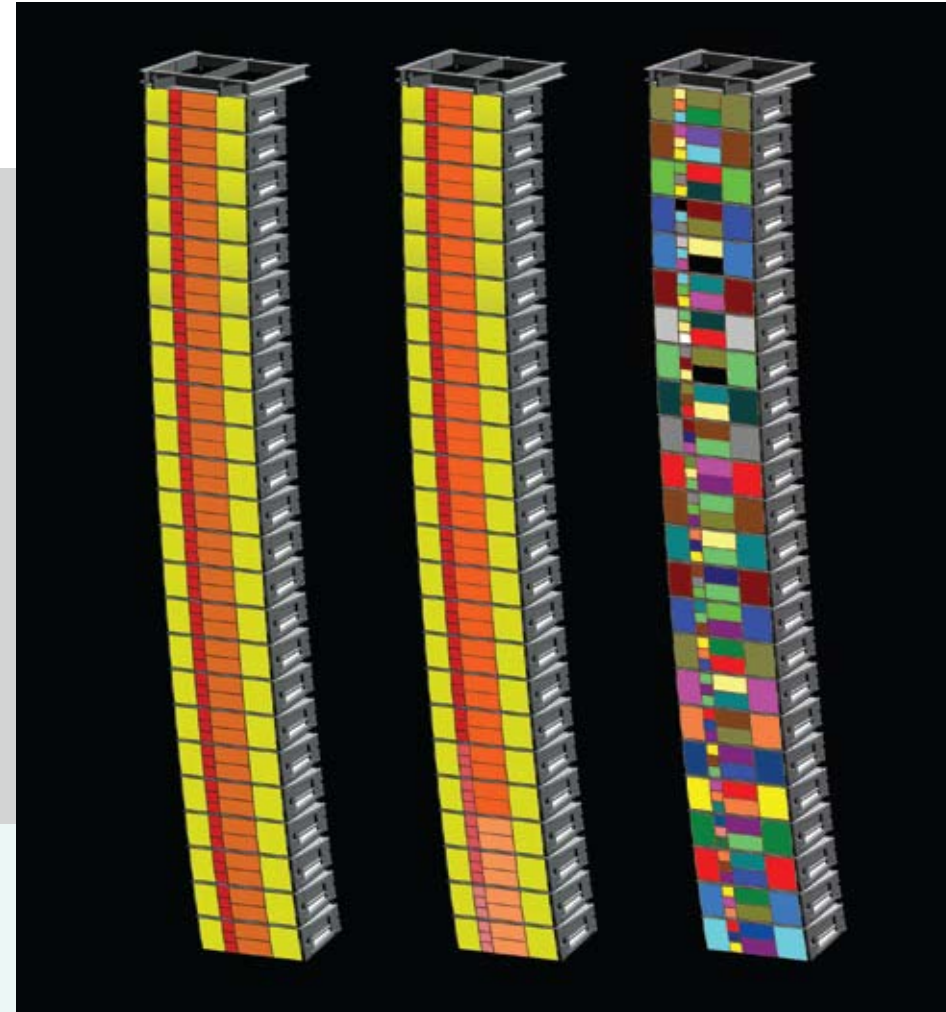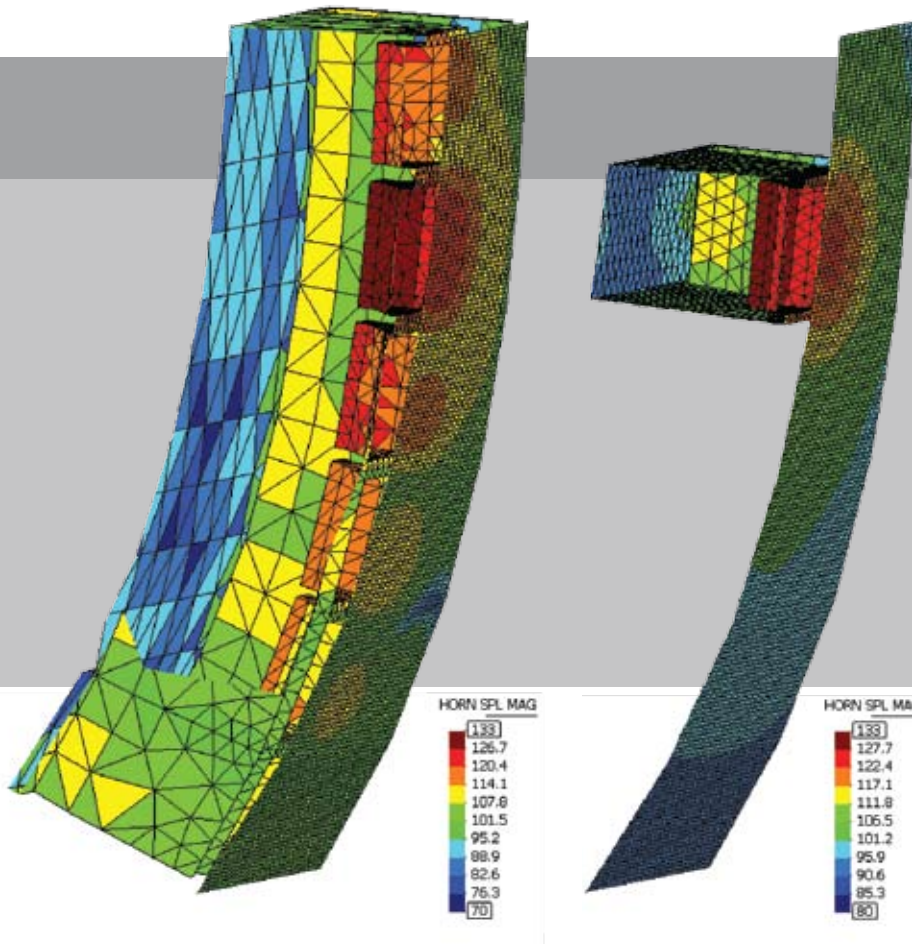

▲ From left to right: 1-zone, band-zoned and multi-cellular MLA system

INDUSTRY-LEADING RESEARCH
BEM – BOUNDARY ELEMENT METHOD

An accurate acoustic model is essential

▲ BEM plot of five adjacent horns

▲ BEM plot of single horn

Much of MLA development took place in the virtual world, using in-house BEM (Boundary Element Method) models which enable hundreds of "what-if?" virtual array configurations to be investigated in very fine detail in a virtual 3D environment. This level of research has transformed our understanding of how arrays really work and shown that the acoustic interactions between array elements are much more complex than originally thought.

An accurate acoustic model is essential. Without one, attempts to optimise the array will never give the right answer.

An industry first is the inclusion in the model of the previously ignored effects of adjacent enclosures. If these are not incorporated into the model, prediction errors can be over 8dB in the midrange. Including the effect of adjacent cabinets is key to the accuracy of MLA's numerical optimisation process and makes the acoustic model of MLA array behaviour the most accurate within the industry to date.

An industry first is the inclusion in the model of the effects of adjacent enclosures

For further explanation on the acoustic model, see S. Feistel, A. Thompson and W. Ahnert, "Methods and Limitations of Line Source Simulation," AES Convention Paper 7524/AES Journal Volume 57 Issue 6 – downloadable from the Martin Audio website.
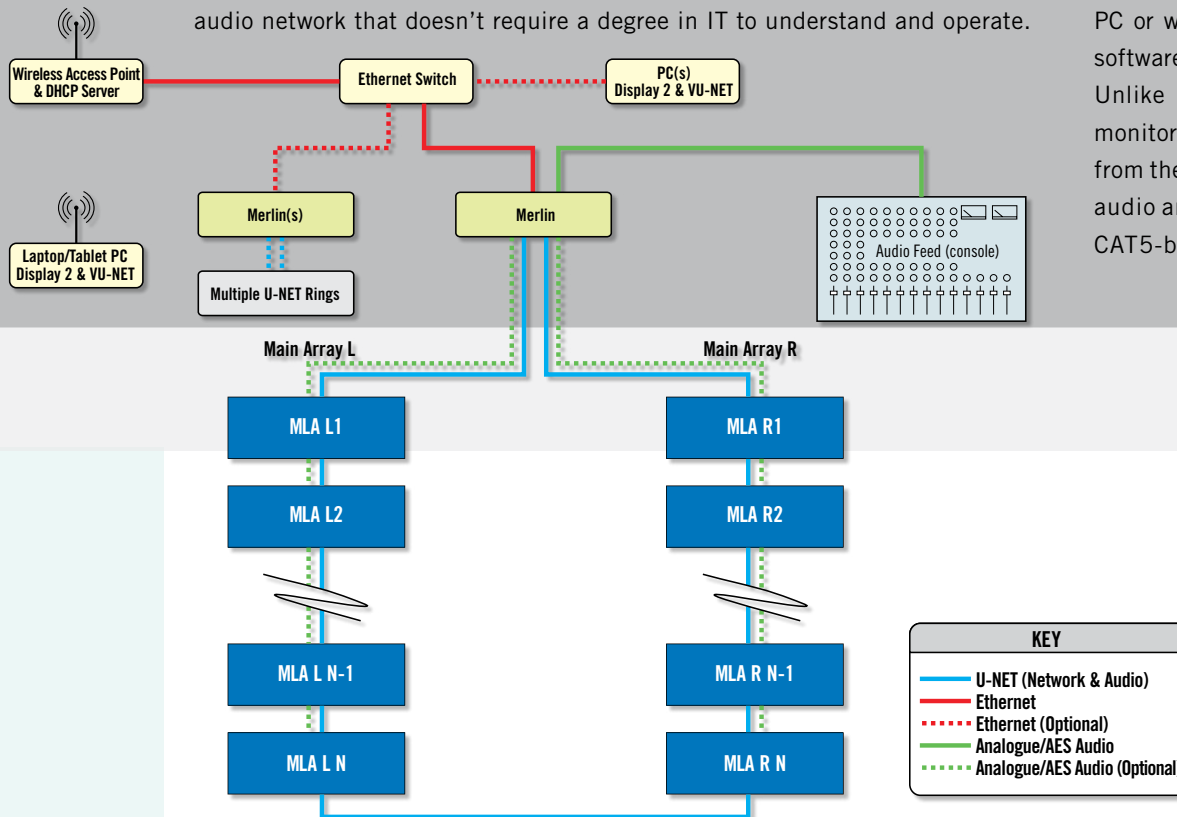
MLA OVERVIEW
A FULLY INTEGRATED SYSTEM

MLA is designed to deliver exceptional power and clarity to over 150 metres from a 24 enclosure hang. Its compact size and inherent scalablity also makes it ideal for theatre applications – making MLA the perfect, single solution for rental companies working across festival, arena and theatre sound reinforcement.

MLA brings together the latest technologies in acoustic design, amplification, DSP and industry-leading, numerical optimisation software for the first time as a fully integrated system – with communications and control via an easy-to-use audio network that doesn't require a degree in IT to understand and operate.

Class D amplification, U-NET™ digital audio network and DSP control circuitry are integrated within each enclosure, greatly simplifying system set-up and operation and eliminating long, heavy-gauge cable runs – a particular benefit in premium fixed installations.

MLA arrays can be remotely controlled from a PC or wireless tablet running VU-NET™ control software with its intuitive graphical interface. Unlike many other systems, where control and monitoring is performed by a separate network from the audio, inbuilt U-NET allows both digital audio and control signals to be transmitted via a CAT5-based, redundant ring.

24 box MLA array ▶

Wireless Access Point & DHCP Server

Ethernet Switch

PC(s) Display 2 & VU-NET

Laptop/Tablet PC Display 2 & VU-NET

Merlin(s)

Merlin

Audio Feed (console)

Multiple U-NET Rings

Main Array L

Main Array R

MLA L1	MLA R1
MLA L2	MLA R2
MLA L N-1	MLA R N-1
MLA L N	MLA R N

KEY
- ─── U-NET (Network & Audio)
- ─── Ethernet
- ····· Ethernet (Optional)
- ─── Analogue/AES Audio
- ····· Analogue/AES Audio (Optional)

MLA OVERVIEW
FEATURES AND BENEFITS

FEATURES

- Numerically optimised, fully integrated, touring sound system
- Compact size and inherent scalability provide ideal "one-box" solution across rental markets
- Cellular array format with built-in amplification, DSP and digital networking
- 6 dedicated Class D amplifier channels per enclosure for individual powering and DSP control of individual cells
- Industry leading DISPLAY2™ intelligent software interacts with onboard DSP for highly accurate array optimisation. Eliminates trial-and-error array preset library approximations
- "Fly-by-wire" software adjusts vertical coverage electronically to cope with changing environmental conditions and last-minute changes in rigging height
- Switched mode power supply with PFC (Power Factor Correction) and global mains voltage operation
- Three-way all-horn design delivers LF/MF/HF peak SPL's of 140/139/145dB @ 1m from a single, compact enclosure
- Fast, integral flying system for suspension of up to 24 enclosures
- True 90° (-6dB) horizontal constant directivity, mid and high frequency pattern control. Consistent and usable out to 120° (-10dB)
- 60Hz–18kHz ± 3dB full bandwidth frequency response

BENEFITS

- Unprecedented, even, house-curve balance achieved right from power-up
- Intelligent numerical optimisation software eliminates trial and error in system set-up
- Improved venue-to-venue, gig-to-gig consistency and repeatability
- Artistic changes to balance at the mix position or elsewhere translate directly and accurately throughout the audience
- Exceptionally high power density means tighter truck-pack for higher SPL compared to other systems
- "Greener" audio power via PFC (Power Factor Correction)

APPLICATIONS

- Large-scale touring sound reinforcement for outdoor festivals, stadia, arenas and concert halls
- Premium fixed installations in concert halls, theatres and sports venues

DISPLAY2™
INTELLIGENT OPTIMISATION

It takes the guesswork out of array design
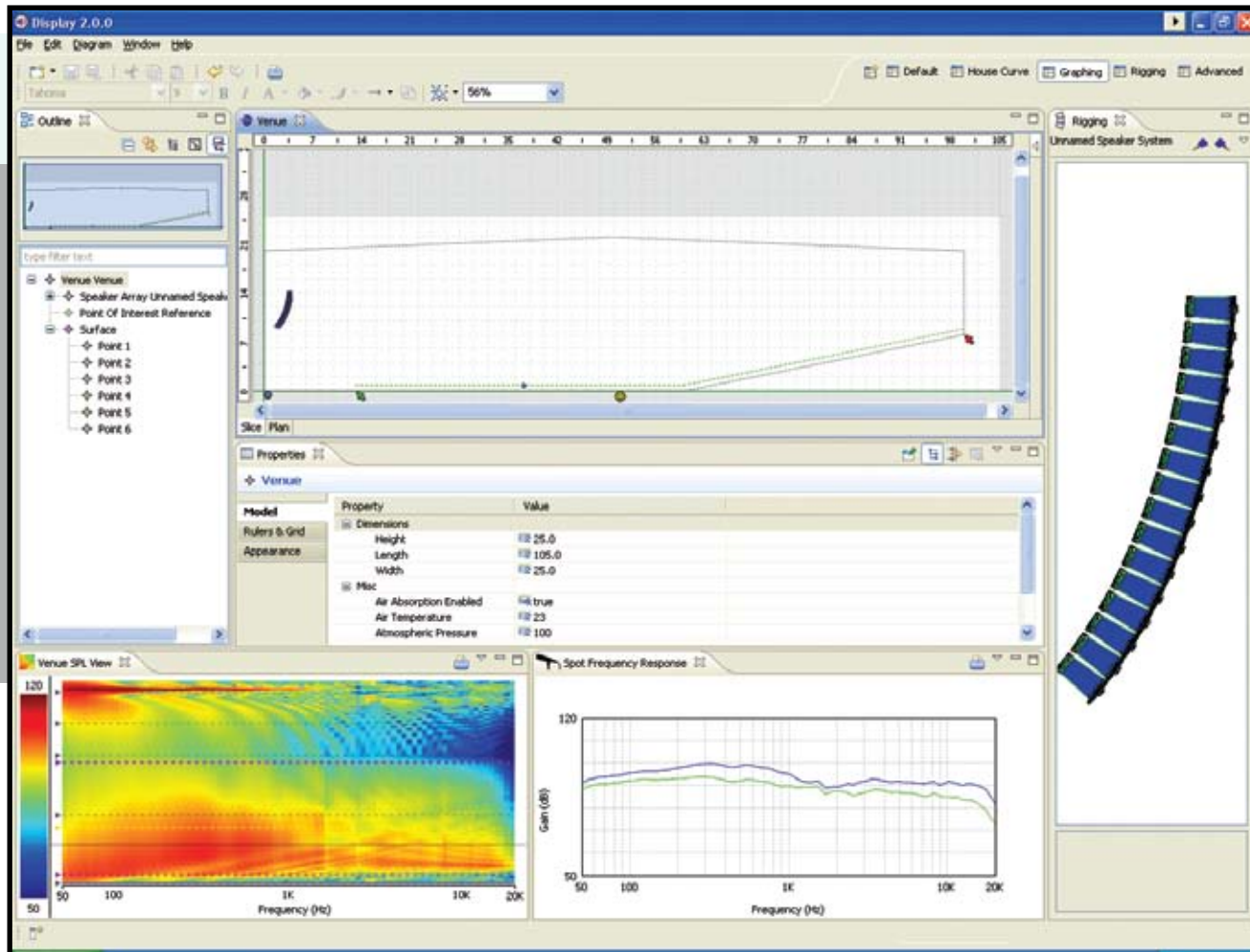
Current array design software expects the user to inspect the results of a trial array, think of something to change, wait… and start over, until they have either run out of time or patience. Our new software reverses the sequence. You start with what you want to hear and the software works backwards to tell you what combination of enclosures and DSP parameters for each individual cell gets closest.

DISPLAY2 is the "brain" of MLA. It provides a virtual environment within which arrays can be configured and optimised – giving a very accurate prediction of the direct sound produced and, in the case of outdoor festivals, over surrounding areas. It takes the guesswork out of array design and deployment – generating highly accurate spot frequency responses and comprehensive rigging information, including mechanical load safety analysis.

DISPLAY2 interacts with MLA's onboard DSP to deliver consistent sound throughout a venue. It calculates the filter parameters for each enclosure – down to the resolution of individual drive units – and downloads it to the enclosure via the U-NET digital network. The link between DISPLAY2 and an individual MLA enclosure is live and bi-directional.

▲ DISPLAY2 is the "brain" of MLA

With the computer
working behind
the scenes, the
engineer retains
full artistic control

DISPLAY2
AUTOMATED SET-UP AND FULL ARTISTIC CONTROL

DISPLAY2's optimisation process starts with a different way of looking at things. Taking a vertical 2D slice through the venue, the frequency response of a candidate array is calculated at 100 or more virtual microphone positions – including the audience areas where the sound is targeted and areas such as ceilings, where it is unwanted. The results are viewed in IndexPlot™ – a new proprietary 2D presentation format, which shows clearly how loud the array is at all the microphone positions and at all frequencies.

The numerical optimisation process evaluates configurations of candidate arrays against various target functions – such as frequency response, flatness, and sound leakage into non-audience areas. With the computer working behind the scenes, the engineer retains full "artistic control" over the house curves and remains the ultimate judge of sound quality. The optimisation routines simply extend what the engineer hears at the mix position through to as many points in the audience as possible.
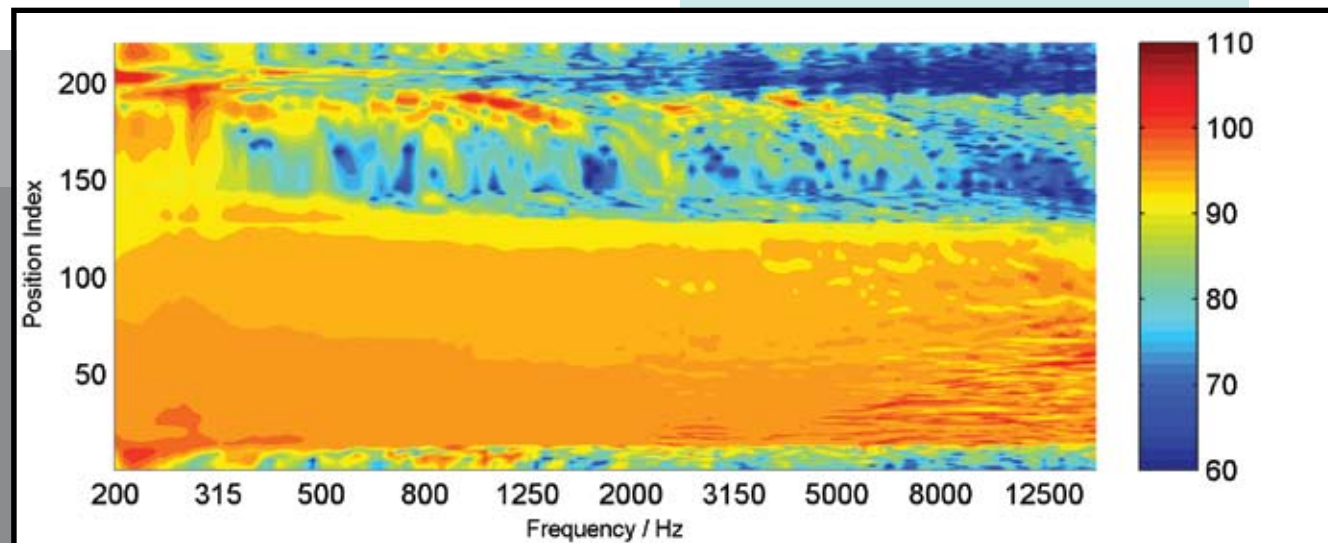
▲ IndexPlot™

DISPLAY2 can also fine-tune the vertical coverage after rigging. This has great relevance for outdoor festivals where reducing sound-spill offsite is of increasing importance to event organisers and licensing authorities.

For further explanation of the numerical optimisation process, see A. Thompson "Improved Methods for Controlling Touring Loudspeakers Arrays," AES Convention Paper 7828 – downloadable from the Martin Audio website.

MLA SYSTEM
THE ACOUSTIC DESIGN

▶ MLA horizontal off-axis frequency response 0,15,30,45 degrees
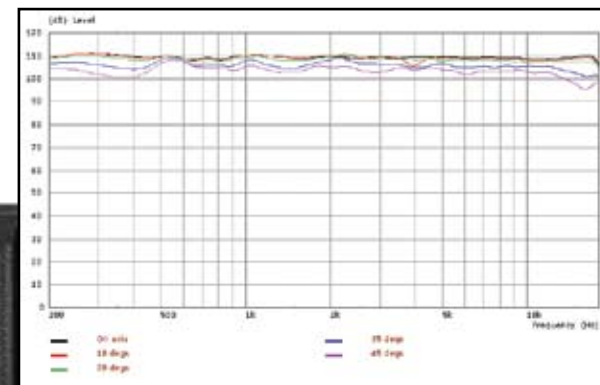
MLA raises acoustic performance to a new level – with increases of 5dB in low frequency output, 10dB in mid frequency output and 10dB in high frequency output over existing, comparably-sized line array products. At 104dB efficiency, MLA's low frequency section easily outperforms direct radiator line array designs whose 98dB efficient bass sections simply don't keep up. At high frequencies, MLA's new wavefront criteria provide greatly improved consistency and summation in the vertical plane.

MLA is a 3-way, all-horn loaded design with an exceptionally smooth frequency response – both on and off-axis. In contrast to designs which utilise direct radiators for the lows and mids, MLA's all-horn design ensures that lows and mids are able to keep up with the very high efficiency HF section. MLA eschews the use of coaxial, co-entrant or cross-firing midrange/HF driver arrangements which introduce acoustic discontinuities that affect the on and off-axis frequency response of both mid and HF sections. MLA's mid and HF horns

are completely separate – a key factor in MLA's ability to produce consistent, true 90° horizontal constant directivity coverage. This gives startlingly consistent frequency response when listening off-axis and "walking the field".

Sonically, MLA brings a new level of performance in terms of clarity and detail over distance, and its peak output capability at 1 metre, of 140dB LF, 139dB midrange and 145dB HF, per box is huge.
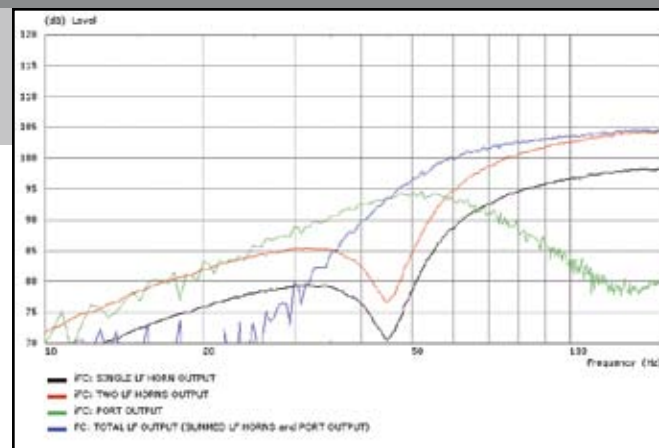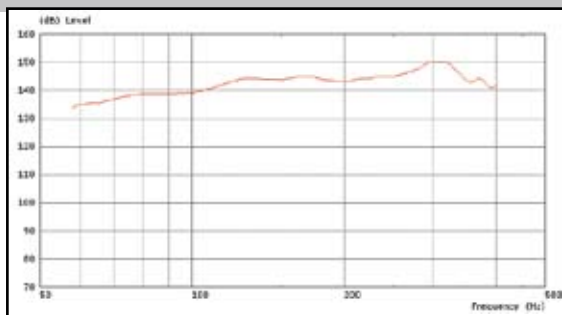
MLA SYSTEM
DUAL HYBRID® BASS SECTION
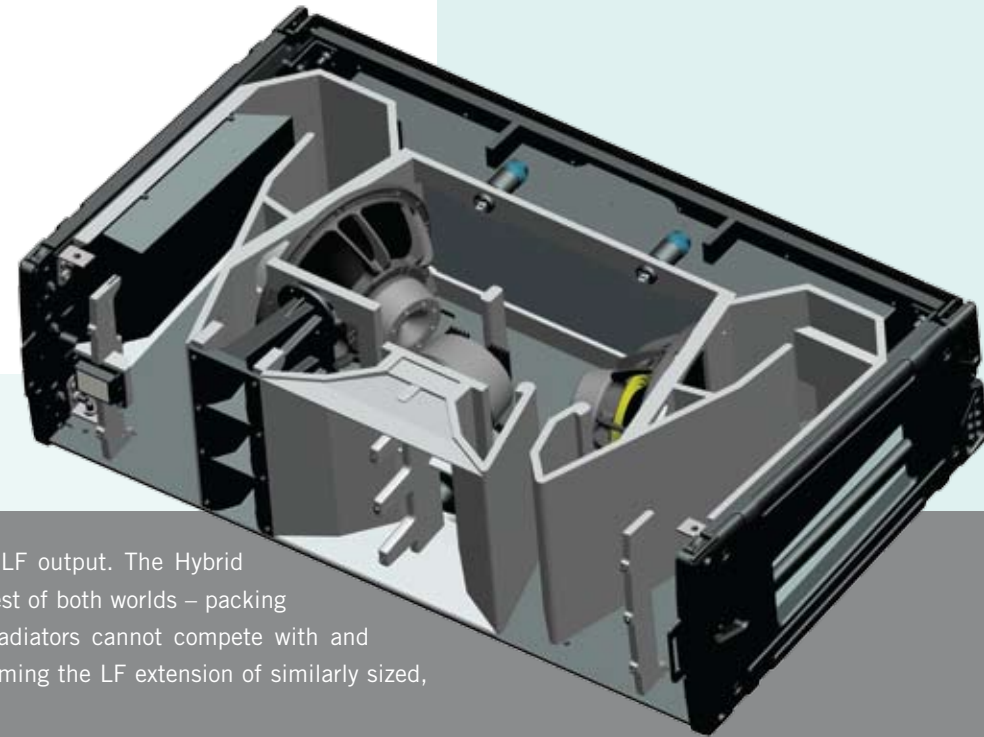
The efficiency of the MLA LF section is 104dB @ 1m/2.83V compared to a typical 98dB for a direct radiator design. This gives MLA a big advantage over direct radiator designs when it comes to projecting maximum LF output over distance.

MLA's LF section utilises 2 x 12" (305mm)/3" (75mm) voice coil, neodymium drive units in Martin Audio's trademark Hybrid low frequency horn configuration. Each driver is front loaded by a hyperbolic horn with a low flare rate, whilst the rear of the driver is reflex loaded to extend the LF output. The Hybrid design provides the best of both worlds – packing a punch that direct radiators cannot compete with and convincingly outperforming the LF extension of similarly sized, horn-only designs.

The twin LF drivers have individual, separate horns spaced as far apart as possible within the enclosure. This double-source arrangement significantly improves the directivity control of the LF section down to 150Hz, reducing mid-bass output at the sides and rear of the array. The LF drivers themselves are very high excursion with forced air cooling to reduce power compression.

▶ LF peak output
(burst measurements)

◀ LF horn, port and
combined output

MLA SYSTEM
NO-COMPROMISE MIDRANGE

With so much design effort concentrated on the vertical performance of arrays, the horizontal dispersion can sometimes suffer – particularly in designs that use coaxial, co-entrant or cross-firing midrange arrangements. The MLA has completely separate mid and HF horns and the horizontal off-axis response tracks the on-axis response exactly. Martin Audio has 30 years' experience developing cone-driven midrange horns, and this experience, together with BEM optimised horn geometry has been put to good use in the design of the MLA midrange section.

The mid horn of the MLA utilises 2 x 6.5" (165mm)/2" (50mm) voice coil neodymium drivers to produce 112dB @ 1m/2.83V – a huge gain on the typical efficiency of 102dB for cross-firing direct radiator designs. This is a result of painstaking acoustic and thermal design, utilising forced-air cooling and a thermally conductive aluminium housing.

The horizontal off-axis response tracks the on-axis response exactly

Generally, adding a horn to a cone loudspeaker increases its acoustic output in a non-uniform manner – with the greatest output in the lower part of the horn's operating band and output tailing off toward that of the cone itself at the upper end of the passband. In the MLA's midrange horn, a patented*, toroidal phase-bung is placed between the driver cone and the throat of the horn. This counteracts the tendency of the horn's frequency and energy response to tilt downwards as the frequency rises.
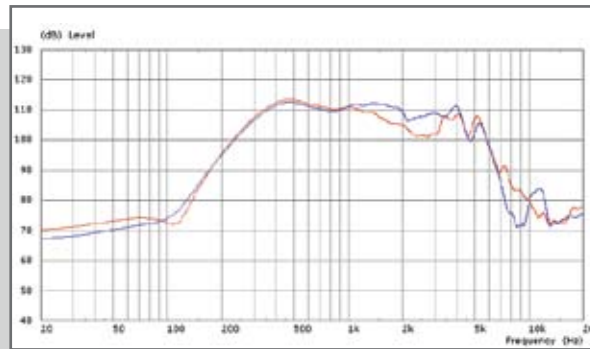
▲ Mid response with phase bung (blue) & without (red)
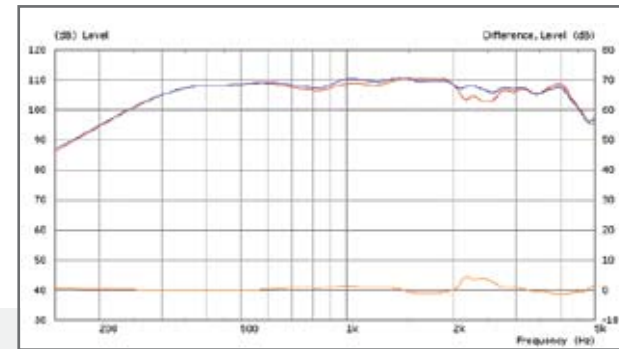
▲ Mid response with HiBlade (blue) & without (red)

Another feature of the MLA's midrange horn is the HiBlade™ device, which modifies the wave-propagation in the horn throat. This further increases acoustic output, smoothes the frequency response and maintains constant directivity up to the 4kHz crossover point. This is high for a midrange horn and is key to enabling the use of 1" compression drivers for reproduction of high frequencies. MLA's 6.5" cone/1" compression driver combination replaces the more traditionally used large format compression driver and has less distortion, as well as having a much more extended HF response.
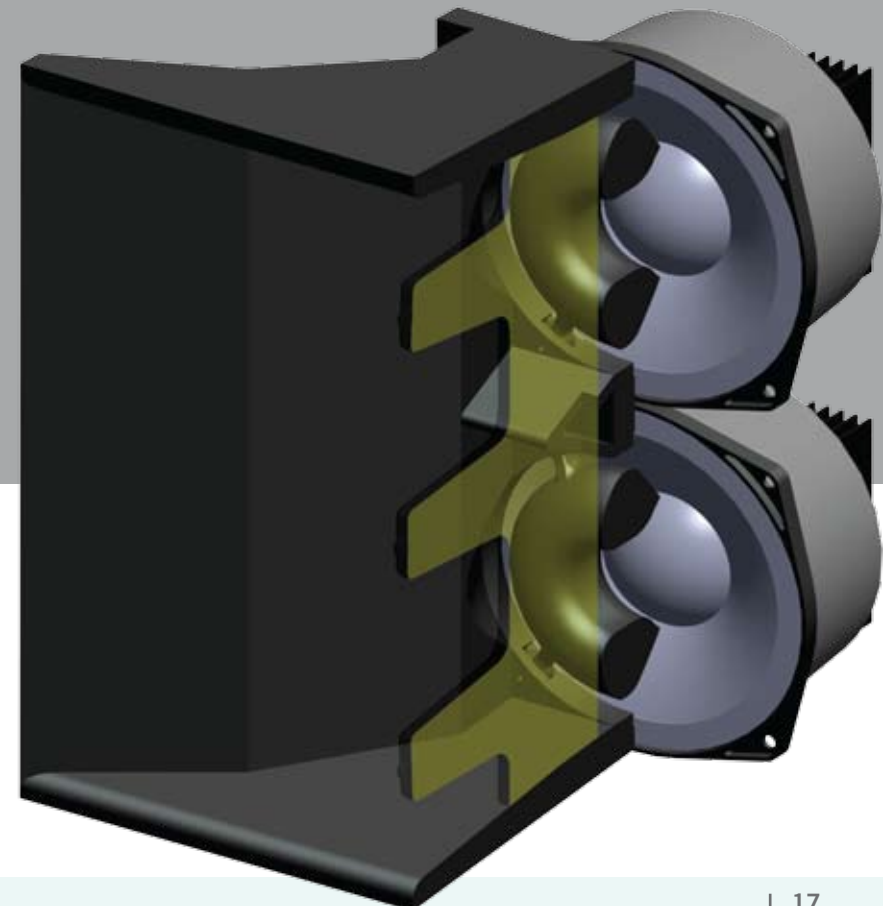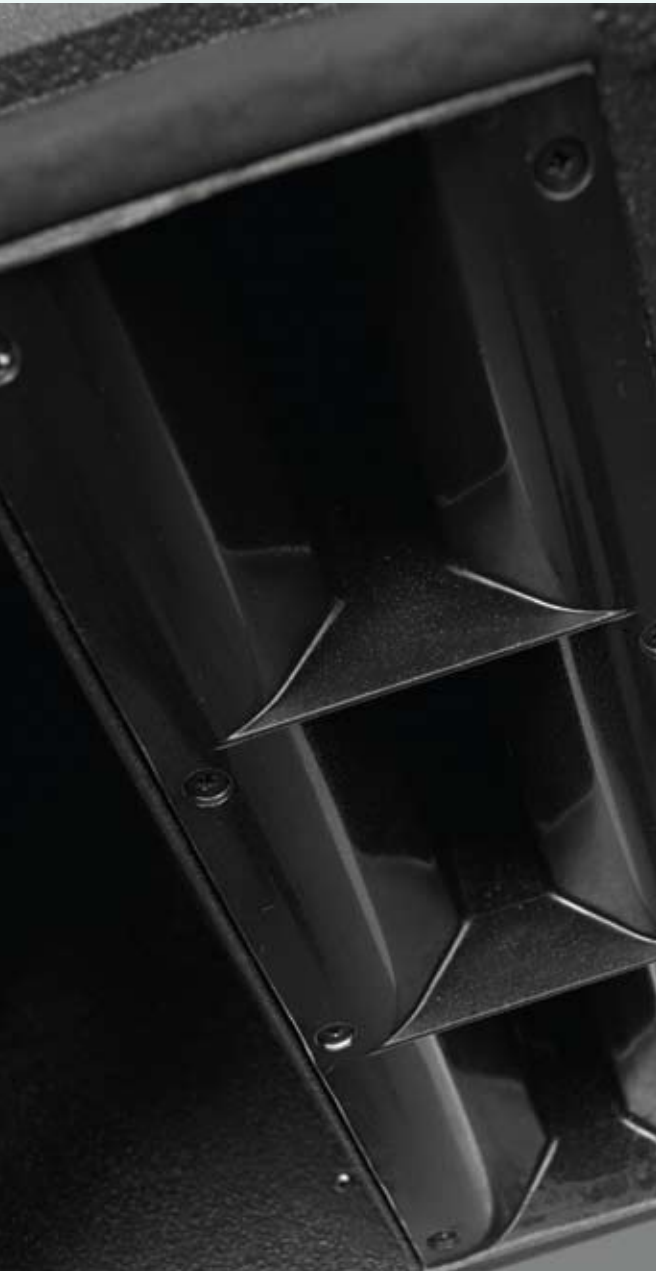
* US Patent 6950530
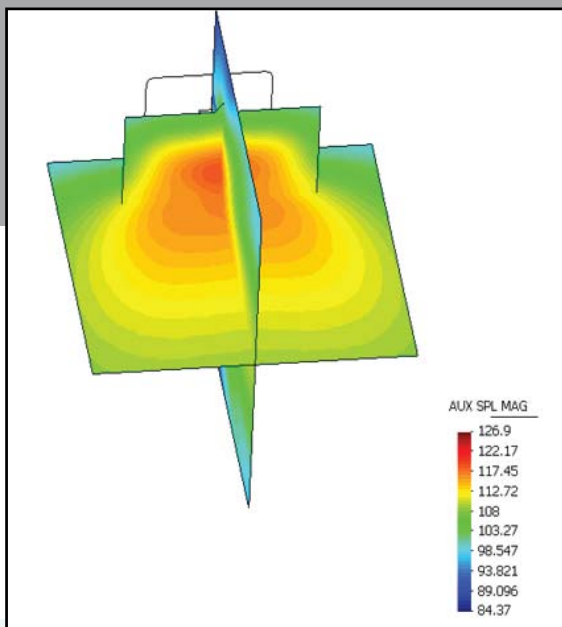
▲ Mid directivity with HiBlade
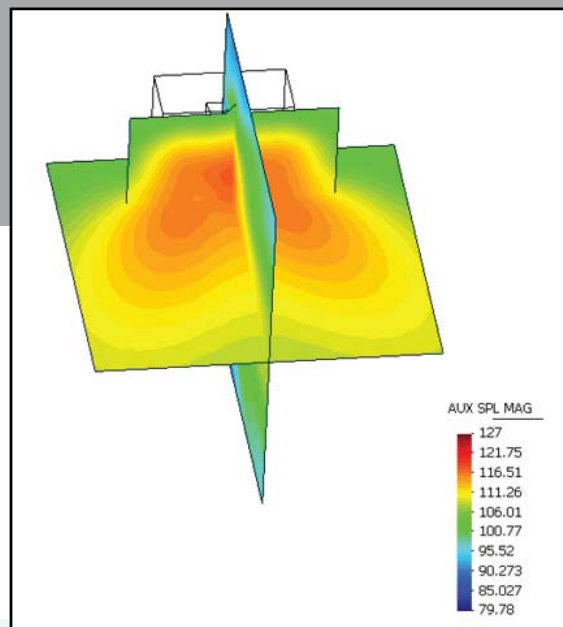

▲ Mid directivity without HiBlade

MLA SYSTEM
NEW HF WAVEFRONT CRITERIA

MLA's HF section utilises 3 x 1" (25mm) exit neodymium compression drivers which feed separate, diffraction slot horns for true 90° horizontal constant directivity. In the vertical plane, MLA makes significant advances over previous thinking by adopting new vertical wavefront criteria.

Early proponents of touring line arrays strongly advocated a flat wavefront from each individual HF element. However, our sophisticated in-house BEM (Boundary Element Method) modelling techniques have shown that slightly curved wavefronts deliver much more consistent SPL's to the audience in real-world use where the array is curved.

BEM models of a conventional horn show that the waveform expands as its travels down the horn to produce a convex vertical wavefront which would generally be too curved for an ideal array element. Placing a kite shaped "wedge" part-way down the horn* introduces a concavity in the waveform which compensates for this. By suitable choice of the length and shape of this wedge, the overall curvature of the exiting wavefront is accurately and specifically optimised to meet our new wavefront curvature criteria – neither flat nor excessively curved.

* Patent Application WO2007054709
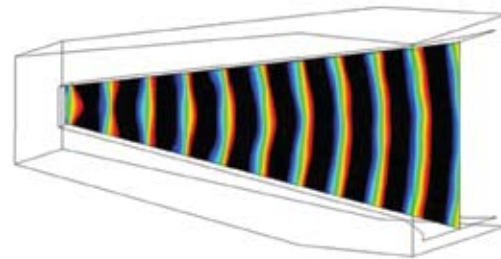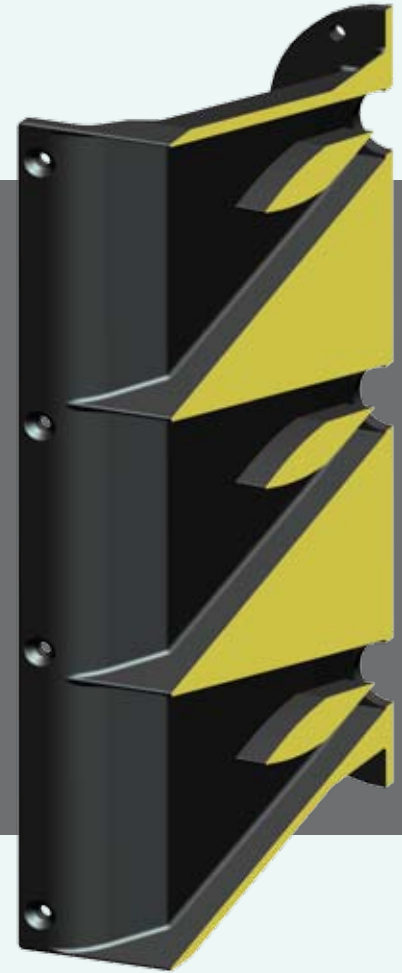
▲ Conventional horn: wavefront is too curved
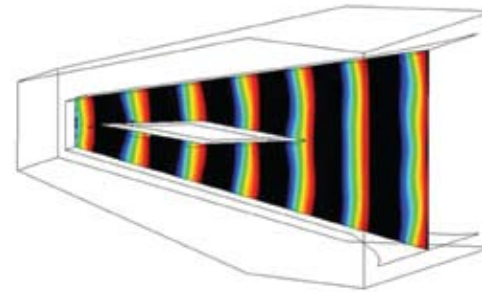
▲ MLA horn with wedge: curvature is ideally optimised

MLA SYSTEM
FIR CROSSOVER FILTERS

Like all three-way systems, MLA's low, mid and high frequency sections are combined by a crossover. Up to now, Linkwitz-Riley, 4th order filters have been the industry standard. With traditional filters like these, overlap at crossover can result in a non-symmetrical horizontal polar pattern if the devices being crossed-over are side by side.

In the theoretical opposite extreme, a brick-wall filter would completely eliminate overlap, and the polar pattern would be symmetrical.

MLA's practical implementation uses very steep, VanishingPoint™, FIR filters. They are not actually brick-wall, because of the effects of brick-wall filters on transient response. Listening tests confirm that the two devices are impossible to locate separately, but sound like a single acoustic source, located at the point in space at which we have optimised the FIR filter.

MLA's VanishingPoint FIR filters give us the freedom to physically separate the mid and HF horns, so they do not compromise each other's dispersion pattern, yet achieve the spatial performance of a single device – giving us the best of both worlds.
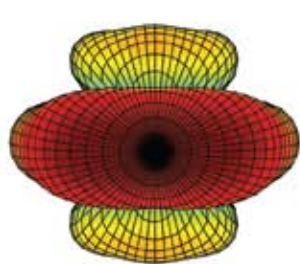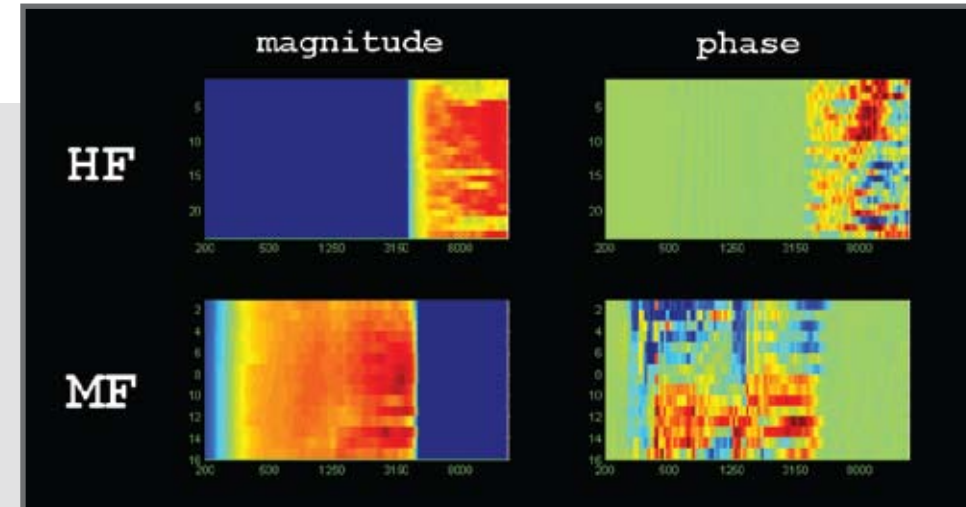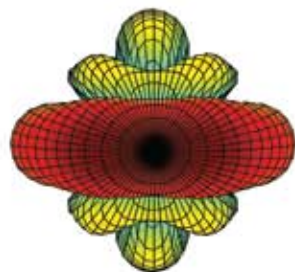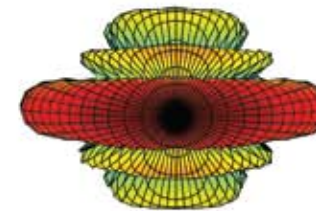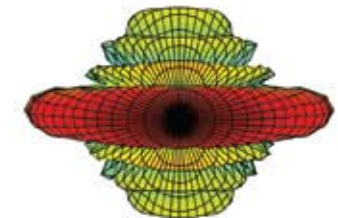

2051 Hz   2439 Hz   2900 Hz   3449 Hz   4101 Hz

MLA SYSTEM
ONBOARD AMPLIFICATION

One channel drives both LF units, with each mid driver and each HF driver being driven individually. This fine degree of resolution enables the benefits of MLA's cellular format to be fully realised.

The lightweight, switched-mode power supply auto-ranges to global mains voltages from 100 to 240V 50/60Hz. Power Factor Correction smoothes out the mains current draw over the whole of the AC waveform, effectively reducing cable losses caused by high peak currents in the mains distribution system.

The module features advanced monitoring and protection, including over-temperature power limiting, short-circuit and overload protection. Amplifier monitoring via U-NET includes input signal, output signal at the drive unit terminals, limiter status, heatsink temperatures and fault conditions.

Each MLA is fitted with a 6-channel amplifier module. Its Class D circuitry delivers a total of 3kW continuous and 6kW peak output, whilst producing significantly less heat than a linear output stage design. All channels share the same circuit topology and are driven from the same power supply. This configuration effectively shares the total power available between the LF, mid and high frequency channels – providing high continuous power for the low frequency channel and high peak power for the mid and HF channels.

The amplifier section is designed to withstand the various environmental conditions typically found in live sound applications – such as rain and ambient temperatures of up to 45°C. A sophisticated cooling arrangement, where air is forced over the amplifiers' heatsinks through a metal tunnel, employs an IP rated fan with intelligent drive for quiet operation when the system is used at lower powers. A rain cowl provides additional protection from rain and direct rays from the sun.
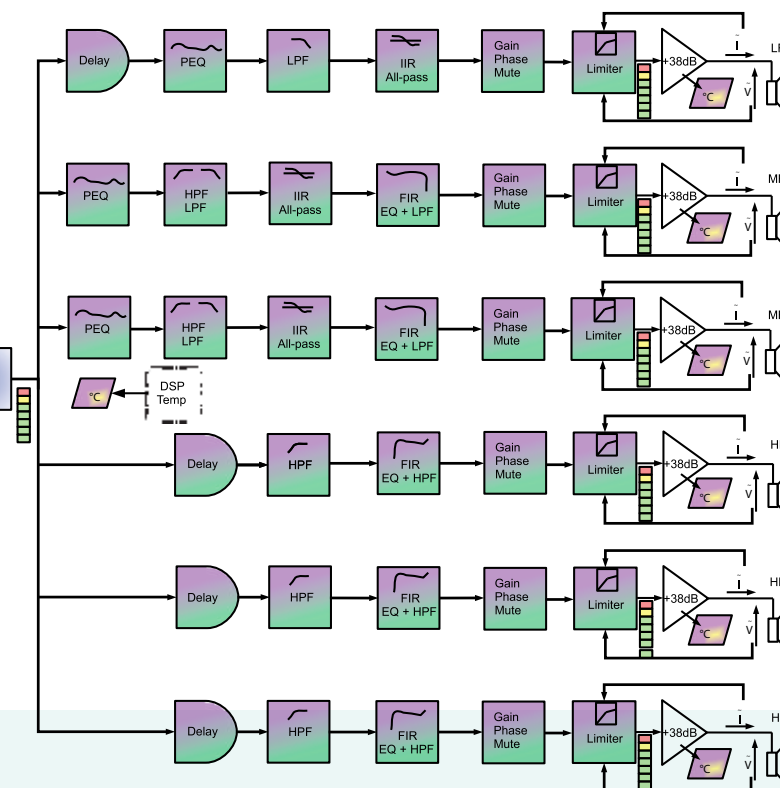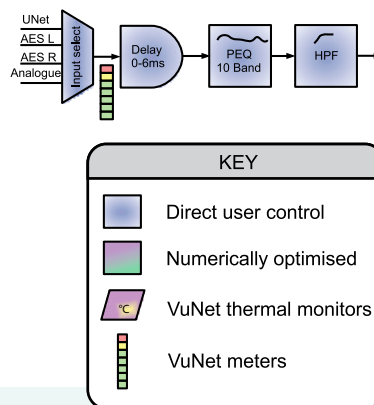
MLA SYSTEM
ONBOARD DSP, NETWORK & CONTROL

MLA's powerful onboard DSP performs all crossover and EQ functions via a combination of IIR and advanced FIR filtering. Each acoustic cell has its own limiter, which monitors the current flowing through the voice coil to protect the unit from damage.

MLA arrays can be remotely controlled from a PC or wireless tablet running VU-NET control software with its intuitive graphical interface. Unlike many other systems, inbuilt U-NET allows both digital audio and control signals to be transmitted via the same CAT5 cable. In order to bring networking into the touring environment, MLA uses ruggedised CAT5 cables and robust, quick-lock, IP68 rated connectors.

U-NET itself is a redundant ring, fault-tolerant protocol carrying up to 64 channels/48kHz or 32 channels/96kHz, low latency, 24 bit digital audio plus control and monitoring data. Up to 254 devices can be linked and controlled by VU-NET. For even more ambitious systems, VU-NET can control multiple U-NET rings, each comprising up to 254 devices.
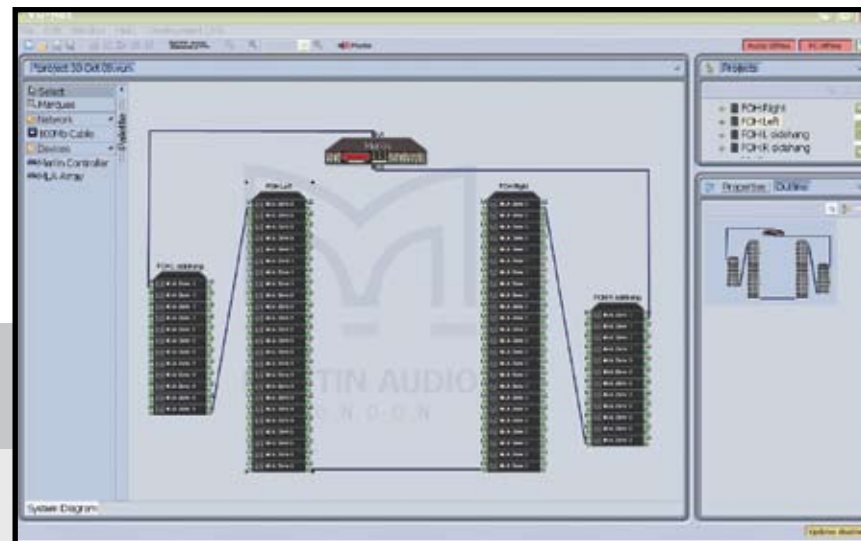
VU-NET monitors each amplifier module and also enables the user to switch on identification LEDs on the front grille with automatic identification of neighbouring enclosures and connectivity confirmation.

KEY

- Direct user control
- Numerically optimised
- VuNet thermal monitors
- VuNet meters

MLA SYSTEM
ENCLOSURE AND RIGGING

The MLA rigging system combines the speed of our previous line array family with even greater precision. A maximum of 24 enclosures can be suspended via MLA's two-point-lift flybar. The same hardware can also be used for single point lifting of up to 10 cabinets, as well as ground stacking of MLA's up to 6 high.

Inter-cabinet connections utilise custom. quick-release pins for fast system rigging and de-rigging. At the front of each enclosure, sliding tongues drop down to the enclosure below to form a secure front pivot – locking the enclosures together with only a few millimetres spacing between them, to maximise HF coupling and consistency.

At the rear of the enclosure, splay arms determine the vertical array angles from 0°–7.5°. All loads are borne by the integral metalwork and release pins – not the enclosure. DISPLAY2 determines the safe limits and tilt angle of a specific array configuration, with BGV C1 safety calculations done on the fly.

The enclosure itself is of exterior-grade birch and poplar ply construction and is finished with a thick, hard-wearing polyurea coating. The sides of the enclosure, which take the brunt of damage on the road, are fitted with replaceable, steel-reinforced rubber mouldings with integral interlocking skids. A long bar-handle facilitates rigging and general handling, and a quick-release wheelboard and fabric transport cover complete the package.

MLA SYSTEM
THE MLD DOWNFILL

The second loudspeaker component in the MLA system is the MLD Downfill. In order to match the performance and tonal balance of the MLA, it is designed around the same acoustic format and electronics package. Coherent arrays of MLA and Downfill can easily be constructed to seamlessly cover the audience planes.

Line array systems project or, throw, better when the inter-cabinet angles are small. Unfortunately real-world requirements often dictate that the flown array must cover right up to the stage barrier. Arrays designed in this manner take on the familiar, highly curved, banana shape. This is wasteful of array elements as almost half the array ends up being used to cover the first thirty metres – leaving fewer boxes to reach the back seats.

The solution is to add a cabinet with a wider vertical dispersion. In the Downfill's case this is 20°. Using only one – or at the most two – Downfills at the bottom of an array results in a lower-curvature, more directional array that projects much further and covers right up to the stage barrier.

The Downfill's benefits are not confined to the vertical plane. With an extremely wide horizontal dispersion of 120°, the Downfill reaches to front-row-central as well as the ends of the front rows. Our HiBlade patent-pending technology ensures ultra-high frequencies propogate right out to the edges of the dispersion pattern. Conventional 120° horns without this device tend to lose high frequency sparkle rapidly, as the listener moves off axis.

▲ Banana array is wasteful of array elements

MLA SYSTEM
THE MLX SUB-BASS

A system as advanced and capable as MLA demands a subwoofer of the highest calibre. With a massive output level, compact size and advanced DSP-based realisation of directional arrays, the MLX Sub comfortably meets this challenge.

Capable of more than 150dB peak output at 1m (half space, measured), the MLX Sub is an incredibly dynamic performer. These class-leading output levels are reached by combining our Hybrid horn/reflex loading with IPAL driver and amplifier technology. The two Hybrid loaded 18" drivers perfectly balance low frequency extension with chest-thumping punch that has to be experienced to be believed.

The MLX Sub can be flown alongside or at the top of MLA arrays, as well as being ground stacked. A maximum of 15 Subs can be suspended from the MLA flybar which can also handle mixed systems of up to 12 MLA's and 6 MLX's. Symmetrical rigging even allows flown Sub cabinets to face backwards – so directional flown, as well as ground stacked arrays are possible. This wide variety of configuration options maximises versatility from a single inventory enclosure.
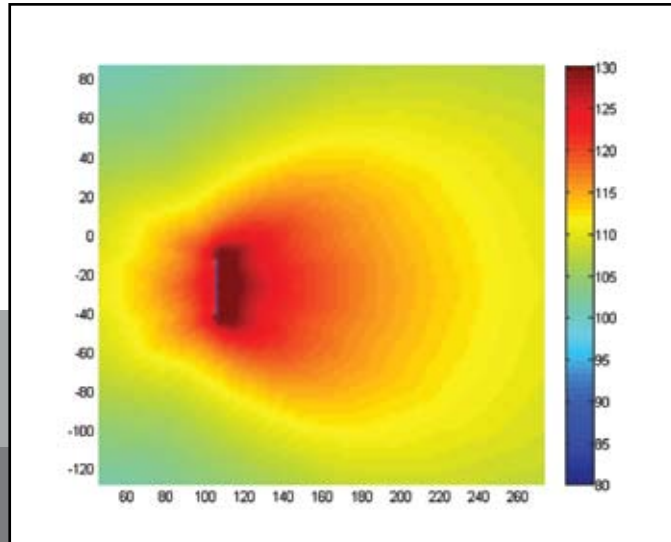
Beyond cardioid – forward output as well as rear rejection can be specified and optimised.

An individual MLX Sub is omnidirectional, yet as few as two MLX's can be configured into a directional array. This approach allows you to design in low frequency directivity when you need it, and to increase output even further if you don't.

With DISPLAY2, the same numerical optimisation software as MLA, MLX subwoofer arrays can be designed and DSP coefficients generated. The DSP settings are then downloaded straight into the MLX Subs via the VU-NET network to configure subwoofer arrays with specific directional properties. Now we can take the bold step beyond cardioid – into a world where the forward output, as well as the rear rejection, can be specified and optimised. Cardioid subs were great for the monitor engineer – now, with the MLX Sub, we can look after the crowd too.

25

MLA SYSTEM
THE ECONOMICS OF EFFICIENCY

Tour sound systems have to be moved from one venue to another – with associated financial and environmental costs of transportation. With artists becoming increasingly aware of the carbon footprint of their tours, any new sound system must begin to consider the factors which contribute to these financial and environmental overheads.

The most important factor in transportation is how much space the system takes up in the truck. We can express this as a simple metric in terms of how many dB's it can produce, for a given unit volume. Since MLA is a powered system, we don't have amp racks or speaker cables to take up additional space, which is a benefit.

Another major factor is the efficiency at which the acoustic components convert electrical input power to acoustic output, rather than heat. The standard efficiency metric is how many dB's the acoustic components produce at 1m for an input of 2.83V. MLA's all horn-loading maximises efficiency – with class-leading figures of 104dB, 112dB and 122dB for the LF, MF and HF respectively. Since the power drawn by the system is directly proportional to its acoustic and electrical efficiency combined, it is also important that the amplifiers use high efficiency topologies such as Class D.

The weight of the system is also significant. A fully-laden truck uses more fuel. Extrapolate that to air freight and the carbon footprint becomes even more of an issue.

Right from the outset, the MLA has been designed with these factors in mind. This has real benefits for the financial and environmental cost of ownership, the importance of which can only increase as we step into a lower carbon future.

MLA SYSTEM
OTHER SYSTEM COMPONENTS

Merlin Controller/U-NET Hub

The Merlin loudspeaker and network management system is a digital matrix processor configured as a 4-input/10-output, 1U device with accompanying VU-NET software. Any input or group of inputs can be routed to any output and VU-NET provides full control of Merlin via an intuitive graphical user interface running on a wired PC or wireless tablet.

Incorporating our proprietary U-NET audio network protocol, it forms the heart of a networked MLA system with control of up to 254 U-NET equipped devices using VU-NET control software via a wired or wireless Ethernet connection. For simplicity and flexibility, Merlin can also be controlled directly from the front panel.

Mains Distro

Multi-core IP67-rated cables and break-out boxes supply power to each MLA array. Single or three-phase distribution panels connect these multi-core cables to the overall audio mains distribution system, via 63A Ceeform (230V) or 300A Cam-Lok® (115v) options.

Network Interconnects

Rugged, yet flexible CAT5 cabling, terminated in IP68-rated, quick-release, metal connectors is used throughout the U-NET network ring, providing reliable and durable communications.

PC/Wifi Connection

MLA can be controlled by a tablet PC connected via Wifi link to the Merlin controller/U-NET hub. To ensure reliable connection over 100 metres plus, each MLA system is supplied with a high-power WLAN access point, 1U Ethernet switch and a high power USB Wifi dongle. PC connection to Merlin via wired Ethernet is also supported.

MLA SYSTEM
MLA & MLD DOWNFILL SPECIFICATIONS & DIMENSIONS

Acoustical

TYPE			Three-way cellular drive, active array element
FREQUENCY RESPONSE (1)			52Hz–18kHz ± 3dB
MAXIMUM SPL	@ 1m	**MLA**	LF: 133dB continuous, 139dB peak (3)
			MF: 134dB continuous, 140dB peak (4)
			HF: 139dB continuous, 145dB peak (4)
	@ 1m	**MLD**	LF: 133dB continuous, 139dB peak (3)
			MF: 133dB continuous, 139dB peak (4)
			HF: 134dB continuous, 140dB peak (4)

Drivers

LF	2 x 12" (300mm)/3" (75mm) voice coil, ultra-long excursion, neodymium magnet drivers, Hybrid® bass horn loaded
MF	2 x 6.5" (165mm)/2" (50mm) coil, neodymium magnet drivers, horn loaded
HF	3 x 1" (25mm) exit neodymium magnet compression drivers, horn loaded

Rated Power (2)

LF	800W AES, 3200W peak
MF	400W AES, 1600W peak
HF	150W AES, 600W peak

Dispersion

MLA	(-6dB)	90º horizontal
	(-10dB)	120º horizontal
		7.5° vertical
MLD	(-6dB)	120º horizontal
	(-10dB)	140º horizontal
		20° vertical

Crossover Frequencies

320Hz	8th-order Linkwitz-Riley
4kHz	Vanishing Point™ FIR filters

Audio input

CONNECTORS	Female XLR input, male XLR link output
ANALOGUE INPUT IMPEDANCE	20kΩ balanced to ground
MAXIMUM ANALOGUE INPUT LEVEL	6.15Vrms (+18dBu), over voltage protected
NOMINAL SYSTEM GAIN	28.5dB
AES/EBU IMPEDANCE	110 Ohms balanced, Receive and transmit termination

Network

CONNECTORS	2 x IP68 rated 8-way, quick-release type
PROTOCOL	U-NET

Amplifier Module

TYPE	Six channel Class D, fixed frequency
PEAK OUTPUT POWER	6000W
AVERAGE EFFICIENCY	75%
COOLING	4 x temperature controlled internal fans
	1 x low-speed internal blower
	1 x temperature controlled external fan
MAXIMUM AMBIENT TEMPERATURE	45°C (113°F) for full output

Power Supply

TYPE	Switch mode, fixed frequency with PFC
AC INPUT OPERATING RANGE	100 – 240V ~ AC, 50 – 60Hz
POWER FACTOR	> 0.95
NOMINAL POWER CONSUMPTION	900W
MAINS CONNECTOR	16A IEC309 (Ceeform) – IP44 rated

General

ENCLOSURE	Vertical trapezoid with 3.75º [**MLD 10º**] wall angle, multi-laminate birch and poplar-ply construction
FINISH	Textured black PU coating
PROTECTIVE GRILLE	Black HEX perforated steel
FITTINGS	Proprietary rigging system
	Bar handles on each side
	Protective rubber side-cheeks incorporating skids
	Wheel-board
	Transit cover
	Weather protection cowl
IP RATING	IP 24
DIMENSIONS (inc. wheel-board)	**MLA** (W) 1136mm x (H) 372mm (376mm) x (D) 675mm (825mm) (W) 44.7in x (H) 14.6in (14.8in) x (D) 26.5in (32.4in)
	MLD (W) 1136mm x (H) 454mm (458mm) x (D) 680mm (840mm) (W) 44.7 x (H) 17.9in (18in) x (D) 26.8in (33.1in)
WEIGHT (ex. wheel-board)	**MLA** 87.5kg (193lbs) **MLD** 91.5kg, 201lbs

Accessories

	Flying frame (including clinometer)
	Ground stacking bar
	Flying pin
	Mains distribution system
	Tour-grade network interconnects
	Merlin Controller/U-NET Hub

Notes
(1) Measured on-axis in open (4ϖ) space at 4 metres, then referred to 1 metre.
(2) AES Standard ANSI S4.26-1984.
(3) Measured in half-space at 1 metre with a tone burst signal, then referred back to open (4ϖ) space.
(4) Calculated from 4m 2.83v sensitivity, referred to 1m.

MLA SYSTEM
MLX SUB SPECIFICATIONS & DIMENSIONS

Acoustical

TYPE		Hybrid® horn/reflex subwoofer
FREQUENCY RESPONSE (1)		35Hz–150Hz ± 3dB
MAXIMUM SPL		LF: 140dB continuous, 150dB peak (3)

Drivers

	LF	2 x 18" 115mm / 4.5" voice coil, ultra-long excursion, high efficiency neodymium magnet

Rated Power (2)

	LF	3000W AES, 12000W peak

Dispersion

	Digitally controlled in an array

Audio input

CONNECTORS	Female XLR input, male XLR link output
ANALOGUE INPUT IMPEDANCE	20kΩ balanced to ground
MAXIMUM ANALOGUE INPUT LEVEL	6.15Vrms (+18dBu), over voltage protected
AES/EBU IMPEDANCE	110 Ohms balanced, Receive and transmit termination

Network

CONNECTORS	IP68 rated 8-way, quick-release type
PROTOCOL	U-NET

Amplifier Module

TYPE	Single channel Class D, fixed frequency
PEAK OUTPUT POWER	8500W
AVERAGE EFFICIENCY	85%
COOLING	2 x temperature controlled internal fans
	1 x low-speed internal blower
	1 x temperature controlled external fan
MAXIMUM AMBIENT TEMPERATURE	45°C (113°F) for full output

Power Supply

TYPE	Switch mode, fixed frequency with PFC
AC INPUT OPERATING RANGE	100 – 240V ~ AC, 50 – 60Hz
POWER FACTOR	> 0.95
NOMINAL POWER CONSUMPTION	600W
MAINS CONNECTOR	16A IEC309 (Ceeform)

General

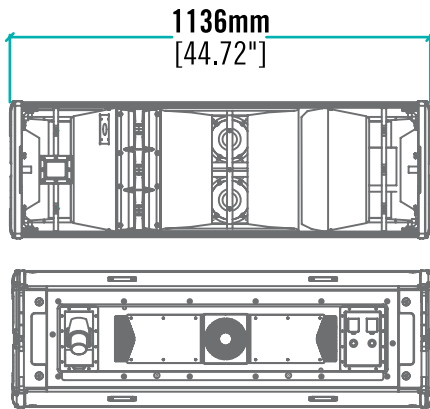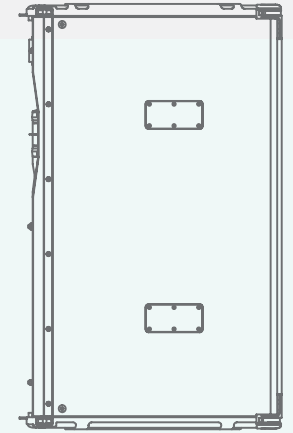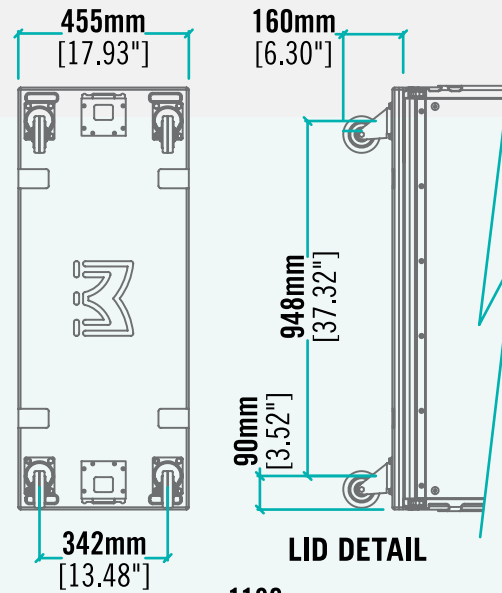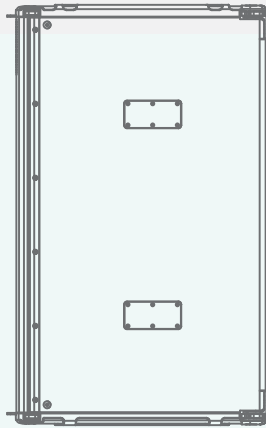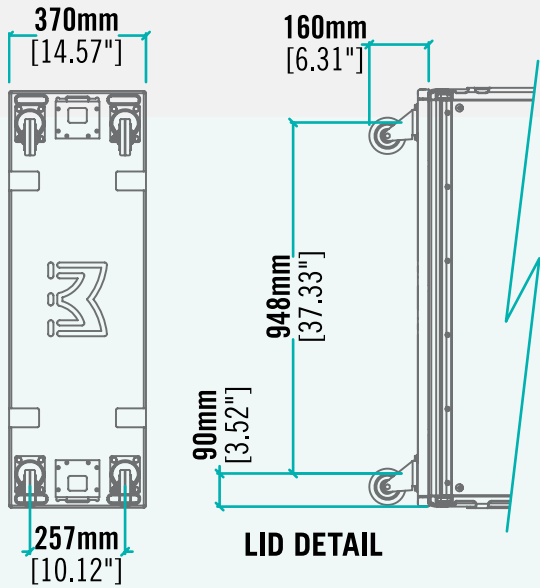|	
ENCLOSURE	Extensively braced multi-laminate birch-ply
FINISH	Textured black PU coating
PROTECTIVE GRILLE	Black HEX perforated steel.
FITTINGS	Proprietary rigging system.
	Protective rubber side-cheeks incorporating skids.
	Wheel-board
	Transit cover
	Weather protection cowl
IP Rating	IP 24
DIMENSIONS (inc. wheel-board)	(W) 1126mm x (H) 607mm (607mm) x (D) 1027mm (1200mm)
	(W) 44.4in x (H) 23.9in (23.9in) x (D) 47.2in
WEIGHT (ex. wheel-board)	160kg (352lbs)

Accessories

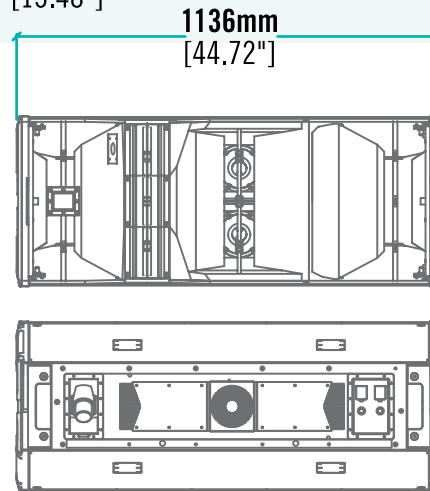|	
	Flying frame (including clinometer)
	Flying Pin
	Mains distribution system
	Tour-grade network interconnects
	Merlin Controller/U-NET Hub

Notes
(1) Measured on-axis on ground plane (2ϖ space) at 2 metres, then referred to 1 metre.
(2) AES Standard ANSI S4.26-1984.
(3) Measured in half-space at 1 metre with a tone burst signal.

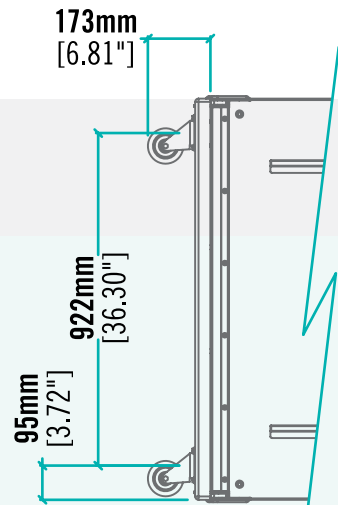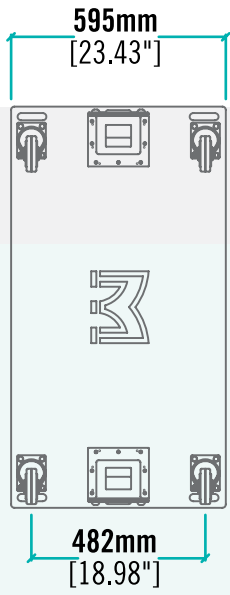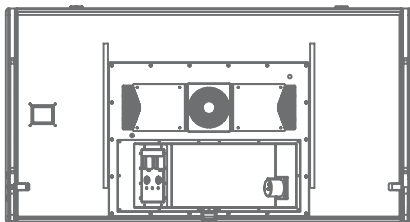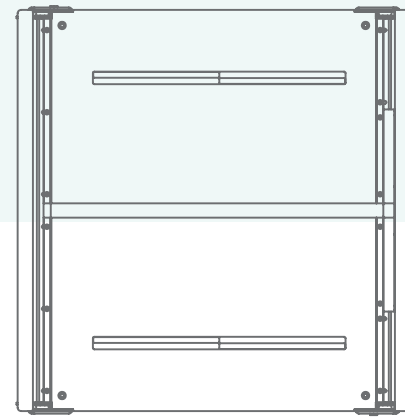# MLA SYSTEM
DIMENSIONS

370mm [14.57"]

160mm [6.31"]

948mm [37.33"]

90mm [3.52"]

257mm [10.12"]

LID DETAIL

1136mm [44.72"]

25mm [0.98"]

675mm [26.58"]

372mm [14.63"]

283mm [11.15"]

MLA

455mm [17.93"]

160mm [6.30"]

948mm [37.32"]

90mm [3.52"]

342mm [13.48"]

LID DETAIL

1136mm [44.72"]

20mm [0.78"]

680mm [26.78"]

454mm [17.89"]

230mm [9.04"]

MLD

595mm
[23.43"]

173mm
[6.81"]

922mm
[36.30"]

95mm
[3.72"]

482mm
[18.98"]

LID DETAIL

1126mm
[44.33"]

33mm
[1.31"]

1027mm
[40.43"]

33mm
[1.31"]

607mm
[23.90"]

595mm
[23.43"]

MLX
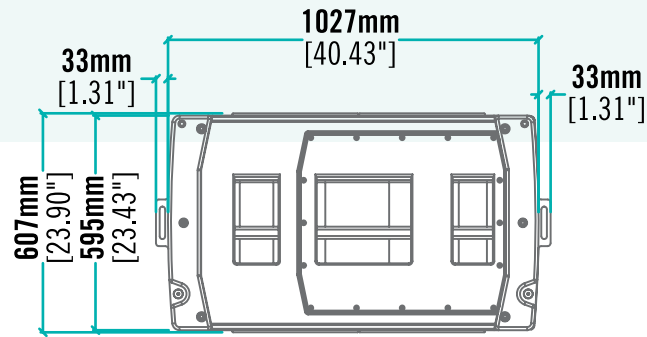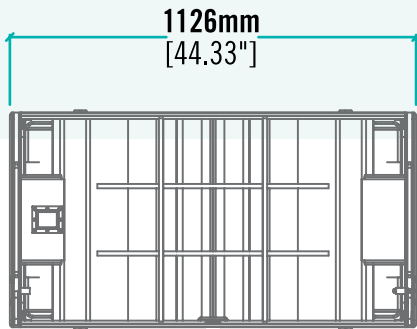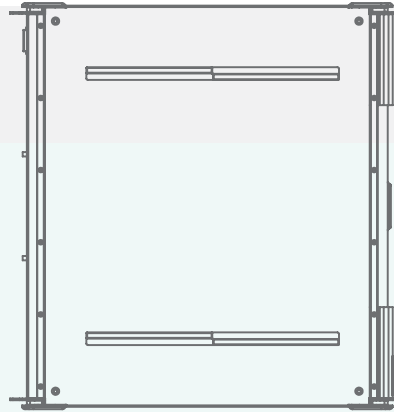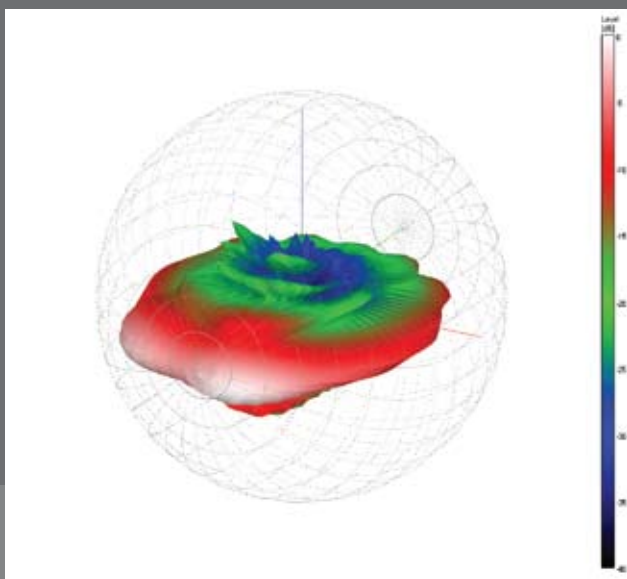
▲ MLA GLL sphere, 1000Hz

EASE GLL

Since its introduction as a concept in 2005, Martin Audio has recognised the EASE GLL as a major step forward — with entire systems, including high-resolution complex acoustic data, crossover filters and mechanical properties all bound together in one file. Martin Audio's newly developed, true-superpositional data is implemented in the MLA GLL. This increases simulation accuracy by taking into account the previously ignored, yet very significant, acoustic effect of neighbouring enclosures in the array*.

A particularly useful feature of GLL is the ability to import and export whole system configurations. This allows seamless inter-operability between EASE and DISPLAY2 optimisation software – so that entire array systems complete with filters can be passed directly into EASE.

The MLA GLL can be downloaded at https://www.martin-audioftp.com/index.php

* S. Feistel, A. Thompson and W. Ahnert, "Methods and Limitations of Line Source Simulation," presented at the 125th Convention of the Audio Engineering Society (2008 Oct.), convention paper 7524.

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