MARTIN AUDIO
LONDON

MLA™

MULTI-CELLULAR LOUDSPEAKER ARRAY

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LONDON

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.

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.

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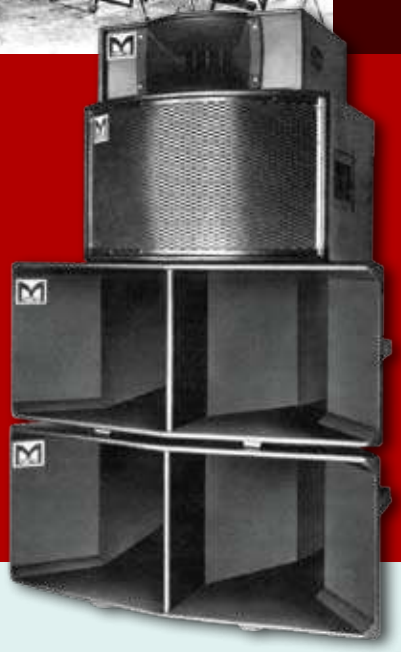


1971
Martin Audio founded in Covent Garden, London

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

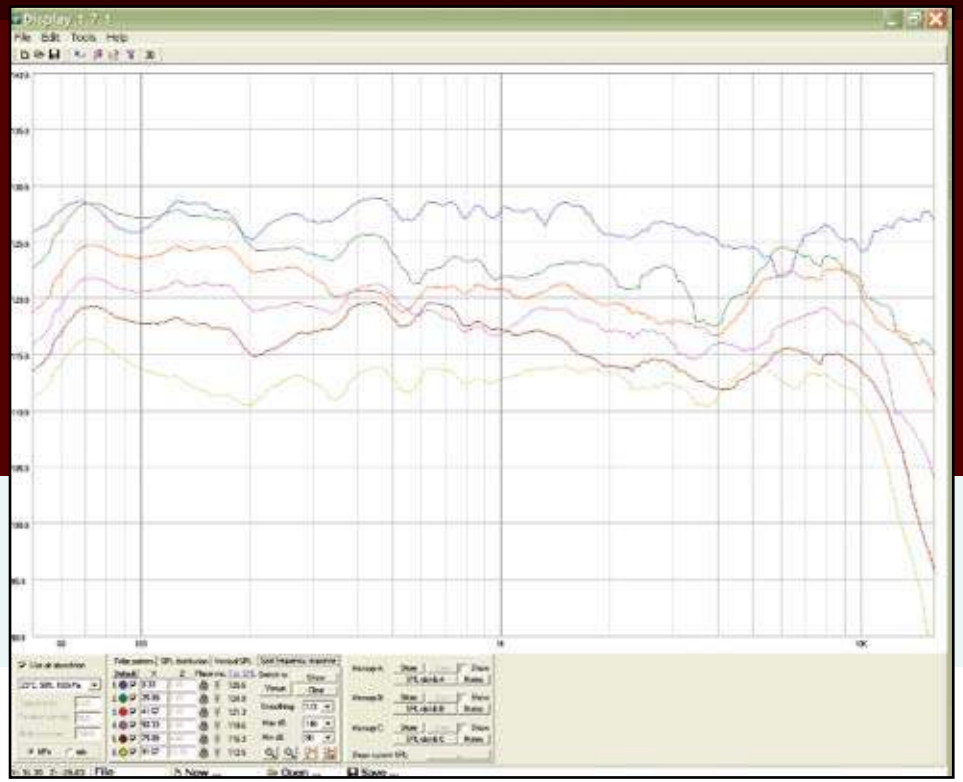
2002
Martin Audio W8L touring line array introduced

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 DON'T 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

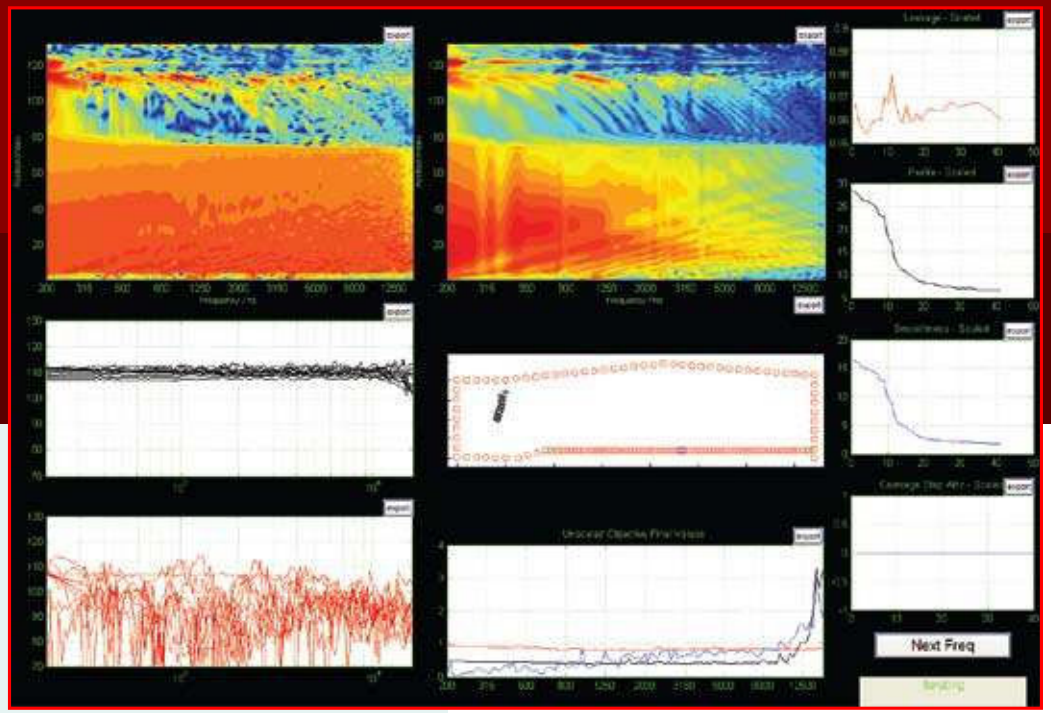
MLA SYSTEM
HOW DOES MLA ADDRESS THESE ISSUES?

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.

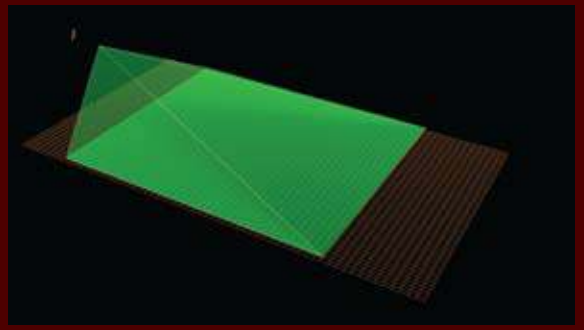
At the heart of the MLA optimisation process is the most accurate acoustic model of array behaviour within the industry to date.



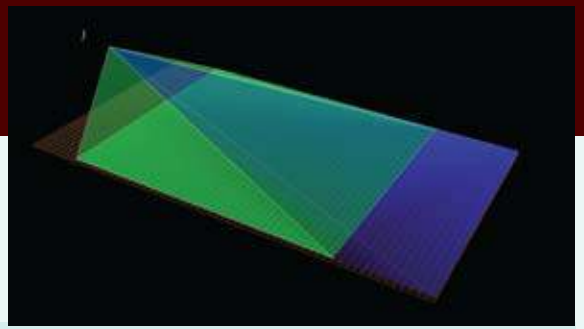
◀ Matlab® acoustic simulation

▶ Unique drive signal for each cell

DESIGN BACKGROUND
BEYOND LINE ARRAY



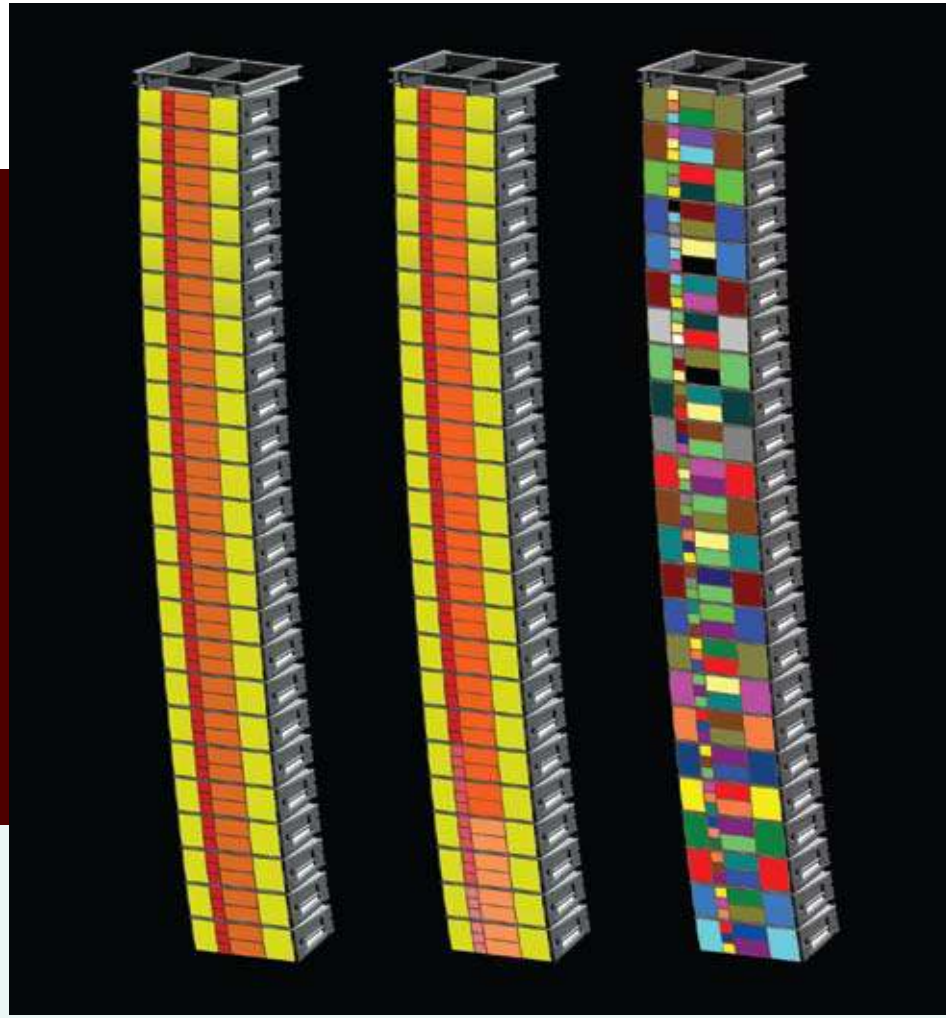
▲ Native array coverage



▲ 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.

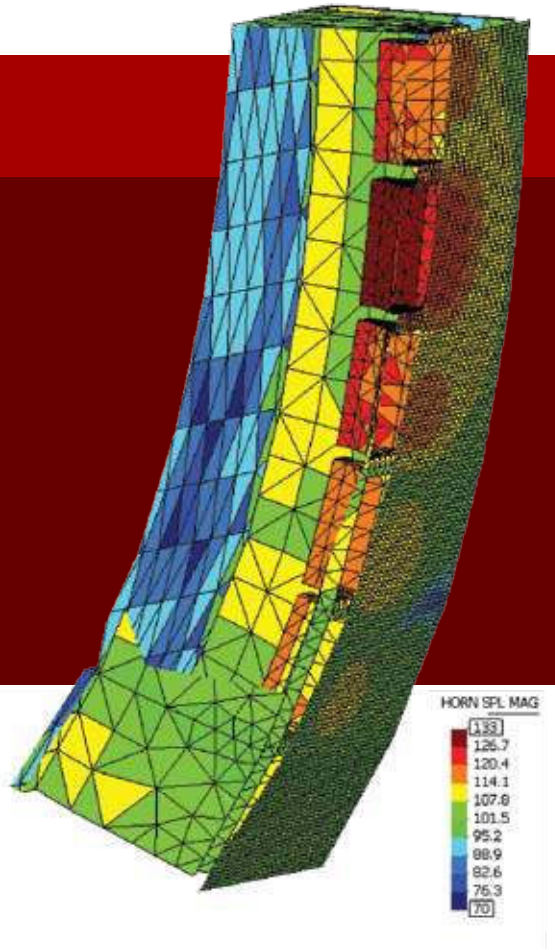
Also, as a "fly-by-wire" system, with so many individually driven and optimised cells under software control, MLA's vertical coverage pattern can be adjusted electronically in real time to cope with changing environmental conditions and last-minute changes in rigging height. So, if coverage cuts off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

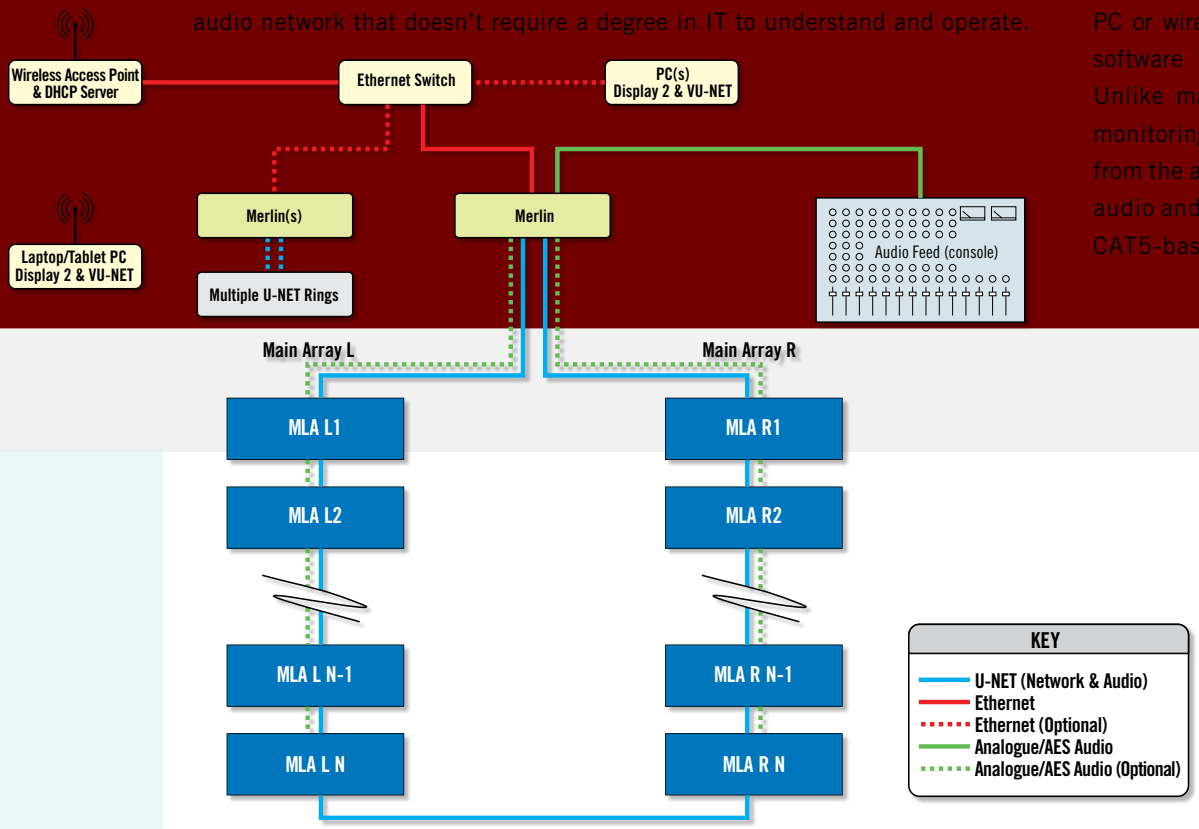
MLA OVERVIEW
A FULLY INTEGRATED SYSTEM

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 ▶

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

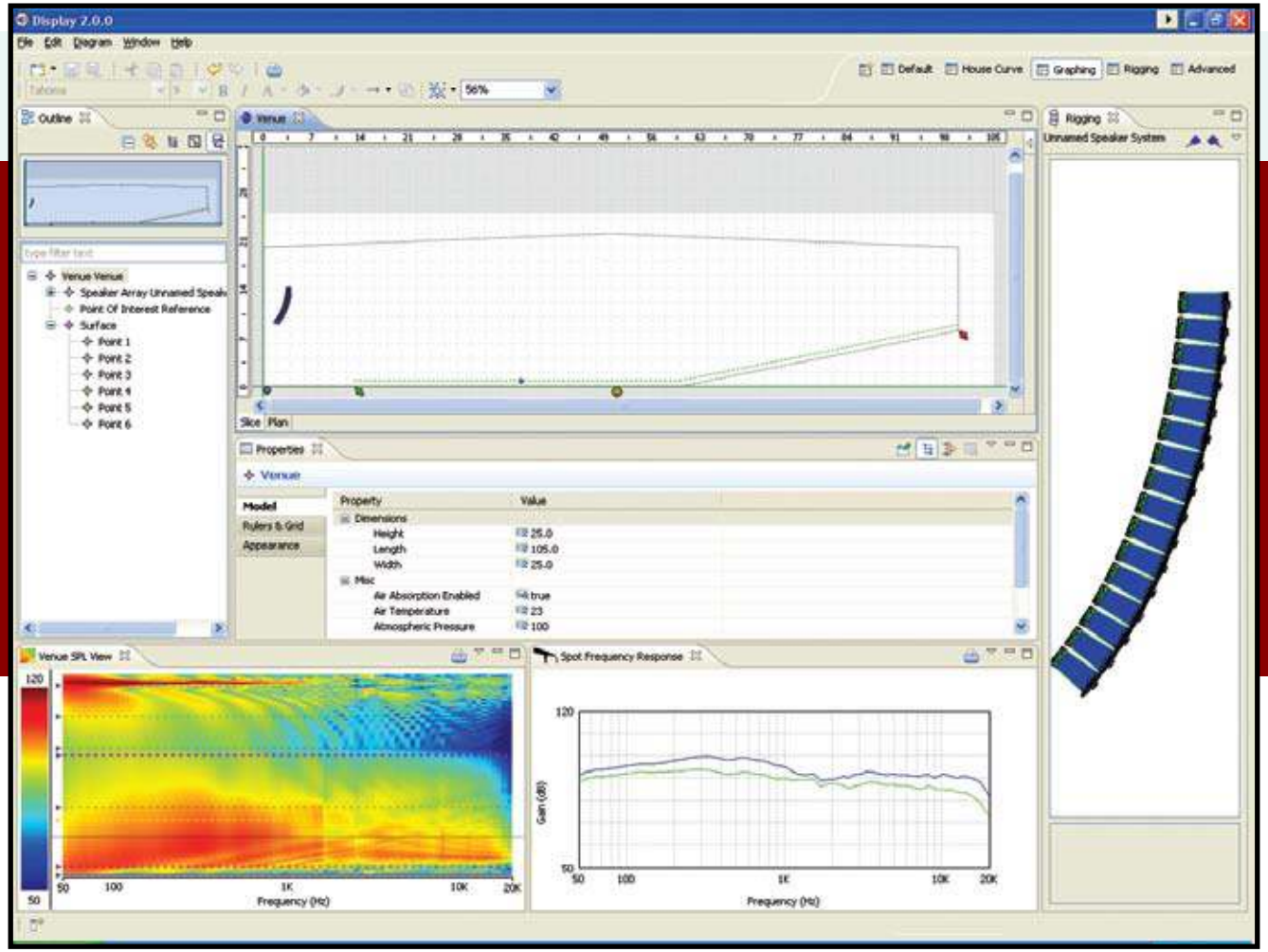
- Unprecedented, even, house-curve balance achieved right from power-up
- Intelligent numerical optimisation software eliminates trial and error in system set-up
- Improved venue-to-venue, gig-to-gig consistency and repeatability
- Artistic changes to balance at the mix position or elsewhere translate 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



▲ DISPLAY2 is the “brain” of MLA

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.

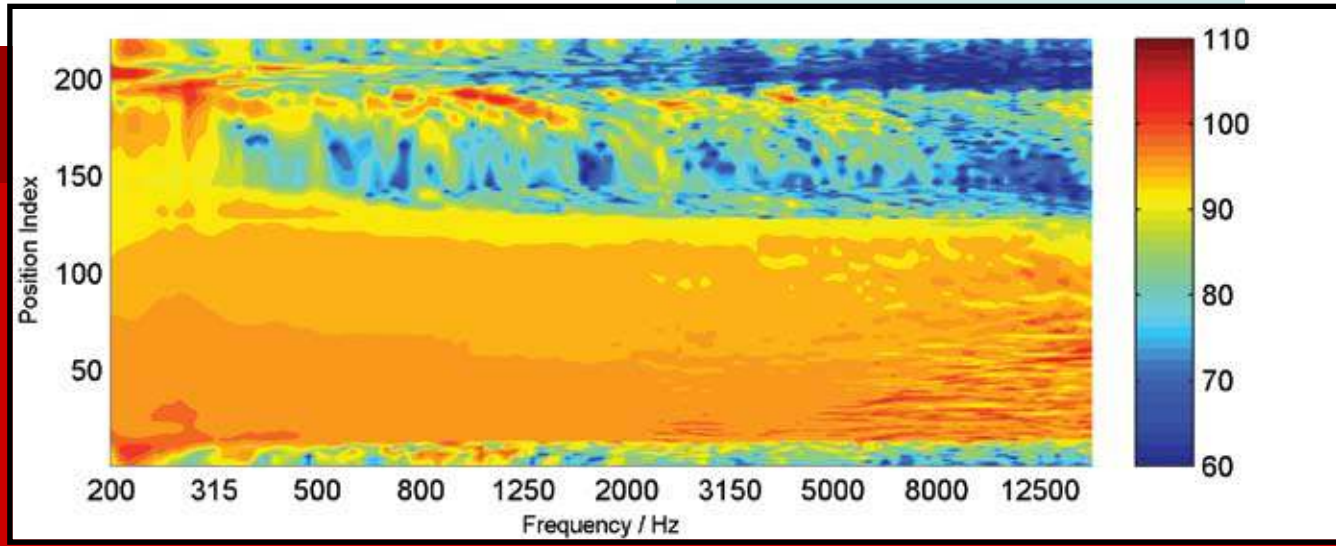
DISPLAY2 is the “brain” of MLA. It provides a virtual environment within which arrays can be configured and optimised – giving a very accurate prediction of the direct sound produced and, in the case of outdoor festivals, over surrounding areas. It takes the guesswork out of array design and deployment – 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
AUTOMATED SET-UP AND FULL ARTISTIC CONTROL

With the computer working behind the scenes, the engineer retains 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.



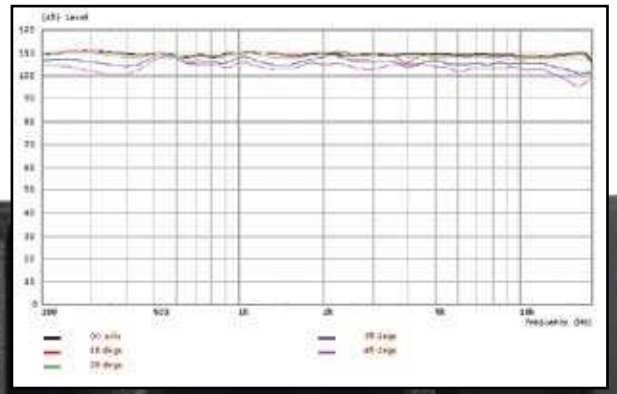
▲ IndexPlot™

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.

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



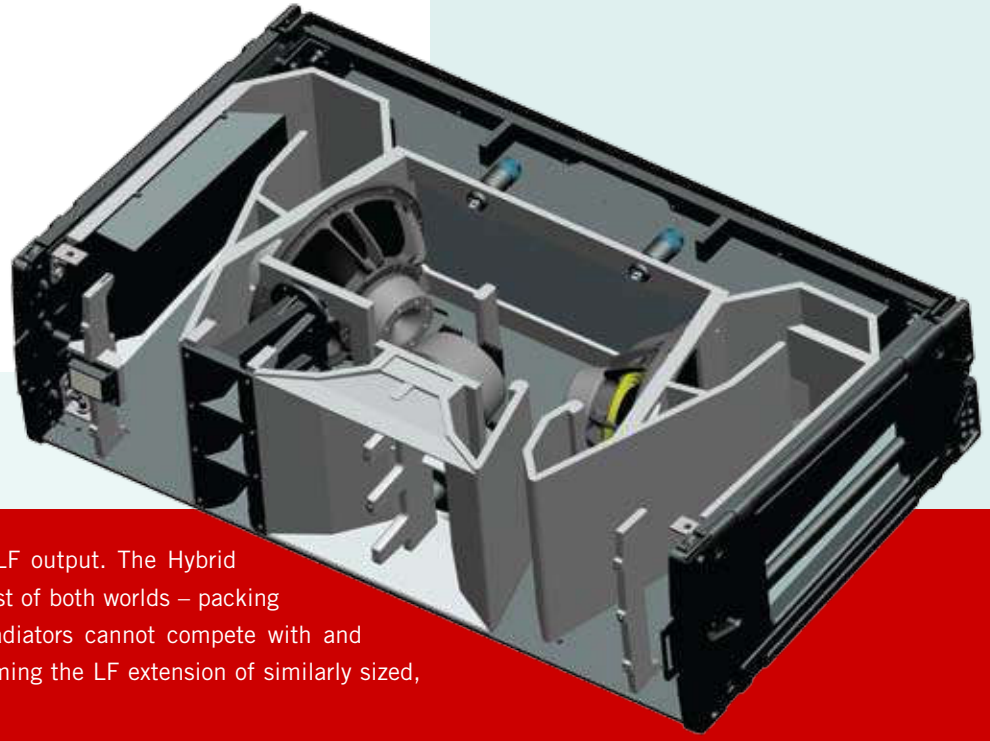
▶ MLA horizontal off-axis frequency response 0,15,30,45 degrees

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

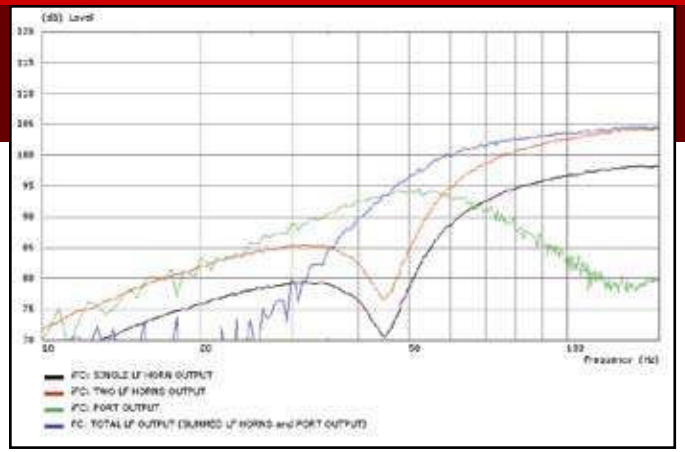


The efficiency of the MLA LF section is 104dB @ 1m/2.83V compared to a typical 98dB for a direct radiator design. This gives MLA a big advantage over direct radiator designs when it comes to projecting maximum LF output over distance.

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

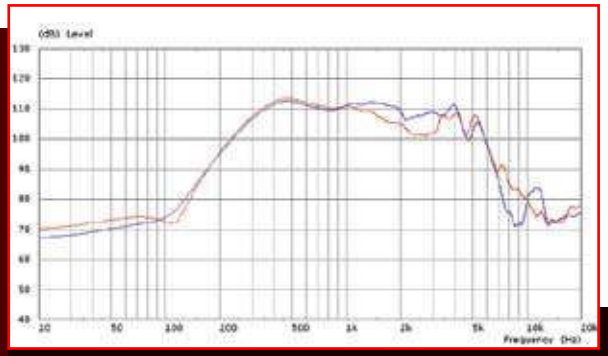
MLA SYSTEM
NO-COMPROMISE MIDRANGE

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.

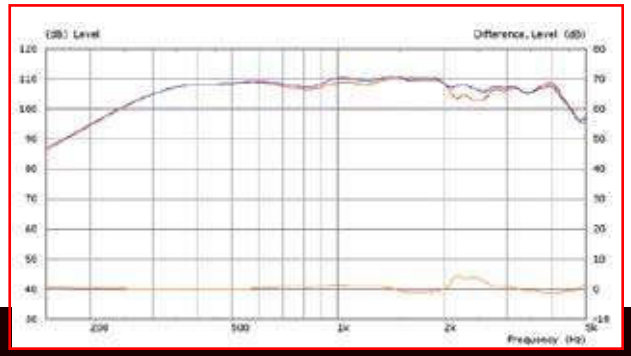
The mid horn of the MLA utilises 2 x 6.5" (165mm)/2" (50mm) voice coil neodymium drivers to produce 112dB @ 1m/2.83V – a huge gain on the typical efficiency of 102dB for cross-firing direct radiator designs. This is a result of painstaking acoustic and thermal design, utilising forced-air cooling and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



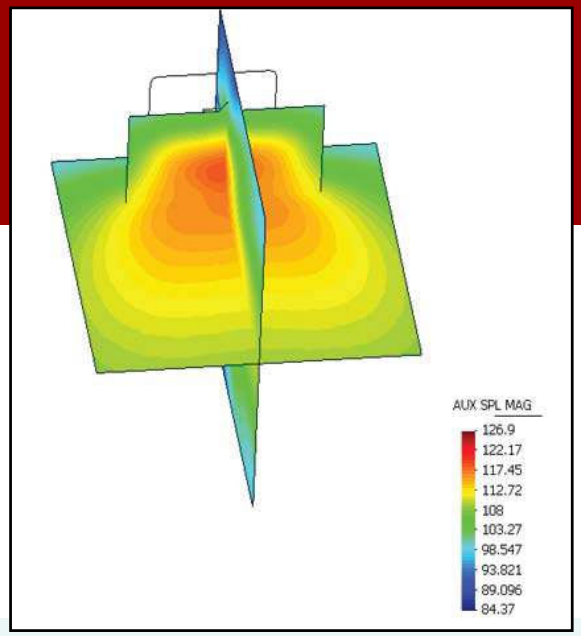
▲ Mid response with phase bung (blue) & without (red)



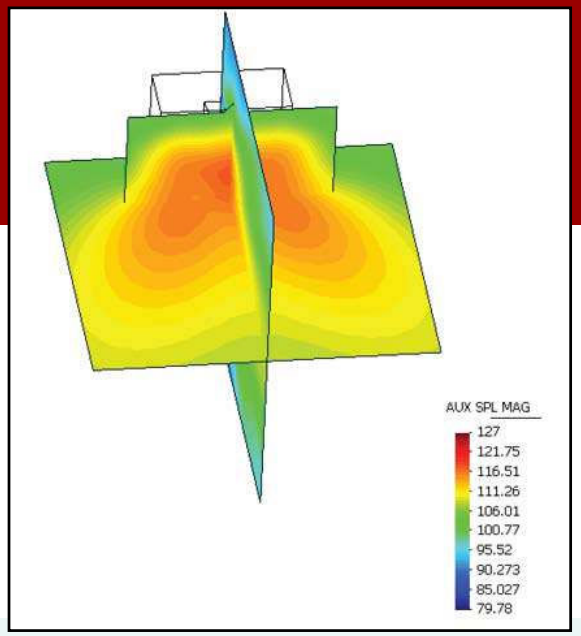
▲ Mid response with HiBlade (blue) & without (red)

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.

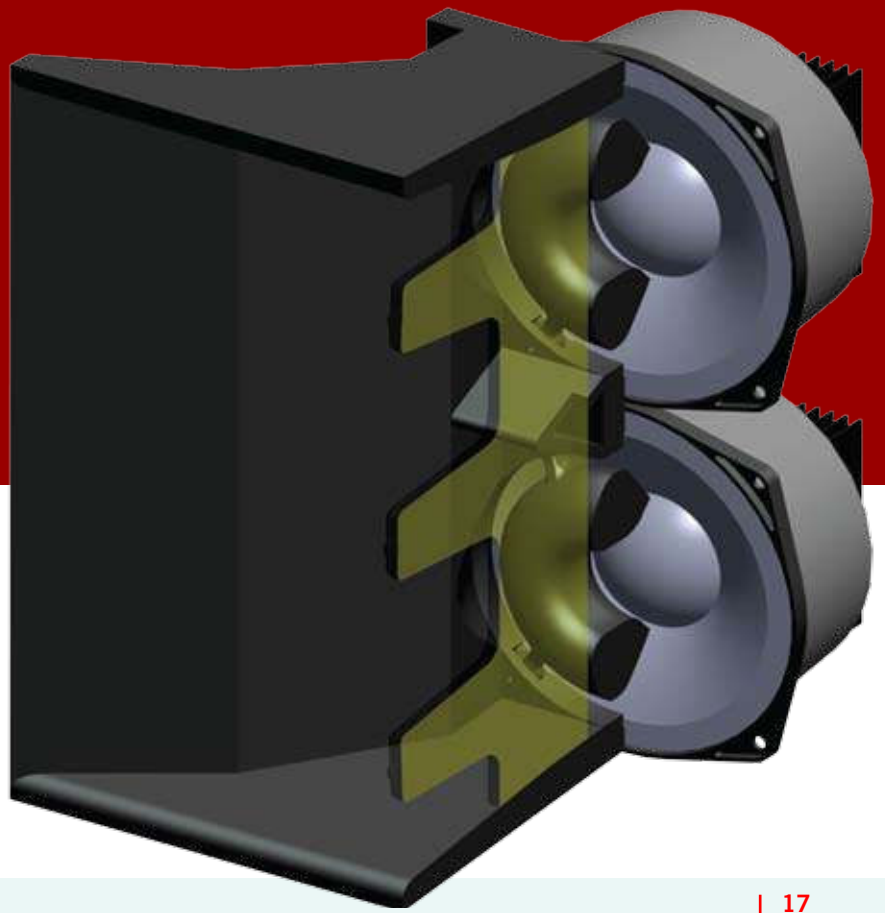
* US Patent 6950530



▲ Mid directivity with HiBlade



▲ Mid directivity without HiBlade



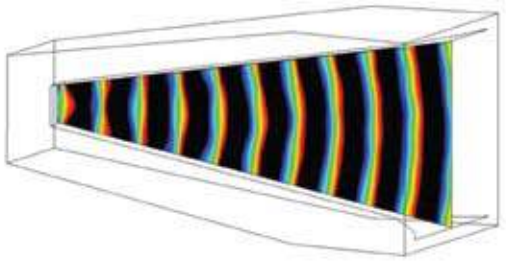
MLA SYSTEM
NEW HF WAVEFRONT CRITERIA

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.

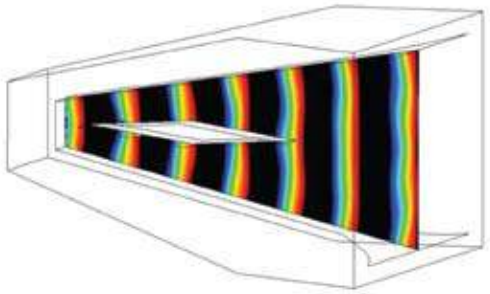
Early proponents of touring line arrays strongly advocated a flat wavefront from each individual HF element. However, our sophisticated in-house BEM (Boundary Element Method) modelling techniques have shown that slightly curved wavefronts deliver much more consistent SPL's to the audience in real-world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

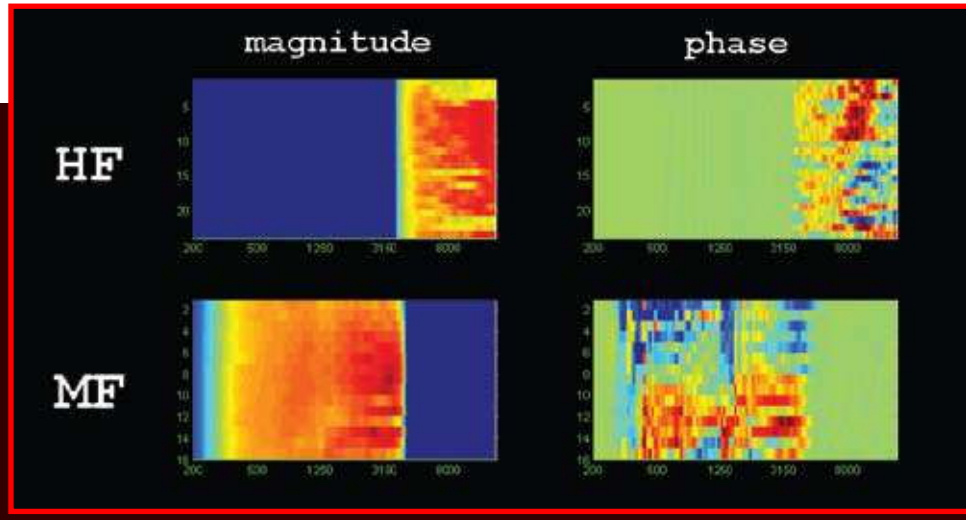


▲ Conventional horn: wavefront is too curved



▲ MLA horn with wedge: curvature is ideally optimised

MLA SYSTEM
FIR CROSSOVER FILTERS

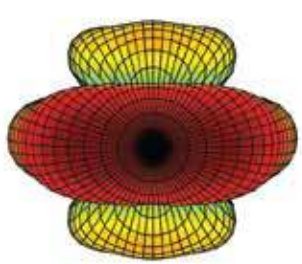


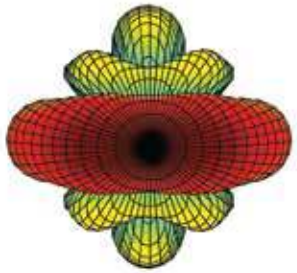
Like all three-way systems, MLA's low, mid and high frequency sections are combined by a crossover. Up to now, Linkwitz-Riley, 4th order filters have been the industry standard. With traditional filters like these, overlap at crossover can result in a non-symmetrical horizontal polar pattern if the devices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

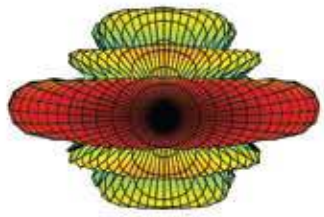
MLA's practical implementation uses very steep, VanishingPoint™, FIR filters. They are not actually brick-wall, because of the effects of brick-wall filters on transient response. Listening tests confirm that the two devices are impossible to locate separately, but sound like a single acoustic source,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

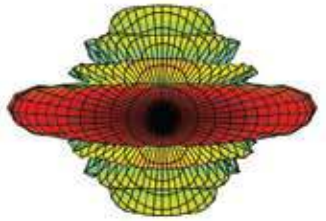
MLA's VanishingPoint FIR filters give us the freedom to physically separate the mid and HF horns, so they do not compromise each other's dispersion pattern, yet achieve the spatial performance of a single device – giving us the best of both worlds.


2051 Hz


2439 Hz


2900 Hz


3449 Hz


4101 Hz

MLA SYSTEM
ONBOARD AMPLIFICATION

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.

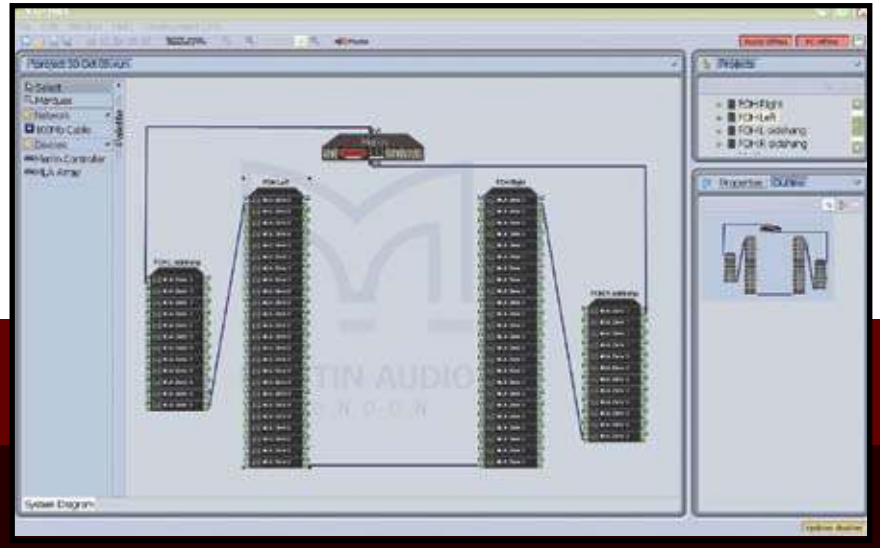
One channel drives both LF units, with each mid driver and each HF driver being driven individually. This fine degree of resolution enables the benefits of MLA's cellular format to be fully realised.

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.

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

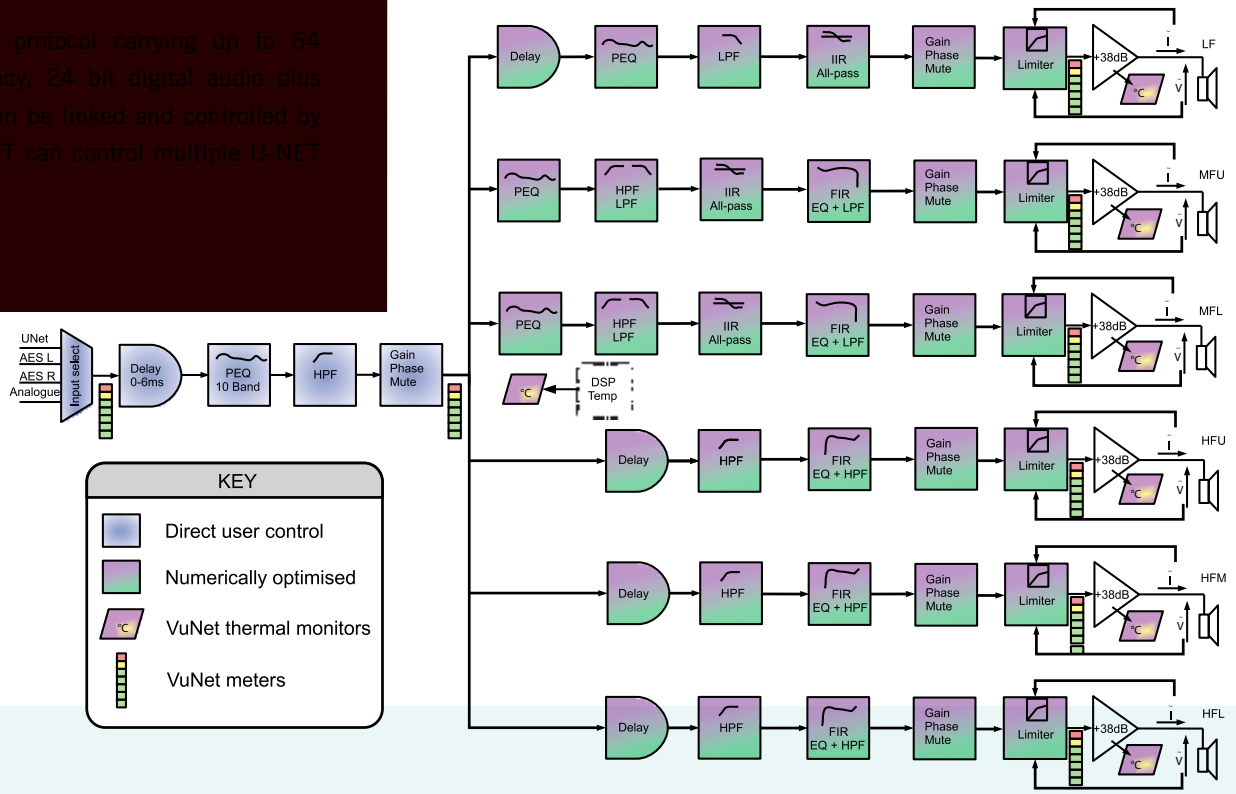


MLA's powerful onboard DSP performs all crossover and EQ functions via a combination of IIR and advanced FIR filtering. Each acoustic cell has its own limiter, which monitors the current flowing through the voice coil to protect the unit from damage.

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.



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

▲ Banana array is wasteful of array elements

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.

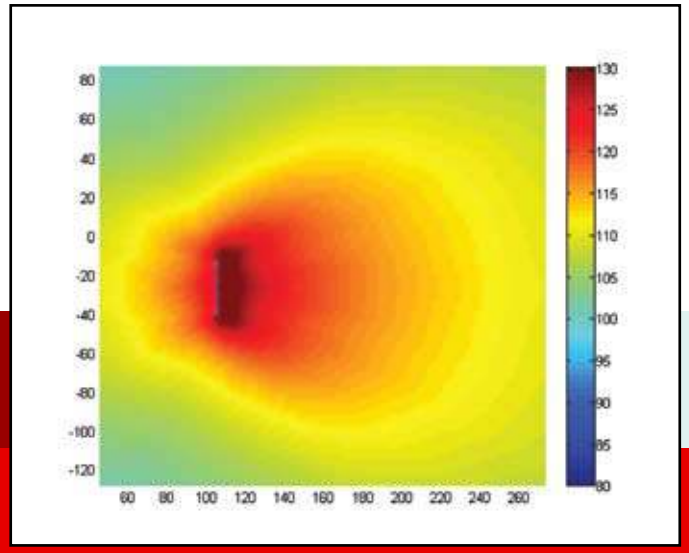
The Downfill's benefits are not confined to the vertical plane. With an extremely wide horizontal dispersion of 120°, the Downfill reaches to front-row-central as well as the ends of the front rows. Our HiBlade patent-pending technology ensures ultra-high frequencies propogate right out to the edges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

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.

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

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.

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

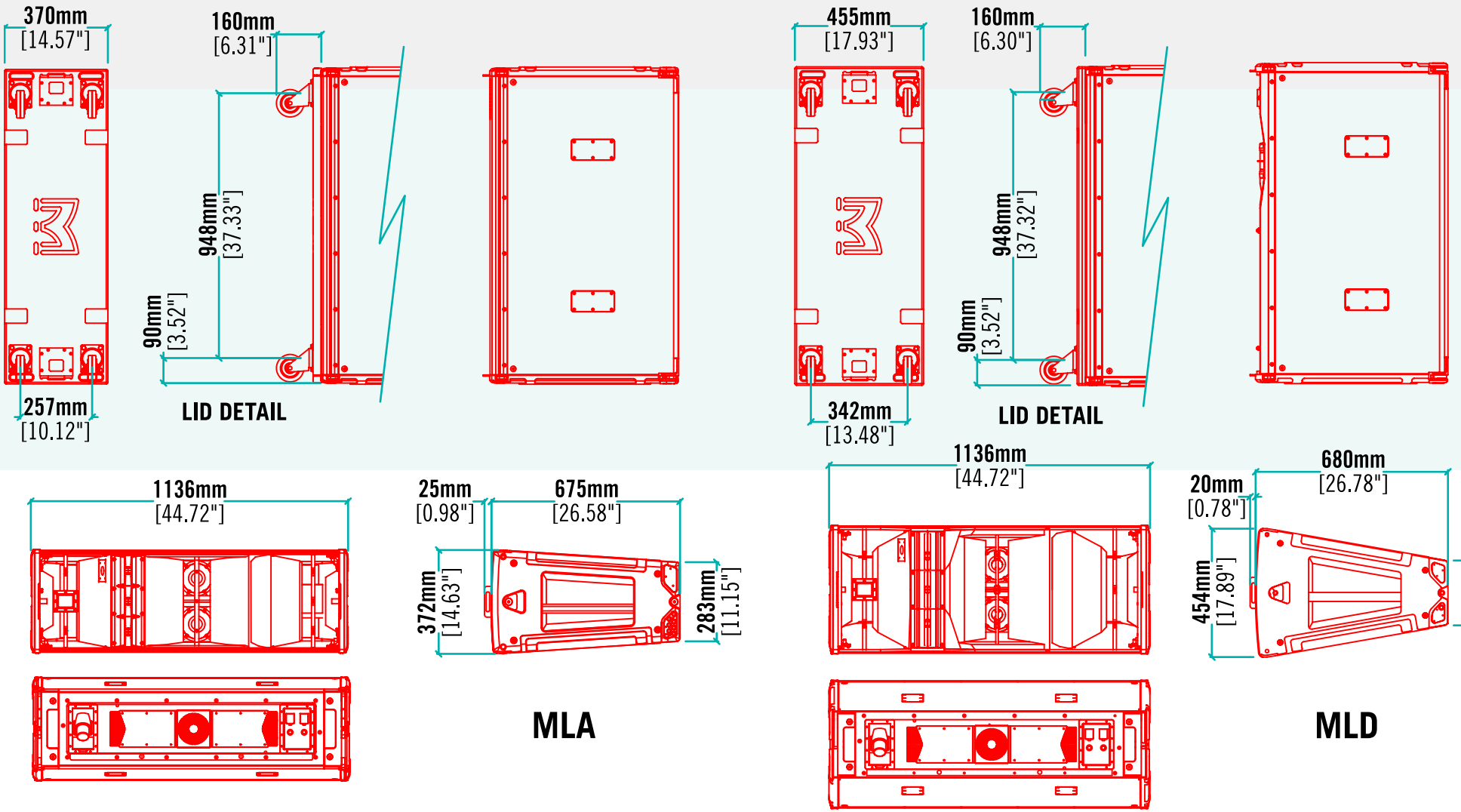
MLA SYSTEM
MLX SUB SPECIFICATIONS & DIMENSIONS

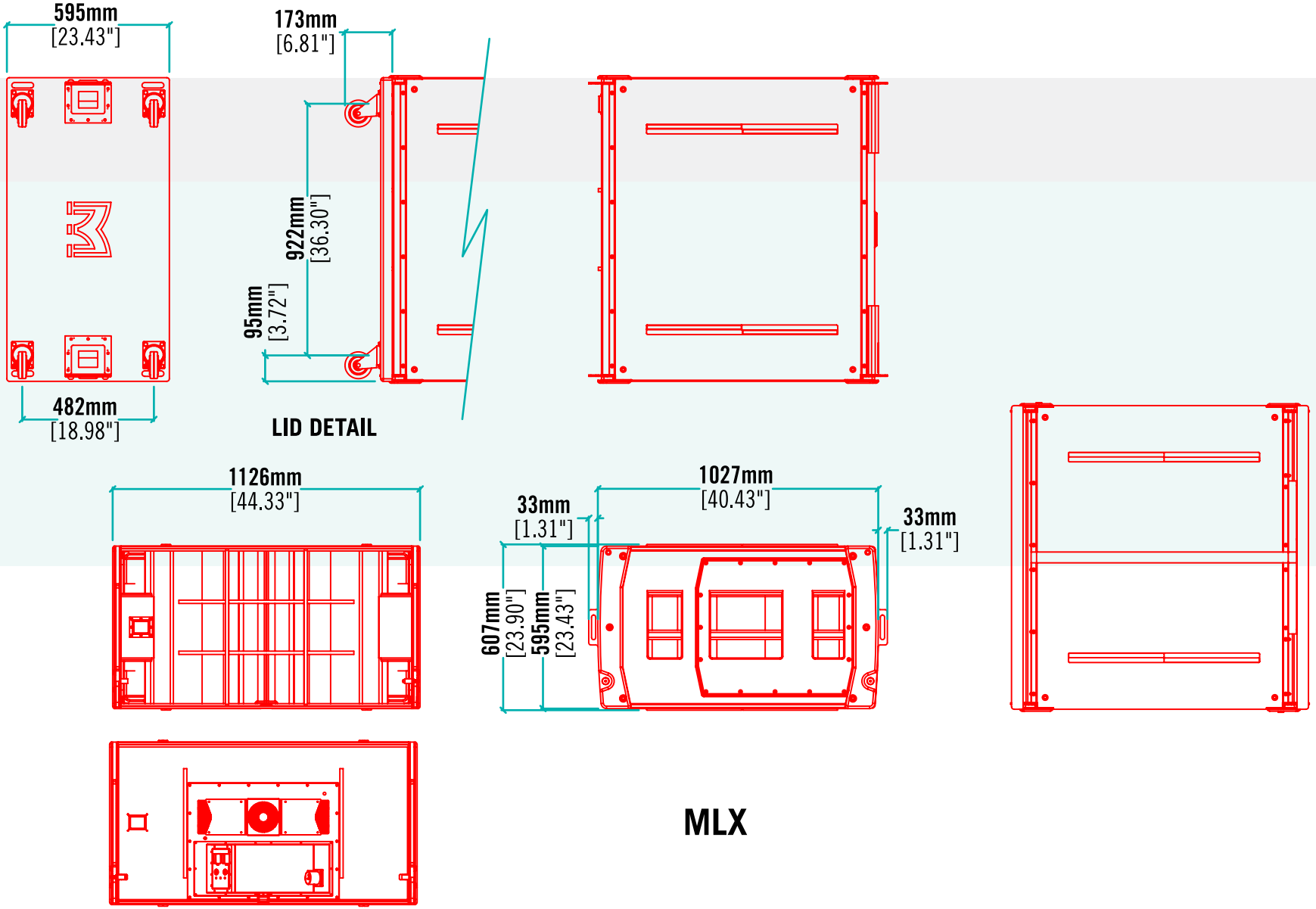
Acoustical	
TYPE	Hybrid® horn/reflex subwoofer
FREQUENCY RESPONSE (1)	35Hz–150Hz ± 3dB
MAXIMUM SPL	LF: 140dB continuous, 150dB peak (3)
Drivers	
LF	2 x 18" 115mm / 4.5" voice coil, ultra-long excursion, high efficiency neodymium magnet
Rated Power (2)	
LF	3000W AES, 12000W peak
Dispersion	
	Digitally 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

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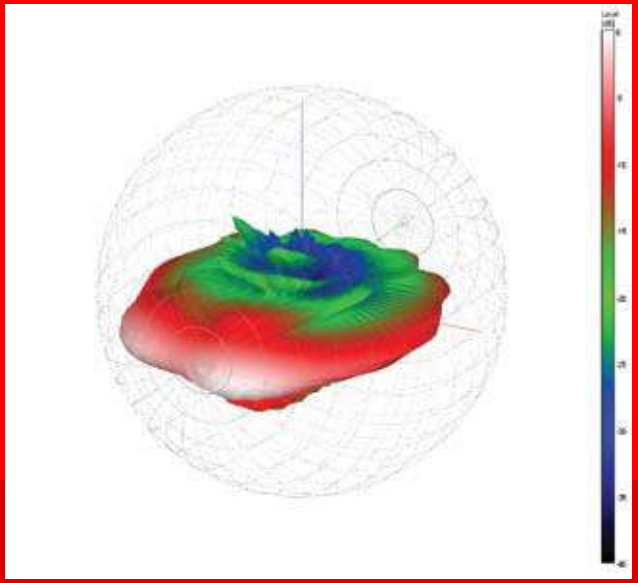
MLA SYSTEM
TECHNICAL SPECIFICATIONS



▲ 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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MLA COMPACT™

MULTI-CELLULAR LOUDSPEAKER ARRAY

MARTIN AUDIO
LONDON

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

Driven by research, Martin Audio's latest developments — first seen in the MLA® system — combine ground-breaking cellular array design with fast, automated intelligent software to deliver a dramatically increased level of performance and coverage consistency compared to conventional line array technology.

In the short time since its introduction, MLA has received multiple awards for innovation. Now, MLA Compact™ brings the revolutionary cellular technology behind MLA to a wider range of touring and installed sound applications.

▲ MLA: Royal Albert Hall, London

▲ MLA: United Center, Chicago

▲ MLA: Philips Arena, Atlanta

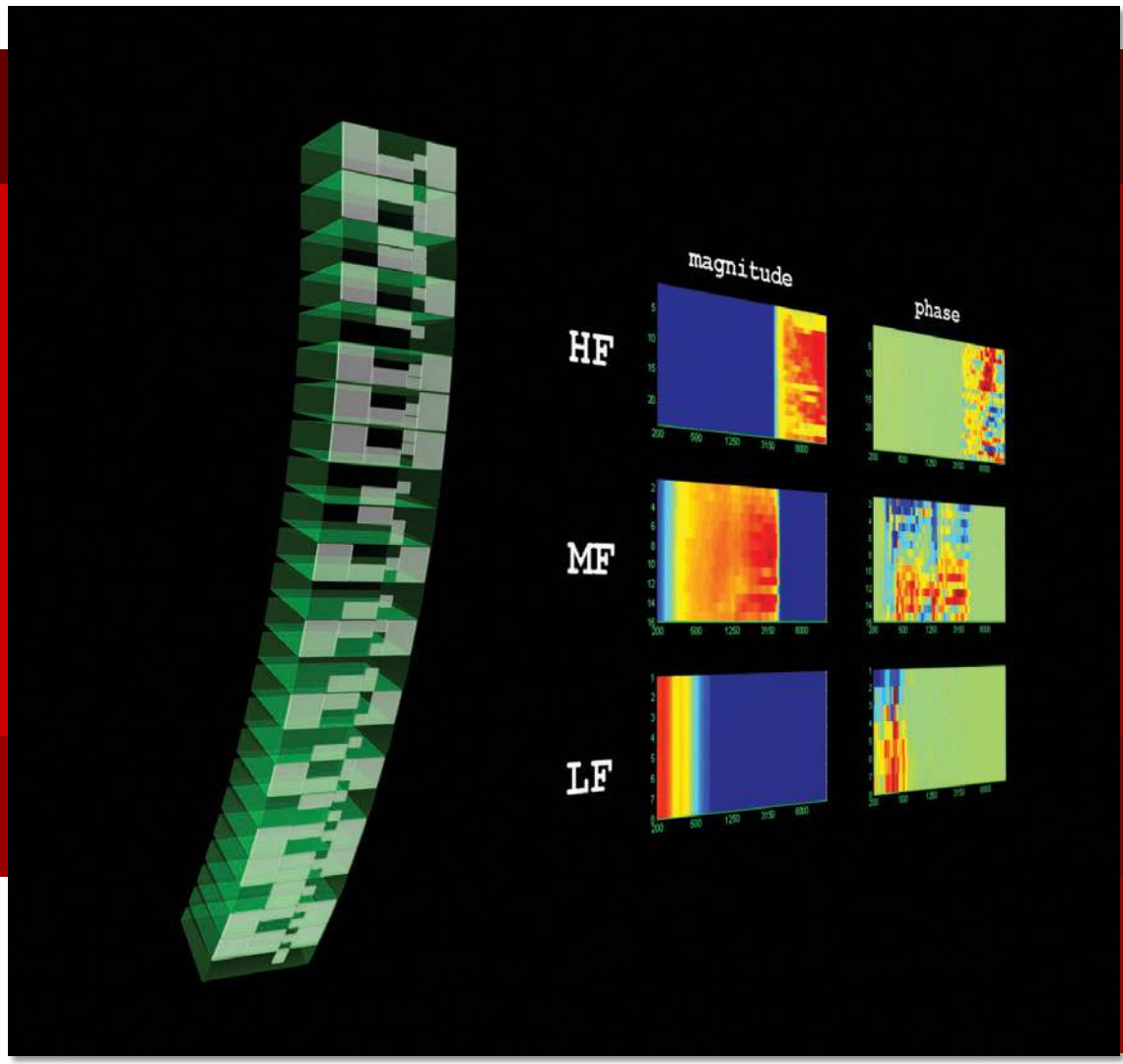
THE CELLULAR REVOLUTION
BEYOND LINE ARRAY

Every so often a new technology renders previous technologies obsolete, or relegates them to the second-tier. Just as line array took over from point-source systems to become the touring standard over the last decade, in 2010 Martin Audio's MLA® Multi-cellular Loudspeaker Array introduced a revolutionary new technology to touring sound.

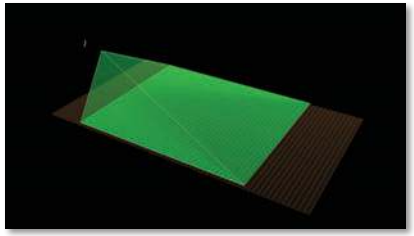
MLA's combination of cellular drive and fast, automated optimisation software delivers the engineer's mix throughout the venue with an accuracy and consistency simply not achievable with traditional line arrays.

Unlike line arrays — which aim to produce iso-phasic wavefronts as they exit from the array (usually up in the air in real-world applications) — MLA cellular technology is designed to achieve phase-coherent summation across the audience itself. MLA technology holds both frequency response and SPL within a very tight, user-specified window — from the front rows to the rear balconies.

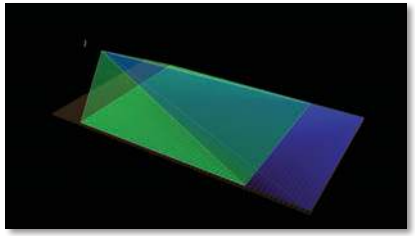
MLA technology gives the system tech the tools to control sound throughout the venue with absolute confidence, and the FOH engineer can mix knowing that the balance set at the mix position will be heard everywhere.



▲ MLA cellular drive



▲ Native array coverage

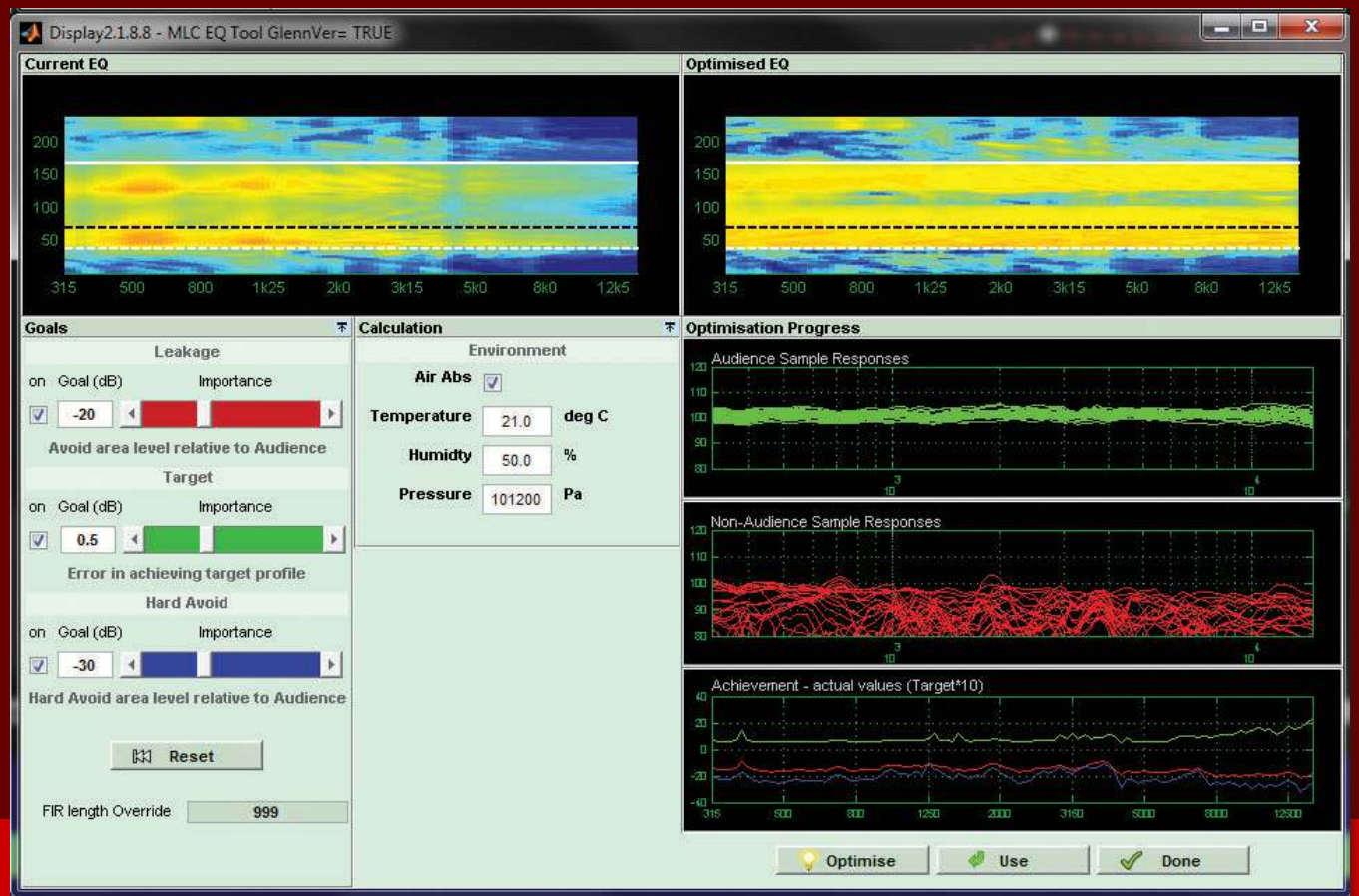


▲ Coverage extended electronically

Measurements of line arrays in the field have shown that SPL and frequency response vary widely at different distances from the array. And setting up a line array remains a trial-and-error process, with preset libraries under constant revision.

MLA cellular technology takes a radically different approach — replacing trial-and-error with automation and an accurate acoustic model. Everything is done from an audience perspective. First, audience and venue criteria are entered into intelligent optimisation software, which calculates exactly what acoustic source is required. Secondly, the software configures an array and calculates the individual DSP parameters for each cell within the array that will generate this source.

As a computer-controlled system, with so many individual cells under software control, vertical coverage can also be adjusted electronically to cope with changing environmental conditions and last minute changes in rigging height. No need to re-rig. "Hard-avoid" areas — such as ceilings, balcony edges, stage areas and venue perimeters — can also be programmed in. Physical fixes, such as balcony bars, are no longer relevant.



▲ Automated optimisation

MLA COMPACT
SCALABLE AND VERSATILE

MLA cellular technology is a breakthrough in the way touring loudspeaker systems are arrayed and controlled. In a short time, the flagship MLA has received multiple awards — including the PLASA Gold Award for Innovation, the MusikMesse International Press Award, and the Parnelli Indispensable Technology Award.

Now, the MLA Compact brings MLA technology to the wide range of applications that do not require the full power and throw of the full-size MLA, or where a smaller, lighter system is called for. MLA Compact shares the sonic attributes of the flagship MLA and is designed for medium-scale touring and fixed installations. Its compact size belies its output capabilities — a 12-box array can easily deliver full rock SPL's in a 5000 seat venue, whilst a 24-box array will approach the output of many "full-size" systems which have less efficient acoustic elements.

Scalable and versatile, MLA Compact is the ideal system for ballroom, theatre and HoW applications and is the natural choice as a side-hang or front-fill for the full-size MLA.

Its compact size belies its output capabilities

MLA COMPACT
FEATURES AND BENEFITS

FEATURES

- Numerically optimised, fully-integrated, compact touring sound system
- Cellular array format with built-in amplification, DSP and digital networking
- 5 dedicated Class D amplifier channels per enclosure for individual powering and DSP control of individual cells
- Industry leading DISPLAY2.1 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. "Hard-avoid" areas, such as on-stage, ceilings and site perimeter, can be programmed in
- Switched mode power supplies with PFC (Power Factor Correction) and global mains voltage operation
- Three-way design delivers LF/MF/HF peak SPL's of 135/135/135dB @ 1m from a single, compact enclosure
- Fast, integral flying system for suspension of up to 24 enclosures
- True 100° (-6dB) horizontal constant directivity, mid and high frequency pattern control. Consistent and usable out to 130° (-10dB)
- 65Hz–18kHz ± 3dB full bandwidth frequency response

BENEFITS

- Desired house-curve achieved right from power-up
- Automatic, intelligent configuration and optimisation 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 powerdensity means tighter truck-pack for higher SPL compared to other systems
- "Greener" audio power via PFC (Power Factor Correction)
- Programmable leakage parameter to meet environmental noise constraints

APPLICATIONS

- Premium touring sound reinforcement for medium-size venues
- Fixed installations in concert halls, theatres, ballrooms and HoW
- Side hang for MLA festival and arena systems

MLA COMPACT
A FULLY INTEGRATED SYSTEM

MLA Compact is a fully integrated system. It brings together the latest technologies in acoustic design, amplification, DSP and industry-leading optimisation software — with communications and control via an easy-to-use audio network. MLA Compact arrays can be remotely controlled from a PC or wireless tablet running VU-NET™ control software.

Class D amplification, U-NET™ control network and DSP circuitry are integrated within each enclosure, simplifying system set-up and operation and eliminating long, heavy-gauge cable runs — a particular benefit in premium fixed installations. Reducing cable runs to just inches within the enclosure means that all the power produced by the amplifier goes directly to the speakers and is not dissipated in the cables.

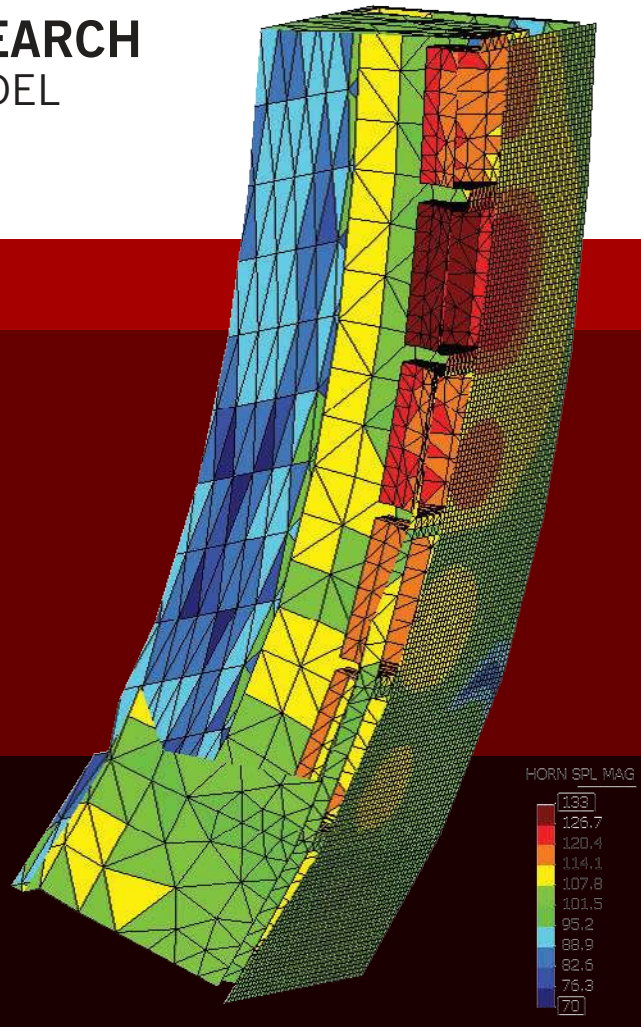
With MLA Compact, external amplifier racks are dispensed with — saving valuable space both on tour and in fixed installations. From the outset, MLA Compact has been designed with the financial and environmental aspects of running a system in mind; use of maximum-efficiency acoustic and amplifier technologies reduce both the size and weight of the system, assisting transportation as well as reducing the mains or generator power needed to run the system.

Arrays can be remotely controlled from a PC or wireless tablet

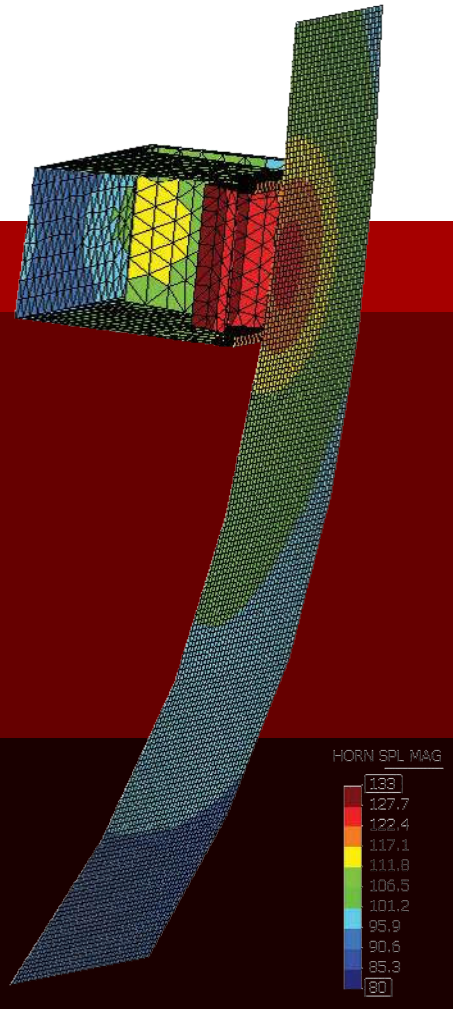
DRIVEN BY RESEARCH
THE ACOUSTIC MODEL

Since it is a practical impossibility to measure every possible array configuration with different combinations of enclosure numbers, splay angles and drive signals, an accurate acoustic model is essential. Without one, attempts to configure and optimise an array will never produce the right answer. Martin Audio's in-house BEM (Boundary Element Method) models 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 important factor and 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 the optimisation process and makes the acoustic model of MLA systems behaviour the most accurate within the industry.



▲ BEM plot of horn in an array



▲ BEM plot of single horn

For further explanation on the acoustic model, see 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).

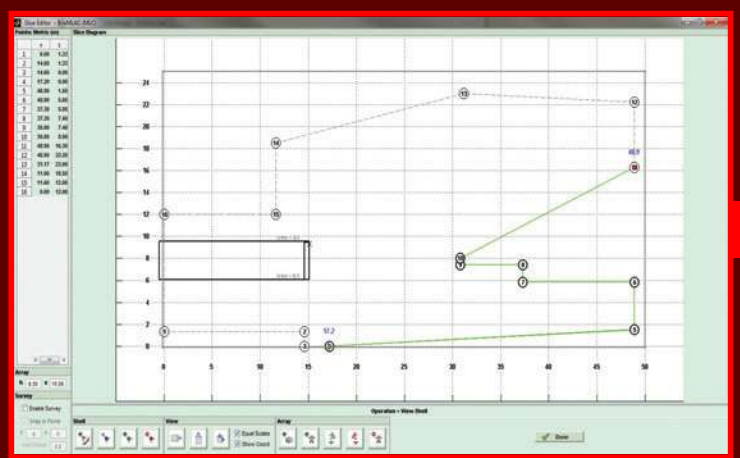
DISPLAY2.1™
AUTOMATION AND ARTISTIC CONTROL

Current array design software depends on trial-and–error — expecting the user to inspect the results of a trial array, think of something to change, wait... and repeat. Our new software reverses the sequence. Starting with a specified SPL and response over the audience floor, the software works backwards to configure an array that will give the required result.

DISPLAY2.1 is the "brain" of MLA Compact. It provides a virtual environment within which arrays can be configured and optimised — giving a very accurate prediction of the direct sound produced over the audience and also over areas where sound is to be avoided. 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.

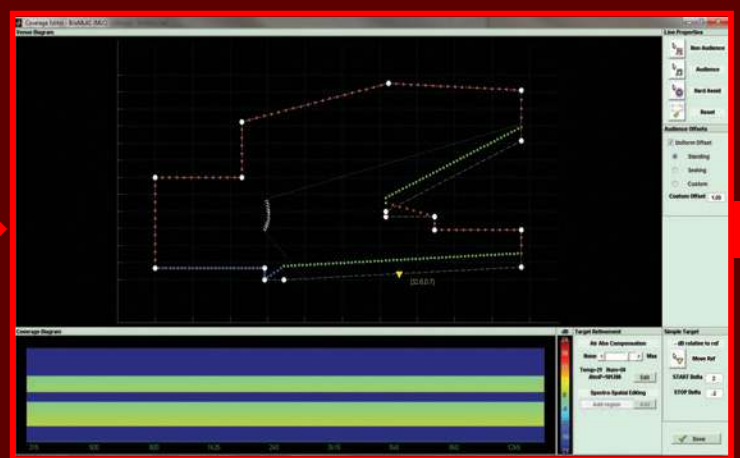
DISPLAY2.1 interacts with MLA Compact's onboard DSP to deliver consistent sound throughout a venue. It calculates the filter parameters for each enclosure — down to the resolution of individual drive units — and uploads them to the enclosure via the U-NET™ digital network. The link between DISPLAY2.1 and an individual MLA Compact enclosure is live and bidirectional.

VENUE ENTRY



1. Measure the room and enter shell into D2.1
2. Decide how many cabinets
3. Position array
4. Set coverage start and stop

SET COVERAGE PARAMETERS



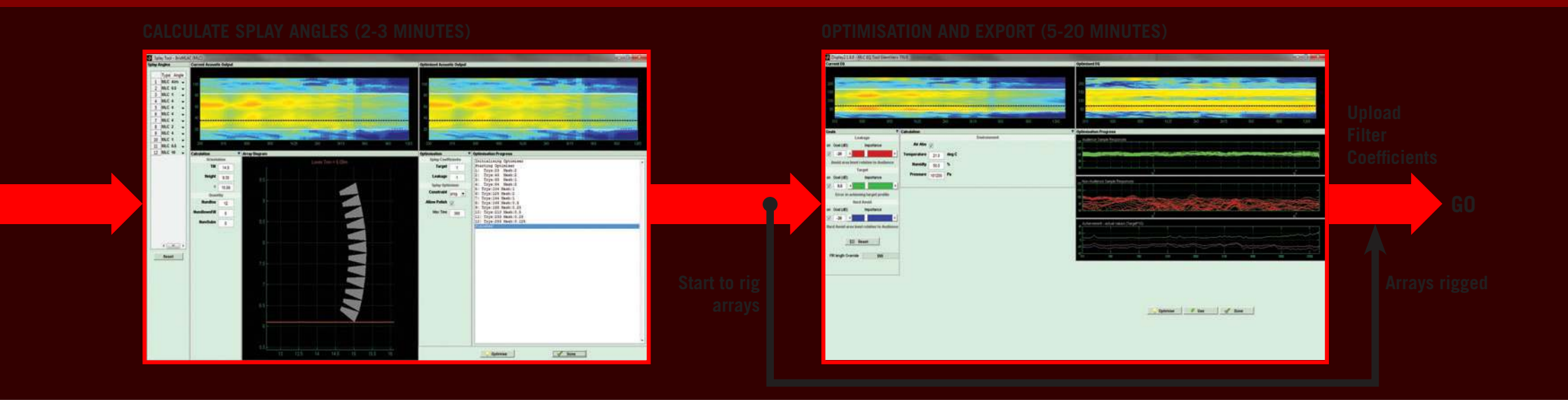
1. Assign audience, non audience and hard avoid areas
2. Set reference position
3. Set front-to-back SPL delta directly in dB's
4. Enter atmospheric conditions and desired compensation

The engineer retains full artistic control over the house curves

DISPLAY2.1's optimisation process starts with a new 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 measuring positions — including the audience areas where the sound is targeted and "hard-avoid" areas 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 measuring positions and at all frequencies.

The intelligent 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 — the optimisation routines simply replicate what the engineer hears at the mix position through to as many points in the audience as possible.

DISPLAY2.1 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.



1. Automatically calculate the tilt and splay angles
2. Start to rig the arrays

1. Set optimisation targets for non-audience, audience and hard avoid surfaces
2. Automatically calculate filter coefficients — 3200 per MLA Compact enclosure
3. Can now view SPL at any point on the venue shell
4. Export filter coefficients and upload to arrays via VU-NET

MLA COMPACT
ACOUSTIC DESIGN PHILOSOPHY

MLA Compact delivers power, clarity and detail

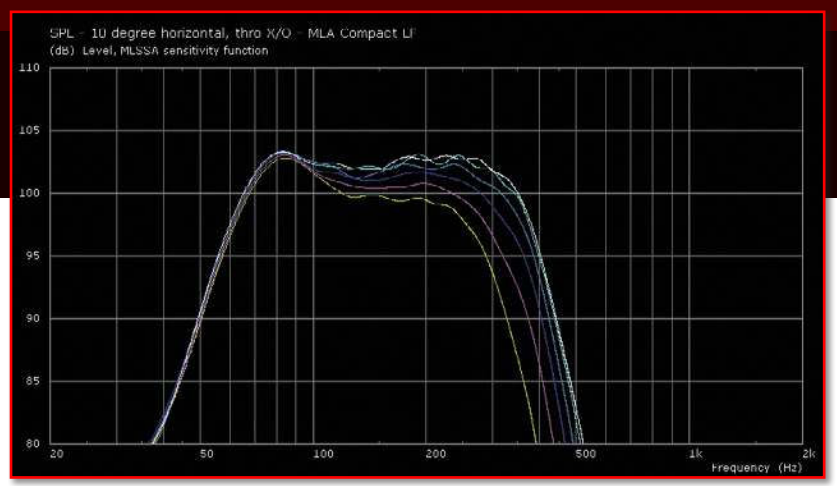
Very compact systems generally use direct radiators for the lows and mids because more efficient acoustic technologies are hard to adapt to small cabinet volumes. MLA Compact's designers have overcome this constraint and raised performance to a new level for such a compact system by applying innovative, slot and horn-loading techniques to the low and mid sections. Sonically, the 3-way MLA Compact delivers power, clarity and detail, with a peak output capability of 135dB LF, 135dB midrange and 135dB HF, per box at 1 metre.

Up to now, with so much attention focussed on the vertical aspects of array behaviour, horizontal dispersion has sometimes been compromised. In common with all Martin Audio touring arrays, MLA Compact deliberately avoids 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. In MLA compact, the mid and HF horns are completely separate — a key factor in its ability to produce consistent, true 100° horizontal constant directivity coverage. In use, this translates into startlingly consistent frequency response when listening off-axis and "walking the field".

MLA COMPACT
SLOT-LOADED HYBRID® LF

MLA Compact's LF section utilises 2 × 10" (250mm)/2.5" (63mm) voice coil, neodymium drive units in a unique Hybrid® configuration. Each driver is slot-loaded into a truncated horn with a low flare rate, to give a high sensitivity of 103dB @ 1m/2.83V — whilst the rear of the driver is reflex loaded to extend the LF output. MLA Compact's Hybrid LF arrangement provides the best of both worlds — raising the acoustic efficiency and packing a punch that direct radiators cannot compete with, as well as maintaining the LF extension.

The slot-loading allows the twin LF drivers to be optimally spaced within the enclosure. The double-source arrangement significantly improves the directivity control of the LF section maintaining the 100 degree system beamwidth down to 250Hz and reducing mid-bass output at the sides and rear of the array. The LF drivers themselves are very high excursion with vented poles to reduce power compression and virtually eliminate turbulent air noise.



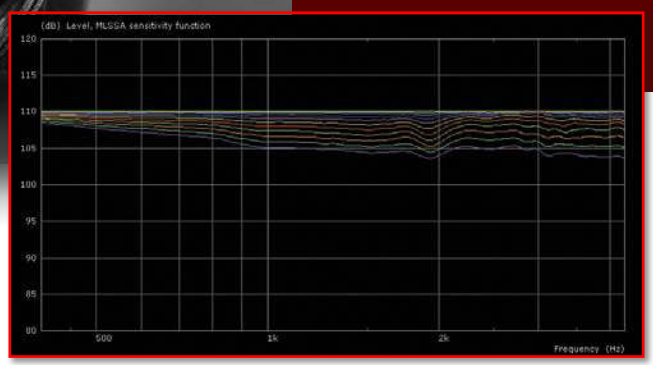
◀ LF horizontal directivity

MLA COMPACT
EXEMPLARY MIDRANGE & HF

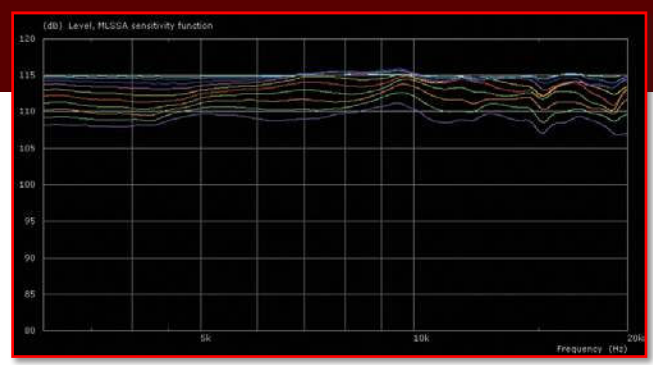
With so much design effort concentrated on the vertical performance of arrays, the horizontal dispersion can sometimes be less than ideal, with dispersion varying at different frequencies — particularly in designs that use coaxial, co-entrant or cross-firing midrange arrangements for the mid/HF. MLA Compact has completely separate, mid and HF horns with horizontal constant directivity characteristics — so the horizontal off-axis response tracks the on-axis response exactly. Martin Audio has over 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 MLA Compact's mid and HF sections.

The mid horn utilises 2 × 5" (125mm)/1.5" (38mm) voice coil neodymium drivers to produce 109dB @ 1m/2.83V — a big gain on the typical efficiency of 102dB for cross-firing direct radiator designs in comparably sized systems. This is a result of painstaking acoustic and thermal design, utilising forced-air cooling and a thermally conductive aluminium housing.

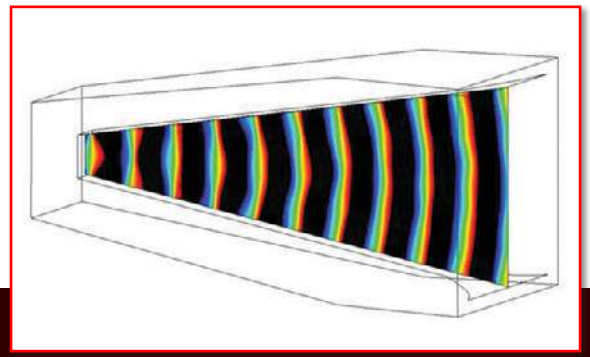
The 5" cone/0.7" compression driver combination replaces the more traditionally used large format compression driver and has less distortion, as well as having a much more extended HF response.



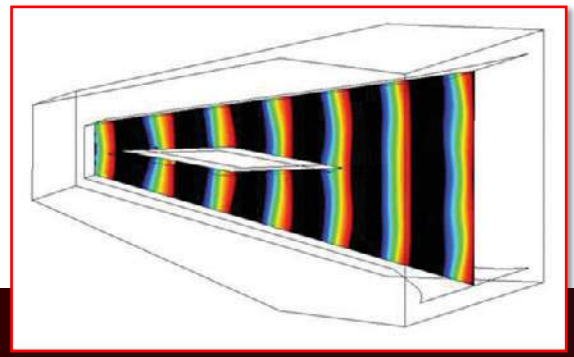
▲ MF horizontal directivity — normalised



▲ HF horizontal directivity — normalised



▲ Without wedge: wavefront is too curved



▲ With wedge: curvature is ideally optimised

MLA Compact's HF section utilises 4 × 0.7" (19mm) exit neodymium compression drivers which feed separate horns for true 100° horizontal constant directivity. In the vertical plane, MLA Compact makes significant advances over previous thinking by adopting new criteria for vertical wavefront curvature.

Instead of adopting flat wavefronts as advocated by early proponents of touring line arrays, 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 where the array is curved — as in most practical, real-world applications.

Placing a kite shaped "wedge" part-way down the horn* enables a specific, desired curvature to be achieved — depending on the shape of this wedge. In the case of MLA Compact, the HF wavefront is curved to provide a balance between optimal summation over distance and summation at the maximum inter-cabinet splay angle of 10°.

*Patent GB2446547

Section through HF horns ▶

MLA COMPACT
ONBOARD AMPLIFICATION, DSP & NETWORKING

Each MLA Compact enclosure is fitted with a state-of-the-art five-channel amplifier module — with high-efficiency Class D circuitry delivering a total of 2.1kW continuous and 4.2kW peak output. One channel powers both LF drivers in parallel and two channels drive each mid independently. For the HF section, two channels drive the four HF drivers in parallel pairs, making a total of five independently powered acoustic cells per enclosure.

Lightweight, switched-mode power supplies auto-range to global mains voltages from 100 to 240V 50/60Hz, whilst Power Factor Correction smoothes out the mains current draw over the whole of the AC waveform. The amplifier section is designed to withstand rain and ambient temperatures of up to 45°C and features advanced protection — amplifier monitoring via U-NET includes input signal, output signal at the drive unit terminals, limiter status, heatsink temperatures and driver fault conditions.

Powerful onboard DSP performs all crossover and EQ functions via a combination of IIR and advanced FIR filtering — fast VanishingPoint™ FIR filters give the freedom to physically separate the mid and HF horns — so they do not compromise each other's constant directivity dispersion pattern — yet achieve the spatial performance of a single device.

Arrays can be remotely controlled over U-NET from a PC or wireless tablet running VU-NET™ control software with its intuitive graphical interface. VU-NET also enables the user to switch on enclosure identification LEDs with automatic identification of neighbouring enclosures and connectivity confirmation.

MLA COMPACT
ENCLOSURE AND RIGGING

MLA Compact's rigging system combines speed with precision

MLA Compact's rigging system combines speed with precision. Up to 24 enclosures can be suspended via its two-point-lift flybar, and the same hardware can also be used for single point lifting of up to 12 cabinets, as well as ground stacking up to 6 high.

Inter-cabinet connections utilise custom quick-release pins. All loads are borne by the integral metalwork and release pins — not the enclosure. Accompanying software determines the safe limits and tilt angles of a specific array, with BGV C1 safety calculations done on the fly.

The enclosure itself is of birch and poplar ply construction and finished with a thick, hard-wearing polyurea coating. The enclosure sides, which take the brunt of damage on the road, are fitted with replaceable, steel-reinforced rubber mouldings with integral interlocking skids, and an ergonomic bar-handle facilitates rigging and general handling. MLA Compact's are supplied in flightcased pairs, with the flightcase base doubling as the wheelboard for the pair.

MLA COMPACT
DSX SUB-BASS

MLA Compact deserves a subwoofer that can match its performance. With an extremely high output level, compact size and advanced DSP-based realisation of directional arrays, the DSX more than meets this challenge.

Capable of 146dB peak output at 1m (half space, measured), the DSX powered and networked subwoofer is an incredible performer. Its high output level is achieved by combining state-of-the-art LF driver technology with an onboard Class D amplifier module which can deliver 6kW peak power.

The DSX features 2 × 18" (450mm)/4" (100m) voice coil, ferrite drivers in a reflex-loaded enclosure with four flared ports, carefully designed to improve linear airflow. Each driver is housed in its own separate chamber to move any cabinet resonances out of band. Sonically, the DSX is a perfect balance of low frequency extension and punch.

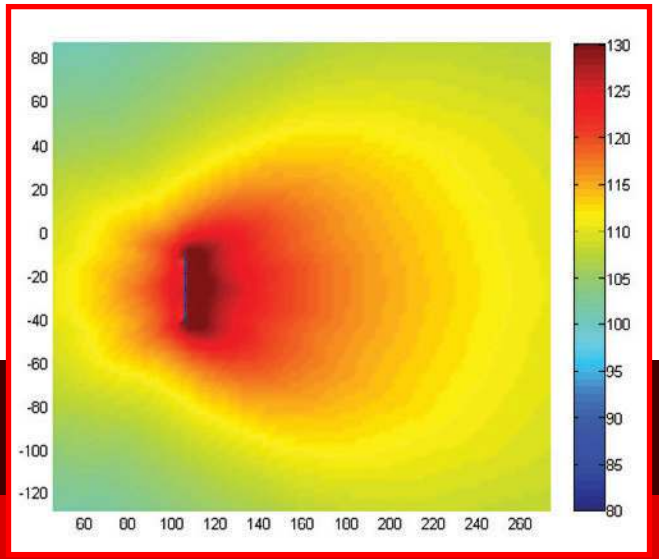
A flying version, the DSX-F Sub, can be flown alongside or at the top of MLA Compact arrays, as well as being ground stacked. A maximum of 15 DSX-F can be suspended from the MLA flying frame and symmetrical rigging allows flown DSX-F cabinets to face backwards — enabling directional flown as well as directional ground stacked arrays to be configured.

The ground-stack DSX can be upgraded to the DSX–F by the addition of an easy-to-fit accessory kit.

▲ Flown DSX-F Array

▲ DSX

▲ DSX-F



Sub array directivity plot

With Sub-bass directional properties becoming increasingly important, much emphasis has been placed on systems in which each individual enclosure has fixed cardioid properties. This always means sacrificing some frontal energy — even in applications where rear rejection is not necessary. The DSX adopts a less wasteful approach by optimising the directivity of the overall Sub-bass array instead of fixing the directivity of each enclosure. So, whilst an individual DSX Sub is omnidirectional, two or more can be configured into a directional array. This allows you to design in low frequency directivity only when you actually need it and to maximise frontal output even further if you don't.

DSX subwoofer arrays can be designed with specific directional properties and DSP settings uploaded straight into the DSX Subs via the VU-NET network. This goes beyond cardioid — to 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 DSX, the audience can benefit too.

DSX subwoofer arrays can be designed with specific directional properties

DSX directional ground-stack

MLA COMPACT
SPECIFICATIONS & DIMENSIONS

Acoustical		
TYPE		Three-way cellular drive, active array element
FREQUENCY RESPONSE (1)		65Hz–18kHz ± 3dB
MAXIMUM SPL @ 1m		LF: 129dB continuous, 135dB peak (3)
		MF: 129dB continuous, 135dB peak (4)
		HF: 129dB continuous, 135dB peak (4)
Drivers		
	LF	2 × 10" (250mm)/2.5" (63mm) voice coil, long excursion, vented pole, neodymium magnet drivers, Hybrid® slot-horn loaded
	MF	2 × 5" (125mm)/1.5" (38mm) coil, neodymium magnet drivers, horn loaded
	HF	4 × 0.7" (19mm) exit neodymium magnet compression drivers, horn loaded
Rated Power (2)		
	LF	500W AES, 2000W peak
	MF	180W AES, 720W peak
	HF	40W AES, 160W peak
Dispersion		
	(-6dB)	100° horizontal
	(-10dB)	130° horizontal
		10° vertical
Crossover Frequencies		
	400Hz	8th-order Linkwitz-Riley
	4.25kHz	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		22dB
AES/EBU IMPEDANCE		110 Ohms balanced, Receive and transmit termination
Network		
CONNECTORS		2 × IP68 rated 8-way, quick-release type
PROTOCOL		U-NET

Amplifier Module	
TYPE	Five channel Class D, fixed frequency
PEAK OUTPUT POWER	4200W
AVERAGE EFFICIENCY	78%
COOLING	2 × temperature controlled internal fans
	1 × 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) – IP44 rated (IP67 when mated with mains distribution equipment supplied with system)
General	
ENCLOSURE	Vertical trapezoid with 5° 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
	Weather protection cowl
IP RATING	IP 25
DIMENSIONS	(W) 788mm × (H) 280mm × (D) 500mm (W) 31in × (H) 11in × (D) 19.7in
WEIGHT	49.5kg (109lbs)
Accessories	Flightcase for two enclosures
	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 6 metres, then referred back to 1m.
(4) Calculated from 4m 2.83v sensitivity, referred to 1m.

DSX
SPECIFICATIONS & DIMENSIONS

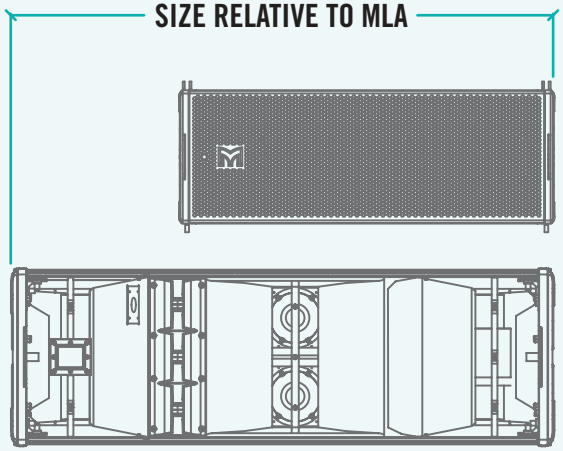
Acoustical		
TYPE		Dual 18" reflex loaded subwoofer
FREQUENCY RESPONSE (1)		35Hz–150Hz ± 3dB
MAXIMUM SPL		138dB continuous, 146dB peak (3)
Drivers		
	LF	2 × 18" 100mm/4" voice coil, ultra-long excursion, high efficiency ferrite magnet
Rated Power (2)		
	LF	2400W AES, 9600W peak
Dispersion		
		Digitally 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
Internal Processing		
		Single channel DSP, programmable via network
		10 PEQ/shelving filters
		Up to 48dB/Oct HPF and LPF
		Up to 1 second of delay
		Limiters with amplifier output current monitoring
Network		
CONNECTORS		IP68 rated 8-way, quick-release type
PROTOCOL		U-NET
Amplifier Module		
TYPE		Single channel switch-mode, fixed frequency
PEAK OUTPUT POWER		6000W
AVERAGE EFFICIENCY		85%
COOLING		2 × temperature controlled internal fans
		1 × low-speed internal blower
		1 × temperature controlled external fan
MAXIMUM AMBIENT TEMPERATURE		45°C (113°F) for full output

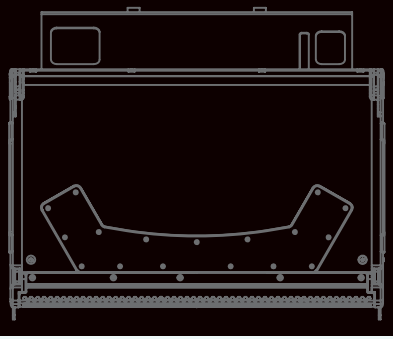
Notes
(1) Measured on-axis on ground plane (2π space) at 2 metres, then referred to 1 metre.
(2) AES Standard ANSI S4.26-1984.
(3) Measured in half-space at 1 metre with a tone burst signal.

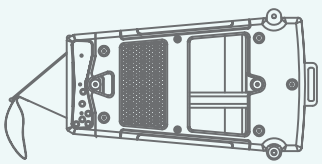
Power Supply		
TYPE		Switch mode, fixed frequency with PFC
AC INPUT OPERATING RANGE		100 – 240V ~ AC, 50 – 60Hz
POWER FACTOR		> 0.95
NOMINAL POWER CONSUMPTION		900W
MAINS CONNECTOR		16A IEC309 (Ceeform) – IP44 rated (IP67 when mated with mains distribution equipment supplied with system)
General		
ENCLOSURE		Extensively braced multi-laminate birch-ply
FINISH		Textured black PU coating
PROTECTIVE GRILLE		Black HEX perforated steel.
DSX FITTINGS		Two skids on base, with mating channels on top
		Four interlocking skids on each side
		Large bar handle on each side
		Four rear-mounted 100mm (4in) castors
		DSX transit cover, with integral plywood lid
		Weather protection cowl
DSX-F FITTINGS		Rear castors replaced by front-mounted wheelboard
In addition to DSX fittings, apart from where indicated		Four proprietary flying brackets and quick-release pins
		Side-mounted skids replaced by four interlocking rubber side cheeks
		DSX-F transit cover, with integral plywood lid
IP RATING		IP 25
DIMENSIONS	**DSX**	(W) 1060mm × (H) 595mm × (D) 834mm (1027mm with vent flap open)
		(W) 41.7in × (H) 23.4in × (D) 32.8in (40.4in)
	DSX-F	(W) 1125mm × (H) 595mm × (D) 847mm (1027mm with vent flap open)
		(W) 44.3in × (H) 23.4in × (D) 33.5in (40.4in)
WEIGHT	**DSX**	122.2kg (269lbs)
	DSX-F	147.6kg (325lbs) ex. wheelboard
Accessories		Flying frame, including clinometer (DSX-F)
		Flying Pin (DSX-F)
		Mains distribution system
		Tour-grade network interconnects
		Merlin Controller/U-NET Hub

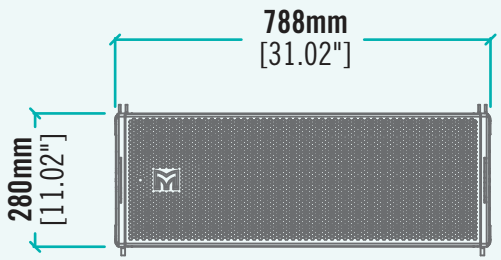
MLA COMPACT

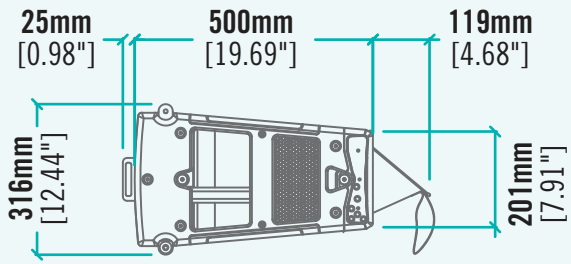
MLA COMPACT & DSX DIMENSIONS

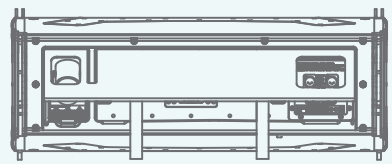


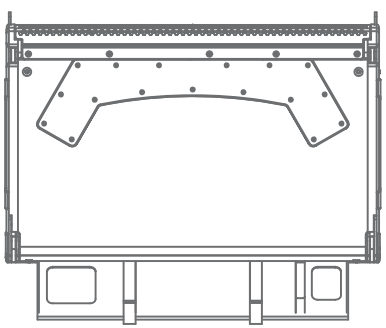




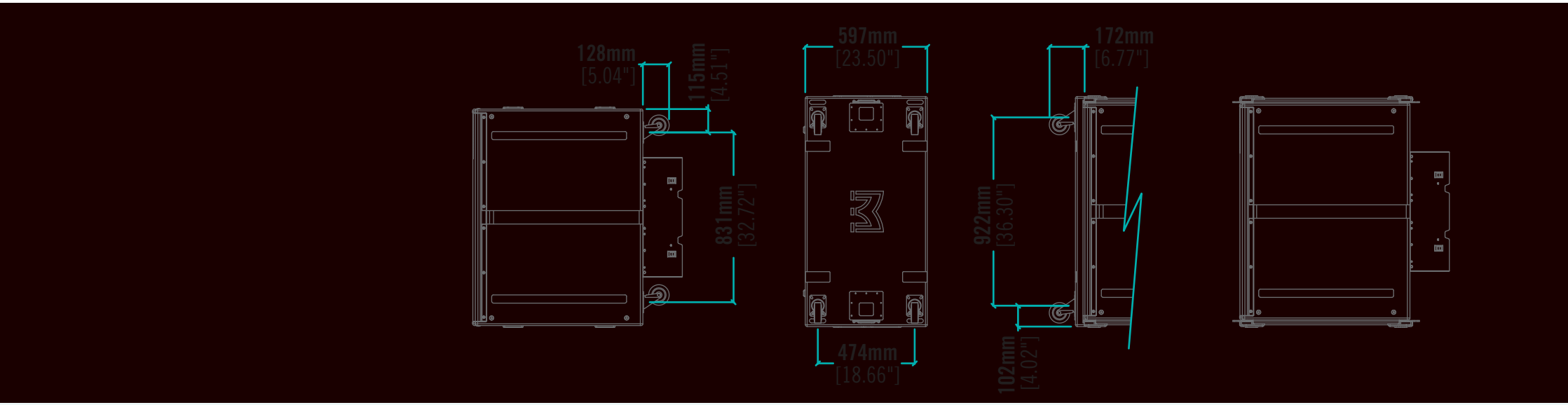


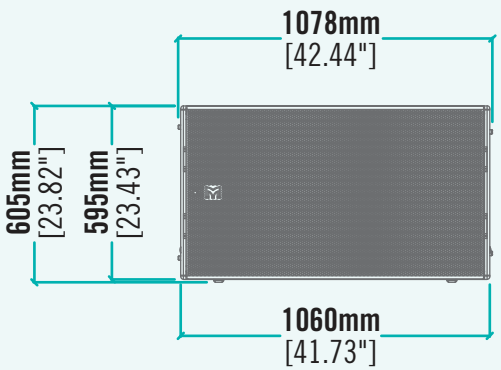


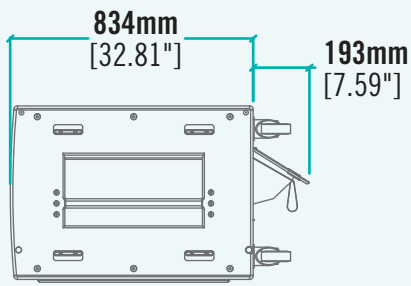


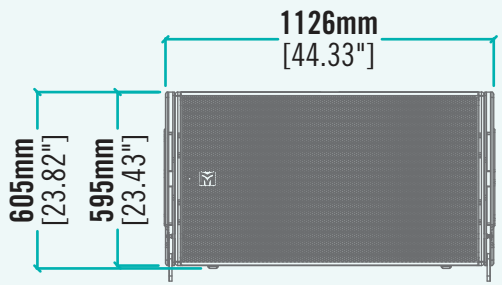


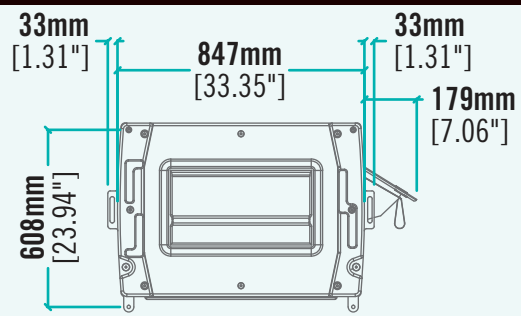
MLA COMPACT

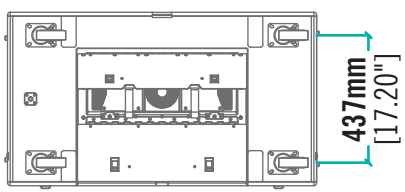


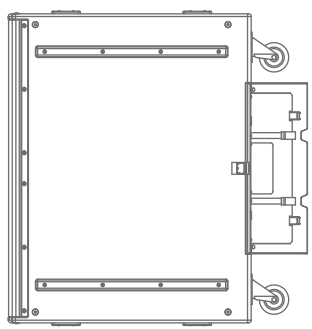




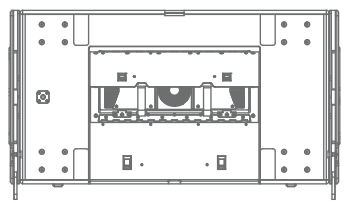




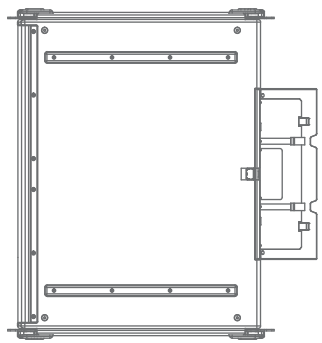




DSX



DSX-F



Note: Not to same scale as page 22

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MARTIN AUDIO
LONDON

MLA™ MINI

ULTRA-COMPACT MULTI-CELLULAR LOUDSPEAKER ARRAY

MARTIN AUDIO
LONDON

With the introduction of the award-winning MLA® and MLA Compact™ systems, Martin Audio turned the line array world on its head. Different in concept to line array, MLA's combination of individually driven cells and automated numerical optimisation delivers much more consistent sound across the audience, puts an end to trial-and-error tuning sessions and reduces sound spill – both on stage and beyond the audience boundary.

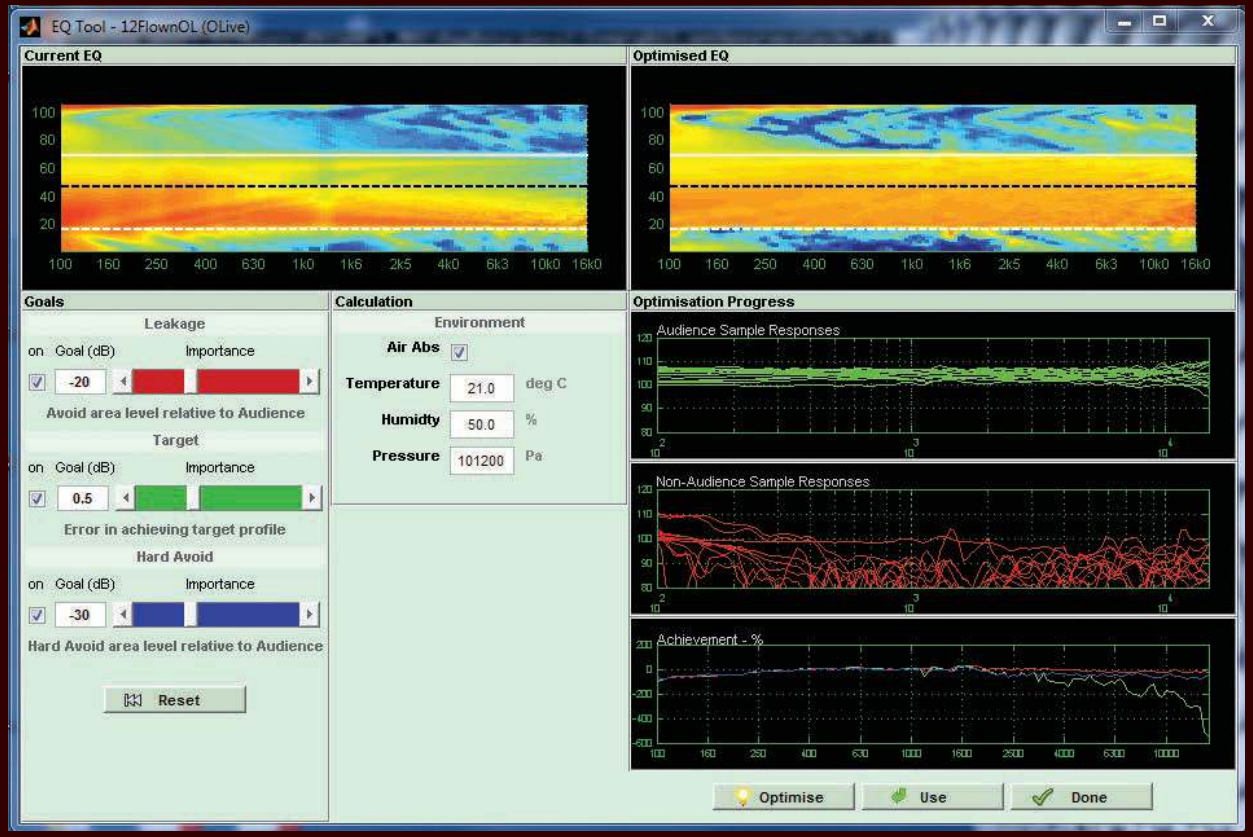
Now, the ultra-compact MLA Mini™ brings revolutionary MLA cellular technology to an exceptionally wide range of smaller-scale portable and installed sound applications. Its very small footprint and light weight makes it the system of choice for smaller venues which require the ultimate in fidelity, consistency and control.

MLA CELLULAR TECHNOLOGY
BEYOND LINE ARRAY

With conventional line arrays, the aim is to produce coherent wavefronts as they exit the speaker grilles – with the user having limited control over what actually arrives on the audience floor.

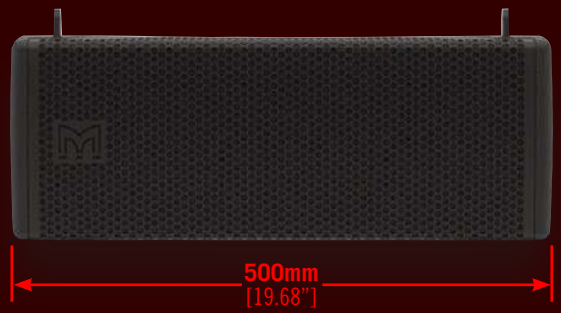
MLA cellular technology takes the reverse approach. The user specifies exactly what SPL and frequency response is required at various points throughout the venue and intelligent software automatically determines the array configuration and controls each individual cell in the array to produce that result. With independent control of every cell in the array, MLA systems are not constrained by the 3dB decrease in SPL with doubling of distance associated with conventional line arrays. Instead, the frequency response and SPL's at the rear seats closely track the front rows.

With every cell under software control, 'Hard-avoid' areas, such as onstage, the ceiling and the venue perimeter can also be programmed in to reduce sound spill, and vertical coverage can be fine-tuned electronically in-situ without the need to re-rig the array.



▲ Automated optimisation

MLA MINI
ULTRA-COMPACT VERSATILITY



Scalable and versatile, MLA Mini is ideal for portable sound rental, small-to-medium ballroom, theatre and HoW applications and is the natural choice as an infill for MLA Compact systems. Its ultra-compact size understates its output capabilities – a 12-box array will throw beyond 35 metres (115ft) and deliver live music in venues of 750-1000 people.

MLA Mini is designed as a complete system, with a companion MSX mini-sub power plant which houses the amplification and DSP to power and control itself and up to 4 MLA Mini enclosures. Up to 16 MLA Minis can be flown in an array and powered by 4 ground-stacked MSX's. Alternatively, 12 MLA Minis can be flown below 3 MSX's in the same array. Since MLA Mini is a 2-way system, a 12-box array has a total of 12 HF cells and 12 LF cells, each individually powered to provide consistent coverage.

Arrays and MSX's can be remotely controlled from a laptop or wireless tablet running VU-NET™ control software with its intuitive graphical interface. In the simplest configuration, 4 MLA Minis can be pole-mounted above the MSX as a plug-and-play system using onboard presets instead of computer control.

MLA Mini is designed as a complete system

MLA MINI
FEATURES AND BENEFITS

FEATURES

- Numerically optimised, ultra-compact loudspeaker system
- Cellular array format with amplification, multi-cellular DSP and digital networking housed in companion sub-bass
- Dedicated Class D amplifiers for individual powering of individual cells
- Industry leading DISPLAY 2.1™ intelligent software interacts with DSP for highly accurate array optimisation
- Vertical coverage can be fine-tuned electronically to cope with changing environmental conditions and last minute changes in rigging height. “Hard-avoid” areas, such as on-stage, ceilings and site perimeter, can be programmed in
- Switched mode power supplies with PFC (Power Factor Correction) and global mains voltage operation
- Two-way design delivers LF/HF peak SPL’s of 130/132dB @ 1m from a single, ultra-compact enclosure
- Fast, integral flying system for suspension of up to 16 MLA Mini or 12 MLA Mini + 3 MSX enclosures
- True 100° (-6dB) horizontal constant directivity. Consistent and usable out to 125° (-10dB)
- 76Hz-18kHz ± 3dB frequency response

BENEFITS

- Automatic, intelligent configuration and numerical optimisation eliminates trial-and-error tuning sessions
- Desired house-curve and precise audience coverage achieved ‘straight out of the box’
- Artistic changes to balance at the mix position (or elsewhere) translate directly and accurately throughout the audience
- “Greener”, more efficient audio power via PFC (Power Factor Correction)
- Programmable leakage parameter to reduce sound spill

APPLICATIONS

- Small-to-medium scale theatres
- Small-to-medium live music venues
- Corporate AV events
- Fixed installations in concert halls, ballrooms and HoW
- Side-fill for MLA Compact systems

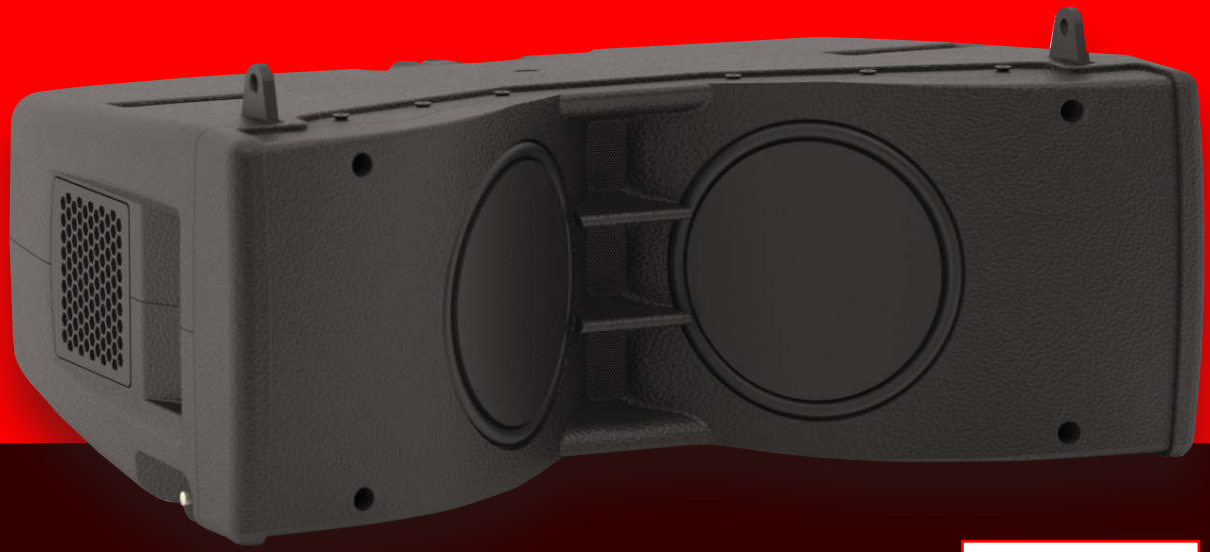
MLA MINI
INNOVATIVE ACOUSTIC DESIGN

Each LF diaphragm follows the contours of the horn wall

Each MLA Mini enclosure houses 2 x 6.5” (165mm)/2” (50mm) voice coil LF drivers and a vertical column of 3 x 1.4” (35mm) aluminium dome HF drivers on a 100° horizontal dispersion horn. The LF drivers are located in the side walls of the horn. In a system using conventional cone drivers, this arrangement would introduce cavities into the horn walls which would degrade the horizontal dispersion characteristics. MLA Mini adopts an ingenious solution – each LF driver has a solid moulded diaphragm and low-diffraction surround which closely follows the contours of the horn wall.

Each LF driver also features a demodulation ring in the neodymium motor system to minimise distortion and maximise mid-band sensitivity, and the entire magnet structure is retained within the aluminum chassis for good thermal conduction.

In the triple-HF section, the voice coil of each HF driver is thermally coupled to its neodymium motor assembly and aluminium heatsink. An elastomer surround and low compression ratio combine to achieve low distortion, and a copper pole sleeve maximises HF efficiency. Each individual HF wavefront is precisely coupled to the horn throat via a short waveguide, for exemplary 100° horizontal constant-directivity coverage.



HF driver section ▶

MLA MINI
MSX MINI-SUB POWER PLANT

Amplification, networking and DSP are all housed in MLA Mini's companion MSX power plant, which includes 9 channels of Class D amplification – 1 channel for itself, and 8 channels to provide cellular drive of up to 4 bi-amped MLA Mini enclosures. Crossover, delay and EQ functions are implemented by a combination of IIR and FIR filters.

MLA Mini arrays and MSX's can be remotely controlled over the U-NET™ network from a laptop or wireless tablet running VU-NET control software. Small-scale systems – such as the configuration of 4 x MLA Minis and 1 x MSX – can be set up to plug-and-play without external control, with onboard presets recalled by a rear panel selector switch.

The MSX is the same width as the MLA Mini and can be integrated into flown arrays or ground-stacked separately. It features a 15" (380mm)/4" (100mm) voice coil, long-excursion driver reflex-loaded in a very compact enclosure.

For complete installation versatility, the power plant module itself can be rack-mounted and its sub-bass amplifier channel used to power either an MSX or an alternative Martin Audio 4 Ohm passive subwoofer. For ultimate sub-bass performance, the MLA Mini/MSX combination can be used with the powered DSX subwoofer.

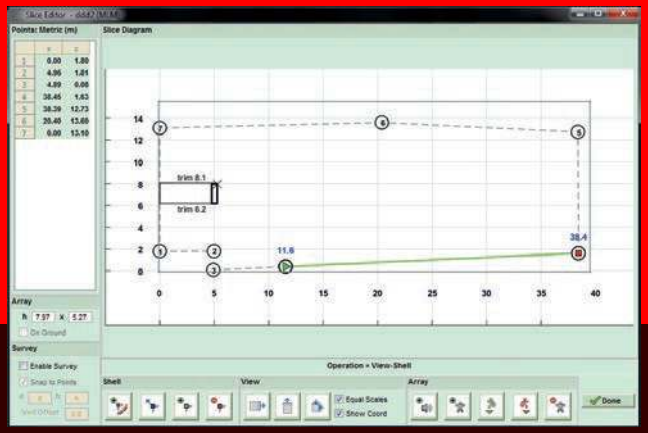
DISPLAY 2.1
AUTOMATED CONTROL SOFTWARE

Deliver consistent sound throughout the venue

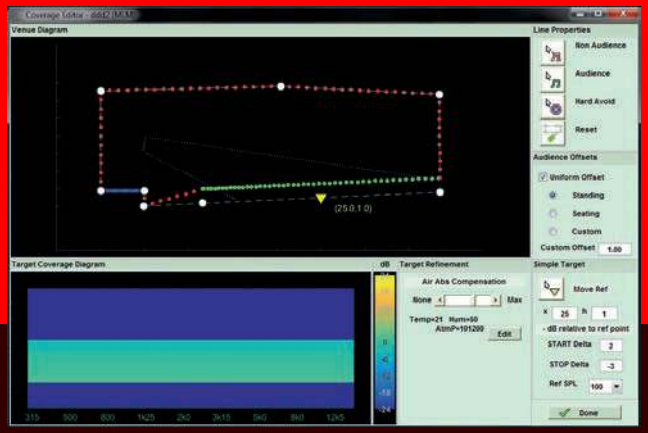
DISPLAY 2.1 is the brain of MLA Mini. Based on a highly accurate acoustic model of array behaviour, it gives a very accurate prediction of the direct sound produced over the audience as well as areas where sound is to be reduced. Its numerical optimisation process eliminates lengthy trial-and-error tuning sessions – an MLA Mini system achieves the required audience coverage straight out of the box.

DISPLAY 2.1 works from an audience perspective. Starting with a user-specified SPL and response over the audience floor, it automatically determines the array configuration that will give the required result. 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. The software interacts with onboard DSP in the MSX to deliver consistent sound throughout the venue. It calculates the filter parameters for the LF and HF cells within each MLA Mini enclosure and uploads them via the U-NET digital network.

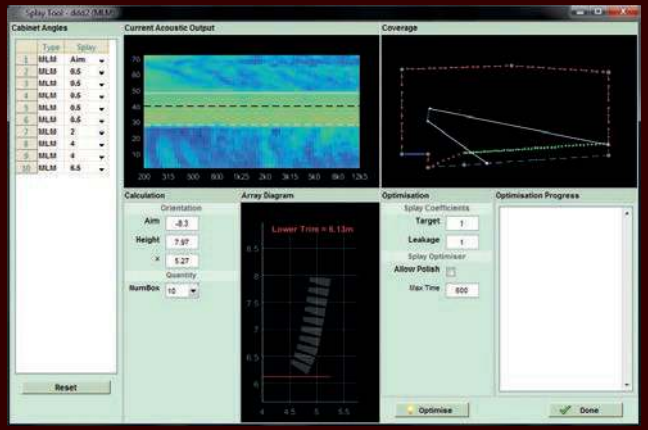
It can also fine-tune the vertical coverage after rigging without the need to reposition the array or change the inter-cabinet splay angles.



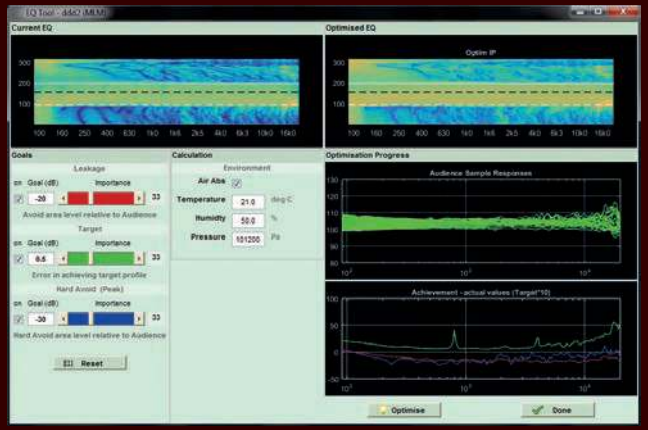
▲ Step 1: Venue entry



▲ Step 2: Set coverage parameters



▲ Step 3: Calculate splay angles



▲ Step 4: Optimisation and upload

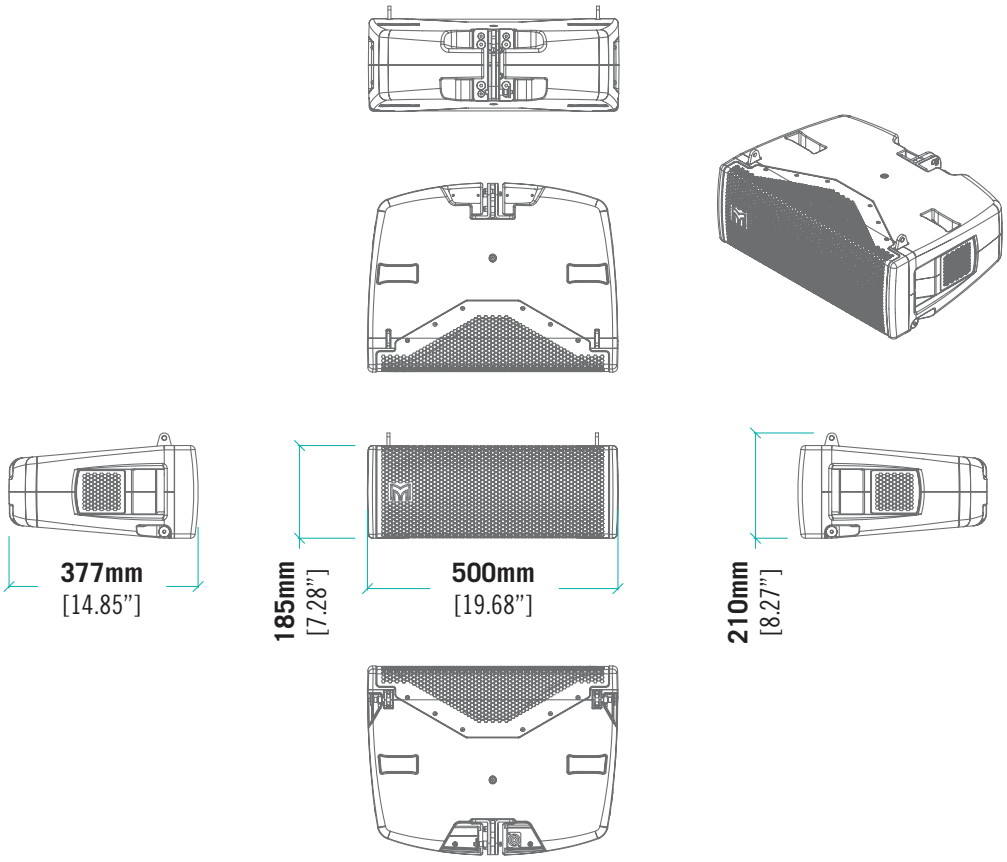
MLA MINI
FLEXIBLE CONFIGURATIONS

MLA Mini is portable, easy to rig and fulfils a wide variety of applications. Its integral rigging system combines speed with precision. Up to 16 MLA Mini enclosures or 12 MLA Minis + 3 MSX's can be suspended via the single/two-point-lift flying frame – with a separate transition frame used to fly the MLA Minis beneath the MSX's. The flying frame can also be used to ground stack up to 6 MLA Mini enclosures.

Inter-cabinet connections utilise quick-release pins, with all loads being borne by the integral metalwork. DISPLAY 2.1 determines the safe limits and tilt angles of a specific array – including BGV C1 safety calculations. For small venues and infill applications, up to 4 MLA Minis can be pole-mounted above an MSX and aimed by means of an optional bracket assembly with precisely adjustable tilt angle. The same bracket can also be used to suspend 4 MLA Minis from a truss.

An optional flight case enables 4 MLA Mini enclosures to be transported face-down and the rear splay angles set whilst in the flight case prior to lifting. The MSX has a removable wheelboard option, and a protective transit cover is also available.

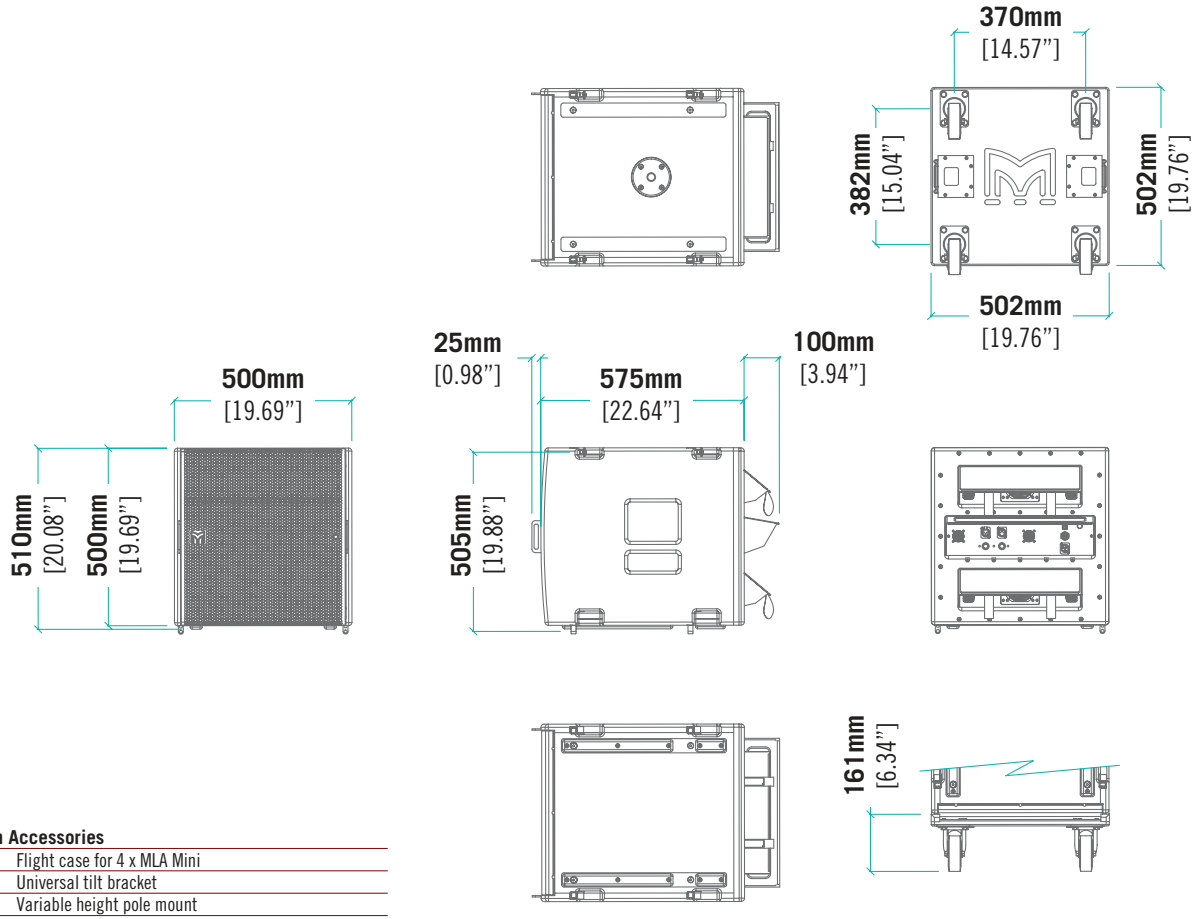
MLA MINI
SPECIFICATIONS AND DIMENSIONS



Acoustical		
TYPE		Two-way cellular-drive, array element, driven from MSX mini-subwoofer power plant
FREQUENCY RESPONSE (1)		76Hz-18kHz ± 3dB
		-10dB @ 63Hz
MAXIMUM SPL @ 1m		
1 x MLA Mini		LF: 127dB continuous, 130dB peak (3)
		HF: 122dB continuous, 132dB peak (3)
4 x MLA Mini		LF: 139dB continuous, 142dB peak (3)
		HF: 132dB continuous, 142dB peak (3)
Drivers		
	LF	2 x 6.5" (165mm) contoured-diaphragm/2" (50mm)
		edge-wound CCAW voice coil, neodymium magnet
		drivers, reflex loaded
	HF	3 x 1.4" (35mm) aluminium dome/1.4" (35mm) voice
		coil, neodymium magnet compression drivers on
		constant-directivity waveguide
Rated Power (2)		
	LF	300W AES, 1200W peak
	HF	90W AES, 360W peak
Dispersion		
	(-6dB)	100° horizontal
	(-10dB)	125° horizontal
		10° vertical
Crossover Frequency		
	1.2kHz	Vanishing Point™ FIR filter
Audio input		
CONNECTORS		NL4 input, connects to MSX power plant
		LF 1+, 1-, HF 2+, 2-
General		
ENCLOSURE		Vertical trapezoid with 5° wall angle. Skeletal steel braced, ribbed ABS structural foam construction
FINISH		Textured black paint
PROTECTIVE GRILLE		Black HEX perforated steel, Declon™ backed
FITTINGS		Integral flyware for suspension of up to 16 MLA Mini
		Ergonomic handles on each side
IP RATING		IP 25
DIMENSIONS		(W) 500mm x (H) 210mm x (D) 377mm (including flyware)
		(W) 19.7in x (H) 8.3in x (D) 14.8in (including flyware)
WEIGHT		13.8kg (30.4lbs)

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) Calculated in half-space at 1 metre.

MSX
SPECIFICATIONS AND DIMENSIONS



System Accessories

	Flight case for 4 x MLA Mini
	Universal tilt bracket
	Variable height pole mount
	MSX transit cover with integral plywood lid
	Wheelboard with 4 x 100mm castors
	Flying frame, including clinometer
	Transition frame for suspending MLA Mini beneath MSX
	Flying pin
	Ground stack bars
	Ground stack base plate
	Mains distribution system
	Tour-grade network interconnects
	Merlin Controller/U-NET Hub

Acoustical	
TYPE	15" reflex loaded subwoofer
FREQUENCY RESPONSE (1)	50Hz-150Hz ± 3dB
	-10dB @ 42Hz
MAXIMUM SPL @ 1m	133dB continuous, 136dB peak (3)
Driver	
	1 x 15" (380mm)/4" (100mm) voice coil, ultra-long excursion, high efficiency ferrite magnet
Rated Power (2)	
	800W AES, 3200W peak
MSX Dispersion	
	Omnidirectional. Cardioid arrays possible, using multiple MSX enclosures
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
Internal Processing	Multi-channel DSP, programmable via network
	10 PEQ/shelving filters per channel
	Up to 48dB/Oct HPF and LPF
	FIR filtering on MLA Mini channels
	Up to 1 second of delay
	Limiters with amplifier output current monitoring
Network	
CONNECTORS	IP68 rated 8-way, quick-release type
PROTOCOL	U-NET
Amplifier Module	
TYPE	9 channel switch-mode, class D
PEAK OUTPUT POWER	7000W total
	1400W MSX (or alternative 4 Ohm subwoofer)
	700W MLA Mini LF x 4
	700W MLA Mini HF x 4
CONNECTORS	2 x NL8 outputs to MLA Mini x 4
AVERAGE EFFICIENCY	85%
COOLING	2 x temperature controlled internal fans
	1 x low-speed internal blower
	2 x temperature controlled external fans
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	Neutrik® Powercon True1
General	
ENCLOSURE	Extensively braced multi-laminate birch-ply
FINISH	Textured black PU coating
PROTECTIVE GRILLE	Black HEX perforated steel
FITTINGS	Two skids on base, with mating channels on top
	M20 top-mounted thread plate for MLA Mini pole
	Integral flyware for suspension of up to 4 MSX
	Large bar handle on each side
	Two front-mounted latch plates for wheelboard
	Optional weather protection cowl
IP RATING	Indoor (without weather protection cowl)
	IP 25 (with weather protection cowl)
DIMENSIONS	(W) 500mm x (H) 510mm x (D) 575mm (675mm with vent flap open)
	(W) 19.7in x (H) 20.1in x (D) 22.6in (26.6in)
WEIGHT	58kg (128lbs)
	65kg (143lbs) inc wheelboard

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) Calculated in half-space at 1 metre.

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