



# NTL720 Line Array System

Integrating multiple EAW technologies in a miniscule package



Is it really possible to pack 10 pounds of stuff into a 5-pound bag? Further, can all of that “stuff” be painstakingly formed into a cohesive unit capable of meeting critical challenges and professional expectations?

EAW set out to answer these questions in the affirmative – and more – with the new NTL720, an extremely compact, self-powered line array loudspeaker system. The result is a package that integrates fresh and genuinely exciting design developments with a lion’s share of the most significant technological advances that have been pioneered over the past three decades.

Though so small (9.4 x 24 x 14.3 inches) and light in weight (less than 50 pounds even with onboard tri-amplification) that we’ve nicknamed it the “baby” line array module (BLAM for short), the NTL720 is outfitted with a true three-way design that delivers full-sized performance. From the outset, EAW committed that

its new baby would provide maximized vocal clarity via a correctly executed three-way design with superior mid-range performance – regardless of the miniscule footprint. From there, the development team defined a long, detailed list of other absolute “musts” to be accomplished for the NTL720 to be worthy of exceeding requirements in virtually every medium-format live and installed sound application. Every item on that list has a big check mark next to it, and as noted, all of these individual technologies are united as a seamless system easily optimized under a user-friendly software interface.

## ***A LOOK INSIDE***

Let’s start with a look at the horn and driver components and technologies of the NTL720 before moving along to other crucial aspects. When the (stainless steel) grille is removed from the front of the cabinet, the first thing that stands out is that the entire front face of the enclosure is filled by a full-sized mid/high horn providing 110-degree (horizontal) by 12-degree (vertical) dispersion. The extreme size of this horn – an approach first applied to our lauded KF730 and 760 line arrays and KF750 concert systems – has proven to insure broadband pattern control, particularly in the entire MF/HF pass-band.

High frequencies are produced by six 1-inch dome tweeters, configured in two vertical columns (each with three tweeters) mounted on a manifold that feeds a single slot in the center of the horn. This is highly effective in controlling vertical dispersion, and with equivalent output of a 1-inch-exit, 44-millimeter voice coil compression driver. The HF section serves the 1.5 kHz to 21 kHz frequency range.

Flanking the HF section, dual 6-inch cone woofers handle the MF range, also loading on to the large horn. A primary design goal was to minimize the space between the MF and HF components in order to enhance coherency and improve overall off-axis response. Further, a symmetric layout of the MF drivers (placed on both sides of HF) would promote a symmetric horizontal off-axis response.

Openings needed to be incorporated in the horn for these MF drivers. The easiest approach would have been to provide openings the same size as the MF cones, but this creates a large void in the HF horn wall, causing HF energy to “escape” into this void, reflect off of the MF cone, and arrive later in time than the direct energy.

A slot in the horn was another possible approach, reducing the void in the horn and somewhat minimizing interference to the HF while also decreasing the distance between the acoustic centers of the MF drivers. Yet a large percentage of the horn wall

is missing since the void in the horn wall is still relatively large as compared to the overall size of the horn.

The solution deployed on the NTL720 stems from a great deal of research during the development of the acclaimed AX Series of large-format installation loudspeakers. Called Concentric Summation Array (CSA) technology, it calls for several smaller openings in the horn, with a close look at the horn surface revealing these openings to be “randomized” cutouts in diamond-shaped patterns. The cutouts decrease the acoustic center of the mids while also decreasing the percentage of open area at any point along the horn. The result is greatly minimized interference to the HF. (Figure 2)

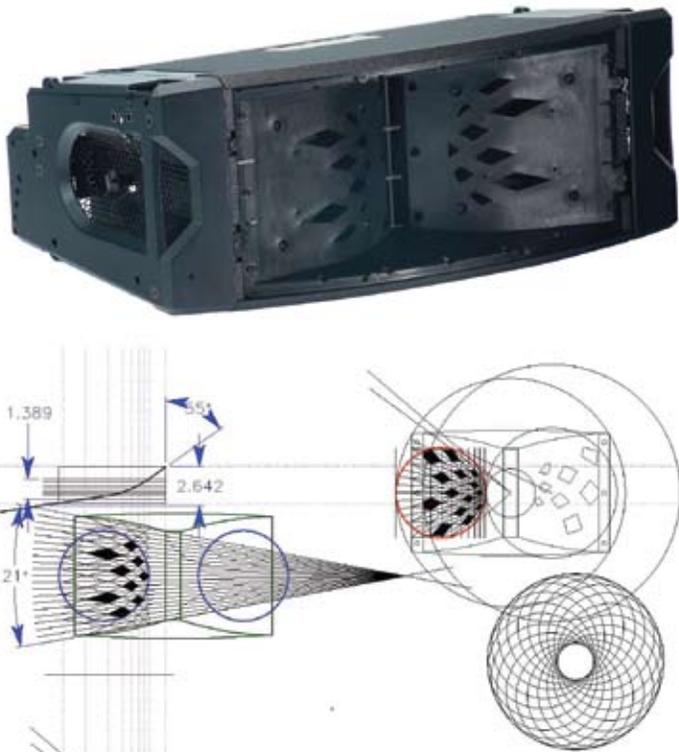


Figure 2

Another EAW focus over the past several years has been beam forming and array shading; in other words, the creation of precise beam shapes combined with the ability to steer them as desired for more tightly focused coverage, particularly at longer distances. As a result, all transducers in the NTL720 are highly efficient and capable of very high output – and packed into the smallest space possible – while the large-mouth horn enhances pattern control.

Called Phased Point Source Technology (PPST), it was first developed for the EAW KF900 Series of extreme long-throw loudspeakers. Briefly, PPST works in tandem with digital processing to create a unified source sound impulse at all points within the coverage area. Building upon our previous use of phase and frequency “shading” techniques to manipulate beam profiles and to blend vertically dissimilar subsystems, the outcome is further integration of loudspeaker modules within an array into a single acoustical element.

In tandem with PPST principles, EAW’s Divergence Shading technology, utilized in the KF760 large-format line array, has been applied to further achievement of even sound pressure levels over distance. With Divergence Shading, the pressure remains constant throughout the source while the curvature of the wavefront is varied. (Figure 3)



Figure 3

A flatter wavefront produces higher pressure at distance while a tightly curved wavefront produces lower pressure at distance. Because the input is constant across the source, the rate of change of pressure magnitude is small, resulting in smooth frequency response.

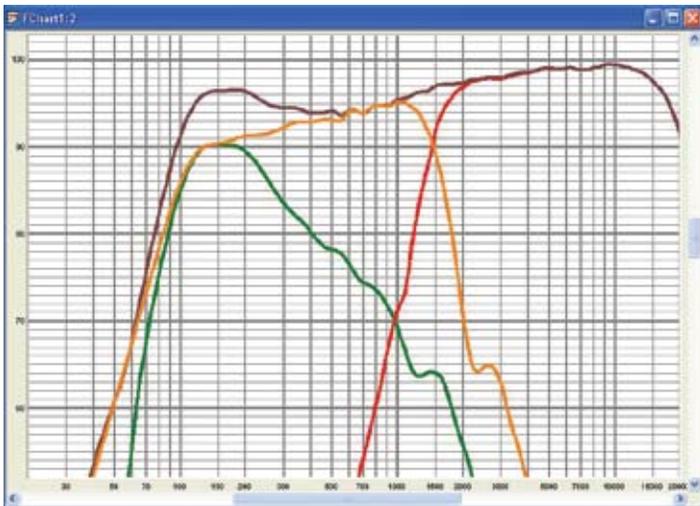
#### **BOLSTERED LOWS**

During the development of the KF730 small-format line array, the desire to employ as large of a MF/HF horn as possible led the EAW engineering team to devise a truly innovative solution: side-firing LF drivers. Research showed that spacing the drivers as far apart as possible ensures delivery of the lowest possible frequencies, with the side-mounted “figure-8” configuration extending horizontal pattern control well into the LF range.

This proprietary approach, called Phase Aligned, also creates an off-axis null in the horizontal plane, putting more acoustical energy on axis. Sure, the look of drivers firing out the side of the box is different, but extensive listening tests backed by measurement proved the design.

This proven LF method was again deployed in the NTL720. Like the MF section, the LF woofers are 6-inch, with all four of these drivers outfitted with powerful neodymium magnet structures that also reduce weight.

While these drivers may seem a bit on the small side, the ability of the Phase Aligned drivers to extend LF performance is particularly advantageous in meeting the needs of applications requiring a bit of added punch. In addition, the response of the MF drivers is also extended down to 100 Hz, furthering low-end presence and impact. (A low-pass filter on the LF drivers curtails their output at about 300 Hz.) (Note the NTL720 crossover points presented in *Figure 4*.)



**Figure 4**

### **THE GUNNESS FOCUSING™ DIFFERENCE**

The onboard self-powering technology developed and proven in the EAW NT Series, has been further extended for the NTL720. It includes three individual modified 500-watt Class D (digital) amplifier modules tailored for their respective subsections (LF, LF/MF, and HF – all 4-ohm loads) and also precisely matched to their own digital signal processors.

This reliable and very lightweight (9 lbs) amplification package is easily field-replaceable (more on this later). It includes an intelligent power supply control that affords optimum efficiency with rock-solid immunity from AC line variations, with self-resetting protection circuitry guarding against output overload, overheating, power supply faults and excess output current. Convection cooling eliminates the need for fans. (*Figure 5*) Each DSP is tailored to best optimize its respective subsection, providing response correction as well as EQ, delay, level, and delay for additional tailoring and alignment control. Excursion limiters add another layer of protection for the components.



**Figure 5**

Headlining the processing, however, is EAW's revolutionary Guinness Focusing™ alignment and driver processing algorithms that deliver horn-loaded performance comparable to premium direct-radiating studio monitors. Also first unveiled in the NT Series, Guinness Focusing is now available – via the UX8800 digital processor – for an ever-increasing number of conventional EAW loudspeakers, but it's already onboard the NTL720.

To the point, Guinness Focusing eliminates the traditional characteristics of “honk” and “splashiness” that can plague horn-loaded loudspeaker designs. The honk of a horn is normally heard in the lower frequencies of its band pass, while splashiness (an attribute of compression drivers) is usually heard at the highest frequencies and obscures the fine detail in instruments, such as cymbals.

Likewise, cone drivers have inherent resonances in their upper frequency range that result in “muddiness” in the middle of the vocal range. These HF and LF behaviors combine to produce a sonic signature commonly referred to as “coloration.”

DSP is the primary tool available for dealing with these types of loudspeaker anomalies, with the EAW engineering team recognizing that the key is understanding the trade-offs of traditional DSP implementation. Therefore, the team first developed a proprietary, software-based spectrograph for acoustical analysis. This spectrograph, along with other analysis tools, was used to investigate the unprocessed responses of HF and LF subsystems in various directions and at various levels.

The analysis allowed various performance anomalies to be isolated from each other. In this way, those anomalies that were linear, time invariant, spatially consistent, and therefore correctable, could be distinguished from anomalies without those characteristics, and which were therefore not correctable. The next step was to apply appropriate DSP to the correctable anomalies.

Another analysis was performed on the standard, universally used DSP algorithms. This test proved that these standard algorithms simply did not produce filters with response shapes, temporal behaviors, or resolutions with anywhere near the required precisions or accuracies necessary to correct those anomalies to which they were being applied. (*Figure 6* presents before and after spectrographs of the dramatic impact made by Guinness Focusing.)

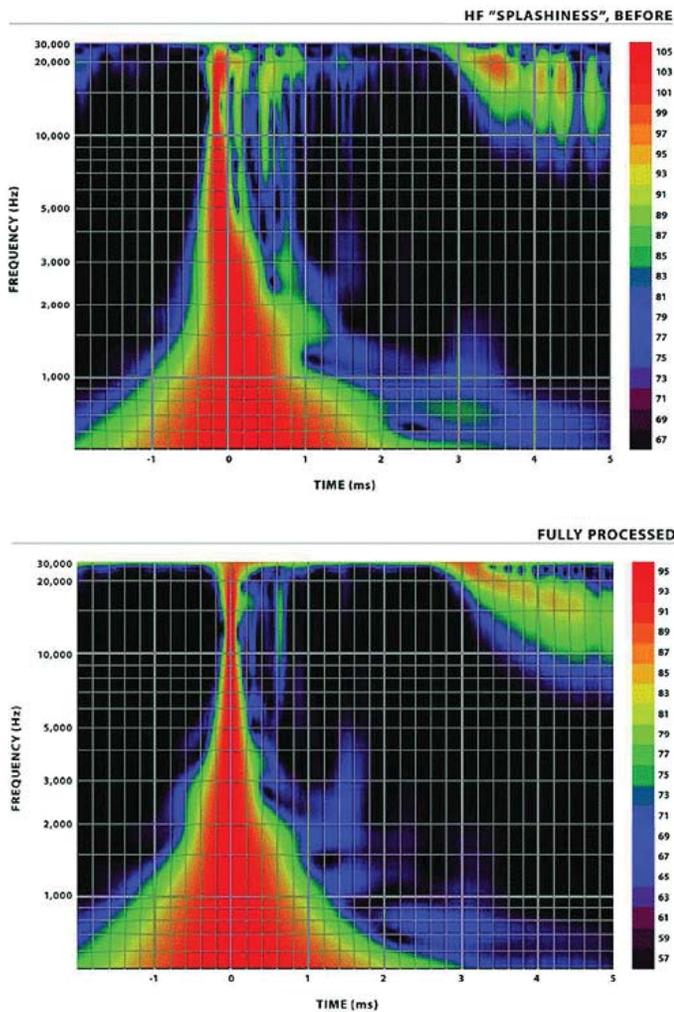


Figure 6

To solve this dilemma, the company undertook development of custom (and rather radical) DSP algorithms specifically engineered to provide the required filters for correcting loudspeaker anomalies. The resulting filters had to possess the required precision and accuracy in both the frequency and time domain. At the same time, any uncorrectable anomalies would have to be ignored by the filters.

This advanced processing, now called Gunness Focusing, cannot be applied “as is” to just any loudspeaker, let alone be something that even the most astute of users can set up. The anomalies and resonance problems cured by Gunness Focusing are very specific to each loudspeaker design.

Thus, the internal physical details must be known, the anomalies must be carefully analyzed, with appropriate filters custom designed by EAW and implemented via the UX8800 processor – or, in the case of the NTL720, it’s incorporated within the system.

### CONTROL & MUCH MORE

EAWPilot control software provides comprehensive DSP control as well as monitoring of amplifier status for each NTL720 module in an array. And it does much, much more. When connected, all loudspeakers in the audio system comprise a network in which EAWPilot recognizes each individual loudspeaker as well as arrays of loudspeakers acting as a single unit.

The roots of this software package stem from the KF900 project’s optimization program, FChart, which uses high-resolution measurements of each individual driver in an array to predict and optimize total array performance. EAWPilot employs this same approach to control multiple loudspeakers in a total system environment.

Not only does EAWPilot assist in optimizing a wide range of loudspeaker and array parameters, but its Wizard modeling software helps in automatically configuring array DSP for optimal performance fitting specific audience areas, greatly simplifying system setup and alignment. This even extends to providing the user with input on building optimum array structures and selecting correct pickpoints on the array flybars for a given array configuration. (Figure 7)

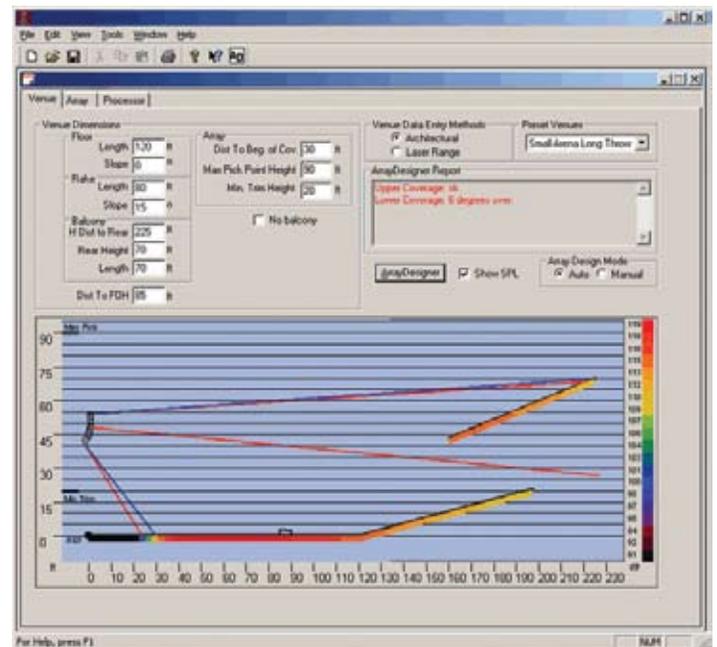


Figure 7

Input selection provided on NTL720 cabinets is both simple and flexible – the user has a choice of analog, AES left/right, and EAW’s proprietary U-Net. Drawn from the UX8800 and other EAW products, U-Net provides full digital control of each device in a system, including audio signal, processing parameters, routing – in addition to accommodating EAW Smart tuning and analysis platform. (Figure 8)



Figure 8

Communication connection options also include U-Net, as well as a USB port on the back panel for interfacing with the DSP. In addition, each back panel also offers HF boost and nearfield contour controls, as well as a range of LED indicators for signal, limiter, clip, input selection, U-Net status, amplifier status, HF boost engagement and nearfield contour engagement.

### ***SIMPLE, FLEXIBLE RIGGING***

One of the most exciting aspects of the NTL720 is its proprietary FastLatch™ integral rigging system. Representing more than two decades of tireless effort in getting this crucial facet exactly right, the rigging design offers an easy, convenient “hinge-and-latch” design, with the essential components being two heavy-duty hinge mechanisms on the back of each cabinet and a latch mechanism on the underside of each cabinet.

When flying an array, the first module attaches to the flybar, and then each subsequent module is lifted up (remember, total weight is under 50 lbs) and hooked to the hinges on the rear corners of the above cabinet, and then the box is simply pushed forward by the bottom of the cabinet until it swings up to be secured by the latch. This process is repeated until the desired array size is achieved, with cabinet splay angles (a choice of 12, 9, 6, 3, and 0 degrees is provided) easily selectable by carrier brackets that accompany the hinges. (Figure 9)



**Figure 9**

The hinges hold so securely that the rigger can actually walk away from the array, and then return later to swing the box up to its latch above. And because of the light weight, it's also easy to fly two modules at once, further saving time. Once the latch has locked into place, two safety pins are inserted to further secure the attachment.

Striking NTL720 arrays proves to be as easy – just reverse the process, including the ability to take down two boxes at a time. Anyone working with this rigging system finds it extremely fast and intuitive, with a 10-box array able to be assembled and flown within about five minutes.

The flybar can also be used as a stable, safe groundstack platform. It's outfitted with (optional) threaded feet for adjusting the level and tilt angle of the array with the use of a hex bit on a power drill. (Figure 10)



**Figure 10**

### ***REPLACE IT IN PLACE***

The rigging design allows individual components and even entire modules to be replaced within built array structures, whether flown or stacked. In other words, a cabinet can be removed for service without having to take down the array. Removal is easy and safe, with just four integral spring bolts on each side of the cabinet needing to be loosened to free the cabinet. And the spring loading keeps the bolts in place within the array frame so they don't fall out.

Another option allows removal of the amplifier package by loosening just six screws on the back panel. Two plug connectors that directly connect the amplifier to the PCB inside of the cabinet not only ensure a solid, lock-tight fit, but it also eliminates the hassles of cable connections.

Yet one more option allows the user to easily remove the front grille to access the horn, which itself can also be removed to access all of the drivers. Loosen several screws, and the entire MF and HF assembly can be lifted out.

Finally, NTL720 cabinets are finished with a tough RoadCoat™ finish that is highly scratch-resistant, and the grille is durable stainless steel. Cabinets come in black as standard, and EAW can meet any specialty paint color and finish needs that are desirable in certain fixed installation situations.



**Testing and optimization of NTL720 arrays was done in real-world conditions at the Stadium Theater in Woonsocket, Rhode Island.**

### ***SMALL BUT MIGHTY***

EAW likes to call the NTL720 a “small system born of big ideas,” encompassing the creative thinking and hard work of the full force of the company’s engineering team over the course of more than a quarter century. As a result, it’s no wonder that a lot of us consider it a new baby, small stature notwithstanding.



**The EAW engineering team that collaborated on the development of the NTL720.**

And the company believes that the purpose-motivated integration of the sheer number of useful, proven technologies contained within the NTL720 will soon have users considering it their own baby as well.