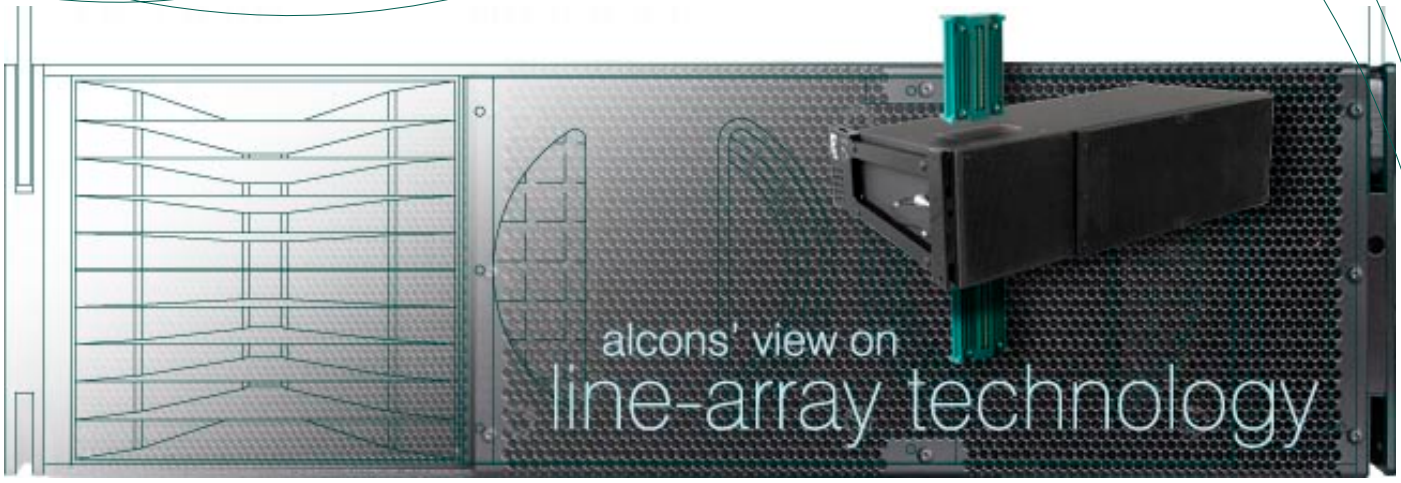
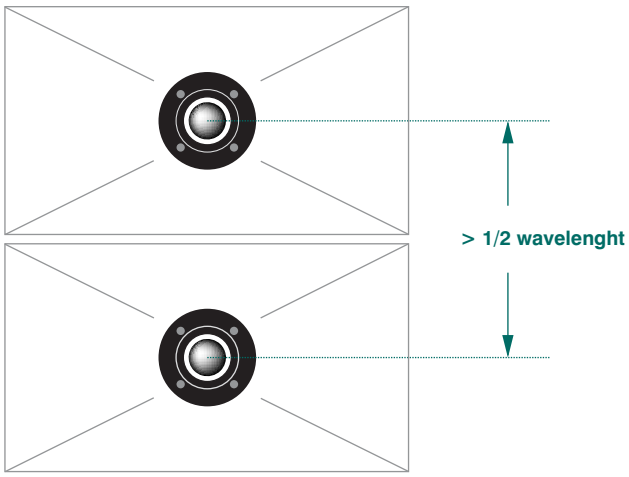


contents

introduction

Line-arrays, although not new, seem to be the latest "flavour of the month" in sound reinforcement. And indeed, a line-array can offer significant advantages in throw and control, when designed correctly.

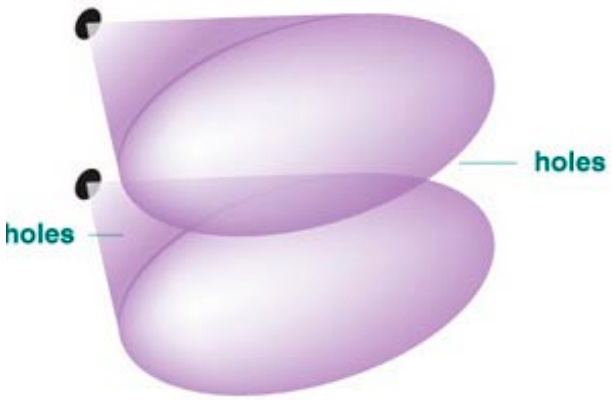
The biggest advantage of a (well designed) line-array is the efficiency and relative simplicity of the sound system, in providing SPL and coverage control over a defined area.
For a line-array (basically "an array of line sources"), a true cylindrical wave front is the (only) key to a good working line-array system and many attempts are being made to create this type of wave front with traditional compression drivers.



The main criteria for getting a well designed array, is to get all drivers working together, instead of working against each other. Since each frequency has a different wave-length, the secret to "summing" is that the sources/speakers must be closely coupled, with a distance less than half a wavelength of the highest frequency they have to reproduce.

For low frequencies this is no problem, where the size of the speaker is well within "half of the wavelength". The real challenge is in mid and high frequencies; Here the physical size of the speaker is too big for its wavelength, resulting in individual point sources instead of a seamless cylindrical wavefront.

If we calculate half of the wavelength with the formula "Wavelength = Speed of sound divided by Frequency", we can see that for correct summing, a frequency of 20.000 Hz, should be reproduced by a transducer not bigger than 8,6mm.. Knowing that (one of) the smallest HF speakers measures 24mm (so effective up to 4,1kHz), it is clear that this is not possible. Taking half the frequency (10kHz.), the required speaker size is still only 17,2mm. And we didn't even mention usable SPL with a speaker this size…!



The only possibility of getting correct summing at these frequencies, is to generate/simulate an cylindrical/ Isophase wavefront.

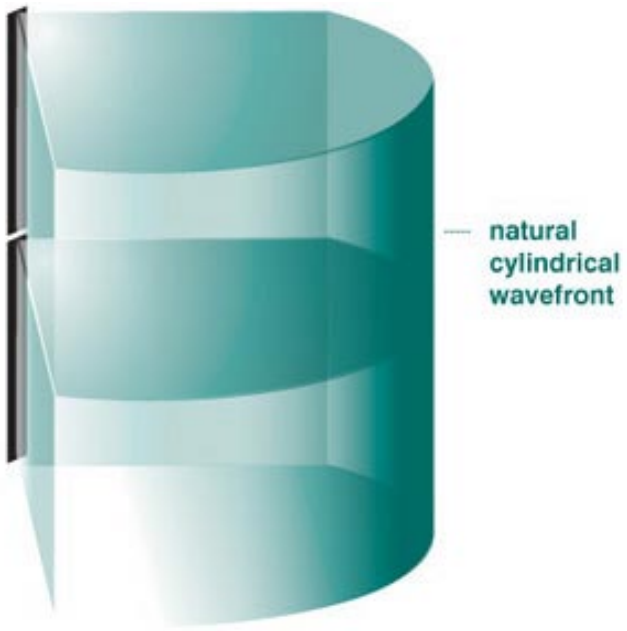
One can thus try to transform a point source (dome tweeter, compression driver) into an isophase/cylindrical wavefront (as done by every manufacturer in more or less successful way), but this will be done at the expense of substantially decrease of sound quality;
The waveguides necessary for this, introduce a further increased distortion as result of reflection and compression, as induced by the channelled sound waves.

In combination with a generally used compression driver (that isn't exactly known for its uncoloured, distortion-free high transient response to begin with…) this leads to a very bad "signal-to-noise" (S/N) ratio.

Taking the above-mentioned negative side-effects into account, one would ideally like to start with an "instant" isophase wavefront, instead of going through this "creative plumbing" ……

it's only natural...

A pro-ribbon driver (a "flat diaphragm tweeter") is by nature, a line source; A multiple of point sources generating planar sound waves, resulting in all natural cylindrical wave front.
It's obvious that this type of MF/HF driver would be the ideal building block for a line-array, as acknowledged by (almost) every line-array manufacturer.



The R&D team of Alcons Audio has been involved with pro-ribbon technology for over 20 years. Their research has led to many generations of high powered pro-ribbon drivers for professional application.

In 1997 the R&D team worked together with the late Johan van der Werff (of Peutz consultancy) on a modular line-array system, called the "Newton". The spectacular system was developed for large-scale sound reinforcement in reverb-sensitive areas; This was made possible by the system's combination of line-array technology with (48 channel) DSP controlled dispersion ("beam steering").

Since then, the R&D team has applied parts of the Newton research in products and followed the developments of line-array technology in the market very closely.

the RBN family of pro-ribbon drivers

The current acceptance of line array technology and the development of the Alcons RBN series of pro-ribbon drivers has led to the initiative of developing a ribbon-loaded line-array system for high power applications.

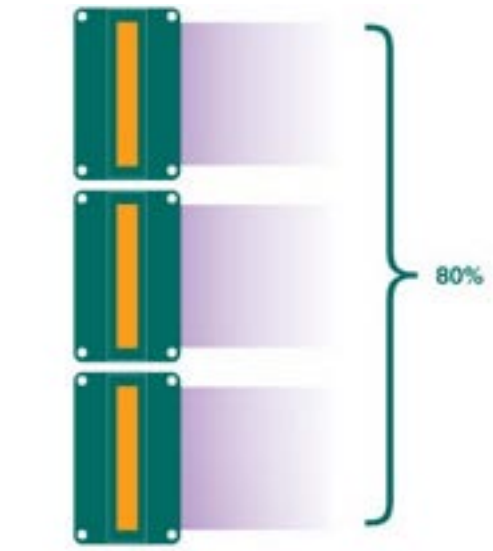
The RBN601 pro-ribbon driver, the first developed driver of the RBN series, has some specific features, making it uniquely suitable for line-array application;
1) Apart from the natural cylindrical wavefront, the physical shape of the driver also addresses another requirement for perfect isophase wavefront;
2) The radiating surface is near 80% of the total driver height.
3) The RBN pro-ribbon drivers are the only ribbon drivers with a “real90” horizontal dispersion up to and beyond 20kHz.

The astonishing sound quality of a pro-ribbon driver (only 1/10th of the distortion of a compression driver, very high transient response/no time smear, etc.) is even more emphasized in a line-array application. Especially the fast transient response caters for extended intelligibility in the far field (one could see this as a new definition of “throw”..).

Alcons’ pro-ribbon driver for the LR16 was developed by Philip de Haan, sr. R&D engineer and 20+ year veteran in pro-ribbon transducer technology. He is initiator of a number of significant patents and can be seen as “father” of today’s high-output pro-ribbon technology.

De Haan; “Since 1983 we’ve been expanding the learning curve and did a lot of research on new materials, techniques and production processes. We’ve tested every medium-to-large sized pro-ribbon driver on the market, to see and measure for ourselves what the current status of pro-ribbon development is. Now this know-how has led to a new generation of pro-ribbon drivers with the RBN601 being the first one.”

Over the last years, the pro-ribbon has gained popularity in the pro-audio market, because of the fast transient response and the accurate sound reproduction, required by today’s new high-resolution media. The low weight moving mass of the diaphragm results in a transient response which delivers exceptional clarity, intelligibility and throw. Pr-ribbon drivers feature extreme low distortion, only 1/10th of the THD of existing (compression or dome) drivers. Because of the different working principle, a pro-ribbon driver does not have a “compression threshold”, maintaining the same tonal balance at all sound pressure levels. The flat-response caters for increased “gain-before-feedback” even in the most critical circumstances.



frontview
RBN ribbon drivers

the RBN family of pro-ribbon drivers

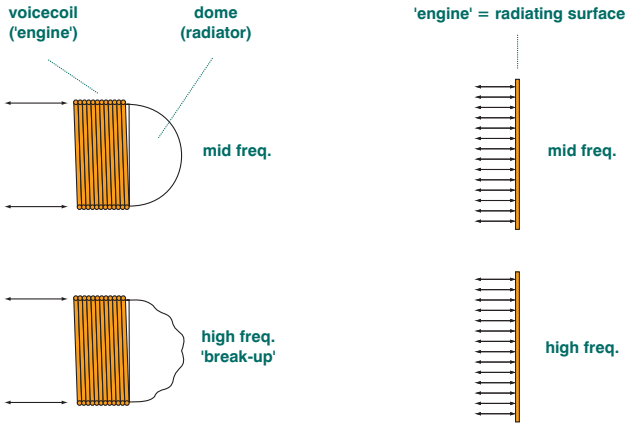
The Alcons RBN pro-ribbon drivers are the only ribbon drivers delivering real 90° horizontal coverage (multiple-patented). The wide dispersion, combined with the natural cylindrical wave pattern, makes it ideal for line-array applications.

The RBN601 of the LR16 has a true power handling of 70W/1000W, enabled by the proprietary designed heat-management (patent pending) and an unsurpassed efficiency of 105dB (log average 2-10kHz 1W/1m on 90°x10° waveguide). The latest Alcons driver, the RBN1801, has a power handling of 210W/3000W and an efficiency of 110dB/1m (w/o waveguide).

Ribbon tweeters have traditionally been characterized as fragile, with low power handling, low efficiency and low impedance. In practice, however, the “fragile-presumed” ribbon diaphragm is much stronger than a compression driver diaphragm, as a result from the light weight moving mass.
The compression driver diaphragm starts to break-up at 8kHz. (= 8000 cycles per second) because the moving mass can’t follow the speed / forces applied to it. This means, with “clarity” frequencies around 16kHz (= twice the problem speed) often boosted more than 3dB (= double the power), that the diaphragm starts to “break-up” (non-linear movement), which is (one of) the most common reasons for compression diaphragm blow-up.

Contrary to this, as a result of the very lightweight moving mass, the pro-ribbon driver handles these frequencies and boosts without failure.

Philip de Haan; “During the market research we found that not only the technology but also accuracy of the production process is critical with this type of technology. True craftsmanship and experience are essential for production stability with this type of transducer technology.”



the pro-ribbon driver's advantages

HiFi sound at concert SPL! The RBN pro-ribbon drivers have up to 90% less distortion than any conventional mid/high transducer (@ same SPL), because of the lack of a compression chamber and the light weight diaphragm (with integrated voice-coil).

Absolute maximum "gain-before-feedback"; The light weight of the moving-mass offers an unprecedented fast transient response. In combination with the flat frequency response of the RBN drivers, this caters for the absolute maximum "gain-before-feedback".

Perfect speech-intelligibility The fast transient response + the lack of compression "threshold" (the level under which the compression driver doesn't make enough compression to have actual HF output) brings perfect intelligibility and tonal balance at lowest as well as highest SPL's.

No listening fatigue Another benefit of the superb transient response and the lack of "time-smear" (a result of the slow moving mass/diaphragm at high frequencies) is the lack of listening fatigue, even after prolonged listening hours.

True 90 degree dispersion The RBN pro-ribbon drivers features Alcons' patented "Real-90" dispersion in the horizontal plane. The Alcons ribbon drivers with "Real-90" are the only pro-ribbon drivers offering 90° dispersion up to and beyond 20kHz. (others up to 9kHz. max.)

Digital dynamics The extreme RBN601 power handling of 1000W (for 200Ms, which is 10 times the industry standard!), together with the ultra-low power compression (resulting from the patent-pending heat management + the direct air contact of the voice-coil) brings unsurpassed dynamic response, with an RMS-to-peak ratio of 1:15 (compression driver 1:2).

Note; In practice, the "fragile-presumed" ribbon diaphragm seems to be much stronger than a compression driver diaphragm, as a result from the light weight moving mass; The compression driver starts to break-up at 8kHz. because the mass can't follow the speed. With "clarity" frequencies around 16kHz (= twice the problem speed) often boosted more than 3dB (= double the power), the ribbon driver handles this without failure, contrary to compression drivers (break-up is most common reason for compr.diaphragm blow-up).

"Inaudible waveguide" The RBN drivers are mounted on the unique HempHorn™, made of a new combination of composite materials with natural hemp fiber structures. Contrary to the traditional glass fiber horns, the HempHorn™ features the same stiffness, but is characterized with a much higher internal damping (at same weight).

Very clean signal path As a result of the flat impedance of the RBN drivers, no impedance correction is needed in the crossover. This allows simpler filter designs, placing fewer parts/obstructions in the signal path, thus offering improved clarity and accuracy of the sound. The "Current-to-light" driver protection, inaudibly protects the drivers for input overload.

Truly accurate mid and bass response; The Alcons systems are SIS pre-wired for SIS (Signal Integrity Sensing) circuit; In combination with the ALC controller amplifier, cable/connector influences are completely compensated for (with damping factor of 10.000). Class-G switching principle for powerful and best sound quality.

Maximum and reliable performance The front-accessible SDP processing module in the ALC changes the stereo amp into a dedicated powered controller of the Alcons speakers, offering dedicated excursion protection, system –eq, filtering and power control, for maximum component performance.

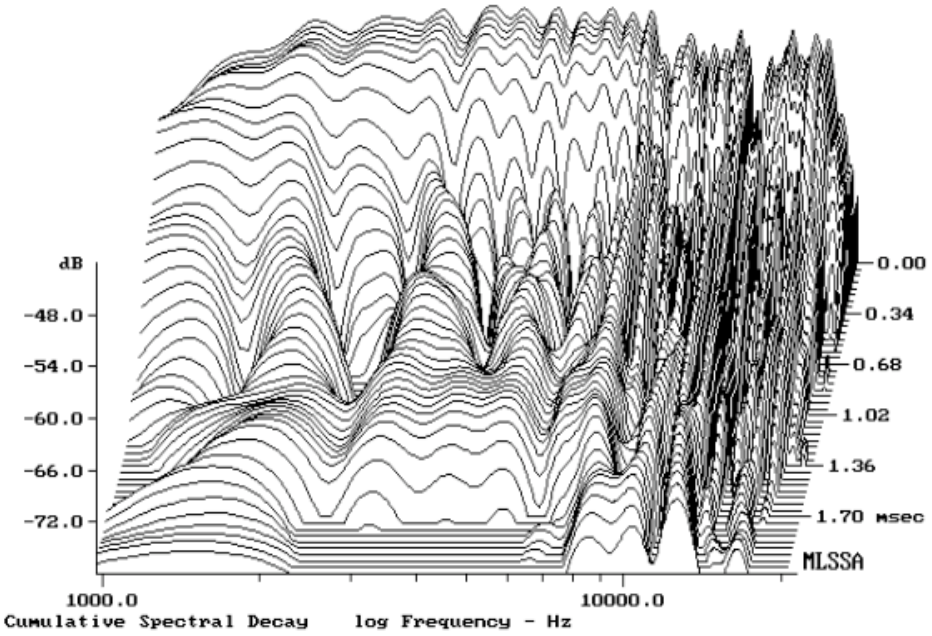
Extended headroom With system equalizing done by the SDP circuit of the ALC controller-amp (instead of by the passive crossover), the passive Alcons systems deliver up to 4dB more system headroom, starting at 800Hz. It's combining passive-filter amplifier-efficient powering with active-filter component-efficiency output.

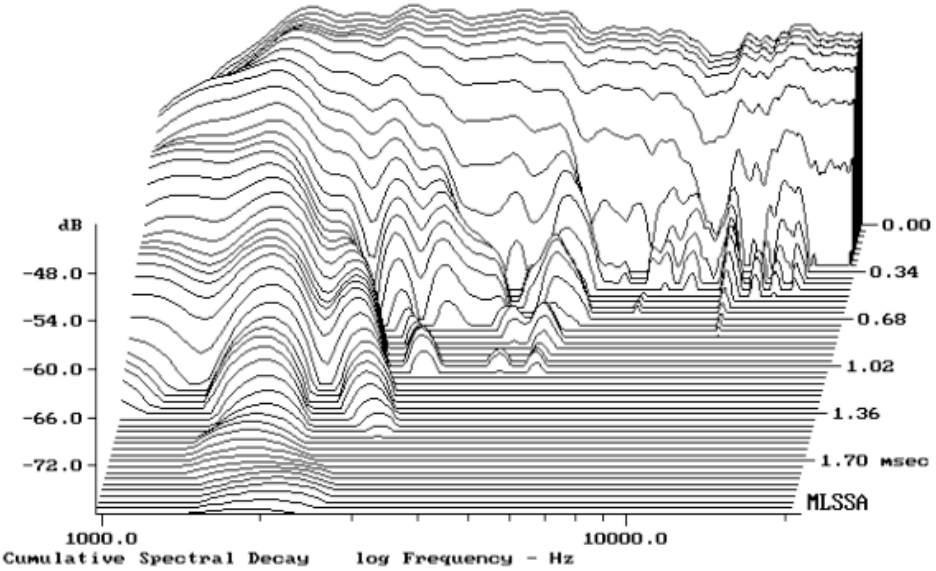
alcons pro-ribbon driver vs. 2″ compression driver

Below are two spectral decay (“waterfall”) plots, which show the response behavior of a loudspeaker. The x-axis shows the frequency response from 1000 to 20.000Hz., the y-axis shows level in dB and the z-axis shows the time in milliseconds.

This is the response of a 2” state-of-the-art” compression driver. It is clearly visible that the initial frequency response changes at around 8kHz. The time-(impulse)response shows that the membrane of the speaker is still generating sound, even after the signal has stopped. This is due to the heavy moving mass of the compression driver, which causes “time-smear” and distortion.

This is the response of the 6” pro-ribbon driver. The initial response remains flat up to the highest frequencies. The time-(impulse)response shows that the membrane of the speaker stands still very soon after the signal has stopped (“high transient response”). This is due to the light-weight moving mass of the ribbon.





cylindrical wavefront not a "fit-to-function" solution

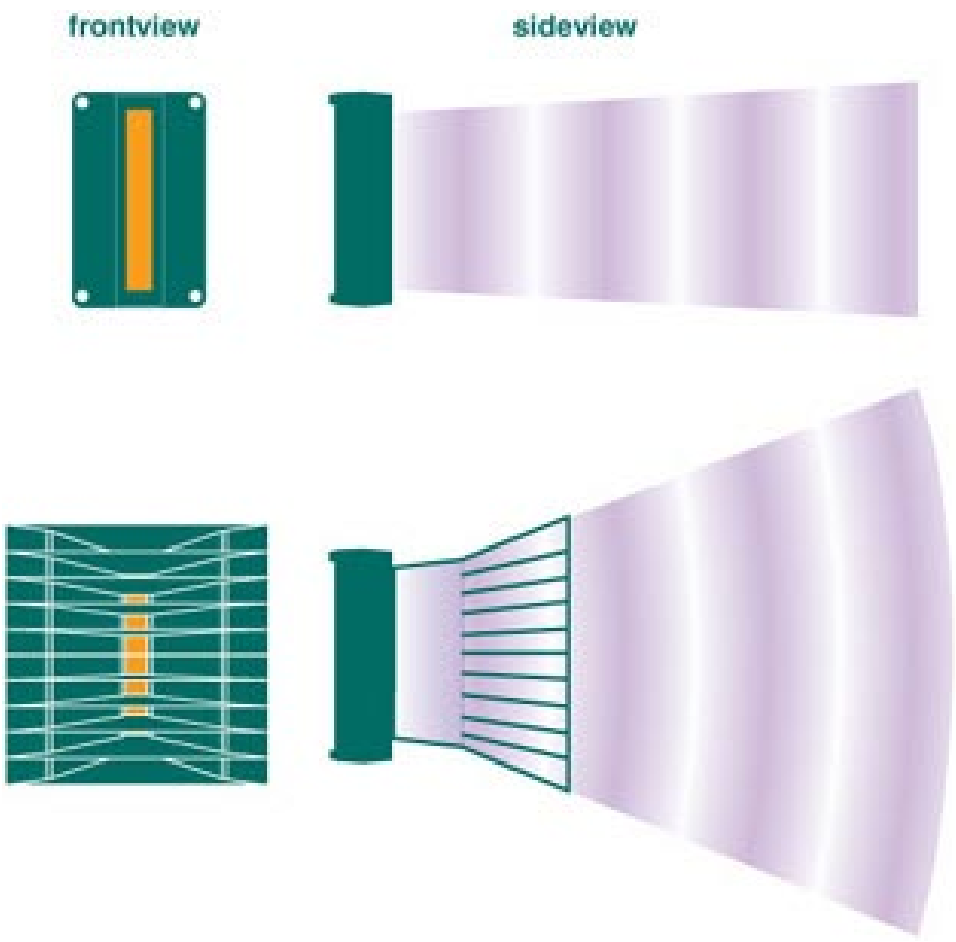
The RBN family is truly a leap forward in ribbon transducers specifically and high SPL sound reproduction in general.

The all-natural flat Isophasic wavefront of the RBN drivers, however, is not a "fit to function" solution, as many people think; In "J-curved" array designs, the isophasic wavefront needs to be curved as well, in order to get a smooth transition between the individual cabinets/ wavefronts.
In order to control this curving, Alcons developed the "Morpher" waveguide; A short waveguide which forms a slightly curved isophasic wavefront, without sacrificing sound quality.

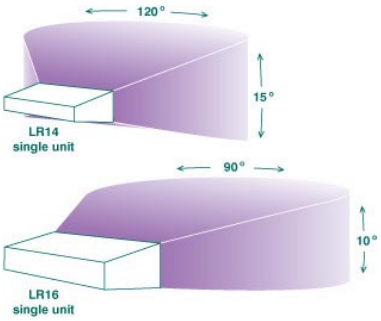
Remarkable detail of the "Morpher" wave-guide of the RBN's, is the unique "HempHorn™"; This wave-guide is made of a new combination of composite materials with natural hemp fiber structures. Contrary to the traditional glass fiber horns, the HempHorn™ features the same stiffness as conventional (glass fiber) horns, but is characterized with a much higher internal damping (at same weight). This results in a so-called "inaudible" waveguide, without the well-known "harsh horn sound".

Another criteria for a good-working line-array is the requirement of the highest degree of frontal radiation possible. Although publications state 80% as a minimum, one can say that the higher the percentage of total sound radiating surface (of total array length), the better the coupling up to the higher frequencies will be.

The Alcons LR16 has a 92% active frontal radiation and the LR14 even up to 94%, which are (one of) the highest in the industry.



the L-series line-array modules



The downscaling of line-array technology continues: The ultra-compact line-arrays are really coming-up in theatres and fixed installations, with (relative) short distances to cover, but wide areas to cover (front rows of seats). With the LR7 micro line-array, Alcons takes a step ahead with bringing her line-array strength to the install and AV applications.

These compact systems have a minimal horizontal coverage of 90 degrees to 120 degrees, and vertical 10 to 15 degrees. Therefore they can be completely curved (“J-curve”, curved Isophase wavefront) and be used for near-, mid- and far field. The medium and large systems have a vertical coverage of 5 degrees and are therefore not suitable for strong J-curving; With these systems a larger number of cabinets has to be used for coverage in combination with separate front-fill cabinets.

Also the price levels of the compact models make them attractive for also smaller rental companies and theatres. Now the ultra-compact line-arrays are really coming-up in theatres and fixed installations, with (relative) short distances to cover, but wide areas to cover (front rows of seats).

All Alcons pro-ribbon line-arrays have the same system philosophy, with system tuning down to 55Hz., eliminating the immediate need for subwoofers in many applications.

Also, each system can be “application-fit” with a dedicated bass system and / or a groundstacked subwoofer from Alcons’ B-series, to offer a versatile, thus economic system.
The LR16 is an active-filtered 2-way compact line-array system, featuring the RBN601 pro-ribbon driver on a 90° x 10° “Morpher” waveguide (up to 92% frontal radiation) and double 8” mid-bass drivers. In applications where extended flown mid-bass response is required, the LR16 can be combined with the LR16B pressure-bass system, featuring double 15” in dual-tuned band-pass configuration.
The Alcons LR14 is a passive-filtered 2-way ultra-compact line-array system and features the RBN401 pro-ribbon driver on a 90°/120 x 15° “Morpher” wave-guide (up to 94% frontal radiation) and double-6.5” mid-bass drivers. The LR14 is available with 90° and 120° horizontal dispersion.
In applications where extended flown mid-bass response is required, the LR14 and LR14/90 can be combined with the LR14B pressure-bass system, featuring double 12” in dual-tuned bandpass configuration.

The Alcons LR7 is a passive-filtered 2-way micro line-array system and features the RBN401 pro-ribbon driver on a “Morpher” wave-guide (up to 94% frontal radiation) and one 6.5” mid-bass driver. As the LR14, the LR7 is available with 90° and 120° horizontal dispersion. Its 16 ohms system impedance enables an amplifier-efficient package.

All L-series line-arrays are Signal Integrity Sensing™ pre-wired, ensuring complete cable/connector compensation between the LR and ALC controller-amplifier. The ALC controller-amplifier also takes care of all processing and protection, making “The Ribbon” line-array system completely “plug & play”, without the need for additional (tamper-sensitive) processors.

the alcons ribbon line-array's advantages

The LR line-arrays form together the "The Ribbon": a complete "plug & play" line-array system philosophy, with speakers, amplifiers, dedicated processing, flying hardware, connector panels, prediction software and transport solutions. Some unique advantages of The Ribbon include:

1) **input = output** The LR deliver a 1:1 reproduction of the original source, with all stereo and placement information as recorded in the studio or performed on stage. This makes a very significant different listening experience compared to traditional systems.

2) **HiFi sound at concert SPL's** The RBN pro-ribbon driver has up to 90% less distortion than any conventional mid/high transducer (@ same SPL) and a super fast transient response. The high power handling of 1000W (RBN601, from 1kHz.up), enables a 130dB system peak output.

3) **Unsurpassed "throw"** The combination of excellent pro-ribbon transient response with the perfect coupling from the up to 94% active-frontal radiation (no side-lobes), results in truly unsurpassed "throw" and "proximity-experience" over longer distances.

4) **Absolute maximum "gain-before-feedback";** The light weight of the RBN601's diaphragm moving-mass offers an unprecedented fast transient response. In combination with the flat frequency response of the RBN601 driver, this caters for the absolute maximum "gain-before-feedback".

5) **Perfect speech-intelligibility** The fast transient response + the lack of compression "threshold" (the level under which the compression driver doesn't make enough compression to have actual HF output) brings perfect intelligibility and tonal balance at lowest as well as highest SPL's.

6) **No listening fatigue** Another benefit of the superb transient response and the lack of "time-smear" of the RBN's (a result of the slow moving mass/diaphragm at high frequencies) is the lack of listening fatigue, even after prolonged listening hours.

7) **Digital dynamics**/ **max. headroom** The high power handling (RBN601/1000W, RBN401/800W, for 200Ms, which is 10 times the industry standard!), together with the ultra-low power compression (resulting from the patent-pending heat management) brings unsurpassed dynamic response from 1kHz. up. with a RMS:peak ratio of 1:15.

8) **All-natural cylindrical wavefront;** The cylindrical wavefront of the pro-ribbon driver makes complex horn constructions ("creative plumbing") obsolete. This keeps the acoustical signal path clean and distortion-free. Main features of this mid/high transducer are perfect (speech-)intelligibility and a very large dynamic range.

9) **Very clean signal path** As a result of the flat impedance of the RBN, no impedance correction is needed in the crossover. This allows simpler filter designs, placing fewer parts/obstructions in the signal path, thus offering improved clarity and accuracy of the sound. The "Current-to-light" driver protection, inaudibly protects the drivers for input overload.

10) **Truly accurate mid and bass response;** The LR's are pre-wired for SIS™ (Signal Integrity Sensing) circuit; In combination with the ALC controller amplifier, cable/connector influences are completely compensated for (with a damping factor of 10.000 at the speaker cabinet terminals!).

11) **Full-range;** With "step-down" cabinet tuning, the accuracy of a mid-bass driver and the wide response of the RBN (starting at 1200Hz), the pro-ribbon line-arrays features broadband-response starting at 70Hz up to 20kHz. (55Hz. -10dB) with only two components. Therefore there's no immediate need for additional bass systems in many applications.

the alcons ribbon line-array's advantages

12) **Very high " side"-lobe suppression;** With up to 94% frontal radiation, the pro-ribbon line-arrays offer a very sharp-edged vertical directivity, with absence of spikes above (ceiling reflections) and under (feedback) the array. Together with the patented horizontal dispersion up to 20kHz., they offer a high constant directivity projection over a wide frequency range.

13) **True 90 and 120 degree dispersion** The RBN's feature Alcons' patented "Real-90" dispersion in the horizontal plane, up to and beyond 20kHz. In combination with the 120° waveguide, a Real-120 projection up to 20kHz. is obtained; This brings a much larger "sweet-spot" and dramatically enhances the stereo-imaging, in both depth and width.

14) **Maximum and reliable performance** The front-accessible SDP processing circuit in the ALC changes the stereo amp into a dedicated powered controller of the LR's, offering dedicated excursion protection, system –eq, filtering and power control, for maximum component performance.

15) **Clever logistics,** The integrated flying system enables quick and easy set-up, without extensive "weight-lifting"! The dedicated transport cases are an integral part of the easy set-up and strike of the system.

16) **Accurate prediction software;** With the ARC™ software the performance is simulated, with desired angles calculated, with highest accuracy (LR16/0,7deg, LR14/1deg, LR7/1,5deg). The extensive information resulting from the simulation, transforms the LR line-array into a true precision instrument.

17) **Durotect™ cabinet coating** The LR cabinets are finished with an impact-resistant and weatherproof 2-component polyurea coating. This special coating stays flexible and thus offers a much better scratch-insensitivity/visibility than the generally used polyurethane (solid) coatings.

18) **The Ribbon Network;** Owners of The Ribbon become member of " The Ribbon Network", Alcons' international network for dry-hire cooperation between members, joined product development, information exchange and factory-direct support www.theribbon-network.net

19) **One world, one standard;** Compatibility from standardized system lay-out brings seamless up scaling to any size sound system from multiple inventories, without heavy investments. Alcons line-array systems bring the highest possible compatibility and system integration of any global operating network.

20) **"No Hassle" warranty** As Alcons truly believes in the quality of her handcrafted/computer-controlled products, the LR16 is backed by a 6 years limited warranty; "we put our money where our mouth is!".

the ribbon network

The LR7, LR14 and LR16 are part of “The Ribbon” line-array, which consists of speakers, amplification, processing, racks, cables, flying hardware, prediction software (“ARC”), AC distro, etc., making it a “plug & play” system.

The owners of such a system, can become member of The Ribbon Network; A dry-hire cooperation between rental companies. This makes the inventory of a company not limited to the ownership, but extends the inventory to almost unlimited system size, dramatically enlarging the market proposition of the rental company. Furthermore members of The Ribbon Network join in product development, information exchange and factory support.

More info on www.theribbonnetwork.net

how to evaluate a line-array in the field?

With the current hype around “line-array”, it has almost become a magic word. A lot, if not most currently available line-arrays (even from the “big names”!) claim to be a “line-array” but in fact aren’t.

The relative short experience (”learning curve”) that most users have with this type of sound system, gives plenty of room for badly engineered line-arrays, before they realize there are very significant quality differences”. But the effects are very audible; Lack of HF throw (a result of lobing), spikes/lobes, frequency / angle dependent dispersion, excessive high-mid response in front and low gain before feedback, are some of the effects that usually occur with a poorly designed array system.

Below we’ve given some indicators of the engineering quality of a line-array.

Important features of a good engineered line-array are;

1. even, consistent coverage of all frequencies from front to rear of the room. Changing response in MF/HF represents bad coupling in the vertical plane (so not according to line-array criteria).

Check by walking away from the array (near-field) to the end of the area (far-field).

2. “throw”, The ability of a system to actually bring critical information to the end of the listening area; The main design reason for line-arrays! Most line-arrays do not have this at all!!

Check by standing at the farthest point in the room and listen if the sound is “in the face”.

The throw can also be heard when walking away from the array; At some point you loose the intelligibility of the sound, that’s the limit of the throw of the system. Note that “intelligibility” is something completely different than “SPL”..

3. even, consistent coverage in the horizontal plane; The audible coverage of HF determines the real actual dispersion of a system.

Check by walking left to right in front of the array. Sound should be “in the face” and intelligible from the farthest dispersion angle of the system. After that, the sound should “roll-off” with similar frequency response. Most systems in practice do not meet their figures on paper!

4. absolutely no HF sound directly under the array; Any MF/HF sound under the array represents bad coupling in the vertical plane. What you hear is actually a huge “side-lobe” (with a vertical array, side-lobes are under and above the array; Whereas with a horizontal array, these lobes are really on the side of the array). The same amount of energy that is being fired downwards (under the array, problems with feedback!) is also being fired upwards, against the ceiling (problems with reflection!).

Check by standing under the array and listen. The MF/HF sound should come to the listener ONLY though reflection from the room (and not from the array).

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