



DESIGN GUIDE

# CONSTANT BEAMWIDTH TECHNOLOGY CBT SERIES PASSIVE CONTROLLED-COVERAGE COLUMNS



# 1. INTRODUCTION

It is very rare for sound systems to be deployed in the perfect acoustic environment. Whenever there is an increase in environmental background noise or reverberation time, there is a decrease in the intelligibility or performance of the loudspeaker system in the space.

JBL CBT series' primary purpose is to overcome the challenges of highly reflective or reverberant acoustic environments. CBT focusses the sound energy precisely and solely on the audience, and it does this with sonic performance rivalling some of the most complex and expensive line array systems. The footprint, ease of deployment and aesthetics are far better suited to architecturally sensitive spaces than typical line array systems.

Conventional loudspeakers typically have a wider coverage pattern with limited control over the mid and low frequency spectrum. This results in sound reflecting off room boundaries and delivering less direct sound from the loudspeaker to the listener. Thus, increasing the number of unwanted reflections. The differing arrival times of some of these reflections result in a lack of clarity for the listener, and consequently a reduction in intelligibility.

JBL CBT series is a proven and unsurpassed design shattering the notion of passive column speakers as performance-limited solutions to sound reinforcement with many of the benefits of a beam steering column style array.

The JBL CBT series raises the bar far beyond the competition with patented technologies that draw upon and adds to the long history of JBL innovation, delivering new capabilities, many of which are firsts in the industry and still unrivalled in a passive column, and in many active column and line source arrays.

Often the **challenges** with traditional passive columns are:

- The coverage continually narrows at higher frequencies, resulting in much of the listening area being covered by only part of the sound spectrum.
- Driver interactions cause the frequency response to change at every point – on and off axis and at every distance away from the speaker. Each listener hears a different balance of sound.
- Lobes of sound projecting outside the listening area increase the reverberation, reducing intelligibility and interfering with musical quality. Any lobes that project into the audience further degrade the evenness of performance.
- Often manufacturers use 'Commercial-grade' transducers without any waveguide. These products are targeted at low-cost or voice-band / background music audio reproduction.

The solution is JBL's patented Constant Beamwidth Technology (CBT), which is different from traditional passive columns. It solves these problems by locking in and maintaining a specific coverage over a very wide bandwidth. The CBT models deliver smooth, consistent coverage that is typically associated with complex and far more expensive line arrays.

We also draw on generations of innovative driver and waveguide technology to deliver power, accuracy, and frequency response far beyond the expectations of conventional column speaker products.

CBT series loudspeakers combine constant directivity coverage with line array efficiency, delivering surprising evenness of level and frequency response whether you are near or far, on or off axis to the speaker.

Conventional loudspeakers typically have a wider coverage pattern with limited control over the mid and low frequency spectrum.

## 2. PORTFOLIO

Designed for venues that would typically use larger point-and-shoot speakers, the CBT models incorporate technical advancements that allow them to vastly outperform competitive systems, with a level of user-friendliness that virtually eliminates the challenges of delivering great sound.

The JBL CBT series comes in a variety of sizes and performance capabilities designed to suit many different applications and can be split into two distinct areas of use

1. Traditional column applications
2. Performance audio applications



CBT 50, 100 and 200 products can be used where traditional column or point source loudspeakers would be deployed.

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### Common features of CBT 50, 100, 200

- Patented Constant Beamwidth Technology™ provides true wide-band constant directivity coverage up to the highest frequencies and reduces out-of-coverage lobing
- 50mm, custom-designed, true full-range drivers
- Specifically tailored performance with on board selectable Music & Speech modes
- Narrow width of 98.5 mm (3.8 in) fits visually into a wide variety of applications.
- Dynamic Sonic-Guard™ low-audibility overload protection maximizes clarity at high drive levels while protecting the drivers from damage due to overpowering
- Swivel (pan)/tilt wall bracket included
- Built-in 70V/100V transformers, plus low impedance capability
- Weatherised as standard – IP55
- Black or White versions available
- Paintable

#### Ideal applications:

- Lecture halls
- Difficult acoustic environments
- Transport hubs
- Conference rooms
- Houses of Worship
- Multi-purpose spaces
- Architectural spaces
- Shopping Malls



CBT 70 and 1000 products suited for performance audio applications.

#### Common features of CBT 70 and 1000:

- Asymmetrical vertical coverage sends more sound toward the rear of the room, making front-to-back sound levels more consistent
- Patented Constant Beamwidth Technology™ provides constant directivity up to the highest frequencies and reduces out-of-coverage lobing
- Switchable vertical pattern coverage
- Switchable voicing provides flat response in music mode or mid-range presence peak in speech mode
- Dynamic SonicGuard™ overload protection of HF devices
- Swivel (pan) / tilt wall bracket included
- Low impedance drive
- Weatherised as standard – IP55
- Black or White versions available
- Paintable

#### Ideal applications:

- Full range high sound level A/V applications
- Small to large performance spaces
- Small to large houses of worship
- Full fidelity lecture halls
- Delay/fill applications for larger systems
- Transit hubs with highly reverberant acoustic environments
- Large-scale Immersive audio and surround sound systems
- Outdoor systems such as sports fields, racetracks, and theme parks
- Multi-purpose mixed content spaces



### 3. CBT APPLICATIONS OF USE

CBT speakers are fantastic for challenging acoustic spaces, places where you want to keep sound focused on the audience and avoid unwanted reflections from hard walls or ceilings that can seriously degrade intelligibility. Churches, cathedrals, lecture theatres, modern glass-riddled acoustical nightmares, this is where the CBT series really shines. But they are also perfect for any situation where discreet, multi-purpose and high-fidelity audio is required.

Here are a just a few case studies of CBT in use:

#### COAL DROPS YARD - UK



Outdoor Public Space – CBT series used for public address and music applications – [read more](#)

#### Samsung KX – London UK



Retail Experience Centre – CBT is used with a 32-foot Screenmax LED display wall for presentations, demonstrations, discussions, gaming, and cinema movie nights – [read more](#)

## CALI BEACH CLUB, AUSTRALIA



Cali Beach Club is a \$10 million Ibiza-inspired beach club in the heart of Surfers Paradise. [read more](#)

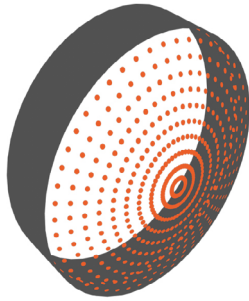
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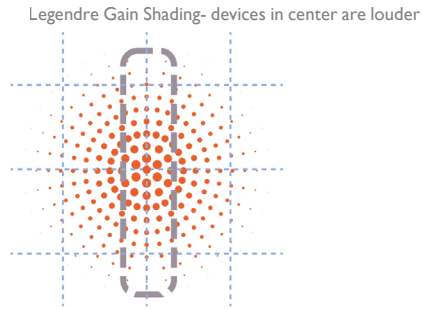
Modern meeting spaces equipped with JBL CBT loudspeakers. [read more](#)

## 4. CBT - THE TECHNOLOGY

- CBT's initial R&D concept was adapted from military research on sonar where a physical sphere of transducers is deployed along with gain reduction which gradually increases with each driver as they fan out from the center. The resulting beam is clean, uniform and does not suffer from lobing issues that are inherent in flat designs without this 'Legendre shading'



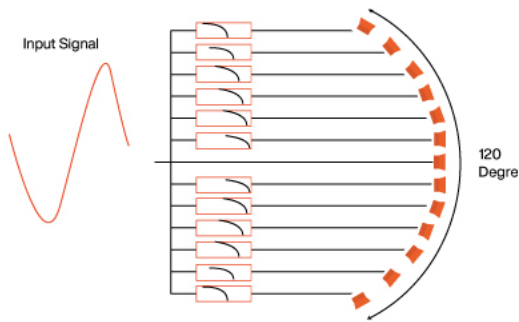
Spherical array of transducers



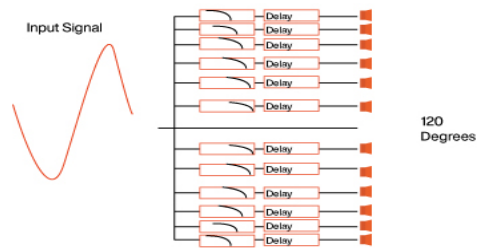
CBT Loudspeakers use a vertical cross-section of this technology

- The second stage of JBL's research took this technology further, instead of physically curving the array we use a passive delay and filter network to achieve the same time alignment in a straight form factor.

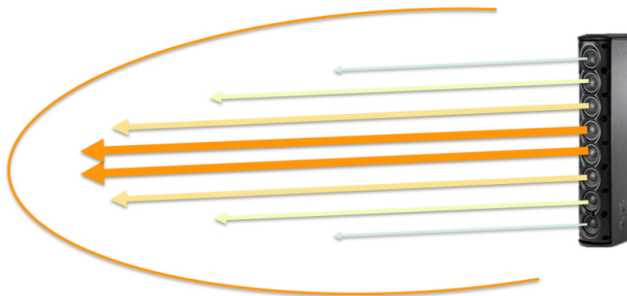
Physically Curved Array:



CBT

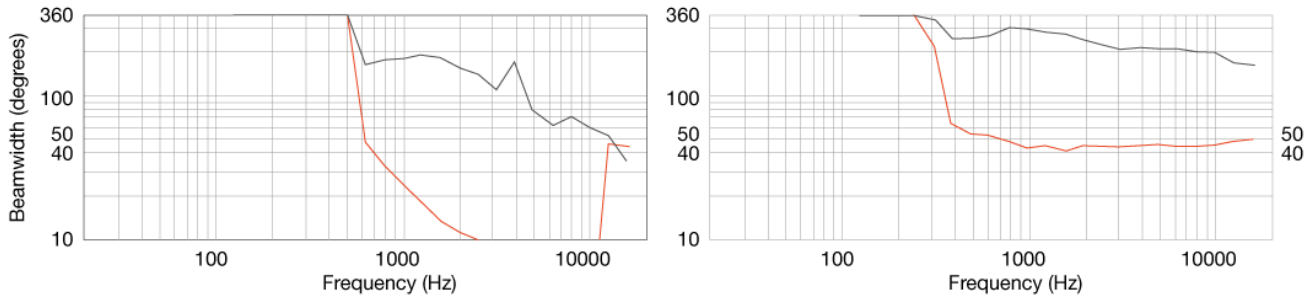


- The technologies combine to allow us to create a tight, uniform, and coherent beam from a single, straight column, without negative lobing effects that this format naturally exhibits:





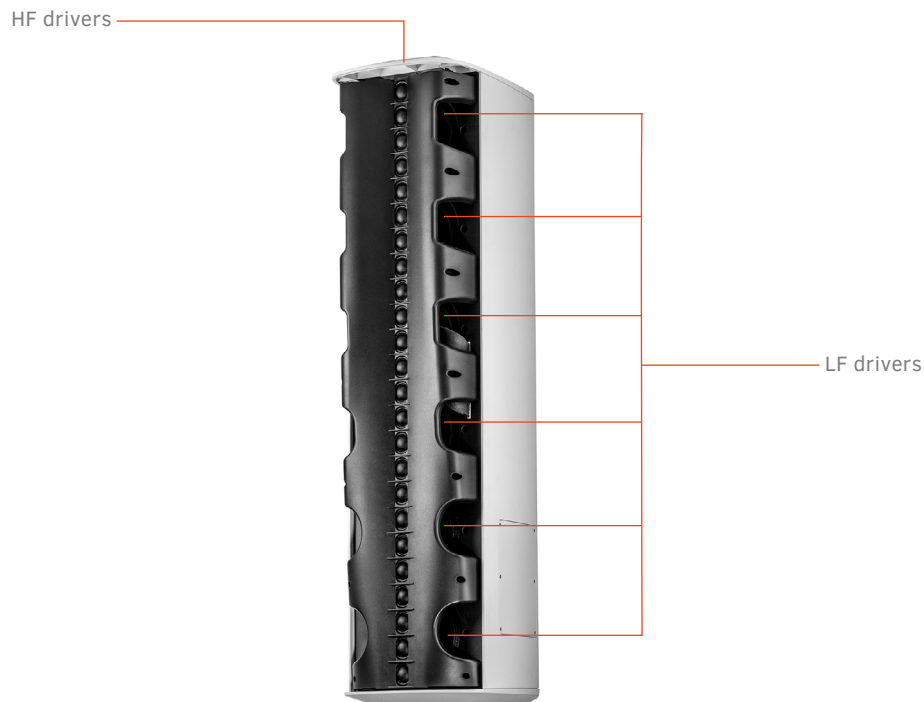
- Because CBT produces fixed beam patterns, we can also use waveguide technology to highly optimise the coverage for this predetermined dispersion. This also has the added benefit of making the system simple to specify and use.



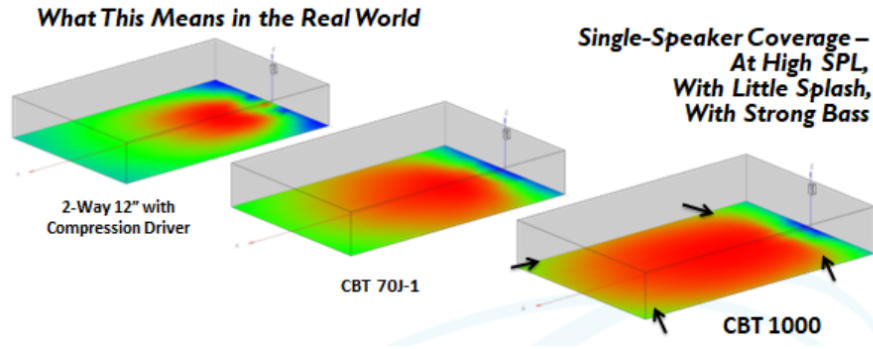
- Beam width of a typical Column Design: CBT:
- CBT also employs dual voice coil motors with neodymium magnets on every model in the range. In the CBT 70 and 1000 we add an array of custom, high performance high frequency drivers and further tour sound features to the bass drivers like copper shorting rings and highly damped surrounds. This is done for 2 reasons-

1) These products are intended to be a reference for performance quality.

2) This high level of performance is required while keeping the dimensions of the driver narrow and shallow to maintain the discrete aesthetics of a column design.





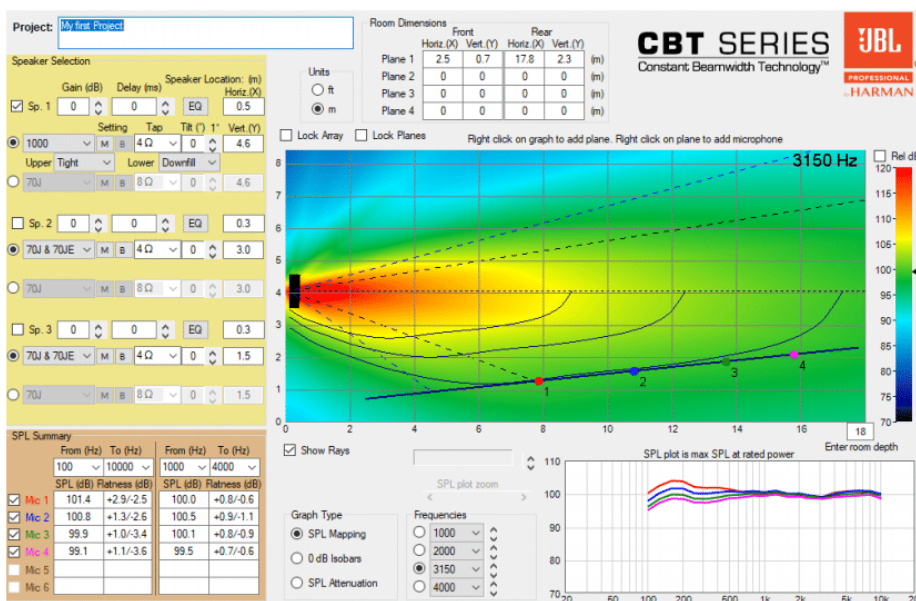


Energy concentrated in front of the speaker vs energy spread evenly over the audience

Another useful tool JBL has developed is the design and modelling software, CBT Calculator. JBL's CBT Calculator software is a precision engineering tool allowing audio professionals to design JBL's CBT Constant Beamwidth Technology line array column loudspeakers into a wide variety of venues.

CBT Calculator shows the vertical coverage of CBT models in venues via a cross-sectional sound level coverage display. The program allows the use of up to 3 CBT speakers and virtual adjustment of their various adjustable settings for vertical coverage (narrow or broad) and voicing (speech or music/flat), in a space with up to 4 independent listening planes.

In addition to the SPL vertical coverage mapping of a proposed design, the CBT Calculator also shows the frequency response for up to 6 listener locations as well as an SPL summary of the listener locations over user-defined frequency bands. It helps designers to determine the best CBT model selection, the proper vertical coverage and voicing settings, mounting height and the down-angle, allowing audio professionals to design CBT column line array speakers into many venue-application types.



JBL's [CBT Calculator](#) is free to download from the JBL website.

The JBL CBT Calculator dashboard used to model the deployment of all CBT loudspeakers.

## 5. COLUMN LOUDSPEAKERS IN APPLICATION

From their inception in the middle of the last century right up to today, the benefits of the column loudspeaker have been known about and utilised in professional install applications.

In the latter part of the 20th century beam steering using delay, driver spacing, and filtering came to the fore. Both technologies help to maximise the direct sound reaching the audience and reduce the spill into the reverberant field, however the lobing and inconsistencies in beam pattern at different frequencies tend to make them less than ideal for critical listening and performance applications.

JBL's CBT series of loudspeakers have been designed from the ground up to overcome these issues and create a range of products with the desirable sonic characteristics of the best point and line source designs while achieving the same beam-steering and design format of a versatile column system.

All of this is achieved using passive electronics and waveguides, making installation the same as a conventional loudspeaker.

With the CBT Series, every seat in the house experiences the same superb quality of sound, regardless of position. CBT series is a tool kit of options allowing many acoustical and architectural challenges to be overcome. Add to this the freely available modelling software, it really becomes easy to define a great sounding system using JBL CBT series for almost any application.

## PRODUCTS



### CBT 50LA-1

Representing a breakthrough in pattern control, with Constant Beamwidth Technology™, the CBT 50LA-1 utilises analog delay beam-forming and amplitude tapering to accomplish consistent vertical coverage without the narrow vertical beaming and out-of-coverage lobing that are typical of straight form-factor passive column speakers.

Learn more on our [website](#)



### CBT 50LA-LS

The CBT 50LA-LS utilises analog delay beamforming and amplitude tapering to accomplish consistent vertical coverage without the narrow vertical beaming and out-of-coverage lobing that are typical of straight form-factor passive column speakers. This loudspeaker is EN 54-24 compliant for life safety applications.

Learn more on our [website](#)



### CBT 100LA-1

Representing a breakthrough in pattern control consistency, the CBT 100LA-1 utilizes complex analog delay beam-forming and amplitude tapering to achieve consistent vertical coverage without the narrow vertical beaming and out-of-coverage lobing typical of straight form-factor passive column speakers. Ideal for speech and full-range background music.

Learn more on our [website](#)



### CBT 100LA-LS

EN54:24 certified variant of the CBT 100LA-1, featuring the same 50mm (2") drivers, switchable voicings and coverage. The most suitable applications include lecture halls, transport hubs, houses of worship, conference rooms and complex acoustic spaces.

Learn more on our [website](#)



### CBT 200

Double the size of the CBT 100LA-1, this model offers an additional increase in the precision control of lower frequencies than its smaller series counterparts. Asymmetrical Progressive-Gradient settings give the 32 2" drivers residing within this 2m column array enhanced front-to back coverage consistency.

Learn more on our [website](#)



### CBT 70J-1

Sixteen 1" HF and four coaxially arranged 5" HF drivers ensure the consistency of Constant Bandwidth Technology, offering enhanced control and reproduction of low-end frequencies down to 60Hz. Asymmetrical vertical coverage ensures sound is distributed more towards the far-field than the near-field. The CBT 70J-1 is capable of 127dB maximum continuous (133dB peak) SPL and can outperform some conventional line-array systems whilst maintaining a smaller footprint.

Learn more on our [website](#)



### CBT 70J-1 + 70JE-1 System

Coupling a 70J-1 with the 70JE-1 extension introduces an extra 6 dB of sound level capability and frequency response down to 45 Hz. The doubling in length over a singular 70J-1 broadens pattern control down to 400 Hz, covering the vocal range. The 70JE-1 extension is ideally deployed in small to medium performance spaces with varying degrees of reflectivity, where more low-end and pattern control is needed than a 70J-1 can handle alone.

Learn more on our [website](#)



### CBT 1000

Passive crossover circuitry equips the CBT 1000 with a total of sixteen possible vertical coverage patterns to cover a wide array of high-level performance and listening spaces. It can deliver a frequency response between 40Hz and 134 dB maximum continuous SPL (137 dB peak), is made possible by six 165 mm (6.5") high-excursion LF drivers coaxially arranged with twenty-four 25 mm (1") extra-high-power soft dome tweeters.

Learn more on our [website](#)



### CBT 1000 + CBT 1000E System

Additional loudness, pattern control and low-end frequency response down to below 38 Hz is made possible by extending the CBT 1000. The combined solution not only lends itself to medium or large performance spaces, houses of worship and full fidelity lecture halls, but can also act as a delay module within a larger sound system or as an immersive sound module in large-scale A/V applications.

Learn more on our [website](#)



#### About HARMAN Professional Solutions

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