Advanced Topics – Speaker Arrays

Line Arrays or Conventional Arrays – Which is best?

By Vance Breshears

The best speaker system for any particular facility will be dependent upon the room architecture, seating configuration, acoustical environment and program material to be played. With the proliferation of line array systems in the audio industry today, particularly in the touring market, I regularly get asked if such speaker products are the best choice for a permanent installation in a church. Like most questions of this type the answer is - it depends. The bottom line is that there are advantages and disadvantages to different types of designs and philosophies. While there may be a "better way" to design and setup a system, there may not necessarily be a right or wrong way. Well, there probably are some "wrong" ways, but we'll assume that those aren't even being considered.

In the interest of furthering our understanding of speaker systems, how they work and the best application for various types of products, let's take a look at the two basic types of arrays that are widely found on the market – line (or vertical) arrays and conventional (or horizontal) arrays.

Line Array Systems

Just because a sound company uses a speaker product for a well known artist tour doesn't mean that it's the right product for a worship facility permanent installation. Then again, it also doesn't mean that it's not.

Line arrays have been successful in the touring market for several reasons. In the past, many conventional touring designs did not take into account the interaction of adjacent speaker devices and their influence on each other and the outcome of the entire system as a whole. Line arrays provide a "pre-engineered" approach to systems design that looks at the system as a whole and can therefore provide greatly improved performance.

In general, line array systems use fewer cabinets than many of the previously popular touring systems. They provide a more coherent wavefront output and by their nature are easy to rig and load in and out. They also have greatly improved low frequency directivity control in the vertical plane and can provide improved coverage – particularly in long aspect ratio rooms or in long-throw applications. For the touring engineer, the contemporary line array system is a substantial improvement over almost every previous touring system design.

In a permanent installation, the ease of getting equipment in and out or rigged is not an issue, so we focus on the sonic and directivity characteristics of a line array. Once again, a line array has some distinct advantages over a conventional array in the ability to throw a relatively longer distance than a conventional array. This can result in fairly consistent coverage from the front to the back in a room if the system is properly designed. A line array uses the physical characteristics of wave propagation to its advantage to achieve the desired coverage results.

Line arrays can generally provide greater output in a more coherent fashion than can a conventional array. Because you generally have multiple drivers covering the same area, higher output can be achieved and it can be done in a way that provides clear coherent sound. The further away you get, the more coherent the sound will be.

With anything good, there are often tradeoffs. Line arrays are no different. In some applications, to get a line array to work properly and for the benefits of the technology to be realized, there may be a requirement for a fairly large number of devices which means a very tall vertical height. Also, by their nature, line array products have challenges achieving consistent frequency response in the horizontal plane. As you move outward from the on-axis point in the horizontal plane, the tonal quality can vary through the included coverage area. Also, the sound level tends to drop off as you move horizontally off axis. This can result in unacceptable differences in sound quality between seats, particularly in a wide room. This difference in horizontal coverage sound levels in a multi-channel or stereo line array system may make the stereo effect useless to all but the very center section of seats. Even a well designed line array can have inconsistent coverage and frequency response in the horizontal direct field plane and gaps in coverage between various devices in the vertical plane.

When it comes to cost, often times line array systems can be substantially more expensive than a conventional system would be in a permanent installation application. This is because of the significant number of devices that are often required to get the system to work correctly.

Conventional Arrays

Conventional arrays, if properly designed, can have improved and more consistent sound across the horizontal plane than a line array system can provide. Depending on the shape and size of the seating area, this horizontal plane is often the axis where the greatest number of listeners are located. Consistent horizontal coverage frequency response can be achieved to an even greater degree if frequency shading techniques are used between adjacent speaker devices.

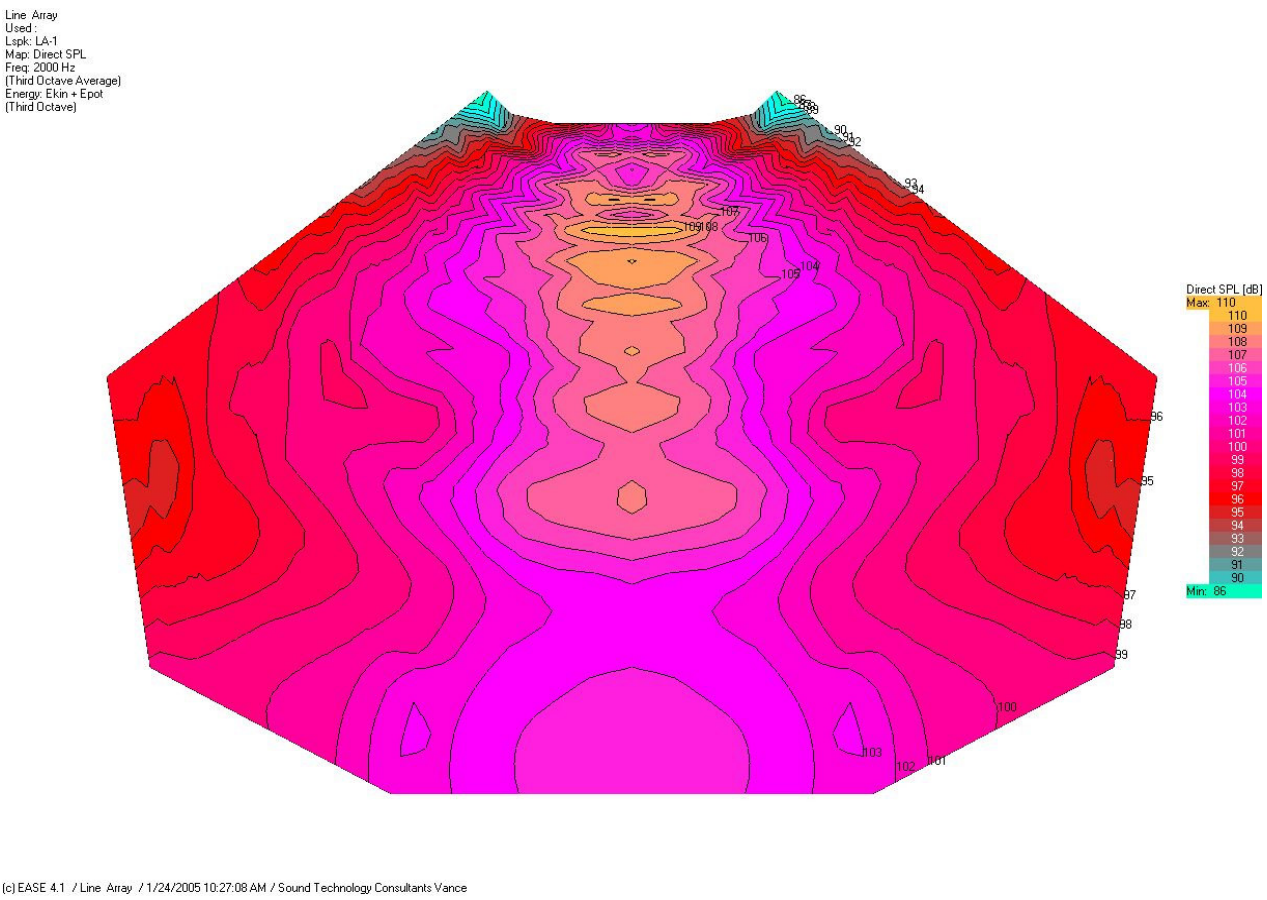
As far as coverage is concerned, the concept of putting sound into the back corners of a rectangular seating area is often better achieved by using two or more horizontally arrayed speaker devices that provide on-axis direct sound to the back corners. The back corners are generally the most difficult areas to cover from a central point. But again, this is all dependent upon the room size and shape, and the configuration of the listening area.

When it comes to the ever more popular multi-channel systems that utilize left, center, and right channel primary sources, it is often easier to achieve direct sound coverage for stereo imaging to most of the seats by using a conventional array. Once again, this is mainly because a line array drops off in level as you move further off-axis in the horizontal plane where a conventional horizontal array can be designed to be more consistent and provide very wide coverage. In general, wide “stereo” imaging can be better achieved with a conventional array design approach.

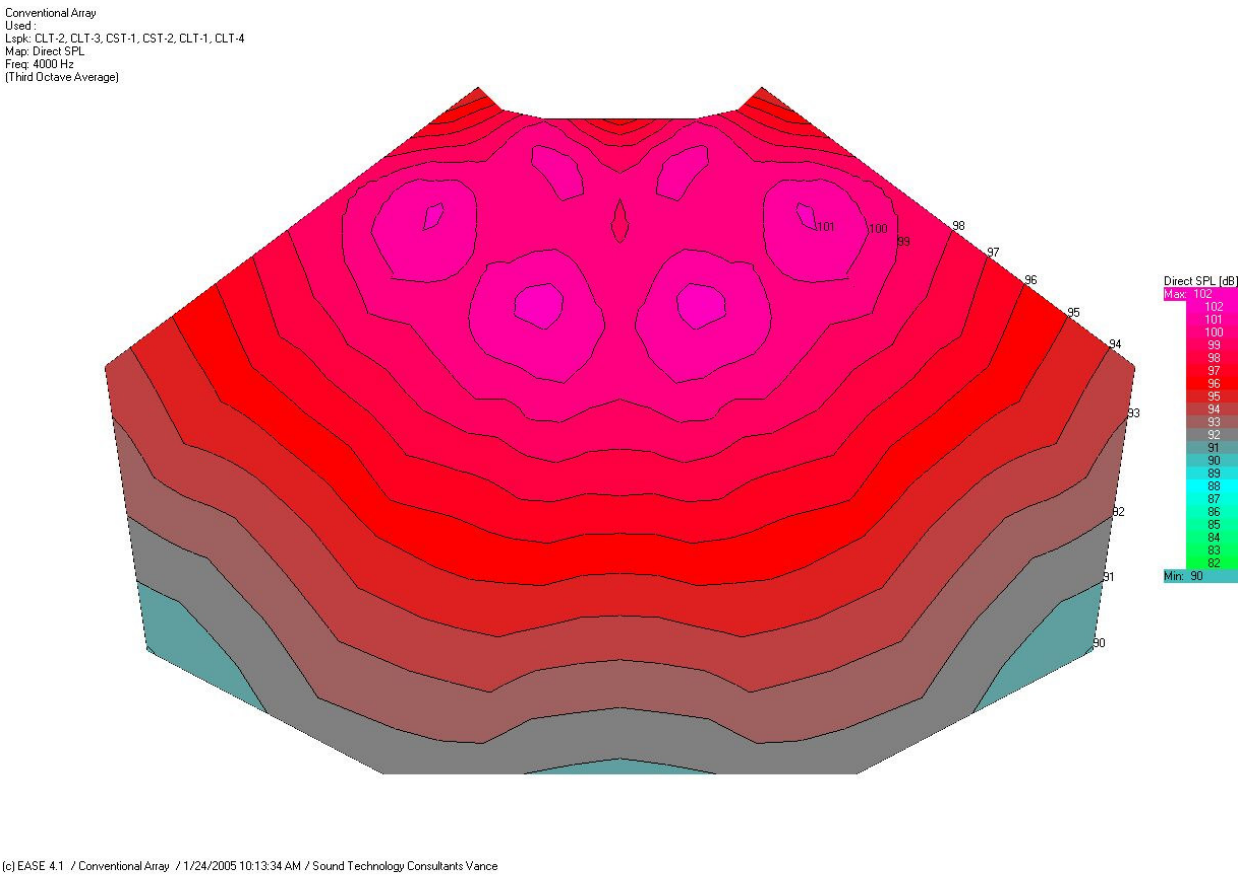
The shortcomings of a conventional array also happen to be the strengths of a line array. Conventional arrays will generally not provide as much output and will not have the vertical pattern control of a line array. In long throw applications, conventional arrays will often require one or more rings of delay speakers to achieve consistent front-to-back coverage. Sometimes the addition of delay speakers can make the conventional speaker system more expensive, but sometimes not. Once again, it all depends on the configuration of the listening area.

The Right Answer

Line array or conventional array – the bottom line is that designers have many new tools available to use these days when designing a system for permanent installation. It’s a matter of selecting the right product or system, and using it in the appropriate application that will make the project successful and meet the needs of the client. Whether a line array or a conventional array, the right answer depends on the specifics of the application.



This figure shows the coverage of a line array at 2kHz. Note that the array can throw well to the rear of the room, but in the side areas of coverage are inconsistent in coverage and frequency response.



This figure shows the coverage of a conventional array at 4kHz. Note the consistent coverage in the horizontal plane but the limited ability to cover the rear of the room without delay speakers.

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