



## Exhibit Acoustics

**This is not meant to be a primer on exhibit acoustics. It is an attempt to list a few of the pitfalls encountered in adding audio to exhibit spaces. If you have any questions, we strongly suggest that you consult an expert in the field. We will be happy to recommend consultants who are very familiar with both exhibit acoustics and our arrays.**

### *Adding sound to exhibit spaces presents some unique challenges:*

- 1. The spaces are generally open with little or no acoustic isolation between exhibits.*
- 2. There are multiple sound sources in close proximity.*
- 3. Aesthetics and budget constraints limit the amount of acoustic absorption.*
- 4. Building or exhibit design may limit or dictate the placement of the sound source.*

Many of the inquiries we receive are from museums looking for a "magic solution" to a difficult audio problem. Usually they have already tried several types of speakers for the exhibits with unsatisfactory results. Rather than face the real problem, which is the acoustics of the space, they continue to look for the "magic" loudspeaker which will solve the problem.

In the most common inquiry, the exhibit area is a large echo chamber. The sounds from the exhibits and people bounce around forming an unpleasant cacophony of sound filling the area.

Another scenario that is becoming increasingly common is art galleries that wish to add audio to an exhibit. The rooms are very quiet with very little to absorb sound energy. Individual voices are easily heard anywhere in the room. While the Dakota Audio array will considerably reduce audio spill, depending on expectations, the final result may not be satisfactory.

Dakota Audio arrays are a useful tool in these situations, but they are not the total solution. Equally important are the customer's expectations, acoustic design, and the audio track.

The following is a list of a few of the problems and mistakes we have seen in exhibit acoustics. Again, if you have any doubts, we strongly suggest you consult an expert with considerable experience in exhibit acoustic design.

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## Exhibit Acoustics (cont.)

1. Once acoustic energy is released into a space, it will bounce around until it is absorbed. While the Dakota Audio array will introduce considerably less total energy into the space than a standard non-directional speaker, the sound energy that is produced will reflect off surfaces until it is absorbed. In a typical exhibit space, careful thought should be given to the acoustic environment.
2. Just because a material is labeled "acoustic", it does not necessarily absorb sound energy. The term acoustic may mean that the material is transparent to sound, blocks sound transmission, or absorbs sound. In general, sound is absorbed by the friction of air molecules against some surface. Sound-absorptive material, often nicknamed "fuzz", provides a large surface area to interact with air molecules. To absorb sound at the frequencies we need, the material has to have some thickness. A thin, acoustically transparent material glued to a hard surface will not absorb much sound energy at the frequencies of interest.
3. The thickness of the acoustic material has a direct relation to the frequencies that it will absorb. The thicker the material, the lower the frequencies where it will be effective. Generally there is much more absorption at higher frequencies than lower frequencies in an exhibit space.
4. While it is beyond the scope of this paper, there are other types of absorption such as diaphragmatic absorption of surfaces that an expert can use to help control low frequency reflections.
5. Typical commercial carpeting has fair to good absorption at higher frequencies, decreasing rapidly at lower frequencies.
6. Some acoustic ceiling tile is better than others at absorbing sound. Sealing the pores on the front of the tile with multiple coats of black paint does not help the acoustic characteristics of the tile. Again, an expert can provide guidance.
7. In a well-designed space, the total of the noise from people, exhibit audio, mechanical equipment, lighting, and so on will fill the space with a low level "murmur". There will usually be much more low frequency energy to this murmur than higher frequencies since there are more low frequencies generated and less sound absorption. However, unless it is loud enough to be distracting, this can be desirable.
8. Noise can be your friend. Experience tells us that if the level in the focal point of our arrays is set to 15 to 20 dB above the general background noise level in the room, the listener will not be distracted by the background noise. A few feet away from the array, the sound leakage from the array will be inaudible above the general noise level. The key is to establish a constant noise level from HVAC systems in the galleries that is not so high that it forces one to raise both voices and audio programs to be heard, yet not so quiet that the slightest sound that is made from any source becomes painfully obvious.

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