



Hybrid Acoustic Design – LRS and Mezzanine Surrounds

The Science of Sound is easy. Mostly because the engineering principles that govern how audio is perceived by the human brain have been studied and applied to speakers for many years. Such factors as distortion, power response, phase, etc. are well understood and their effects have been used to improve the design and manufacture of Consumer Electronics Products long before I was a part of this industry.

The Art of Sound is another matter. There are always new products that come to market that demonstrate ways in which consumers can be attracted to a new and different concept. It is the proper application of known scientific data and invention to new products that is the Art of Sound.

Cary Christie

President & CEO, ARTISON

Our goal in creating a surround speaker was simply to make something that worked on all types of source material. Monopole vs. Dipole has been an area of contention since the concept of Home Theater first came into existence. The benefit of a monopole is the ability to steer the sound and let the recording engineer have total control over the sound effects that the film demands. The benefit of a dipole is the non-directional component that gives the illusion of space and keeps you from pointing to the source of the sound, the speaker itself thus reducing the experience. The Dolby standard for surrounds is a monopole while THX promotes a dipole. Some manufacturers have made speakers that could be converted from one to the other with a switch. It is hard to imagine a customer getting out the ladder to switch surround modes depending on the source material.



Our approach to the problem was to look at what the customer expected from a surround speaker and create a product definition that would allow us to build the best possible design. Our design requirements for a surround were:

- A small and inconspicuous speaker that could be easily mounted and made invisible
- A speaker that would allow sound steering when desired but disappear otherwise
- Good dynamic range and power handling with low distortion

We started on this project by examining the frequencies at which the various effects that we wanted to control in our surround had their fundamentals and first series of harmonics. We found the most of the frequencies where a sound producer wanted to steer the sound were below 3 kHz. People talking, Cars, Planes, Instruments, etc all had there origins at the lower frequencies while the ambient or hall information occurred at both very low and high frequencies, see Figure 1. Since our surround was not intended to work below 80 Hz we only had to focus on eliminating the location the source of high frequencies for the listener. It seemed obvious that if we made frequencies below 3 kHz monopole and above 3 kHz dipole we could create a surround that would be both practical and work for all types of source material. So that's what we did. We call our surround a Hybrid Acoustic Design because it is both a Monopole and a Dipole...And it works.

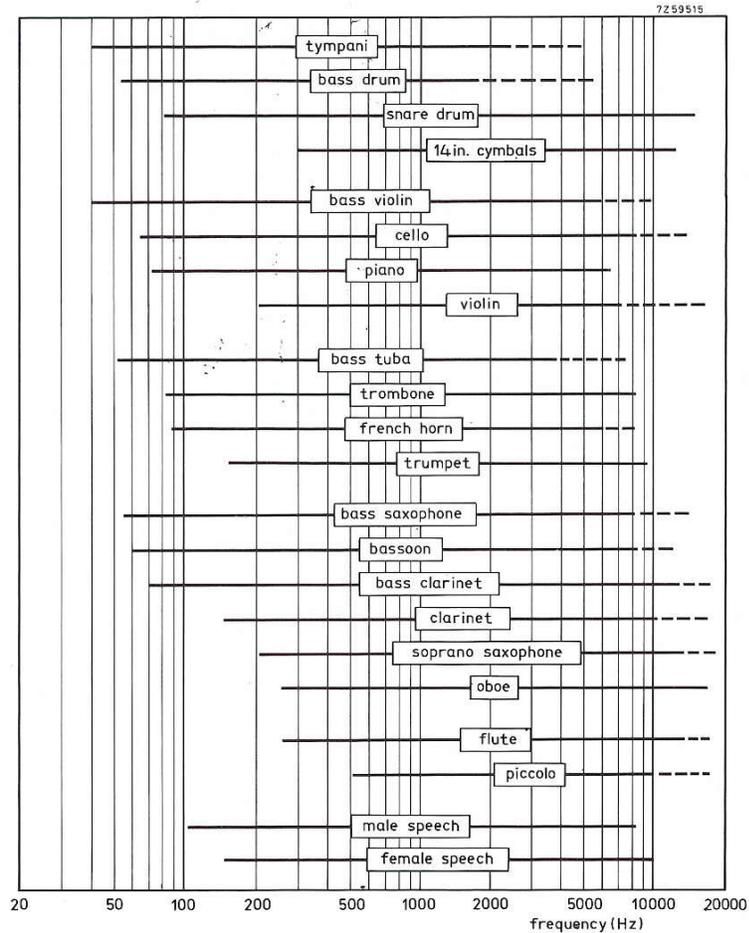


Figure 1 - Frequency Range for Various Sources

Driver Technology

We use the same driver and crossover components that are in our front channels compensated for frequency tailoring and timbre matching. Carbon Fiber has been used by other manufacturers of high quality speaker systems. It is a great material because it is an engineer able material. What I mean by that is once the design is done it is easy to control consistency. What you design is what you produce. Carbon Fiber is also inherently well damped, and has good stiffness to mass properties. We design and build our own



Midrange/Woofer drivers because we are also looking to build in polar patterns to help us with our imaging. We made the cone material black so it would not be seen behind the grille in final installation. All of our woofers have extended pole pieces, aluminum shorting rings, and long throw (also known as X-Max) engineered into them to allow the speakers to play very loud with good dynamics, low distortion, and good phase characteristics.

Super Audio Tweeters are our primary high frequency drivers not because any of us can hear 50 kHz but because they are light and therefore have excellent transient response at the frequencies below 20 kHz. This is important to the detail that the speaker has when playing complex information where a speaker has to react to a signal and the instantly stop its motion. The artsy part of tweeter selection is again the art of listening to something for what are called its "Musical" qualities.

Crossovers

The job of the crossover is to separate the incoming amplifier signal into multiple signals that are sent to the various drivers in a way that both integrates them and provides a seamless transition from one drive unit to the other. Proper crossover design will result in a focused single speaker image and will generate a very high Q null at the crossover frequency when the drivers are hooked up out of phase. High quality components such as metal film capacitors and air core inductors are also important to the sound.

Enclosures

We needed a way to easily mount our surrounds to or in a wall or ceiling that was secure, would not vibrate, and could be used in multiple configurations and room environments. The main enclosure needed to be made of a thin material that was rigid and allowed for



the shape necessary to create the Hybrid Acoustic Model that we had determined worked best. An Injection molded, fiberglass filled ABS material was chosen because it not only met all of our acoustic requirements it was readily available using known manufacturing methods. The rear enclosures used on all of our surround speakers are designed to control the performance independent of the environment or enclosure they are mounted in.

In keeping with our goal of providing state of the art performance from and inconspicuous and as close to invisible speaker as possible, we designed an ultrathin, Magnetically attached grille assembly that use a very small (3mm) trim and micro perforated metal that can be painted as an assembly and help make the installed speakers blend into virtually any room décor.