



The Loudspeaker Problem

Loudspeakers

As a lover of music and /or movies, you can't live with them and you can't live without them. While some may dispute the claim, your speaker is the single most important and problematic piece of your audio or video system. If you are unhappy, it is most often the culprit, through sins of commission or omission. And, while most of your prized gear is probably of the "newish" high tech variety, most of the parts and technology in your loudspeaker date back twenty to fifty years. To be fair, there have been improvements in basic speaker and driver technology over the past several decades, but most of these have not addressed some of the fundamental problems inherent in existing transducer technology.

There are two fundamental areas of driver technology, the motor and the diaphragm. Both combine to create drivers in a very few categories ... types which have been well known and studied for many year. The two primary motor types are electromagnetic (dynamic) where a coil and magnet electromechanically driving a diaphragm and electrostatic, where charged electrodes drive a membrane. The three primary diaphragm types are dome & cone (the std. stuff), film and leaf (electrostatics and ribbons) and bending wave (Airfoil, Manger, DDD).

In choosing a path, we took many factors into account and came down on the side of electromagnetic drive (for its ruggedness, simplicity and power handling) and bending wave for it's freedom from limitations which cripple the other two diaphragm classes. An analysis of these issues follows.

Here are some of the some basics and a bit of review.

- Aside from bending wave drivers there are two main types of speaker drivers:
cones/domes, ribbons/electrostatics
- Both of these are designed to move air by back and forth in a piston motion
- This motion causes rapid changes in pressure that our ears/brain tell us is sound

(note however that this piston motion creates positive & negative pressure which never occurs in nature)



To achieve theoretical perfection, the above driver types would need:

- Near zero mass to move quickly enough to reproduce a broad range of frequencies (too heavy and you can't move the driver fast enough to reproduce the high frequencies, too light and the lows can't be reproduced)
- Infinite strength to maintain perfect driver shape during this piston motion. If the membrane flexes while moving back and forth the sound is distorted.

Moreover, these drivers, often used in combination with other types, would have to marry together to:

- Generate coherent timber, phase and launch speed over the full frequency range
- Present a uniform and seamless dispersion pattern
- Function as a point or line source (to maximize soundfield presentation)
- Present broad horizontal dispersion to maximize the sweet spot

The net result is that speakers using cones, ribbons or electrostatic panels usually require multiple drivers of different sizes to reproduce the broad range of sounds our ears can hear. To make these drivers operate coherently, crossovers are required and these are often very complex. The simple fact is that many crossover types can drastically alter the sound you hear, particularly in the sensitive mid range. And, despite best efforts, rarely do drivers blend seamlessly.

The facts of speaker life outlined above have been known for well over half a century! These "rules" however, draw the boundaries ... set the stage ... and start the best speaker designers on the path to compromise.



Impact goes its own way

We can't help it. At Impact, we want, indeed demand a different way. In the face of advances in sources (analog and digital) and electronics, the speaker becomes, more than ever, the bete noir. Our search for technologies that rewrite the rules led us to develop the Airfoil loudspeaker. This product will shatter your preconceptions of what a loudspeaker is capable of!

The Patented Airfoil Driver

We start with the Airfoil Driver, a unique broad band bending wave driver. That technological mouthful, however, can be distilled into a few easy to understand facts. The driver membrane is flexible and will not distort the sound as it moves. In fact, it moves in waves, mimicking the way sound travels through air! It does not struggle to be a perfect piston! It is thin and light so it can move fast and reproduce the highest frequencies. But that's not all. This 6" driver covers frequencies from 170 Hz to over 20KHz! Fast? Powerful? You bet! Imagine a 1000 lb. race car with a 500 hp engine and you'll get the idea! In addition it has true time and phase coherence across its operating bandwidth.

The Airfoil Driver transducer has other great benefits. It reproduces transients in a natural way. Human response to the leading edge of transients (the first attack of sound to reach our ears) is at the heart of the psychoacoustics of hearing. The Airfoil preserves the natural attack of transients, which eliminates listener fatigue. In addition, the Airfoil has ultra low distortion which in fact decreases as the frequency increases.



The airfoil driver is certainly different. Let's look at the differences:

- The motor is electromechanical and its back and forth motion flexes the diaphragm which causes energy to propagate as a wave through the diaphragm
- The diaphragm is pliable. It doesn't need to maintain a rigid shape and actually bends with the waves of sound
- It has no limitations in reproducing high frequency sound
- It can reproduce a wide bandwidth of sound and requires only a simple crossover for low frequency information
- The driver is time and phase coherent and has extremely low distortion

Moreover, unlike other bending wave drivers, the Airfoil is rugged, requires no tight tolerance parts, is not easily damaged by prying fingers (you can poke and prod the membrane while it is making sound) and these drivers can be used singly or ganged up in almost any number. Additionally, the Airfoil transducer benefits by being able to radiate sound across its entire surface into the room. Imagine sound radiation over 150 degrees within 2 dB ... experience, with Airfoil, a listening room which is one huge sweet spot!

The Airfoil 5 Loudspeaker System

No matter how great the driver, you fail unless you get it into the right loudspeaker. The Airfoil series from Impact Technology is such a line of loudspeakers. Our first offering, the Airfoil 5, is our statement product and it allows the full potential of the Airfoil driver to be realized. No compromises, no shortcuts!

The heart of the Airfoil 5 is a line source tower utilizing nine Airfoil drivers in a vertical array. This is a true line source with excellent imaging and extended vertical and horizontal dispersion. In fact, horizontal dispersion is phase correct and within 2 dB over 150 degrees! The panel takes advantage of this wide bandwidth and the ultra-low distortion of the Airfoil driver to achieve stunning resolution and transparency. The array covers 170 Hz to over 20 KHz, eliminating the need for crossover points anywhere near the critical mid frequencies. The Airfoil array exhibits not only remarkable reproduction of inner detail but also is free of the phase anomalies that introduce time alignment errors.



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A pair of high performance sealed box, coupling woofers, complements the Airfoil arrays. Each coupling woofer, which acts as a base for the towers, has two 6.5" drivers in an ultra-linear alignment. This sub-enclosure operates from 170 Hz to 80 Hz. Below the coupling woofer, the signal is handled by two patented Balanced Force Compression subwoofers. These unique devices reproduce the remainder of the low frequencies to 17 Hz. They do so with a speed and lack of distortion unheard of in this type of device. The patented enclosure eliminates nearly all of the vibration and therefore the coloration associated with most subwoofers.

The Airfoil 5 is supplied with a passive, first order series crossover network between the array and the coupling woofer and an active crossover, which includes level and variable phase control for the subwoofer signal. The subwoofers are self-powered by built in 1000 watt solid state amplifiers.

The sound? The Airfoil 5 directly and positively speaks to the music. It confirms that reproduced sound can move us in the way that live music does. It is not HiFi sounding, and always prompts listeners to use words like natural, musical, un-fatiguing, engaging (particularly at the end of listening sessions which are many hours long). Hear the magic for yourself. Visit an Impact dealer and audition the Airfoil 5. It defines our creed and proves that... **imitation is not our strategy!**

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