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Docket Number:	09-AFC-07C
Project Title:	Palen Solar Power Project - Compliance
TN #:	202489
Document Title:	Ex.1141 - Biological Resources Supplemental Opening Testimony of Elwood G. Norris â€™ Description of HyperSound Technology
Description:	N/A
Filer:	Marie Fleming
Organization:	Galati Blek LLP
Submitter Role:	Applicant Representative
Submission Date:	6/23/2014 3:11:04 PM
Docketed Date:	6/23/2014

**PALEN SOLAR ELECTRIC GENERATING SYSTEM
BIOLOGICAL RESOURCES
SUPPLEMENTAL OPENING TESTIMONY
DESCRIPTION OF HYPERSOUND TECHNOLOGY**

I. Name:

Elwood G. Norris

II. Purpose:

My testimony provides a description of a technology under development (Hypersound™) that could have application at the Palen Solar Electric Generation System (PSEGS) (09-AFC-7C) or similar projects as an avian deterrent technology.

III. Qualifications:

I am an American inventor and serial entrepreneur, having founded multiple public corporations in which I have held officer and director positions, including:

- 1980: LRAD Corporation of San Diego, CA.
- 1988: e.Digital Corporation of San Diego, CA.
- 1992: Patriot Scientific Corporation of Carlsbad, CA
- 2000: AirScooter Corporation of Henderson, NV
- 2010: Parametric Sound Corporation of Henderson, NV.

I was the winner of the 2005 Lemelson-MIT Prize for my invention of a "hypersonic sound" system which allows sound to be focused with high precision.

A detailed description of my qualifications is presented in the attached resume.

To the best of my knowledge all referenced documents and all of the facts contained in this testimony are true and correct. To the extent this testimony contains opinions, such opinions are my own. I make these statements and provide these opinions freely and under oath for the purpose of constituting sworn testimony in this proceeding.

IV. Opinion and Conclusions:

Parametric Sound Corporation was spun off from LRAD Corporation in September 2010 and later merged with Turtle Beach. Under the brand

HyperSound™ (HyperSound.com), the company markets pioneering directed audio solutions that beam sound to a specific listening area without the ambient noise of traditional speakers. HyperSound™ has applications in digital signage and kiosks, healthcare and consumer electronics.

The hypersonic technology developed and utilized in this application is not the type of ultrasonic technology described by the WEST in Exhibit 1130, which provided the following information regarding the use of ultrasonic sound as an avian deterrence methodology:

UltraSonics

This product is designed to produce sounds for animals with hearing ranges above 20 kilohertz. Evidence shows that ultrasonic devices do not deter birds and that birds do not hear in the ultrasonic range (Erickson et al. 1992). Therefore, this is not a viable option for birds, but might be considered for deterring bats.

Instead, HyperSound™ is a completely new technology that creates sound “in air.”

It is a new paradigm in sound production based on solid, well-known principles of physics.

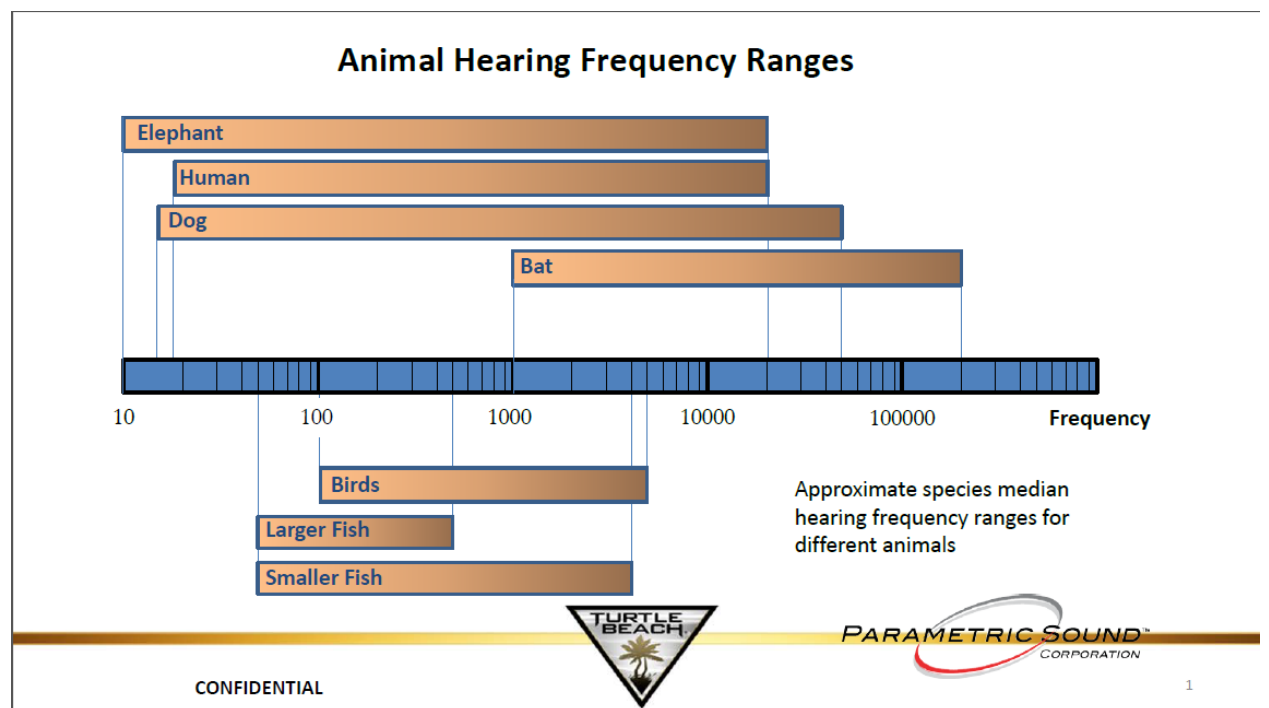
There are no enclosures, crossovers, woofers, midrange or tweeter elements. The sound is generated in the air itself, indirectly, as a conversion by-product of the interaction of ultrasonic waves.

About a half-dozen commonly used speaker types are in general use today. Whether they be dynamic, electrostatic, ribbon, or some other transducer-based design, all loudspeakers today have one thing in common: they are direct radiating—they are fundamentally a piston-like device designed to directly pump air molecules into motion to create the audible sound waves we hear. HyperSound™ technology produces sound in the air indirectly as a by-product of another process.

HyperSound™ technology projects a beam of silent ultrasound energy into the air. The air itself creates audible sound within the column of ultrasonic energy. The sound is actually created in mid-air. This is not an illusion. The acoustical sound wave is created directly in the air molecules by down-converting the ultrasonic energy to the frequency spectrum we can hear.

An important by-product of the technology allows for controlled directionality – the communication of sound clearly and efficiently over long distances in a manner that is extremely directional. In other words, receptors (such as humans and animals) within the energy beam projected by the equipment will hear the sound. Receptors outside of this narrow beam will not hear the sound directly and will only hear audible sound waves that may be reflected by objects within the ultrasonic beam.

Moreover, the wide frequency response means similar deterrence strategies could be applicable to the full range of species, from birds and bats, to mammals. This is illustrated in the following diagram:



WHITE PAPER TECHNOLOGY INTRODUCTION

How HSS™ can shape the future of sound.

HyperSonic™ Sound is a completely new technology that creates sound “in air.”

It is a new paradigm in sound production based on solid, well-known principles of physics.

There are no enclosures, crossovers, woofers, midrange or tweeter elements. The sound is generated in the air itself, indirectly, as a conversion by-product of the interaction of ultrasonic waves.

HyperSonic™ Sound is NOT a new upgraded surround-sound system using old technology.

Nor is it a mixing or amplification system designed to trick the listener's ear. It is not a new driver for polyfoam or styrofoam diaphragms, a new speaker enclosure or some sort of digital speaker system (which still drives diaphragms mechanically).

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TECHNOLOGY INTRODUCTION

These days it is highly unusual to find something that is truly original. The terms “quantum leap” and “paradigm shift” are so overused that, when one runs across a technology that is truly worthy of such a description, few believe it.

Fortunately, like all extraordinary developments, HyperSonic Sound can be described with an economy of words:

About a half-dozen commonly used speaker types are in general use today. Whether they be dynamic, electrostatic, ribbon, or some other transducer-based design, all loudspeakers today have one thing in common: they are direct radiating—they are fundamentally a piston-like device designed to directly pump air molecules into motion to create the audible sound waves we hear. HSS technology produces sound in the air indirectly as a by-product of another process.

HyperSonic Sound Technology projects a beam of silent ultrasound energy into the air. The air itself creates audible sound within the column of ultrasonic energy. The sound is actually created in mid-air. This is not an illusion. The acoustical sound wave is created directly in the air molecules by down-converting the ultrasonic energy to the frequency spectrum we can hear. An important by-product of HSS is that sound may be directed to just about any desired point in the listening environment. This provides outstanding flexibility, while allowing an unprecedented manipulation of the sound’s source point.

See page 8 for a more detailed description.

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Potential HyperSonic Sound Applications

HSS™ puts sound only where it is needed.

Do you need to communicate clearly and efficiently over long distances to a single group of people? HSS lets you “beam” sound to a single point hundreds of feet away.



Focus drive-thru restaurant ordering station sound directly into the car window, eliminating “noise pollution” of the surrounding environment.

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In a grocery store aisle, advertise a special sale price or promotion directly in front of the product... without disturbing other customers.



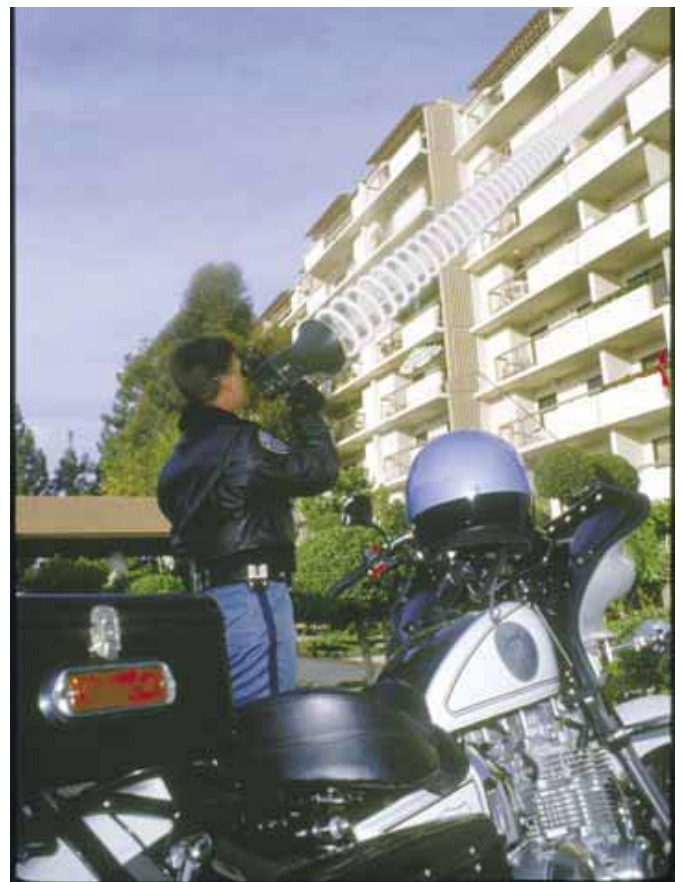
HyperSonic Sound can “focus” audio at your tradeshow exhibit. It lets you communicate directly with your target customer at a demonstration kiosk without bothering anyone else around the exhibit.



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As you move from display to display in a museum, HyperSonic Sound can present the “audio story” for each individual display.



Bottom line: HyperSonic Sound is the first audio technology that allows individual communication in public spaces.

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Potential applications & markets include...

Paging Systems
Communications
Toys / Novelties
Cinema / Theater
Sound Reinforcement
Museums
Retail Stores
Amusements
Theme Parks
Kiosk Displays
Trade Shows / Events
Audio Conferencing
Noise Cancellation
Military Communications
Aircraft Communications
Automobiles

Just think of the THOUSANDS of possibilities for specific Products which might fall into one of the Market categories listed at left.

Given the unique properties of HyperSonic Sound, we have the potential for many new products that haven't even been thought of yet!

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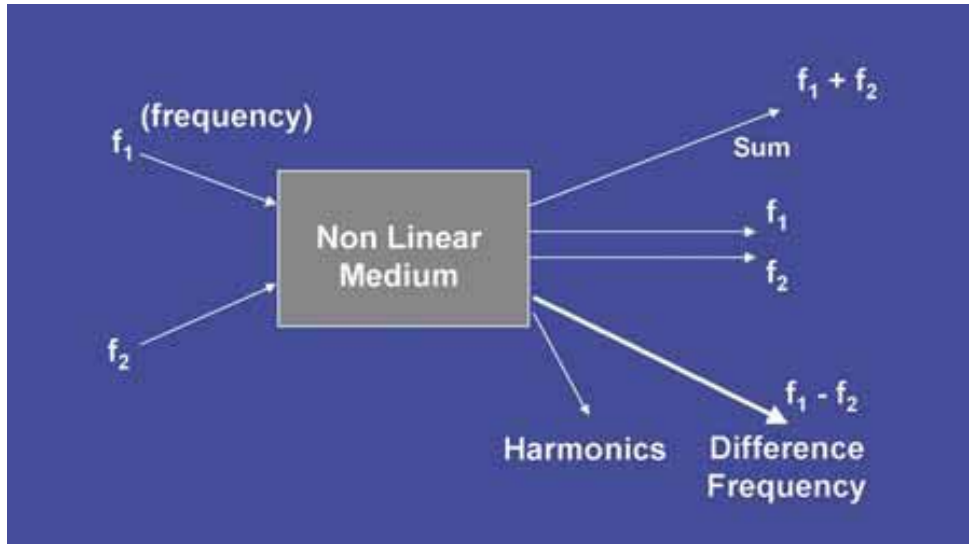


As you can see, the proprietary HSS™ ultrasonic emitter device is flat, thin and easy to mount.

Wall mounts and ceiling mounts are available.



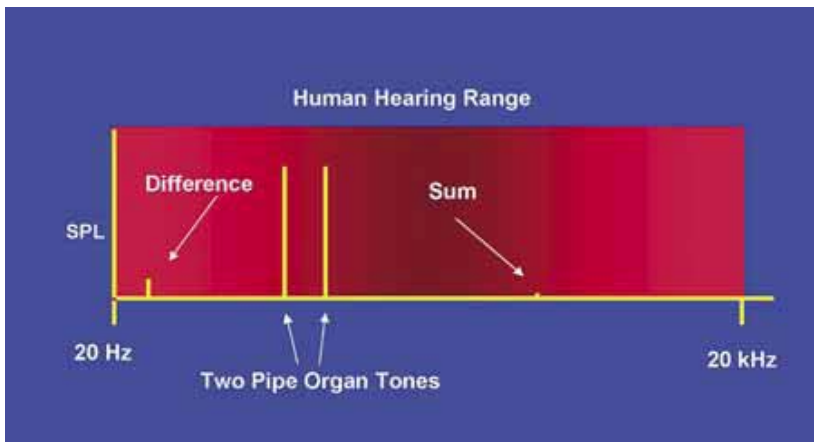
Basic HSS™ Technology Overview



A Non-Linear Medium

It is understood from the world of electronics, that sending two frequencies (represented here by f_1 and f_2), into a Non Linear device (such as a mixer or heterodyne

circuit) produces an output which contains both of the original signals F_1 and F_2 , plus the sum of the two, the difference of the two, and a set of harmonics. For HSS, we are most interested in the difference frequency, f_1 minus f_2 .

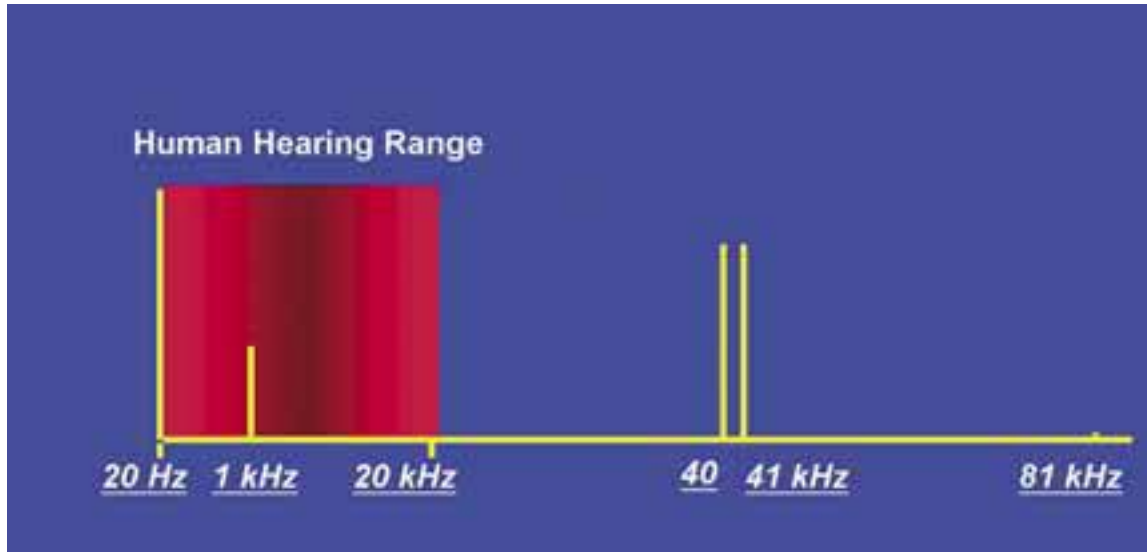


Air is a Non-Linear Medium

Approximately 150 years ago, a German Physicist named Hermann von Helmholtz discovered that air is non-linear. He played two organ notes very loudly on his pipe organ and was able to hear what he thought to be a higher frequency and

a lower frequency. Through careful measurement, he proved that these new frequencies did exist as new tones and were measured to be the sum and the difference of the original notes.

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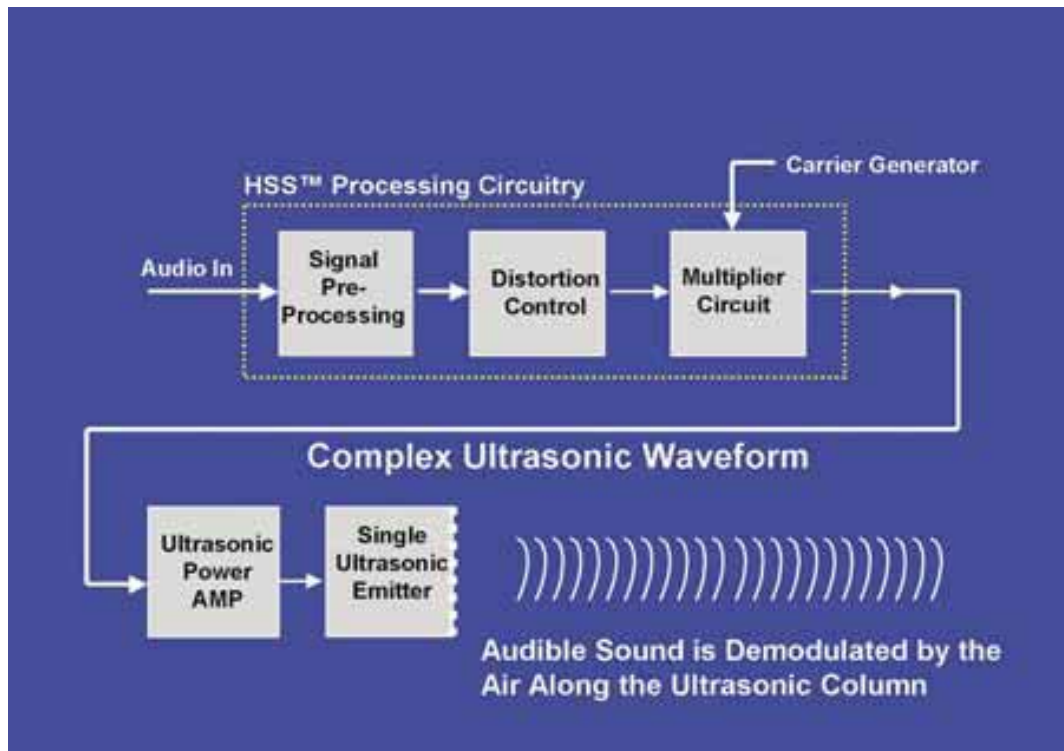
The Helmholtz experiments were further explained 150 years later by Westervelt (Brown University) and Blackstock (University of Texas at Austin). They proved that the new tones were the result of propagation distortion caused by the air itself.

Moving Fundamental Tones Beyond Range of Hearing

“What if we move the two fundamental tones beyond the range of hearing?” If, for example, we could project 40 kHz and 41 kHz tones into the air, the physics tell us that we would produce a “sum tone” of 81 kHz, (well beyond the range of hearing) and a “difference tone” of 1 kHz which we can hear. Since we do not often listen to sine waves, our founders decided to find a method to produce complex wave sounds in the air such as voice or music.

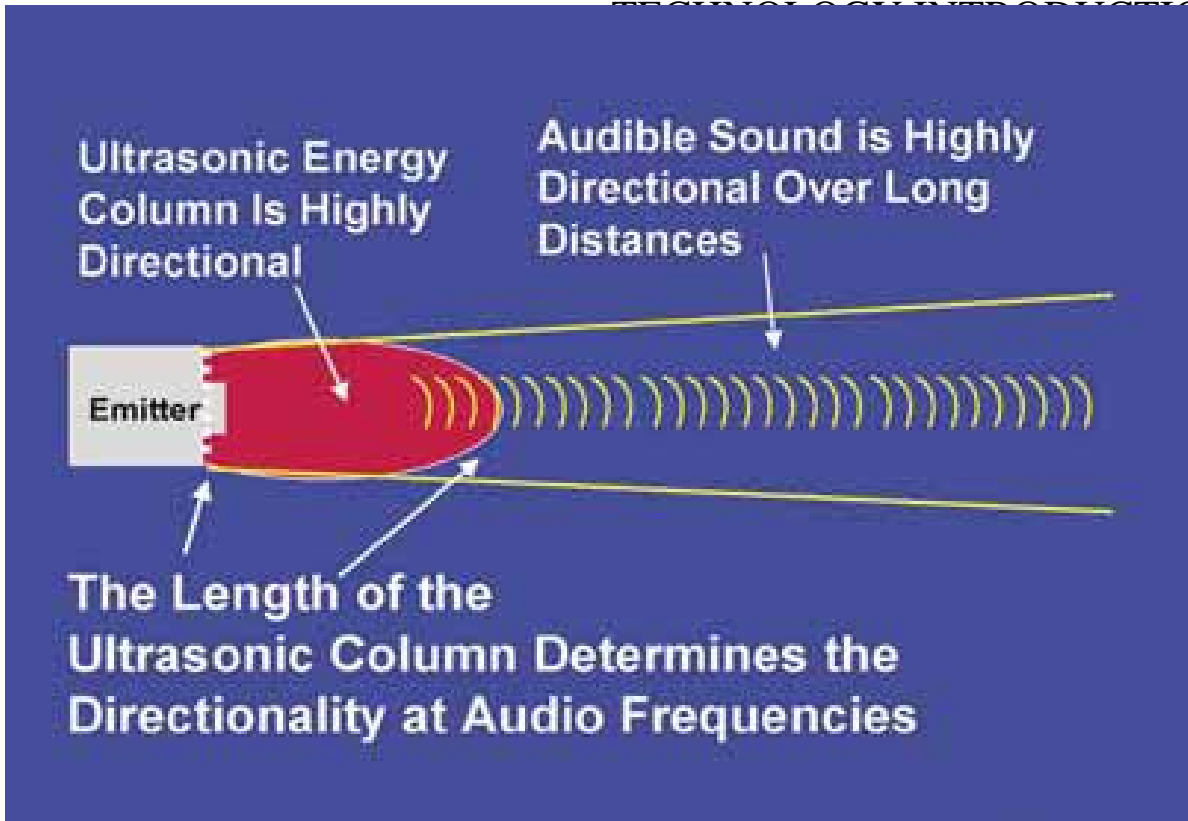
We developed a set of electronics that produces a complex waveform containing all the required components to make difference tones in the air, and then project that waveform from a single, ultrasonic emitter!

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Basic HSS Block Diagram

And that is the basis of HyperSonic Sound technology. Audio is sent to a proprietary electronic preprocessor circuit, distortion control circuit, and then through a multiplier circuit where a composite ultrasonic waveform is produced. This ultrasonic signal is then amplified and sent directly to a proprietary emitter device. A column of ultrasonic energy is produced in front of the emitter which contains all required properties for the air to produce audio frequencies or sound that we can hear. Audible sound is demodulated all along this column of ultrasonic energy.



Ultrasonics & Audio

As the ultrasonic sound wave dissipates, the sound pressure level of this wave will fall below the air's threshold of non-linearity and will no longer produce difference tones (audible sound). Audible sound is demodulated by the air all along the column of ultrasonic energy and continues to propagate far beyond the region of the ultrasonic energy.

The length of this useful ultrasonic column can be referred to as the "Effective Beam Length" and can be controlled by adjusting the carrier frequency and array configuration. A longer effective beam length will provide greater directionality.

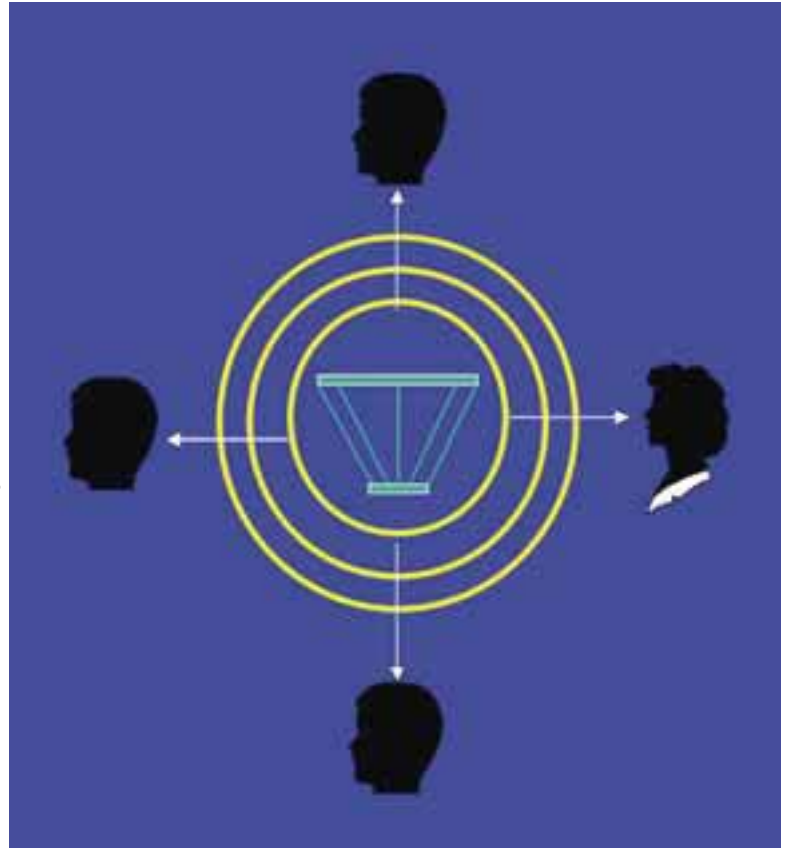
This brings us to the first major benefit of HyperSonic Sound - controlled directionality. The audio is highly directional because it is created in a virtual end-fired array (the ultrasonic energy column). This end-fired array is relatively long because the ultrasound is highly directional.

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Conventional Loudspeakers

Think of a conventional loudspeaker for a moment. It basically radiates sound in all directions. It does not matter where the listener is positioned, he will always hear the sound from the loudspeaker. You can point directly at the loudspeaker from anywhere in a room and say “that is where the sound is coming from.”

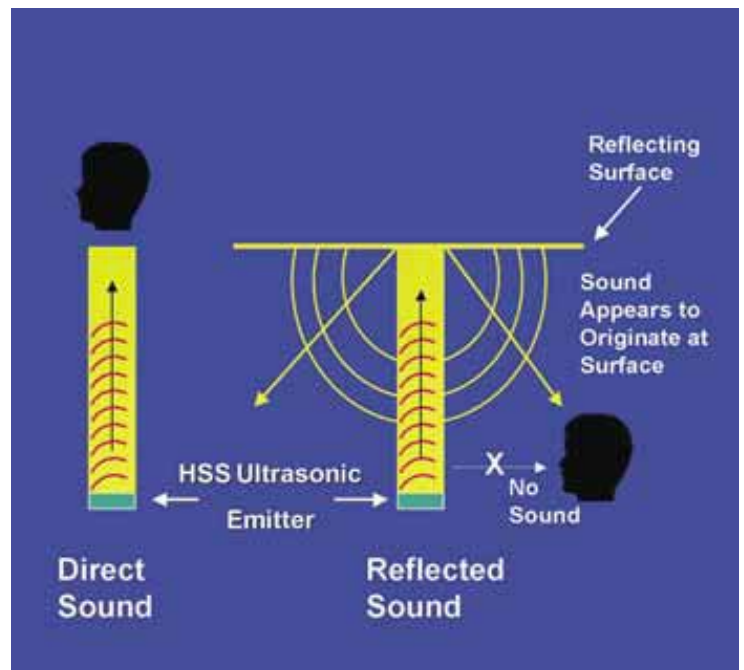
We might think of the loudspeaker as a light bulb. A light bulb spreads light in all directions, just as a loudspeaker spreads sound in all directions.



Direct Sound versus Virtual Source Sound

HSS™, however, is more similar to a flashlight. If you project the HSS emitter device directly towards a listener, he would hear the sound formed in the column of ultrasonic energy just like he would see the light from a flashlight, if it was aimed directly at him. However, if a listener stands to the side of an HSS emitter, he only hears the sound that is reflected from a boundary surface, just like he would see the light of a flashlight only when it is reflected off the wall. Since the listener does not hear any sound from the emitter itself, he hears only the sound that is reflected from the wall.

Never, in the history of loudspeakers have we been able to apply this degree of controlled directionality to audible sound.



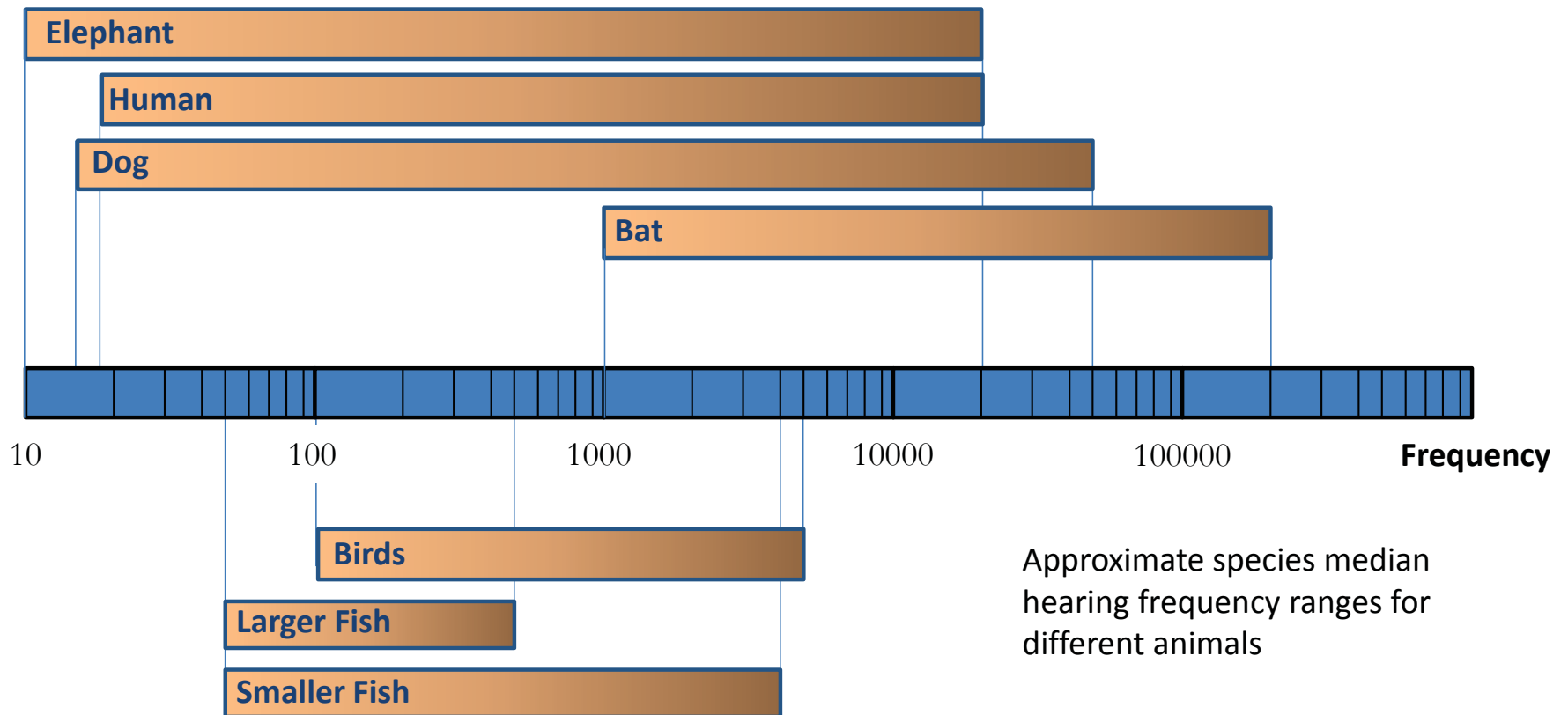
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HyperSonic Sound Technology Benefits

<p>Ultrasonic Emitter Devices</p>	<p>Not only has the conventional speaker’s crossover network and enclosure been eliminated, but HSS’ ultra-small radiating ultrasonic emitter is so small and light-weight that the inertial considerations ordinarily associated with traditional direct-radiation speakers are virtually non-existent. (And so is just about everything else associated with the conventional speaker: the voice coil and support structure normally used to attach the moving cone in place.)</p> <ul style="list-style-type: none"> • Small & light weight • No magnets or voice coils • Easy to mount, very thin & flat • No cabinets, boxes or housings required • No Mechanical Vibration or Microphone coupling • No back wave emissions, can be surface mounted
<p>Controlled Directionality (Directivity)</p>	<p>Using HSS Technology, designers could control the vertical and horizontal size of the ultrasonic energy column. Sound could be “focused” directly at the listening audience, reducing the reflections and destructive interference from the surrounding walls, floor, and ceiling. For the first time in history, we can largely ignore the negative effects of room acoustics on sound reproduction.</p>
<p>Project audio over long distances while maintaining intelligibility</p>	<p>Since the projection of HSS over long distances does not follow the traditional Inverse Square Law, HSS is ideal for long distance audible communications.</p> <p>HSS will maintain intelligibility for hundreds of feet, far more than any conventional speaker system. Since SPL is significantly maintained for long distances, the SPL at the emitter can begin at a lower level than conventional speakers. We no longer need to deafen those close to the speaker in order to communicate long distances.</p>
<p>Reduce microphone / speaker feedback</p>	<p>One byproduct of the non-linear de modulation process is a break in the traditional microphone / speaker feedback loop. Live microphones can be used with HSS with improved feedback immunity.</p>
<p>Technology paradigm shift</p>	<p>This is change to build and market something “truly new”. Your customers require the benefits of HSS and they will be excited by the marketing potential of a technology paradigm shift.</p>

Animal Hearing Frequency Ranges



CONFIDENTIAL



Woody Norris

Elwood “Woody” G. Norris won the 2005 \$500,000 Lemelson-MIT Prize as inventor of the year. He holds 47 U.S. patents with more than 100 pending patents worldwide. Woody Norris is widely recognized as prolific inventor and a talented technology integrator. His interest in electronics started at a young age, with rigorous experimentation method of inventing that he continues to this day.

He joined U.S. Air Force in 1956 and was trained as a Nuclear Weapons Specialist, specializing in electronic fusing systems. He studied electronics in the University of New Mexico. After his honorable discharge in 1959, he began employment at the University of Washington where he continued his practical education, elevating his position from technician to Director of the Engineering Experiment Station for the campus within two years.

Upon conceiving his first commercial invention in 1970, Mr. Norris left the university and embarked on entrepreneurial career. He invented a phonograph tone arm that initially was developed for a contest, and was later sold for \$20,000.

Many of Mr. Norris’s inventions are not just single product ideas, they shatter technology barriers creating multiple applications and a lasting impact. Among those technical breakthroughs is HyperSonic® Sound (HSS®) a revolutionary directional loudspeaker that focuses sound to a specific location. It also shapes the sound wave to fill on a predetermined area as much as a spotlight narrows its beam. He also developed and patented Flashback, the first digital recording technology that allowed digital recording of information on non-volatile flash memory rather than tape. He is also the inventor of the Transcutaneous Doppler System (U.S. Patent #3,631,849) commonly known as the sonogram, and has licensed the technology to Medical Development Corporation (later acquired by American Hospitals).

Mr. Norris invented and patented over 20 other diverse product ideas and technological breakthroughs. In 1980, he founded American Technology Corporation (ATC), where currently works as Chairman, as a means to promote his inventions.