VOLUME 35, ISSUE 10 AUGUST 2022

VOICE COIL

THE PERIODICAL FOR THE LOUDSPEAKER INDUSTRY

IN THIS ISSUE

Focus

China + 1 Audio Manufacturing Sourcing Series

The Philippines

By Mike Klasco (Menlo Scientific, Ltd.)

Most sourcing specialists have been on a mission to find alternative vendors outside China ever since the US imposed heavy tariffs in 2018. But in the preceding years, pricing of Chinese products had already began to ramp up. The status quo of the established and often deep relationships between Chinese factories and western brands was further shaken with the pandemic. The strict lockdowns in Dongguan, Shanghai, and Beijing, concurrent with the closure of the largest Chinese shipping ports for months, has dramatically impacted the global supply chain. The reduction in shipping capacity resulted in both long shipping times as well as literally a 10x increase in transpacific container pricing.

The most simple solution was to just spread speaker production to Malaysia, Vietnam, Thailand, the Philippines, or even look further to India, Cambodia, or Myanmar. Yet China's strength is in its infrastructure for both materials and component supply such as magnets, low carbon steel, speaker cones, voice coil winding, and more. If your speaker assembler is outside of China, most likely it will be facing the same or worse challenges in supply of critical parts from Chinese parts manufacturers as Chinese speaker assembly factories.

Many of these alternatives to mainland China factories are recently established, or have greatly expanded since the tariffs. COVID-19 has not helped the maturing of the workforce, and the high transpacific shipping costs and delays from everywhere in Asia remain.

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		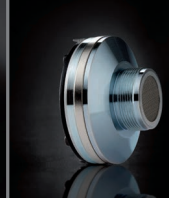	

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audioxpress VOICE COIL LIS LOUDSPEAKER INDUSTRY SOURCEBOOK

August 2022
ISSN 1521-091X

Head Office:
KCK Media Corp.
Phone: (434) 533-0246
P.O. Box 417, Chase City, VA 23924

US Advertising:
Strategic Media Marketing, Inc.
2 Main St., Gloucester, MA 01930 US
Phone: (978) 281-7708
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E-mail: voicecoil@smmarketing.us
Advertising rates and terms available on request.

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Subscriptions:
Voice Coil, The Periodical for the Loudspeaker Industry, is published monthly by KCK Media Corp. Subscriptions to Voice Coil are available in print and digital versions. To subscribe, please visit our website at www.voicecoilmagazine.com and complete a qualification form. Qualified subscriptions run for two years.

When you qualify, you will receive an e-mail confirming your subscription with a link to your account. From your account, you can manage your subscription, update your address, and digital subscribers can access the current issue along with archived issues.

For those overseas, the cost of a printed subscription is $150.00 per year.
Order your subscription online at www.voicecoilmagazine.com.

Questions/Problems can be sent to: customerservice@circuitcellar.com

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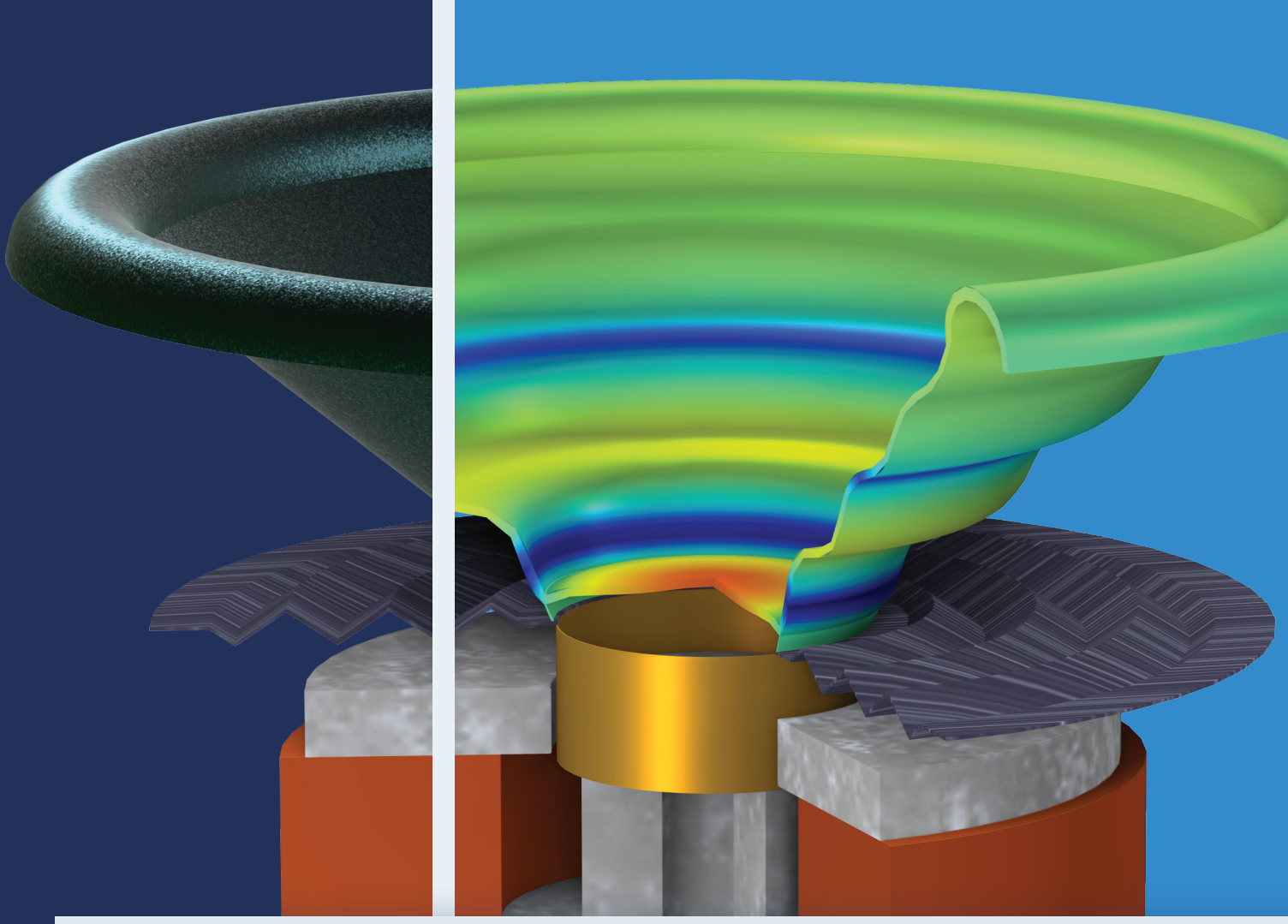
Editorial Dept., P.O. Box 417, Chase City, VA 23924.
Fax material to: (888) 980-1303 or E-mail: editorial@audioXpress.com

Printed in the United States



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For these reasons and many more, we won't be completely leaving China anytime soon, thus the strategy of China +1. Vietnam looked be a good bet due to its close proximity to China and close access to parts supply via air, sea, or land. Back in the September 2019 issue of *Voice Coil*, we explored the rapid growth of speaker assembly and audio products manufactured in Vietnam, yet many of these satellite factories are still shaking out the bugs. English communications can be a struggle and without the factory visits that usually are needed to straighten out tough issues, the problems have been compounded by Vietnam's pandemic border closures, although for the time being that has finally passed.

Another Pacific Rim contender is the Republic of the Philippines, a democracy in Southeast Asia just south of Taiwan. The Philippines and the US are treaty allies under the Mutual Defense Treaty. The Philippines is the oldest security ally of the US in Southeast Asia and one of the five treaty allies of the US in the Pacific region. Most trade to the US is a few percent and most of the factories discussed in this article ship from the Special Economic and Free Trade Zones, such as the Cavite, Subic Bay, and Clark ports.

The Philippines is also the only country in Asia where English is the official business language, including for correspondence, contracts, and other documents. The most westernized country in Asia, it was part of the Spanish Empire for more than 300 years. After the Spanish-American war, the Philippines became a US territory for almost half a century (from 1898 until 1946). Sharing maritime borders with Taiwan to the north, Japan to the northeast, Indonesia to the south, Malaysia to the southwest, Vietnam to the west, and China to the northwest. The Philippines population is around 109 million people, making it the world's 13th most populous country.

Dai-ichi

I have been traveling to the Philippines for the last 30 years working with Dai-ichi and AV-Leader. Dai-ichi Electronics Manufacturing was originally founded in 1972 as Micro Global Manufacturing Co.—a speaker parts kit assembly operation. By 1976, it had expanded and changed its name to Dai-ichi, initially producing only price-driven OEM speakers. Gradually, Dai-ichi built a reputation for consistent quality and reliable delivery, focusing mainly on the Philippines' domestic market.

In the late 1980s, Dai-ichi began to offer significantly higher quality OEM speakers. The management, led by its founder, Pablo Tobiano, opted for higher end products because the market was overrun by inferior goods from neighboring countries. Tobiano graduated with a degree in Electronic engineering, which enabled him to recognize the industry's rapid transition from tubes to transistors, and he decided to focus on speakers where evolution was more gradual.

Tobiano worked for Pioneer in Japan (1968) and was involved in Completely Knocked Down (CKD) and Semi Knocked Down (SKD) processes for amplifiers, speaker systems, tape decks, record players, and car stereo production in Philippines and other countries. Years later, Dai-ichi had a joint venture with Panasonic for driver production and export back to Japan and was a subcontractor manufacturer supplying Foster of Japan.

During the early 1990s, Dai-ichi began a strong R&D push that continues today. I began my consulting services with Dai-ichi in 1992 on a handshake, and we celebrated 20 years together with an island-hopping tour in July 2012, and now after 30 years we are celebrating …..COVID.

For the Philippines, a new opportunity to flourish has arrived. Western buyers who once sourced from the Philippines are returning to the country for a second look. Existing customers are expanding the product lines Dai-ichi produces for them. For buyers and engineers looking for alternatives, this update on Dai-ichi will provide some insight into its current capabilities.

Dai-ichi still focuses on the details that many of China's companies do not easily handle. Typically, it is Dai-ichi's in-house component vertical production that provides the capacity to take on products with unique parts bin requirements. For example, a couple speaker brands have offered motorized, premium in-wall and ceiling speakers, which Dai-ichi provides. Dai-ichi also supplies outdoor speaker product lines, ribbon planar speakers for several high-end brand customers (as well as developed and produced the legendary OPPO PM-1 ribbon planar headphones).

Dai-ichi winds its own voice coils and even does in-house wire flattening for its wound on edge wire coils. Also in-house are state-of-the-art cone and spider fabrication, injection and roto-molding, a wood working factory, electroplating and powder coating, and other vertical operations. This is especially relevant for not just higher grade and complex projects but for stable production and delivery avoiding erratic supply from China. Dai-ichi's main factory, R&D and offices are in Manila, with a production facility in the Cavite free-trade zone shipping port, just outside of Manila.

There is no issue with engineers migrating to competing companies and so new product development remains within the company, which is quite compelling. Even the most honest factories in China have engineers who leave with their customers' trade secrets and future product plans.

Dai-ichi has taken a more profitable direction by developing design and production skills that differentiate its OEM factory from its competitors. It offers greater process control, including tighter production tolerances (especially for tweeters), higher power handling, and higher sensitivity. The company also offers unique products (e.g., planar speakers, weatherproof speakers, and high-excursion woofers). Dai-ichi has also taken a balanced geopolitical approach, building production bases in both the Philippines and in Shanghai, China. The unique, high-end products are made in the Philippines, while in Shanghai the focus is on high production runs of conventional speakers, using automated production lines.

The Shanghai base specializes in car audio systems, indoor/outdoor speakers, in-wall/in-ceiling speakers, marine speakers, and home hi-fi systems. The Philippines operation does R&D and tooling, short runs of high-value products (e.g., motorized in-wall speakers for top brands, high output woofers, OEM production of high-end ribbon line array movie theater speaker systems, and other products with high intellectual property levels). Recently, Dai-ichi

added Radian Audio, a compression driver manufacturer in California, to the mix of its production capabilities.

AV-Leader

Another top manufacturer, AV-Leader, a well-known ODM/OEM of professional microphones and headphone offerings, also has its production base in the Philippines. Founded by CEO and owner Linda Kuo in 1988, with corporate and R&D offices located in New Taipei City, Taiwan.

To understand AV-Leader means getting to know Linda Kuo. In the 1980s, Kuo was the marketing manager at a large microphone factory. She recognized the opportunity to make "real" professional microphones, including measurement microphones. Kuo did not like what she saw as many companies began shifting production to China. She wanted trustworthy subcontract vendors and her understanding of the intellectual property control issues as engineers changed companies convinced her to base AV-Leader's production in the Philippines.

During my first visit to AV-Leader about 30 years ago, I was horrified to see what I thought were perfect counterfeit microphones of many quality brands. I asked Kuo—someone with great integrity—how she could rationalize building for pirates. She responded that she had no interest in counterfeiters, and they had no interest in her products because they were too expensive. So everything being built was for the actual brands. Back in September 2002, I wrote a *Voice Coil* profile on AV-Leader, calling Kuo "the Queen of Microphones" and I updated the profile in the June 2013 issue.

While much has changed, much is also the same. Kuo is still a perfectionist, loved by her staff but she is very demanding. Going to lunch or dinner at a fancy restaurant with Kuo is a treat—she immediately takes charge. After everyone sits down, she heads to the kitchen for final "outgoing quality control"—vegetables fresh with not too much oil, and meat properly cooked. But my favorite story, which is also the best indication of Kuo's personality, took place when I was watching her inspect her factory's production of a German brand's professional microphones as she questioned various aspects of the run. A tall, gray-haired engineer from the customer's company finally yelled to her in his thick German accent: "Linda, it is good enough!"

Over the years, AV-Leader has become known for its exceptional microphone work; however, other efforts have focused on headphone and in-ear monitors (IEMs). Although AV-Leader is focusing on OEM products co-developed with its customers, it also offers a range of open headphone and earphone tooling to new customers who want a short time to market with minimal development costs. Products with open tooling include DJ, broadcast, audiophile, and fashion headphones. Headphone drivers include in-house and high-grade, Japanese-sourced components.

Its production base, Subic Technics, was established in Subic Bay, the Philippines, in 1994. Anyone serious about sound has probably used microphones, headphones, or other professional audio products produced by AV-Leader. Most of the leading European microphone

brands use AV-Leader as a crucial parts vendor for labor-intensive quality microphones.

AV-Leader's supply chain and operation are different from the almost universal Taiwan transplant model that utilizes Chinese production. Instead small custom craftsman shops near her Taipei Hsien office on the outskirts of Taipei are used. These are trusted long-term vendors she has worked with for decades, and the components they machine for AV-Leader are inspected, staged, and shipped to the Subic Bay operation for final assembly. Once the components arrive, 100% of them receive anechoic chamber testing. Conveniently, Subic Bay Airport is a few minutes from her factory.

Subic Bay has a wide range of hotels, and there are other many resorts in the area. The US Naval Base at Subic Bay was a major ship-repair, supply, and rest and recreation facility for the US military. In fact, the naval base was the US's largest overseas military installation after Clark Air Base in the Philippines.

The base "officially" closed in 1991 although there always seemed to be a lot of US Navy personnel and equipment, including nuclear subs, hanging around. In any case, the naval base was converted into the Subic Bay Freeport Zone (SBFZ), a tax and duty-free zone. AV-Leader moved its operations there in 1994. In 2012, the Philippine government said the US military could use the base, as long as prior approval was granted. Today, Subic Bay hosts US ships, aircraft, and personnel on a semi-permanent basis.

Other international audio companies in the Philippines include Sonion and Knowles, which produce balanced armature earphone and hearing air transducers; Grandsun, which builds earphones and headphones; AAC, which makes microspeakers; and Kaertech, which makes earphones and electronics. (See the directory for contact information.)

Philippines Audio Factory Directory

AAC Technologies
Cavite Philippines, General Trias, PH Cavite
Contact: Daniel Jansson (Director of Marketing, AAC Technologies, DanielJansson@aactechnologies.com)
www.aactechnologies.com/en

AAC Technologies Holdings, Inc. is one of the leading microspeaker manufacturers whose main operations are in China, but in recent years it has diversified its operations throughout Asia. In 2014, AAC Optics Philippines was established in Gateway Business Park in General Trias, Cavite for microspeakers.

AV-Leader Corp.
No. 24, Lane 90, Guiyang St, Taishan District
New Taipei City, Taiwan 243
Contact: Linda Kuo (President & General Manager, lindak@avleader777.com.tw)
https://avleader.com.tw

Corporate HQ and engineering is in New Taiwan City, while the factory division is Subic Technics in Subic Bay Freeport Zone (SBFZ) Philippines. AV-Leader is a famous OEM/ODM for professional microphones and headphones whose headquarters and engineering is in Taiwan and manufacturing has been long established in Subic Bay Philippines.

Dai-ichi Electronics Manufacturing Corp.
160 Floor, Mariano Ave, Pasig, 1612 Metro Manila Philippines
Pasig City and Cavite, Philippines
Contact: Pablo Tobiano CEO (ptobiano@daiichielectronics.com)
www.daiichielectronics.com.ph

Dai-ichi is a highly respected OEM and ODM for many leading speaker brands, both consumer and pro-sound. One of the only "organic" speaker factories in the Philippines, Dai-ichi was established more than 40 years ago.

Grandsun Advanced Electronics Phils. Co., Inc.
Panorama Building I, Panorama Compound Lima Technology Center, SEZ, Apolinario Mabini St., Santiago, Malvar Batangas 4233
Contact: Giovanni Gapasin (Vice President Operations, giovanni@grandsun.com)

Grandsun is a Chinese transplant manufacturing of earphones and headphones in the Philippines.

Kaertech Electronics Philippines, Inc.
Building 3, EZP Compound Laguna Technopark, Biñan, 4024 Laguna, Philippines
Contact: International Representative Dave Lindberg (lindberg@db-ent.com)

Kaertech is an OEM/ODM manufacturer of earphones, speaker systems, and audio electronics.

Knowles Corp.
Cebu Light Industrial Park, Basak, Lapu-Lapu City
Cebu Philippines
info@knowles.com | www.knowles.com

Knowles is famous for its pioneering development of MEMS mics and balanced armature transducers for earphones, hearing aids, mobile phones, and IoT devices. Knowles has manufacturing sites in various locations including the Philippines.

Sonion Philippines, Inc.
First Philippine Industrial Park, Inc. Lot 30-A Phase 1B, Road Lot 8. Barangay Ulango Tanauan City, Batangas Philippines 4232
P: +63 43 430 8888
Contact: Greg Hovland (Key Account Manager at Sonion)
sonionph@sonion.com | www.sonion.com

Since 1974, Sonion's components and solutions have been helping people listen to each other, to their bodies, to their environment and to the world. ***VC***

Directory

Global Voice Coil Winders and Converters 2022

By Nora Wong (Menlo Scientific, Ltd.)

US Voice Coil Winders

Precision Econowind, Inc.

8940 North Fork Drive, North Fort Myers, FL 33903
P: 866-856-4783 or 239-997-3860 | www.precisioneconowind.com
Contact: Terry Tingley, President (ttingley@precisioneconowind.com)
info@precisioneconowind.com

Most of the coils wound at Precision Econowind in Florida are high-temperature automotive aftermarket and pro audio coils. Many of the automotive aftermarket coils are flat aluminum wire in four- and eight-layer dual, quad, and parallel dual configurations with diameters ranging from 2″ to 8″. Precision Econowind makes many high-temperature flat and round wire coils, and several of them are shipped off to China to be built into high-performance subwoofers. The pro-sound coils are mostly high-temperature edge-wound coils for companies in the US, Canada, Europe, and South America. Automotive OEM coils are sourced from Po-Yun.

Asian Voice Coil Winders

The following is a brief overview of many of Asia's Voice Coil winders. A few of these vendors are "converters" and sell coated bobbin materials, coated magnet wire, collar materials, adhesives, and such to other independent coil winders and to speaker manufacturers that wind their own coils. We have converters, leadout flex wire vendors, magnetic fluid, and other special components listed at the end of the directory.

A-TON Industrial Co., Ltd.

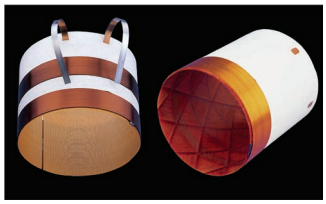
98/57–60 Moo 11, Putthamonthon 5 Rd., Raiking District
AmphurSampran, Nakhonpathom, Thailand 73210
P: 662-811-8860 | www.aton.co.th/product/voice-coils
marketing@aton.co.th

A-TON achieved success by establishing itself in Thailand and received notoriety by specializing in relatively low-cost flat wire voice coils. While the US speaker industry initially had trouble adjusting to the metric sizes, US designers warmed to this, especially for tweeters. A-TON has been strictly a coil winder, not a converter or wire house, but recently expanded to dampers (spiders) and woofer surrounds and tweeter diaphragms. A-TON's sister operation is P-Audio, a pro-sound speaker manufacturer.

AudioStar (HuiZhouAudioStar Electronics Co.)

North LianfaDadao, Tongqiao Town, Zhongkai Hi-Tech District, HuiZhou City, Guangdong, China 516032
P: +86-752-3882-999 | www.audiostar.cn
audiostar@audiostar.com.cn or mina@audiostar.cn

Founded in 1999, this Chinese operation is run by a sophisticated engineer-owner. AudioStar is a medium-size voice coil winder offering specialty products (e.g., high-power voice coils). The company also provides commodity voice coils to service its customers' requirements. AudioStar passed ISO/TS 16949:2002 quality system certification in 2005. More recently, the company introduced automated production and test systems and opened a new factory. By virtue of technology, equipment, and process improvements, the voice coil quality and consistency is very good and cost remains competitive. AudioStar's raw material is imported chiefly from Denmark, UK, US, Japan, and Germany and it is RoHS compliant.



BOWI Industry Co., Ltd.

Head Office: Room 2103, C-Block, Hebang Building, 899 Tiantong North Rd., Yinzhou District, Ningbo, China

Branch Office: Room 1502, Good Hope Building No. 2 Zhongxing Northern Rd., No. 601, Yuecheng District, Shaoxing, China
P: +86-575-88960068 | www.cn-bowico.com
Contact: judy@cn-bowico.com or sales@cn-bowico.com

Bowi Industry Co., Ltd./Shaoxing Youming Import and Export Co., Ltd.

Room 1107, Building 2, Haowang Mansion, Didang St. Yuecheng District, Shaoxing City, Zhejiang Province, China 31200
P: 0086-575-88969548
www.cn-bowico.com or www.bowielectronic.com
Contact: sales@cn-bowico.com or sales@bowielectronic.com

BOWI manufactures voice coil materials: cone paper, enameled wire, voice coil winding machines, TSV-TIL film-coated SV glue, KSV-polyimide film, and other parts.

FSK (Thailand) Co., Ltd. (formerly Suzuki Kanshi)

3 1/2 Moo 2, Banmoh, Phromburi, Singburi 16120 Thailand
P: +66-36-598111 | www.skt-bobbin.com
Contact: Tomo Shimakawa (tomo@foster.co.jp)

Founded in Japan in 1966, Suzuki Kanshi expanded to Thailand in 1997. In October 2017, the company was acquired by Foster Japan and the name was changed to FSK (Thailand) Co., Ltd. FSK is a quality converter specialist in voice coil materials and parts fabrication (e.g., bobbins and collars).

(Shenzhen) Guangn Nan Electronic Co., Ltd.

No. 30, BuChong Industrial Zone, ShaJing Town, BaoAn District, ShenZhen City, GuangDong Province, China
P: 0755-2-726-8862 | www.gonna.cc
voice@gonna.cc

(Suzhou) Guangn Nan Electronic Co., Ltd.

No. 8, CaiJiaBang Rd., GuoXiang Town, Wooing District SuZhou City, Jiangsu Province, China 215000
P: 86-512-6708-1499 | www.gonna.cc

Guangn Nan (Gonna) is based in Shenzhen and is a voice coil wire vendor and a converter (a supplier of bobbins and other voice coil materials). The company was established in 2000

and it opened a second factory in Jiangsu Suzhou in 2006. The company is a one-stop shop for components to fabricate coils—voice coil bobbin materials, voice coil skeleton material, SV self-adhesive enameled wire, (super) high-tension self-sticky line, copper-clad aluminum self-adhesive coated voice coil wire, all kinds of flat wire, stripping agents, white and blue gum, and other infrastructure and supporting material.

Goto Electronic

Established in Japan in the early 1960s, Goto opened its first Chinese branch in Shanghai in 1980 and a Mexican operation in the mid-1980s. Goto in South China was established in 2001, bringing down the cost of Goto's high-performance flat and square wire and high-temperature coils and making them more accessible to Chinese speaker factories. Goto is a vendor for square wire for voice coils and perhaps most famous for its high power flat wire woofer coils. Goto Electric has several locations:

Goto California, Inc.
6120 Business Center Court, Suite F 200, San Diego, CA 92154
P: 619-691-8722 | www.goto-california.com

Dongguan Huangjiang Goto Co., Ltd.
128 Industrial Park, Huangjiang, Huangjiang, Zhenbanhu Guang Dong, China
P: +86-769-8363-7601

Goto Electronic (Shanghai) Co., Ltd.
121 Jingang Rd., Pudong New-Area, Shanghai, 201206 China
P: +86-(21)-5032-5121

Goto Japan
5340, Inabu Ina-Shi, Nagano, Japan 3960011
P: 0081-265-72-3869 | www.goto-denshi.com
Contact: Hiroaki Goto (info@goto-denshi.co.jp)

HaiYun Electronics Co., Ltd.

Shuguang Rd., Chenjiang Town, Huizhou City, Guangdong Province, China
P: +86-752-389-8319 | www.haiyun.biz
Contact: Chen Yi (pyszdzgs@public.szptt.net.cn)

HaiYun offers a range of voice coils from medium price to high-power high-performance coils. Huizhou Haiyun was established in 1999 in Shenzhen.

MingYang Voice Coil

No. 151, Chang An Wei Chang Long Village, Huang Jiang Town, DongGuan City
GuangDong Province, China
P: +86-769-83514466 |
http://mingyangvc.com
Contact: Mr. Yang
(jason@mingyangvc.com)

Founded in 2003, MingYang Voice Coil is located in Dongguan City. The company

is focused on R&D, production, and sales of high-powered voice coils. High-power flat wire, round wire, and other materials are imported from the US, Germany, Japan, and other countries. Advanced production and testing equipment improve the technical level of the company and ensure the reliability and long-term stability of product quality.

Nikkei Electric (Shanghai) Co., Ltd.
No. 11 Lane, 1175 Tongpu Rd., Shanghai, China 200333
P: 21-52702721 | www.shnikkei.com/english
yingye@sh-nix.com

Nikkei Electric (Shanghai) Co., Ltd., whose precursor was a Chinese-Japanese joint venture named Shanghai Nix Electronics Co., is a company specializing in developing, manufacturing, and selling voice coils. Nikkei Electric produces low-end voice coils with "Lock" lower temperature adhesives (130°C) and some SV medium temperature and high-temperature coils.

Po Yun
Headquarters—Taipei Office: 6th Floor, No. 506-4 Yuansan Rd., Chung-Ho, Taipei Hsien Taiwan
P: 886-2-2221-4959 | www.poyun.com
tpsales@voicecoil.com or tpsales@poyun.com

China Office: No. 355, Xu Pan Rd., Xu Hang Town, JiaDing District Shanghai, China 201809
P: +86-21-3-953-3322
Contact: Chang Pen Min (changpenmin@poyun.com)
Factory: Yu Ning Industrial Zone, Heng Li Town, Dong Guan City Guang Dong Province, China 523460
P: +86-769-8-372-0950
Contact: Walter Lee (Overseas sales, walterlee@poyun.com), Frank Lo (Domestic sales and marketing, frank@poyun.com), Yoken Chen (Yin Chen factory sales and marketing, yoken@poyun.com)

Po Yun is one of the top contenders in the Asian voice coil business. The company was established in 1979 with its headquarters in Taipei, Taiwan. The main manufacturing facilities are located in Shanghai, Dongguan, and Vietnam. In the US, Po Yun coils can be sourced from Precision Econowind.

US Agent (Precision Econowind, LLC)
8940 North Fork Drive, North Fort Myers, FL 33903
P: 239-997-3860 | www.precisioneconowind.com
Contact: Terry Tingley (President, ttingley@precisioneconowind.com)

Precision Econowind assists the US customer base with communication, quality monitoring, technical support, stocking issues, distribution, quotes, and sample requests.

Shu Kae Industrial (M) Sdn. Bhd.
20/21, 22/21, 24/21, 26/21, 28/21
Taman Gurun, Jaya 08300 Gurun, Kedah
P: 886-4-4686261 | http://shukae.com
Contact: shukae@szonline.net

Shu Kae was established in Taiwan in 1977 and opened plants in China and Malaysia. Shu Kae vertically expanded

with slitting, die cutting, and coating bobbins. Shu Kae developed its own magnet wire insulation and outer bond coat, establishing a magnet wire insulation and outer bond coating operation in 1987. Shu Kae supplies speaker factories with adhesive-coated bobbin materials as well as its self-bonding magnet wire for in-house voice coil winding.

Zenith Audio Electronics Co., Ltd.
Ju Long Science & Industrial Park, Tian Xin Village, Huang Jiang Town, DongGuan City, 523763
info@audiovoicecoil.com | www.audiovoicecoil.com

Dongguan Zenith Audio Electronics Co., Ltd., was founded in 1996 and offers a range of specialized coil techniques from inside/outside bobbin winding, wet winding process, ribbon, and high-power coils.

European Voice Coil Manufacturers

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Via Maestri Del Lavoro, 23-60010 Ripe (AN) Italy
P.I./C.F. Registro Imprese 02098350420 REA AN 160875
www.boxal.it | info@boxal.it

Boxal is a professional voice coil winder for several pro-sound speaker brands. The company's product range includes fiberglass bobbins with round aluminum or copper-clad aluminum wire (CCAW) and also copper wire. With more than 30 years of experience, Boxal's customers are the top European speaker factories. Its manufacturing machinery is made in-house.

Converters, Lead Out Wire, and Magnetic Fluid Suppliers

(Sharp-eyed readers will notice a number of the converters also manufacture finished voice coils and are already listed.)

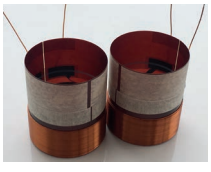
estron a/s
Industrivej 5, DK-8653 Them, Denmark
P: +45 86 84 88 77 | www.estron.dk/products | info@estron.dk

estron offers revolutionary lead-out wires for long-term durability that are ideal for small- and mid-range speakers. estron pioneered the litz wire industry more than 25 years ago. Today, estron is famous for high-quality litz wires, miniature connectors and plugs, and ultra-fine cable solutions. The components are used in hearing aids, earphones, and security—all demanding applications requiring the most reliable operation.

Ferrotec (USA) Corp.
33 Constitution Drive, Bedford, NH 03110
P: 603-472-6455
www.ferrotec.com | https://ferrofluid.ferrotec.com
Contact: Vanessa M. Rene (Senior Product Specialist, vanessa.rene@ferrotec.com)

Ferrotec (formerly Ferrofluidics) is the developer and world leader in the supply of magnetic fluids for voice coil air gaps in speaker drivers. Thermally conductive, enabling approximately four times the thermal power handling of air alone as well as enhanced voice coil centering, magnetic fluids are found in almost all tweeters, and many compression drivers.

FSK (Thailand) Co., Ltd. (formerly Suzuki Kanshi)
3 1/2 Moo 2, Banmoh, Phromburi Singburi 16120 Thailand
P: +66-36-598111 | www.skt-bobbin.com
Contact: Tomo Shimakawa (tomo@foster.co.jp)



Founded in Japan in 1966, Suzuki Kanshi expanded to Thailand in 1997. In October 2017, the company was acquired by Foster Japan and the name was changed to FSK (Thailand) Co., Ltd. FSK is a quality converter specialist in voice coil materials and parts fabrication (e.g., bobbins and collars).

Guangn Nan Electronic Co., Ltd. (Shenzhen)
No. 30, BuChong Industrial Zone, ShaJing Town, BaoAn District, ShenZhen City, GuangDong Province, China
P: 0755-2-726-8862 | www.gonna.cc
Contact: voice@gonna.cc

Guangn Nan Electronic Co., Ltd. (Suzhou)
No. 8, CaiJiaBang Rd., GuoXiang Town, Wooing District, SuZhou City, Jiangsu Province, China 215000
P: 86-512-6708-1499 | www.gonna.cc

Guangn Nan (Gonna) is based in Shenzhen and is a voice coil wire vendor and a converter (a supplier of bobbin and other voice coil materials). The company was established in 2000 and it opened a second factory in Jiangsu Suzhou in 2006. Guangn Nan Electronic Co. is a one-stop shop for components to fabricate coils—voice coil bobbin materials,

voice coil skeleton material, SV self-adhesive enameled wire, (super) high-tension self-sticky line, copper-clad aluminum self-adhesive coated voice coil wire, all kinds of flat wire, stripping agents, white and blue gum, and other infrastructure and supporting material.

Jung Shing Wire Co., Ltd.

No.231, Sec. 3, Chung-cheng Rd.
Jen-teh District, Tainan City
71757, Taiwan
P: (886)6-270-5211 #332
www.jswire.com.tw
sales@jswire.com.tw

Founded in 1971, Jung Shing Wire Co., Ltd. is a joint venture with Furukawa Magnet Wire Co., Ltd. The company's headquarters is located in Tainan City, Taiwan with three overseas production facilities in Dongguan and Suzhou, China, and Vietnam. Magnet wires are the main products focusing on microspeaker and loudspeaker applications with diameters ranging from 0.05mm to 1.00mm; and the total capacity is more than 1,000 tons per month. JS Wire specializes in customized products and has developed new eco-friendly materials. Its SV self-bonding magnet wires are UL certificated and are supplied to customers worldwide.

Maeden International, Ltd.
8th Floor, No. 588, Ruiguang Rd., Neihu District
Taipei City 11492, Taiwan
P: 886-2-8797-7966 | www.maeden.com.tw/en
Contact: Emily Lin (emily@maeden.com.tw)

Maeden is famous for high-performance lead-out flex wire from the voice coil to the speaker terminals. High power, long flex life, and other enhanced characteristics has positioned Maeden as a leading go to vendor for more critical applications.

New England Wire
130 North Main St., Lisbon, NH 03585
P: 603-838-7042
Contact: Melissa Poore (Marketing Manager)
www.newenglandwire.com/service/litz-wire

New England Wire offers an extensive range of Litz wire.

Shu Kae Industrial (M) Sdn. Bhd.
20/21, 22/21, 24/21, 26/21, 28/21, Taman Gurun, Jaya
08300 Gurun, Kedah
P: 886-4-4686261 | http://shukae.com
shukae@szonline.net

Shu Kae was established in Taiwan in 1977 and later opened plants in China and Malaysia. Shu Kae vertically expanded with slitting, die cutting, and coating bobbins. Shu Kae developed its own magnet wire insulation and outer bond coat, establishing a magnet wire insulation and outer bond coating operation in 1987. Shu Kae supplies speaker factories with adhesive-coated bobbin materials as well as its self-bonding magnet wire for in-house voice coil winding. ***VC***

Directory

Magnet Vendors and Distributors Directory 2022—The Americas

By Mike Klasco (Menlo Scientific, Ltd.)

Next month *Voice Coil* will publish its magnet report and the international listings. But since most of the developments have been in the US (for once!) and include neodymium (neo) manufacturing plants and neo recycling facilities as well as next-generation magnetics (e.g., Niron), we have decided to separately list these pioneers, as well as the established US, Canadian, and South American manufacturers and distributors for magnet materials.

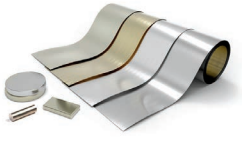
Alliance, LLC
1450 Clark Drive, Valparaiso, IN 46385
P: (219) 548-3799 | https://allianceorg.com
sales@allianceorg.com | support@allianceorg.com

Alliance Is a leading supplier of permanent magnets for products made in the US, including custom-designed magnetic assemblies using neodymium, AlNiCo, SmCo, and ferrite magnets. Valparaiso, IN, is not just home to Alliance, but for more than a century has been ground zero for the magnetics industry and a rich source of magnetics knowledge.

Allstar
6205 NE 63rd St., Vancouver WA, 98661
P: (360) 693-0213 | https://allstarmagnetics.com
sales@allstarmagnetics.com | saleseast@allstarmagnetics.com

Allstar Magnetics is a leading industry expert in magnetic manufacturing offering customers a strategic partnership centered on its expertise in prototype engineering, production, and manufacturing services, and global distribution and shipping arrangements.

Arnold Magnetic Technologies
Permanent Magnet Division and Headquarters:
770 Linden Ave. Rochester, NY 14625
P: (800) 593-9127
www.arnoldmagnetics.com/speakers-microphones



Arnold Magnetic Technologies is an engineering solutions company that manufactures high-performance permanent magnets, flexible magnets, electromagnetics, magnetic assemblies (including rotors, stators and motors) and precision thin metal foils as thin as 2 microns. With more than a century of high-tech materials development, today Arnold offers the speaker industry neodymium iron boron magnets for speakers, headphones and microphones, alnico magnets for guitar pickups, titanium, beryllium, and other thin metals for speaker domes, and magnetic viewers for tape restoration. Arnold is a US-based corporation with locations in the US, United Kingdom, Switzerland, and China.

Bunting
500 South Spencer Rd., Newton, KS 67114
P: (800) 835-2526 or (316) 284-2020
newton@buntingmagnetics.com | www.buntingmagnetics.com

Headquartered in Newton, KS, Bunting has multiple locations including Bunting-Elk Grove Village; Bunting-DuBois; Bunting-Berkhamsted and Bunting-Redditch in the United Kingdom; Victoria, Australia; and Ningbo, China. Manufacturing operations in Newton focus on the design and manufacture of magnetic separation, metal detection, and material handling equipment.

CMS Magnetics, Inc.
1839 Wall St., Garland, TX 75041
P: (972) 516-0692 or (866) 342-1300
Contact: Kelly Jones (East Coast, kjones@cmsmagnetics.com) or Jeff Lee (West Coast, jefflee@cmsmagnetics.com)
www.cmsmagnetics.com

Established in 1999, CMS Magnetics Corp. specializes in providing various magnetic materials. CMS offers significant advantages in price, delivery, and other terms. Warehouses in Dallas, TX, and Romulus, MI, provide all types, grades, shapes, and dimensions of magnets including neodymium magnets, ceramic magnets, flexible magnets, AlNiCo magnets, and SmCo magnets.

Dexter Magnetic Technologies
1050 Morse Ave., Elk Grove Village, IL 60007
P: (847) 380-1333 | Info@DexterMag.com

Dexter has been partnering with customers to deliver innovative magnetic solutions for more than 60 years and is a leader in the specification, design, and fabrication of magnetic products and assemblies.

ECI
53 Main Line Drive, P.O. Box 1536, Westfield, MA 01086
P: (413) 562-7684 | www.eciworld.com/contact

ECI is a global designer/manufacturer of custom electromagnetic components. From its facilities in the US and Europe, ECI supports worldwide markets ranging from consumer and commercial to military and aerospace. ECI is an international manufacturer of electromagnetic components supplying OEMs.

Ferrotec (USA) Corp.
33 Constitution Drive Bedford, NH 03110
P: (603) 472-6455 | https://ferrofluild/ferrotec.com
Contact: Vanessa M. Rene (Sr. Product Specialist—ferrofluids, vanessa.rene@ferrotec.com)

Magnetic fluids, the first nano-materials consisting of coated magnetite particles in a carrier fluid. Developed for speaker applications by Ferrofluidics (now Ferrotec), the fluids are used in essentially all tweeters and many compression drivers. Ferrofluid in the voice coil gap confers higher thermal power handling and enhanced coil centering.

National Magnetics Group, Inc.
1210 Win Drive, Bethlehem, PA 18017-7061

P: 610-867-7600 | www.cmi-ferrite.com
sales@magneticsgroup.com

The National Magnetics Group of companies manufactures technical ceramics (magnetic and advanced materials) and powdered iron cores.

Neo Materials
Suite 1740, 121 King S. West, Toronto, ON, Canada M5H 3T9
P: (416) 367 8588 | www.neomaterials.com

Neo Materials manufactures advanced industrial materials, which serve as the building blocks of many modern technologies that deliver enhanced efficiency and sustainability. The company specializes in magnetic powders and magnets, specialty chemicals, metals, and alloys.

Niron Magnetics
650 Taft St. NE, Minneapolis, MN 55413
www.nironmagnetics.com
Contact: Tom Grainger (Director, Strategy & Business Development, tom@nironmagnetics.com)

Niron Magnetics was founded in 2014 as a spinoff of the University of Minnesota and has developed an advanced manufacturing process for the mass production of proprietary Iron nitride magnets. Inherently higher magnetization can be produced at a lower cost compared to today's rare-earth magnets. Ground was broken in February for Niron's prototype production facility. Construction is on track for occupancy of the manufacturing space for fall 2022 and commissioning in the first half of 2023.

Noveon Magnetics, Inc.
1550 Clovis Barker Rd., San Marcos, TX 78666
https://noveon.co | contact@noveon.co

Urban Mining Company (UMC) is now Noveon Magnetics, a US domestic manufacturer of neodymium-iron-boron (Nd-Fe-B) magnetic materials, products, and systems. It is the sole manufacturer of Nd-Fe-B rare earth magnets in the US and the only producer globally that uses alternative, abundant resources—waste magnetic materials—to support Nd-Fe-B magnet manufacturing. Noveon is currently operational and has the capability to produce both virgin and recycled magnets.

Supergauss
Rua D. Aguirre, 607, Santo Amaro, 04671390 São Paulo, Brazil
P: (11) 5693-6322 | https://supergauss.com.br/en/home-en
Contact: Rogério Pireangelo (supergauss@supergauss.com.br)

Supergauss, founded in 1971, is the largest ferrite magnet manufacturer in Latin America and has much of the magnet business for autosound speaker factories in the region.

TSC Ferrite International
39105 North Magnetics Blvd., Wadsworth, IL 60083
P: 847-249-4900 | www.tscinternational.com
sales@tscinternational.com

TSC International is a manufacturer of magnetic materials for markets including automotive, computer, lighting, telecommunications, instrumentation, industrial and consumer product industries. Combined, TSC International has 125,000 square feet of manufacturing space and 70 presses. ***VC***

Acoustic Patents

By James Croft (Croft Acoustical)

The following loudspeaker-related patents were filed primarily under the Office of Patent and Trademarks classification 181 for acoustical devices and 381 for electrical-signal processing systems and HO4R for international patents. This also includes new patent applications that are published in the *Patent Application Journal*.

Title: Linear Motor Magnet Assembly and Loudspeaker Unit
Patent Publication Number: 2022/0191621
Inventors: Timothy Ruben Scheek (Amsterdam, NL)
Assignee: Mayht Holding B.V.
Filed: July 18, 2019
Current International Classes: H04R 9/06 20060101 H04R009/06
Granted/Published: June 16, 2022
Number of Claims: 17
Number of Drawings: 5

Abstract from Patent

A linear motor magnet assembly 2 for use in a loudspeaker unit 1, with a fixed base actuator component 4 and a membrane actuating element 5, the membrane actuating element 5 having a linear excursion axis A. A first auxiliary magnetic element 7 and a second auxiliary magnetic element 8 are present, the first auxiliary magnetic element 7 providing a first auxiliary spatial magnetic field with a major axis aligned with the linear excursion axis A. The second auxiliary magnetic element 8 is fixedly connected to the membrane actuating element 5 of the linear motor magnet assembly 2 and has a second auxiliary spatial magnetic field, the second auxiliary magnetic field overlapping the first auxiliary spatial magnetic field and being substantially similarly oriented as the first auxiliary spatial magnetic field over a first predetermined excursion range E1 of the linear motor magnet assembly 2.

Independent Claims

1. A linear motor magnet assembly for use in a loudspeaker unit, the linear motor magnet assembly comprising a fixed base actuator component and a membrane actuating element, the membrane actuating element having a linear excursion axis (A), the linear motor magnet assembly further comprising a first auxiliary magnetic element (7) and a second auxiliary magnetic element, the first auxiliary magnetic element providing a first auxiliary spatial magnetic field with a major axis aligned with the linear excursion axis (A) of the linear motor magnet assembly, the second auxiliary magnetic element being fixedly connected to the membrane actuating element of the linear motor magnet assembly and having a second auxiliary spatial magnetic field, the second auxiliary magnetic field overlapping the first auxiliary spatial magnetic field and being substantially similarly oriented as the first auxiliary spatial magnetic field over a first predetermined excursion range (E1) of the linear motor magnet assembly.

Reviewer Comments

Last month, we reviewed one of the early Mayht patents covering their general bipolar, interleaved multiple motor structure architecture that is the basis for a number of their stated claims in terms of performance and packaging.

This month's entry is a continuation of the series of reviews on the new Mayht transducer technology recently acquired by Sonos for the tidy sum of $100 million dollars. We will delve into their most recent US publication (June 16, 2022), which addresses the most dramatic claim of all "Air pressure issue solved," with the ability for the transducer technology to allow a contravention of Hofmann's Iron Law and provide a greater-than 10× reduction in enclosure volume, while maintaining the same efficiency and bandwidth as compared to the current state of the art.

If this aspect of their technology were found to be valid and it could achieve this level of miniaturization without a significant cost or performance penalty, one could argue, that no other loudspeaker company would be able to compete with this >10-to-1 scale of advancement.

As previously mentioned, the Mayht topology in general appears to be a useful innovation relative to efficient packaging, such that it may allow a slightly smaller device for a given performance. But to achieve anything that could provide at least a 3-to-1 size advantage, and certainly if it can achieve a 10-to-1 size reduction, a sophisticated technological advancement would have to be applied. Historically, the substitution of the internal atmosphere with specialized gasses, heated, Freon-filled absorption fibers, and advanced materials, has tended to be limited to enclosure expanding conferrals of less than 3-to-1, and most of those have included undesirable side effects, such as high levels of damping, which ultimately undermined any potential gains.

To achieve something anywhere near to a 10-to-1 reduction in enclosure volume has only been approached theoretically, or realized in the lab, in a manner that was not practical as a real-world device. The two methods that have at least suggested a possibility of overturning Hofmann's Iron law, (where it is known that to have an improvement in any one of efficiency, bass bandwidth, or enclosure volume requires a commensurate compromise in one or both of the remaining parameters) have been that of a stabilized vacuum enclosure, or a negative spring applied to the woofer diaphragm, to offset the stiffness of the enclosure air spring. The first of the two solutions, the vacuum enclosure with a positive spring counterbalancing force, while exhibiting the greatest theoretical potential, is fraught with a variety of practical problems, from maintaining a vacuum seal to dealing with crushing forces on the diaphragm and suspension components, and, much more.

The Negative Spring systems, as we have discussed in previous reviews, operate based on having an additional apparatus built into a transducer, which applies a force that is in opposition to the air spring of the enclosure. A simple example form of a mechanical negative spring is an old-fashioned light switch, or toggle-switch, where it is very difficult to hold it in the center position; as it has a tendency to pop in one direction or the other. This same concept is

applied to the moving system of a woofer, wherein when it moves into the enclosure, the "negative spring" pushes the diaphragm into the enclosure, ideally with an opposite and complementary force to the stiffness of the air volume of the enclosure, overcoming that air spring stiffness. Same thing happens when the woofer cone moves outward, wherein the negative spring would help overcome the increasing vacuum applied to the diaphragm. If one could make this bi-directional, negative spring have just the right spring force and also the ability to remain stable and steady in its center position, they would potentially have a working system that, from the standpoint of the low-frequency driver, could make the enclosure seem larger than it really is.

Some negative spring experiments have at least shown some promise in the lab, and there have been hundreds of attempts to create practical devices since the first efforts in the mid-1950s, but to-date these have continued to elude some of the most brilliant minds in the business, with nary a single product based on this technique ever making it to market.

With the negative spring based systems, the "anti-spring" portion can be realized with three different techniques: a mechanical negative spring, as with the light switch analogy; a pneumatic negative spring (e.g., two balloons being pushed together and tending to move in one direction or another); and a magnetic negative spring, arranged to use either a multiple magnet repelling force, or attracting force, to assist pushing or pulling the woofer diaphragm into, or out of, the enclosure.

The invention disclosed in the current Mayht patent application publication is a means to reduce enclosure volume while maintaining efficiency and bass bandwidth by applying an additional "auxiliary" magnetic system to enhance the transducer's ability to overcome enclosure air spring stiffness by using this magnetic system as a compliance augmentation device. (Going forward, any references to "auxiliary magnetic elements 7 and 8" identifies the additional magnetic components added to form the "negative magnetic spring".)

As stated by the inventor: *"The present invention provides in various embodiments a device using a combination of at least two permanent magnets to improve the performance of a linear motor actuator system by effectively decreasing the enclosure and suspension stiffness over the complete excursion range of the linear motor, effectively decreasing the power needed by the linear motor system to travel over the excursion range. The present invention provides in various embodiments a device using a combination of at least two permanent magnets to improve the performance of a linear motor actuator system by decreasing the stiffness over the complete excursion range of the linear motor, effectively decreasing the power needed by the linear motor system to travel over the excursion range."*

Figure 1a shows a cross sectional view. **Figure 1b** shows a perspective view of one embodiment of the present invention loudspeaker unit 1 having two opposing membranes 3, each being driven by two linear motor magnet assemblies 2, on opposite corners of the transducer where the additional compliance enhancing magnet structures have also been implemented.

The magnet assembly 2 comprises a fixed base actuator component 4 and a membrane-actuating element 5 (such as a voice coil or a mobile magnet in a moving magnet based motor). The fixed base actuator component 4 is mechanically connecting two axially aligned magnetic elements 7 and 7* which are part of the linear motor magnet assembly 2. The material of the fixed base actuator component 4 is of a non-magnetic material, ensuring a proper magnetic field distribution for cooperation between the two axially aligned magnetic elements 7, 7* and a membrane actuating element 5.

The membrane-actuating element 5 is moveable and has a linear excursion axis A, (i.e., the direction in which the membrane 3 moves up and down). Upon actuation, the membrane-actuating element 5 moves the magnetic assembly 2 that is connected to the membrane 3. The motor magnet assembly 2 further comprises a first auxiliary magnetic element 7 (one of the two axially aligned magnetic elements 7, 7*) and a second auxiliary magnetic element 8. The first auxiliary magnetic element 7 provides a first auxiliary spatial magnetic field with a major axis aligned with the linear excursion axis A of the motor magnet assembly 2. The second auxiliary magnetic element 8 is fixedly connected to the membrane actuating element 5 of the linear motor magnet assembly 2 and has a second auxiliary spatial magnetic field. The second auxiliary magnetic field overlaps the first auxiliary spatial magnetic field and is substantially similarly oriented as the first auxiliary spatial magnetic field over a first predetermined excursion range E1 of the linear motor magnet assembly 2.

Loudspeaker unit 1 has two opposing membranes 3

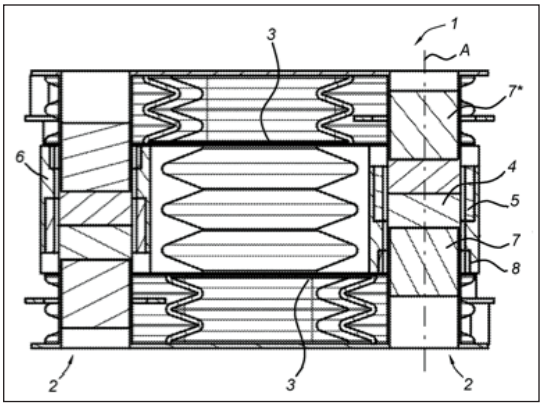


Figure 1a: This image shows a cross-sectional view of the invention with two opposing membranes, each being driven by two linear motors and additional compliance increasing magnet assemblies.

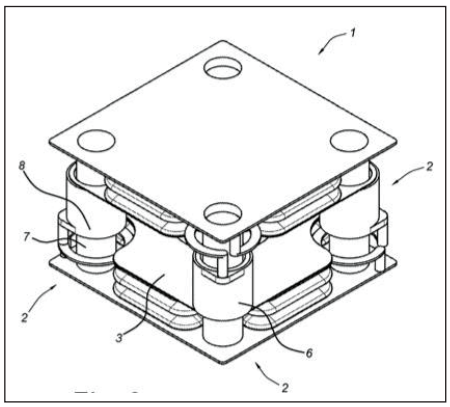


Figure 1b: This image illustrates a perspective view of the invention with two opposing membranes, each being driven by two linear motors and additional compliance increasing magnet assemblies.

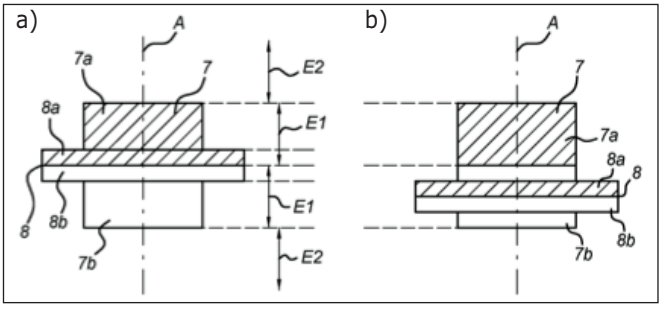


Figure 2: Figure 2a and Figure 2b show an example of the repulsion version of the permanent magnet compliance enhancing structure in two operational situations.

that are placed on the upper and the lower surfaces of the loudspeaker unit 1. The base element of each of the membranes 3 is structurally connected to two linear motor magnetic assemblies 2 at two of the diagonal ends of the membrane 3. As shown in Figure 1b, the base element of the lower membrane 3 is structurally connected by two different linear motor magnetic assemblies 2 that are positioned on both of the membrane's lower diagonal ends and the base element of the upper membrane 3 is structurally connected by two different linear motor magnetic assemblies 2 that are positioned on both of the membrane's upper diagonal ends. The effect of this combination of features is an increasing magnetic force (or a reduced stiffness) in the excursion direction in the first predetermined excursion range (i.e., the first and second auxiliary magnetic element are aiding in overcoming the suspension force and air compression forces in the loudspeaker unit 1). The second auxiliary magnetic element 8 is attached to the membrane actuating element.

In an additional embodiment, the second auxiliary magnetic element 8 is positioned at a first distance along the linear excursion axis A from the membrane-actuating element 5. **Figure 2a** shows an operational situation in which the second auxiliary magnetic element 8 is positioned at the center of the first auxiliary magnetic element 7 along the linear excursion axis A. **Figure 2b** shows an operational situation in which the second auxiliary magnetic element 8 is positioned away from the center of the first auxiliary magnetic element 7 along the linear excursion axis A, representing a movement of the actuating element, or voice coil, making an excursion for which the auxiliary magnetic elements augment the movement of the voice coil with an additional force, used to offset at least a portion of the enclosure and suspension stiffness.

Another form of the invention relates to the linear motor magnet assembly, wherein the first auxiliary magnetic element 7 has a predetermined shape, providing a predetermined first auxiliary spatial magnetic field profile over the excursion range of the linear motor magnet assembly. The predetermined shape can be a double (e.g., truncated) cone shape with a largest diameter at a middle part of the first auxiliary magnetic element 7. This can be implemented by having one of the magnets as a cone shaped magnet, wherein that shape creates a magnetic field of varying strength over the excursion. This is said to allow the system to more efficiently control the relative movement of the second auxiliary magnetic element 8 with respect to the first auxiliary magnetic element 7 considering the varying strength of the magnetic field.

Figure 3 shows a cross-sectional view of a linear motor magnet assembly in accordance with a further variation of the present invention, comprising two magnetic bodies 7′ opposed to each other forming the first auxiliary magnetic element, with a magnetic body 8′ forming the second auxiliary magnetic element positioned in between such that a permanent magnet 8′ is mounted on the membrane of the loudspeaker unit, and static magnets 7′ are placed above and beneath the membrane. As opposed to the previous embodiments, where the repulsion of two magnets with like polarities, the Figure 3 embodiment represents a center magnet with an opposite polarity relative to the outer magnets, such that the center magnet, connected to the diaphragm, is attracted to the lower magnet on an inward diaphragm movement caused by the voice coil and the primary motor system and attracted to the upper magnet during and opposite, an outward diaphragm movement caused by the voice coil and the primary motor system.

The last seven paragraphs represent essentially the full teaching of the patent. Any additional text appears generally repetitive and doesn't appear to teach any substantial novelty or basis for how to fully optimize such a negative magnetic spring system. If it has any unique aspects, it would seem they are focused on how prior art magnetic negative spring concepts can be adapted to the Mayht transducer architecture.

For example, **Figure 4** is one of the earliest prior art magnetic negative spring woofer systems from a German patent filed in 1967, DE1,299,327B, "Lautsprecher mit Kolben insbesondere Konusmembrane" (Loudspeaker with Particular Cone Piston Diaphragm) by Edmund Meyer, assigned to Isophon Wereke.

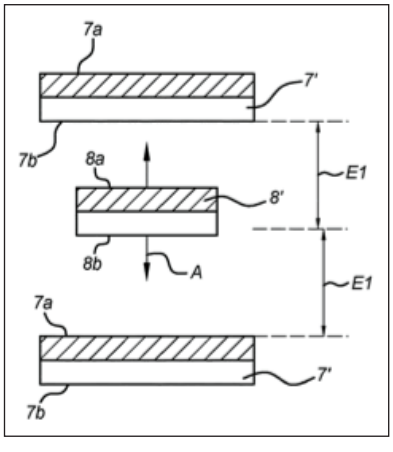


Figure 3: Here is a cross-sectional view of a magnetic attraction version of the additional compliance enhancing magnet assembly.

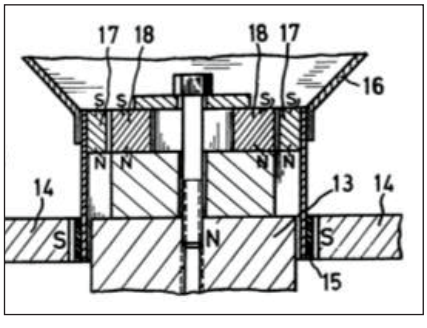


Figure 4: This illustration is from one of the earliest prior art, compliance enhancing, negative magnetic spring patents.

It can be seen in Figure 4 that the conventional portion of the motor includes the voice coil 15 located in the magnetic gap between magnet 13 and the magnetic return top plate 14. The additional, auxiliary, ring magnets 17 (mobile and attached to the neck of the diaphragm 16) and 18 (fixed and attached to the center pole piece) are coaxially aligned, and magnetized with the common polarities adjacent each other when the diaphragm is in the resting position. It can be seen that magnet 17 would be unstable and have a tendency to move in repulsion from stationary magnet 18, applying a force to the diaphragm 16, compelling it to move up or down. Ideally, when mounted in an enclosure, as the program signal would cause the voice coil 15 to urge the diaphragm into the enclosure, compressing the enclosed air spring, the mobile auxiliary magnet 17 would add an additional force, "assisting" the movement of the diaphragm against the air spring and into the enclosure. The opposite action would happen upon the program signal moving the diaphragm out of the enclosure with the auxiliary magnet 17 adding force to offset the air spring (and suspension) from keeping the diaphragm from moving out of the enclosure.

While at first this seems like an excellent expedient toward overcoming the air spring stiffness of the enclosure, there are many troublesome issues that must be overcome to make the system practical. The first, and foremost, is that of the instability of the auxiliary magnets and their tendency to move off-center relative to the constant magnetic forces, independent of the program signal. In any of these systems, if the auxiliary magnetic forces are so powerful as to be adequate to the task of overcoming the air spring stiffness of a small enclosure, then they will also have a greater tendency for instability. Therefore, any negative spring based transducer, must also have an additional device of some type that can compensate for the instability.

Figure 5 is a prior art magnetic negative spring woofer from a 2003 patent, US6,574,346, "Bass Reproduction Speaker Apparatus" by Shoji Tanaka, assigned to Matsushita Electric. Its auxiliary magnetic circuit is very similar to that of the German patent in Figure 4, with mobile magnet 133 attached to the voice coil former and repelling from the common polarity of the fixed magnet 134, but in this device a Hall element senses any offset with feedback to a power amplifier in order to correct for any unstable mobility unrelated to the program input signal. This approach and other separate systems, such as slow reacting air pumps raising or lowering the pressure at a less than 5Hz rate, have been applied in an attempt to correct for any drift in diaphragm position. Such a system and negative spring devices in general, are explored in a paper in the *Journal of the Acoustical Society of America* in 1971, written by Terrance Matzuk from Gulf Research, and titled: "Improvement of Low-Frequency Response in Small Loudspeaker Systems by Means of the Stabilized Negative-Spring Principle."

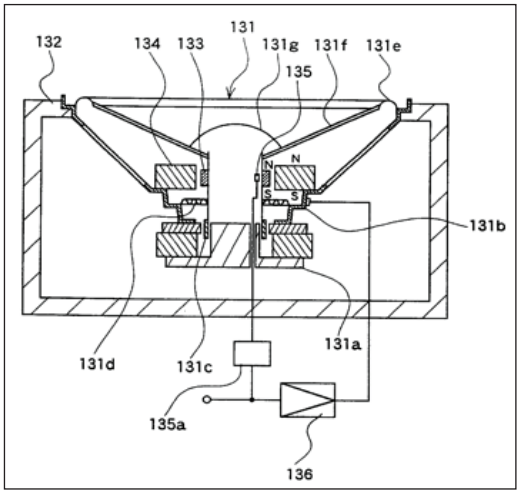


Figure 5: This illustration of a prior art shows magnetic repulsion architecture of a compliance enhancing negative magnetic spring from US6,574,346.

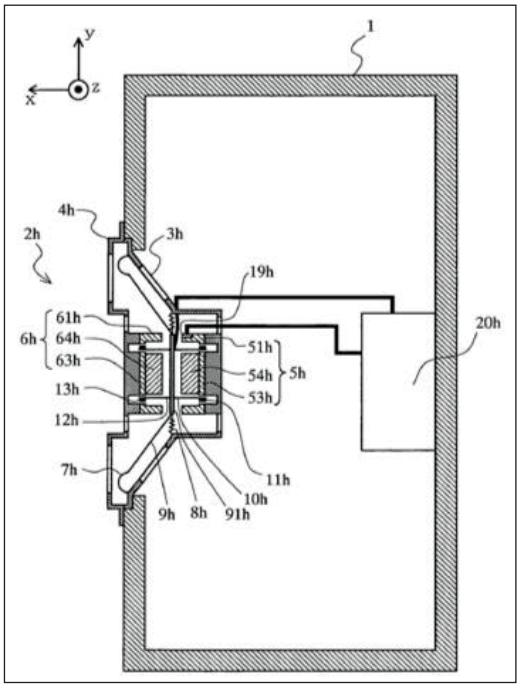


Figure 6: This illustration of a prior art exhibits magnetic attraction architecture of a compliance enhancing negative magnetic spring.

A second issue with negative spring devices is that of getting the "spring rate," or change in stiffness relative to change in diaphragm position, of the magnetic counter-force, to match that of the suspension and air spring in the enclosure over an adequate range of excursion. With the repulsion type magnetic negative springs, the magnet force tends to be very strong as it first moves off-center, but gets weaker with extended excursions, as the centers of magnetic force move farther apart from each other. For short excursions the spring rates can be matched more easily, but for any significant diaphragm excursions, which will tend to be greater in these smaller, "negative spring, miniaturized" devices, for a given output the issue becomes more problematic usually requiring larger auxiliary magnetic structures in an attempt to at least minimize the problem.

This is where some explorers of this concept have abandoned the "repulsion" approach and have used additional magnets to an attempt to utilize magnetic "attraction" instead.

A third issue is that the addition of the auxiliary magnet being attached to the voice coil bobbin or neck of the diaphragm, can substantially increase the moving mass of the transducer, which can reduce efficiency in a system that has the goal of maintaining efficiency, while extending low frequencies.

The prior art device in **Figure 6** shows a magnetic negative spring

woofer from a patent filed in 2005, US7,724,915, "Speaker Device" by Toshiyuki Matsumura, and Shuji Saiki, assigned to Panasonic Corp. This system offers an alternative approach in an attempt to address the second and third issues.

It can be seen in Figure 6 that stationary magnets 64h and 54h are above and below the diaphragm 9h, which has a center portion 91h of the diaphragm, which is made of magnetic material other than a magnet, such that as the diaphragm is driven by voice coils 11h and 13h, the magnetic material of the diaphragm is "pulled" with additional force in the same direction to help offset the air spring stiffness of the enclosure. In this case, the force of the auxiliary magnets on the diaphragm increases as the diaphragm gets closer to magnet 64h or 54h, which can complement the air spring stiffness increasing as the diaphragm moves further in either direction.

A magnet could be used in place of the magnetic material 91h, but in this embodiment of the prior art patent, 91h uses a magnetic material other than a magnet to reduce the moving mass impact of a magnet.

Of course, any magnetic material, such as iron or permalloy sheet will have greater mass than standard diaphragm materials, but potentially much less than the magnet. This prior art patent also teaches the use of a variety of different types of sensing and feedback stabilization systems to help maintain the behavior of the fundamental instability of the negative spring system. With each of these additional variations of this system type, there have historically been pitfalls that have not been overcome, at least not in a practical manner that resulted in a net advantage over a conventional system.

Many years ago, a very talented engineer and owner of a prominent subwoofer company, shared his stories of the long and painful attempt to realize a practical negative spring woofer system. By the time he increased the negative spring rate to adequately overcome the air spring of the enclosure and provide significant reductions in enclosure volume, the feedback correction power required to maintain stability and keep the woofer from getting "stuck" all the way at one excursion extreme or another, required more amplifier power than was required to merely equalize a conventional, optimized driver in the same, small-sized enclosure. I'm certain that this effort has been duplicated many times at various loudspeaker companies over the years.

This brings us back to Mayht and their magnetic negative spring patent and the reference to their claim of greater than a 10x reduction in enclosure volume. While the patent puts forth a good starting point for developing a compliance enhancement system, as many patents have done in the past, it certainly doesn't teach how to reduce this type of system to practice in a manner that addresses the various additional issues that cannot be ignored if one is to have a successful outcome.

There are no specification of any of the forces and magnetic and air stiffness relationships, no measurements or specificity in claimed outcomes, and no mention of any supplemental electronics that may be required to control and stabilize the system.

The Mayht patent claims *"to provide a more energy efficient linear movement system" and "the permanent magnets being placed in a way that the combined magnetic fields of the permanent magnets of the permanent magnet system counter the increasing stiffness over the excursion of the linear motor actuator system."* It uses both the repulsion magnetic layout and a magnetic attraction approach where a permanent magnet is on the membrane of the loudspeaker unit, and static magnets are placed above and beneath the membrane.

The basic architecture is in place to achieve some level of a compliance enhancement effect, but it is difficult to determine the effectiveness of the system as disclosed. Additionally, in this reviewer's interpretation, it would appear that the primary independent patent claim substantially describes the prior art, so it may be difficult to get the US Patent and Trademark Office (USPTO) to grant their application as it stands currently.

Overall, it is still an exciting proposition, and again, one would have to assume that Sonos applied significant diligence and achieved substantial verification before writing the check. But, one can only presume that a greater than 10× reduction in enclosure volume would require significant additional magnetic counter force, which would cause even greater instabilities, such that if this is a practical system as claimed, we will be learning much more about how the device is optimized and most likely will be reviewing another much more in-depth patent describing those details. ***VC***

B&C Speakers DE111-8 1” Pro Sound Compression Driver

By Vance Dickason

The first transducer I examined this month, the DE111-8, came from Italian OEM manufacturer B&C Speakers. This ultra-compact neodymium motor compression driver (**Photo 1**) is the latest addition to B&C Speakers’ extensive 19 model ferrite (11) and neo (8) motor 1” exit compression drivers. In terms of features, the B&C Speakers DE111-8 is designed for use with 1” throat horns, which means it has a 25mm (1.0”) throat diameter and a HT Polymer diaphragm driven by a 36mm (1.4”) diameter voice coil wound with aluminum wire on a high Qm non-conducting former driven by a neodymium ring magnet, plus a 1.2kHz recommended crossover frequency (second-order or higher high-pass filter).

The DE111 is a new variant of the DE110, offering a lower crossover frequency of 1.2kHz with its updated Ketone polymer suspension and dome. This compact 60mm diameter compression driver has a 2.83V/1m 107dB sensitivity and 50W continuous power handling making this tiny driver universally applicable for a variety of small monitor and PA applications. This also makes the DE111-8 an ideal candidate for the new generation of lighter, more compact line array loudspeakers.

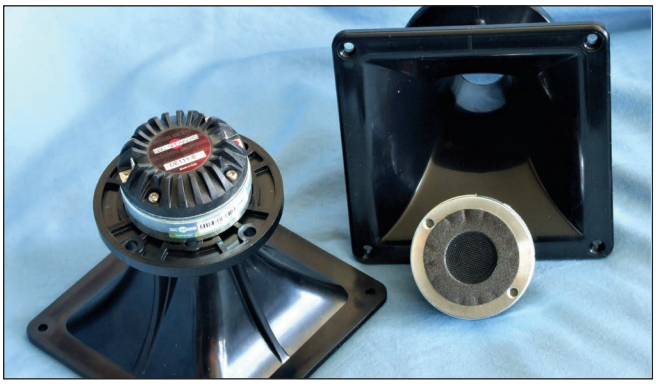


Photo 1: B&C Speakers DE111-8 driver and ME10v2 horn

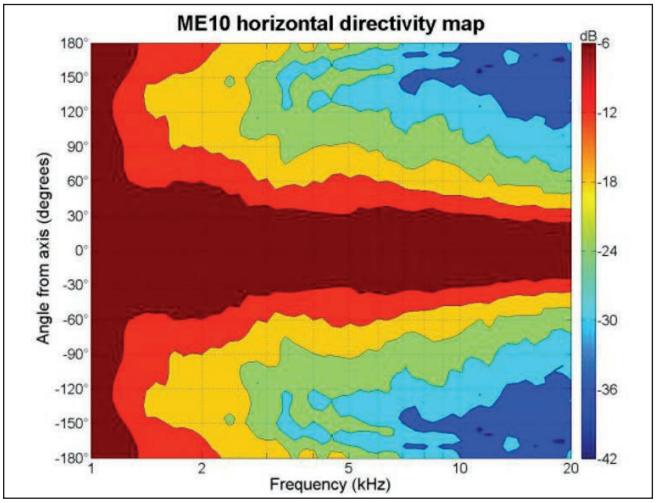


Figure 1: B&C Speakers M10V2 horizontal directivity map

The horn supplied for use with the DE111-8 by B&C Speakers was the ME10v2. This Hyperbolic Cosine flare horn has a 1” exit bolt on type made from injection-molded ABS, and provides a 90° x 60° coverage pattern and a 1500Hz cut-off frequency, making it a good match for the DE111-8 compression driver. **Figure 1** and **Figure 2** give the horizontal and vertical directivity maps for the ME10v2, while **Figure 3** and **Figure 4** display the horizontal and vertical polar plots. However, it should be noted that the bolt pattern of the ME10v2 does not fit the DE111 and has to be modified (new bolt holes drilled into the mounting plate), which is what I did for this explication. However, if you are buying OEM quantities of the DE111/ME10v2, I’m quite certain B&C Speakers can accommodate this issue.

Testing began using the LinearX LMS analyzer to produce the 300-point stepped sine wave impedance plot shown in **Figure 5**, with the solid black curve showing the B&C Speakers DE111-8 mounted on the ME10v2 horn and the dashed blue curve representing the compression driver without the horn. With a 6.22Ω DCR (Re), the minimum impedance of the DE111/ME10v2 was 6.9Ω and at 4kHz.

For the next set of SPL measurements, I free-air mounted

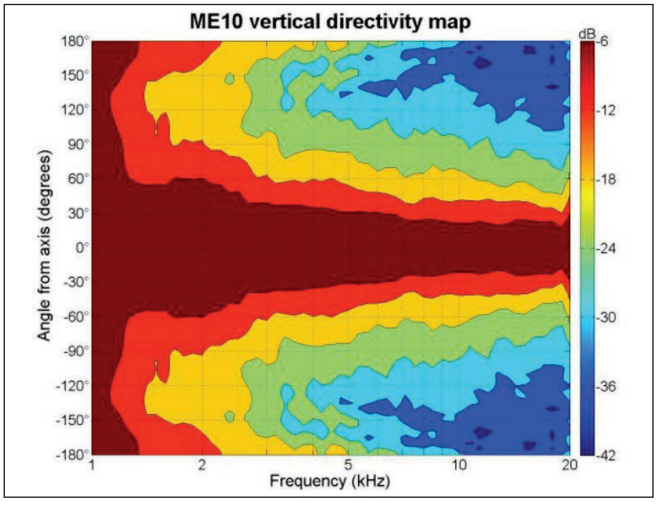


Figure 2: B&C Speakers M10V2 vertical directivity map

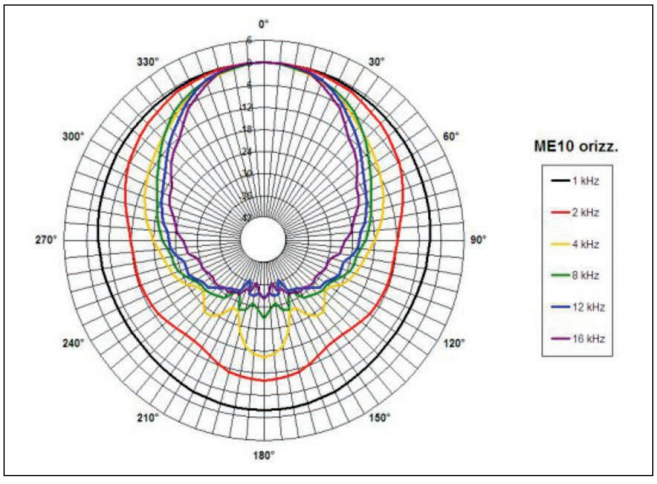


Figure 3: B&C Speakers M10V2 horizontal polar plot

the DE111/ME10v2 combination without an enclosure and measured the horizontal on- and off-axis at 2.83V/1m. I measured the on- and off-axis frequency response using the Loudsoft FINE R+D analyzer (provided to *Voice Coil* by Loudsoft) and the GRAS 46BE 1/4" microphone (courtesy of GRAS Sound & Vibration). The equipment was set up to measure the 200Hz to 40kHz frequency response (using a 192kHz sampling rate) at 2V/0.5m normalized to 2.83V/1m. Sweeps were performed at 0°, 15°, 30°, 45°, and 60° off-axis. Note, since B&C Speakers supplied the directivity maps and polar plots for the ME10v2, I chose not to do the vertical SPL measurements, but will show both the horizontal and vertical polar plots using the CLIO Pocket Analyzer.

Figure 6 illustrates the on-axis frequency response of the compression driver/horn combination, which is smooth with

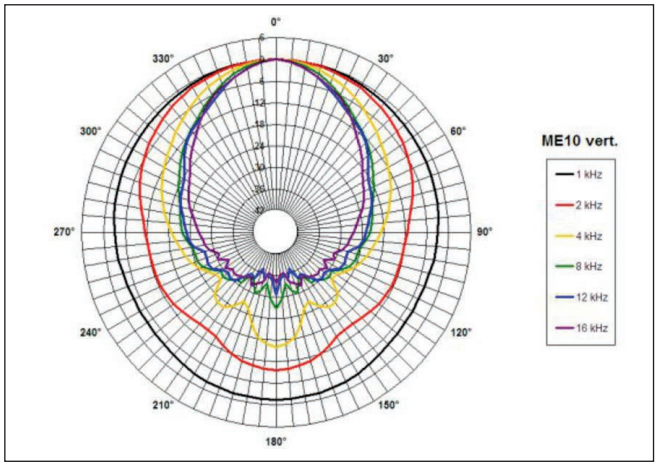


Figure 4: B&C Speakers M10V2 vertical polar plot

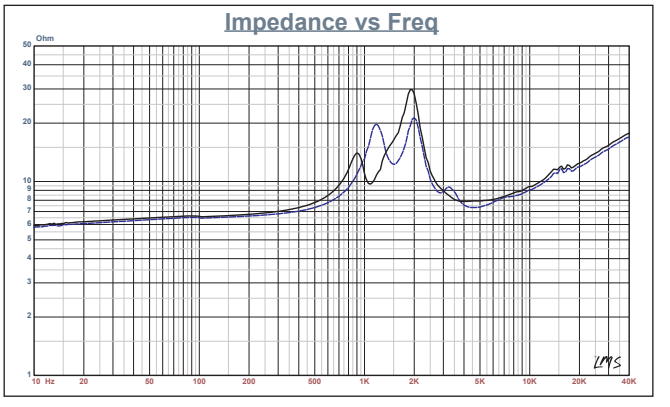


Figure 5: B&C Speakers DE111-8 free-air impedance plot

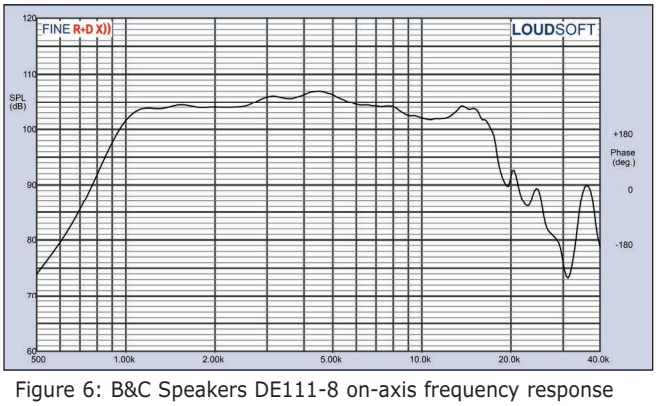


Figure 6: B&C Speakers DE111-8 on-axis frequency response

no major anomalies with a declining response as frequency increases above 4.5kHz, and extending to somewhat beyond 17kHz, requiring the usual horn equalization.

Figure 7 depicts the on- and off-axis response in the horizontal plane. **Figure 8** displays the normalized horizontal plane response. **Figure 9** shows the CLIO Pocket analyzer-generated the 180° horizontal polar plot (in 10° increments with 1/3 octave smoothing applied). **Figure 10** shows the vertical polar plot. Last, **Figure 11** illustrates the two-sample SPL comparison showing the two B&C Speakers DE111-8 compression driver samples to be very closely matched ≤ 1dB throughout the operating range of the transducer.

I then set up the Listen, Inc. AudioConnect analyzer, SoundCheck 20 software, and the Listen, Inc. 1/4" SCM

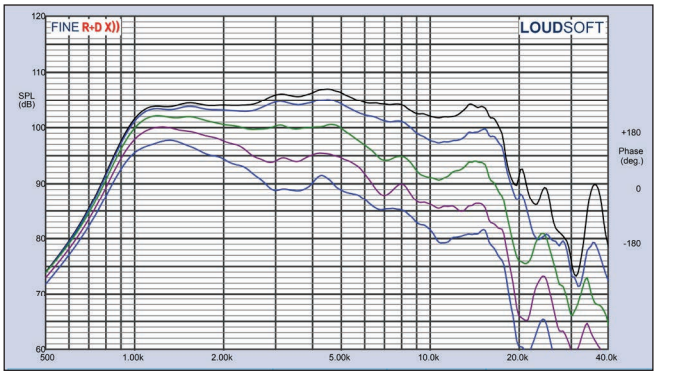


Figure 7: B&C Speakers DE111-8 horizontal on- and off-axis frequency response (0°=solid; 15°=dot; 30°=dash; 45°=dash/dot; 60°=dash)

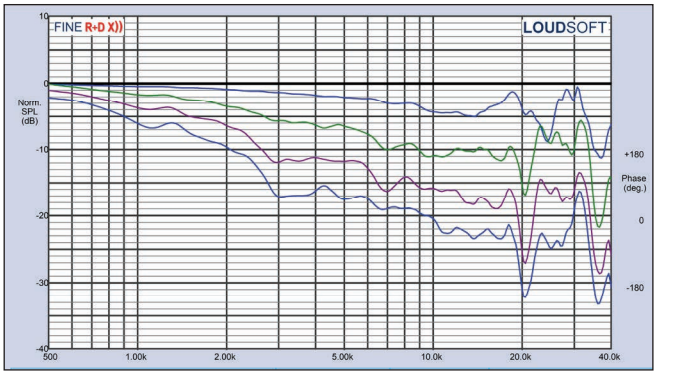


Figure 8: B&C Speakers DE111-8 normalized horizontal on- and off-axis frequency response (0°=solid; 15°=dot; 30°=dash; 45°=dash/dot; 60°=dash)

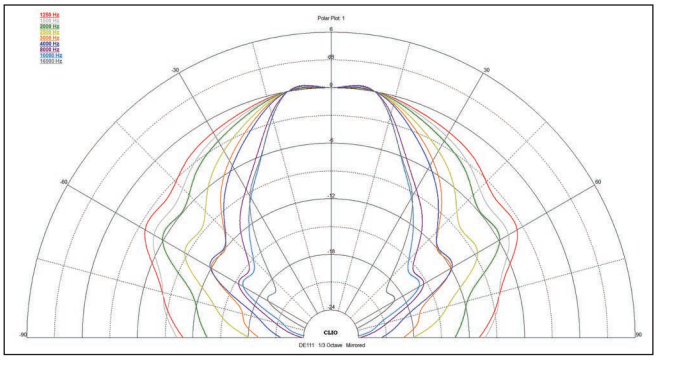


Figure 9: B&C Speakers DE111-8 0°-180° horizontal plane polar plot (in 10° increments)

microphone to measure distortion and generate time-frequency plots (courtesy of Listen, Inc.). For the distortion measurement, I again mounted the DE111/ME10v2 combination in free-air in the same manner as was used for the frequency response measurements, and set the SPL to 104dB at 1m (2.49V determined by using a pink noise

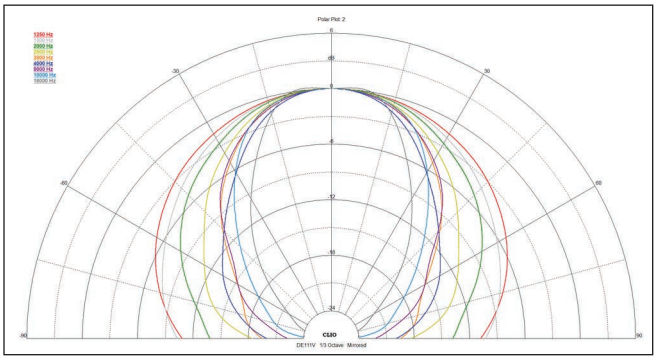


Figure 10: B&C Speakers DE111-8 0°-180° vertical plane polar plot (in 10° increments)

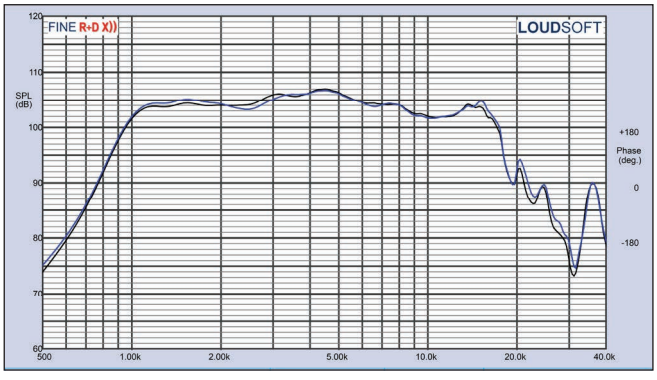


Figure 11: B&C Speakers DE111-8 two-sample SPL comparison

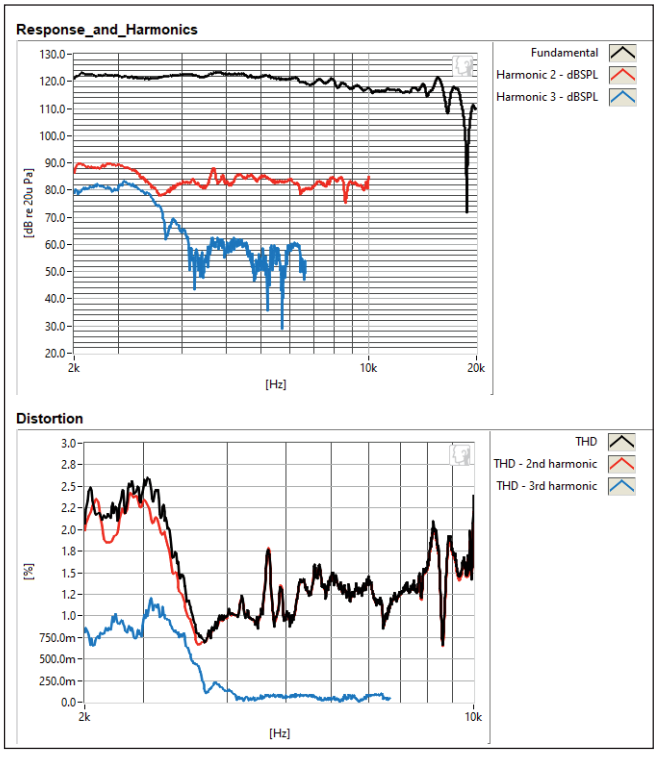


Figure 12: B&C Speakers DE111-8 SoundCheck distortion plots

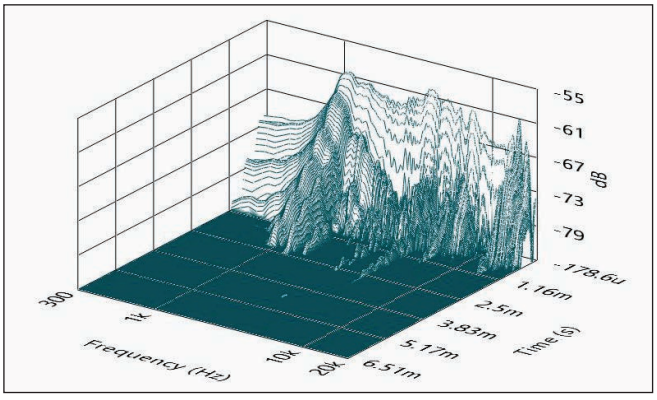


Figure 13: B&C Speakers DE111-8 SoundCheck CSD waterfall plot

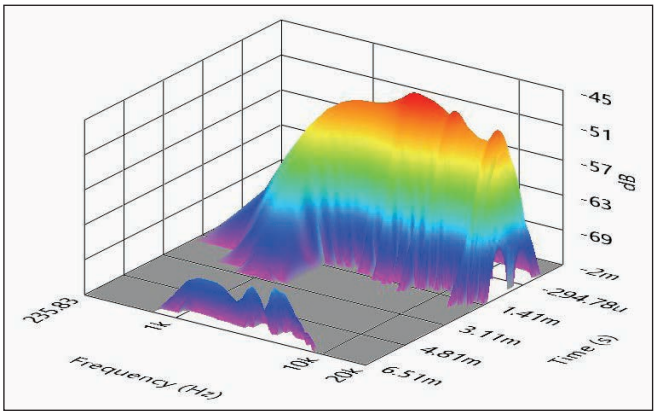


Figure 14: B&C Speakers DE111-8 SoundCheck Short Time Fourier Transform (STFT) plot

stimulus generator and internal SLM in the SC20 SoundCheck software). Then, I measured the distortion with the Listen 1/4" measurement microphone located 10cm from the mouth of the horn. This produced the distortion curves shown in **Figure 12** (the red curve=second harmonic, and the blue curve=third harmonic).

Following this test sequence, I then set up SoundCheck 20 to generate a 2.83V/1m impulse response for this driver/horn combination and imported the data into Listen's SoundMap Time/Frequency software. **Figure 13** shows the resulting cumulatvie spectral decay (CSD) waterfall plot. **Figure 14** shows the Short Time Fourier Transform (STFT) plot.

From the above measurements, the compact DE111 displays excellent performance for such a small package, and is a nice addition to B&C Speakers' extensive lineup of neo motor 1" compression drivers. For more information, contact B&C Speakers N.A., National U.S. Sales Office, 220 W. Parkway, Unit 11, Pompton Plains, NJ 07444; call (973) 248-0955; e-mail Bennett Prescott at bprescott@bcspeakers.com; or visit the B&C Speakers' website at www.bcspeakers.com. ***VC***

Submit Samples to Test Bench

Test Bench is an open forum for OEM driver manufacturers in the loudspeaker industry and all OEMs are invited to submit samples to *Voice Coil* for inclusion in the monthly Test Bench column.

For information about how to submit samples to Vance Dickason, visit www.audioxpress.com/page/Voice-Coil-Magazine.

Test Bench

The MD60N-6 2.5" Dome Midrange from the SB Acoustics Satori Line

By Vance Dickason

Over the last several years, Indonesian-based Sinar Baja Electric in partnership with Danesian Audio of Denmark (Danesian Audio was founded by of a team of dedicated Danish loudspeaker engineers, who have been working closely together since 1997), have generated an excellent reputation for the high-end home and car audio drivers that have been marketed under the SB Acoustics name. This month, SB Acoustics sent *Voice Coil* the MD60N-6, a new 2.5" diameter soft dome midrange from its premium high-end Satori line (**Photo 1**).

Features for the MD60N-6 include a non-resonant coated cloth 2.5" diameter diaphragm and surround, a 60.5mm diameter voice coil wound with round copper wire on a vented aluminum voice coil former. The motor system consists of large neodymium (neo) ring magnet with a low carbon content steel return. The device incorporates a dynamic dome stabilizer and flow resistor, which takes the form of a 1mm thick perforated dome-shaped aluminum grille that sits underneath the soft-dome (spaced 2mm to 3mm). There is also a damping pad mounted directly on the back side (covering its entire surface). This fires into the injection-molded back-closed transmission line enclosure that is filled with Thinsulate (acoustic/thermal insulation material). Other features include 95dB 2.83V/1m sensitivity, a machined aluminum faceplate, gold-plated terminals, braided silver Litz wire tinsel leads located on opposite side of the dome to minimize voice coil rocking, a 120W-rated power handling, 0.5mm Xmax, and a nominal 6Ω impedance.

Photo 1: SB Acoustics Satori MD60N-6 2.5" driver

Testing commenced using the LinearX LMS analyzer to produce the 300-point impedance sweep illustrated in **Figure 1**. With nominal 6Ω impedance, the MD60N has a 5.25Ω DCR, with minimum impedance mounted of 5.8Ω and at 2kHz.

Following the impedance test, I recess mounted the SB Acoustics midrange dome in an enclosure with a baffle area of 15"×6" and measured the on- and off-axis frequency response again using the Loudsoft FINE R+D analyzer (provided to *Voice Coil* by Loudsoft) and the GRAS 46BE 1/4" microphone (courtesy of GRAS Sound & Vibration), which were set up to measure the 200Hz to 40kHz frequency response (using a 192kHz sampling rate) at 2V/0.5m normalized to 2.83V/1m. Sweeps were performed at 0°, 15°, 30°, and 45°.

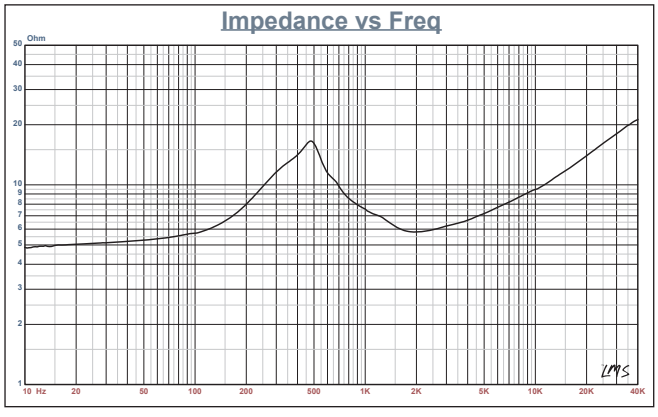


Figure 1: SB Acoustics Satori MD60N-6 impedance plot

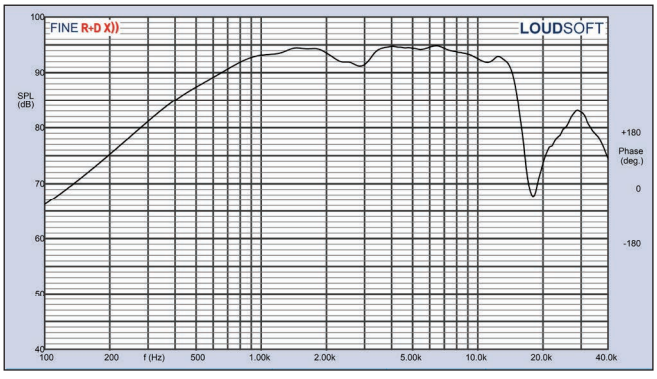


Figure 2: SB Acoustics Satori MD60N-6 on-axis frequency response

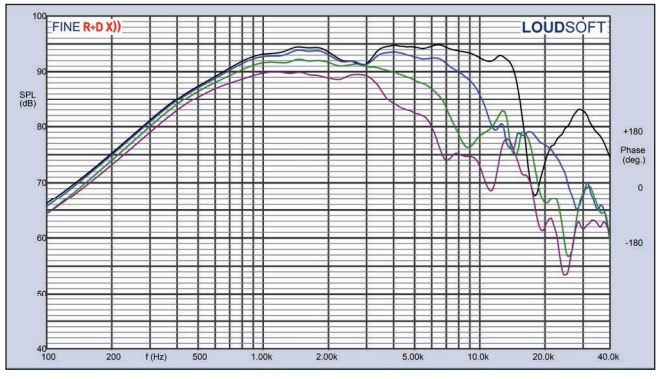


Figure 3: SB Acoustics Satori MD60N-6 horizontal on- and off-axis frequency response (0°=black; 15°=blue; 30°=green; 45°=purple)

Figure 2 shows the on-axis response of the SB Acoustics midrange dome, which measured ±2dB from 0.73kHz to 14.8kHz, when it began its second-order low-pass roll-off.

Figure 3 gives the on- and off-axis response of the MD60N-6 midrange dome. **Figure 4** shows the off-axis curves normalized to the on-axis response. **Figure 5** displays the CLIO 180° polar plot (measured in 10° increments with 1/3 octave smoothing). The device is –3dB down at 30° off-axis with respect to the on-axis at about 3.5kHz, likely the highest crossover frequency that should be considered to produce an adequate system power response.

Figure 6 shows the two-sample SPL comparison of the SB Acoustics Satori midrange dome, indicating the two samples were closely matched to within 0.5dB throughout its operating range from 700Hz to 15kHz.

I fired up the Listen, Inc. SoundCheck AudioConnect analyzer along with the Listen Inc. SCM 2 1/4" microphone (provided courtesy of Listen, Inc.) and measured the impulse response with the midrange dome recess mounted on the same 15"×6" test baffle. Importing this data into the Listen SoundMap software produced the cumulative spectral decay plot (commonly referred to as a "waterfall" plot) shown in **Figure 7**. **Figure 8** depicts the Short Time Fourier Transform (STFT) displayed as a surface map plot.

Then, I set the 1m SPL to 94dB (2.86V) using a pink noise stimulus, and measured the second and third harmonic distortion at 10cm, illustrated in **Figure 9**. Distortion is dominated by the second harmonic with a very low third harmonic distortion, however even the second harmonic content is well below 1% above 1kHz.

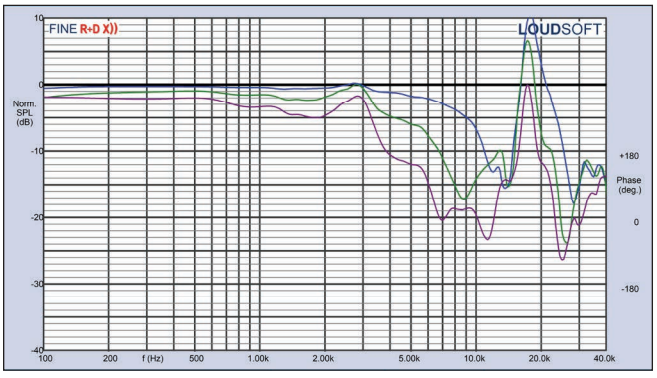


Figure 4: SB Acoustics Satori MD60N-6 normalized on- and off-axis frequency response (0°=black; 15°=blue; 30°=green; 45°=purple)

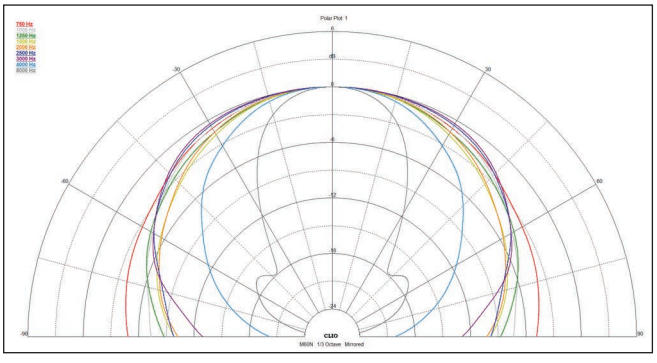


Figure 5: SB Acoustics Satori MD60N-6 180° horizontal plane CLIO polar plot (in 10° increments)

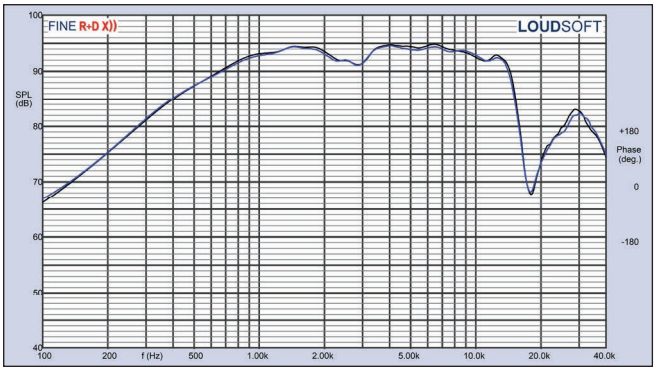


Figure 6: SB Acoustics Satori MD60N-6 two-sample SPL comparison

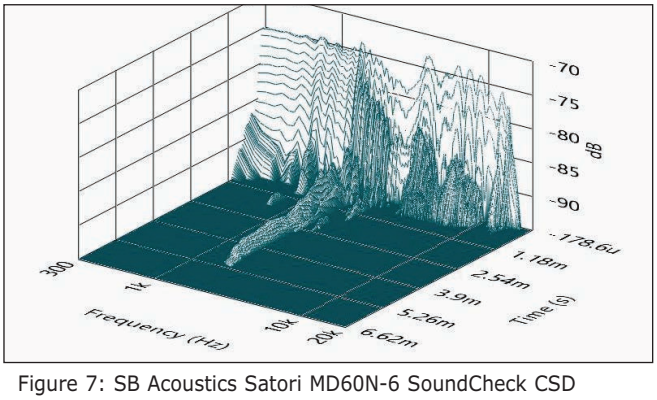


Figure 7: SB Acoustics Satori MD60N-6 SoundCheck CSD waterfall plot

The build quality of the MD60N-6, like all SB Acoustics' drivers (especially the Satori line products), is definitely appropriate to the high-end two-channel and studio monitor market for which it is intended. So, given all the data collected for the MD60N-6 midrange dome, I would have say that SB Acoustics has created another highly useful transducer. For more information the SB Acoustics Satori MD60N midrange dome and other home hi-fi drivers, car audio, and pro sound drivers, visit the SB Acoustics website at https://sbacoustics.com. ***VC***

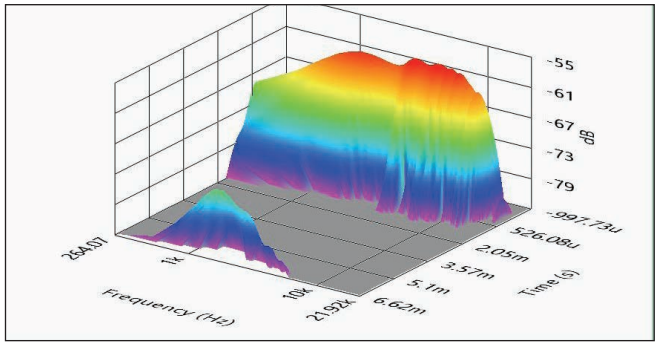


Figure 8: SB Acoustics Satori MD60N-6 SoundCheck STFT surface intensity plot

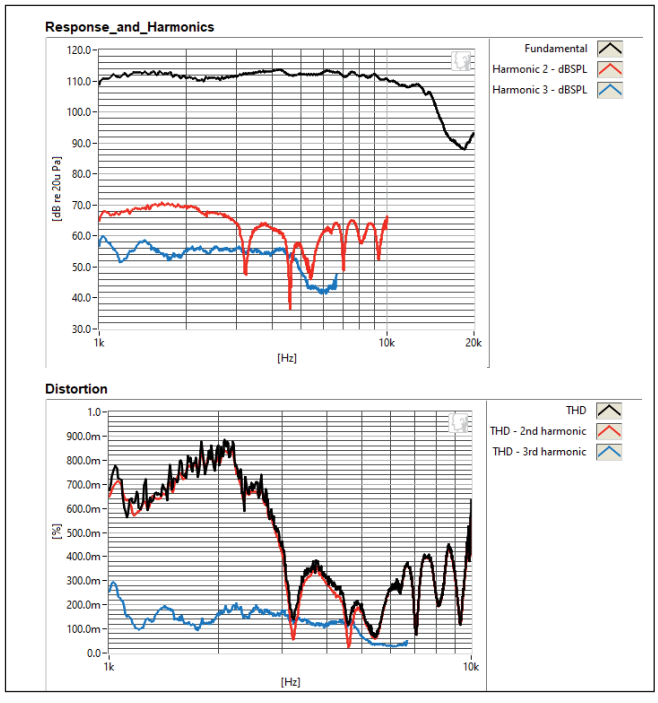


Figure 9: SB Acoustics Satori MD60N-6 SoundCheck distortion plots

Submit Samples to Test Bench

Test Bench is an open forum for OEM driver manufacturers in the loudspeaker industry and all OEMs are invited to submit samples to *Voice Coil* for inclusion in the monthly Test Bench column.

Send samples in pairs and addressed to:

Vance Dickason Consulting
4330 Imperial Drive
West Linn, OR 97068
(503-557-0427) | vdconsult@comcast.net

All samples must include any published data on the product, patent information, or any special information necessary to explain the functioning of the transducer.

Industry Watch

By Vance Dickason

Klipsch and Resonado Labs Announce Partnership

Klipsch and Resonado Labs announced a strategic partnership to develop a new line of Klipsch home audio solutions integrating Resonado technologies. Together, the companies aim to define the next era of audio by developing a line of products engineered to deliver the highest output possible in sleek and compact form factors.

The world of audio has changed dramatically in the past two decades—with the advent of new technologies, the diversity of audio products and prevalence of audio in the average person's daily lives has exploded. By 2026, soundbars alone are projected to top $12 billion in annual sales globally. Consumer demand has shifted to audio products that take up less space and provide a full acoustic range in a single package.

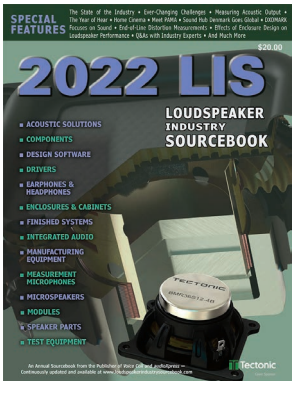
Resonado's flagship technology, Res-Core—(formerly described as Flat Core Speaker (FCS)—was designed to address this industry shift. A novel take on the conventional loudspeaker with a proprietary motor, Res-Core was engineered to deliver high-performance audio in compact form factors. The technology represents the first step in Resonado's pursuit of providing listeners everywhere with unprecedented sonic immersion by innovating at the core.

Klipsch has remained an American icon through decades of change by relying on founder Paul W. Klipsch's underlying sound principles and philosophy to reproduce the power, detail, and emotion of the live experience. While others prioritize secondary features, the two companies are aligned in delivering big, powerful sound straight from the hardware—and Resonado is enabling Klipsch to extend this philosophy to a series of compact new products.

Learn more about the Klipsch and Resonado partnership at klipsch.com/klipsch-audio-and-resonado-labs-sound-partnership.

2022 *Loudspeaker Industry Sourcebook*

The 2022 *Loudspeaker Industry Sourcebook* (LIS) is now available online and print copies are in the mail! *Loudspeaker Industry Sourcebook* provides a comprehensive guide of manufacturers and their products and services, not only with its annual printed publication, but also with its dedicated, always-online directory available. View the 2022 edition now thanks to this year's cover sponsor Tectonic.



LIS 2022 offers listings in 24 categories from more than 700 companies based in 45 different countries, providing manufacturers with lots of options. In addition to serving as a great resource for products and services in the audio industry, the 2022 LIS also features some timely and informative articles. The publication opens with "The State of the Loudspeaker Industry 2022," by J. Martins. In previous editions of LIS, market research firms were invited to share an overview of the market and the trends that influence the loudspeaker and audio industries. Due to the unpredictability of the overall supply chain and market demand fluctuations over the past two pandemic years, the editors decided to compile their own industry review. His market reflections were followed by Jann U. Evers' article "Working Within the Ever-Changing World" in which he discusses doing business where sourcing and sustainability are providing unique challenges.

Roger Schwenke and Merlijn van Veen, co-chairs of the Audio Engineering Society SC-04-03-A Task Group, discuss "The New AES75 Standard," which provides a "better way to measure the acoustic output of loudspeakers." And Andrew Bellavia of Knowles Corp. discusses "The Year of Hear," in which he predicts a proliferation of audio devices that take into account consumers' unique hearing responses.

Although people are slowly starting to venture out, many of them continue to expand their home entertainment options, and Tony Ostrom (WiSA Association President) focuses on "Home Cinema Evolvement." This edition also introduces the Professional Audio Manufacturers Alliance (PAMA), courtesy of Jennifer Shockley (PAMA's executive director); and Sound Hub Denmark, as Rie Kold Pripsø shares information about "the world's first international sound technology and innovation hub." Readers can also learn more about DXOMARK, which is better known as "an image quality expert," and for their renowned smartphone quality testing scores. Now they are also focusing on sound quality assessment of consumer audio speakers.

To wrap up this year's sourcebook, Steve Temme (founder and president of Listen, Inc.) discusses "End-of-Line Distortion Measurements," and Alan Petrillo (COMSOL) shares his take on "The Sight of Sound: Revealing the Effects of Enclosure Design on Loudspeaker Performance." Two great articles from two industry experts, addressing the latest advancements on audio test and measurement and multiphysics simulation. Available in print ($20) or online (no-charge), LIS can be ordered at www.cc-webshop.com.

Lavoce at the NAMM Show

Lavoce Italiana released two to high-frequency transducers, the DN14.30K and the BF10.10LA, at the 2022 National Association of Music Merchants (NAMM) trade show. The DN14.30K (**Photo 1**) is Lavoce's new next-generation 1.4" Exit neodymium compression driver. Exhibiting a smooth extended frequency response to 20 kHz and low distortion, DN14.30TK has an 110W AES Power rating, 3" edgewound copper-clad aluminum voice coil and 108dB sensitivity. This driver employs the same phase plug as the larger Lavoce DN14.300, but in a slightly more compact product footprint (120mm diameter) with a hybrid Titanium diaphragm with a Polyimide surround.

Photo 1: DN14.30K

Compared to a one-piece titanium diaphragm and surround, the hybrid titanium/polyimide diaphragm assembly used on DN14.30TK offers a lower resonant frequency (Fs) due to the softer surround material. This enhances the low-frequency performance around the recommended crossover point, 1.2kHz, which can help simplify the crossover designs and improve the quality for and improve the quality for vocal reproduction. DN14.30TK also employs Lavoce's patented Integral Input Surface (IIS) phase plug technology, which incorporates a perfectly smooth, one-piece, input surface for the dome of the phase plug that reduces the risk any misalignment issues in this critical high-pressure area. Together with its improved assembly topology, this technology ensures production batches are fully compliant to performance requirements and maintains consistency in the field.

The BF10.10LA (**Photo 2**) is a ferrite magnet compression tweeter designed as a simple solution for adding high frequency to a multi-way sound system design using one or multiple devices, or as the high-frequency section for a professional bass guitar cabinet. The bullet tweeter employs a one-piece aluminum diaphragm and surround with a 1" copper-clad aluminum voice coil on a Kapton former and offers a 20W AES Power rating, 106dB sensitivity and a frequency range of 2500Hz to 18000Hz with a 5000Hz recommended crossover point. For more information, visit at www.lavocespeakers.com.

Photo 2: BF10.10LA

New 10" Pro Sound Woofer from Celestion

Photo 3: CF1025BMB

Celestion has recently introduced the CF1025BMB 10" (254mm) diameter ferrite magnet, cast-aluminum chassis professional audio driver (**Photo 3**). Designed for both bass and mid-bass applications, the new CF1025BMB particularly excels as a bass unit in compact subwoofer applications.

The Celestion CF1025BMB features a 2.5" (64mm) multi-layer voice coil wound on a polyimide former, providing 300W (AES standard) power handling and 92.5dB sensitivity with an output frequency range of 45Hz to 5000Hz. The elastomer surround enables a longer Xmax compared to a conventional 10" mid-bass speaker, allowing the CF1025BMB to better reproduce lower frequencies. This makes the driver a natural solution for discreet, compact subwoofer applications. However, it also performs very smoothly up to 2kHz, making the CF1025BMB also suitable for two-way designs with the added advantage of exceptional low-frequency performance.

In addition to the extended low-frequency performance, features include Celestion's smart airflow vented magnet assembly for dynamic heat dispersion to minimize power compression during operation; and an optimized T-pole magnet assembly to maximize the stability of cone movement for enhanced Bl symmetry for lower distortion. Other features include glass loaded paper cone with weather resistant coating, 4.65mm Xmax and chrome plated color-coded push

terminals. The Thiele-Small parameters for this driver are Fs=40.9Hz, Mms=55.87 grams, Qms=7.95, Qes=0.371, Qts=0.355, Re=6.04Ω, Sd=346 cm^2, and Vas=46.1 liter. For more information, visit www.celestion.com.

AES 2022 International Audio for Virtual Reality Conference

The Audio Engineering Society (AES) is holding its fourth International Conference on Audio for Virtual and Augmented Reality. This conference will gather research scientists, engineers, virtual reality (VR) and augmented reality (AR) developers and content providers to explore and discuss topics such as: spatial audio capture rendering and synthesis over headphones and loudspeakers; binaural, ambisonics, and wave field synthesis techniques; 3D sound field navigation; HRTF modeling and derivation from optical and/or acoustic measurements; reverb and room acoustics synthesis; 3D audio mixing and content production; and sound design for VR/AR, and best practices.

The three-day conference program, set for August 15-17 at the Digipen Institute of Technology in Redmond, WA, will focus around the dissemination of top-level research in the field of spatial audio for virtual and augmented reality, and discussion of technical solutions and recommended practices. In addition to the paper and poster sessions, the conference will also consist of invited presentations from key researchers, practitioners and industry leaders, demonstrations, panel discussions, tutorials, and workshops. For more information, visit www.aes.org.

ALTI Update—August 2022

Although COVID-19 is still with us, people are learning to live with it and moving forward with ALTI-EXPO '22 taking place on June 5–6 in Las Vegas, NV. That statement alone is an important step to whatever "normal" will be going forward. It also may have been Audio & Loudspeaker Technologies International's (ALTI) best event.

ALTI-EXPO '22 experienced several challenges in planning and execution. Attendance was down. Two exhibitors pulled out just before the event and two presenters pulled out the Friday before the event. Another industry event's closing day was ALTI's opening day. And while challenging, it was the positive attitudes and the commitment by all of those involved that made ALTI's EXPO so successful. Exhibitors and attendees alike commented on the quality of the presentations and the business contacts gained at ALTI-EXPO. The networking was also successful, as many attendees got to know the exhibitors and other attendees better both during the show hours and after.

ALTI-EXPO organizers want to express gratitude to all the participants for ALTI-EXPO '22 and are working on ALTI-EXPO '23 in Orlando, FL, scheduled for June 11–12, 2023.

ALTI also commissioned an industry survey and analysis of Supply Chain issues, which is available via a link on the ALTI website and through a link in the ALTI newsletter. The entire two days of break-out sessions was recorded and will be available. Watch the ALTI newsletter for details. Not yet a subscriber? Sign up for free at https://altiassoc.org. ***VC***

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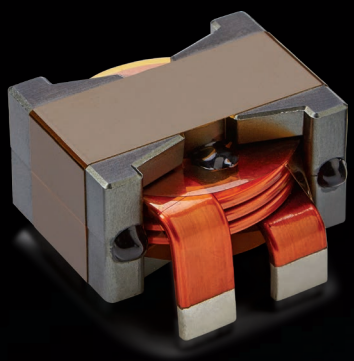

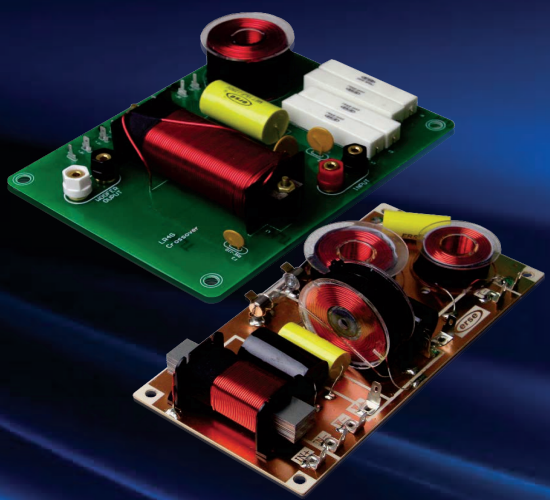

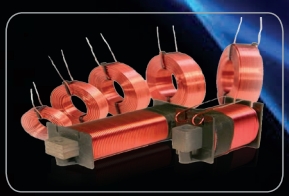

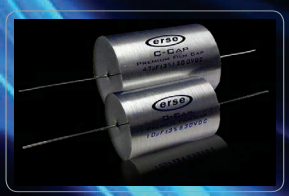

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