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## **KILLER BASS**

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# JL Audio Fathom f112 Subwoofer

Robert Harley

Can a car-audio company raise the bar in high-end subwoofer performance?

I first encountered JL Audio at the 2005 CEDIA Expo—the event this respected manufacturer of car-audio speakers and electronics used to launch its entry into the high-end-audio and home-theater markets. To say I walked into JL Audio's press conference and demo with trepidation would be an understatement. I had visions of one-note-bass “boom” trucks playing rap music at knee-weakening sound-pressure levels. However, once the press was seated, and after a short introduction,

the demo began . . . with a piano trio track!

Although JL did subsequently demonstrate its subwoofer's brute-force ability to move large amounts of air at very low frequencies, its surprising choice of gentle piano-trio music to start the demo spoke volumes about the company's aesthetic.

Can a company whose entire experience is limited to mobile audio bring something new to the high-end audio arena? The surprising answer is

that the mobile environment presents a rigorous set of engineering challenges and requires build-quality standards that make it the ideal proving ground for developing high-performance audio products. With 15 years of experience building *ne plus ultra* car-audio gear, JL has accumulated some serious engineering chops, particularly in designing low-frequency drivers. Take the 13.5" woofer used in the Fathom f112 reviewed here. In development for seven years, the unit is the subject of 7 granted patents. (It's



surprising that a basic technology that's been around for decades—the moving-coil driver—could be the subject of 7 new patents.) This driver is a serious piece of engineering, with great attention paid to every element of its design and construction (see sidebar). The abuses routinely inflicted on woofers in the car-audio world led JL to develop design techniques that would make its drivers virtually indestructible. Moreover, I've recently discovered that at the upper end of car audio, enthusiasts share an aesthetic similar to that of the audiophile (forget about boom cars—I'm talking about a completely different mindset).

JL Audio's single-minded pursuit of creating high-performance woofers has given the company a different perspective on creating a home subwoofer for high-end music reproduction.

## Overview

The Fathom f113 looks at first glance like an ordinary subwoofer—a 13.5" cone driver in a sealed rectangular black box with front-panel controls and rear-panel heatsinks and input jacks. The unit accepts unbalanced input signals on RCA jacks or balanced signals on Neutrik XLR/.25" TRS jacks. Multiple Fathoms can be connected together, with one acting as "master" and the others as "slaves." The front-panel controls provide a wide range of useful adjustments. In addition to the usual

## The driver was in development for seven years and is the subject of 7 granted patents

level, phase, and crossover-frequency controls, the Fathom's low-pass filter slope is adjustable (off, 12dB/octave, 24dB/octave) to help achieve a better blend between the subwoofer and the main speakers. The ELF Trim (Extreme Low Frequency) control boosts or cuts the signal at 25Hz (up to 12dB of cut, up to 3dB of boost), to prevent room overload at the lowest frequencies.

Note that the Fathom doesn't incorporate a high-pass filter for rolling off bass to your main speakers. You can high-pass-filter your main speakers with the bass-management settings in a home-theater controller, buy an external line-level crossover, or simply run the main speakers full-range and match the Fathom's crossover frequency and low-pass filter slope to your main speaker's natural roll-off. This latter method, however, doesn't provide the dynamic-range advantage conferred by keeping low bass out of your main speakers. Keep in

mind that a subwoofer crossover must be designed and built to the same standards as a high-end preamplifier—any less and the sound from the main speakers will be compromised.

The Fathom incorporates the JL-developed ARO (Automatic Room Optimization) program that smoothes the worst room-induced frequency-response peak. You simply connect the supplied calibration microphone and push the ARO Calibrate button. The Fathom outputs a series of tones that are picked up by the microphone and analyzed. An algorithm creates a filter to attenuate the room's most severe peak. Although ARO doesn't address frequency-response dips (the correction of which could be a prescription for driver or amplifier overload), it does have adjustable bandwidth to more precisely tame the peak. Note that ARO calculates the filter parameters digitally, but then engages an analog filter in the signal path.

The rear panel and dual heatsinks (which are, thankfully, rounded rather than sharp-edged) are made from a single piece of metal. Even when driven very hard for long periods, the heatsinks were never warm to the touch.

The overall level of design and execution is first-rate. I got the feeling that the Fathom's designers did everything they could to build in quality rather than look for corners to cut. In addition, the owner's manual is a model of clarity, and even the shipping carton is well thought out.



## Listening

I evaluated the Fathom f113 in three widely varying system configurations, each designed to reveal different aspects of the unit's performance. I first mated the f113 with a pair of Totem Arro speakers, using the crossover in an Arcam AV9 controller to high-pass-filter the Arro and low-pass-filter the Fathom. Mating a 13.5" woofer with the Arro, a 4.5" two-way, is perhaps not a real-world scenario, but one that nonetheless reveals much about a subwoofer's upper-bass performance.

I'm accustomed to setting a subwoofer's crossover frequency as low as possible under the assumption that subwoofers are simply not as good reproducers of midbass and upper bass as are main speakers. The higher the frequency a subwoofer is asked to reproduce, the greater the potential for hearing the sub's weaknesses, as well as its inability to blend smoothly with the main speakers. A low crossover frequency minimizes the sub's potential to do more harm than good. To my surprise, the Fathom blended extremely well with the Arro, augmenting the Arro's limited bass extension without calling attention to the fact that the midbass and lower bass were being reproduced by a radically different

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transducer than was the upper bass. In fact, with some careful tweaking (see the accompanying subwoofer primer this issue for set-up techniques), I'd go so far as to call the match nearly "seamless."

What this configuration would not reveal, however, was the Fathom's capacity for delivering high levels of low bass; the Arro's woofer bottomed out well before the Fathom approached its limits (even with a very high crossover frequency). So I added the Fathom to the mighty Wilson MAXX 2 loudspeakers, crossing the system over at 50Hz. In effect, the Fathom replaced the Wilson's bass below 50 cycles. This was a different kind of torture test for a subwoofer; the MAXX 2 has an extraordinary bottom end in every respect: dynamic coherence, transient fidelity, extension, ability to play loudly without strain, and resolution of bass

detail. Nonetheless, adding the Fathom didn't degrade the MAXX 2's bottom end and even extended the system's response in the very lowest registers (kick drum and pipe organ territory). I was also able to achieve a continuous transition between the MAXX 2 and the Fathom; the bottom-end sounded "of a piece," rather than as if a weight were dragging down the rest of the spectrum. I also ran the MAXX 2s full-range, with the Fathom coming in at 30Hz with the steepest possible low-pass roll-off (24dB/octave).

The Fathom's remarkable ability to blend with such diverse loudspeakers is, I believe, due to this subwoofer's tremendous agility, high resolution, and superb transient behavior. Forget the stereotypes of subwoofers—slow, turgid, thick, sounding like a disconnected boom underneath the music; the Fathom can

## Transient Performance Über Alles

Subwoofer designers face tradeoffs when choosing how to load the woofer into the cabinet. As explained in the accompanying technical primer (page 74), reflex-loading (a ported enclosure) offers the advantages of deeper low-frequency extension, greater acoustic output, and increased sensitivity compared with infinite-baffle loading (a sealed enclosure). But those advantages come at a price, primarily poorer transient behavior and the potential for hearing air flow through the port (“chuffing”).

Although a few reflex-loaded designs have managed to avoid these problems, the majority of ported woofers sound sluggish and thick, which has led to a general mistrust of subwoofers among audiophiles.

I’m convinced that a woofer’s transient performance is of utmost importance to good sound. It is, I believe, a key determinant of whether or not the woofer blends with the main speakers and if the woofer sounds “musical.” This transient behavior takes two forms: How quickly the woofer responds to a steep waveform, and how quickly the woofer

***“It’s perhaps no coincidence that the Fathom’s designers chose to load the driver in a sealed, rather than a ported, enclosure”***



stops after the signal has stopped. If the transient’s leading edge isn’t reproduced with the same speed (rise time) as the input signal, music’s dynamic impact is reduced, and so is the musician’s expression. Similarly, if the woofer keeps moving after the transient has decayed (overhang), we hear this as a turgid thickness. When audiophiles talk of a woofer that sounds “slow,” overhang is usually the culprit.

A slow rise time and woofer overhang smear music’s dynamic structure, spreading out the energy of transient signals over time. Dynamics are a vital component of musical expression, and any alteration of this component of the sound affects our perception of the musician’s expression. As I noted in the review, poor bottom-end dynamic performance tends to make a tight rhythm section (on music with bass guitar and a drum kit) sound less tight, lessens the feeling of the band being “in the pocket,” and robs the music of its propulsive drive. It’s easy to envision how a smearing of transient energy would lead to those perceptions. More specifically, however, poor dynamic behavior alters the relationship between the kick drum and bass guitar—the two instruments that form the rhythmic and tonal bedrock of much music. The kick drum’s dynamics should “jump out” sharply over the bass guitar rather than sounding like a dull thud underneath it.

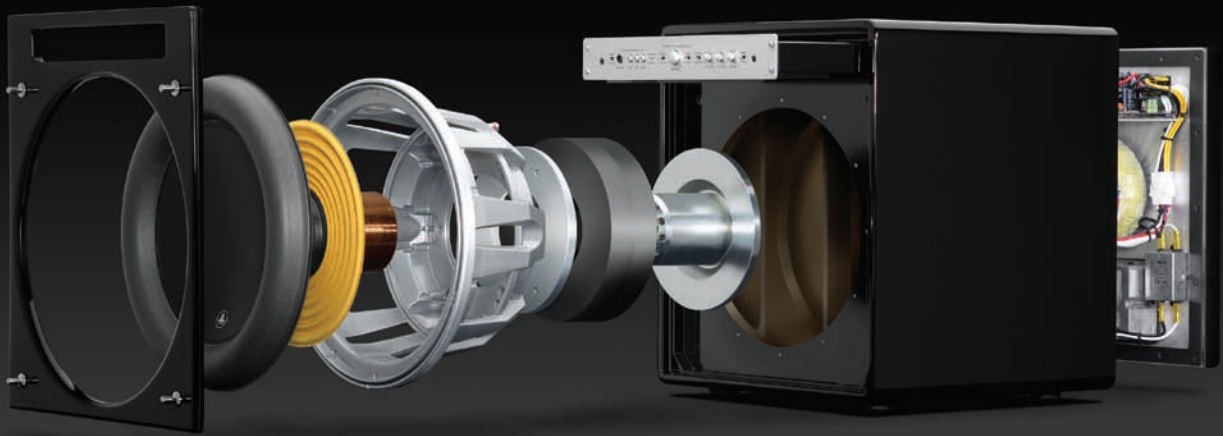
This is yet another example of how poorer technical performance in a playback system translates directly to a dilution of musical expression and to decreased listener involvement.

What makes the Fathom f113 special, in my view, is its combination of outstanding transient fidelity with brute-force power. It’s perhaps no coincidence that the Fathom’s designers chose to load the driver in a sealed, rather than a ported, enclosure. **RH**

turn on a dime, starting and stopping with surprising precision. In the midbass the Fathom sounded like a fast and tight 8” driver in a sealed enclosure; in the low bass, the sub delivered the full measure of this extraordinary driver’s capacity for deep extension and explosive dynamics. It was the best of both worlds—finesse backed up with seemingly unlimited depth and impact.

These qualities were abundantly apparent in the Fathom’s reproduction of kick drum. How a subwoofer portrays kick drum separates those few subs worth owning from the vast field of also-rans. All subs will deliver a thump in the bottom end, but only a select few will reproduce the sudden impact and equally sudden decay of well-recorded kick drum. If a sub doesn’t faithfully reproduce this dynamic envelope, the result is an apparent slowing of the rhythm, which fosters the interesting perception that the band is a little lazy or sloppy. But when the kick drum, working with the bass guitar to form the music’s rhythmic and tonal foundation, is reproduced with lifelike transient fidelity, music takes on a much more viscerally engaging and upbeat quality. This is particularly true of drummers with rhythmically interesting right feet—Terry Bozzio (Zappa), Peter Erskine (Weather Report, Steps Ahead), Mike Portnoy (Dream Theater), Rod Morgenstein (Dixie Dregs), Steve Gadd (everyone), and Jack DeJohnette, for examples. Drummers who use double bass drums present an even greater challenge to subwoofers; the closely spaced transient attacks tend to smear into each other if there’s even a hint of driver overhang. The Fathom was remarkable in this regard, presenting clearly differentiated attacks even on fast double-bass-drum rolls.

I was also greatly impressed by the Fathom’s resolution of pitch, subtle dynamic shadings, and inner detail. Acoustic bass was rendered with a wealth of information about the mechanism creating the sound, from the attack of the string to the sonorous resonance of the instrument’s body. Passages in which the bass doubles another instrument playing the melody were particularly revealing of the Fathom’s tight dynamic rendering and precise pitch articulation. Electric bass had a satisfying “purring” quality, coupled with a weighty warmth, that made



music physically as well as emotionally engaging. All of the Fathom's qualities were on display when I listened to bassist Abraham Laboriel's terrific playing on Victor Feldman's *Audiophile* on the JVC XRCD label. (*Audiophile* is a compilation of two direct-to-disc LPs originally released on the Nautilus label and engineered by the great Alan Sides.)

Throughout the audition, I had a real sense of hearing musical pitches, dynamic expression, and timbre—not of a cone flapping back and forth and of air chuffing through a port. In their quest to deliver low bass from small cabinets, many ported woofers end up overlaying the music with artifacts such as port noise, driver overhang (the woofer continues moving after the drive signal has stopped), and the sound of the cone moving in the box. The Fathom didn't impose a sound of its own, which is why it was so revealing of bottom-end detail.

Although capable of great delicacy and nuance, the Fathom had a bottom-end solidity, power, and iron-fisted control in the lowermost octave that was jaw-dropping. The f113 can move a large amount of air at very low frequencies (-3dB at 17Hz) with effortless ease and a feeling of anchored solidity. Even when reproducing the most demanding music at very high volume, the Fathom never gave any indication that it was nearing its limit.

The final system configuration in

## Technology

The Fathom's heart is the so-called "W7" driver that is the subject of 14 granted patents. This driver has been in use in somewhat different forms in high-end car audio; the version in the Fathom f113 is one specially designed for home use. The 70-pound unit is massively overbuilt and designed to withstand the rigors and abuse of the mobile-audio world. This includes a massive magnet structure, huge voice coil, an unheard-of excursion of four inches, and several techniques to get heat out of the voice coil (excessive heat is the most common cause of driver failure). Several of JL's 7 patents on the driver are aimed at improving transient response. These include the "DMA-Optimized Motor Structure" that addresses how the motor system behaves under dynamic conditions. The goal is to keep the magnetic forces linear throughout the voice coil's entire excursion range. The "W-Cone" patent was granted for the cone-construction technique, which reportedly combines extremely high stiffness with low mass. Another patent is on a discrete control circuit within the Class D amplifier that reportedly increases the amplifier's damping factor and thus its transient performance. The amplifier, rated at 2500W RMS, was designed specifically for the W7 woofer's characteristics.

The enclosure is made from CNC-cut MDF and braced internally. JL Audio manufactures the driver in-house at its 140,000-square-foot Florida factory. **RH**

which I auditioned the Fathom was in a multichannel system that included the MAXX 2s, a Wilson WATCH center channel, four Revel Embrace surround speakers, an Arcam AV9 controller, Anthem P5 multichannel power amp (on the surrounds), and a Mark Levinson No.436 3-channel amp driving the front three speakers. I used a pair of f113s, with one acting as "master" and the other as "slave." The Fathoms were driven by the AV9's subwoofer output jack, which is a monophonic mix of the Low Frequency

Effects (LFE) channel and the bass from any other channel designated as "Small" in the AV9's set-up menu.

I might be in the minority of audiophiles, but I greatly enjoy musical performances on DVD in multichannel sound. A great example of the Fathom's ability to keep up rhythmically and convey a tight, high-energy performance with a rock-solid bottom end is on the John Mayall & The Bluesbreakers DVD of a concert performance on Mayall's 70<sup>th</sup> birthday (which reunites Mayall with

## Cover Story

Eric Clapton after 34 years). This band's sharp-as-a-tack rhythm section was well served by the Fathom's combination of agility, quickness, and center-of-the-earth solidity. These guys have been playing together for years (the drummer has been in the band for 17 years), and the Fathom locked right into the groove along with the band.

Finally, I drove the Fathom to over-the-top sound-pressure levels with the most demanding bass content I could find and still didn't hear any signs of distress. Watching the driver during this exercise suggested that the cone didn't reach its maximum 4" excursion.

## Conclusion

The JL Audio Fathom f113 is, in my experience, among the top echelon of subwoofers. In fact, I can't name a better-sounding subwoofer that I've had in my system. The Fathom not only sounds great, it's exquisitely engineered and built to an extremely high standard.

I walked into JL Audio's 2005 press conference and demo skeptical that a car-audio company could compete at the top level of high-end audio—and with its first home product, no less. But based on what I heard at the demo, I walked out enough of a believer to ask for a review sample. I'm glad I put aside my prejudices, because the Fathom f113 is not only one of the world's great subwoofers, but at \$3200 an amazing bargain.

## Specs & Pricing

### JL AUDIO

10369 North Commerce Parkway  
Miramar, Florida 33025  
(954) 443-1100  
jlaudio.com

**Driver:** 13.5" (1)

**Enclosure:** Sealed

**Integral amplifier power:** 2500W RMS (short term)

**Frequency response:** 17–200Hz, +1, –3dB

**Inputs:** Stereo or mono RCA; stereo or mono XLR; XLR master output and XLR slave input

**Dimensions:** 18" x 15" x 18.63"

**Weight:** 130 lbs.

**Finishes:** Satin black or gloss black

**Price:** \$3200 for satin; \$3300 for gloss

# JL Audio's Carl Kennedy talks with Robert Harley



**Robert Harley: Tell us about JL Audio and how the company made the leap from mobile audio to high-end home products.**

**Carl Kennedy:** JL Audio began initially as a manufacturer of regionally distributed speakers in 1977 and grew to a large-scale mobile audio manufacturer in 1989. The company was founded by Lucio Proni, who continues to be our CEO and Chief Design Engineer. About ten years ago he brought in Andy Oxenhorn as partner and President. Andy came from MB Quart. In 2003, I was approached by them to develop a home and professional division for JL Audio. I was working for Miller and Kreisel at the time. We had a similar vision for what we wanted to do in home audio and hit it off right away.

**RH: I've come to learn that JL Audio is highly regarded in high-end car audio. CK: My forte isn't car audio, but I've**

learned an awful lot in the past few years I've been with the company. JL Audio is in the first position in mobile audio. Lucio's woofer designs set us apart since the company's inception. After he developed the W6 and W7 drivers, however, that put us over the top. A few years ago we broke into the amplifier business and now have the number-one selling amplifier in the market. So we had woofers, amplifiers, and enclosures—it made sense to put it all together into a home product.

**RH: I tend to associate mobile audio with loud one-note bass, not with subtlety, refinement, and other qualities that audiophiles value.**

**CK:** Well, you and I are cut from the same cloth, because I came to my initial meeting with JL Audio from a similar position. I was a bit skeptical as to what we might have in common, but as it turns out, you need to study any topic before reaching your conclusions. I heard some



of the show cars that we have here, and learned of the work that JL Audio had been involved in, and was pleasantly surprised. At the top of the quality heap, so to speak, car-audio guys have the same set of criteria that we would use in an audiophile or professional application. At the core of it is sonic excellence. I also saw immediately that JL had an advantage in developing high-end audio and professional products because we have a demanding fan base. That is, the products not only have to sound great, but they must be able to withstand a tremendous amount of abuse on a daily basis. That caused JL to address certain design parameters—excursion and thermal management, for examples—in a way that set the bar higher. When we approached making a home subwoofer, we had extremely high expectations and standards of performance for the product.

One of the things that Lucio, Andy, and I agreed on when I joined the company was that we wouldn't enter a category unless we felt we could create something significantly superior to the best products available. We didn't want to make "me-too" products that just tried to take market share from another manufacturer. Unless we could build the best product of its kind, we weren't

interested in doing it. We also felt that a whole generation of young people who revered JL Audio was growing up, settling down, having families, and looking for home audio. We had a built-in market of people who appreciated what we'd done in car audio and who would respond to our home products. This expands upon the traditional home-audio or home-theater customer base and allows us to drive new customers into our dealers' showrooms.

**RH: Let's talk a little bit more about the driver, because that's really the heart of the f113.**

**CK:** There are seven issued patents on it and it took a total of seven years to design and build. It revolutionized the mobile audio industry prior to our development of home products. We make different variations on it for different applications. The total peak-to-peak excursion is 4", and it's linear for about two-and-a-half inches of excursion. It has an enormous excursion "comfort zone," if you will. It has a patented over-roll design for the surround that accommodates the huge excursion and doesn't waste any cone area. It's not obvious with regard to the Fathom, because there's a beauty panel that covers it, but if you were to look behind the beauty panel on the front of the subwoofer you'd see actually that there's no exposed mounting hardware. The surround ends in a small, aluminum extrusion, and that's all you see of the speaker, and by bringing the surround to the outside edge of the frame, we actually get much more cone area than a conventionally designed driver of thirteen-and-a-half inches. In fact the surface area is comparable to that of a typical fifteen-inch driver.

**RH: These are the "OverRoll Surround" and "Floating Cone Attached Method" patents?**

**CK:** Yes. We also have several patents that apply to cooling. One is a cross-drilled pole piece, and then there's the whole method of getting convection currents to flow through the driver and draw heat away from the voice coil. These ideas come from the requirements of the car-audio world. If you can't make a driver that will withstand daily abuse, you'll die from warranty claims or from a fan base that's lost faith in you. We had to develop

techniques that would not only make the driver perform better, but that would also be virtually indestructible under the harshest of conditions.

**RH: Why choose a sealed enclosure for the driver?**

**CK:** There are a number of loading permutations—sealed, ported, transmission line, horn—and most of them can perform well if done correctly, with the key word being "correctly." We could have built an outstanding ported enclosure if size were not an issue. But a sealed enclosure allows us to equalize the driver for flat response, to tailor the roll-off, and to eliminate the possibility of port noise. We built the first prototype with flat response to 5Hz, just to see what we could accomplish. I knew from my background as a mastering engineer that 5Hz extension wasn't going to be useable, nor would it be appropriate. We spent the better part of a year tailoring exactly where to start rolling off and at what rate. The shape of the roll-off is quite thoroughly calculated.

**RH: How big is JL Audio in terms of employees and factory space?**

**CK:** We have about 300 full-time employees. We're based in Miramar, Florida, where we have about 140,000 square feet of manufacturing and office space. We have a facility in Phoenix with another 40,000 square feet where the electronics development and West Coast distribution takes place, plus development labs in Atlanta and in Geneva, Switzerland. One-hundred percent of our R&D, assembly, testing, and quality-assurance processes are done in-house. We make our own drivers and have a complete CNC machine shop and woodworking facility to make cabinets.

*Carl Kennedy is Director of Home and Professional Products at JL Audio. Carl has been a professional studio and touring musician since 1968, playing drums, guitar, keyboards, and bass. In 1972 he began designing large-format loudspeaker systems, primarily for sound reinforcement and studio monitoring. He has also worked as a multitrack recording engineer, studio designer, record producer, mastering engineer, and sound designer. He has worked with such clients as Emerson, Lake, and Palmer, Scorpions, Sony Pictures, Paramount Pictures, MGM, Sony Records, Charisma Records, and Polygram Records.*