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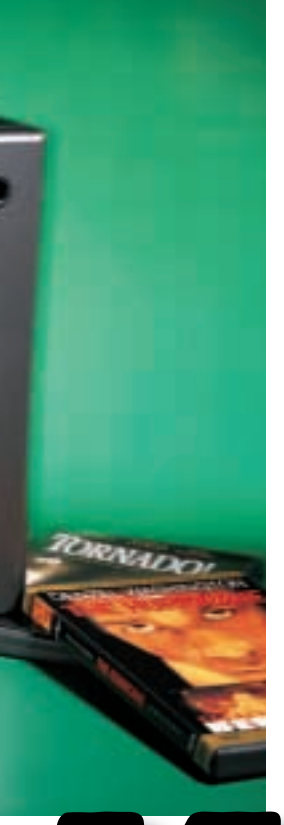


Five subwoofers that get big bass out of small cabinets

by Tom Nousaine

K BUSTERS

Yes, an R2D2-sized subwoofer with an 18-inch driver and a thousand-plus watts of amplification can look and sound awfully impressive — and can cause some pretty serious seismic damage to boot. But let's get real: how many of us can afford something like that? And even if you could afford it, would your significant other let you bring it into the house?

While most subwoofers come in only one shape — the ubiquitous cube — they do come in a variety of sizes, and smaller subs are becoming more and more popular. Why? Because many of us have our home theaters in rooms that don't easily accommodate a big, black cube — thus the growing demand for smaller boxes that can still put out clean and copious deep bass.

Clockwise from left, the PSB SubZero*i*, JBL HTPS-400, Cambridge SoundWorks Newton P200, M&K K-10, and Velodyne SPL-1000 subwoofers.

Smaller subs have the same basic advantages as their bigger brethren. Most important, they can reproduce the rumbles and explosions on movie soundtracks that most satellite speakers can't handle. Also, using a standalone sub greatly increases your speaker-placement options. Splitting off the deep bass and sending it to a subwoofer lets you place the main-channel speakers where they'll sound best without having to worry about their bass performance.

Now that I've sung the praises of smaller subs, let's take a look at five of them: Cambridge SoundWorks' Newton P200 ($600), JBL's HTPS-400 ($2,000), M&K's K-10 ($599), PSB's SubZero*i* ($299), and Velodyne's SPL-1000 ($1,499). All but one have a footprint of around a square foot and a gross volume of about a cubic foot — the JBL takes up a still unobtrusive 1½ square feet of floor space and has a volume just under 2 cubic feet. All but the ported PSB have sealed enclosures. All but the JBL provide both line- and speaker-level inputs (the JBL has just a line-level input). And all but the M&K have circuits that keep the sub on standby power until a signal appears at its inputs.

But for everything they have in common, these subs differ in a couple of respects. Their amp ratings vary considerably, and each rests on its own rung of the price ladder. But our mission here is to compare subs of similar size — not power or price.

To see how they fared, I set each sub up in the optimal corner of my large, 7,500-cubic-foot room with my reference speaker system. In every case, after experimenting with crossover settings, I ended up with an

optimal setting of around 80 Hz — though the actual setting varied considerably from the *marked* setting on all five subs. I listened to the same familiar CD and DVD tracks in each case (see "Tom's Top 10 Torture Tracks" on page 102) as well as other recordings with deep-bass content.

After listening, I measured each sub following my usual procedures (see "In the Lab," page 104), with one notable addition. I generated a figure that doesn't normally appear in our lab tests: "usable bass." First, I balanced each subwoofer with my stereo pair of powered speakers and played "976-BASS" from Bass Erotica's *Bass Ecstasy*, a track that has very strong energy in the lower bass range combined with midrange vocals. Then I slowly turned up the volume until either the subwoofer audibly protested or there was an obvious shift in overall tonal balance, which occurs when the sub can't "keep up" with the main speakers.

I call the peak SPL reading over the first 60 seconds of this test track the sub's *usable* bass. Because the test is so dependent on the particular speaker system, my particular room, and this particular recording, the usable-bass figures can't be taken as absolutes, but they do give a *relative* ranking of dynamic performance.

PSB SubZero*i*

The most wallet-friendly sub in this batch, the SubZero*i* breaks out of the typical cube to assume more speaker-like proportions. The front-mounted level and crossover controls are useful if you like to tailor the sound for each movie or if you just don't want to have to move the sub out of position to make adjustments. And a toggle switch lets you bypass the crossover if you'd rather handle that function through your preamp or receiver. I had little trouble integrating the PSB sub with my satellite speakers.

The SubZero*i* did an excellent job with soft jazz and rock tunes. It might seem strange to talk about imaging and midrangey things like vocals and trumpets in the same breath as a subwoofer, but the upper end of a sub's range can reach into the lower end of a voice's or instrument's range. And a sub that can't put out sufficient deep bass can cause the tonal balance of the entire system to shift upward by putting the emphasis on the middle and upper frequencies at higher listening levels.

At normal listening levels, the PSB sub got the tonal balance just about right, helping to keep the vocals and instruments clearly placed and stable. But it did occasionally swallow a lower bass note in "You're Sensational," from the Mary Stallings *Live at the Village Vanguard* CD. And the sound lacked the *n*th degree of punch on "The Higher You Rise," from Sheffield Labs' *The Drum and Track Disc*, as well as a full sense of envelopment on "Places You Find Love" from Quincy Jones's *Back on the Block*. The SubZero*i* never infected any vocalist's chops, however, or interfered with acoustic instruments working above the bass range.

In general, the PSB offers better-than-average output for its price class. But as the reference material got more challenging and the sound-pressure level (SPL) passed 90 dB on the meter, the tonal balance shifted upward significantly, empha-

FAST FACTS

	CAMBRIDGE SOUNDWORKS NEWTON P200	JBL HTPS-400	M&K K-10	PSB SUBZERO*i*	VELODYNE SPL-1000
DRIVER SIZE	10 inches	12 inches	8 inches	8 inches	10 inches
ENCLOSURE TYPE	sealed	sealed	sealed	ported	sealed
AMPLIFIER POWER (continuous)	200 watts	1,000 watts	75 watts	100 watts	750 watts
FREQUENCY RESPONSE	25 to 200 Hz –3 dB	28 to 250 Hz ±3 dB	35 to 200 Hz ±3 dB	36 to 150 Hz ±3 dB, –10 dB at 32 Hz	24 to 120 Hz ±3 dB
INPUTS/OUTPUTS	line- and speaker-level inputs	line-level input and output	line- and speaker-level inputs, LFE input	line-level inputs, multiway binding-post speaker-level inputs	line-level inputs and outputs, speaker-level inputs
HIGH-PASS OUTPUT FILTER	none	none	none	none	80 Hz at 6 dB per octave
VARIABLE LOW-PASS CROSSOVER	60 to 200 Hz	50 to 150 Hz	50 to 125 Hz	50 to 150 Hz	40 to 120 Hz
CROSSOVER BYPASS	no	yes (with THX contour)	no	yes	yes
FINISH	black vinyl	black woodgrain	flat black or white	textured black or cherry vinyl veneer	black woodgrain vinyl
DIMENSIONS (W x H x D)	12 x 13 x 13½ inches	14⅝ x 14⅝ x 14⅝ inches	13¾ x 10⅛ x 10 inches*	9⅝ x 13¼ x 14½ inches	12⅜ x 12⅞ x 13⅞ inches
FOOTPRINT	1⅛ square feet	1½ square feet	1 square foot*	1 square foot	1⅛ square feet
GROSS VOLUME	1¼ cubic feet	1⅞ cubic feet	¾ cubic foot*	1⅛ cubic feet	1¼ cubic feet
WEIGHT	30 pounds	68 pounds	22 pounds	23 pounds	47 pounds
PRICE	$600	$2,000	$599	$299	$1,499
MANUFACTURER	Cambridge SoundWorks www.hifi.com 800-367-4434	JBL www.jbl.com 800-336-4525	M&K Sound www.mksound.com 818-701-7010	PSB Speakers www.psbspeakers.com 888-772-0000	Velodyne Acoustics www.velodyne.com 408-465-2800

* The M&K K-11 is 15 inches deep (due to protruding driver) and has a footprint of 1½ square feet and a volume of 1¼ cubic feet.

One of the Tom's favorite torture tracks, Chapter 18 of *End of Days* produces plenty of low-end subwoofer rumble.

sizing the upper-bass registers. There was no "chuffing," however, or any of the other overload annoyances that are sometimes heard with ported speakers.

The SubZero*i* managed to make it down to a convincing 32 Hz — which is probably low enough for modest home theater setups. You can't help but admire a product that knows its limits and faithfully observes them.

M&K K-10

In general, the M&K K-10 is a reasonably well-equipped sub, lacking only a power switch and pass-through speaker-level outputs for hooking up your front left/right speakers. Since the sub is always on when it's plugged in, you'll want to connect it to a switched outlet on your receiver — just make sure it's rated to supply 200 watts.

The M&K produced a deep and honest 20 Hz, although lower organ notes, as in the Bach Toccata and Fugue in D Minor played by Virgil Fox, sounded choked off whenever the volume rose above moderate levels. That's because at louder levels, the sub exhibited fairly significant "doubling," an effect in which a speaker produces higher-frequency harmonics of the lowest bass tones that are louder than the fundamental. The result in this case was an upward shift in tonal balance.

With jazz and softer rock, the M&K did a good job of anchoring the soundstage, helping to keep voices and instruments in their proper places. Full, well-rounded bass can help to increase the sense of spaciousness, but the K-10's contribution was occasionally anemic, compressing the soundstage from front to back.

As an interesting wrinkle, I also tested the K-10 stacked with M&K's K-11 sub — which is identical to the K-10 in price and in almost every other way except that its driver is mounted with the magnet sticking out of the cabinet (see photo below) and wired with opposite polarity. Combined, the K-10 and K-11 operate in "push-pull" fashion, where one sub's driver pushes out while the other's pulls in. This is said to both improve the sound quality and increase total output.

Measured alone, the K-11 had slightly less output than the K-10 and a marginally different response curve, but these differences are probably due either to the change in the K-11's internal cabinet volume caused by the inverted driver or, more likely, to the normal manufacturing variations between two samples of the same speaker.

When the two subs were placed next to each other or stacked, the SPL measured from the pair was 5 dB higher than from one alone. But I wasn't able to detect any improvement in sound quality that couldn't be attributed to that increase in dynamic capability. Did the push-pull woofer alignment make the K-10/K-11 combo work significantly better than simply using two K-10s together? I'm not convinced, but the stacked arrangement did produce a more spacious, enveloping sound than the single sub.

Cambridge SoundWorks Newton P200

The Newton Series P200's trim, tall profile keeps its floor-space requirements down to just over a square foot. Like the M&K, the P200 gives you the basic input options but fails to provide any pass-through outputs. All the operating controls are on a small panel at the rear of the sub, which can be hard to reach for on-the-fly adjustments. The sub's 10-inch driver sports the kind of wide (1½-inch) surround used in car woofers. This wider surround is supposed to allow the cone to move farther forward and back than usual, thus moving more air and producing louder bass.

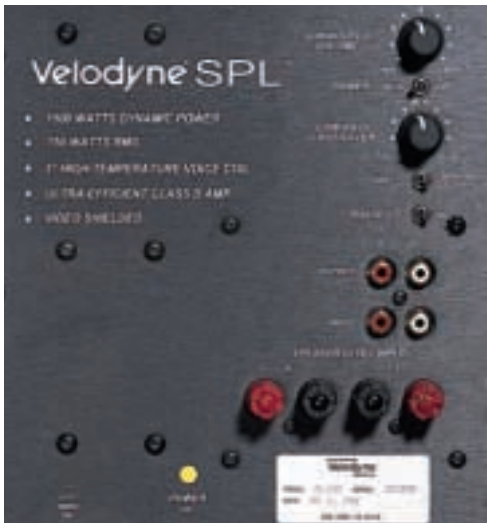
The Newton P200 did a good job with both rock and jazz, although there was a little less stage depth and overall spaciousness than I've heard from other subs in this price range. The sub never intruded on vocals or upper-range instruments, but Vicenti Arthur's acoustic bass on Mary Stallings's "You're Sensational" wasn't always as well defined as it could have been. When I drove the Newton hard, it sounded burbly, which in turn gave the kick drum on *The Drum and Track Disc* a "bonky" sound. When kept within its limits, though, the P200 delivered slightly more usable bass than the M&K pair did.

Velodyne SPL-1000

Velodyne has long been considered a leader in subwoofer design. And the SPL-1000's styling and finish suggest that the company hasn't had any trouble moving into the 21st century. The sub has a full set of features, including pass-through line- and speaker-level outputs and magnetic shielding, which allows you to place it close to your TV without screwing up the picture.

I was immediately struck by the Velodyne's clean, strong bass. It revealed abundant details in just about every type of music, even if most of these "details" occurred in the sub's upper range. The SPL-1000 caused less of a tonal shift at high levels than the other subs and produced such strong energy that I could feel the vibrations in the floor and furniture.

The kick drum on *The Drum and Track Disc* delivered a powerful blow to my chest. Being able to *feel* as well as hear the



first, distant dinosaur step on "Jurassic Lunch" from *The Great Fantasy and Adventure Album* helped to create an impressive sense of spaciousness and envelopment. Even the relatively modest demands of Ray Brown's acoustic bass on Oscar Peterson's "You Look Good to Me" showed off the Velodyne sub's ability to convey detail as well as a realistic sense of soundstage depth.

Able to go down to 25 Hz and hit a respectable 91-dB SPL, the SPL-1000 did its part to maintain Velodyne's reputation. The less expensive subs here will give you decent enough middle and upper bass, but the SPL-1000 will take you most of the way to real deep bass.

JBL HTPS-400

With the biggest driver, most power, biggest footprint, and biggest cabinet, the THX-certified JBL HTPS-400 is better equipped than any other sub here to plumb the sonic depths. (Of course, it's also $500 more than the next most expensive sub.) But size doesn't always (or even often) equal subtlety, so the JBL also had to prove that it could sound musical.

The HTPS-400 proved to be an adept performer throughout its frequency range, keeping the instruments firmly anchored in their places on "You Look Good to Me" while adding to the sense of stage depth. On "The Higher You Rise" from *The Drum and Track Disc*, the clean, clear kick drum packed a terrific punch. The JBL also delivered a rousing 101 dB of solid bass on Bass Erotica's go-for-broke *Bass Ecstasy* CD, giving both the floor and furniture a serious shake.

The JBL HTPS-400's solid performance at 25 Hz showed that it's every inch a true subwoofer. It certainly made its imposing presence felt among the smaller entries in this comparison.

When Small Is Big

What can we learn from this exercise? For all of the advantages of small enclosures, the bigger the subwoofer — in size, power, weight, and price — the better it's likely to perform. So it's not too surprising that the $2,000 JBL proved to be the best subwoofer of the lot, with the $1,499 Velodyne not far behind.

The $600 Cambridge SoundWorks, $299 PSB, and $599 M&K entries might be better termed bass modules than subwoofers since they can't play Herculean program material at true subwoofer levels like the Velodyne and JBL can. But that doesn't mean they can't significantly im-

Tom's Top 10 Torture Tracks

CDs

- **Bass Erotica, *Bass Ecstasy* (Neurodisc), "976-BASS"** This track's high-SPL tone at 22 Hz will let you know if a sub emphasizes the upper harmonics over the fundamental. It also ruthlessly exposes limited bandwidth, port noise, amp clipping, and other forms of distortion.
- ***The Great Fantasy and Adventure Album* (Telarc), "Jurassic Lunch"** This recreation of the movie's T-Rex attack has low-frequency content down to a subwoofer-taxing 10 Hz. A good sub will render the dinosaur's first, distant footstep as a subtle, but forceful, shock wave. A great sub will cause the later steps to vigorously shake the room.
- **Virgil Fox, *Plays Selections of Bach, Franck, Dupré . . .* (Laserlight), "Toccata and Fugue in D Minor"** Not many subs can handle this organ track's 16-Hz fundamentals, but any decent one will reproduce the 32-Hz fundamentals with authority. Watch out for subs that reproduce the second harmonic above the bass tone louder than the fundamental, which makes the sound appear higher in pitch and less full.
- **Quincy Jones, *Back on the Block* (Warner Bros.), "Places You Find Love"** This track has two bass lines going at the same time. Any sub should be able to reproduce the upper one, but it takes a real subwoofer to reveal the strong 35- to 40-Hz segments in the lower line.
- **Oscar Peterson Trio, *We Get Requests* (Verve), "You Look Good to Me"** With the acoustic bass in the right channel, the drums in the left, and the piano dead center, this is a good track to use when you want to see what impact your sub is having on imaging. The instruments should be solidly locked into their proper positions.
- ***The Drum and Track Disc* (Sheffield Labs), "The Higher You Rise"** This dynamic rock & roll track features high-level hard percussion and extremely tight bass and guitar. Your sub should reproduce it with plenty of punch but no extraneous noises, and the sound should remain balanced as you increase the volume.
- **Mary Stallings, *Live at the Village Vanguard* (MaxJazz), "You're Sensational"** As with most recent pop CDs, the recording engineers didn't place the bass on this track anywhere in particular on the soundstage but instead have it envelop the entire ensemble. Properly reproduced, it should sound warm, soft, and full, but never boomy, and it shouldn't interfere with the other instruments.

DVDs

- ***End of Days* (Universal), Chapters 17 and 18** The subway scene in Chapter 17 has lots of strong 25-Hz energy, and the beginning of Chapter 18 has a low, loud rumble that goes on for quite a while, giving you a good chance to assess the sound.
- **THX trailer** You probably have at least one DVD that includes the THX trailer where the synthesizer fades in and fills your speakers with sound. The final chord has plenty of activity at 30 Hz.
- ***Godzilla* (Columbia TriStar), main menu** This menu is an excellent subwoofer test loop because it features a clip from the movie with plenty of 25-Hz information that repeats itself until you choose an option.

prove the overall sound of your system. They're best suited for small rooms or for systems that are geared toward less demanding music recordings and movie soundtracks.

If you're looking to keep things small, the M&K K-10 has just a tad less gross volume than the PSB and Cambridge Soundworks subs. As for footprint, it's the SubZero*i* and the K-10 in a photo finish, with the Newton P200 a nose behind. But we're talking about minor size differences with all of these bass boxes.

As for style, beauty is always in the eye of the beholder. For me, the PSB and Velodyne subs take the prize. The PSB sports a striking industrial design, and the Velodyne, while kind of stumpy, has the best fit and finish of the bunch — and a beguiling blue pilot LED.

No, your sub doesn't have to overwhelm your room, visually or sonically, to get the job done. Any one of the models reviewed here will help you strike an appropriate balance among price, size, and performance. So you don't have to be seduced by those hulking bass monsters on display in the audio dealer's showroom. Sometimes the best way to get something big is to think small. **S&V**

IN THE LAB

	CAMBRIDGE SOUNDWORKS NEWTON P200	JBL HTPS-400	M&K K-10	PSB SUBZERO*i*	VELODYNE SPL-1000
FREQUENCY RESPONSE	59 to 207 Hz ±2.4 dB	47 to 130 Hz ±2.3 dB	48 to 118 Hz[1] ±2.3 dB	47 to 128 Hz ±2.4 dB	59 to 207 Hz ±2.4 dB
LOW-END EXTENSION (at 10% distortion)	25 Hz at 87 dB SPL	25 Hz at 95 dB SPL	20 Hz at 69 dB SPL[2]	32 Hz at 95 dB SPL	25 Hz at 91 dB SPL
TONE-BURST SEQUENCE (25 to 62 Hz, 10% distortion limit)					
average SPL	98 dB	104 dB	94 dB[3]	101 dB[4]	101 dB
maximum SPL	105 at 62 Hz	112 dB at 62 Hz	103 dB at 62 Hz[5]	108 dB at 62 Hz	106 dB at 62 Hz
USABLE BASS	97 dB SPL	101 dB SPL	92 dB SPL[6]	91 dB SPL	100 dB SPL

[1] Same together with K-11. [2] 75 dB SPL together with K-11. [3] 99 dB together with K-11. [4] 32 to 62 Hz. [5] 107 dB together with K-11. [6] 96 dB together with K-11.

I measured the near-field frequency response of each sub with its level control fully up and its crossover set for maximum bandwidth. I also verified crossover slopes and the acoustic turnover points at the marked frequency positions, or at full, half, and minimum rotations for dials with no interim frequency markings. All these subs had crossover slopes of 24 dB per octave except for the M&K, which was just under 30 dB per octave. Typically, as the crossover frequency was lowered the output level fell somewhat, so if you adjust the frequency, you'll need to adjust the level also. The PSB SubZero*i* had the least such interaction between the controls, with very little over the top half of rotation and only 2.5-dB level reduction at the lowest crossover setting. The Cambridge SoundWorks Newton P200 had a minor 4-dB level interaction, all of which occured in the bottom half of the crossover control's rotation. The other three subs had about a 7-dB crossover/level interaction.

Next I measured the actual peak SPL with a 10% distortion limit at one-third-octave frequencies over each subwoofer's full bandwidth using a special ramped 6.5-cycle tone burst. For these measurements I installed each subwoofer in the optimal corner of my 7,500-cubic-foot listening room, with the microphone at an optimal listening seat 2 meters away. A distortion-sensing microphone was also placed close to the speaker. The figures were averaged over the 25- to 62-Hz range, where most of the bass in popular film soundtracks resides (32 to 62 Hz for the PSB). I also recorded the maximum SPL attainable at the lowest frequency the subwoofer was capable of producing with low distortion. Better subwoofers go lower in frequency, play louder with low distortion, and have a smoother power bandwidth.

Usable bass is the peak SPL reading over the first 60 seconds of the "976-BASS" track from *Bass Ecstasy*, which I played while slowly turning up the volume until either the subwoofer protested or there was an obvious shift in tonal balance. Because this test is so dependent on the particular system, room, and recording, it can give only a relative dynamic ranking of these subwoofers' performance. In rooms smaller than mine, you can expect 2 to 3 Hz deeper extension and 2 to 3 dB higher SPL — the smaller the room, the lower and louder the bass response. — *T.N.*