Subject: Re: Basshorns - Pros and Cons
Posted by Wayne Parham on Tue, 29 Aug 2006 15:47:48 GMT
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I'm with you on this. If you want to hit the really low notes, it's hard to properly implement a horn. There are ways to do it, but they all result in a pretty large package. Using a transmission line or tapered pipe is a worthy compromise. But so is a bandpass system, bass-reflex or sealed sub. There are always tradeoffs with any design.Don't get me wrong, I love horns. And I've made some really great basshorns that I'm proud of. But the problems that present themselves when designing a basshorn are challenging. Seems like people tend to want to ignore some of the facts about horn loading when it comes to basshorns. This is true especially when they want to make their basshorns portable. The easier a speaker is to carry, the more popular it will be, especially if you can push the idea that it works as well as a real horn of adequate dimensions.Fitzmaurice's basshorn designs are usually pleasantly small and easy to carry. But they also tend to suffer in terms of quality, having response curves with lots of peaks and dips. Further, his designs depend on the woofer as a direct radiator for the lowest frequecies. In my opinion, the way they're tuned pushes the driver way too hard, way beyond its mechanical limits. The rear chamber is large and Fitzmaurice generally suggests light-cone, low-excursion drivers. That approach is acceptable for a light-duty system, but I wouldn't suggest it for high-power basshorns.His approach makes a couple very unattractive things happen. One is driver over-excursion. I expect that's probably the main failure mode in Fitzmaurice designs. The other is distortion. Since he often suggests that his basshorns be used well below the frequency where the horn is useful, it basically becomes a direct radiator in a large box. So driver excursion goes way up, distortion skyrockets and the harmonics produced are amplified by the horn. In a design like this, distortion is louder than the fundamental for a good deal of its range. It would be interesting to see distortion measurements of Fitzmaurice designs, but he doesn't have any good measurements of his horns, just graphs made using primitive sound meters.I've also seen the opposite argument made just as forcefully. Tom Danley was on a crusade pushing low-fs drivers a while back on Audio Asylum. I think his basic deal was that his Servodrives had high-mass drivers because of the fact the motors were pushing belts and pulleys in addition to cones. So he was forced into finding horn solutions that worked with high-mass drivers. Of course, on a bass system, mass isn't your enemy like it is on higher-frequency drivers. So he was able to design with it pretty successfully, and when using linear motor drivers, he tends to choose drivers with similar specs.Danley pushes the idea that basshorns should have high-mass, low fs and loose suspensions. His opinion is that the rear chamber volume should be used as the main suspension force and that the driver's mechanical suspension should therefore be loose. Danley suggests that the driver's suspension isn't uniformly compliant, and that's why he likes using the rear chamber volume as the main suspension instead. But to tell the truth, I don't think acoustic suspension is the real reason Danley likes this tuning method. I think Danley likes high-mass drivers because that's what the Servodrive motors have, and it is what he is comfortable with. All of Danley's newer designs tend towards this same approach, with a twist like using boundary reinforcement to augment mouth area or making a tapered quarter-wave pipe having similar proportions and characteristics. Edgar is a different breed, since he doesn't ask as much of his basshorns. He does't ever expect them to see more than a handful of watts, so excursion is never a problem. He tends towards the same idea as Fitzmaurice, which is to use a light cone and to push the driver well below horn cutoff, using EQ to extend bass response. In Edgar's case, this is an acceptable compromise since the horn will never be pushed very hard. But I do wonder what kinds of distortion are generated by

his basshorn designs.  I don't think I've ever seen distortion measurements of an Edgar basshorn.Edgar tends to use high quality drivers, so that helps a lot.  I've always liked Edgar's choice of drivers.  But his choice to increase output below horn cutoff with EQ is something that even the best driver can't help.  Shorting rings are ineffective below 100Hz.  So distortion must rise pretty steeply at subwoofer frequencies in his basshorn sub design.  When a basshorn is used below cutoff, the harmonic distortion is amplified by the horn but the fundamental isn't.  So distortion may be louder than the signal sent to the driver.For all these reasons, I've generally preferred direct radiating subs.  A good horn sub can be made, but it must be large.  And I think it wise to employ other distortion reduction mechanisms like push-pull drive.  That's how I've made basshorns that worked well, using a combination of each of these things.  My thinking is this:  If a basshorn is going to be a compromise, why build the basshorn at all?