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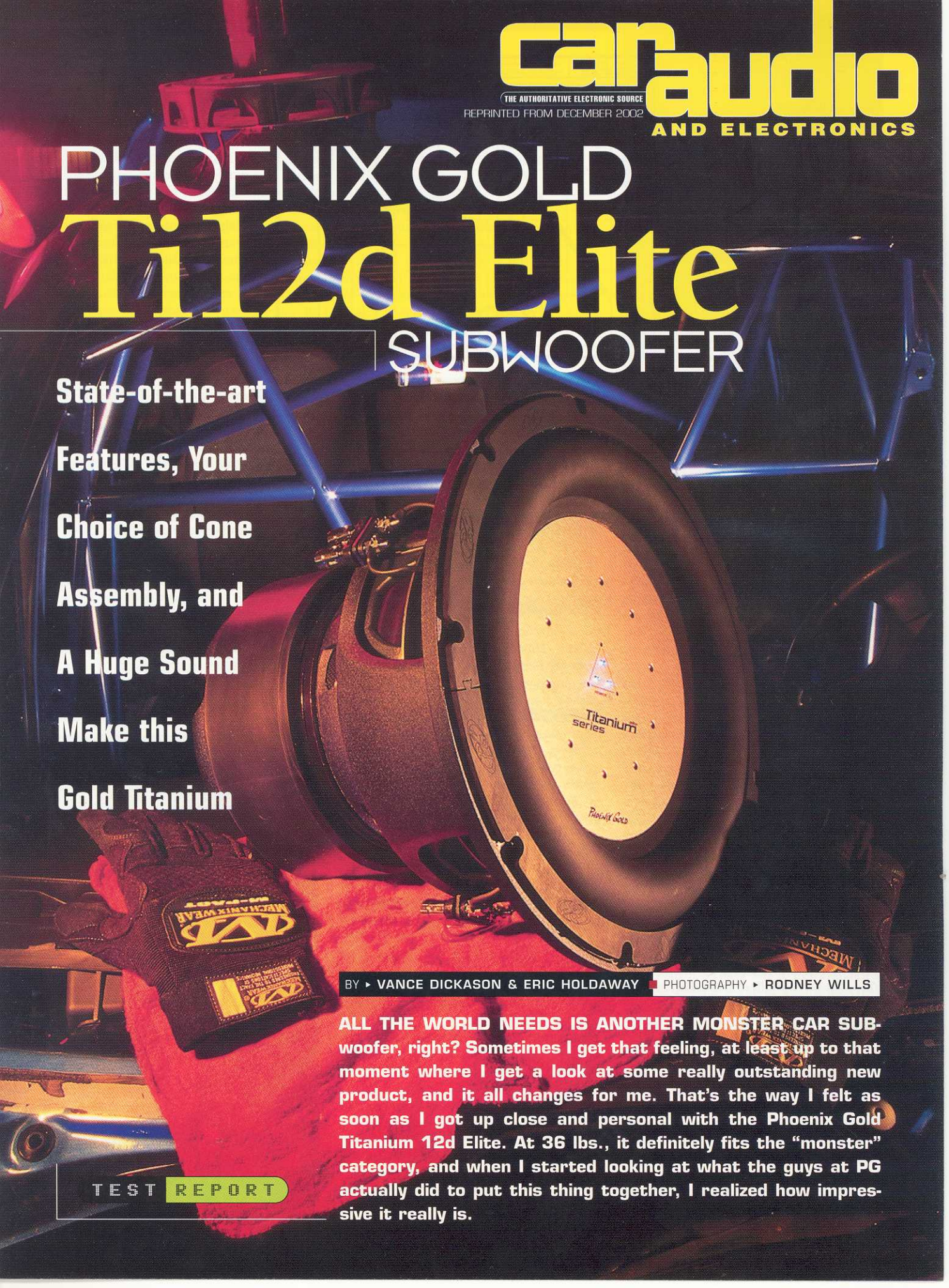
PHOENIX GOLD Ti12d Elite SUBWOOFER

State-of-the-art Features, Your Choice of Cone Assembly, and A Huge Sound Make this Gold Titanium

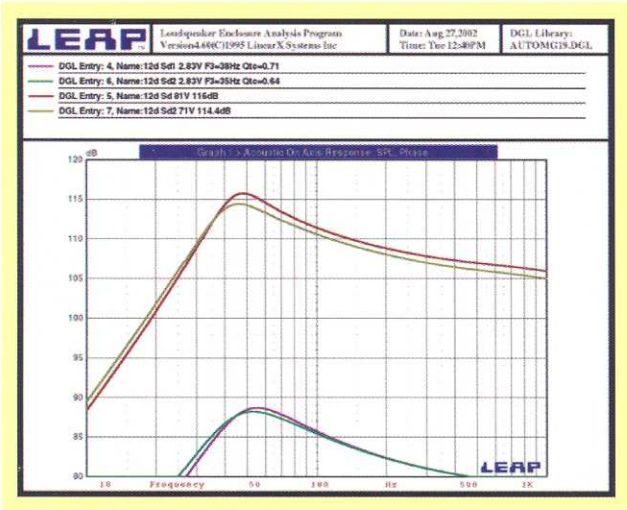


BY ▸ VANCE DICKASON & ERIC HOLDAWAY ■ PHOTOGRAPHY ▸ RODNEY WILLS

ALL THE WORLD NEEDS IS ANOTHER MONSTER CAR SUB-woofer, right? Sometimes I get that feeling, at least up to that moment where I get a look at some really outstanding new product, and it all changes for me. That's the way I felt as soon as I got up close and personal with the Phoenix Gold Titanium 12d Elite. At 36 lbs., it definitely fits the "monster" category, and when I started looking at what the guys at PG actually did to put this thing together, I realized how impres-sive it really is.

TEST REPORT

Phoenix Gold has been in the car audio business since 1985. It started out in the accessories and interconnect business, but by 1991 had begun producing a complete line of car amplifiers. With a nearly immediate market-wide acceptance of its amplifiers, PG decided to enter the car audio speaker market in 1993. In fact, things were going so well, the company went public in 1995 and became a publicly traded company, with stock listed on the NY Stock Exchange. Very few companies in the audio industry are sufficiently successful that they become publicly traded, so the folks at PG are definitely doing something right (check out the Web site at www.phoenix-gold.com).



The Ti12d Elite 12" subwoofer combines a long list of the kind of state-of-the-art features that you expect to see in a serious, high-performance, competition-grade subwoofer. The custom-tooled, three-spoke, slate blue-painted, cast-aluminum frame is a carefully thought out design that is configured to accommodate up to 4" of cone excursion, and that's a big number for a 12" woofer. This frame (sometimes also called a "basket") includes nine one-inch-diameter "windows" with metal screens below the spider-mounting level that contribute substantially to the heat dissipation required in a woofer rated at 1200 watts RMS.

Most high-end products like the Ti12d tend to have some special "trick" that has been incorporated into the design. In the case of this sub, it has a user-replaceable cone assembly (the cone assembly includes the cone, surround, spider and voice coil). This is a feature you sometimes find in Pro Audio products, where field replacement can be essential, but not often in a car audio subwoofer. PG offers this for two reasons. In the unlikely event that you ever burn up a Ti12d, you don't have to send the woofer in to be rebuilt, you just get yourself a new assembly, remove the nine screws that hold the surround to the frame and the nine that fasten the spider assembly, and you are back in business. Probably more important, however, is the fact that this allows PG to offer three different types of cone assemblies that are specifically designed for special purposes, such as SQ, SPL and all-around type applications.

The cone assembly itself has a lot of important features, starting with a totally rigid cone composed of a Kevlar-impregnated, conventional, flat-sided paper that is totally covered by a 7.25-inch-diameter, matt gray, anodized aluminum plate. This plate is part of a cone "sandwich" that uses a special high-density "gator" foam sandwiched between the aluminum plate and the Kevlar-impregnated cone. However, the really cool feature here is the triangle of three bright blue LEDs (Light Emitting Diode) mounted at the center of the woofer. When this puppy gets pumping and you have 12 volts hooked up to the third connecting terminal on the frame, the light show this woofer puts on is definitely hot!

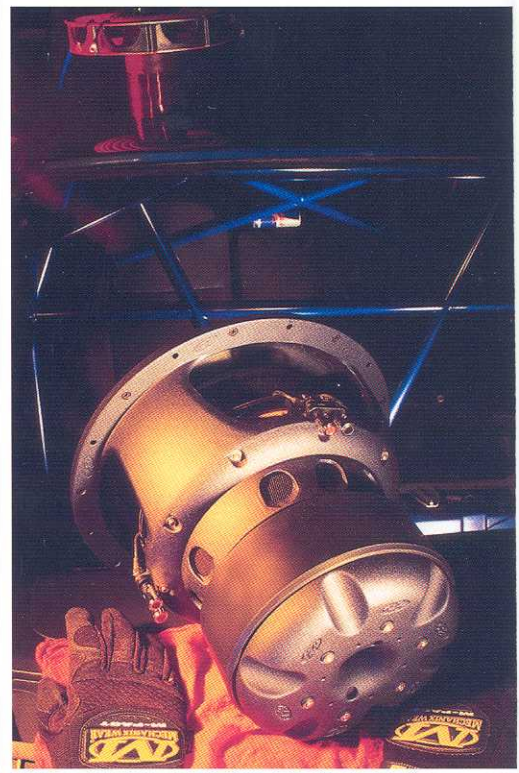
Suspending this cone "sandwich" is a 1.375-inch-wide and 0.75-inch-high, heat-formed, Santoprene surround. The remaining compliance for this woofer is supplied by the dual-progressive, roll mirror-imaged spiders (one spider is turned upside down so that the first fold is going upward on the top spider and downward on the bottom spider. This lowers distortion). Both of these 8-inch-diameter poly cotton spiders are mounted on a custom injection-molded plastic standoff that fastens to the frame with screws as part of the user-removable cone assembly feature. This not only allows removal of the cone assembly, but also gives two and a half inches of excursion below the lower spider and two inches of rearward travel for the upper spider. The progressive roll also means that this woofer can be used successfully in vented- as well as sealed-type enclosures.

Driving the cone assembly is a 3-inch-diameter, four-layer dual voice coil wound on a black-anodized, aluminum former with aluminum wire. The black anodizing helps the former conduct away built-up heat and the aluminum wire makes for a lighter assembly, which equates to more efficiency. Both 3-ohm voice coils have their tinsel leadout wires connected to a pair of spring-loaded, silver, color-coded push terminals. The lead wires are stitched at their center point to the upper spider, as opposed to being woven into the spider like some woofers reviewed in the last couple of years. This accomplishes the task of keeping the lead wires from bouncing against the rear cone surface and probably puts less motion stress on the lead wires compared to the woven method.

Like most of the really professional speaker manufacturers that provide products for review in *CA&E*, Phoenix Gold uses a lot of advanced computer modeling to develop a woofer like the Ti 12d. The list given to me by PG had some of the best FEA (Finite Element Analysis) and woofer modeling programs in the field. This included such programs as Fine Cone, SpeaD, Magneto and Quickfield (programs I have written articles about as editor of Voice Coil, the professional newsletter that is read by speaker manufacturers). The motor structure combines a machined T-yoke (backplate/pole piece combination) that has been painted with a black emissive coating to enhance heat dissipation. Riding piggyback on the backplate is a massive cast-aluminum heatsink that works in conjunction with the one-inch pole vent and six peripheral vents (vents from inside the gap area to the outside) for additional cooling.

As with the T-yoke, the front plate is also milled, but polished and given the same black emissive, heat-dissipating coating. For additional cooling, PG has also installed a thick, black-anodized and machined-aluminum cooling ring located between the front plate and the frame. Powering this behemoth is a stack of three ceramic, 5-ferrite magnets (Y33 grade for you techno freaks) that are covered by the customary injected rubber "boot."

T/S parameters (numbers that can be used to describe woofer performance) were measured using the LinearX LMS



analyzer and LEAP CAD software. Impedance was made using a LinearX VI Box (current source method), which means that the analyzer was connected directly to an amplifier driving the woofer. Instead of a single impedance curve, the procedure produces separate voltage and current curves at a 1V drive level. These two curves are then divided using Ohm's Law (V/I=Z) to come up with the final impedance curves. Once the free-air and test box impedance curves were created, the two curves were transferred to the LEAP program to calculate the T/S parameters. The resulting parameters and computer box simulation data are given in the Data Chart with the LEAP sealed-box simulation graph shown in Figure 1.

The measured parameters shown in the Data Chart were used to produce two differently sized sealed-box simulations. As mentioned previously, vented-type enclosures are certainly possible with the Ti12d woofer, but my personal opinion would be that you would get a much more musical speaker in a sealed box, so no vented simulations were attempted. Although sealed rear-chamber bandpass enclosures are also possible using the Ti12d woofer, the small front box volume and low tuning would make it difficult to realize in practice with anything close to a sufficient vent area.

In a compact 0.8-cubic-foot sealed box the Phoenix Gold Ti12d Elite woofer produces an F3 of 38Hz with a well-damped box "Q" (Qtc) of about 0.71. Of the two box sizes simulated, it gives the highest linear SPL and power handling, and would elicit very good performance from such a moderately sized box. For a somewhat lower F3 and a perhaps more accurate sound at higher volume levels (remembering that lower Q numbers mean a subjectively more accurate sound and that Q numbers get higher as the woofer heats up), the slightly larger 1.4-cubic-foot simulation produced a –3dB frequency of 35Hz, but with increased excursion. With the tremendous cooling capability afforded by the various bells and whistles in the motor structure of the Ti12d, the thermal limitations of this woofer are certainly high enough that you'll easily go deaf before burning one of these out. With either box volume, the computer simulation showed the driver would make the 115dB and higher range before the voice coil started to operate out of the gap at all. However, as with all high performance car audio subwoofers, their ability to get loud without distortion is extremely impressive, but also potentially hazardous to your hearing. A good thing to remember is that if you feel a little twinge of pain in your ears, you are absolutely doing damage.

Given the outstanding cosmetic appearance, the cool blue light show in the center of the woofer cone, the enhanced thermal cooling capability, and the good small sealed-box performance, this sub should be a popular choice for both street users and those in IASCA/USAC competitions. All of this is only computer predicted performance, however — the real bottom line is how it sounds. For that, I put my trust in Eric's ears. —V.D.

TEST REPORT

Listening

Oh Vance, you say the sweetest things!

So I get back from my vacation. Had a very nice time with my family, thank you very much. As soon as I hit the front door of my office, the phone is ringing and Casey is telling me to look in my stock room and check out my next project. Casey sounds awfully excited, so it must be something interesting.

In my stockroom are two boxes. Two very LARGE boxes! One of them weighs a **ton**. (It's really about 40 lbs., but it feels like a ton if you're not expecting it!) The other box is very light. I bust open the heavy box and find that I am looking at the new Phoenix Gold Ti12d Elite. In the box, the Ti12d Elite looks like a pretty normal subwoofer. Get it out of the box, and it no longer looks so normal. This subwoofer is **massive** in every direction. It looks taller than it does around, but it's not. The mounting depth is a record breaking 10-1/2", so that makes the total height about 11 inches! The overall diameter is 13-1/4". The huge motor structure and frame dominate the impression that this subwoofer imparts.

As with the other massively structured subwoofer that I tested, the shipping carton for the Ti12d Elite is unique too. On the outside of the packaging, there is a label that tells the purchaser to keep the original carton and inserts in case the subwoofer ever needs to be shipped back to Phoenix Gold. The label tells you that if you do not keep the packaging, it will cost $50.00 to replace it for shipping. Keep your boxes folks!

To get the all important application information on the proper use of this hulking subwoofer, I was advised to seek out the man that gave birth to it, Bill Hasbrook. (Dang, that must have hurt!) Bill is the Acoustics Engineering Manager for Phoenix Gold and a total transducer geek! He really knows his stuff and is very frank. I like that, or at least I did until Bill said something about a "Fat Bastard." Being in shock, I was trying to come up with a better come back than a really lame, "Oh yeah..." That's when Bill explained that Fat Bastard is the nickname attached to the Ti12d Elite and not what he was calling me. (I can tell you I was really glad to hear that, because I was really stuck on, "Oh yeah...")

So I get Bill on the phone to ask for the official recommendations of the proper style and size of enclosure to achieve maximum sound quality. He recommended a sealed enclosure with a net volume of **only** 1.25 ft3. Bill also told me that the Ti12d Elite's displacement is a very large 0.2 ft3! Bill also recommended that the enclosure be built in either 1" or dual layer 5/8" MDF.

Data Chart

Brand	Phoenix Gold
Model	Titanium 12d Elite
MSRP	$899
Warranty	3 yrs (dealer installed)

Mechanical Specifications

Weight	36 lbs.
Rear mounting clearance	10.25"
Woofer Magnet dim. (dia. x ht. in mm)	185x57 (using three stacked magnets)
Woofer Voice coil diameter (mm)	76 (3")
Voice coil wire layers	4 (two 2-layer coils)

Measured T/S parameters

Nominal Impedance (Ohms)	2
Revc (Ohms)	1.52 (both 3-ohm voice coils connected in parallel)
Sd (cone area in sq. Meters)	0.043
BL (motor strength in Tesla Meters)	11.2
Vas (in Liters)	36.2
Cms (micrometers per Newton)	140.4
Mms (Grams)	278.9
Fs (Hz)	25.5
Qms	3.38
Qes	0.54
Qts	0.47

Power and Excursion Data

Sensitivity (2.83V/1M in dB)	89.4
Continuous power handling (watts RMS)	1200
Peak power handling (watts)	2000
Xmax ([coil length-gap height]/2 in mM)	25.4

Computer Simulation Data

Enclosure size for simulation (cubic feet)	
Sealed (1)	0.8 (50% fill material)
Sealed (2)	1.4 (no fill material
-3dB (F3) at 2.83V	
Sealed(1) (Qtc=0.71)	38Hz (note Qtc without fill material is 0.75)
Sealed(2) (Qtc=0.64)	35Hz
Voltage to achieve Xmax + 15%	
Sealed(1) (max 29.2mm)	81V
Sealed(2) (max 29.2mm)	71V
SPL at Xmax + 15% (see Fig. 1)	
Sealed(1)	116dB
Sealed(2)	114.4dB

This is partially due to the weight of this subwoofer and partially because of the intense internal pressure that this subwoofer should be able to create within the enclosure.

I opted for the 1" MDF panels. I had my guys at Speaker Works in Orange, CA, build a sealed enclosure of 1.45 ft3. This will give us a net enclosure volume of 1.25 ft3, exactly what Bill prescribed for maximum sound quality. So far, so good, until we found that the Ti12d Elite's mounting hole needed to be 11-1/2", almost 5/8's of an inch larger than most subwoofers. Unfortunately, there is no template to explain this. I am told that the production subwoofers will come with a rubber gasket and trim piece that will act as the template, saving the installers "cut and try" time.

Once I got the Ti12d Elite into its enclosure, I headed out to my ultra-sleek, high-gloss-black Ford F-350 Super-Duty Diesel truck. In the Ford, I found that the Ti12d Elite worked well in most locations, but it really kicked butt with the enclosure placed on the floor between the front and back seat, subwoofer facing up. That worked for me.

To power the Ti12d Elite's subwoofer, I bridged two Crossfire VR1000d monoblock amplifiers together using the built-in bridging module. Doing this allowed me to wire the Ti12d's dual 3-ohm voice coils in parallel for a 1.5-ohm load. Two Crossfire VR1000D amplifiers strapped together will produce over 2000 watts of power! I used the internal crossovers from the amplifiers and bypassed the subsonic filters.

The front half of my reference speaker system consists of a pair of USD Audio B-62 WaveGuide separates. This system features a pair of USD Audio 622 6.5" midrange/woofers, a pair of the BC-300 horn-loaded compression driver tweeters called WaveGuides and a pair of specially tuned passive two-way crossovers called PX-BCs. I power these on a Zapco Competition C2K-4.0X amplifier (in stereo) at a conservative 100 watts per channel. (I did not run the rear surround speakers that are in my truck.) The built-in high-pass crossover filter was used to block the bass to the component system.

What do I think of this subwoofer? This subwoofer kicks booty. **Hard!** It's expensive, yes — it retails for $899.99. However, in this case you get what you pay for. My last few reviews have all been on ultra high-end, expensive equipment, and *I love them!* Quart Q's, Morel Supremo's, JL W7's — I love to listen to this stuff because it sounds **so dang good!** And I just have to say that there are **reasons** that this stuff is more money than the other less-expensive gear. They are better designed, and use more expensive components, so they just flat out rock!

MUSIC SELECTION

Artist & title	Music Type	Points Possible	Phoenix Gold Ti12d
Quincy Jones Back on the Block	Rap	10	9
Sting A Brand New Day	Pop	10	9
Goo Goo Dolls Gutter Flower	Rock	10	9
Sade Lovers	Soul/ R&B	10	7
Marc Cohn Marc Cohn	Folk Rock	10	8
Total		50	42

For example, I decided that this subwoofer looked like it should just beat the hell out of me with rap, so I started with the title track from Quincy Jones' *Back on the Block* album. This is a rap album, honest! This track features Ice T doin' his thang. The Ti12d Elite sounds really nice and musical. Good impact, with control and minimal hangover. Then this track takes a twist: at 01:27 I am **slammed** with the drop bass from hell. **Holy subwoofer!** At 40Hz, this subwoofer kicks in like a turbo! It is tight, clear, and loud.

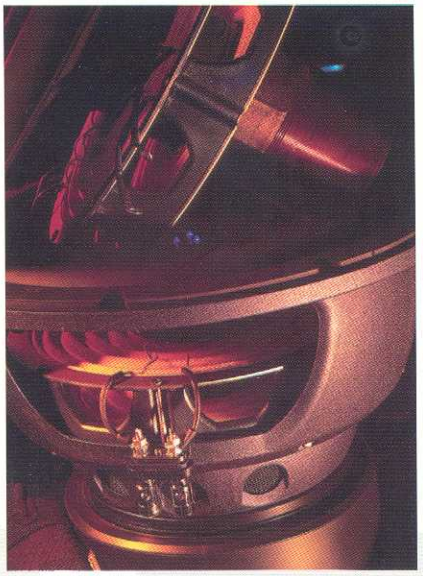
Now I really want to try out this earthquake generator. The first six bars of Sting's *A Brand New Day* album intros with some 30 to 50Hz bass rumble. **Everything** loose in my truck was dancing! The rumble gives way after 0:37 seconds to the first track, "A Thousand Years." Kick drums and the bass guitar are tight and clean! This track gave my kidneys a beating. The upper midbass line is a little light compared to the lower frequency stuff, but still sounds great.

On Marc Cohn's fine self-titled album, I listened to the last track, "True Companion." At 01:12, a large concert bass drum is introduced to great effect. The lower frequency extension and impact is very good and realistic.

Next I played the title track off of Sade's *Lovers Rock* album. This track has a bass line that moves from 80Hz to below 40Hz. It revealed a linearity problem in the Ti12d Elite's response. If I set the amplitude response of the system to match at the subwoofers' 40Hz volume level, then the upper midbass is thin and not as full as it should be. This should not be a problem if you are using some heavy-duty midbass speakers up front. When I set the amplitude response to match at the subwoofer level at 80Hz, the deep bass comes on big time. In a way, this is kind of fun, and it does help compensate for road noise when driving.

SUBJECTIVE SCORE CHART

	Points Possible	Phoenix Gold Ti12d Elite
Overall Sound Quality	50	43
Tonal Balance	10	8
Low Frequency Extension	10	10
Clarity at Low Volume	10	9
Clarity at High Volume	10	9
Impact	10	9
Total Subjective Score	100	88



I've now shifted gears to the Goo Goo Dolls' *Gutter Flower* album. The opening track, "What a Scene," is full of guitars, drums, and keyboards — layer upon layer, and all at once in a "wall of sound." The Ti12d Elite has no trouble reproducing these layers with clarity, impact and very low distortion.

SPL in-car measurement at 2.83 volts, at 1 meter Peak reading non-weighted:

40Hz.....99.4dB
80Hz.....94.1dB

Music played really loud:
Max SPL.....130.7dB

Phoenix Gold has designed a subwoofer that advances the art of car audio. Its incredible excursion limits are remarkable. It is likely new loudspeaker designs such as this will trickle down into the mainstream platforms, but not for a while. The Phoenix Gold Ti12d Elite is comparable to the other high tech subwoofers that are priced in the ballpark of the $899.99 retail that PG has set for this subwoofer. This, and subwoofers like it, are exciting, bold, and fun — and yes, expensive. I am thankful that there are companies like PG that are still spending the money and time to do the intense research needed to keep creating the technological breakthroughs to advance our art. I do think that Phoenix Gold gave into the marketing geeks by going with the LEDs in the cone, but it did it in a way that does not harm or degrade the quality of the product or integrity. And its advertisements are still about the products and technology instead of half-naked ladies. You've got to love that. —E.H.