Enthraals Build Thread

New Project Enthraals Intro!

This is a project I've been excited to start for a while, called the Enthraals, they feature high end no holds barred drivers from Raal and CSS

Drivers are Raal 70-20 tweeter, CSS LDW7 midwoofer, SDX-10 subwoofer and two APR-10 passive radiators per cabinet.

In this installment I unbox the drivers and go over what I'm doing with this project, enjoy!

Project Enthraals Part 2, Walnut Selection!

Hey everyone! In this installment I discuss my thought process for selecting the hardwood I'll be using for this project. I'll get more into the cabinet construction in Part 3.

But you gotta see this gorgeous walnut I picked out, can't wait to see the Enthraals come to life!

Project Enthraals Part 3 - Base Cabinet Construction and Bracing

Now we're cutting wood! In order to laminate the walnut over the cabinet I'll first need a base cabinet to attach to, this base cabinet is the backbone of the speaker supporting the drivers and walnut, I chose to build it with 1/2" Russian Birch and 3/4" Russian Birch bracing.

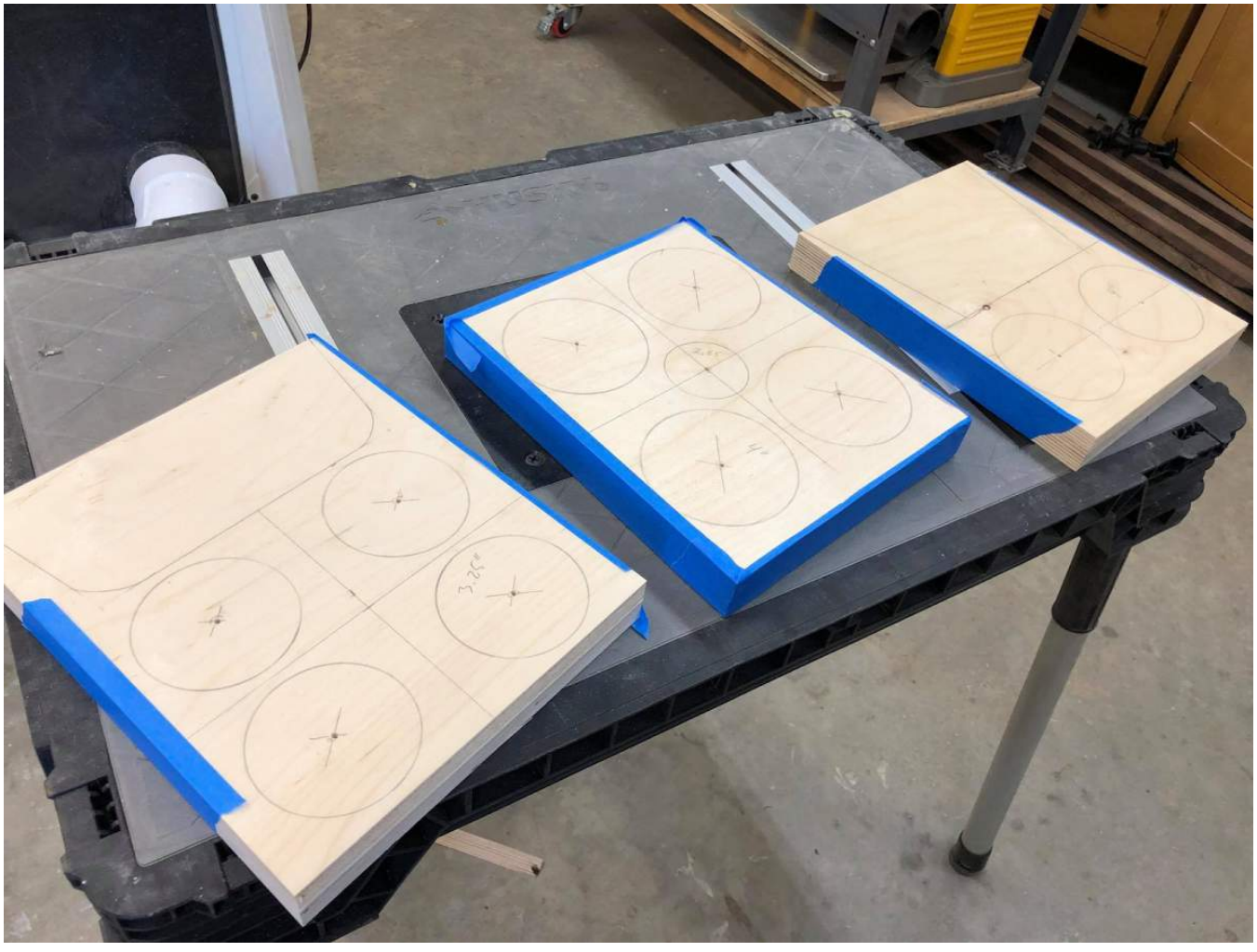
Dimensions and driver layout are critical as eventually I'll be "cutting blind" for drivers so all brace dimensions are carefully measured.

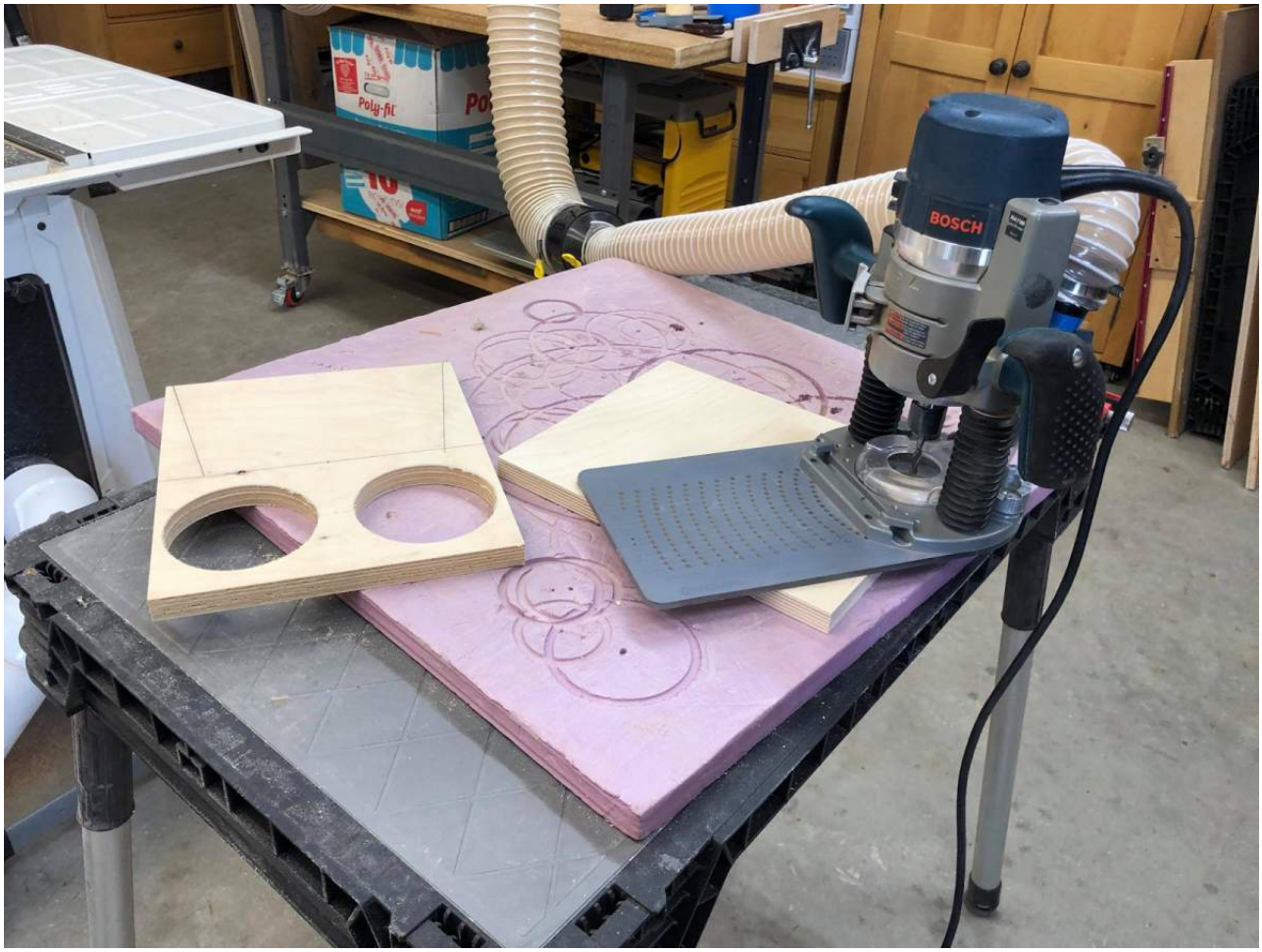
Since the base cabinet won't be being routered in any way (aside for driver cutouts), I used air powered brad nails to speed up the assembly, I don't normally do that but in this case it made things go

much quicker.

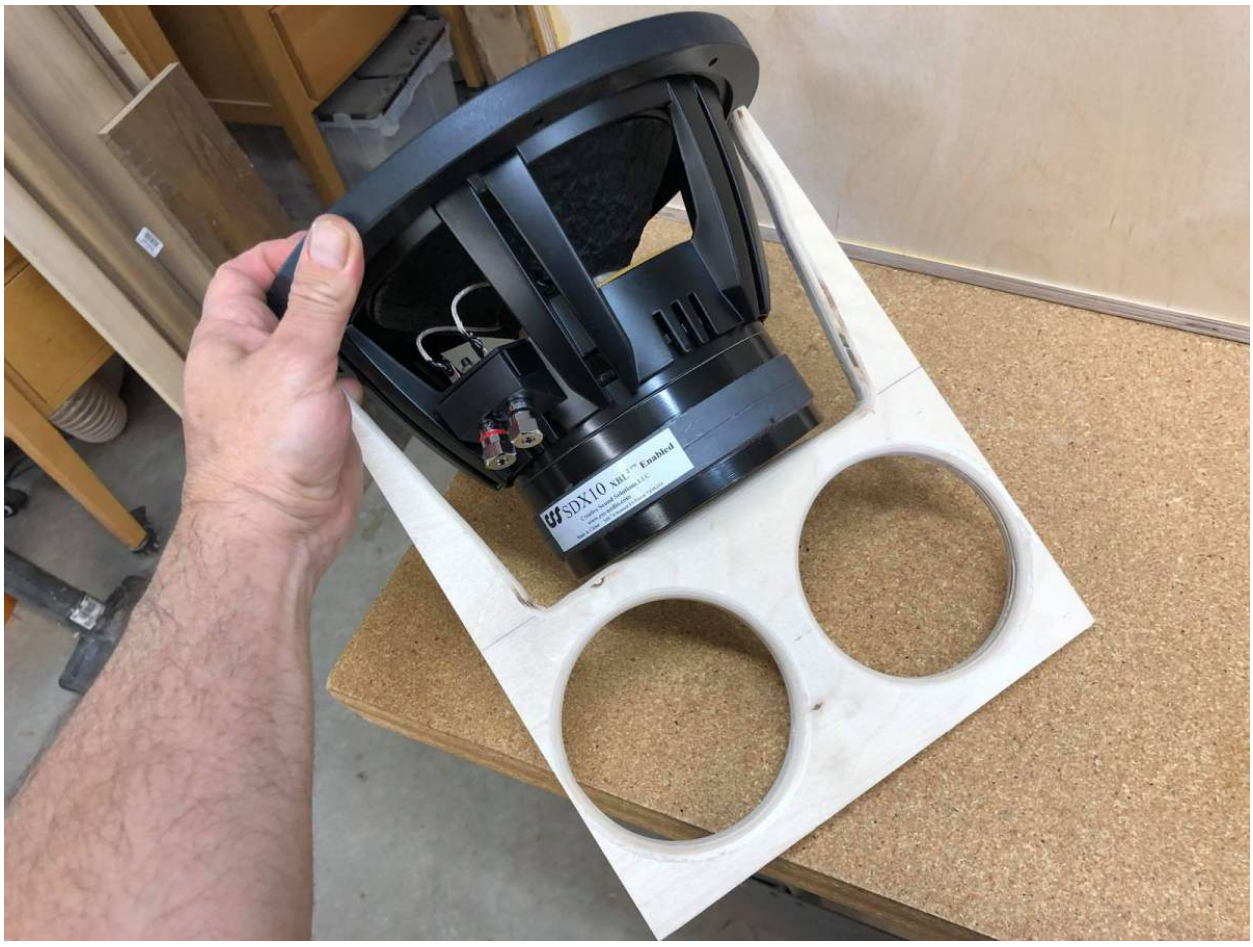
The video explains everything and gives some close up shots of the final

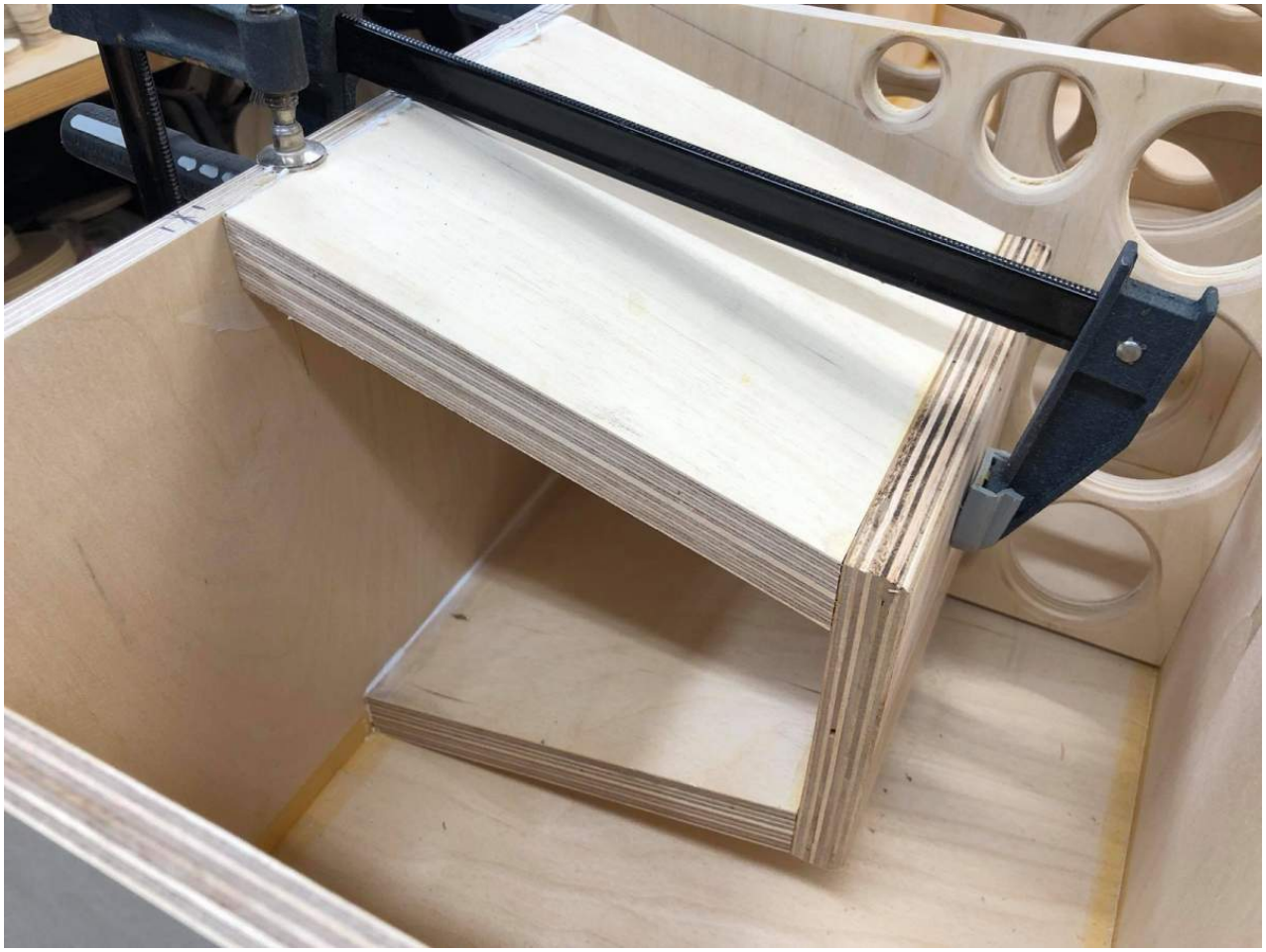
bracing.




BOSCH
Poly-fil


FRONT


SDX10




HUSKY

Project Enthraals Part 4 - Interlocking Walnut Construction Detail

Alright finally we're ready to use this quarter sawn Walnut!

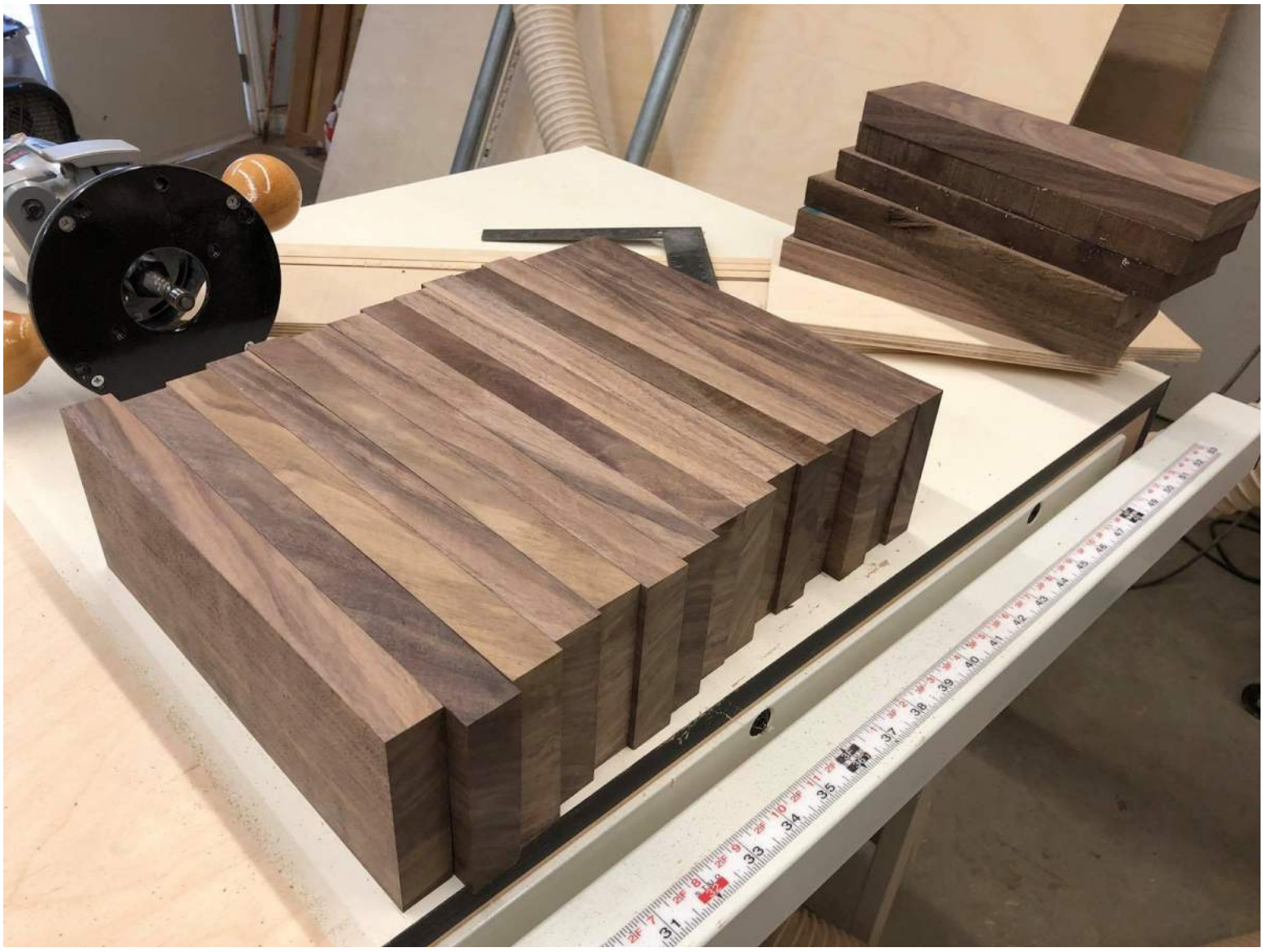
First off if you're not familiar with the project please feel free to get caught up on the first 3 updates under the announcements section.

Watch the video to get the best idea of what I'm doing here, I am also documenting with pics too.

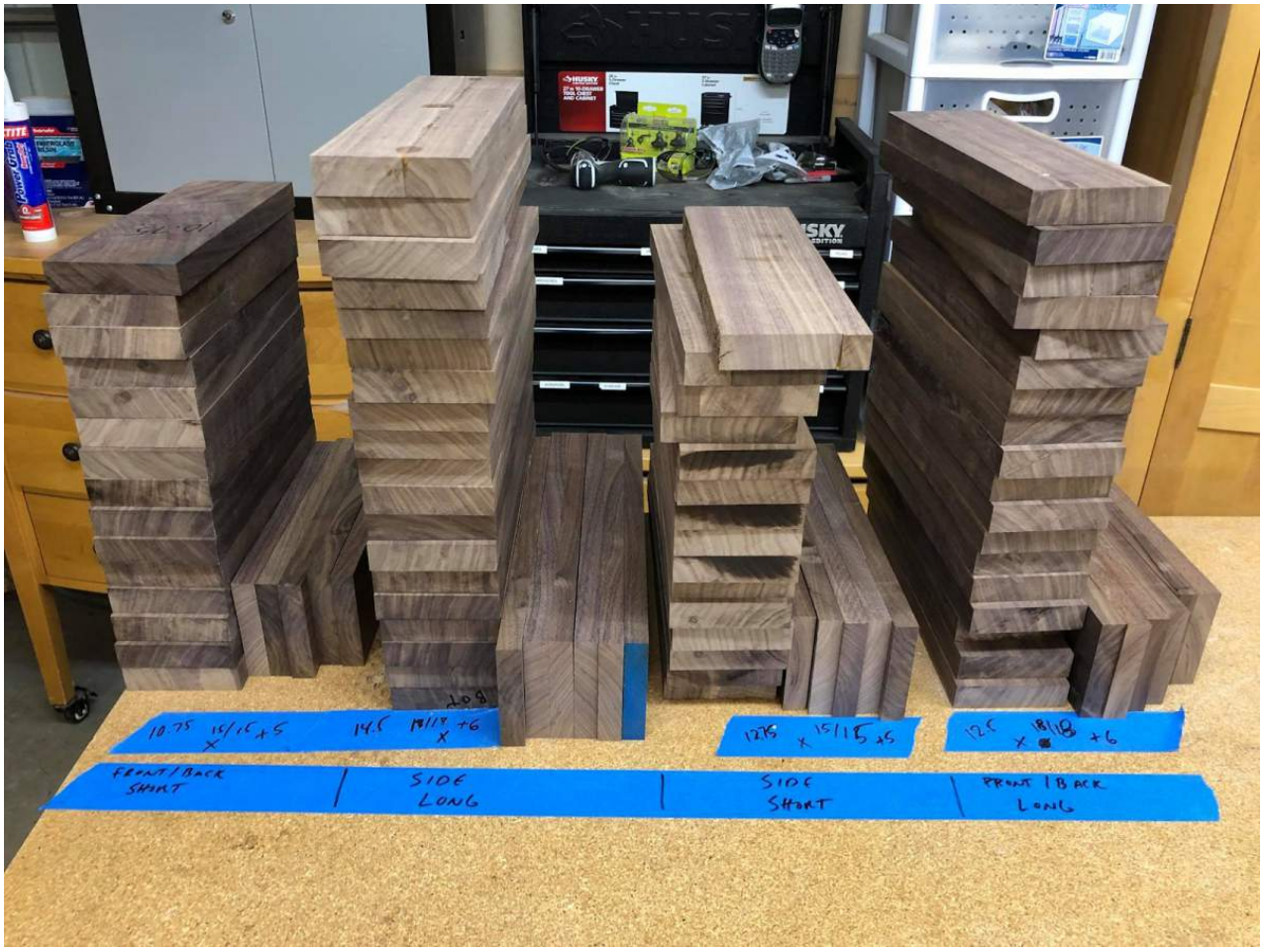
Basically I'm laminating this Walnut horizontally on the cabinet in a corner interlocking fashion, each layer is 3.75" wide and each cabinet will have 11 layers. I am clamping each layer at a time, pieces are biscuited together as well which greatly helps in assembling each layer and adds additional strength.

These cabinets are going to be monsters, final wall thickness will be almost 1.5" thick or over 30mm, they will be very heavy I estimate about 130lbs once done. (My back!).

Thanks for following along, please watch the video and see the pics, I should be done with this phase of the project this weekend.



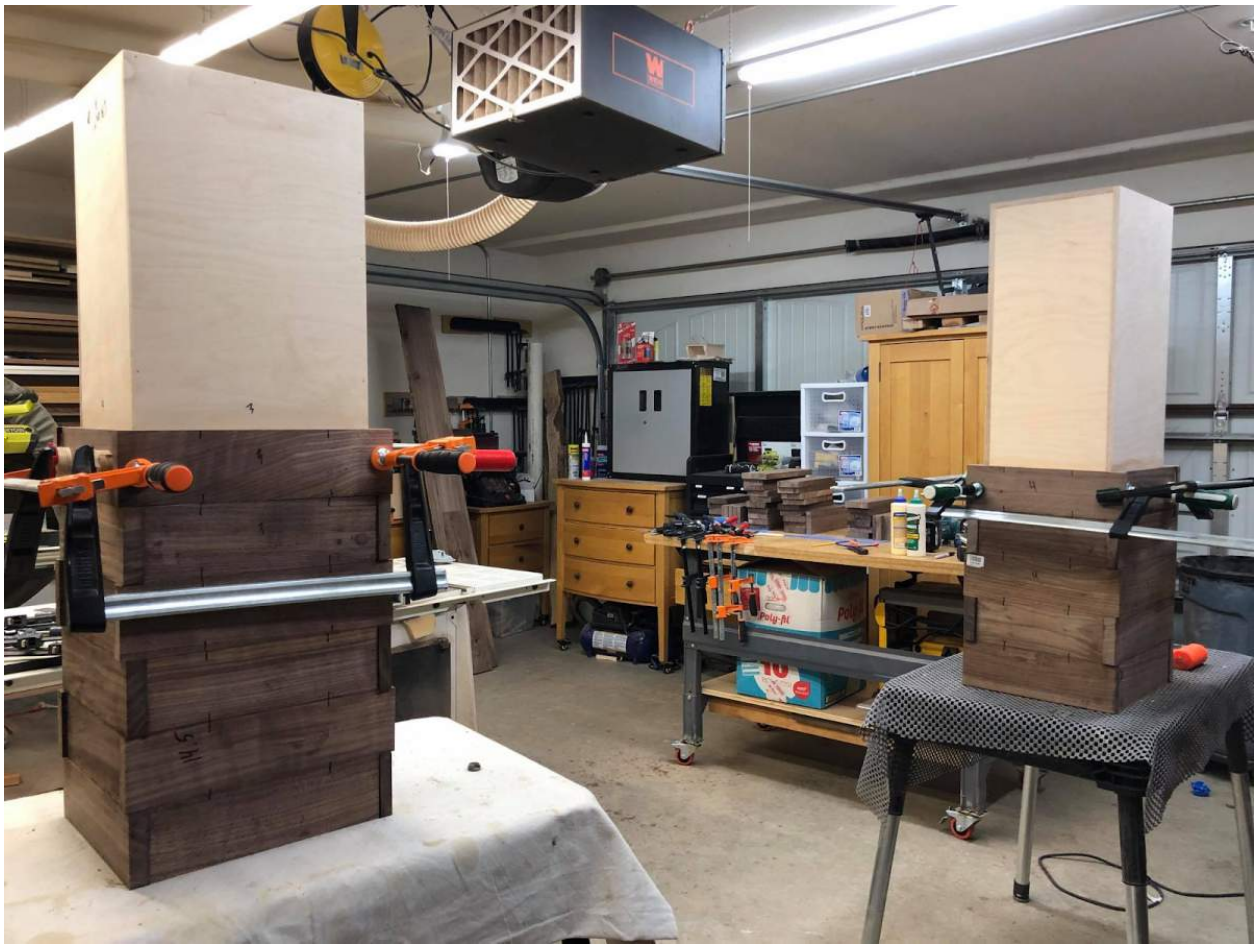

12.5
12.75


10.75 15/15 +5
14.5 18/18 +6
12.75 15/15 +5
12.5 18/18 +6
FRONT / BACK SHORT
SIDE LONG
SIDE SHORT
FRONT / BACK LONG


TOP B


TOP A


14.5
FRONT



Project Enthraals Part 5 - Walnut Cabinet Construction Continued

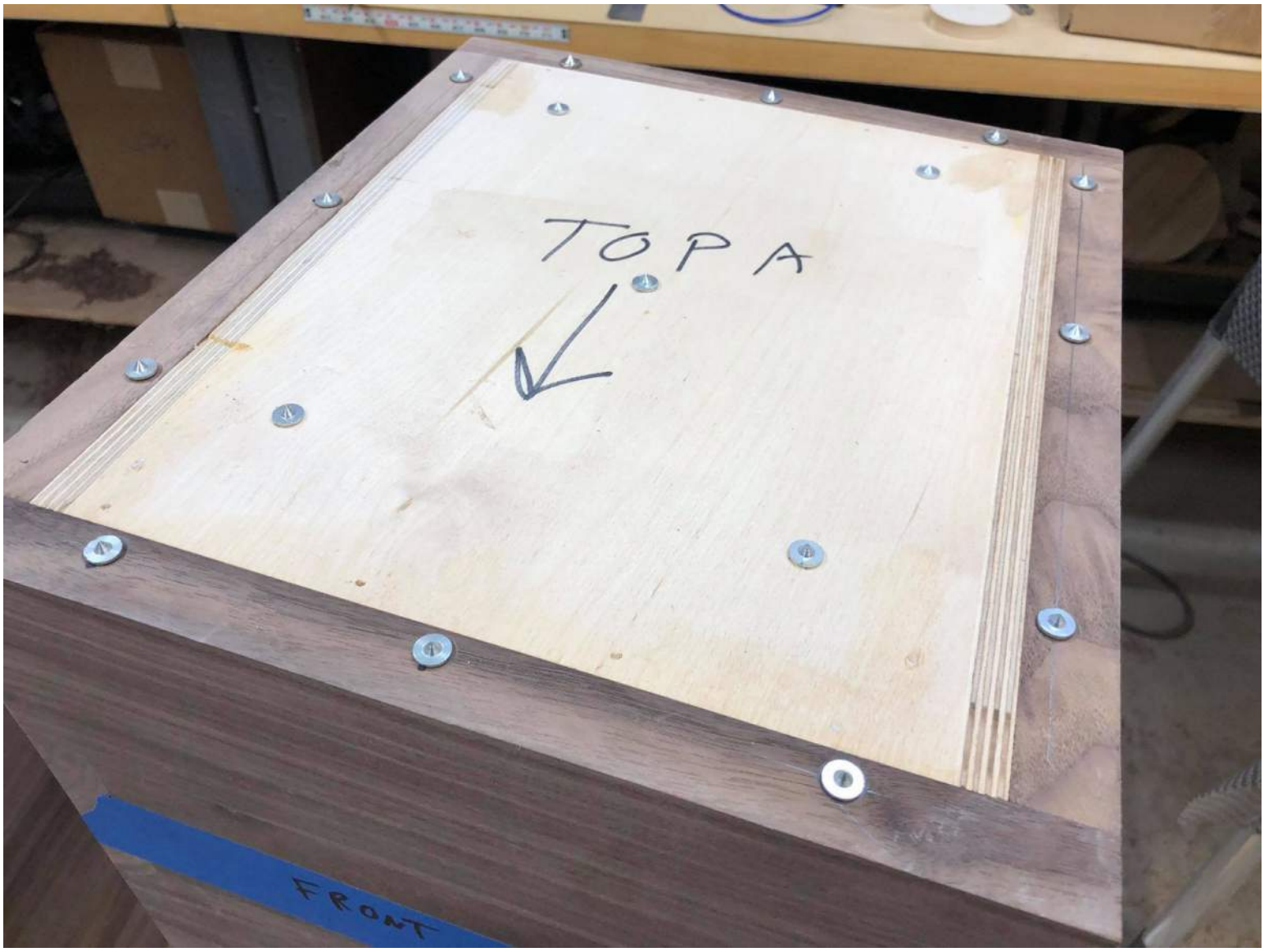
Last time I discussed how I was stacking the layers of Walnut strips, that process has continued and I now have all layers stacked, a 1/4” thick Walnut veneer applied to the bottom and the 15/16” thick solid walnut top laminated well.

I have also sanded the entire cabinet smooth (all 8 sides plus top and bottoms) with 60-grit.

Another necessary step before sanding was to cut the ends off the long intersecting strips. I tried 2 methods- first was a pull saw and the second was a Makita Oscillating multi-tool with a precision end cutting blade in it. The pull saw method was clearly more accurate and a cleaner cut, but it took longer and was much more effort, so I used the multi-Tool to do all the cuts, I didn’t need them to be super clean as I was going to flush trim it all and sand it anyway. See the video of me using it, great tool and super handy if you’ve never used one.

Please browse the images and videos below to get a good idea of each step I’m taking here.

I’m really thrilled with how these are turning out and after sanding I’m getting a glimpse of what they’ll look like, stay tuned!




.8"


3/4" X 10' S40 A53A-E INDONESIA

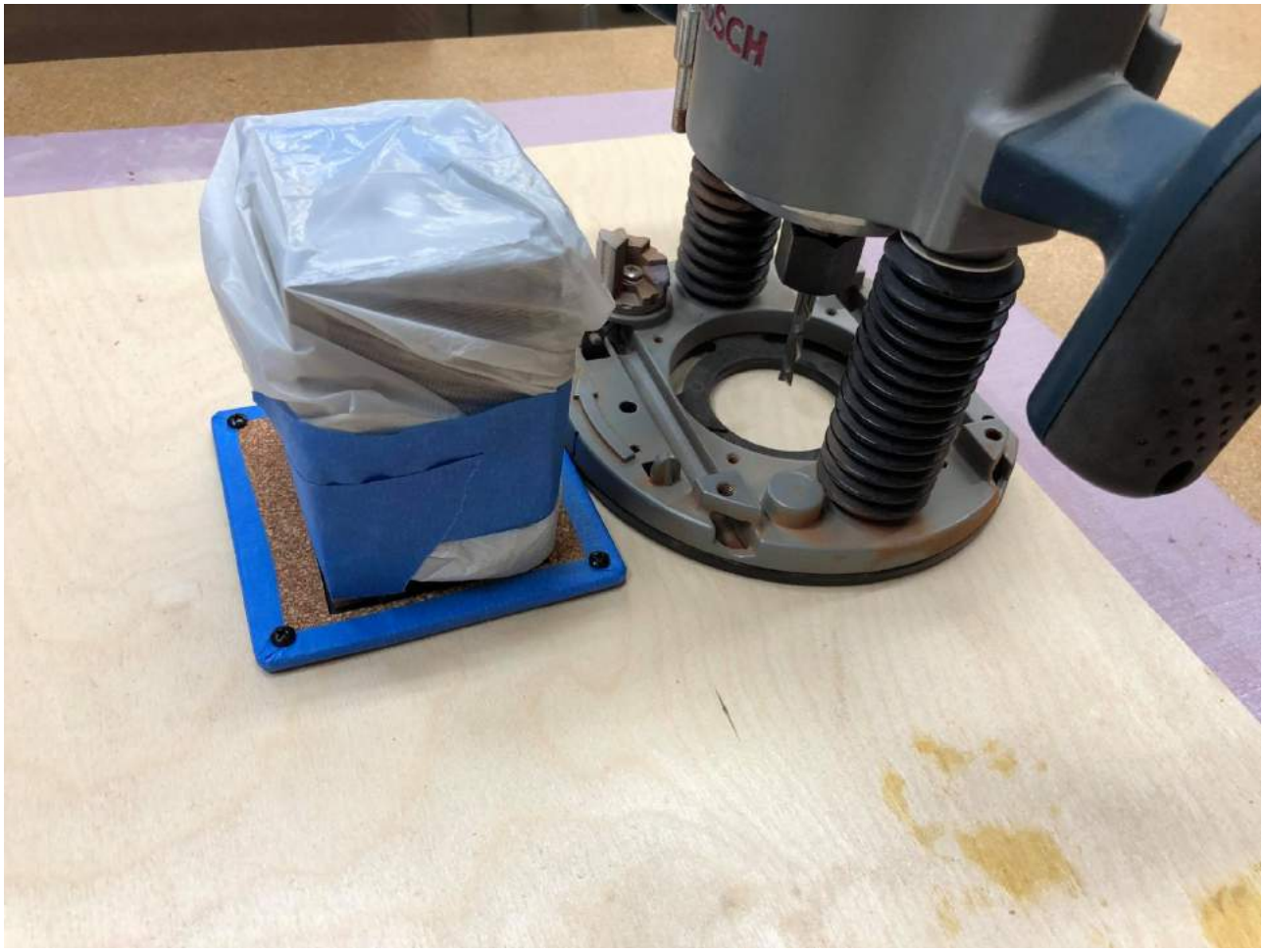
Project Enthraals Part 6 - Raal Tweeter Flush Mount

As always I document these odd shaped non circular driver recesses.

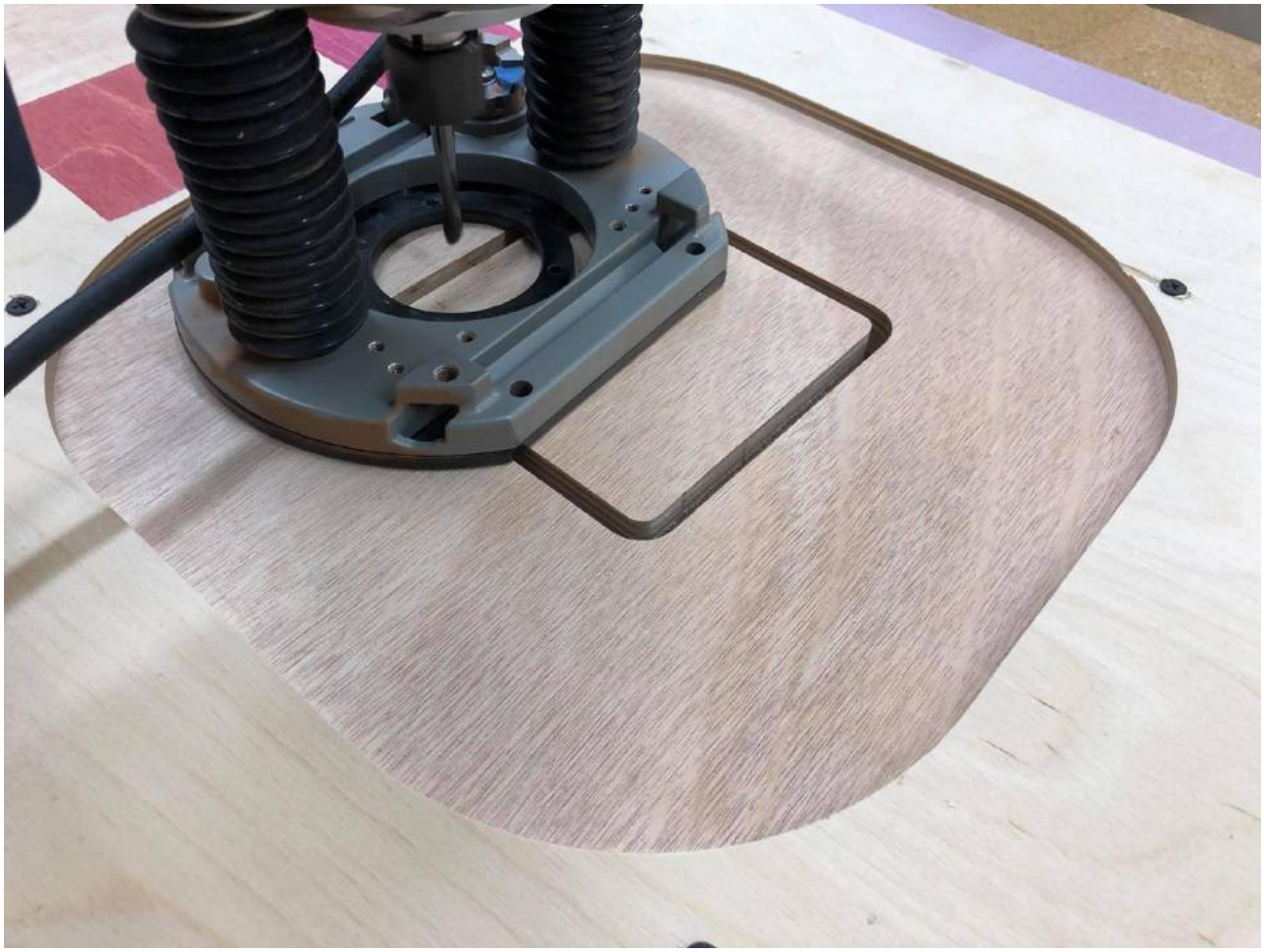
See attached photos for step by step, super easy once you get the hang of it!

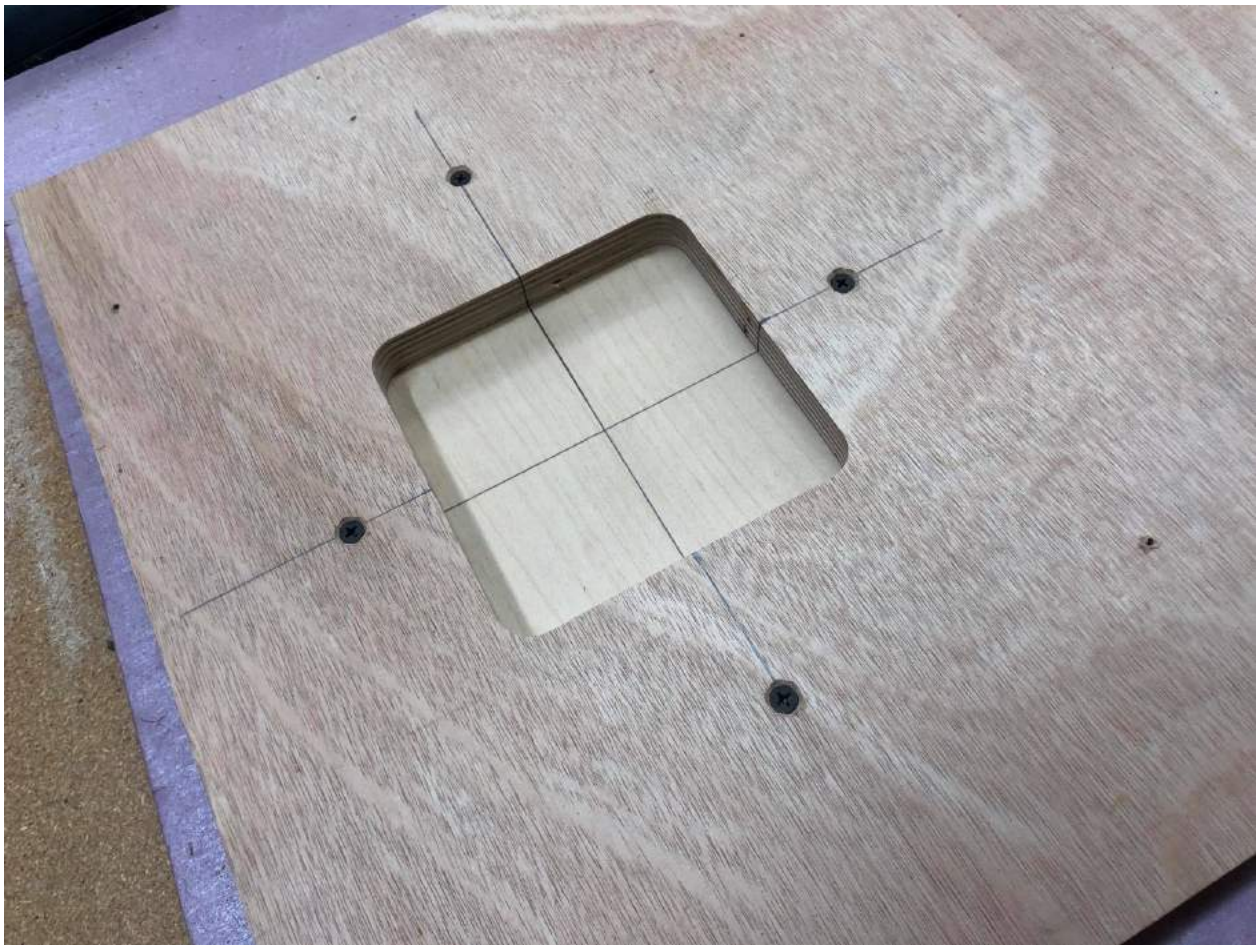
On challenge with this Raal is that the corners have a 5mm radius which doesn’t align to US sizes, as a bonus this technique accounts for whatever radius the corner has. The only trick was that I needed a flush pattern bit that was smaller than 10mm diameter, a 3/8” (9mm) diameter Amana router bit for the bill perfectly.

Enjoy!

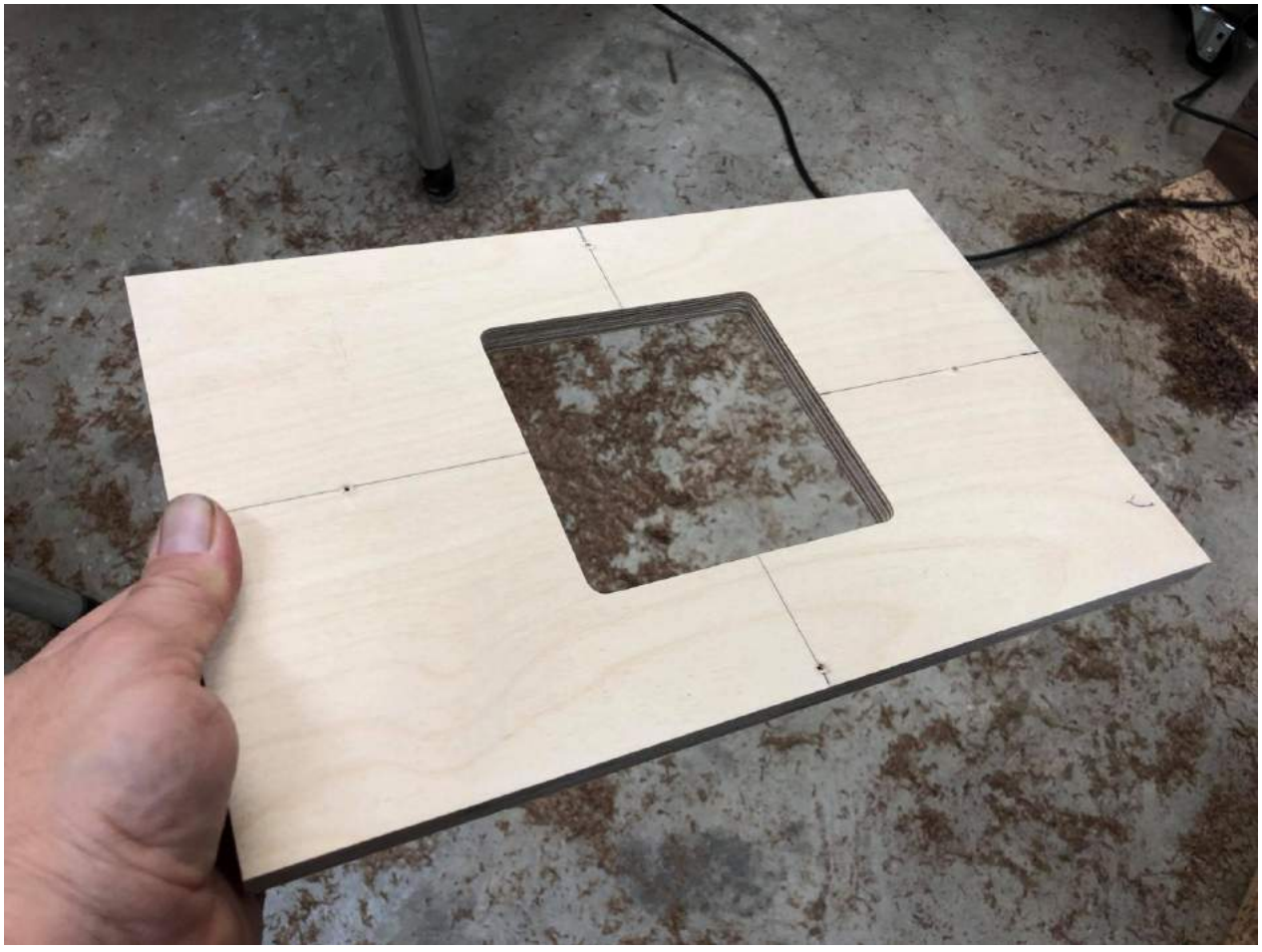

SCH


SCH






BOSCH



Project Enthraals Part 7 - Cabinet Construction Continued and Driver Cutouts

Things are coming together!

First was to flush the top, little tip that really helps when working in a tall cabinet like this is to bar clamp the cabinet to a work bench, makes it very stable. In my case I have a work bench on locking casters so I just roll it over to the speaker and attach.

Then some fun roundovers, 1” up the front baffle sides, 1/2” on the back edges and 1/4” on the top. After routering I sanded with 80 grit to get rid of any router or burn marks (going over the alternating end grain along the sides).

I had to start thinking about feet too and you’ll get a glimpse of what I’m thinking in the attached pics.

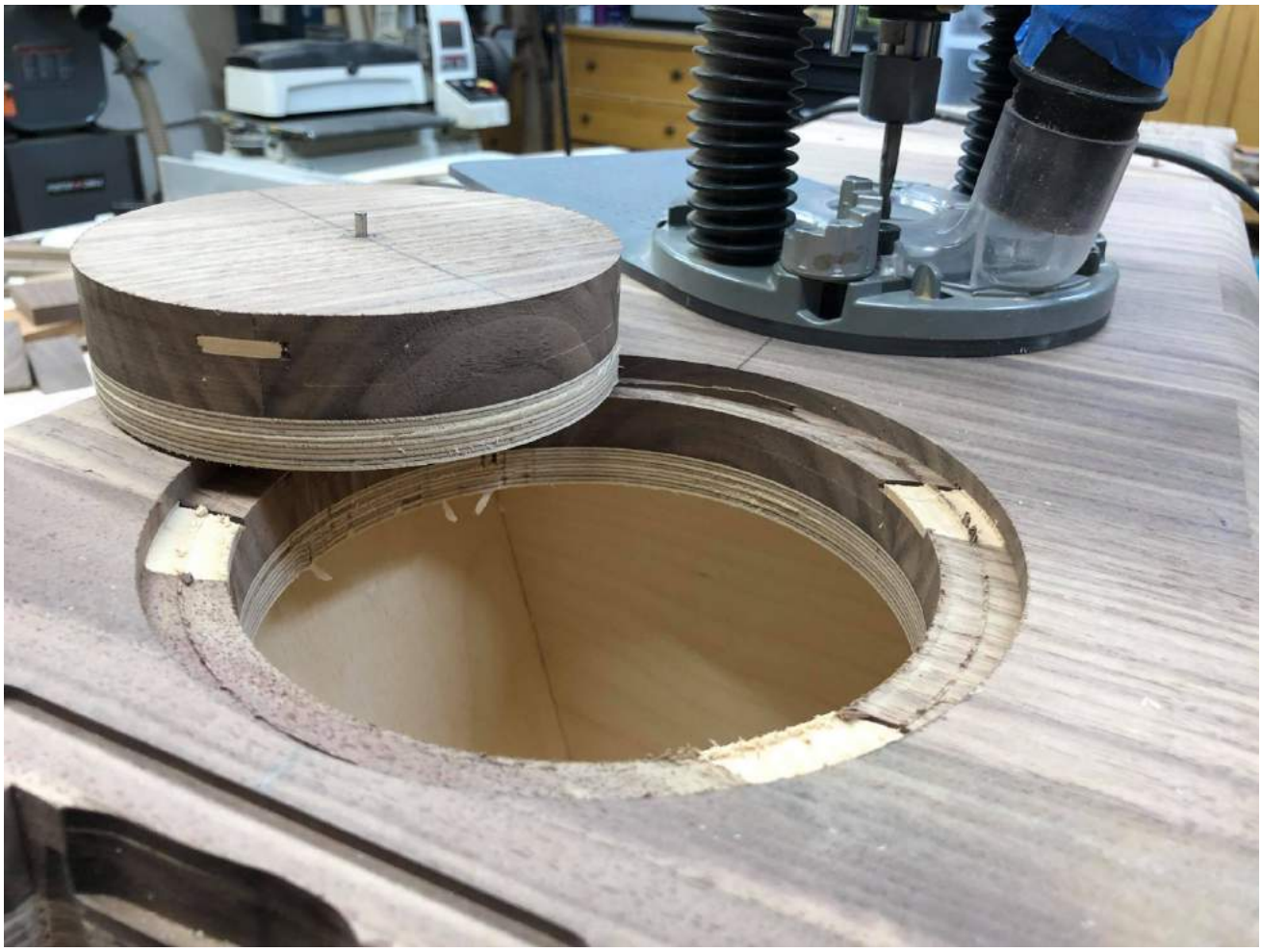
Then flush mounting all drivers, always nerve wracking but I nailed it all perfectly. I purposely oversized the flush holes by 1/16” to allow for wood movement and easy driver removal if necessary. I’ve found over the last dozen builds that the perfect fit I always strive for means stuck drivers if I don’t leave some wiggle room.

I decided to add another Creative Sound Solutions APR-10 to the back of the cabinet after consulting with Jeff, we felt it allowed more excursion than the woofer is capable of and should be a solid setup for over 300watts. I’ll be documenting how I do that in light of a brace being there already.

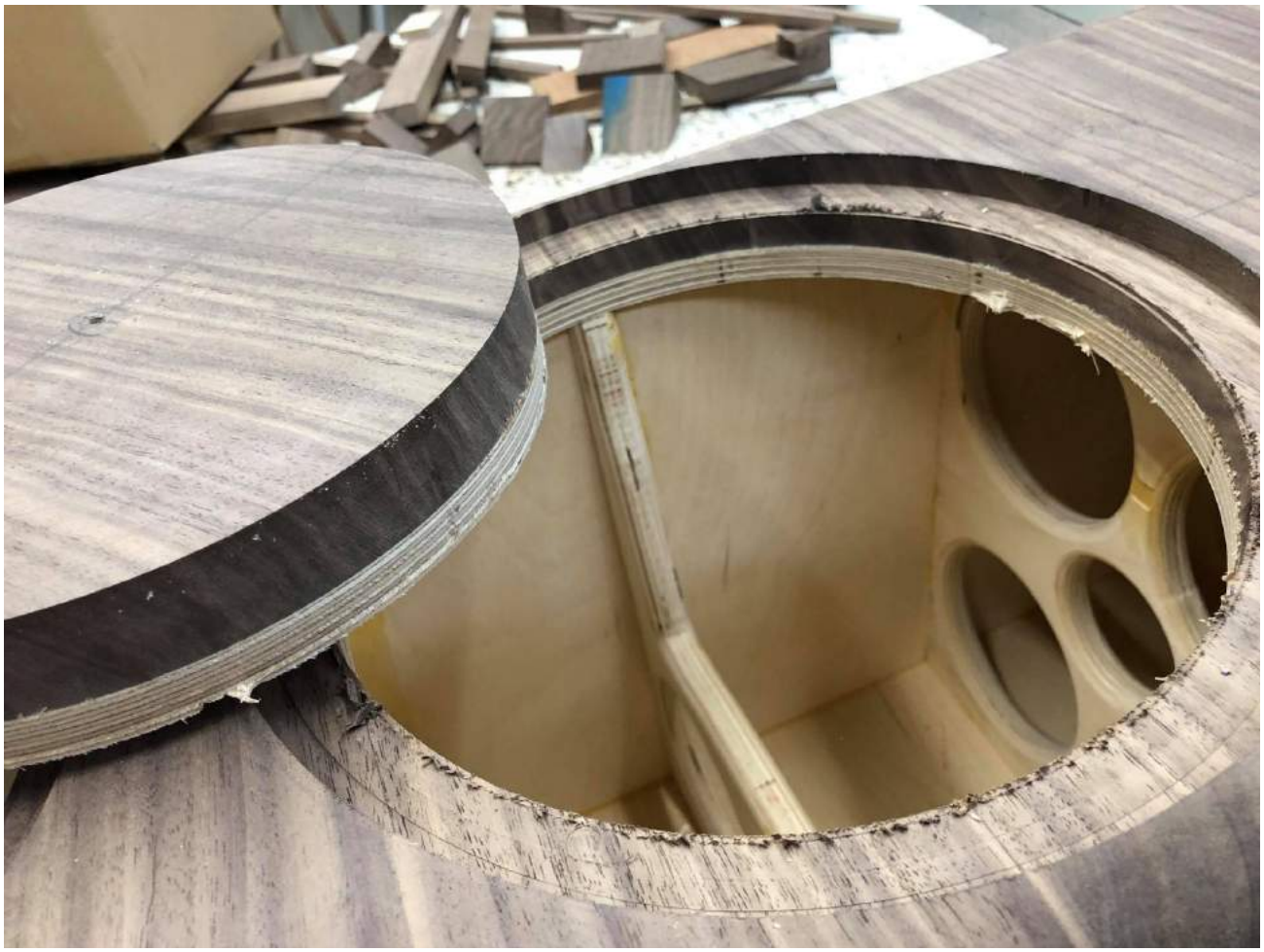
Stay tuned for more!

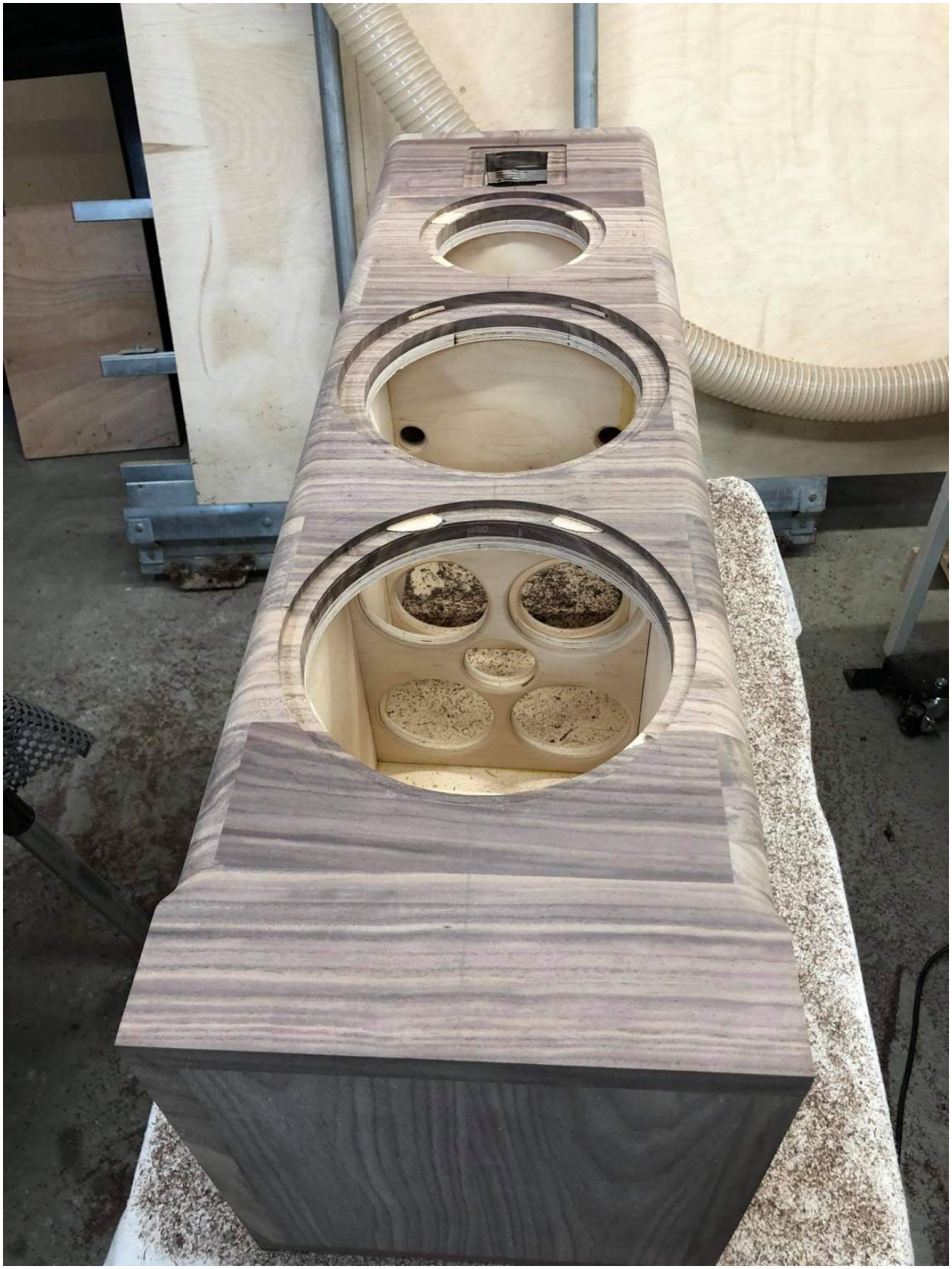

FRONT UP


CSS
LOW7
7 3/16 OD
6" ID




SCH





Project Enthraals Part 8 - Outrigger Feet Construction

My last 3 projects I've attempted to experiment with new concepts for feet, I spent hours searching online and it seems every outrigger foot design is about the same with very little variation or creativity.

I let this quandary crunch in my head for a week with the criteria of playing off the "overlapping wood corner theme" and I finally came up with this.

Other criteria are that the feet must be removable for easier transport, must match the theme visually and must accommodate some 2" long threaded load leveling feet.

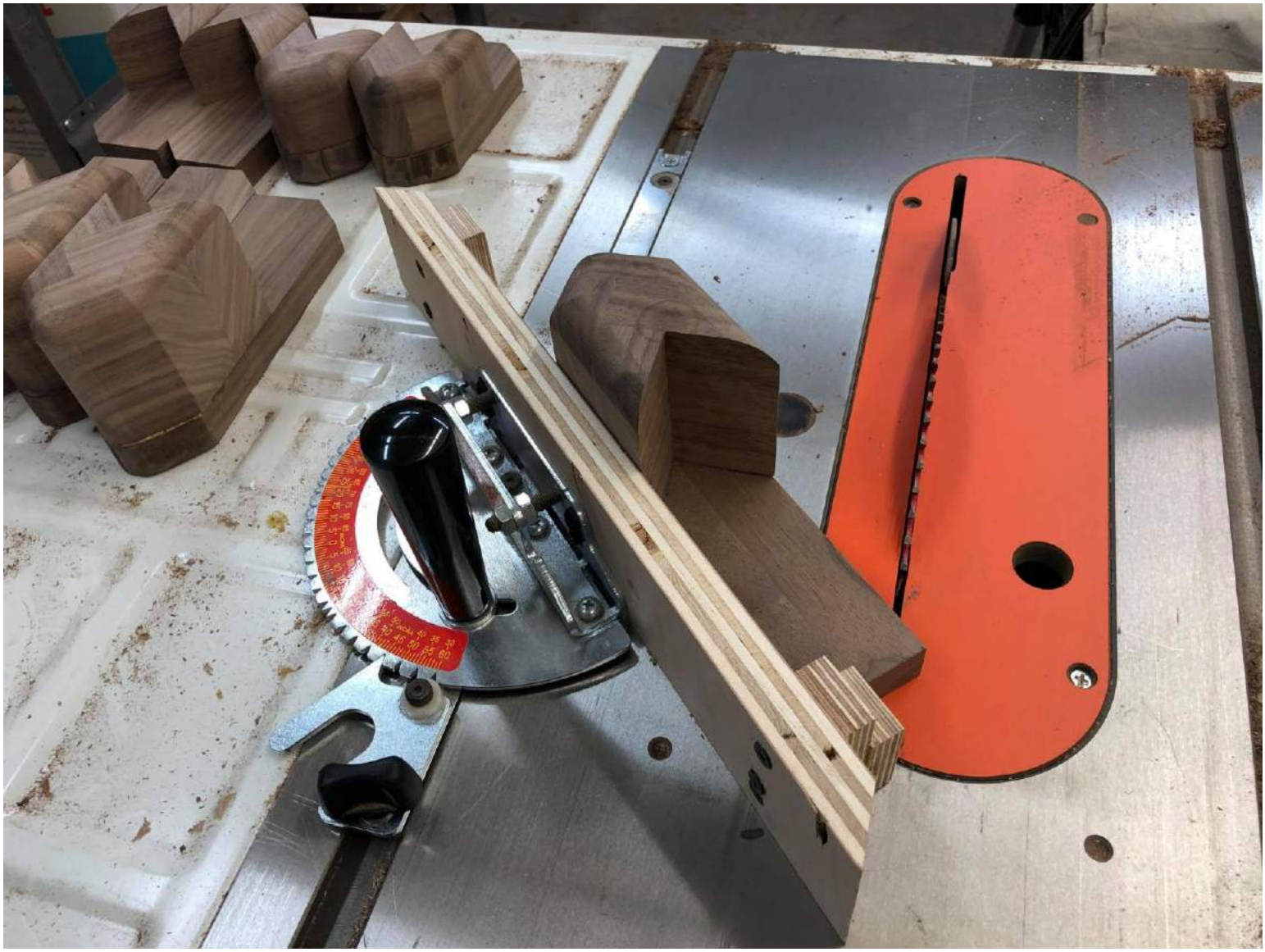
I started by cutting wood and gluing it in the alternating overlapping pattern you see below, once I had those glued up I made a series of fixtures to cut angles and shape the feet. Then routering and rounding over work.

A final step was to attach the feet to the cabinet using epoxied in e-z thread inserts and finding suitable mounting knobs.

More jigs and fixtures ensure standardized mounting provision locations to ensure each location doesn't have a custom mounted foot.

The front feet are much larger than the rear to further reinforce which way is forward on the speaker and add some visual interest.

I like the way they turned out, it's a very unique look, I feel they tie in perfectly, they contribute substantially to the speaker's stability and allow perfect leveling on any surface. As a bonus spikes could easily be substituted for the feet as well.




Poly-

Project Enthraals Part 9 - Final Details, Binding Posts, Sanding, Finish Prep

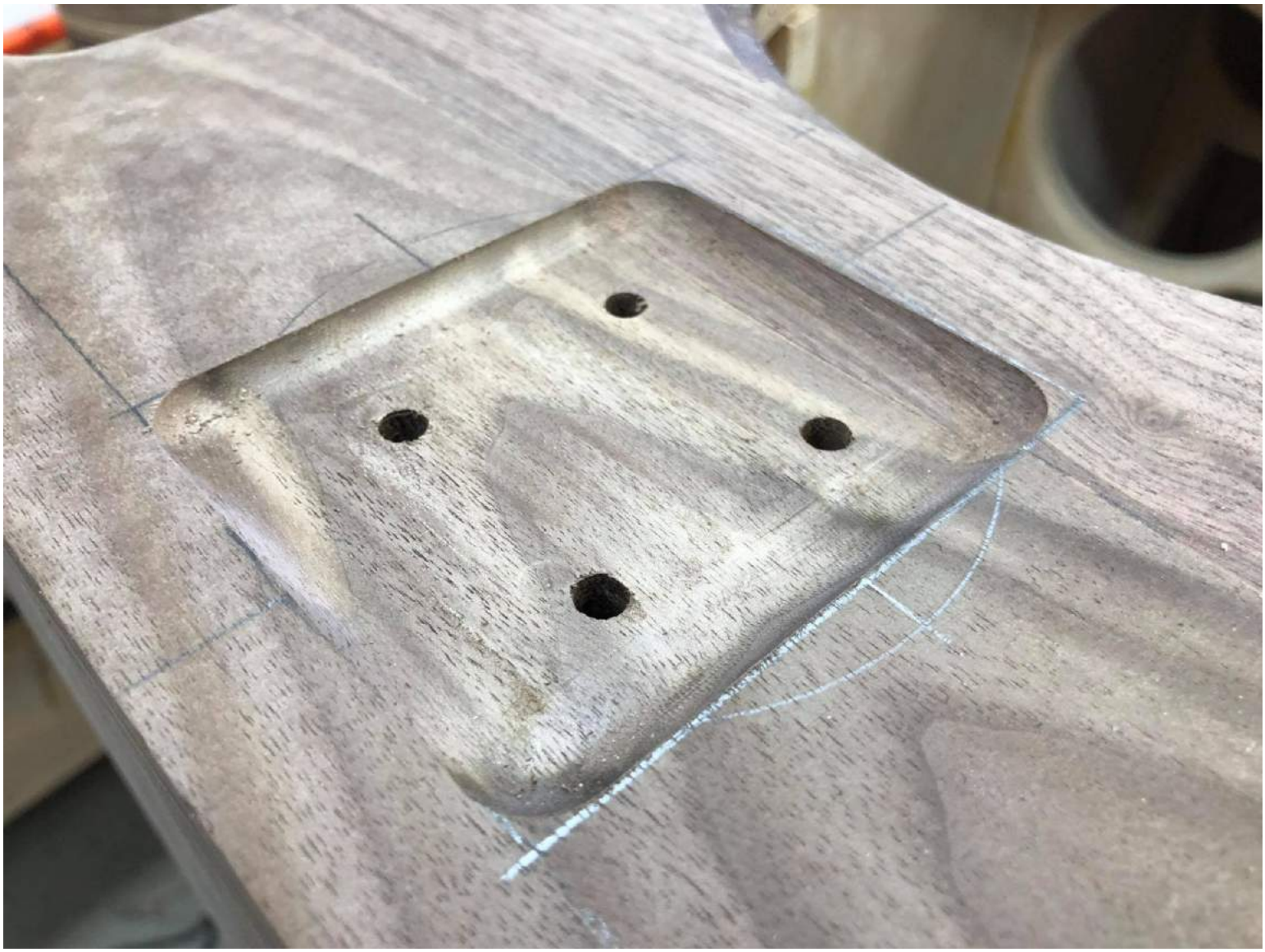
Ok since the last update, I cut the back 2nd passive radiator which wasn't planned initially, I had to cut the brace to make room for the new PR, there was also the challenge of getting the cutout out since it was attached to the brace.

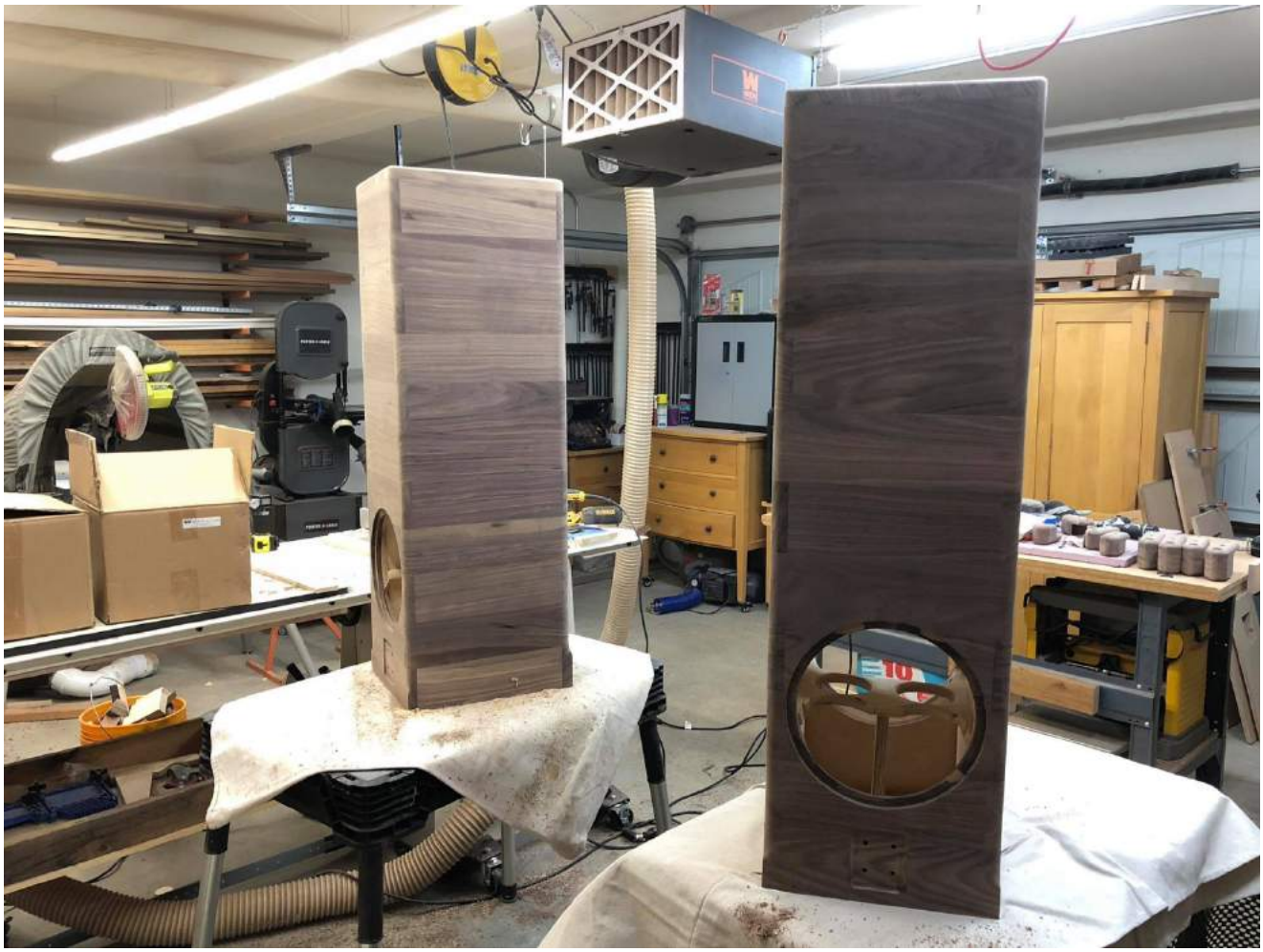
Routed the recess for the binding posts, I went with double sets so I have the option to run the sub separately at some point or do a semi active system.

Final sanding with 180 and 220 grit, some sanding of small filling of chips and scratches.

All surfaces vacuumed carefully to eliminate any dust.

Next step, one coat of Rubio Monocoat, then on to crossover tuning!





Project Enthraals Part 10 - Rubio Monocoat Application

Wow what a thrill to finally put some finish on these guys! This is RMC Pure Oil Plus 2C, really pops the grain and leaves behind a uniform matte finish that looks very professional. The beauty is, 1 coat, no sanding, just let it cure for 2-3 weeks. I like to give it a coat of furniture wax when cured to give it a nice sheen.

Next step is to wire up the cabinets, install drivers and start crossover tuning.


BRUTE
ITEM: CBS.APS 10
QTY: 1 PCS/CTN
N.W.: 1.5 KG
G.W.: 2.4 KG
MEAS: 33X33X15.5 CM

Project Enthraals Part 11 - Initial speaker measurements and preliminary crossover design

I got these up and playing on Friday and had the chance to measure, model and listen to one speaker so far, over the weekend.

Very pleased with what I'm hearing, this Raal 70-20 doesn't disappoint, it is incredibly detailed and has a lifelike sound that I've only heard from a beryllium dome tweeter. Can't wait to hear a stereo pair.

The LDW7 plays beautiful and smooth midrange, and the SDX-10 is delivery really deep, authoritative and clean bass.

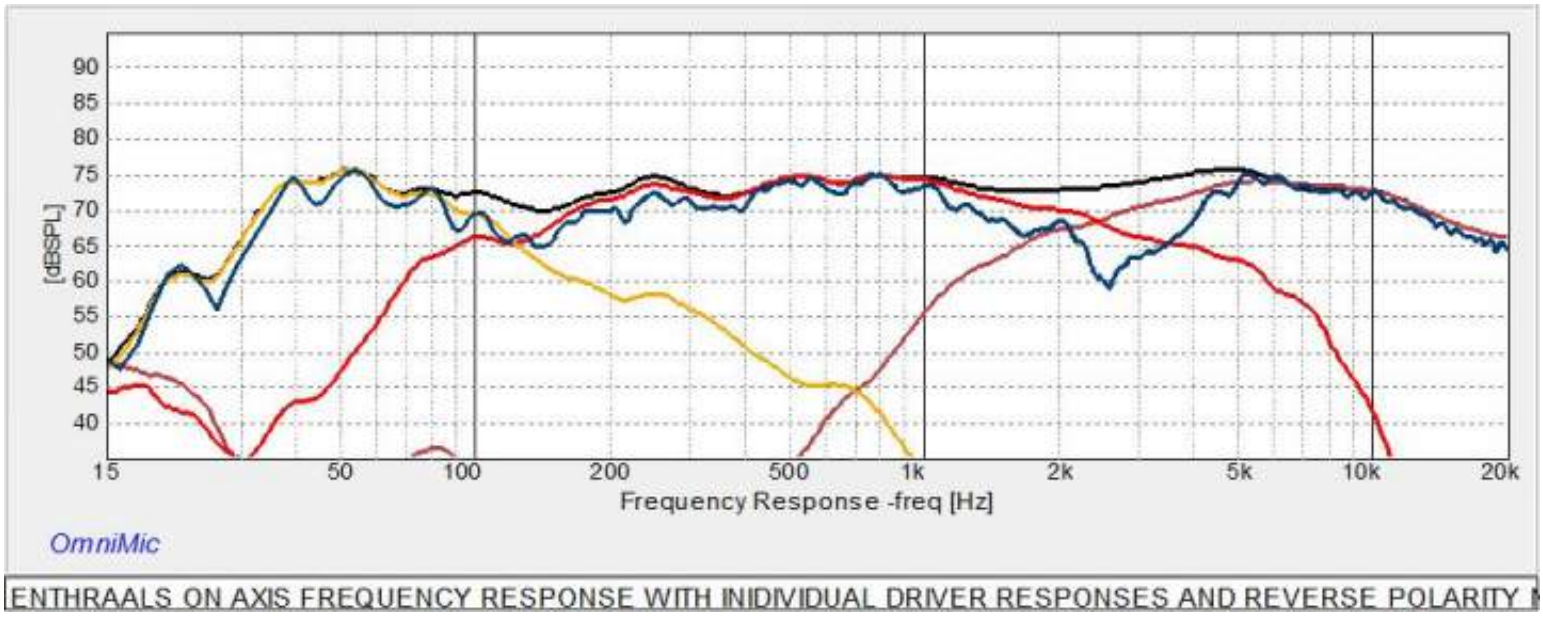
I was a little concerned at the tweeter's top end response but after discussing with Jeff and comparing to his original measurements I'm measuring very consistent to what he got with the Testarossas.

After setting the offset between drivers modeling and actual measurements line up almost identically which makes tweaking the crossover in the model easy.

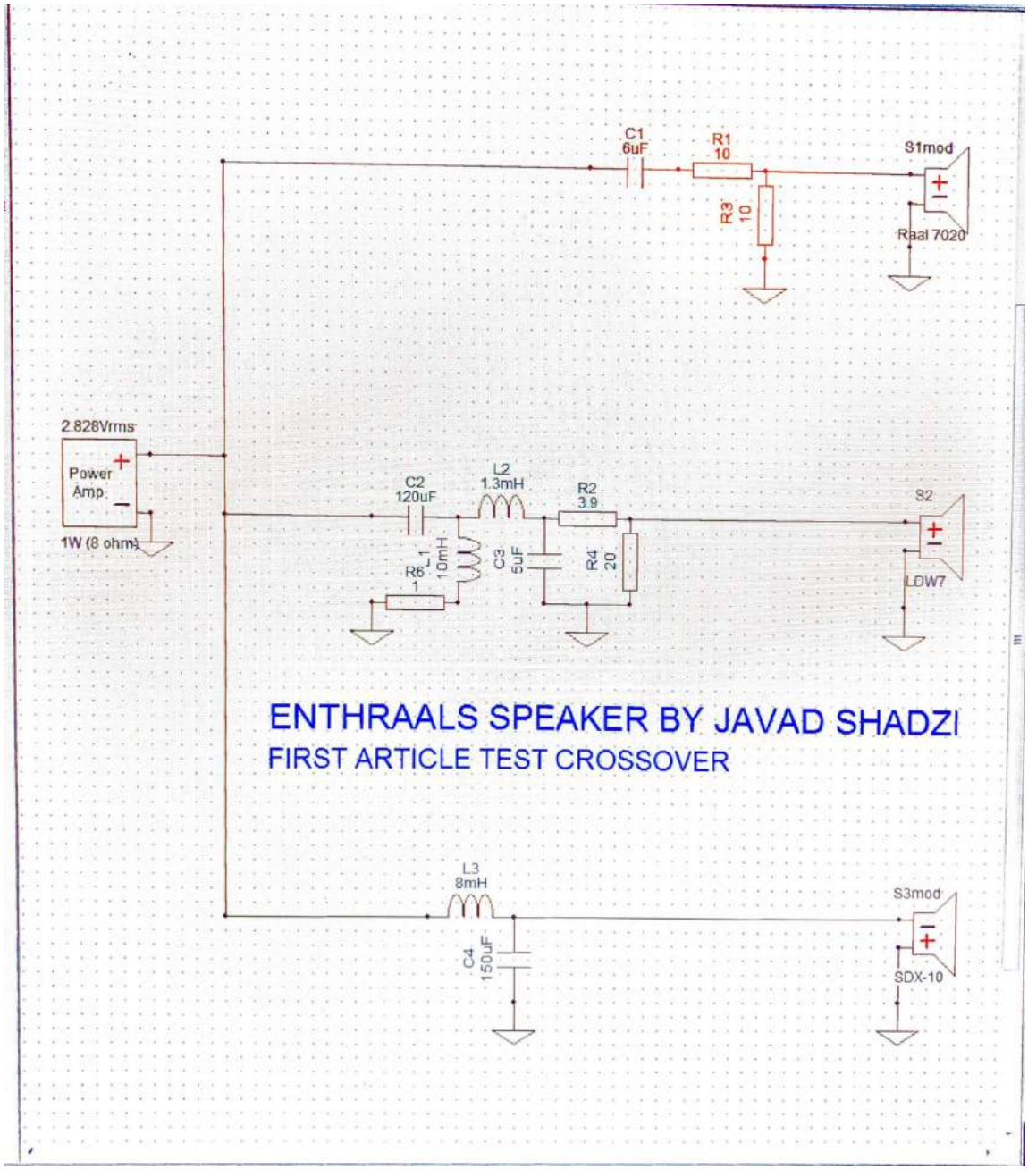
See attached for various measurements with explanations on each. Phase performance is good (see reverse nulls), crossover points are about 150hz and 2500.

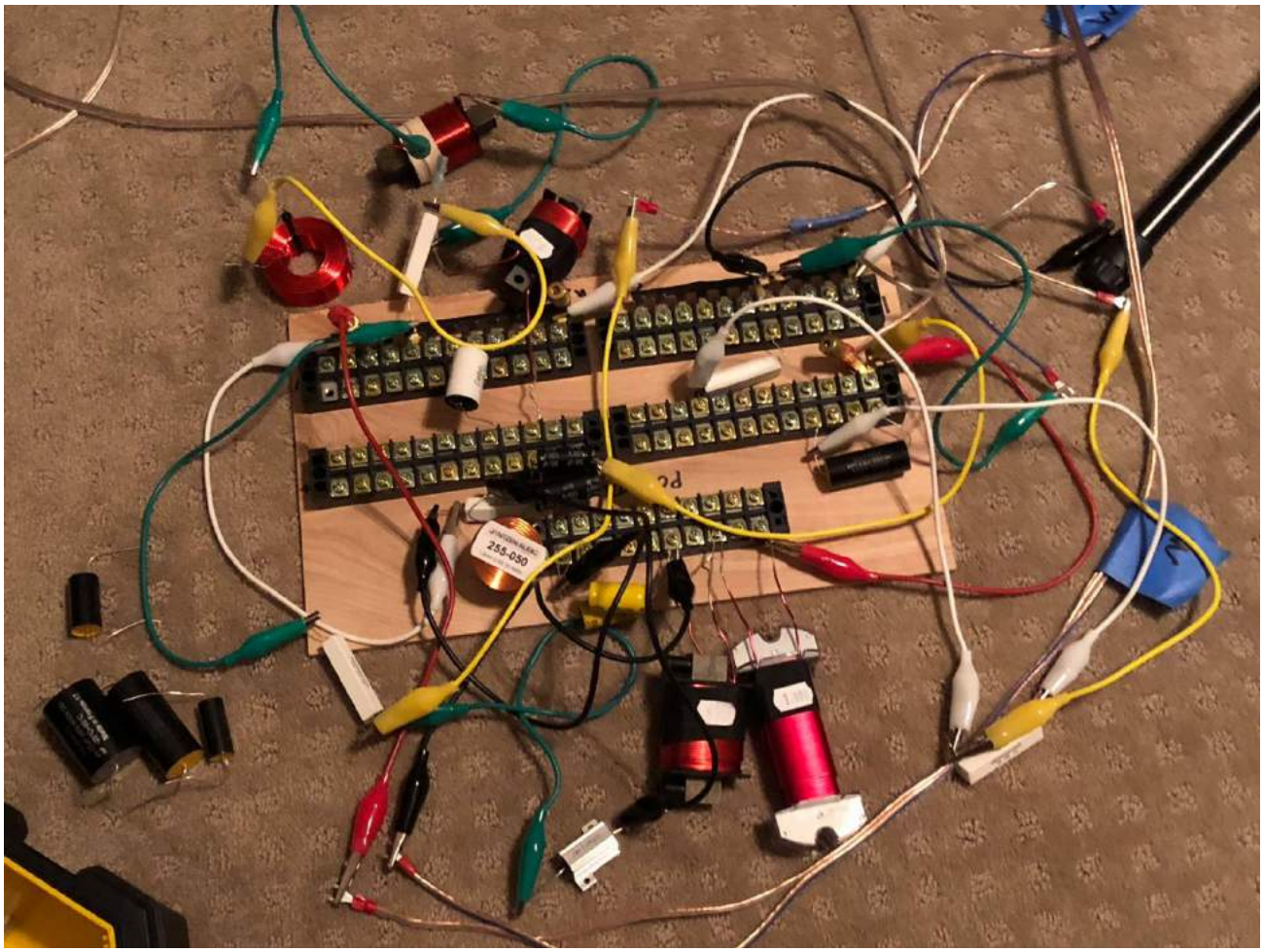
The Raal is an interesting driver as it's coil has inductance so a one component capacitor creates a 12db slope with a 4th order acoustic roll off, then it's just a matter of padding it to the level desired.

Any thoughts welcome, keep in mind this is the very first pass and now I'm waiting for components to show up to test this particular layout. Thanks!



ENTHRAALS ON AXIS FREQUENCY RESPONSE WITH INIDIVIDUAL DRIVER RESPONSES AND REVERSE POLARITY





Project Enthraals Part 12 - Crossover Finalizing

Ok the last update is here where I dug in to the initial crossover design

https://www.facebook.com/groups/DIYLoudspeakerProjecPad/permalink/708272739528566/

Overall I was happy with the sound and measurements but the Raal 70-20 was dropping off above 15k more than I'd like, a little further work and bypassing the series resistor with a cap allowed me to choose how much top end I wanted to bypass around the resistor and at what frequency.

This tweak really brought back some of the missing detail and "air" that was missing above 10k, I like the sound much better with this extended response. This tweeter continues to amaze me, I know it's cliche but I do really hear things in the music I hadn't heard before, can't wait to spend more time with this tweeter!

This is a high end build so I chose high end components, compared to the cost of the rest of the project they are in line, but certainly not cheap - parts for this crossover cost in the $400 range. I went with Jantzen Supreme for smaller values in the tweeter and mid, and Jantzen Cross Caps for larger values In the woofers that I combined to fine tune what value I got. I'd like to do a blind listening comparison at some point, we'll see.

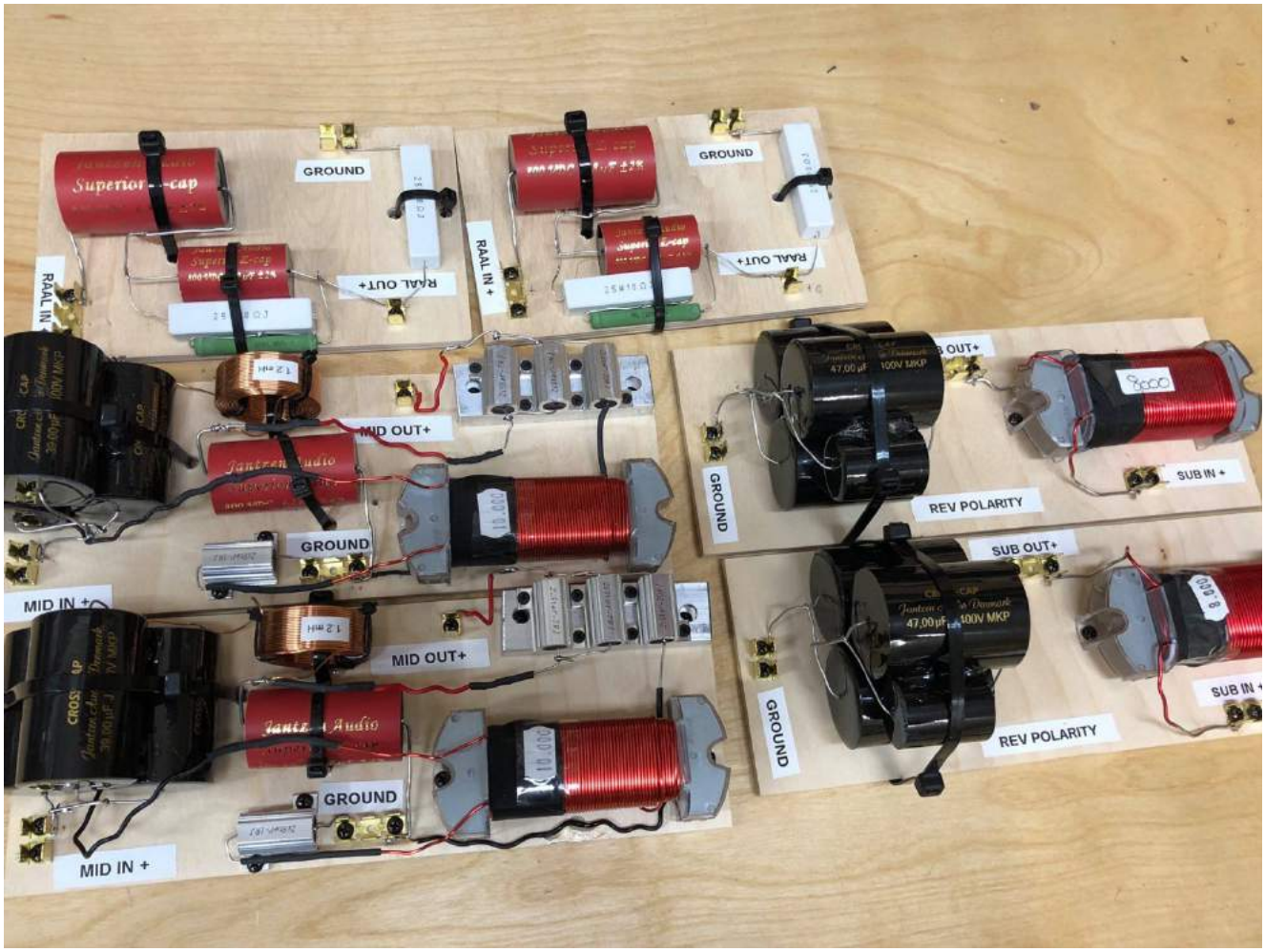
For high current resistors I used Zister units, they are rated for 25 watts and I doubled up on the series units to lower thermal issues even further. The resistors in the mid got quite hot on their own and especially with lower current 10watt units. I did thermal testing on all resistors, I ended up installing the mid resistors on a heatsink to give them further thermal capacity as well.

Large value inductors are Erse laminated steel core with low DCR, the 14g 8mH is only about .2 ohms. Meniscus Audio had everything in stock.

There are two binding posts on the back of the cabinet so the sub crossover has one circuit to the lower post, the top posts drive the mid and tweeter crossovers. This way i can bi-amp the sub if I want or run straps across for just one amp.

I may tweak the tweeter response more based on more extended listening but that's easy to do. The slight dip in the 1-4K range is intentional and tweakable if I desire.

Next step will be finalizing both cabinets, installing these boards with wiring, getting close, thanks for following!



Project Enthraals Part 13 - Finalized Crossover, getting there!

Ok I think I'm done with this crossover! I spent the last week listening to these and finally felt I needed to bring the tweeter down a dB or so and increasing R1 to 13ohms did the trick. I added a provision to make swapping this resistor out easy so all I have to do moving forward is pop out the lower passive radiator to make a quick change if I want.

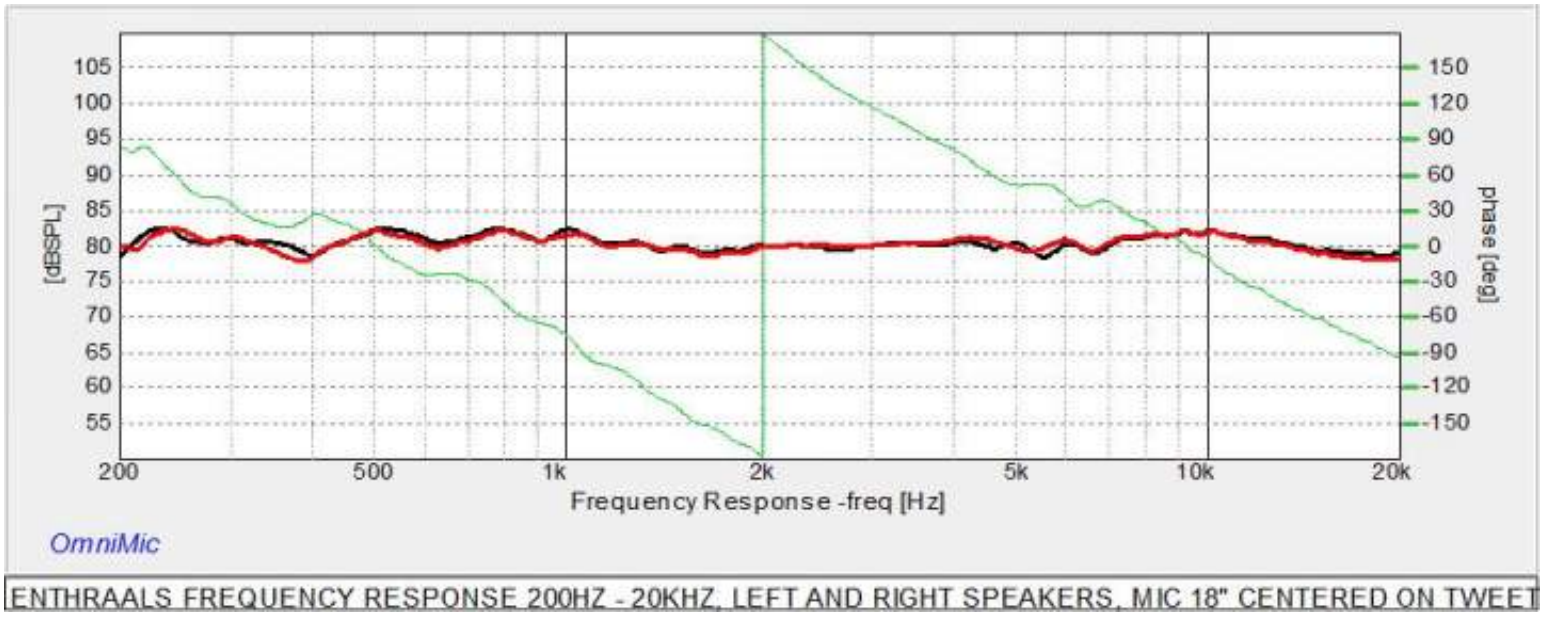
IMO this is one of the best sounding speakers I've built or heard to date, looking forward to hearing other's impressions as people hear them at my house and on the road next year, but this Raal tweeter reveals so much in recordings that I thought I knew well, but hadn't in fact heard.

It's cliche to say but I have been listening through my music library to song after song and shocked as to what I hear. A down side is it's not always good, sometimes it makes the song less pleasing to hear, for example a mic clipping in the recording is shockingly obvious. In one song I'm familiar with, I was convinced the Raal was either blown or distorting badly, I scrambled to try to find out what was wrong, listening to another speaker didn't reveal it. I finally listened to the song on my Beyerdynamics headphones and was relieved to hear it there too, it was the mic clipping in the recording ever so slightly (I can only assume).

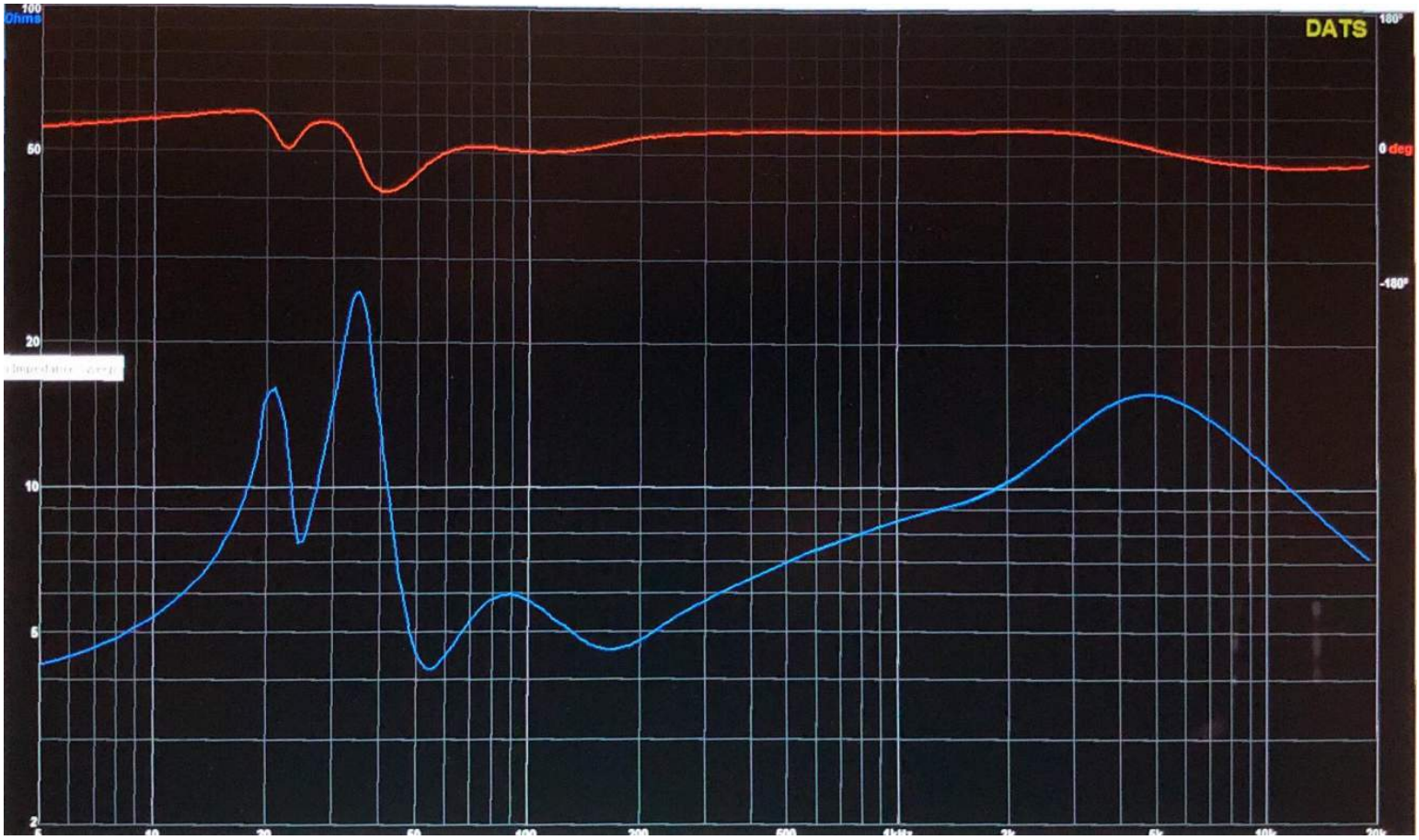
Amplifier distortion is very noticeable in this speaker too, I can immediately hear the sound become colored and the tone change as I push the amplifier, it's very noticeable as the amp clipping light starts to blink, the sound through the speaker changes immediately.

I am also very happy with the bass response from the Creative Sound Solutions SDX-10, this subwoofer hits every low note, has miles of excursion and hasn't gotten out of shape once in all my listening, it can easily drive my Adcom GFA-5800 into clipping and not get out of shape. I'm quite happy with the bass response but I will play with PR tuning a little to see if I can further optimize the bass and extend the response lower, but I don't want to trade off in the 30-50hz range which I'm very happy with.

Thanks for following along!



ENTHRAALS FREQUENCY RESPONSE 200HZ - 20KHZ, LEFT AND RIGHT SPEAKERS, MIC 18" CENTERED ON TWEET



Project Enthraals Part 14 - Finale

Project Entrhaals are finished, I'm thrilled with how they turned out and feel they met all the hopes I had for them being a true high end speaker.

The interlocking solid Walnut construction created a truly striking and unique look. The cabinet is incredibly non-resonant, a combination of the 15/16" thick Walnut, 12mm thick Russian Birch plywood sub-cabinet, the 1" thick wall mid woofer sub-enclosure and the extensive internal bracing. With the speakers playing at well over 110db, I can place my ear pressed directly on any surface of the cabinet and hear almost nothing. Many speakers doing this could give you hearing damage.

The Raal 70-20XR tweeter is as stunning as I remember it the first time I heard it in Jeff's Testarossa's, at which time I knew I had to work with this tweeter. There is a realism in this tweeter I've never heard before, and not the "cliche like you are

there” realism, but this tweeter makes sounds that don’t sound like a speaker. Often I feel like I’m hearing a song for the first time, hearing sounds I’d never heard before, or shocked hearing notes or sounds in music with realism and detail I’ve never heard before in any other tweeter. In addition, the Raal presents and images in a “holographic” way, creating a depth of sound and a realism in sound stage presentation I’ve rarely heard before. A real honor to get to hear and work with this tweeter!

The Raal sets a high standard and matching it in the mid and bass section is no small feat, but I’m very pleased at how the CSS LDW7 and SDX10 keep up. Midrange is smooth, clean and detailed and overall this driver was very easy to work with. The SDX10 really blew me away and makes the Enthraals a true full range speaker with flat in room extension to 25hz. What shocked me about the SDX10, and its something I don’t think I’ve heard in a 10” subwoofer, is that it maintains composure and tonality whether at 1mm or 15mm of excursion thanks to the XBL^2 motor. Normally as bass volume increases, I’m used to hearing a shift in tone and and increase in distortion, but the SDX10 does this better than any 10” subwoofer I’ve heard.��The APR10 passive radiators work as intended, with two there is no danger of over driving the PR’s and even at full volume you rarely see them move more than 10-15mm. Final PR tuning is around 23hz. I ended up designing and CNC machining some billet aluminum dust caps to replace the stock plastic “plus plugs” which I felt didn’t keep up with the overall high end nature of the build. In addition I 3D printed some black plastic trim rings to replace the rubber “gaskets” that come with the SDX10 and APR10, also giving a more finished and high end look. These trim rings attach to the driver mounting screws using high strength neo magnets.

See below for a list of all the posts for the Enthraals Project, thank you for following along and please enjoy the final project photos!: