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Subject:
Date: 17 February 2020 at 20:20
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SK

Tall Story Build Notes

DML Parts List

1. PAR Hardwood e.g. Cherry or American Oak 40mm by 20mm by 1150mm by 8 pieces
2. PAR Hardwood Spars 12mm by 40 mm by 310mm- 12 pieces
3. Hardwood Mounting Spine 12mm by 60mm by 310mm - 2 pieces
4. Base Panels Ply 352mm by 352mm by 12mm- 18mm - two pieces.
5. Base upright panels for mounting Frames- cuts according to final fit.
6. Birch Ply DML Panels - 300mm by 1160mm by 4mm B/BB Grade
7. Speaker Cloth to taste
8. Connectors - banana sockets and plugs
9. Spade connectors for testing
10. Hook up wire of choice - I use magnet wire.

DML Panels

The panel material I have used is 4mm Birch Ply BB grade

Birch BB grade Plywood is good for full range from 40 Hz out to 16k Hz with mild EQ.

I have not tried this profile with any other material so I can't vouch for any performance with alternatives like EPS/XPS

Width 300mm/ 12 inch

Height 1160mm/45.6 inch

The panels have a ratio of 1 to 3.86. This is obviously well off the ranch in terms of the normal suggested ratio of 1:1.618 and 1:2 which I have had success with as well, but I have had a lot of time to measure and listen to this ratio now and it works very well. The NXT patent implied that there were alternative ratios to the 'conventional' ones but did not detail them. I may well have stumbled across another 'correct' one by accident but I have not explored around it yet so cannot be certain it's the best slim ratio.

Exciter

I use the Dayton Audio DAEX32EP-4 Thruster 32mm Exciter 40W 4 Ohm currently priced at $19.98 each. Link here. https://www.parts-express.com/dayton-audio-daex32ep-4-thruster-32mm-exciter-40w-4-ohm--295-230?gclid=Cj0KCQiAkKnyBRDwARIsALtxe7iolret3J9qn9UbKRnf-WBTpeOfxVu3BdfhZiv4P9_mmlfQKWZHnW0aAh0lEALw_wcB

They are good all-round exciters and one will drive this size of panel to a good volume in an average room. There is a lot of evidence that the best sound comes from a single exciter per panel. If you want more volume build another panel with another exciter. They drive my larger panels which are 600mm by 1200mm very well so the smaller panels will be fine.

Test the exciters you buy! You can do this easily by wiring them up temporarily, e.g. using push on spade terminals, and hold them against the panels. Usually they are fine but every now and then you can get one with a problem. Send it back for a replacement. Sometimes you get an exciter that rings. This is the metal suspension vibrating along to the signal. This can be cured using a dot or two of silicon sealant on the spider arms.

Exciter placement

Most of the build is simple and does not demand real precision. Exciter placement needs a bit more care. This is the method I used, which Veleric noted in a post way back.

Place your panel horizontally on two supports, two spaced chairs will do nicely. If the contact point is hard, use some cloth between the chair and the panel to prevent buzzing. It will look a little like a bridge, with most of the panel unsupported. Wire up your exciter and for now leave the tape it comes with covered so you can slide the exciter about on the panel. Play a track you know well and really like, one with lots of frequency content and natural instruments and voices. This is important, it's easy to get what sound like a great sound with a heavily produced noisy track that then sounds terrible when you play something more natural.

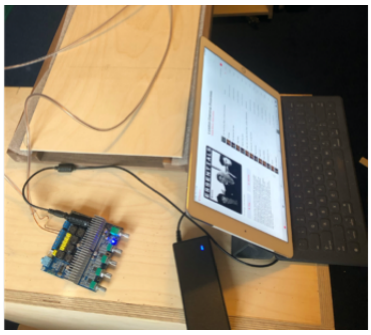
The process is simple but time consuming and you won't want to be interrupted. Play the track and place the exciter on the panel. Move the exciter systematically across the surface until you find a spot that sounds good. Mark it with a pencil and move on. After a while you will have several spots that sound good to you. Turn everything off, go have a coffee or watch some TV. Come back and play a different track you really like and test the spots you marked. There won't be one spot that is perfect, but some will sound better than others.

I found that with this narrow panel profile that just off-centre from the vertical axis and about a third of the way up gave me the best balance. The closer to the centre the more bass you got but the less air, the closer you got to the vertical sides the brighter the sound and the less bass.

To refine further you might want to have a reference speaker plugged into the other channel of your amp and use the balance to swap between the two to check the frequency balance. Just bear in mind that the panel will not be Eq'd at this point and so you won't get a perfect match, you are aiming to reduce the extremes and as its all subjective having a known and tested reference speaker helps.

Once you are happy, mark the final position.

Repeat for the second panel



Exciter fixing

You want the best possible fix between the exciter and the panel. There is a bit of mystique about choice of adhesives, but my findings are that the tape as supplied works fine until the exciter drops off. I have had this happen once on a particularly hot day in France. The alternatives are contact adhesive or Araldite. Araldite will give the best bond and should be considered permanent. You can remove an exciter that has been Araldited to the plywood using a new and sharp putty scraper, (e.g. https://www.homedepot.com/p/Husky-2-in-Stiff-Putty-Knife-DSX2S-HUS/310955126) but there is a risk you might damage the exciter contact surface if you are not careful.

Exciter Spine

I have used a spine in this design, but it is removable, which I would suggest you do too. Instead of gluing the spine to the frame permanently using PVA wood glue I use foamed double-sided tape from an automotive DIY store as it has good adhesion combined with a degree of vibration absorption. It's the sort of tape you use to stick wing mirrors and spoilers to car bodies. This sort of tape is used everywhere in industry today from automotive to aerospace. It's much better than the tape you can get for general purpose use having a higher tack.

This tape approach has two benefits. The 1 mm foam layer helps to isolate the frame from the exciter spine stopping the spine 'buzzing'. And It means you can remove the spine should you need to replace the exciter. If you ever need to do this, you can use a sharp and stiff putty knife to ease between the spine and the frame to release the tape bond. The tape is tough stuff and you need to make sure that you use a firm but controlled pressure inserting the corner of the blade first and work the rest of the blade in. Be patient and don't use excessive force or you might damage the frame wood.

Unlike the panel fixing the exciter to the panel where you want a hard and tough bond like Araldite to transmit the maximum amount of energy, you want a compliant bond between the exciter and the spline. I use an elastomeric material that I also use for damping but other materials like rubber will work fine. (e.g. https://www.amazon.com/Isolate-Sorbothane-Vibration-Isolation Square/dp/B07G5GG3T2/ref=pd_sbs_60_7?_encoding=UTF8&pd_rd_i=B07G5GG3T2&pd_rd_r=bddcc1fc-18ef-4804-a78d-7b4d72388c22&pd_rd_w=AdKoQ&pd_rd_wg=V4cXK&pf_rd_p=7cd8f929-4345-4bf2-a554-7d7588b3dd5f&pf_rd_r=QMW7TFQZ3QGMCV3RQZP9&psc=1&refRID=QMW7TFQZ3QGMCV3RQZP9) You cut a square of the material to make a pad to fit between the exciter and the spine. The elastomer I use is kind of sticky in its own right, and it compresses a lot, so you may not want to glue the pad to the exciter. However, if you are going to use the panel full range including bass, I would advise using double sided tape on both the frame side and the exciter side of the pad to bond the exciter, the pad and the spine together.

The best way to assemble the spine is to do a test run first. Position the spline on the frame, you can use a small amount of the double side tape to hold it in position temporarily and check the clearance you have between exciter and spine. Make up your isolation pad so that it is a good fit. You are aiming for good

contact but no pressure on the back of the exciter. A slight pressure won't matter too much, but you don't want to move the exciter voice coil out of its rest position. Once you are happy with the fit, replace the small amount of tape you used to fix the spline temporarily with enough to provide a good bond between spline and frame. Remove the double-sided tape protection film from one side of the isolation pad and apply the pad firmly to the back of the exciter. Then remove the remove the protection film from the spline adhesion tapes and the isolation pad tape facing the spine side and carefully offer the spine to the exciter and the frame. Make sure the spine covers the back of the exciter fully. If you are happy with the position, press the spine home.

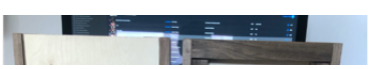
Frames

I am appending pictures of the frames I built, but any frame design that supports the panels allowing them good freedom of movement will work.

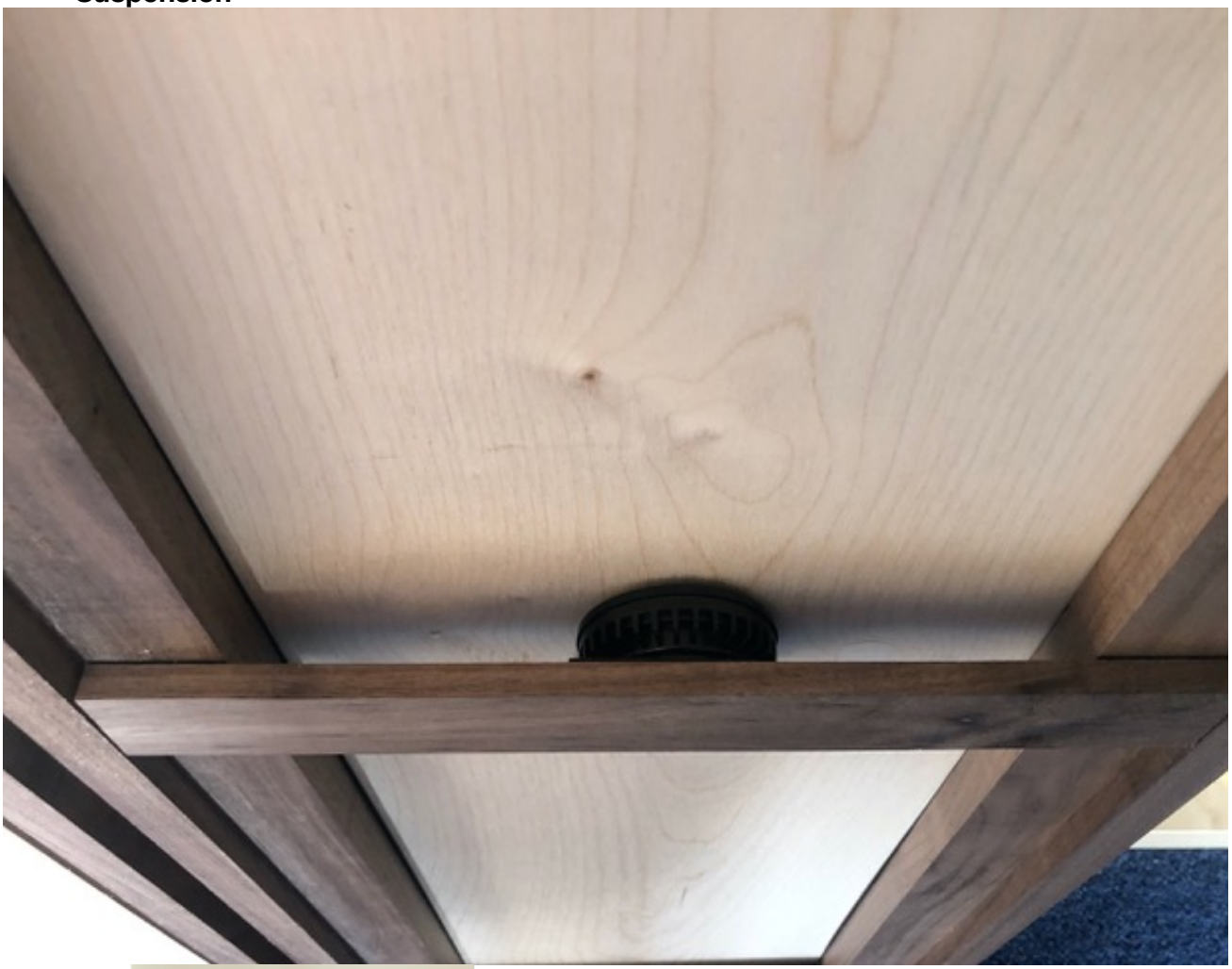
If you want to use the panels for bass rather than cross over to a sub you need to make sure the frames are solidly constructed and firmly mounted to their base as they will receive a lot of energy from the exciter especially if you use a spine. If you are using the panels for 100 Hz up, then a lighter weight construction is possible.

As you will see in the pictures, I don't use screws, just a good quality PVA glue and clamps. The quick drying PVA gives a good bond and is handleable after a couple of hours so if you are impatient like me buy several small cheap clamps so you can glue more than one piece of wood at a time.

The frame base design I use is included in the photographs but any variation on the theme will work provided it gives a good solid foundation.



Suspension



Keep it minimal. I have used five strips of 3mm thick double-sided tape per long side, each strip 100mm long by 10mm wide. The strips are positioned 10mm from the top and bottom edges of the frames and then spaced equally along the long edge. Keep the strips symmetrically positioned left and right side.

If you cannot find thick foamed double-sided tape locally you can make your own very simply using automotive insulation foam tape combined with the foamed double-sided tape I mentioned above. (This stuff works well https://www.amazon.co.uk/gp/product/B07QDQ9547/ref=ppx_yo_dt_b_asin_title_o00_s00?ie=UTF8&psc=1.) You apply the 3mm foamed insulation strip to the frame using its adhesive side, then apply the foamed double- sided tape to the top of the insulation strip. The double-sided tape is about 1mm thick so you will end up with a suspension 4mm thick which works well. When you are ready to mount the panels remove the remaining protective film, position the panel carefully, and lower it into place. You have one shot at this as the tape adhesive is very sticky so you might want t get help. It pays to practice positioning first with the protective film in place, so your helper knows what you are trying to do. As usual, take it slowly and carefully and it will be right first time. If it all goes horribly wrong don't worry. That putty knife you bought will help you remove the panel and you can start again once you have replaced the suspension tape. If you do have to do this, you can 'roll' the tape off the frame and the panel using your thumbs. This is a long boring and, towards the end. a painful process, but don't be tempted to cut corners using solvents. You will ruin your frame and the DML panel cosmetically and that will drive you nuts over time.

Damping

I am separating suspension and damping although in effect the suspension also supplies damping. By damping I mean additional damping material used to control unwanted resonances.

I applied damping after assembling the panels in the frames. I ran a sweep signal using an online frequency generator and sweeping the signal from bass out to treble frequencies. I discovered a big resonance at circa 95 Hz and another at 2000 Hz. You can apply elastomeric damping pads to reduce these resonances but use the minimum you can to achieve this. The pads don't have to be big, coin sized is ideal.

Place the panels horizontally and isolate the frames from the supports you use- e.g. two chairs with towels over the chair backs will be good enough as before. Keep the volume control low while you sweep the frequency range and note where resonances occur. Then dial in the frequency where the unwanted resonance occurs and systematically apply the damping material to positions on the panels. You are 'scanning' the panel to find the right spot to reduce the resonance. You will hit the 'sweet spot' when the resonance reduces in volume. Once you have found the right spot increase the volume and add another elastomeric pad (coin sided) to reduce the resonance. Repeat for the next resonance you recorded. Be systematic, take your time. It's a bit of a chore but worth it.

I found that most of the resonances I found could be tamed by applying the elastomeric pads between the panel and the frame in the clearance between the pane and the frame created by the suspension method noted above. If you need to place the pads on the panel you can place the elastomeric pads on the back of the panel.

Wiring

It's the detail that counts. Whatever you use to hook up the exciter permanently you must ensure there is

no contact between the wires and the panels. If like me you like to use magnet wire you will have to isolate that as well or it will ring. I use a cotton or a nylon sleeve which you can buy online. https://www.hilltop-products.co.uk/hilflex-pg-12-cls-white.html?utm_source=google_shopping&ppc_keyword=&atrkid=V3ADW1A4763C1_45045777064_pla-297612067635__170050851794_g_c_pla__1o1&gclid=CjwKCAiAx_DwBRAfEiwA3vwZYj-sY5v39EXAf5HPIRcd7zAPfugT_ynk6iMYgMpyepkphR_ap2kwJhoC-E4QAvD_BwE

Testing

I use the following Apps and online tools to test my panels. There are far more sophisticated and expensive ways of doing this, but these will get you most of the way home before you need anything fancy.

Online

Tone generator https://www.szynalski.com/tone-generator/

White noise generator https://mynoise.net/NoiseMachines/whiteNoiseGenerator.php

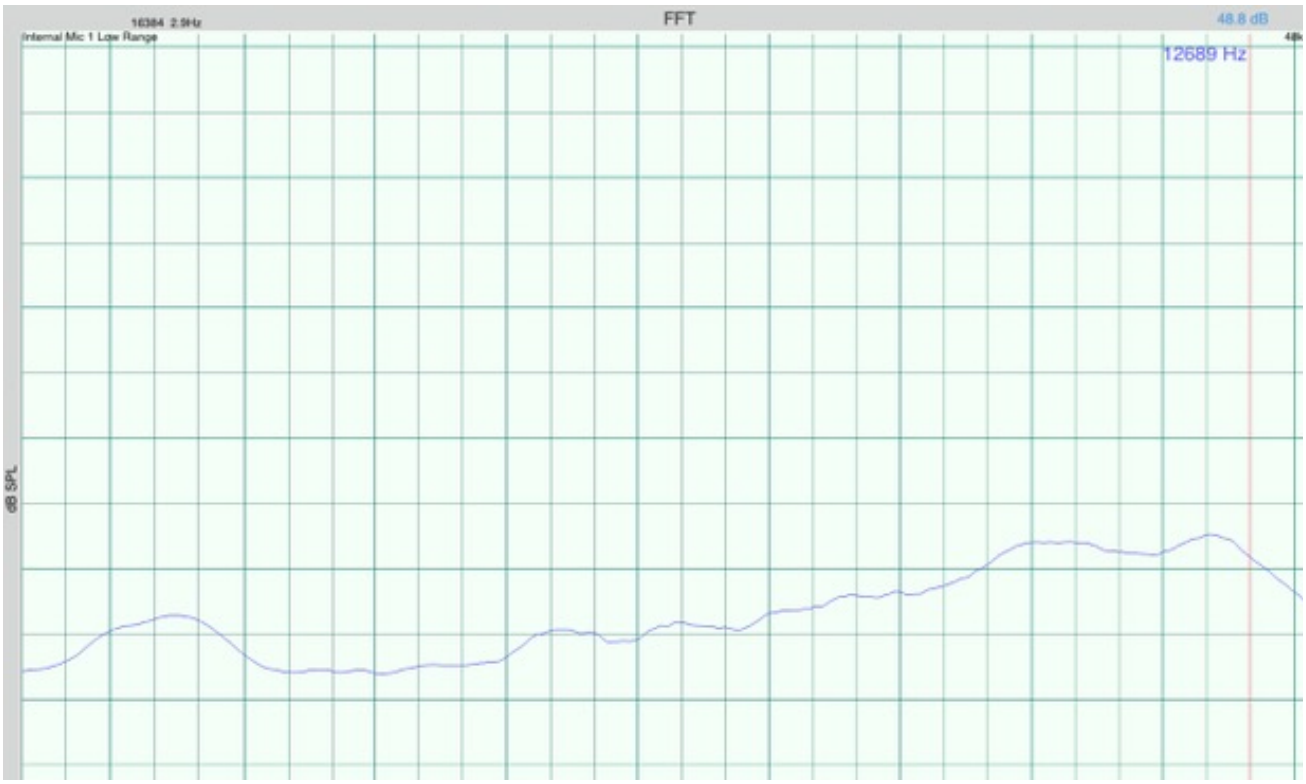
iPhone Apps

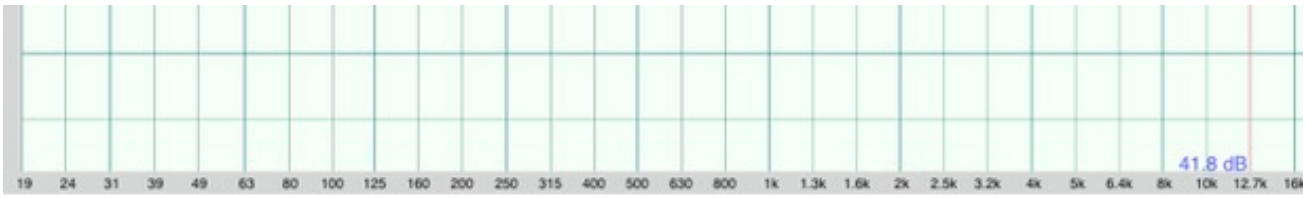
AudioTools - This App includes an FFT analyser, A loudspeaker THD analyser, and tucked away in the Utilities tab a sound recorder.

WhiteNoise Tone Generator

White Noise Noise Generator

Using the FFT tool I found the panels need Eq to tame the top end, which rises at circa 6dB/O above 1kHz, and bring up the drooping response from 49 Hz to 315 Hz. See below





I did this using an equaliser but there are far more exotic solutions like DSP to play with. If you are perverse you could use a passive EQ correction for the 6 dB/O rise as it perfectly matches a first order Butterworth response so a capacitor of the right value in parallel or shunt mode to the panels would tame this. This would be a very cheap and purist solution. The capacitor is not in the signal path so would not have a detrimental effect on performance and as it is first order it would introduce no phase problems. You could go mad and wire up a capacitor made from hand-made paper in virgin olive oil crafted by Buddhist monks to a long-lost vintage specification developed by Western Electric, but a stock polymer cap used in loudspeaker crossovers would work fine.

If you have more sophisticated methods available, you can spend many hours tweaking that last 1%-2%

Problems

If you are using these panels for bass you may find the occasional buzz that you missed that needs tracking down, I did. You will probably find that the frame itself may join in on really heavy bass, so make sure you build it heavy enough and solidly enough to avoid this. The sections I used could do with beefing up a bit, say 15% all round. It can be damped out, but it's a real pain to track down exactly what is doing the buzzing. You won't have this problem if you cross over to a sub and you will gain higher SPL. I would go this way if you like stadium volumes combined with seismic bass. For those who prefer the more nuanced music, or those with wives, the panels on their own will work fine, just don't expect Soundsystem dub bass from them.