'Practical' Home Studio Construction in the Nashville Area

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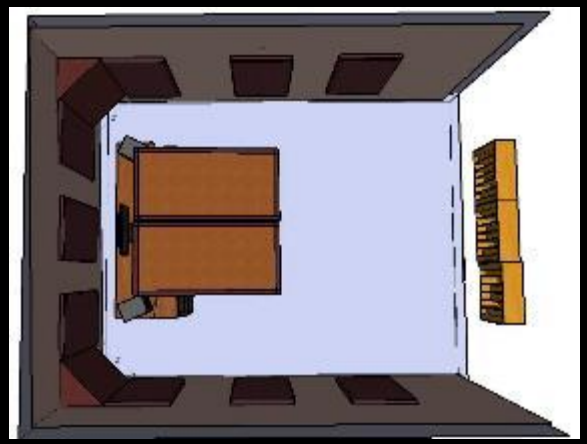
Images: Justin Dowse



Disclaimer & Acknowledgements

- Speaker is a theoretical astrophysicist by profession and an amateur musician, not an acoustical consultant nor an audio engineer
- Received advice & help from Justin Dowse*, Luke Gilfeather*, Sal Greco, Mike Poston, Sam Neff, Mike Janas, Shane Wilson, Greg Bieck, Lance Alvis, Marshall Myhan, Dave Tough, Steve Allen, Scott Glasel, Alison Moore, George Moore, Chris Frasco, David Axlerod, Stacy Scruggs-Gilfeather, Mark Covert, Matthew Burgess, Beverly Wilson, Rob McClain, Drew Ramsey, Rex Paul Schnelle, John Strickland

Video: The Tour

- http://youtu.be/v3b9UbTAxsI

Background Information / Principles

- Acoustics - PHY2010 course, book by Everest
- Electrical - PHY2250, AET3260, Hire an electrician*
- Real Estate - changes must be removable: buyers don't want studios ("Swimming Pool Analogy")
- Saving Money – get hand-me-downs, Craigslist, etc. ("Baby Clothes Analogy")
- Uniqueness / Generalities - Every project & room is unique. Adapting takes expertise. There are commonalities..
- All work/treatment is "AS NEEDED" - some treatments may not be necessary, check before you buy/build.
- Forget about the low end. ;-)

Specifications

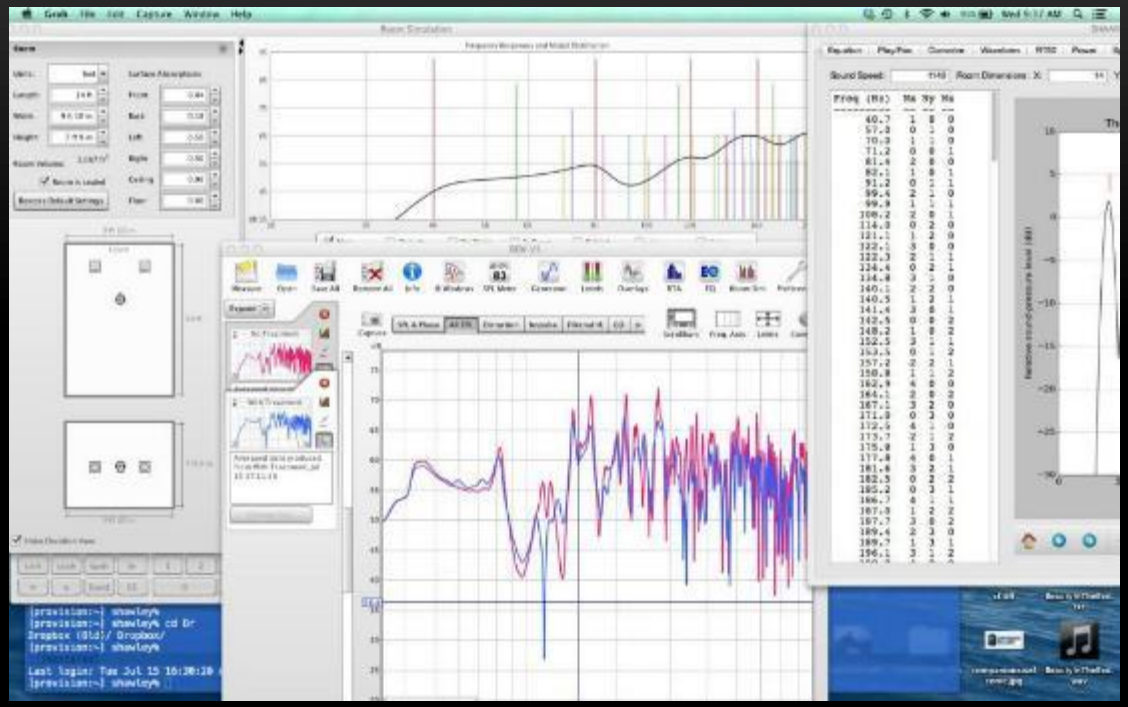
- Intended Use
  - How: mixing / mastering / recording?
  - Who: others / just you?
- Limitations / How Good is “Good Enough”
  - Taming low frequency behavior requires space and mass, and thus money
  - May not need to fully soundproof
  - All practicing engineers work with imperfect rooms & must learn to compensate
- Budget
  - Hundreds / thousands ?
  - You may not want to know. ;-)

Assessment

- Physical Dimensions
  - Tape measure
  - MagicPlan app:

    http://tinyurl.com/8sy9zfq
- Acoustical Measurements
  - Room EQ Wizard

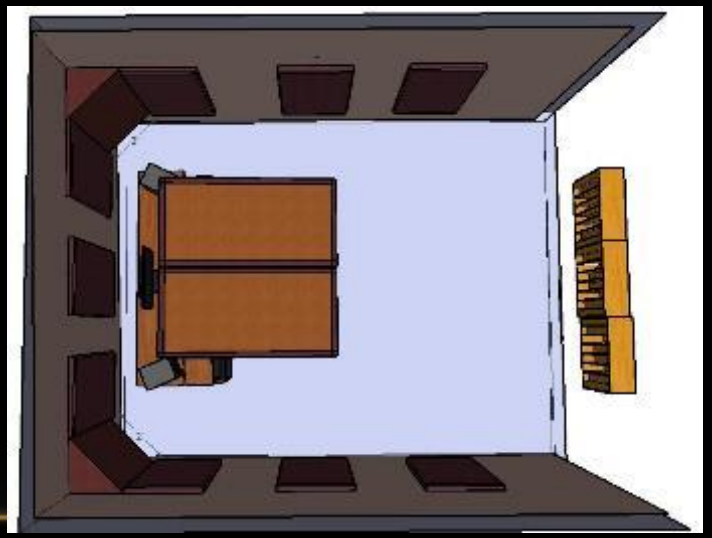
    http://www.roomeqwizard.com/
  - SPL meter
- Identify Problems
  - Frequency domain: modal frequencies
  - Temporal domain: impulse response, early reflections
  - Spatial domain: locations of nodes & antinodes



Design

- Speaker Placement
  - Where do you like to sit?
  - > 1-2 ft away from walls if possible
- Room Shape & Dimensions
  - Boxy can be good.
  - Sometimes shrinking room can actually yield better acoustics.
- Placement of Absorption
  - Stop early reflections
  - Fill corners
- Mock-Up, Software – SketchUp or Blender

'Standard' Home Studio Design
(Justin Dowse)



Design p.2

- Simulation
  - Room EQ Wizard's Room Simulator Tool
  - In Future: AcouSTO (Ben Shaw)
- Aesthetics – Making it "look cool"
  - Google others' designs for ideas
  - Lighting: IKEA, "Pottery Barn Kids"
  - Lots of studios incorporate red

My Design

My SketchUp 3D Warehouse File
http://tinyurl.com/mgry2sq

Construction

- Electrical – AS NEEDED
  - You *do* want fully-grounded 3-prong outlets, may need to upgrade wiring.
  - work need not be by “licensed” electrician, but still hire a (semi-)pro*
  - Bad: GFCIs, dimmers, multiple grounds
  - Good/ Nice to have: Surge-protecting breaker
  - May not need: dedicated earth grounds, power conditioners, transformers, TVSS. Look into if needed. Furman PCs hold up well, can get used.
- Isolation / “Soundproofing” – See separate slide
- Absorption – See separate slide
- Diffusion – For small rooms, probably won’t have much effect. Ethan Weiner: “Be one foot away from diffusor for every inch of diffusor depth”.

*Electrical work for me: Marshall Myhan (TN Tech Engineering/Physics grad): (615) 374-1254

Isolation – “Soundproofing”

- Room usage: will you be recording, or “just” mastering/mixing?
- Goal: Keep sound out, keep sound in (neighbor relations), or both?
- External noise & the “need” for isolation – You may not need* all this!!
  - If it’s intermittent, how inconvenient is this for you (e.g. to re-record)?
  - If recording, check it: Many audible noises won’t get picked up by (close, directional) microphones.
- General principles: “Heavy” and “Airtight” (next slide)

*or want to spend money on

Isolation p.2

- **Heavy** – massive window plug, heavy door, "box-in-box" or "DDGG"
  - Doors
    - Custom (Home Depot):
      - 2"-thick solid slab, cut to size & hung, edge-cut filled w/ Bondo™
      - Exterior door frame w/ weatherstripping already installed.
    - Pre-hung (Home Depot): Masonite SoliDoor™ is "ok"
    - Habitat ReStore doors aren't that cheap, not great selection. (IMHO)
    - Fill in cracks around door frame with rockwool. Caulk seams.
- **Airtight**
  - Door seals – thresholds, sweeps, weatherstripping
  - Caulk everything.*
  - Note this kills HVAC airflow.

*Your contractor has already heard every 'caulk' joke imaginable

Isolation p.3

- Walls:
  - "DDGG" – Double Drywall with Green Glue in between
    - But one-room's-worth of GG is ~$800. ☹
    - Note: DD w/o GG makes transmission *more efficient. (=bad)*
  - "Box in Box" – way cheaper, still removable
    - Build a separate set of interior walls. Actually not that hard!
  - Electrical boxes supposed to be covered w/ acoustical clay (seal leaks).
- Windows: Caulk first, then…
  - "Plug" windows with MDF panel, cut to size, then caulked.
  - Or cover with clear Mass-Loaded Vinyl. (Lets in the light)

Isolation: Window Plug

We accidentally cut MDF a little smaller than intended. Made up the difference via cheap rubberish weatherstripping along the edge, secured w/ Spray Adhesive, and "lubed up" with vaseline so it wouldn't tear during insertion. …Caulk.

Isolation – Priorities / FlowChart

1. Listen and Look. Can you identify where then sound is getting in/out? If so, skip down to the item that applies. Or else just move on to step 2.
2. Cracks. Seal/treat doorframes, window frames, drywall, moulding, etc. Then return to step 1.
3. Windows. Then return to step 1.
4. Doors. Then return to step 1.
5. Walls. Then return to step 1.
6. Ventilation. Then return to step 1.
7. Floor. Then return to step 1.

Absorption

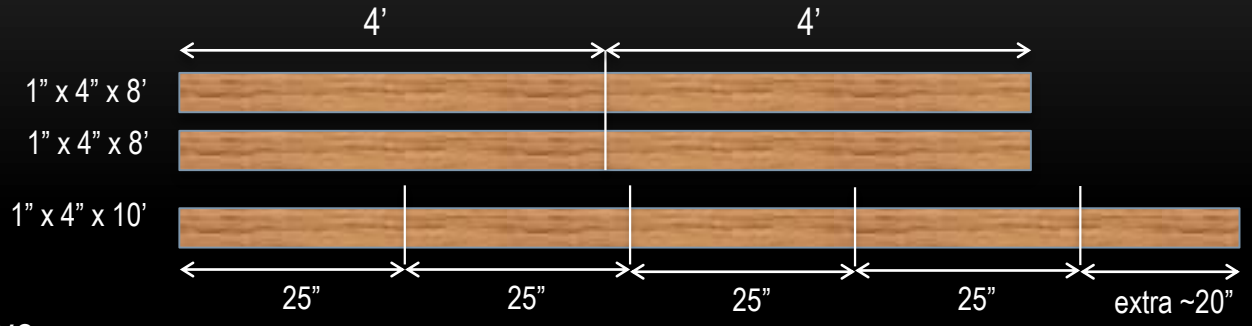
- Go to **Insulation Supply Co**. in East Nashville and get 2'x4'pieces of either
  - Owens-Corning 703. Rigid, itchy. More expensive than…
  - **ROXUL “Rockboard”. Fairly rigid, still itchy, cheaper than 703. Can cut with a bread knife.
  - I recommend 2” thick, can double them to get 4”. Cost ~$5 / piece of rock wool
- Use gloves and a respirator. Do not want 703 or rockwool on skin or in lungs
- Get fabric to cover: Go to Jo-Ann Fabric in either Cool Springs or Madison.
  - Download coupons first!
  - Want air-permeable fabric. (“Blow test”) Recommend “Jet Set” fabric.
- Mounting: Either “impale” onto wall or build frames & hang (on studs!) like paintings
  - Frames: next slide

Cf. HomeStudioDAWg's YouTube:
https://www.youtube.com/watch?v=RqZPhfxSaTk

Absorbers with Frames

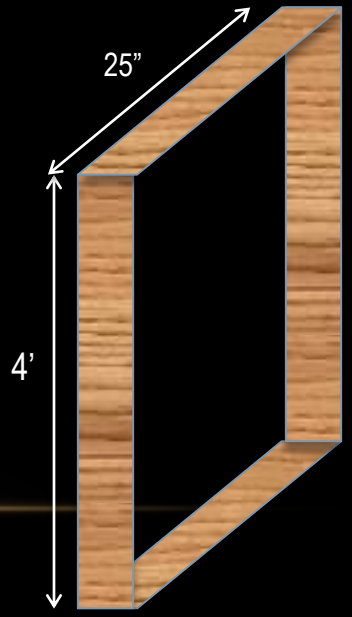
- Makes two frames:

  Have HD cut for you



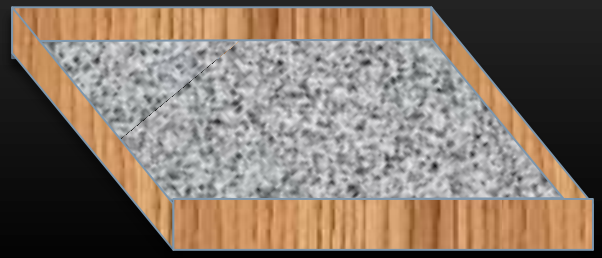
- Get some small steel eye screws and 20-gauge "Multi-Purpose Wire" ($7.50 for 100ft)

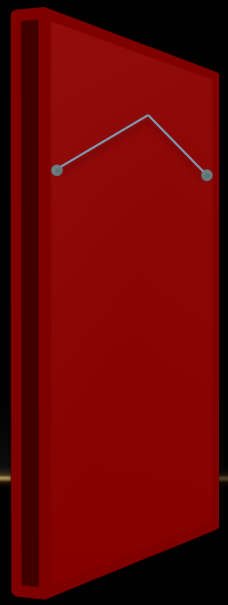
- Use two 25" pieces to "cap" the ends of the 4' pieces. Fasten with something sturdy, e.g. screws at a 45 degree angle at the corners. May use glue / nail gun to hold frame in order to use screws, but glue / nail gun is not enough to support weight



Absorbers with Frames p.2

- Shove 2'x4' piece(s) of rockwool or 703 inside each frame you made.
- Cut fabric and cover. Spray adhesive is fine. I also staple-gunned a lot.
- Put the eybolts in the frame, say 1' from the top, run the wire through them like a picture-hanging wire. Drill 3" drywall screw at 45 degree angle into wall stud, hang absorber on screw!





Corner Absorber “Towers”

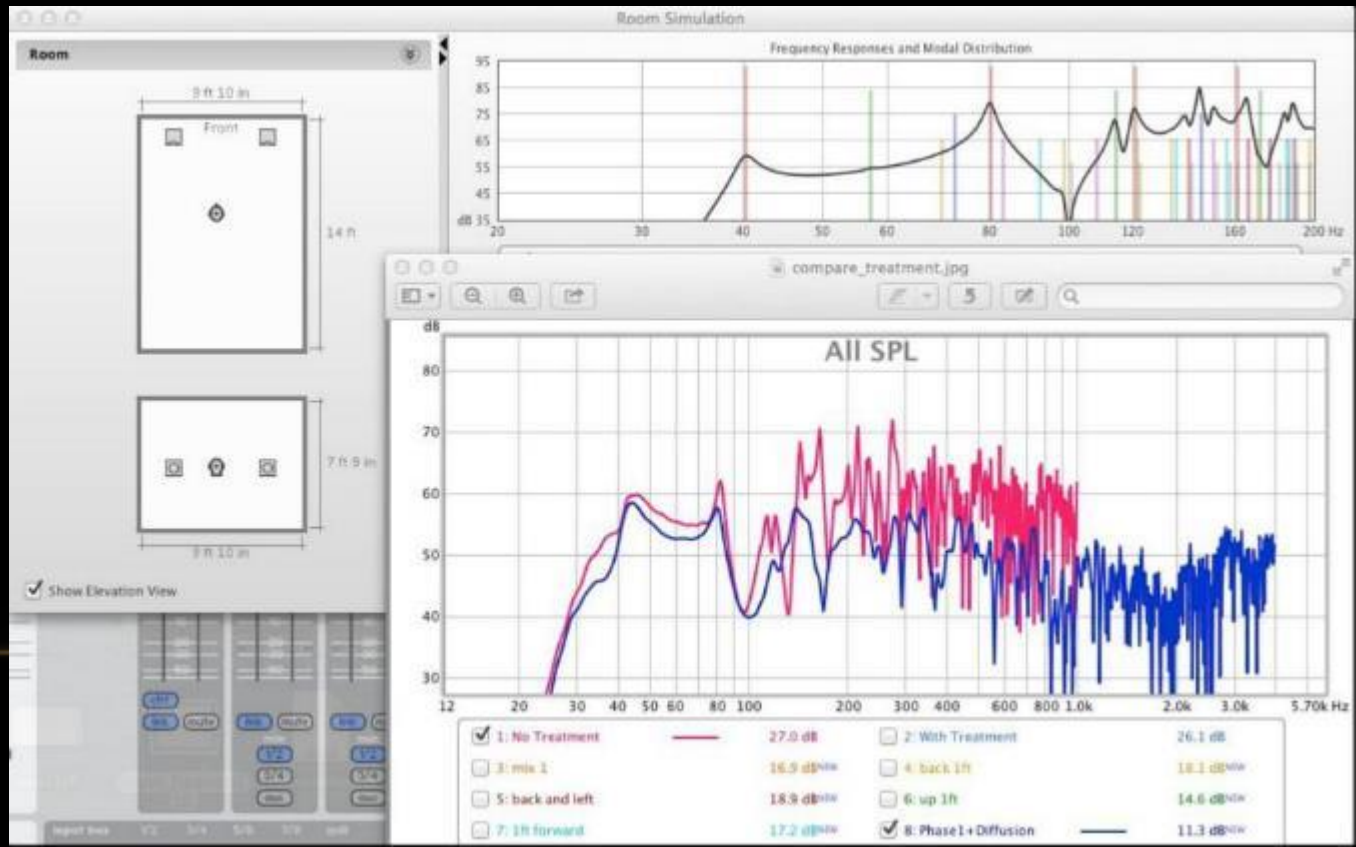
- HD’s Rockwool is ~15” wide. Fabric is 44” wide
- Pythagorean Thm is your friend: 15*sqrt(2) = 22
- Build corner shelves to help support (soft) rockwool

Diffusion

- Collective wisdom:
  - “Diffusion on back wall of studio was introduced because engineers in studios with only absorption (on backwall) were overcompensating & adding too much reverb.”
  - “For small rooms, diffusion is not necessary because it has almost no effect”
- If you want to do it anyway…
- Pre-Fab (plastic):
  - Shells from Auralex, *filled in* with foam/rockwool.
- Custom/DIY (wood):
  - 1D – “Leanfusor” from http://arqen.com/sound-diffusers/ (a Master’s Thesis)
  - 2D – “Skyline” designs available all over internet

Post-Treatment Re-Assessment

- ‘Scoop’ at 100 Hz is a tangential mode
- Adding stuff to corner had no effect
- Will just live with it



Resources

- My ‘guide’: http://hedges.belmont.edu/~shawley/homestudio/
- General contractor/handyman: Lance Alvis: http://www.lancealvisdesign.com/
- Electrical work: Marshall Myhan (TN Tech Engineering/Physics grad): (615) 374-1254
- HomeStudioDAWg: roxul, video: https://www.youtube.com/watch?v=RqZPhfxSaTk
- Video: Mitch Gallagher, project studio: https://www.youtube.com/watch?v=FuRiqoNRDmc
- Four-page article by Richard Schrag – “Acoustical Myths” http://tinyurl.com/onkudrh
- Internet Forums:
  - Recommended: HomeTheaterShack, SoundOnSound, AVS Forum
  - Not recommended: GearSlutz (too detailed/advanced/contentious, except Ethan Weiner & a few others)