Amplifier Workshop

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Workshop Objectives

- Context
  - No such thing as ‘stupid questions’ or ‘bonehead opinions’ in this workshop!
  - The only stupid question is the one you do not ask !!!
  - We all bring our own diverse views and wouldn’t it suck otherwise? Share them! Calling out your thoughts is both welcome and encouraged!

- Content:
  - Introductions
  - Amplifier History
  - Building techniques
  - Tone and characteristics
  - Power Levels
  - Maintaining tube amps
  - Open Mic
  - Let’s try some amps!

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Agenda

- Introductions
- Amplifier History
  - Fender, Marshall, Vox, Traynor , Mesa Boogie, Train Wreck X, Dumble, Dr Z, Matchless, Two Rock, Bogner, …
- Building techniques
  - PCBs vrs point to point, tube rectifiers vrs solid state rectifiers, What would Leo do?
- Tone and characteristics
  - Tweed, Blackface, Silverface, Brownface?
  - JTM45, Plexi, Bluesbreaker, 18 watter, JCM800/900
  - Re-issues OR just “vintage amp appearance packages”
- Power Levels
  - How much power is enough power?
- Maintaining tube amps
- Open Mic
- Let’s try some amps!

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1. Amplifier History
2. Building techniques
3. Tone and characteristics
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Amplifier History

- Fender
  - 1940s (the beginnings)
    - Steel guitar, Model 26, Champion, Dual Professional
  - 1950s (the Tweeds)
    - Champ, Princeton, Deluxe, Super, Pro, Bandmaster, Bassman, Twin
  - 1960s (Blackface era – reverb!)
    - Princeton, Deluxe Reverb, Vibrolux, Twin Reverb, Vibroverb
  - 1970s (CBS and the Silverface era)
    - Deluxe Reverb, Vibrolux, Twin Reverb, Vibroverb – nothing new here
  - 1980s (back to black)
    - Revera designs: Super Champ and Princeton II, Squire, Bullets, otherwise drifting along
  - 1990s (aha – let's re-issue our way back to success)
    - Tweed Bassman RI, Blackface RIs, Blues/Hot Rod Deluxe/Deville series?
  - 2000s (we like that re-issue thing a lot … let's do more!)

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Amplifier History

- Marshall
  - Start with a 1959 Fender Bassman which was much loved but much expensive in Britain
  - Copy it British style and make a few changes: separate head and speakers, allow different cabinets, most popular: 4x12 closed back cabinet using Celestion 15W 12 in speakers, change to EL34 tubes and change Rock and Roll forever → JTM45
  - Make 4x10, 2x12 (Model 1962 Bluesbreaker) versions
  - Make an 18W 1x12 combo (Model 1974) and spawn an entire industry of low power British amps
  - Evolve the “British Bassman” with a solid state rectifier, two uniquely voiced input channels, impedance selector and multiple speaker output jacks for multiple cabinets, and “plexiglass” panels → 1987 “plexi”
  - Add another gain stage and up the ante even more (JCM800)
  - Then dominate the world and go nuts selling amps in the 1980s and beyond, again relying on re-issues for revenues beyond 2000

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Amplifier History

- Vox
  - Start with a keyboard amp focus and tube application manual
  - In 1956 Vox launched a Dick Denny original designed 2 channel AC15 with 2 Celestion G12 speakers (2 EL84 tubes in cathode biased Class A config), followed by an AC4 and AC10
  - Followed in the early 60s by the AC30/50/100 amps. The AC30 was very much 2 output stages of an AC15 in parallel, and was soon offered as a separate amp and speaker cabinet. The Vox Bulldog speakers were re-labeled and re-coloured G12s.
  - US distributed Vox amps were designed and manufactured by the Thomas Organ company – they were different (solid state hopped up organ amps) and sounded different. They were not the same amps sued by the British invasion bands and basically sucked!
  - The AC30 Top-Boost had extra gain and a complex tone boost circuit (Treble/Bass/Cut) that stood out from the rest!
  - In the 2000s a novel strategy of using re-issues of famous amps!

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Amplifier History

- Traynor, Mesa Boogie, TWX, Dumble, Dr Z, Matchless, Two Rock, Bogner, …
  - Traynor – Yorkville sound (that's right TO) Canadian made PAs evolving into copies of Fender Bassman, Twin, DR – built like tanks, many other innovations including wedge monitors – Canadian eh? $$
  - Mesa Boogie – Californian made hot rodded Fenders – most desirable was the Mark I with 100W and MV in a DR sized 1x12 combo, many more $$$
  - Train Wreck Express – British re-take of a single channel high gain Marshall plexi amp which appealed to many "amp-heads" and amp modifiers $$
  - Dumble – Howare/Alexander Dumble analyzes each component in a Fender amp and optimize for best possible tone, use FET overdrive circuits (ODS), "sneak up on overdrive tone", real innovations to amps $$$$
  - Dr Z – pick the famous Marshall 18W, Fender Tweeds and early Vox designs and build around those, double up output stages for more power, KISS $$$
  - Matchless – hot rod the best Marshall and Fender designs $$$
  - Bogner – get inspired by hot rodding Marshalls and Fenders , rebuild EVH's Plexi, then build original designs $$$$
  - Two Rock – some audio-phile concepts incorporated in amps inspired by all the greats, their strengths enhanced and weaknesses reduced

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Amplifier History

- What do I do with these 4 inputs?
  - Many older amps were designed with 2 channels, each channel was voiced slightly differently (higher frequency [guitar] and lower frequency [voice and harmonica]– for example) with each having 2 inputs.
  - The inputs of each channel were different in that they allowed different amounts of input signal to the first pre-amp stage. With a SC equipped guitar the amp sweet spot (on the edge of breaking up) is different than with an HB equipped guitar (higher signal), so the SC guitar can sound best in the higher sensitivity channel and the HB guitar sound best in the lower sensitivity channel. Most guitar players determine which is louder and only use that from that point on. ☺
  - Many players use a short instrument cable to connect both channels and use the Volume controls to mix them as desired.
  - Some amps don't work for this (Fender DR, TR, VR, VV) because the two amp channels are not in phase, but the tweeds all do, and Marshall vintage amps like the plexi series (Model 1987x) have unique channels (different frequency range and gain) so there are many combinations.
  - Fat One Amps original designs internally bridge two uniquely voiced (frequency and gain) channels and allow the guitarist to push as much Lows or Highs as they wish

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Building techniques

- PCBs – evil or not?
  - What would Leo do? Use the best available, low cost, supportable technology for the job.
    - Low volume manufacturing benefits less from using PCBs, but in a high volume manufacturing environment, PCBs provide exact copies of the best proven layout and can be done well
    - Good PCBs are thicker ($$) and use through-plated holes for better contact and less corrosion potential ($$), are identical and identically processed (solder, solder temp, soldering time,…)
    - Some mass-produced PCB amps may mount pots and/or tubes on the PCB making amps less robust and if damaged very expensive to repair
    - Fat One Amps does low volume, in some case vintage replicas, so PTP is the way to go. PCBs are not used, instead we use fiber board with eyelets in most replicas, G10 board with turrets in some replicas and G10 board with eyelets in the originals

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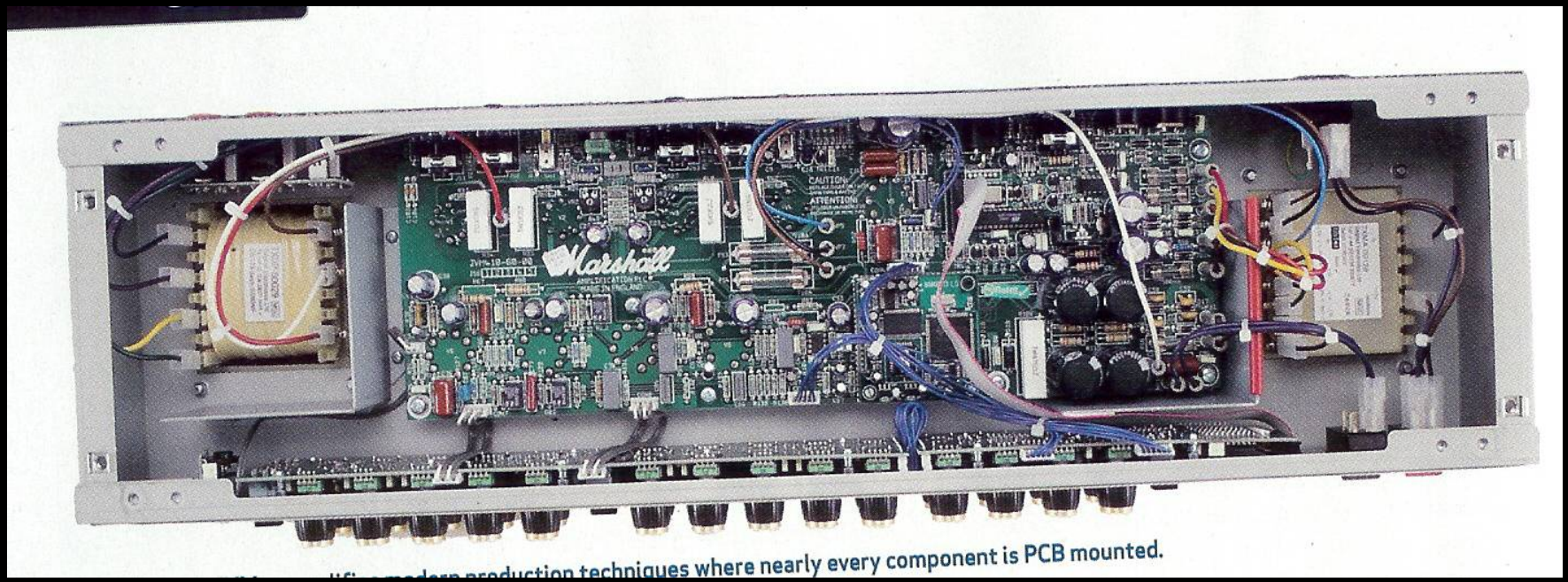
Building techniques

- PCBs – evil or not? Marshall 2008 JVM100 example. One busy PCB with all components mounted to PCBs.



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Building techniques

- PCBs – evil or not? Fat One 5E3 example. Components on eyelet board hand-wired to tubes, pots and transformers.

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Building techniques

- Speakers
  - AlNiCo vrs Ceramic vrs Neo?
  - In the 50s and early 60s, AlNiCo was what was available, but as power levels increased speaker manufacturers turned to other materials → ceramic magnets for example, provided greater energy per weight
  - AlNiCo magnets impart a warmer, smoother tonal characteristic which works very well with the relatively low powered vintage amps → multiple low powered speakers in a cabinet to handle higher power levels
  - Ceramic magnets provide cleaner headroom and a punchier characteristic. They work differently but still sound great when overdriven → higher power ratings possible so smaller combo cabinets possible (MB Mark I 100W 1x12)
  - Neodymium magnets are relatively new and can be half the weight of similarly power ceramic speakers. Their tonal characteristic is considered similar to AlNiCo. One good application is reducing the weight of a bass cabinet by providing lighter speakers with same power handling capability.

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Building techniques

- Tube rectifiers vrs solid state rectifiers
  - What would Leo do? In the 50s and 60s, tube rectifiers were what was available so…
    - Tube rectifiers experience high voltage drops with high current draws (sag), require filament current, generate heat, are limited in the filter capacitance they can drive, and fail frequently
    - Alternatives to tubes are pure solid state or like Weber's Copper Caps, tube rectifier-like solid state rectifiers. These are less limited than tubes, use less power, generate less heat, can drive larger filter capacitors, drop less voltage and may last the lifetime of the amp. Fat One replicas use these instead of tube rectifiers.

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Building techniques

- Carbon composite vrs metal film resistors
  - What would Leo do? In the 50s and early 60s, carbon composite resistors were what was available, but now…
    - Carbon composite resistors are no longer the state of the art, but are expensively available parts, have 20% tolerance from unit to unit, and are noisier devices
    - Metal film resistors can cost less that a penny each, are very consistent, are smaller, generate less noise, and meet a 1% spec tolerance.

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Building techniques

- Capacitors, Transformers, Tubes, the aftermarket business
  - What would Leo do? When Leo was building amps there was no after market business, so he did the best things he needed to do for his business to succeed: balance quality and cost. Now…
    - Prove to me Orange Drop, Dijon, Lemon Drop, “insert boutique name here” capacitor has better tone and I’ll use them. For now, performance and consistency are qualities supplied by Mallory and other similar manufacturers.
    - Same thing for tubes. I spec JJ, EH, Sovtek, etc tubes because they work consistently and sound great. I have access to some NOS tubes and they sound great too, but have unpredictable availability and performance.
    - Similarly for output transformers. Heyboer and Hammond transformers provide huge tone for the money. I like that! Do Mercury Magnetics at twice the cost? I have not seen it or heard it.

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Tone and characteristics

- Fat One Replicas
  - Tweed
    - 5E3 Deluxe – 15W, 1x12 - clean → crunch – perfect jamming tweed combo?
    - 5F4 Super – 30W, 2x10 – clean → bluesy – perfect clubbing tweed combo?
    - 5F6A Bassman – 45W, 4x10 - clean → bluesy - big, ballsy and possibly the best combo amp ever. This is where Marshalls started.
  - Blackface
    - AB763 Deluxe Reverb – 22W, 1x12 – clean → sweet crunch – perfect reverb/tremolo clubbing combo?
  - Marshall
    - 1974 – 18W, 1x12 – British bluesy → British rock – perfect British rock combo?
    - 1987 – 50W – big, full, loud clean → British rock machine – the perfect classic British amp for big rooms?

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Tone and characteristics

- Fat One Originals
  - Jammer
    - Plexi-inspired, combined input channels, 20W, TMB, MV, 1x12
    - Think of a BFDR which can be cranked up to sound like a 1974 (18 W) or 1962 (Blues Breaker) into a wonderful 12 inch speaker
    - Fender clean at lower levels, then when pushed responds like a British rock machine – rock and roll, baby!
  - Clubber
    - Plexi-inspired, combined input channels, 45W, TMB, MV, 2x10
    - Think of a BFSR which can be cranked up to sound like a Plexi into two wonderful 10 inch speakers
    - Big and clean at lower levels, then when pushed responds like its British heritage does. Stand back, Jimmy! I'm rockin' here.

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Tone and characteristics

- Fat One Originals
  - Stager
    - Heavily plexi-inspired, combined input channels, 50W, TMB, MV, head
    - Think of an updated Plexi: very stable solid state power supply, combined adjustable uniquely voiced inputs, selectable Mids boost/raw gain switch, selectable bright switch, vintage/modern character switch, all new high quality components, EL34 tubes (and options)
    - All the thumping lows and singing highs you can handle – at the same time!

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Power Levels

- What do you really need?
  - 100W Marshalls were designed for 60s stadium performances by the Who, Jimi Hendrix, Cream and LZ. They had very limited PAs but had to fill stadiums.
  - PAs have come a long way since the 60s and 70s and your favourite amp can now fill a stadium, if required. Your essential tone still comes from your hands, guitar, effects and amp. The PA just makes it huge.
  - To get “twice the volume” of a 15W amp you need 150W, to double the volume from a 30W amp you need 300W. One of the most popular studio amps is a Fender Deluxe Reverb (22W, 1x12). Many recordings have been made with a Fender Deluxe (14W, 1x12) and smaller amp like a Champ (6W, 1x8).
  - Higher power amps move the sweet spot higher in the volume range, cost more, weigh more, may require specialized tubes or twice the output tubes, will upset all stage sound guys (or worse, make your drummer play louder).
  - If mic’ing an amp, only one speaker is used. If your 22W 1x12 amp sounds great to you… why not everyone?
  - Power soaks and Hotplates? Make power then throw it away?

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Maintaining tube amps

- What does it take?
  - Think of tubes like tires on a car – better tubes provide higher performance and when worn result in poorer performance. Pre-amp tubes can last many years (less current drawn), but rectifier tubes and power tubes (more current drawn) need more frequent replacement. Think 1 to 5 years replacement cycle depending on use.
  - High quality tubes are available from many sources (www.tubedepot.com) at reasonable prices and in most cases are user replaceable. Power tubes should be matched and are available in matched pairs are reasonable costs. Let them cool down first and ALWAYS unplug your amplifier and let the voltages discharge from the filter caps. I suggest overnight.
  - Biasing power tubes is the process of setting the idle current for desired operation. Adjusting bias requires knowing the voltage and current across the power tubes. Some amps (Fender 5E3 and 5F4, Vox AC15/30, Marshall 1974) are “self-biasing” and do not need adjustments. Some tube manufacturers “classify” their tubes to enable direct replacement. Fat One amps have both types of power tube configs and use simple test equipment to measure the voltage and current for a 60% bias point setting.
  - Filter capacitors wear slowly with time. New amps should last 20+ years with no concern, but some vintage amps will need capacitor replacement. Not all though – best to have a tech check a suspect amp before changing anything. First stop → swap out tubes.
  - P2P wiring and terminal boards do enable mods, as well as easier repair. Mods could include more gain, or less gain, different response, more/less treble, MV, …

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Open Mic

- Other opinions, favourite amp stories, missed opportunities, incredible tone machines you almost owned,...
- Can you repeat that part about... ?

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Wrap Up

- Content will be posted to website
  - www.soundluthiers.com
- FX Workshop
  - Date TBD … Guitar FX and how to use them best
  - Wanna Sign Up?
- Coming Soon
  - More Amp, Guitar & Effects Samples on the web page
- Open Mic
  - Starting again in September
- Questions? … call anytime
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