

I Never Met a 2A3 AMP That I Didn't Like

by
Joe Roberts

Nothing in audio is a sure deal but if I were forced to come up with a foolproof recommendation to stake my name on, I would have to go with the classic no-brainer: "It's hard to build a bad 2A3 amplifier."

There might be some bad ones somewhere but I have to say that every 2A3 amp I ever had the pleasure to hear was at least pretty good and some were downright amazing.

My introduction to triode amps came with restoring a few Brook 2A3 amps of the early 1950s, which I didn't get to hear until they were certified antiques in the early 1980s. Even in the late 1940s/early 1950s when they were current models, the Brook designs were a throwback to prewar technologies (see *SP#2*), valued by a few purists who knew that those newfangled pentodes were nothing but a sell out.

The Brook 10C wasn't even a pure Class A design or anything. It used a sliding bias adjustment scheme to switch the push pull 2A3s way into AB2 when the signal peaked. Yet, despite this elaborate and somewhat dubious conception, the 10C still sounded very very good. Real, real good, in fact.

In an attempt to come up with a simpler amp than the Brook 10C, I built the "Recording Amplifier" shown at right (minus the mic preamps). Glory, this was a mighty fine sounding amp and I'd build another one in a second. The "triode sound" is still really there with PP topologies and...*Man*, you can really get some low end out of a pair of these tubes. After all the 2A3s were chosen to run a record cutting head because of their good damping

behavior even sans feedback.

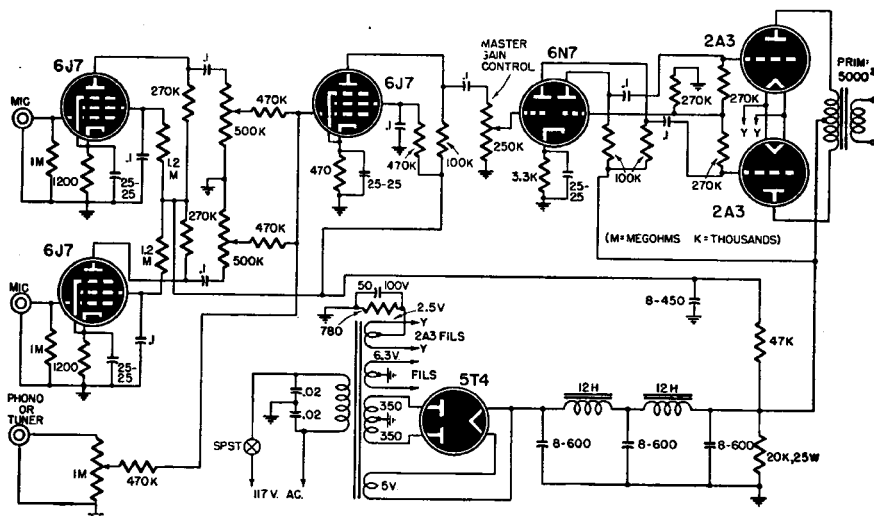
Yeah, somehow PP 2A3s fell through the cracks in this age of SE mania, but, on the other hand, maybe a single 2A3 amp is about as good as it gets. My first exposure to SE amplifiers was a shot in the dark. I

mary of my vintage push-pull UTC LS-55 transformer.

When I turned this Frankenstein on I was floored. It sounded way better than it should have. It was a looser, more open, more organic sound than the PP 2A3, and although the bass wasn't as tight as the PP amp, it was very expressive. This experiment was obviously taking me somewhere I thought I might like to be.

Now, after years of study and experience, I might comment on how the 6J7/2A3 combo is reminiscent of the classic WECO Model 91 pentode driver/300B circuit and blabber on in an Ultra-Fi "dress-to-impress" patois about esoteric bullshit that doesn't matter anyway. Seems like everybody is a triode amp expert today, but back then I didn't know anything but what I was hearing. That's all I needed to know. The rest is history.

One of the things that I know now that I didn't back then was that Nobu Shishido, one of the "crazy Japanese guys" who revived the triode amp, wrote the first article about SE in the modern era in a



10 Watt Push-Pull Class AB1 "2A3 Recording Amplifier" from 1948

remember looking over a SE 2A3 circuit in the 1940 *Radiotron Designer's Handbook* (third edition), provided as an example for calculating the response of the circuit and thinking "Hmmm?"

With a few voltage adjustments, I figured I could scrape a single amp out of my "Recording Amplifier" by hooking the 6J7 straight into the grid of one 2A3. I didn't have any SE transformers back then. I just ran the DC through the pri-

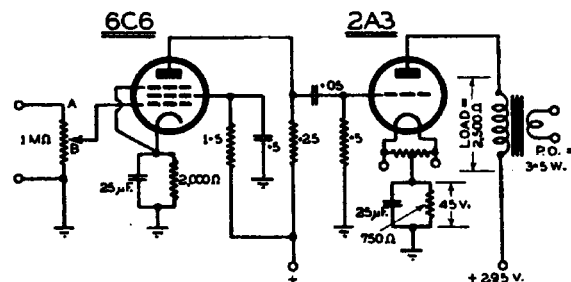
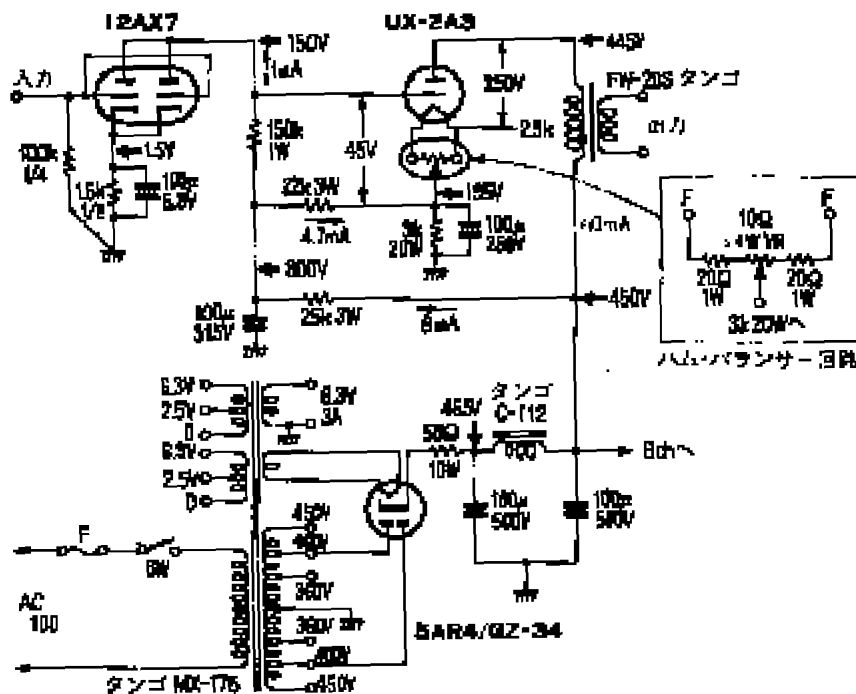


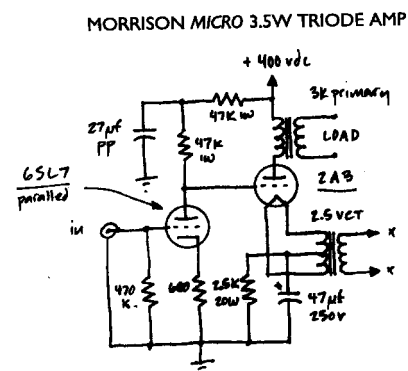
Figure 1

Radiotron example circuit

Fortunately, in this day and age, you can buy super-quality parts to put together a 2A3 of your own, or buy USA-made 2A3 amps, your choice of finished or kit form. For the last 60 years, you had to *really* work to hear 2A3s, but now it's probably easier than it's ever been. That is a strange historical fact and the more I think about heavy historical facts like that, the more I want to stop thinking, spark up a 2A3 myself, and just listen, if you know what I mean.

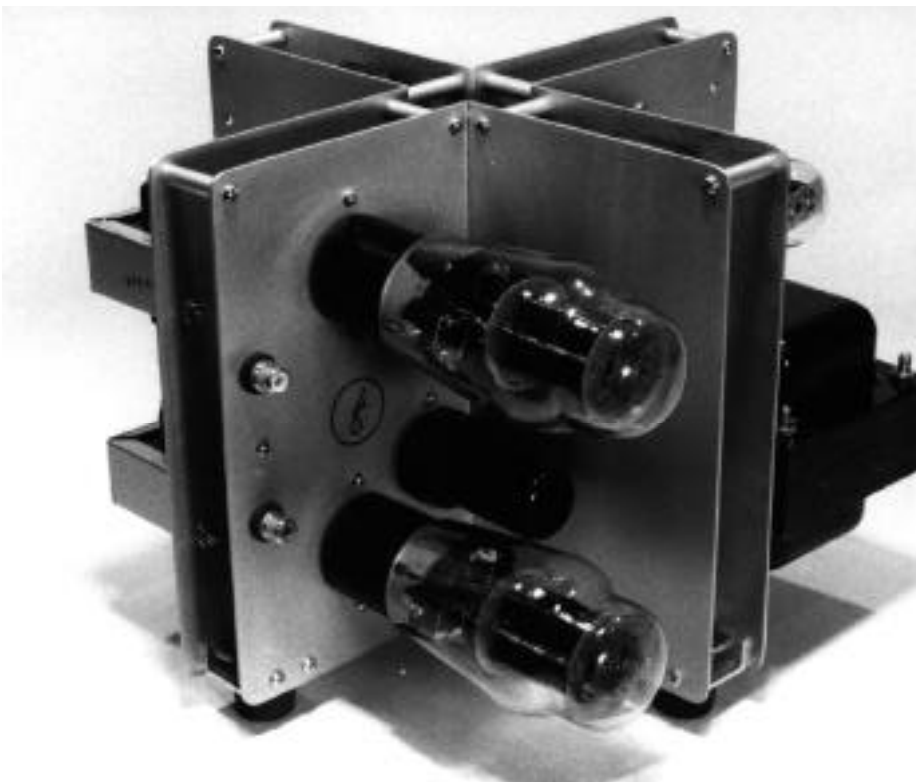


Below: My homebrew Micro 3.5 made the news in Korea!! Don't know what they said about it but I'm sure the words "kicks butt" are in there somewhere



6A5G진 진공관을 사용한 이 앰프의 출력은 약 3.5W. 그 불꽃없는 모습과는 달리 음질만은 매우 대박적이었다.

외 능리
기 위해
할 것
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Fi "X"

direct coupled 2A3 SE

\$895 with Hammonds
\$1175 with MQ iron

I could hardly believe my eyes with the "X" ad spread out in front of me. First of all, you have to ask "What is it?" The answer is that it's a stereo 2A3 single amp. Who would have thought?

I don't usually get sucked in by slick advertising campaigns, but the second I saw the ad for the Fi direct coupled 2A3 "X" amplifier, I immediately had to own one. As a homebuilder, I don't often get the urge to whip out the Amex card for storebought gear but the "X" really hit my button hard.

Despite all the charms of the 2A3, "best tube" according to many confirmed triode nuts, there isn't much perceived desire to own three watt amps yet. People just don't realize what they can do, yet.

Fi's Don Garber has always made 2A3 SEs and I think he always will. Among professional American amp makers, Don is alone in his unswerving dedication to the ancient 2A3, half-pioneer, half-keeper of the faith, and half-artisan—a man of many halves.

"Mr. 2A3" Garber is also in a class of his own as far as visual design goes. You would think you might have to go to Italy or something to get this kind of symbolic *objet d'art* approach to amp design, but Don just dreamed it up while riding home on the subway, "A freakin artist," as they say in New York.

The "X" Amplifier is truly The Death of the

Box. The insides of this amp are mainly on the outside. Actually, it's hard to say what is inside or outside. It reminds me of a revolving door.

Anyway, when my eye settled on that glossy b&w "X" promo snapshot, I instantly decided that I could never be cool again until I had the "X" playing in my system. And, aside from the unquenchable thrust to maintain a hipster self-image, always the best reason to buy audio gear, I had just rebuilt my bi-amp horn setup, using TAD 2001s and Altec 1505B multicell horns. I knew that a single 2A3 would be just the thing to run that overgrown fifteen cell tweeter.

If one could say this amp is art, and I would say so, it is industrial art. It is meant to be plugged into the wall and turned on and used. And treated with some due respect—the open nook and cranny construction and silky aluminum surfaces of the "X" invite the eye and hand, while the B+ terminals lie within reach, daring the uninitiated finger to probe the mysteries of its forbidden interior...

I later found out that Garber *usually* ships the "X" with a protective metal shield, but he shipped mine bare. Now I *know* he's trying to off me, before it was all just talk.

Back in early-80s NYC, the "X" motif was tied in with the whole punk sparseness aesthetic that was so hard to avoid if you lived

in the city. Don might remember this since the "X" circuit adopts a staunchly minimal pose from the standpoint of parts count. This unit is a ruthlessly pruned-down version of Fi's regular 2A3 direct coupled amp, itself already a lean, mean, low parts count machine. The "X" is the Sid Vicious of 2A3 amps. Time to get out the New York Dolls records.

Minimalists take note: the "X" is almost the least hardware you can use for the job—a pair of 6SF5 metal high mu triodes with the plates wired straight to the grids of the 2A3s, a couple resistors and a few electrolytic bypass and filter caps. If simplicity is a virtue, the "X" is a saint. There isn't one extra screw in the whole assembly.

On the other hand, Garber does spring for a tube rectifier, which I was very glad to see, because I know it makes a big difference in the musical flow of an amp's presentation. It's reassuring that Fi didn't skimp down to the 10 for \$1 silicon rectifier level of minimalism, but instead chose the inefficient, wasteful, purist high road. This amp wouldn't be what it is without that tube rectifier—it's as simple as that.

The "stock" trannys are \$75 a pair Hammonds, with MagneQuest DS025s available for an additional buck-fifty per channel. When quizzed, Don seemed non-committal on the value of the \$280 upgrade, saying the difference was "not as different as *some* people might like to think."

I still don't know what the heck that means, but I detected the distinct musky aroma of a reverse-cool parts choice statement in there somewhere. So, I told him, "Look, I use to live in New York myself, just hold the iron, cut the price, and I'll install my own pair of Magnequest trannys." Had some MQ TFA-204s I shook Mike LaFevre down for sitting idle on my workbench and

they were already paid for and broken in, know what I mean?

That may be, but now I feel like I lost out on the cheapo/minimo posture of using the Hammonds and now I wish I had those cheap Hammonds for the urban coolness factor. I know the MagneQuests are probably technically better transformers, but so what?

Visual aesthetics aside, in terms of musical refreshment, I must say that the Fi "X" marks the spot. It's definitely worth the risk of painful electrocution to enjoy an amp with a rich soulful presentation that quickly puts me in the right mood like this amp does.

To generalize, the Fi amp has more of a celebratory musical posture than an analytical presentation, and this is what I am looking for to run my HF horn. It has a soft, seductive, whispery quality that makes me feel like it is singing right into my ear.

I must say that nothing in my experience compares with a good 2A3 in terms of getting just the right balance between *dramatic* and *natural*. A 300B can be more dramatic in some applications, and done well that can be mindblowing, but you always know you're getting a show. The 2A3 pose is perhaps a tad more restrained and a bit easier to believe most of the time.

That said, I wouldn't want to imply that the "X" is a *neutral* sounding amplifier at all. It delivers the full psych-o-delic special effect that triode amps can produce. The "X" creates a narrative drive beyond the usual realm of realistic reproduction, edging into a kind of intimate hyperrealism, but don't knock it until you've tried it. No matter how long I sit there trying to understand and deconstruct the 2A3 illusion, it doesn't go away.

I expected top midrange out of a DC 2A3 and I got that with the "X" but the unexpected BASS performance on my Altec woofer definitely put some funk in my trunk, with grunt factor well beyond my expectations. I do get a bit more weight and control with my "big" 18W pp 6BQ5 Dyna ST-35 on the woofs, but in terms of punch and rhythm, the "X" was no slouch. A cute and effective rig up would be a pair of "X"s for a one-"X"-per-side bi-amp arrangement.

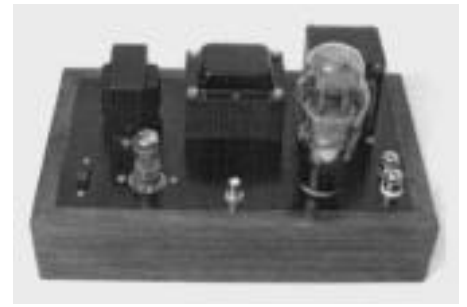
H'mmm, maybe I can work out some kind of involuntary payola arrangement with Don Garber, once he knows I know he usually ship the amps with a metal safety cover—either that or "Move over Jimmy Hoffa, Mr. 2A3 goin out to summer camp in the Meadowlands." They'll be saying, "Yeah I remember Garber, the guy made a helluva 2A3 before he went to Jersey!"

ELECTRONIC TONALITIES AFTERGLOW 2A3 Direct Coupled Mono Kit Amps

No article called "I Never Met a 2A3 Amp I Didn't Like" would be complete without reference to a 2A3 amp I never met. So, before I even get close to finishing, here's one that I only read about: The \$849 *Afterglow* kit from Electronic Tonalities.

Like the Fi amplifier, the *Afterglow* is a direct coupled amp but, unlike the classical Fi "X" 2A3, the Electronic Tonalities design pursues a relatively high-tech approach to a simple two-tube circuit. North Texas amp guru John Camille and ex-Texas refugee to Washington State, John Tucker were involved in this project and those blokes are well known to prefer slick neo-technology over the "Pass the Radiotron, Dear" retro scheme a lot of tubeheads opt to pursue. If this were 1962, these guys would definitely be toting foot-long slide rules on their belts, I'll tell ya.

The driver is a paralleled 5965 running into a Camille C4S cascode constant current source contained on a little circuit board.

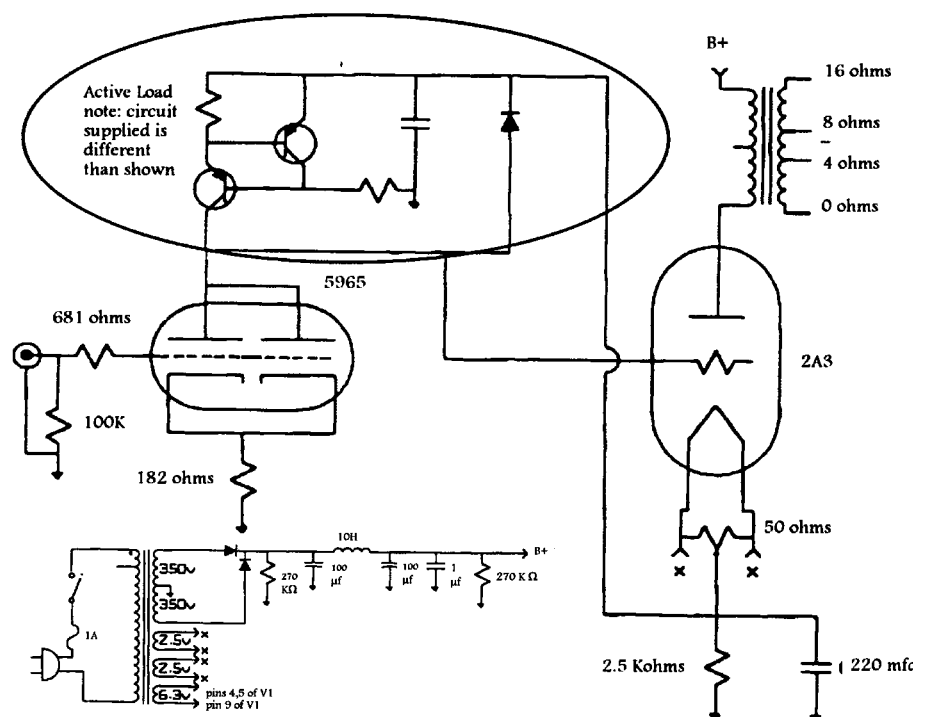


The advantage of this hookup is that the driver tube sees an *extremely high* load impedance (>5 meg)! They sell the board separately if you want to mess with it.

Since I never heard the amp, obviously I don't have too much to say about the sound. ET's Dan Schmalle says that the *Afterglow* is a very clean sounding piece: "A high level of sonic realism is achieved by the direct coupling of these stages"...blah, blah, blah. Know what, though? I believe him.

The *Afterglow* uses the little \$99 TFA-204 from MagneQuest, a good sounding cheap transformer that I used in a number of amps, including my Fi "X." It might not be the best or fanciest output in the whole wide world, but it's good enough for me.

According to the book, the *Afterglow* is good for 2.4 W at 5% distortion and the measured frequency response charts out at -1dB at 28 Hz and 19 kHz. But who cares?—nobody buys 2A3 amps from the spec sheet anyway.





Welborne Labs MOON- DOG 2A3 monos

Kit Less Tubes \$1149

I really like the name of the *Moondog* 2A3 monoblocks from Welborne Labs, and not only because there is a certain timeless quality of regularity and dependability evoked by that lunar imagery. The cyclical theory of history implied by the endless gyrations of the moon kind of fits with the resurgence of this ancestral audio tube, for those who like a little millennial poetic justice and tidal forces with their audio gear.

Beyond all that deep interplanetary symbolism, the name *Moondog* dares to speak the obvious truth—that anybody who has to have a 2A3 amp probably too far gone into audio lunacy to relate to normal society anymore.

And Ron Welborne is in a good position to know about that freaky triode crowd. Hey, Ron, do sales go up during the full moon or what? After all, *you* came up with the name, buddy!

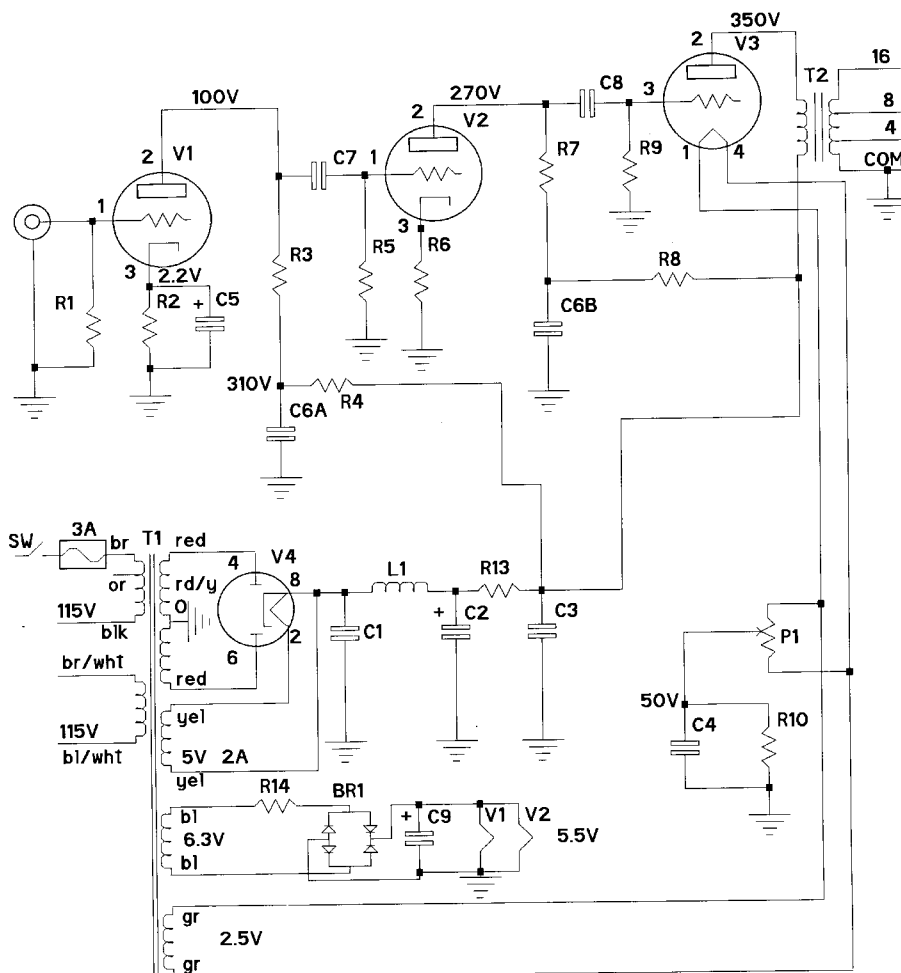
Consistent with the access to ancient natural secrets and dedicated insanity implied by the *Moondog* title, these amps feature the kind of classic technology that is hard to argue against. GZ-37 tube rectifier with a pi-filter using a choke, a pair of 6SN7s and a 2A3. Output transformer is the MagneQuest DS025, my personal favorite Philadelphia-wound transformer. (3/99-see note below)

This amp is a solid, traditional, and somewhat conservative design and, in those respects, it represents what is worth keeping from the retro concept. Except for the DC heater supply for the 6SN7s, the *Moondog* is

a throwback to a long-dormant 1930s all-triode amplifier paradigm, back from the ashes to play the music for the turn of the century

Although I might have an intellectual reaction to a circuit, in one way or another, don't really know how to think about the sound of a given circuit. A circuit is just an abstract picture until you build it out of real world parts. And it is a particular combination of parts that gives each amp its actual sonic character. Often in my experiment with things like 2A3 single amps, I found that a coupling cap swap could impart more flavor than installing a whole new drive stage.

That being said, I still feel good about the *Moondog* schematic. You won't get burn sticking with a classic framework like the two stage medium mu triode *Moondog* voltage amp stage and a 2A3. This approach has become a classic for many reasons, one of



Basic circuit layout of Moondog 2A3. A complete schematic, including part values is available in the kit manual (\$15 refundable with kit purchase)

Moondog 2A3 Amplifier
Welborne Labs
Copyright 1998

NOTE: After publication of this article, Welborne switched to Electra-Print output xfms

them being that a simple circuit that sounds good is a tested recipe for satisfaction. Getting fancy isn't always the point.

The *Moondog* might borrow from bygone traditions, but this amp does not sound very antique at all. I believe that's because of those modern hi-tech components. In these simple, no-feedback amps, you can really hear the parts, every single one.

In the instruction manual, Mr. Welborne says that at first he tried the vintage carbon resistor and oil/paper cap scheme and they were impressed with the tonal results. Then, after swapping in some boutique bits from the Welborne parts catalog, such as Caddock foil resistors, a couple Mills wirewounds, ELNA Cerafine caps, Hovland MusiCaps, and whatnot, Ron felt that they had to go with the fancy stuff for modern audiophile performance aspects, like big soundstaging and sonic detail resolution.

Welborne, ever eager to please, is willing to customize the kit per the customer's individual audio fantasies, so if you're after something special, give the man a call. It's a kit, after all, so if you want to mellow it out with an oil cap or whatever, who's gonna stop you? Certainly not Ron Welborne. He'll even sell you the damn oil cap!

On the whole, the quality of the hardware and components that go into the *Moondog* kit are on the level to be expected from a specialist parts guy: Cardas connectors, OFC wire, name brand components out the wazoo. The *Moondog* package doesn't go over the top with swank and elaboration but there is no junk in sight.

The *Moondog* monos are packaged in the brass plate and walnut wood frame style seen before with the *Laurel* 300B amp. The look is natural and unadorned with a sort of rustic manly character. The amps look handcrafted rather than mass-produced, which is exactly what they are.

Like I said before, I think it's those new-fangled *Welborne Catalog* components, but the *Moondog* I heard, Ron's personal stock *Moondog*, tunes the antique 2A3 for the modern 1990s wide-bandwidth, high-resolution aesthetic. The 2A3 is capable of presenting an astonishingly natural, high-definition 3-D scenario and this amp showcases that impressive trait.

This is one of the important things triodes can do: that very detailed presentation with enough harmonic depth and color to get the emotional encoding of the tones across. In my opinion, the added color

imparted by the 2A3 is just what is needed to warm back to life that cold analytical concept of x-y-z axis positioning as a goal for hi-fi systems. Perhaps some "imaging" is necessary for realistic musical portrayal, but it is not in and of itself sufficient to get the illusion across. Imaging for me belongs the intellectual side of recorded music listening, not the immediate physical communication part. Without that special expressive juice behind it, the image is just a skeleton—the dry, objective component of phonographic realism.

The way some SE triode amps get the audiophile transparency illusion right without sacrificing the vivid life and tonal complexity of music has been a hit with a lot of listeners, including me. Such amps can be shockers to hear.

A clear-voiced 2A3 is especially good at sneaking up on you every once in a while with realism that is scary. Like a bell sound out of nowhere that makes you jump out of your chair. Or how Miles' horn on *Live at the Blackhawk* cuts through the air like a flare. How could anyone not like this magical effect that I'm trying so uselessly to describe?

Since the *Moondog* is being offered in a package arrangement with Lowther Club of America, which I took to suggest a recommendation of the Lowther/*Moondog* combo, I had to try it with my PM6As in *Medallion* cabinets. Indeed, Welborne picked parts using his Lowther PM2As as one of his main reference speaks, so there ya go.

No shock then that the pairing really clicked, as expected. The *Moondog* supported the high-res well-lit effect of the paper cone Lowthers. The incisive midrange added realism where a more flabby mid would have steered the PM6As toward the boozy, lush flavor I got with a lot of my other SE triode amps on my Lowthers. There was something to be said for the tasteful restraint of the *Moondog* in this system configuration.

The *Moondog* also led me to rethink my theory that I really want some feedback on the Lowthers to add control the rear-loaded horn bass. Most no-FB SE amps I've tried on the Lowthers sounded gorgeous in many ways, but more often than not were underdamped in the bottom register.

However, to my amazement, the no-feedback *Moondog* played with excellent low end control, thanks only to the reasonably low damping factor provided by a naked

2A3. The tightness, definition, and punch were right there. Vibrations emanating from tightly-stretched membranes sounded like they were coming from tightly-stretched materials. Good job on the low end.

According to Welborne, most of the people who have been buying the *Moondog* kit own Altecs, Lowthers, or Klipschorns. The K-horn fans are particularly nirvana-stricken with the 2A3s, fitting since Paul Klipsch used Brook 2A3s back in the olden days.

Altec, Klipsch, etc....these are all obvious candidates, but I believe that the clear, crisp, and well-damped character of the *Moondog* would serve the amps well in the quest for matching speakers among the contemporary crop of audiophile boxes.

And if you find yourself in a situation where you think a bit more *whatever* is in order, remember that it's a kit. Feel free to screw around!

Comment

Obviously, I liked both 2A3 amplifiers that I heard quite a bit. Although I purchased the Fi "X" before ever hearing the Welborne *Moondog*, I was never stricken with buyer's remorse. Really, I would have felt the same way if I bought the *Moondogs*. Ahhh, 2A3 amps, I love 'em. These are the kind of amps I started building in order to enjoy. I'm really glad to see that you can go out and buy kits and amps like this now.

On sound alone, I could live with either amp, but with my Altec/TAD setup and system goal to build a funky blues/jazz oriented rig, the Fi amp is just the ticket for the job. Plus it fits on the mantle above my fireplace, an essential part of my babyproof scheme. Plus, plus, it is the coolest looking thing I ever saw and let's not underestimate *that*.

With compression drivers, I like a dash of romantic excess in the amp. These TAD 2001 drivers sure don't donate any romantic excess to the system. If I owned the *Moondogs*, I might try sticking in an oil coupling cap for compression driver use, although many would prefer the clean, low-distortion act of the stock amps Tough to say. What I *think* I want isn't always what I *actually* want when it's playing there in front of me.

On the Lowthers, both amps again did a good job. The Fi 2A3 came across gutsy, rich, and punchy with a full, slightly puffy, and emotive bass. The *Moondog* shifted my attention upward in frequency to the ultra-clean midrange and sparkle effects but had

a low end that was surprisingly crisp and well-articulated for a NFB flea power amp on that rear-loaded bass horn.

Listening to these amps it was hard to shift into an “amp shootout” review mode, because they both sounded so good in their own ways. I just wanted to sit back and listen to what the amps were doing.

SPEAKERS

Two of the big reasons 2A3 amps like the X and *Moondog* aren't more popular is that 1) Most people haven't heard anything like this and don't know how good it can be and 2) It does require a leap of faith to expect that there are speakers that 3W will drive. It is definitely difficult to believe, based on the usual preconceptions, that three watts will drive anything. All I can say is “ha, ha, ha.”

I used to think I needed fifty watts *at least*. Now I can bridge the power outputs of my five favorite amps, and the total wouldn't even hit fifty, probably closer to forty, watts.

Obviously, 2A3 and 45 amps are tailor-made for what I like to use 'em for— efficient multi-amplified horn systems. Indeed, with a horn, power ain't nothing but a number, and you can totally ignore the specs and select amplification on the basis of musical performance criteria alone.

One reality we can never get beyond is that there is always a moment of mystery when you hook up a new amp and speaker combination. The challenge is a bit more obvious when the amp is a three-watter, since engineering feats like high-power and feedback are intended precisely to reduce the mystery of the speaker drive equation, and single 2A3 amps do it without those technical advantages.

On the other hand, at least the 2A3s are great sounding amps, which can't be said for many “drive-anything” amps, because what you have to do to “drive anything” is not free in terms of sonic tradeoffs.

It's easy to overplay the case that three watts is more useful than one would think, for these are indeed very low powered amplifiers that we're talking about. However, except for stupid combinations like Apogees or Magnepans + single 2A3s, I think that the quality and quantity of music that single 2A3s would put out on many “normal” speakers is worthy of respect. Three watts will get some sound out of any speaker, not to say that it would be anything great to hear in many cases.

As for specific speakers, well it either works or it doesn't. Only trying it will tell you if a 2A3 will play loud, play only at low-levels, or not at all on a given speaker. It would be nice if there were some specification that would tell us what we want to know, but there ain't no such thing, unfortunately

Speaker sensitivity helps but may not be important as highish (>8) impedance and general voodoo synergism that applies to system matching. Simple or no crossover designs seem to work out a little better than lossy, complex networks, for obvious reasons, but anything is worth a shot because you never know.

Now that the speaker makers are hip to horns, isn't it time for the single-driver full range revival? Man, that's what we need! I still don't think I ever beat that pair of Altec 755A eight-inchers in 2 cu.ft. wall cabs that I had when I first started messing with low power. Lowthers are good but let's have something we can just stick into a plain old rectangular box and be done with it.

In various pockets of the globe, full-rangers like Diatones, Fostex, Supravox, Siemens, have their devotees, but the US scene never got hip to this classic low-intensity approach. True, single-cone drivers usually can't “do everything,” but, for this kind of thing, it's more important how well they do what they do, mainly the mids.

The way *not* to try a 2A3 on a “regular” speaker, exactly the way most audiophiles would probably do it, is to pull out an old copy of *The Sheffield Drum Record* or “1812” and immediately crank the program up until the amp clips. Sure, it will clip. What did you think?

The right way to try out a low power amp with a “regular speaker” is to go ahead and listen to music as you ordinarily would and see how it works out. What usually happens is that it sounds pretty good, but while you're listening, dreams of horns start dancing in your head. What can I say?

It's strange that amp choice decisions are so often tied in with the speakers already in the listening room, when what we're doing is looking for a new AMP, right? Let's face it, a more productive system-building logic and more satisfying recipe for personal happiness would be to go out and buy the damn 2A3 amp *first* and *then* look for speakers that will work with the new amp. The truth. You heard it here first, fellas!

IN MEMORIAM Koichi “Nobu” Shishido

Master Tube Experimenter



When I heard the sad news that Nobu Shishido died suddenly March 19th on the train home from an *MJ Magazine* party, I had his book open on my scanner, a fresh fax from him on my desk, and this 2A3 article in progress on my computer screen.

I wish that he could have read this article, not that he would learn anything new, but I thought he would get a kick out of seeing what he started many years ago, just like he always did. He was proud of his audio design work, but he seemed to especially relish his role as tube audio preacher.

Nobu was in chancy health for a number of years, but he spent his retirement working tirelessly to stretch the limits of tube audio design. Although best known in recent years for his Inverted Interstage Coupled transmitting tube designs, lately he seemed to consider his main work to be restoration of 78 recordings, even though he still loved tube amps like a little kid.

His last fax to me hinted at his experiments with the new Svetlana 572-3, joking that with the remarkable drive voltages required, “They must have been waiting for a genius like me to come along.” I'll never learn what kind of wicked new driver stage he created this time, but like all the other stuff he did, it was probably one of those things that is perfectly obvious—once Nobu showed us how to do it.

The heroic missionary work begun by Nobu Shishido to tell the world about single-ended directly-heated triodes will surely continue in the power of his ideas. As an ex-advertising man, he enjoyed seeing the world gradually come around to his way of thinking. As a designer and DIY journalist, he participated in building the audio world he wanted to live in. As a friend and teacher, he will be missed by all of us who knew him.

Joe Roberts