Audiophile Still Loves Tube Electronics

A renaissance man discusses tubes, music, recording equipment, and more

SHANNON BECKER: Where do you live and work?

STUART YANIGER: Austin, Texas, the live music capital of the United States. I was aware of this before I came here, but really, I had no idea of how true it was! There's so much music and so many great musicians here.

Austin is not much like the rest of Texas. It's quite a bit like Silicon Valley, but with its own distinctive flavor (and an extra 30° of heat). I moved here from California, with a short stop in Montana, about three years ago.

SHANNON: You are a technologist and an inventor specializing in polymer science. Tell us more about what you do?

STUART: I'm still trying to figure out what I'm going to do when I grow up. These days, my work is verging on biology. But I still have a love for my original specialty, electrically conductive polymers, and I still haven't totally gotten this out of my system. If I can get some time in a good synthetic lab, I have some ideas.

SHANNON: You have been designing and building with tubes and tube circuits for 45 years. How and why did you first get interested in tubes? What keeps you interested today?

STUART: As a nerdy kid, I got a ham radio license. Being a fairly broke, nerdy kid, I had to build a lot of my own equipment. So I was sort of forced to learn electronics. In my teens, I got very serious about music, so my efforts went down in frequency. (Sorry, very bad joke.) This was the 1960s, and tubes were still the easiest and most reliable way to make small electrical signals bigger. I think there's a natural tendency to consider the technologies of one's youth as somehow "normal" or "natural," and maybe that's why I have an irrational love for tube electronics.

SHANNON: I've heard you enjoy the music scene in Austin, TX. Do you play an instrument or have a favorite music genre?

STUART: I play flute and guitar, and can get by on bass.

Photo 1: Stuart Yaniger working at his immaculately organized lab bench. (Cynthia Wenslow photo)

I grew up in Baltimore, MD, and in those days, there was an amazingly lively jazz scene. So, that certainly shaped my listening habits. After my move to Austin, I was overwhelmed by the talent of guys like Lee Barber, Erik Hokkanen, Matt Sever, Southpaw Jones, Robert Ellis, Steve James, James McMurtry, and many others— people who are doing real, direct, and creative things. The other cool thing about the Austin music scene is how friendly and accessible the musicians are. I take my son—he's 11 years old now—to many shows with me. He's gotten accustomed to the idea that when you go to a concert, the musicians will all know your Dad and play your favorite songs. Two of them (Matt Sever and Southpaw Jones) even wrote songs to fit a title that my son suggested. Check out Southpaw's version of "Big Fat Boy" on YouTube; it's a wonderful song.

SHANNON: You have written several audio-related articles. How did you get started writing?

STUART: Blame Jan Didden. As a youngster, I used to devour *Audio Amateur* whenever a new issue appeared. And, I reread older issues until I had them nearly memorized. The later appearance of *Speaker Builder* and *Glass Audio* didn't slow me down. It was more fuel for my imagination. I particularly liked Jan's articles, which were always straightforward and educational. His writing was always about the technology, not about him, which I particularly liked. When I discovered the diyAudio.com website about 10 years ago, he was an active participant. I was very impressed that I could actually talk to this guy! We've since struck up what has become a very close friendship.

Jan liked the stuff I posted on diyAudio and strongly encouraged me to write and submit an article to *audioXpress*. His hints on "do this, don't do that" were the difference between me being a frustrated author and a published author. That article was a real source of pride for me. I was finally contributing to those pages that I had spent so many hours perusing. Since then, Jan has started a "bookzine" called *Linear Audio*, and I've been writing pretty regularly for it. I would also like to do another aX article at some point.

SHANNON: You wrote a great article for *audioXpress* in February 2009, "The ImPasse Preamplifier." It's a pre-amp to drive a pair of Nelson Pass's First Watt F4s in balanced mono. The F4 is a unity gain amplifier requiring a pre-amplifier capable of driving the full expected output swing. As two channels of the F4 should be able to swing 40 V in Class-A, for

100 W of output power, the pre-amp needed to capable of delivering 28.3 VRMS. How did you come up with the design? Do you still use it?

STUART: Thanks for the kind words. Like most of my articles, this was intended as a pedagogical exercise as well as a construction project.

The design was pretty straightforward, though the discussion on cathodyne phase splitter source impedances that it spawned made it quite controversial. The design was done for a friend of mine, Mark Cronander, who runs the operations at diyAudio.com. Mark had built the F4s, wanted something to drive it, and had a very complex solid state unit lined up. I wanted to see if I could equal or exceed the complex transistor design with a hybrid tube unit with a much lower parts count. Surprisingly, it worked! Since my system doesn't need anything like that kind of gain, the major sections of the pre-amp were repurposed. The case now houses a six-channel version of the Heretical pre-amp, a unity gain pre that's on my website. The Heretical controls the output volume of a modified Behringer DCX2496 (Jan Didden's passive RC output mods).

SHANNON: Can you tell us about your website, http://syclotron.com/?cat=7? Why did you start it? And where do you want to go with it?

STUART: A combination of pure vanity, curiosity about using WordPress, and a wife who is an expert coder and wanted to set it up for me. It also is a vehicle for me to make updates, improvements, and rethinking of my projects easily available.

I'll probably continue using it as a site for supplementary information on articles and projects that I publish and a repository for things that just don't fit elsewhere but might be useful (for example, my RIAA noise calculator or the rebuild of the NHT 3.3 speakers). I keep promising myself to start blogging and include the outrageous and non-PC things I say verbally, but that's the sort of thing that can come back and haunt you! I also want to add music and record reviews.

As I do more recording, samples of those will be up there as well. What the world needs is true high-resolution recordings, not the phony stuff made from upsampled 16/44 or mastered from low dynamic range analog tape. And I think the musicians I record are wonderfully talented people whose sounds deserve to be preserved without alteration.

SHANNON: Where do you get your design ideas?

STUART: Usually, I start with defining specifically what I want a gizmo to do. With a tight definition of goals, the design usually comes flopping out by itself. All I need to do is make sure that the proposed design hits the target. Choice of target depends on what I happen to need in my system at any given moment, what a friend might need, or what a magazine editor tells me he needs. So, that's the "where." As for "from whom," besides Jan Didden, I've cheerfully stolen ideas from David Berning (the most original and creative designer in the tube world), Scott Wurcer (maybe the best chip designer out there, and someone who has recently done some terrific work on microphones), and Morgan Jones (who wrote the definitive modern text on tube amplifiers). Morgan and I have had a particularly fruitful interaction—you can see his fingerprints all over my designs. And there's a lot of stuff in the new edition of his book that came out of our correspondence and conversations.

SHANNON: What was your most memorable design? Tell us about the project.

STUART: Most memorable was a failed experiment from about 1980 that I did with Murray Zeligman (a brilliant designer who ought to be better-known). It was an OTL power amp designed by brute-force methods, using 6528 dual triodes—32 of them! The inspiration was a surplus NASA shaker table that had banks of 6528s, so why not find a use for them? It worked as planned, but the heat output and energy draw were crazy-bad. I think we ended up running it for a total of 30 minutes before deciding that this was not our best idea!

SHANNON: What are you working on now? Do you have any new projects in the works?

STUART: My main project now is recording and building recording equipment, especially mikes and pre-amps. I do most of my recording in high-resolution formats (24/96) with no compression or other manipulation, just natural sound. You can hear a few of them on Soundcloud (http://soundcloud.com/stuart-yaniger). I've been using ribbon mikes in Blumlein configuration, but the "Army of Kittens" recording on Soundcloud was done with Scott Wurcer's small disphragm condensors. My microphone

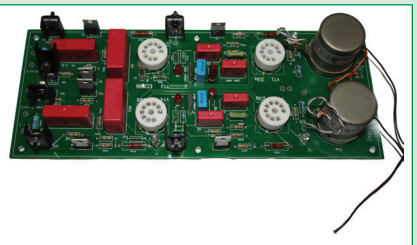

Photo 2: Yaniger's latest version of the His Masters' Noise RIAA tube phono stage for moving coil cartridges. The circuit board design was by aX author Jack Walton. (Cynthia Wenslow photo)

pre-amps are a work in progress, ribbon mike output is on the low side of anemic, so the same low-noise design tricks that worked with my MC stage "His Master's Noise," published at diyAudio.com) come into play here as well. I've been delighted at how well simple chips like THAT1512 and SSM2019 perform regarding noise, dynamic range, and common-mode rejection.

On the bench at the moment is a pre-amp for moving magnet phono cartridges. I'm very unhappy with most current designs and want to see if I can do it better. It uses a balanced input, which can be tricky but can bring great rewards. One big issue that I'm tackling is input capacitance. The usual ECC83/12AX7 approach and

the brute-force high mu high-gm triode approach have severe problems with Miller capacitance, and some of the better MMs don't like more than 150 pF or so. Cascoding can help, but it brings a whole new set of problems like non-existent power supply rejection. Part of my challenge is parts. I have a lovely design, which just can't be duplicated because some of the critical parts just aren't made anymore and fakes abound. Since I want to publish this as a buildable project, that design had to be discarded despite its simplicity and good performance.

SHANNON: You once shared a secret: "All electronics are not created equal." Do you mind elaborating on that thought and sharing your opinion of what makes great electronics?

STUART: And some electronics are more equal than others. Line amplifiers—it's a no brainer to design and build a pre-amp with low enough distortion, noise, and source impedance to be audibly transparent. You could do it with tubes, FETs, bipolars, ICs, whatever. On the opposite ends of the analog chain (mike and phono preamps on the left, power amps on the right) things get more difficult in both design and implementation. A good phono or mike pre-amp is about the hardest thing to design well, and even if you know what you're doing, the tradeoffs are sobering.

SHANNON: Do you have any advice for *audioXpress* readers who are considering building their own amplifiers?

STUART: First, basic instrumentation. Trying to do audio without things like oscilloscopes, voltmeters, and signal generators is like trying to build a car without wrenches. Knowing how to use your instruments, and knowing their limitations, is crucial to success in anything beyond simple kit-building. A smart user with a cheap oscilloscope will get better and more meaningful data than a naïve user with a state-of-the-art oscilloscope with all the bells, whistles, and fancy probes, but no scope at all is crippling.

Second (and I'm afraid that this will turn off many people), a willingness to judge design ideas by listening. Not by seeing, not by processing of preconceptions and unconscious prejudices, but actually listening. This means good, controlled blind testing. Trust your ears, but don't trust that lying brain of yours.

Third, and perhaps most important, is to lay out the engineering requirements first. It's impossible to know if you've hit the target if you haven't put one on the wall to shoot at!

SHANNON: There has been a long-running debate between tube and solid state amplifier aficionados? Do you have a personal preference, and if so, why?

STUART: There's no reason that an amp which is totally transparent to the ear can't be designed and built with tubes, transistors, ICs, or any other analog amplification device. I confess, though, that the anacrophile in me just loves tubes.

As far as preference, I manage to annoy everyone. In my designs, I tend to pick the technologies that work the best in the overall system. For example, in my MC phono pre-amp (His Master's Noise), I mixed tubes, MOSFETs, LEDs, ICs, and bipolar transistors. The MOSFETs are terrific for constant current sources, the LEDs are excellent low-noise constant voltage sources, and bipolar transistors are rugged, high-performance elements in power supply regulators. The tubes do the amplification work, bringing low-grid current, low distortion, and high dynamic range to the table.

Now, to illustrate my point about my designs annoying people, I was showing the schematic of my prototype to Morgan Jones at one of the European Triode Festivals. Tim de Paravicini happened by, looked over my shoulder, jabbed at the schematic with his finger and exclaimed, "This is an absolutely terrible design!" Morgan asked what Tim thought was wrong with it. Tim replied, "In the 1930s when people designed these sorts of things with tubes, no one would have used LEDs or MOSFETS. There were no such things then!" Tim was quite sincerely annoyed. Nonetheless, the preamp worked great, several other people have successfully built it, and the Earth is still rotating on its axis.

That said, I've used tubes in designs where a solid-state approach could give better objective performance, though perhaps not better subjective performance. The power amp I use for the midrange and treble of my speakers, for example (the Red Light District). But just because a modern Lexus can accelerate and corner objectively better than a 1958 Austin Healy Sprite doesn't mean I'd rather have the Lexus.

SHANNON: Imagine you have big budget and tons of free time on your hands to build your audio "dream system." What would it include and why?

STUART: I'd be tempted to build a performance studio and hire great musicians to come play for me! And record them, of course.

Okay, this is a very unpopular thing to say in hobby audio, but… there's really not much of a technical challenge anymore to getting an electrical signal from the microphone to the loudspeaker terminals relatively unmolested. I still enjoy designing and building that stuff, but I don't kid myself that I'm doing anything that's really advancing the state of the art in audio. I'm doing the equivalent of crossword puzzles or sudoku instead of writing literature or opening new fields in mathematics.

The real challenges are in formats—the idea of taking a three-dimensional sound field, compressing it into two one-dimensional signals, then trying to recreate that sound field from the radically compressed information using two spaced transducers is crazy, and the astonishing thing is that it works as well as it does. So my dream system would not be stereo, and the electronics would be (from an audiophile point of view) nothing particularly exotic or special. The real work would be format and transducers. And the room, of course. I've dreamed of having a dedicated listening and recording space, and if I ever win the lottery, that's second on the list of priorities (first is a wood-burning pizza oven).

The interesting hardware that I just don't have time and money for include phono cartridges (I'd love to experiment with strain gauges and FM) and exotic speaker drivers (like ionic or plasma). It would also be interesting to experiment with speakers that turn the usual equations upside-down. In our current paradigm, the piston area is fixed and the displacement varies. What would happen if the displacement were fixed and the piston area varied?

SHANNON: A lot has changed in audio technology during the past few decades. What changes do you consider positive? Any negative?

STUART: Things are better now than ever in nearly all ways. Recording, data storage, and duplication are robust and high performance. I have a little TASCAM portable recorder that vastly outperforms the heavy and fiddly Ampex 351 I started out with. It's quieter, lower distortion, higher bandwidth, and stores several hours of recordings on a $10 chip. It runs for eight hours on a couple of penlight batteries, is the size of a TV remote control, and costs about what a couple reels of tape do.

The Internet has allowed better distribution channels, both for music and for parts; I love the idea of a few clicks on a website and the box of parts appears on my doorstep in a day or two. I love the ability of musicians to bypass the record company gatekeepers and promote/distribute their music themselves. I love the concept of abandoning physical data formats and being able to upload and download music as files, independent of media.

Home computers have revolutionized what hobbyists can do. Speaker and amplifier measurements that were exotic and expensive a few years ago (e.g., FFT, MLS, multitone analysis) are now stunningly cheap and easy. When I first saw Bill Waslo's IMP article in *Speaker Builder*, I grinned ear to ear, ordered the kit immediately, and knew that everything had changed for hobbyists.

The negative is how the technology is being applied in recording. The loudness wars in music production are notorious, and it just pains me to see excessive compression, EQ, fake ambience, deliberate distortion, and rococco multitracking absolutely ruin what are delightful acoustic sounds. I shudder every time I hear the words "plug in." Someone once said that the CD medium is terrific, it's the CDs that suck, and I think that expresses it perfectly. *aX*