

Pat Quilter – Authentic Sound Reinforcement and Solid State Amp Guru **By John Seetoo**

Following is the transcript of the complete, unedited conversation between Pat Quilter and John Seetoo. It contains material not included in the three-part series in Issues 118, 119 and 120.

Since Quilter Sound Company was founded in 1968 and incorporated as QSC Audio in 1973, QSC has grown to become one of the most recognized global names in sound reinforcement. Founded by engineer Pat Quilter and brothers Barry and John Andrews, QSC equipment has become synonymous with exceptional sound reproduction quality. A very incomplete list of Quilter and QSC artists includes Los Lobos, Train, Foo Fighters, Black Sabbath, Albert Lee, A. J. Ghent, Vernon Reid, Hall and Oates, Devin Townsend, Doyle Bramhall II, Brad Paisley, Dierks Bentley and the Zac Brown Band, among many others.

Roughly ten years ago, Pat Quilter retired from day-to-day activities at QSC to focus on his first passion: guitar amps. He launched Quilter Amps, premium-grade amplifiers that deliver high power and volume from small sizes.

Taking a break from the latest project, Pat Quilter spoke with me about his philosophies on music and sound reinforcement, the history of QSC and Quilter Amps, the relationship between home and pro audio, amplified vs unamplified sound and why he still considers himself an analog guy in a digital world.

John Seetoo: You started your foray into amplifier design in the 1960s by building a bass amp for a friend and deployed an almost unheard of design at the time involving bridging the solid state transistors to generate 100 watts into a relatively compact unit. Did you realize at the time how unorthodox this was for guitar/bass amp design and did you foresee how this would be a concept you would use to significant effect with QSC power amps down the road?

Pat Quilter: Yes, I thought it was unusual because I had just read about this trick in *Radio Electronics Magazine*. Back in those days, transistors didn't come in very high voltages. I was laboring under the misimpression that it was necessary to drive an eight ohm load. So, to get 100 watts into eight ohms required more voltage swing than what you could regularly get from a normal single ended transistor design.

Within several years, we had changed our system to drive four speakers into a 2-ohm load. Using a lower voltage and higher current was actually simpler to build. So, we used the bridged output for a couple of years at my original Quilter Sound Company, but we kept suffering from amplifier overload. People would hang another 4-ohm load on top of one of our series/parallel boxes. The amp would overheat, and then we'd have problems.

Actually we made little use of bridged outputs in our power amps at QSC. Marketing wanted us to be able to offer a bridged output from a *stereo* amp, and you can't really bridge a bridge, if you will. Transistors improved greatly in the 1970s, so we were able to deliver respectable power to a single ended, half-bridged design.

JS: As analog solid state technology in the 1960s had a reputation for good cleans but sterile distorted tones, what made you come up with the preamp overdrive concept for the Master Volume knob in your early guitar amps in the late 1960s, which predated all other commercial guitar amplifier manufacturers by at least three years? Are any of those models still in existence?

PQ: Yes, as far as I can tell, we were probably the first to offer preamp overdrive with an adjustable volume control, which we called our "output power control." I had observed my younger brother was systematically using overdrive distortion as part of the hard rock sound that emerged in the late 1960s. I, of course, as a young listener, found it very exciting; kind of like racing cars going at it! (chuckles)

But they didn't want to always use the full 200 watts of the amplifier, especially in small places. So it was just one of those, "Aha!" moments – possibly one of my few original ideas over the years – that has become a mainstay of the art since then.

As for early solid state being clean but kind of brittle: this was obvious to me at the time – the problem (of) being able to get acceptable linearity at less than clipping volume. You need to use a lot of negative feedback, which makes the clipping very harsh. I did various things to try to address that, including moderating – using less negative feedback where possible. But the preamp overdrive was another resource I could use to make a smoother and more forgiving (sound) which I could pipe that back into the power amp, which really wouldn't hit its own clipping point unless you turned the master volume all the way up.

JS: Is that still a fundamental design aspect in Quilter Amps, or are they considerably more sophisticated?

PQ: Yes and no. Our current Quilter amps use Class D power technology, which is much more compact and efficient than traditional solid state, which as you pointed out, is somewhat smaller and lighter than traditional tube technology. As a result, we're able to provide more than enough output power for the intended use of the amp. So if we have an amp that we want to rate at 200 watts, we actually build it with a 400-watt power amp but we set the preamp clipping to happen at 200 watts. This leaves headroom in the power amp for more voltage swings; we can let the speaker breathe a little more. The power amp doesn't have to distort, so we can do all of our tone shaping in the preamp, where we do have some fairly tricked circuits that have all the desirable properties of a traditional tube amp.

JS: In 1968, you officially co-founded QSC Audio with brothers John and Barry Andrews. Was the changeover from guitar and bass amplifiers to power amps for sound reinforcement a predominantly business driven decision or were there other technological and market development factors that appealed to your interests in amp design?

PQ: To correct the record, I founded Quilter Sound Company in the summer of 1968. We didn't actually incorporate as QSC until 1973. So those first few years were our attempts to get into the guitar amp business. There was an opportunity at the time: music had changed dramatically, people were diming their amps, and a lot of amps couldn't take that juice or didn't sound good. But as fate would have it, by the time we got our feet on the ground and learned what we were doing from both a technical and a business standpoint, we kind of missed the boat on becoming a guitar amp company.

During this same time, John and Barry Andrews joined, so when the three of us formed a team in 1973, we made a conscious business decision. We had missed the boat on guitar amps and we needed something that would amount to what you might call, "steady" business, which would allow us to forge ahead with a product that we knew would sell regardless of any change in musical tastes.

Keep in mind that the electric guitar kind of took over youth oriented music like a landslide in the 1960s, but by the early 1970s, you began to see the rise of early synthesizers. It wasn't obvious whether guitars would continue to be the lead instrument in a band.

So we took stock of the technology we had developed. We had some preamp technology. Our cabinet making shop was completely insufficient for any kind of mass production. We realized the one thing that we knew how to do that was hard and that you couldn't readily get out of the back of a book, was power amps. And so, we decided to focus our new company QSC, on professional power amps.

It was a good decision. It led to decades of steady growth in that area, and put the company in a position to invest in digital technology and even back into loudspeakers as the years went by.

JS: Can you discuss a bit about the unique consensus-based management style that you and the Andrews brothers created at QSC?

PQ: Yes. So, first a bit of history. In the early years, I was struggling to both run the company and design new guitar amps, and manage inventory, and all that...I have my moments as a designer, but I'm not particularly good at remaining diligent on everyday things like inventory or finances. "What do you mean our checks are bouncing? I just put money in the account two weeks ago!" (laughs)

So Barry approached me one day. He'd come to work as a carpenter in our cabinet shop. We had kind of hit the skids a little bit and had to reduce our staff. He said, "Pat, I

believe in you as a designer, but you're not really good at running the company. I can see it's a burden for you. Would you be interested in letting me take that part over?" And I (happily) replied, "Would you?"

So Barry took over the customer-based side of the company and his brother John, who was finishing his business degree, joined with some actual business knowledge. And it turned out that the three of us had complimentary skills and temperaments. I'm your classic, engineering-type problem solver in a structured environment. Barry's kind of comfortable going out on a limb, testing the waters, and forging ahead. His brother John is an excellent bridge. He can listen to me and listen to Barry and he could take our ideas and combine them into something that would make sense for all of us.

So we were able to hold fairly wide ranging strategic discussions, consider the viewpoints, lay the cards on the table, and make a logical decision for what we should do. We may have had some intense arguments, but we were always able to settle on an agreed course of action. As John Andrews has said, "Never in the history of QSC have we ever had to settle any issues on the basis of shareholding." That carried us through thick and thin, as we watched other companies who were not so fortunate to have this breadth of management struggle and falter along the way.

So I look back and think that we were pretty lucky. And it served us well until the three of us decided to retire (from day-to-day operations) about 10 years ago.

JS: The personal dynamic within management is so important...

PQ: And it provides a lesson for your readers, if you will: It helped that we had different kinds of expertise. No one was stepping on anyone else's solo, but we were all taking turns doing our thing when it was appropriate, with giving good backup in between.

JS: That's a nice musical analogy lead-in for this next question. As someone with a foot in both the musician and engineering camps of music and performance, one of the more fascinating perspectives that you have from the sound reinforcement side is the challenge of letting an audience hear what each musician might be playing, as opposed to the overall ensemble presentation to a large audience.

Given that most ensembles, ranging from duets to full orchestras, have their instruments now mixed and projected through P.A. systems, do you think that "acoustic" performances, i.e., those not using electric instruments, is now a misnomer?

PQ: Ok, a complicated question. Starting from back in the 1960s...let's go all the way back to the 1920s. I have an extensive collection of vintage 78(rpm) records, so I'm a bit of an amateur student of popular music history. The main purpose of what today we would call a "bar band," was to be a dance band. People would want to go out to a dance hall, and there would have to be a band. Well, the band's got to be loud enough to get the blood pumping, so back in the day, that called for what is now known as a swing orchestra, or Big Band. Trumpets, trombones, saxes, drums, bass, etc. And if

you've ever had the experience of listening to a live big band, they're plenty loud. You have to yell to be heard over their sound, just like with an amplified band.

The onset of PA systems in the 1930s allowed singers with comparatively soft voices to croon into the microphone, and fill a hall. That technology carried into the era of popular singers like Frank Sinatra or Bing Crosby, backed up by a band. And then in the 1950s you had the onset of amplified guitar and bass combos with amplified voices like Chuck Berry and people like that. And in the 1960s, we kind of turned everything up to 11.

But all through that time, you were principally hearing the live acoustic sound of each instrument, even if it was an amplified guitar. It was expected that the guitar amp was going to do the job of filling the hall. The PA system was only intended for a voice, or possibly an acoustic guitar or something that could not fill a hall on its own.

When I was getting into the music business, that was the model I had in mind. I didn't really want everything to come through one big PA, because, heck, if that's what you want, why not just play the studio album at high volume, you know? It would be a cleaner recording.

I wanted the experience of hearing live music and being able to focus my ears on whichever performer I was most interested in. But there's a limit, of course, when you get to stadium-sized concerts, as to just how loud you can be on stage and still have a hope of covering the audience. So inevitably, PAs became the way to do it. Even though there were those fascinating experiments that the Grateful Dead tried, where each of them had a giant slice of PA for their own use...I have to say, I went out of my way to hear that rig at one time and...it wasn't dramatically better than any good, well done PA.

So now we're in the era where everything does come through the PA. Fortunately, the quality of sound is much better than it was in the 1960s, so we can get much more headroom, more clarity; there's a lot more science to it.

Nowadays, "acoustic" basically is the word for, "unamplified." An acoustic guitar or acoustic piano produces a usable amount of sound by themselves – not enough to fill a stadium, but to fill a living room. Now, I've heard four Spanish South American guitar players fill a several hundred seat concert hall in UCI's (University of CA in Irvine) Barclay Hall. Probably 700 seats, I think? With four unamplified Spanish guitars. Yes, you had to be respectful and listen quietly, but they produced a perfectly adequate amount of sound. So it's all a matter of what you're there for and what your expectations are.

But yes, we're kind of in the era now where you have an electric guitar plugged into an amplifier that produces a certain amount of sound, that is then miked or connected somehow to a P.A. which produces even more sound, and then points it in a number of different directions, including back at the performer.

JS: Taking the subject a step further – In what ways do you think that “pure” acoustic concert venues, such as at Carnegie Hall or The Ryman Auditorium, and the construction of acoustically resonant musical performance spaces are no longer relevant due to the sophistication of sound reinforcement systems, finances, and the demands and expectations of the concert going public in this day and age?

PQ: There are traditional forms of music: opera, symphony orchestras, chamber orchestras...and part of the deal is that you're there to be hearing the pure, unamplified sound. That's just part of the art form. We will always have those performances and they will need to be done in acoustically well done halls to provide a nice listening experience for an economically valid number of audience members. Europe has some really wonderful concert halls, but they don't hold enough people to, “pay the freight,” if you will, unless you make the ticket prices unaffordable.

I think the one interesting thing these days is there are some serious attempts to improve the acoustics (of a space) electronically. So you can have a hall that can be relatively dead for plays or speech events but also be live for acoustic events, like a symphony orchestra.

JS: Is any of the work that you or QSC is doing involved with some of that technology?

PQ: We have the technology in our Q-Sys platform. I know Meyer Sound has done a push towards what is essentially an acoustic environment. It's a very expensive way to go, but interestingly, it's less expensive than – let's say you wanted a good hall for plays and a good hall for concerts. You might have to build two separate buildings or settle for compromises with one or the other. If the room is electronically adjustable you could have one hall serve both at a lower cost than it would be to devise an acoustic treatment solution.

JS: It kind of goes back to your original explanation about PAs for sound reinforcement, as opposed to sound reproduction.

PQ: Yes, that's not a bad way to look at it. History will look back on it now of this COVID-19 era being a period of *not* going to large gatherings, and it may or may not leave a permanent impression on how we choose to entertain ourselves in the future. So that will be a wait and see.

JS: That raises a good point – the ubiquity of pre-recorded tracks, outboard DSP effects and Autotune has increasingly blurred the criteria for audiences as to what constitutes a “live” music performance in a concert setting. Has the PA system transformed from being a sound reinforcement system designed to amplify the actual voices and instruments in a performance into an extension of the recording studio? In what ways do you think the FOH (Front of House) mix engineer is more responsible for the sound of a

band in concert than the band itself, and what aspects of QSC gear make the engineer's job as easy as possible?

PQ: Well obviously, the musicians have to make the music, but the console operator is going to determine the overall balance and the relative mix. So yes, they're going to have to work together, and the console operator needs to have a clear idea of what the band is supposed to sound like. Hopefully the band can tell when their sound is in balance, and then you can have a harmonious performance. The sound operator is an absolutely critical part of a musical performance larger than a typical club band.

The clarity and the articulation of the PA gear is crucial, and that is an area that has steadily improved over the years. It wasn't until the late 1970s when I personally heard a PA system that succeeded in being both loud and reasonably clear – where you could actually hear the lyrics without straining or puzzling over what was just said. But even then, it was still, not what I would call, hi-fi. It was just a loud, clean blare, if you will. The modern audio system has approached true fidelity to the point where the only real barrier is that sound can become warped by travelling long distances through the air. Things just don't sound the same at 500 yards away, even if it's loud enough.

JS: Do you think that because of Covid-19 and all of these musicians now streaming live concerts from their homes, that it will create a return to audience demand for more pure performance authenticity and less sound processing and auto-tune in live concerts?

PQ: From time immemorial, in the history of recorded music and going back to the acoustic recording era of the early 20th century, you had recording aficionados and critics. The critics would initially comment on whether or not you could adequately hear a performer on an acoustic record to appreciate what they were doing. As electric recording set in, they started complaining. "This guy is singing right up against the microphone while the band is at a natural distance. It's allowing his weak voice to become a dominant part of the mix! That's just totally wrong! It's so unnatural! If a singer can't belt out to be heard with the band, he has no business being on stage!"

Well, I'm sorry. If you listen to any acoustic recording, they had to crowd around the horn. Caruso would get closer when he was singing softly and back away when he gave one of his famous crescendos. (laughs) It was a very unnatural performance from the beginning!

So use the tools you have to enhance your sound, whatever it may be. Auto-tuning is a sound. Electric guitars came in for a lot of criticism when they emerged in the 1930s. They didn't sound like acoustic guitars. It wasn't just louder, it was different. But brilliant performers made it work and developed a whole new range for the instrument. If you're a bad guitar player and you get an electric guitar, you're just going to be a louder bad guitar player. Some people use auto-tune as a crutch for not being able to hit a note. But I've heard strongly auto-tuned performances (from artists) where they're kind of

playing with it and it becomes an effect like anything else. It doesn't diminish the value of someone who can really hit the notes. There's room for variety, in my opinion.

JS: What do you see as the differences between pro and home audio? There are obvious ones like room size, reliability and SPL requirements – but if it entered the home audio arena, how would QSC approach any of these variables uniquely that would set them apart from its competition?

PQ: We always like to use the metaphor; pro audio is like an 18-wheeler and home audio is like a pickup truck.” They can both haul stuff and most peoples' needs can be met with the pickup truck. But if you're going to carry heavy tonnage on the highway day-in and day-out, you're going to need an 18-wheeler. You need a heavy duty rig that can not just carry heavy weight but do so reliably day-in and day-out. That's the main difference. Pro audio gear is designed to perform at a high average output level reliably for long periods of time, way more than what you would ever need in the home.

At the same time, in order to get that performance, especially with loudspeakers, you have to resort to things like horn-loaded transducers that don't necessarily sound the very best, but they're capable of projecting a large amount of sound over great distances. And with the right design, you can get them to sound pretty good, which is where I think QSC's acoustic design team has done very well. We try to aim for that quality of naturalness which is at the heart of any good hi-fi system. But at the end of the day we've got to be able to make it go loud without breaking up or breaking down. This imposes some design decisions that you would really never use in the home.

For example, my own personal listening system uses a couple of large motion air transformers. High frequency reproducers that were being done by an obscure little company in Redondo Beach, quite a few years back. And if you're familiar with the air motion concept, it's basically a way to take a ribbon tweeter of some actual size, and by folding it up into kind of an accordion, you can compress the frontal area down to, in my case, about five inches tall and two inches wide. It has the surface area of a 5 x 20-inch Mylar film.

So you get that wonderfully liquid, non-diaphragmatic reproduction of an almost infinitesimally lightweight ribbon transducer coming out of a smaller area, so you get a little more dispersion out of it. But it's only capable of going to polite living room levels before it begins to strain or break up. I'm able to use it over a wide enough frequency range that my crossover is low enough that it doesn't create any looming effect with a decent, conventional woofer.

I'm very happy with them. I think the speakers sound great. I can listen to a performance and not really be distracted by the feeling that it's coming through something. But it's not practical for a pro audio application. In fact, some of QSC's smaller five inch 2-way speakers – it's a wonderful sounding speaker for any normal utility purpose. My brother's using a couple of them in his Volkswagen bus as a sound system, which they do very well. I could audition music acceptably through QSC's

powered PA speakers and not feel like I was grinding my teeth, but it wouldn't be as good as an optimized home audio system designed for maximum liquidity at a living room level.

JS: Since *Copper* readers are all audiophiles and gear aficionados, do you mind giving some details on your home audio setup?

PQ: Although I have a CD player hooked up, keep in mind that my rig is kind of optimized for playing vintage 78s, so I will say, in my humble opinion, power amp technology was pretty much perfected in the 1980s. It wasn't easy, but (by then), any good designer could design a clean power amp whose distortion products were orders of magnitude less than anything else in the chain and certainly anything at the speaker end of the chain, or the microphone, for that matter. But the intervening electronics have become essentially transparent. I know arguments rage on about that, but realistically, there are far more parts of the system that are difficult to get right than ordinary, competent electronics. So my amplification is just straightforward solid state stuff.

The speakers are interesting, as I mentioned. I have this Avlar air motion transformer that will go down to 400 Hz at living room levels. So I have a low order 400 Hz crossover to a woofer that's a quarter wavelength away from the high frequency transducers. So I have, practically, a point source. It doesn't have off axis lobing, which you so commonly get when you can't put the woofer and tweeter close enough. Again, it's a system that's optimized for nice living room listening levels.

I made myself a scratch remover preamp that can detect clicks and pops, and sort of sniff them out on the fly. It's being done digitally these days more miraculously than my old analog scheme, but it works pretty well. It has a few little tweaks and adjustments. Of course, anyone who collects old records knows you need a set of different sized styluses to play them correctly. So you get the right sized needle and set your scratch threshold up and, I actually get pretty creditable performance out of, at least, electrically recorded records.

The nice thing about the old records is: these were back in the days when they plopped a mic down in a decent recording studio and told the band to stand at a comfortable distance and just go at it, so you do get a very nice, natural sound quality out of them, although technically, the fidelity is still somewhat limited.

JS: Are there any home audio systems or units that influenced your design work?

PQ: Just because of the nature of how we got to where we are now – keep in mind my early career was electric guitars – that was all about *making* sound, not *reproducing* sound. Then we went through a long period where QSC was strictly an electronics company, making power amps for decades, and then getting into signal processing and what not. And only in the last few decades have we gotten into loudspeakers. We did hire an early loudspeaker designer from a hi-fi background; a gentleman named Paul Hales. He's got his own company now, I believe, in Southern California. He brought a

very high standard of listening quality and an attitude of meticulousness to the work, which are qualities that QSC has built upon ever since. And I'm happy to say, on Paul's behalf, that he used acoustics and science in his work to try to get the best results he could. That got our program off to a good start.

As time went by, especially when we got into powered loudspeakers, we brought more and more people into the team. So it's a much larger part of the organization now, with, golly, dozens of engineers handling various parts of the job. QSC has a broad catalog, so we're working on multiple speakers at any given time.

So, my personal experience with sound systems is generally in raising my awareness of what might be possible, as opposed to learning something that we could actually use. For example, one time at a high-end show connected with the CES, I went and visited the room that was auditioning the plasma tweeters.

To explain briefly, all normal transducers move a surface, which moves the air. But an intervening surface, whether it's a cone, a diaphragm or even a sheet of Mylar, inevitably imposes some limitations on actually getting the air to move as perfectly as you would want. The plasma tweeter ionizes a stream of gas, which can be acted upon directly by an electric field, and literally moves the air with no intervening mechanism.

It was the clearest, most present tweeter I'd ever heard; the only other one coming close being the air motion transformers. It was not very loud and it struggled to keep up with crescendos, but it set (a bar) for quality high frequency sound that has been on my mind ever since. It's a fascinating bit of technology, even if it uses \$0.25 an hour's worth of helium to get the ions flowing. (laughs) It was rather industrial and not particularly living room friendly, but a fascinating demonstration of possibilities.

JS: While QSC equipment is ubiquitous primarily in large outdoor arenas, indoor sports complexes, concert halls, theaters, schools and houses of worship, QSC surround sound systems for home theater appears to be the one arena where QSC has found a surprise niche in the home consumer market, with the SC1120 cinema speaker cabinet of particular interest for rooms 20 feet long and smaller. Have you received sufficient interest to warrant active marketing to this demand, and what would a QSC surround sound home theater system comprise if you were to offer one?

PQ: Keep in mind that I retired from day-to-day work at QSC in 2011. I maintain a strategic management relationship with the company, and I'm chairman of the board. We meet with current management frequently over lunch, but I'm not dialed in to where QSC currently sells to these days. But speaking in general, QSC cinema speakers are designed with the same fundamental ideas in mind: that they should have plenty of headroom and clarity. Cinema sound has always had its own set of standards. You can go back to the early 1930s or late 1920s when talkies emerged. The problem, early on, was that a five watt Western Electric was considered pretty normal state-of-the-art, so they had to be very conscious of using their headroom wisely. We thus developed the Academy tone curve," which is that projected cinema sound quality that tends to persist

even today, when there should be no problem at all in a modern theater. But it still has that (cups hand over mouth) slightly megaphone tone quality that developed in the 1930s, mainly so you could hear the dialogue.

Many, many years ago, when we made our pilgrimage to Disneyland, we went to see the Abe Lincoln animatronics exhibit. Lincoln is in a chair, stands up and takes a few steps to address the audience – all done with Animatronics, which are essentially robots. So you're wowed: "Look! He can move! It looks very natural!" And then this very movielike voice comes out and you go...(sighs). It didn't sound anything like a live person speaking; it sounded like a movie. I don't know if they've improved it since, but at the time, it was very striking. I'm sure the Disney people thought it was fine, because it sounded just like their movies.

The point being that with that quality of sound expected from a movie, it's not surprising that QSC cinema speakers would have a place, at least in the larger, more ambitious home theaters. The director of our cinema division, Barry Ferrell, got his start working projectors. He came up through the ranks in the movie business and ended up as a longtime director in QSC's cinema department. He has always had a preference for high efficiency, high headroom reproduction. Even if you're not using it, there's an element there of effortless, endless headroom that you're still kind of aware of. So that is reflected in the way the product is designed. We always are careful to make sure our bass ports are big enough to reproduce full volume without chuffing or choking. Things like that you won't always get with less expensive products.

JS: You mentioned earlier about Class D amplifiers for Quilter. QSC was an early advocate of Class D amplifier design. They've become common in bass amps, but are also prevalent now in home audio and home theater systems. Has QSC modified the Class D design for the less technically sophisticated house of worship, school and corporate event consumer market vs. the pro audio commercial market to make them more ergonomic and user friendly, and if so, in what ways?

PQ: Class D is a power amp technology. It's a tool. Ideally, it's simply part of the overall piece of equipment that helps the user do his thing without having to worry or be aware of it. One of the hallmarks of my design career has been close attention to protection circuits to make sure the amp won't harm itself when faced with abnormal load conditions. This was a problem early on with solid state amps. Tubes sort of have a natural limit. You can short a tube amp and it will only put out so much power and it won't kill itself. But transistors: good news/bad news is that they have almost no inherent peak power limit. If you don't put something in to restrain them, they can put out enough power to burn themselves out. So limiting the peak power of amplifiers to a safe level without interfering with the desired amount of headroom was one of those technical challenges that made the work interesting.

The same applies to Class D technology. You have to come up with ways to deliver the power you want, but no more, so the user doesn't have to worry about the thing breaking if you accidentally short something. These days, the overall design of the

equipment tends, as far as portable equipment goes, it should have handles in the right places, not be too heavy, have proper mounting points, that sort of thing. And the operation of the equipment is largely driven by onscreen user interfaces, which of course, is an art form in its own right, and an area in which QSC pays as much attention to as anything else.

JS: Did you have much prior engineering expertise in networking when you started the QSCControl system in the 1990s? Did adapting to Ethernet require much modification to QSC gear for Ethernet control applications?

PQ: We had zero experience in networking going in, and we knew we had to come up with something. We made a couple of attempts to use third party solutions with varying levels of performance, but ultimately, we realized that we had to bring some people in, roll up our sleeves, and get our arms around this, and really understand the technology.

We were fortunate that a very sharp group of engineers based in Boulder, Colorado had just finished the Media Matrix program for Peavey Electronics, and were kind of looking for their next gig, so to speak. So we brought them on board, and that is now the nucleus of a 50-member engineering team in Boulder that is primarily devoted to our Q-Sys network.

But before that, they did a system called CobraNet. The problem is that audio needs to be very orchestrated. You can't have gaps and glitches in the middle of streaming audio. But mass market networking like Ethernet is packet based. You don't really care if your file takes a few extra milliseconds, you wouldn't even notice, but that would be a fatal glitch in an audio stream.

The Ethernet is kind of like a freeway. If more people get on it, traffic may slow down for a while, but we'll all get there eventually. Audio has got to get here on time, every time. So it was a challenge to design an operating system, a body of code, that would marshal audio through an indeterministic network in a deterministic way without making the network useless for anything else. Fortunately, mass market Ethernet keeps jumping up in capacity. We went from one Meg to 10 Meg, to what are we up to now? 10 Gigs? Anyway, all of this extra capacity makes things a little easier to take control of some part of that and dedicate it to our audio needs.

The nice thing is the ability to use standard computer hardware that's familiar to the IT departments of the companies we want to sell this stuff to. They know how to hook this stuff and they can probably use routers that they already have – the fiber or cable they are already using.

The whole thrust of the Q-Sys program, which has been going for ten years now, is to make a system that can be maintained by your existing IT department while allowing you to have modern audio and video quality.

JS: You have stated in other interviews that QSC initially focused on amplifiers and eschewed speaker manufacturing because of the larger space needs, heavy equipment, sawdust, and other associated requirements and drawbacks. When QSC made the leap into speakers in the 1990s, did you already have preconceived designs and knew what they should sound like before Paul Hale was involved, or was this a matter of trial and error to make the ideal speakers to fit the sounds you already had in mind to match your amps?

PQ: Even in the 1970s, when we made the conscious decision to get out of building cabinets, there was a lot of automated equipment that you needed to buy if you wanted to be a thriving company (making loudspeakers), and we just didn't have that kind of capital.

By the time the late 1990s rolled around, we needed to get back into it, but of course, by then we had the capitalization and the resources to get serious about it. But yeah, we were beginners, and we brought some people in, we eventually invested in large, complex computer controlled equipment, and...I like to think that even our earliest products were pretty good sounding, but in looking back, I realize that we had a lot to learn about building them economically and being able to sell them at a competitive price. But we got there eventually, year after year of going at it. It helped that we were reasonably profitable, which let us go the distance until we got through the learning curve.

JS: In *Copper 103*, John Strohbeen of Ohm Acoustics touched on how some Japanese customers' sonic preferences (somewhat brighter with tighter bass) might require tweaks to their proprietary speaker designs. As QSC sells its amplifiers around the globe, have you found that various countries' cultural tastes in sound required any modification to your designs or installation parameters? Have you found that European or Asian customers' tastes in sound, for example, resulted in different equipment requests and installation configurations than what you would normally deploy for comparable spaces in the USA?

PQ: I am strategically aware that QSC has sales offices in Asia and Europe. We're trying our best not to be just a US company selling globally, but a global company selling globally. So this sort of regionalization is going to be a factor in QSC going forward. It may be going on to some extent without me being aware of the details. I agree that there are regional sound differences in peoples' expectations. Europe and North America are probably pretty unified in what our musical goals would be. The main problems with India and China are that they often don't have the budgets to buy top of the line stuff, so they are probably well served by equipment that gets the sound out in a reasonably full bodied way but without some of the nuances that we like to see in our high end systems. There are a lot of outdoor movie experiences in India and China, so you're talking about equipment not unlike the old PA horns we used to have here in the 1950s.

JS: Strohbeen had noted that Japanese customers, for example, preferred a much tighter bass and brighter high end, whereas European customers liked a deeper and more robust bass. Have you also found this to be the case, and if so, has it been reflected in the types of systems that they purchase?

PQ: Anecdotally, I kind of agree with that impression of Japanese listeners. But you can also dial in a wide ranging system to sound almost any way you want without undertaking the expense of trying to design specialized stuff for one particular market. I think it was Pete Townshend who said, back in the day, "We mix our music to sound good through a four inch phonograph speaker!" (laughs), because that was their expected audience, you know? Teeny-boppers listening through a little portable phonograph.

Notoriously, British bass amps were, by American standards, practically useless. I'm sure the Brits complained that, "those big, boomy American bass amps are too loud and rude!". To each his own.

JS: QSC's online webinars and source material about sound reinforcement, acoustics, physics, and music sound reproduction are excellent, and far more detailed than any offerings from its competitors. Is the strategy behind this comparable to the extensive targeting of Apple computers in schools to create an educated market that will be immediately comfortable and conversant with its products?

PQ: There's obviously an element of that. QSC is able to take advantage of our size and underwrite the cost of this educational material. But it's also in our direct interest, because the more customers understand what's possible and how to get good results, particularly from our equipment, they can better appreciate the efforts we put into making good stuff. Then they can realize that they're not going to get that performance the same with some of the bargain basement stuff out there. With some proper education, they can then be able to get better results that would not be achievable with the low end stuff.

JS: In testing QSC equipment, do your R&D (research and development) and QC (quality control) divisions use actual pre-recorded music and other sound references at different dB levels? Can you tell us what that process is like and what your criteria is to meet your standards?

PQ: For the electronics, we can pretty much do everything on the basis of meter readings. It's electric in/electric out, the device has a transfer function, so you can tell if it's basically working properly or not just on the basis of that.

Voicing loudspeakers is still an art form. Yes, there are certain measurements you take to get yourself in the zone. QSC has some fairly sophisticated speaker measurement capabilities, including an array of microphones spaced every five degrees so we can capture the entire sound field of a speaker, not just any particular axis. I have a number of relatively subjective opinions about why two loudspeakers that may measure pretty

similarly can sound so remarkably different. One is what I think happens off axis, because the off axis sound bounces around in the room and gets to your ears eventually and definitely affects your perception of the on axis sound. So being able to measure the full frontal sound coming out of the speaker is a nice capability to have.

That said, there are trade-offs. You can't get perfect off axis and on axis response from any practical device. There are lobing effects and cabinet diffraction and various other side effects that prevent you from getting perfect coverage in the room, even with theoretically perfect drivers. So inevitably, there are a series of trade-offs, and that involves listening tests, comparing A vs B vs C, by a panel of people in the company who have been in the field. We have a professional audio crew that takes our stuff out and does road shows with it. So they know what works and what doesn't in a real life environment. So they're definitely part of the auditioning team, as well as the developers of the speakers.

And yes, we use some very popular well known musical pieces that we've heard through a zillion different speakers for evaluating our speakers. And frankly, you can tell an awful lot about a speaker in five seconds with a burst of pink noise, because it highlights all kinds of little resonances and stuff that add to coloration. You can't listen very long; your ears get tired pretty quickly, and it's not really as great a predictor of headroom as actual dynamic music, but it will tell you quickly if your speaker is reasonably normal and natural sounding.

JS: Do you have a personal preference for recorded references that you like to use?

PQ: Well, at Quilter Labs, we just play guitars through them (laughs). I wouldn't remember the names, but we've played the same songs – I don't regularly participate in QSC listening tests these days, but I've been known to drop in now and then, and there's a repertoire of various music styles: jazz, pop, even stuff bordering on heavy metal. Not that there's anything magic about the musical pieces, per se, except that they cover a good frequency range and we're familiar with them, so we can make informed judgments, like, "I heard the bass better on that other speaker," and that sort of thing. .

JS: After retiring from daily duties at QSC, you kept the chairmanship there while coming back full circle to make guitar amps by forming Quilter Labs. Was there a sense of unfinished business that prompted that move, having dropped that product line early in QSC history?

PQ: Well yes. Even during my long career designing one power amp after another at QSC, spring would roll around, the sap would rise, and I would think, "When we exited the guitar amp business, we were really just on the threshold of developing the key elements that I am (now) using in the current generation of Quilter products: a warm sounding power amp, a thoroughly well designed overdrive section, and a surprising amount of nuance in just the equalization curves, and so forth. So when I decided to get back into the business during my retirement, it was a combination of wanting to show

the world what I could do, as well as try to give back to the industry that started it all for QSC, which is live music performance. It's still a large part of QSC's business, even as it proceeds to expand into networking, audio/video corporate communications, and areas like that.

So I observed that guitar amp technology not only has stagnated, in that the premium amps are still based on vacuum tubes, but actually has gone backwards to some degree, because the tube quality is not what it used to be back in the 1960s, when RCA used to make them by the millions to put in their color TVs, which had to work faithfully for at least a ten year lifetime, if their customers were going to be happy.

I enjoy playing music recreationally, and I thought to myself when I was ready to retire from QSC: "Well, all right. What kind of amp should I get for my lap steel?" And of course, I wouldn't want some big, heavy thing. I looked around and noticed that no one was making a nice, warm sounding, lightweight guitar amp with enough headroom to take out and play in front of people but handy enough to have around the house.

So much to my surprise, I realized that's what I'll be doing in my second career. So here we are today. I think that the one thing I bring to the game aside from a bunch of particular tricks is the use of Class D for guitar amps. It's been a part of bass amplification for quite a few years, but it's a resource that hasn't really been explored much for guitar amps, until we got into it a few years ago.

JS: In the 1980s, you worked with Pignose Amps to design their 30/60 combo, a model which I personally owned for several years – a great amp. Can you explain how that connection came about, and were you trying to recreate the already popular Pignose sound in a louder format, or were you going for something different, and did any of those elements carry into Quilter Amps' designs thirty years later?

(Note: In the 1970s, Pignose Amps were one of the first portable battery-powered amps and became popular for practice and recording with Eric Clapton, Terry Kath, Frank Zappa, Craig Chaquico and many other guitarists. It operated on AA batteries and had a 5" speaker. The Pignose 30/60 was a 30 watt, 1x12 combo amp.)

PQ: (laughs) That's a whole story in itself. It's an interesting story, and it's actually relevant because that was at the tail end of our guitar amp work. The 30/60 had all of the key elements in it that we're using today in our amps. So the fact that you liked it is no big surprise, even though as you will hear, there were some frustrations along the way.

The original Pignose – the one watt, battery powered thing – didn't the guitar player for Chicago come up with that?

JS: Terry Kath.

PQ: Yeah. So he basically took one RadioShack power module, which was essentially how I got into the business in college (laughs)! You could go to the equivalent of RadioShack and buy a little AM tuner and a one watt transistor amplifier and hook them up into a little cigar box and make a portable radio, roughly the size of a Pignose.

So he puts this in a little box and makes a cute package around it and makes this blatt-o-matic guitar amp that was amusing as all get out, because you could crank it up – but it didn't really have any great deal of tone. It did what it did; it had a fairly charming little speaker...and they sold like hotcakes. But eventually, the demand sort of petered out and they went out of production.

Then, some years later, there was an MBA student named Candy. Her thesis was on how to take a once popular brand that had gone moribund and bring it back into production and make a million bucks. She had a paper on this. Her professor read the thesis and challenged her, saying he thought it sounded great but didn't think it was realistic. So Candy said, "I'll show you!" and she chose to revive the Pignose brand as a proof of her idea.

The first step was to reissue the \$99 cigar box amp, which they did. Many people remembered them, and there were a certain number of people who'd never gotten one back in the day, and demand took off. That was phase one of her plan: reissue the original product to fulfill pent-up demand.

But in Part B of her plan, she had to issue new products to follow up and expand the brand to turn it into something. She had engaged another designer to do a 10 watt, AC-powered amplifier, but it didn't sound very good and it wasn't very reliable.

I believe it was over the course of a NAMM show or maybe on an airplane – she fell into a conversation with Barry and kind of recounted this tale of woe. "The reissue is selling well, but we can't come up with a follow-up product. It's too expensive, it doesn't sound good..." And of course, this was right at the end of our guitar amp making career.

So Barry goes, "Gee, we know how to make good, cheap guitar amps. Why don't you let us take a crack at it?" Fired up with enthusiasm, I designed this 30-watt amp with high impedance output, a nice overdrive section, three band EQ...originally, we were going to use a nice Celestion Vintage 30 speaker. This thing just sounded great.

JS: It was also one of the first amps at the time to have an effects send and return, too.

PQ: Ah! I'd forgotten about that. But there you go. A logical thing to try and stick in. And it made so much sense because you had your preamp overdrive, which you could then add effects to that, instead of having them buried under the power amp distortion.

Candy was concerned that she had to compete on price with Peavey. I would say my only disappointment with the 30/60 project was that we ended up nickel and diming it. It wasn't bad, but it could have been *awesome*. She wanted it to sell for \$299. I said to

her, “Listen. You’re getting 99 bucks for a \$10 module with a speaker in a nice, charming box. Surely you could get \$399 for essentially a boutique-grade solid state amp that sounds as good as a more expensive boutique amp.” But she had her mind set on competing at the mass market price.

We had to compromise the EQ a little bit. We used a not quite as good speaker. But it was still a pretty good amp, obviously, since you bought one.

JS: I liked it. Mine had an Eminence in it.

PQ: Right. But with all due respect, I didn’t think at the time that the Eminence speaker sounded quite as good as the British speaker. But it played, and it played well. The amp got some accolades, and it looked cool, you know – they had a look. I thought they had a real shot at becoming an interesting boutique brand that wasn’t dependent on tubes. And they did, in fact, work that for a while.

I think QSC built the first runs in our rapidly expanding shop. We used it as an opportunity to develop some higher-volume production. But as we got into power amps, we basically turned the design back over to Candy, who then had it made by some other contract manufacturer. [Amplifier manufacturer] Paul Rivera took over the care and feeding of the line and developed the 60-watt version. They went on for a few more years, but frankly, the guitar amp business got oversaturated, so it became tough to make the big bucks. They soldiered on for a few more years, then they got quiet for a while. Not too many years ago, I think I saw another resurgence, using a cute little 10-watt tube amp as their basis.

So yes, that 30/60 was sort of my last hurrah in what you might call phase one of Quilter Sound. When we came back to it, I had much better technology at hand, ranging from surface mount construction to Class D power amps, to where we could carry forth that formula with much more sophisticated results.

JS: Analog solid state amps have gotten overlooked in the wake of digital modeling, but Quilter amps are all solid state analog circuitry and do an excellent job of reproducing many of the same characteristics of Fender and Marshall tube amps with the MicroPro Mach 2 series. Why do you think tube amps still carry such a mystique among guitar players, and what made you decide to forego designing tube amps with Quilter Labs?

PQ: The electric guitar, as we know it, can now be put in the class of a “traditional” instrument, like the piano or the saxophone. It’s a thing. The electric guitar is much the same and hasn’t really changed in the 50, 60, 70 years since it was introduced. People still buy Telecasters, Stratocasters and Les Pauls, or various imitations thereof.

The amplifier half of the instrument is also a thing. The electric guitar grew up with vacuum tube amplification. And just through almost happy accident, it turned out that magnetic pickups with their rounded tone and somewhat primitive, low fidelity, underpowered tube amps, when overdriven – do some wonderful things together. The

electric guitar and vacuum tube amps just became an item. At first, it was all you could get, but even when solid state replacements were developed, they didn't sound the same, they didn't feel the same, and let's face it, artists like working with time-honored, traditional tools. Obviously now we have artists who can paint on the computer, but there are still artists who like the feel of a brush who oil paint by hand and still make old fashioned oil paintings in this modern day and age.

There'll always be a place for tradition and honoring the history of the instrument. On that basis, the world doesn't really need any more tube amps. The technology's been mature since the 1950s. You can add a knob here and a doodad there but the fundamental sound of a tube amp is basically a done deal. But as I mentioned before, the tubes are not as good as they used to be. So from a sheer practicality and consistency standpoint, it's my theory that a musician needs a more reliable tool. We stand on the shoulders of giants; we're able to look at the work that's been done by previous generations. We study what's good about it and where things fall short and try to emulate the good parts while correcting the bad parts. The result is a better tool to perform a familiar job for the electric guitarist and bass player. That's kind of Quilter Labs' mission.

I kind of asked myself, when I started getting back into it: "We know the amps people like to collect nowadays – vintage Fenders, Marshalls, Voxes and so forth. What will people be collecting 50 years from now? With all due respect, it's kind of hard to imagine that people will be falling all over themselves to score that Line 6 on eBay 50 years from now.

So part of my mission is to make modern amps that are playable, and thus collectible, 50 years from now. I don't know how many of those tube amps will still be operable then. The well-made ones had a good, remarkable lifetime, but just through sheer age – 1960s era Fenders are not quite reliable enough to play on stage when the show must go on. If you're a vintage surf band or something, it's a thrill to play through authentic blonde era (Fender Dual) Showmans, like my brother has, but those amps don't always make it, due to their age and the current quality of tubes. My thought is to make interesting stuff that people might collect 50 years from now. We're not trying to be a mainstream company, but we might be like Magnavox or something. An interesting offshoot brand that has a distinctive sound, unique engineering, and was well-loved by at least certain musicians back in the day.

JS: Is that why you decided to forego digital modeling in the design of Quilter amps?

PQ: Well yeah – partly because, let's face it, I'm an analog guy. I understand in principle what's going on with digital modeling, but I would have to undertake a massive catchup to be competitive in that field. And at the end of the day, the digital models are struggling to capture nuances and effects that just flow naturally from analog circuitry they're emulating. So why not just do it the easy way and do it in analog? Admittedly, the one thing you don't get it is the ability to dial up one out of a hundred different sounds at the push of a button. But frankly, most people only need a few good sounds,

and you've got pedals for the rest of it. My theory, such as it is, is if we can make really charming, good analog amplifiers, that can be the basis of a good rig that you can add to with outboard effects and digital recording processors to your heart's content.

JS: Quilter offers not only small combo amps with huge output, but makes notebook sized amps that can drive 4x12 cabinets and pedal sized amps with DI preamp boxes and speaker emulation for both guitar and bass. How is it that you can get such a wide range of great sounds from such small packages? And what instruments are you using to voice those sounds?

PQ: I myself only collect lap steel guitars – that's my recreational instrument. But the shop has the usual mainstream guitars: Fenders, a Les Paul, an SG, and some of the nice modern offshoots like Kiesel [guitars] to try stuff out with. The original, historic guitar amps from the tube era have relatively simple EQ circuits. So to get many different sounds out of an amp? One way is with a switch that selects a different circuit or switches a relatively few numbers of values in a circuit to give it a different personality.

Essentially, that's what kind of happened with most of the tone standards that we look at today. There was a classic generic circuit that we called the "tone stack," and you could have a bigger or smaller capacitor, and it would have a brighter, brassier, or silkier sound. Different companies kind of put their own stamp on things, and that, combined with the speaker cabinet, became the Marshall sound or the Fender sound, or the Mesa sound, or whatever.

We use a surface mount technology, which is mainstream now. But since it's a lot more compact, it lets us put moderately complicated circuits into tiny, little pedal sized boxes. I've got to be honest: our technology is more advanced than classic tube amp stuff, but it's nothing like what you'd find in a digital pedal, or a cellphone, which involves very elaborate ICs, as well as surface mount parts that I can barely see. But we use the tools we have.

One of my hallmarks as a designer is to seek the simplest way of getting a result, on the theory that it will save money and effort in the long run. Combine that with modern power technology, which is vastly more compact than it used to be, and yes – we can make an amp the size of a library book that cranks out 800 watts. We can easily make 50 to 200 watt amps in that form factor. And a little pedal size amp can use a 33-watt chip that is produced by the zillions for car stereos.

JS: The Panoptigon is something that *Copper* readers might find particularly interesting. It is an ultra-sophisticated optical disc player that provides improved playback of 1970s-era Mattel Optigan discs and also comes equipped with modern DJ functions, including MIDI, reversing, scratching, transposing, speed changes, and looping. Quilter carries an expanding catalog of optical discs for sale, containing a wide gamut of global musical instruments, sound effects, and international vocal ensemble sounds for the Panoptigon

system. Can you give us a bit of the backstory on this early consumer level Mellotron, how you got involved with it, and how it works for contemporary music?

PQ: Sure. This too has a long backstory. When I announced that I was retiring and was interested in doing guitar amps, a couple of co-workers at QSC asked, “Can we come along with you?” Chris Parks was one of them. He’s now Quilter Labs’ CEO, IT manager, jack of all trades, etc. The other working partner is Robert Becker, who was my project manager at QSC, and has become a vital part of the team at Quilter Labs.

Robert has always held a fascination with mobile art. He was looking at an optical mobile some years ago and remembered seeing something like that online. He discovered that it was a system developed in the 1920s in Britain to automatically tell you the time, when you dialed up the time number on a phone. It had rotating glass discs with soundtracks on them, and there was a system of relays that would select the right disc [that corresponded] to the dialed-in number and announce, “The time is…” filled by the ding of a bell for your time tone.

That led him to find a fellow named Pea Hicks, who had created a website celebrating the Mattel Optigan, an obscure device that had a brief popularity in the early 1970s that everyone had more or less forgotten about. Of course, we all know Mattel as a toy company, but they apparently had ambitions to get into a higher price point adult toy range, making home organs.

Now, the home organ of the 1960s was – you basically had two options. You had reed organs, which were cheesy little things, kind of like harmonicas on a stand, or accordion technology with a built-in blower. Or you had elaborate electronic organs such as the Hammond or Gulbransen, which cost thousands of dollars, were as heavy as a piano, and were serious instruments that also required having some actual keyboard skills to play them.

So somebody at Mattel came up with this idea, “If we just recorded rhythm tracks instead of just having a chord button, you’d actually have like an orchestra playing. And we can then sell the E-Z Play songbooks.” They’d set these (Optigans) up outside the organ store at the neighborhood mall and collar people, “Look! You can be a musician! Hold this button down!” – and you’d hear, “shng-a- lunga-lunga (rhythm sound)”. “Now play these notes!” – on the color coded keys. “Two fingers and you’re playing a song!”

And they sold these things for \$600. They had a surge of popularity. They had an ambitious program; they were going to release an endless stream of new discs so the thing wouldn’t go stale, and things took off, but – the machines just weren’t very well made. The discs began to slip; they wouldn’t stay in tune and if you didn’t take care of the clear film discs, they’d get scratchy pretty quick. So after a couple of years, these things all wound up in the closet, and that was that.

Forty years later, Pea Hicks becomes fascinated by it, digs up some interesting material, and manages to contact one of the remaining engineers who had worked on

the project. He kept a carton full of memorabilia about the Optigan, including never issued master tapes. So Pea got his hands on all this stuff and started featuring the Optigan and all its literature on his website.

Robert stumbled across this and chatted Pea up on what was going on. Pea tells him the whole story and then mentions, "My machine needs restoration. You're in electronics, aren't you? Could you do something with it?" So Robert winds up restoring several machines. As time went on, it was kind of a frustrating job. The electronics were kind of Mickey Mouse. You do the best you can, but it still didn't really work that well.

So Robert ends up saying, "I could make a better one from scratch." Long story short, he came up with the Panoptigon, which uses a servo controlled drive so you can set it to discrete pitches. It has the ability to start and stop from the keyboard, you can go backwards...a lot of specific, user friendly features, though it would go much better in the studio than trying to nurse one of these old Optigans along.

Meanwhile, going back to the history: after the Optigan came and went, another company, Vako, issues the Orchestron, which uses the same disc format. The Optigan disc format has 37 keyboard tracks, so you've got 37 notes – and 20 special effects tracks. Five of them are accessible from rocker switches and typically have various kinds of fills that you can trigger, and the other 15 formed a bank of chords, featuring a rhythm orchestra playing the various major and minor chords in 4/4/or 3/4 time.

The Orchestron dispensed with the consumer model and concentrated on making good, clean tracks to compete with the Mellotron, which used little strips of tape that gave you the actual (note sound) attack, but could only play for eight seconds before the tape had to rewind. Of course, you couldn't hit the note again too quickly, otherwise it wouldn't have a chance to rewind. You can imagine how finicky a machine like that could be.

(Note: The Orchestron was used by Kraftwerk on *Radio-Activity*, *Trans Europe Express* and *The Man-Machine*. Patrick Moraz also used one.)

So the Orchestron gave you essentially endless loops of sound of various types: string sections, brass, what not, that you could alter by just slipping in a disc. The machines were a little better built, so they were more capable of being hauled around on tour. But they too gradually went under, as time went by. Digital synthesizers kind of put all these guys out of business, especially when sampling keyboards came out, because they were technically so much better.

So now we come up to the present day, where the optical discs are kind of an art form in themselves, and they do have a distinctive tone quality, and the limitations of the format, with everything in two second loops – can actually be made to be artistically interesting. You can experiment with recursion. By noodling around, you can create interesting rhythm patterns.

I forgot to mention as a side point: Robert – between the time from when he met Pea and had restored a machine or two, Pea mentioned that he had all of these unissued tapes for soundtracks and lamented, “It’s too bad no one’s ever going to be able to record new discs.” You would need an optical pad, as if you were making a film soundtrack, and you’d have to be able to do 57 of these things to get all the tracks. Robert thought, “I can think of a way to do this on a computer with a .WAV file and an art program and bend it around in a loop. We don’t really need an optical head. We can basically do it by plotting.”

So by using modern resources, super hi-res plotters and what not, he was actually able to make a very good, clean optical disc from scratch. So Pea has been able to reissue some promised, but never before issued Mattel discs, as well as creating new ones of their own, including things like one my brother participated in: a surf disc with (mimics drum intro for *Hawaii 5-0*) pounding drums and (mimics octave glissando from “Pipeline”) on one of the effects buttons. And there’s a reverb-drenched rhythm track that’s pretty good. The keyboard track has pizzicato guitar, which is a variation on the normal kind of organ tone they would have put on. And they have a sitar – the sitar plays licks on each note! More or less related to the keyboard, but by moving your finger back and forth, you can almost kind of compose on the fly.

So yeah, they’re having a lot of fun with it, and...it was one of my unspoken missions for Quilter Labs – just to do cool things that you couldn’t justify on a business level, but somebody ought to do it. So this was one of our opportunities to bring something to market that may have a small band of aficionados who appreciate what we’ve done but we can carry on from there. It’s an interesting, creative piece of work that I don’t know where else you might have gotten something like that to happen.

JS: Are the recordings themselves audiophile level quality?

PQ: By no means. They will remind you of 16mm film projectors like what you saw in high school. The soundtrack itself is very similar, technically, to a 16mm film track, which basically has the fidelity of an AM radio station. And that’s part of the charm. It just has a certain sound quality...actually, Robert’s computer-generated discs are a little cleaner than the original Mattel discs, in terms of fidelity. But no, you’re not talking about pristine sound quality and that’s kind of the point. [As another example,] you’re not going to get hi-fi recording quality out of a guitar amp; it has a certain tone of its own.

JS: Since it’s MIDI, the Panoptigon is designed for use with any keyboard? Are you planning a dedicated Quilter keyboard at some point in the future?

PQ: It uses a standard MIDI keyboard. A 61-note keyboard, I believe. It was necessary to program the chords for the 20 bottom-most keys, with the upper tier playing the 37 notes. By demand of at least several people, we have issued a chord button keyboard, an accessory that physically duplicates the chord button arrangement and effects triggers of the original Optigan. We made a small batch of those which will probably last

us a long time, but we do have them available for someone who wants to recreate the full experience of playing Optigan style discs.

JS: I can imagine someone like Brian Eno getting one.

PQ: There have been a couple of famous keyboard players who have either acquired one of these or has expressed interest in getting one from us. It will be another arrow in their quiver. It does things you can't readily do on other keyboards, so it's kind of its own thing.

JS: As a musician yourself, do you share the notion that music is a language and that musicians communicating with each other and with an audience through music is the primary goal for the existence of music? While the amplification of speech is certainly the other critical use for PA systems, in what ways do you think QSC Audio and Quilter Labs have made an impact for musical interaction amongst musicians with each other during a performance, i.e. the ability to hear each other better through monitoring systems, the energy from playing before even larger crowds, and perhaps the use of Q-Sys for interactive remote performance?

PQ: Lots of parts to that question. OK, starting at the beginning, yes. I absolutely see music as a language. I think one of the most fascinating elements of music is that I can go to a foreign country where I don't speak the language, but if I find a fellow musician, if we sit down, chances are we can make music together. We have a pretty worldwide distribution of popular songs, but at least even if we're playing in a western scale, chances are I can listen to what the other person is doing, he can listen to me, and we can end up doing something together that harmonizes. And of course, the word, "harmony" is fundamental to the practice of music. Heaven knows we could use all the harmony we can get in today's world.

Harmoniousness has always been a part of QSC's culture. It's even on our official mission statement, or corporate culture statement. The act of collaborating with other musicians in real time, other than in athletic sports, where you have teams playing together, building off of each other's moves, and achieving the goal of the game, in terms of a pure art form, that collaboration is pretty unique to music. Of course, you can have a solo musician who can be pretty impressive. But an ensemble, for me, is where it's really at. You work with other people, hear new ideas, build on them, it triggers something...if you have experienced the joy of a good musical session, you come away feeling, "I just went someplace I've never really been before, and it was great!" And you live for those moments.

If QSC can help deliver high quality gear that's not distractingly hard to work so can just plug in and get a good sound, and pursue your fundamental purpose of trying to make beautiful music, I will feel that I've done something helpful to the world.

JS: Music has evolved through innovations in technology that expand the possibilities of what the imagination can conjure and continues to do so. You have a record collection

that spans more than a century. In what ways would you cite that technology became a disruptive force in changing music over the past hundred years, and how would you place the contributions of QSC Audio and Quilter Labs in that timeline?

PQ: Another great question. Back in the 1960s, when I was young and knew it all, by virtue of having a record collection that went well into the past – I had a strange fascination for the tinkly cartoon music I watched when I was a little kid on black and white TV – it did seem to me that music changed dramatically about once a decade.

You had your ragtime, early 20th century, the hot bandstand music of the 1920s, which led to the swing era of the 1930s. The main technical impact of the earliest form of music was the fact that it could be recorded at all, so that a band could make a hit record, actually make money off the record, and not simply by having to perform over and over again.

And in the 1920s, the advent of electric recording opened up the sound quality of recordings, and introduced the possibility of a PA system. This enabled a soft voiced crooner to become a popular entertainer. Of course, this is coupled with the advent of radio, which allowed recorded and live music to be piped into millions of homes at the same time.

In the 1930s, the Big Band still remained the way to do it, but the drums got more forward, the bass changed from tuba to string bass, which combined to add the element we call, “swing” to the music. At the same time, vocalists became more and more of a featured performer. So instead of George Olson’s Band with incidental vocals, it became Ella Fitzgerald with Benny Goodman’s Swing Orchestra.

And in the 1940s, this carried on to the vocalist being the star of the show. Frank Sinatra or Bing Crosby with a backup band. This was also driven by the economics of the situation. If you could have a small combo instead of a large band, you had fewer musicians to pay, easier transportation, etc. The demands and limitations of World War II and the wartime economy factored into this as well.

The big story in the 1950s was, of course, the rise of the amplified electric guitar. A small, four piece combo could fill a dancehall with loud, exciting music.

And in the 1960s, amps became bigger, louder, overdrive became a thing, and we had this fantastic outpouring of musical creativity, right when I was just getting started in the business.

And the last thing that I expected was that we would still be listening to those same songs, 50, 60 years later, which is kind of unprecedented. Nobody in the 1960s was listening routinely to music recorded in 1910. There was a certain amount of farming up of old Delta blues records, which basically was a source for more hopped up blues type performances, but people were still inventing new things.

The thing that I would say surprised me the most, as the decades wore on from there, was the advent of the modern keyboard. It's the main primary technical development. A good player on a keyboard can of course, sound like several musicians at once. They can play bass lines, melody lines, and they can sing while playing a keyboard, which you can't do playing horns.

So the economics of music performance continued to drive the music towards fewer performers making a bigger sound, which kind of culminated in both the DJ and the rap artist, being kind of stripped down to vocals and a rhythm section, or a drum track, really.

So it's always fascinating to see in some respects, to trace that history as the systematic paring away of, more or less, superfluous elements, in favor of the heart and soul of music. For most people, it gets down to lyrics and rhythm.

But at the same time, even though rap is a major popular form of music, the other forms that involve more players and melodic elements have remained in play. So we have a very fragmented music scene now, that's not as monolithic, for better or worse, than what we had in the 1960s and 1970s. People then were always waiting for the next big thing, and we would all stop together to check out the new Beatles album. That really doesn't happen anymore. Things are more fragmented.

At the same time, it does mean there are ever more outlets for creative forms of music. One thing that surprises me is I thought that video technology would be one of those major enabling factors that takes music in a new direction, much like the advent of the PA system. I don't see much evidence that that has happened. At least I'm not aware of groups that have been performing as much for video as for audio. It seems like the video is just kind of fancy lighting or something. It's an augmentation or an embellishment of what they've been doing, but it's not an element in its own right. Now maybe there's creative people out there that I don't know about, but I would have thought there would be a form of music that involves as much creative motion as creative sound. If that's not so, I haven't seen it.

JS: Where would you place the contributions of QSC Audio and Quilter Labs within that timeline?

PQ: In terms of live sound and music, you could fairly categorize both companies as, essentially, second to market companies. QSC did not invent the powered speaker or the power amplifier, or any of the things that we do. We have seen trends developing, and have gotten in on them, tried to learn from the efforts that went before, and try to do a better job, hopefully more streamlined and easier to operate. We try to smooth off the rough edges and raise the state of the art. And by the same token, although I still have some hopes of doing highly original things at Quilter Labs, most of our projects have been efforts to do a known job better with the goal of establishing a revenue base to underwrite the development of more out of the box types of things.

JS: Apart from Peavey, Quilter is the only company making amps specifically for the steel guitar.

PQ: That's true. Of course, I've always had a soft spot for the steel guitar, 'cause that's what I play personally. Number one, Peavey did support that art for many years with their Nashville and other series amps, which was good on them. And I think we're doing a better, more musical sounding steel amp, but again, it's an improvement on something that already exists, as opposed to something altogether new under the sun.

We're in a limited health crisis, but hopefully we'll soon be able to have people return to enjoying live music in groups again. That will be nice. It's interesting to see what people can do online. To my knowledge, just due to the inherent propagation delays with the internet, it's not really feasible to play ensemble over the internet. Generally, you can only watch somebody else do it. But it seems at least there might be some possibility to give appreciation as you watch.

JS: Pat Quilter. This has been a wonderful few hours and I thank you for your time. I know you're a pretty busy guy.

PQ: It's been a very fun talk. Thank you.