Happy New Year, and welcome to *Copper* #23, and 2017!

As I look back at 2016...well, Popeye put it best:

http://www.youtube.com/watch?v=h97kbv4mbsc

Really, what more is there to say? Right up to the last minute, the Reaper was ripping creative souls from our midst. Let's hope for a better new year.

In this issue, we start with Richard Murison explaining the convoluted concept of convolution, then go to Dan Schwartz for a tale of musical evolution; Professor Schenbeck takes a look at the best musical releases of that annus horribilus, 2016; Duncan Taylor presents another killer local group, The Railsplitters; and Woody Woodward takes a last, twisted look at Christmas music (no toys this time, but there is an extra-special performance). I pay homage to yet another friend and colleague who passed away this year, Ken Furst, and explore what readers and industry folk would've wanted as an audio gift, if they could just have one precious piece of gear back again. Jim Smith is back with more on the ACK Attack; Ken Kessler is back also, with another batch of artists who really don't deserve to be forgotten; and in our final feature, Darren Myers has an update on the "CNC" DIY phonostage. This issue's reader system is a particularly attractive one, and our issue
closes with yet another gorgeous image from Paul McGowan.

I wish all the best for our readers in the New Year. Next issue I'll be in CES-recovery mode, and may or may not be up to writing about it. ;->

Until then---cheers!

---Leebs.
As I write this, the Old Year is drawing to a close, so media outlets near and far are posting Best of 2016 lists in many categories. Even classical music gets a nod, especially in upscale publications like the New York Times and the Wall Street Journal (not much of a nod there, but check the Radiohead mention). If you’re an active fan or critic, it’s fun to see how their picks compare with your own. You do need to remember a couple things: (1) there’s too much “product” out there for you to hear—and judge—it all; (2) your own taste and experience matter; what you need and what Anthony Tommasini or Jim Fusilli highlight may be miles apart but equally valid. (That second caveat doesn’t apply unless you’ve actually been paying attention: no one develops an actual aesthetic stance—definable here as knowing what you like and why—without making an effort.)
As always, I got a kick out of seeing a few of my top picks show up this year in *TAS* or *Stereophile* or as Grammy nominees. On the other hand, some recordings I genuinely loved never found their way into Too Much Tchaikovsky. Either they didn’t fit a theme, or they duplicated repertoire I’d covered too recently. What follows are thumbnail recommendations for a half-dozen great classical recordings that otherwise got away this year.

*Sibelius: Symphonies No. 3, 6, & 7.* Minnesota Orchestra, Vänskä. BIS-2006; SACD. Minnesota’s plans for a complete Sibelius cycle began in 2012 with a stunning hi-res recording of 2 and 5, the composer’s most popular symphonies. They would have released this, their third and final installment, in 2015, the 150th anniversary of Sibelius’s birth. A bitterly contentious 15-month lockout by orchestra management disrupted those plans and very nearly led to the demise of the orchestra itself. That it was able to regroup under a new contract and with new managers was itself a considerable achievement. The excellence of their now-completed Sibelius cycle indicates an artistic rebirth as well. These three symphonies vary widely in style, making them a good introduction to the composer’s work. (Although longtime Sibelius devotees will tell you that the mighty Second Symphony is a better place to begin!) Here is a bit of the brisk, clean Third’s triumphant first movement:

And the sombre opening of the single-movement Seventh:

*Mozart: Great Mass in C Minor [K427]; Exsultate, Jubilate.* Bach Collegium Japan, Suzuki. BIS-2171; SACD. Most of Mozart’s church music belongs to his childhood and youth in Salzburg, because he was obliged to write liturgical music there. Two works from his grownup years are exceptions, and exceptional. The Requiem is well-known thanks to the tragic circumstances of its creation. Here’s what I like about K427, the other: in 1782–83 Mozart was fully grown but still young, exploring the world of Bach and Handel for the first time courtesy of his friend and patron Baron van Swieten. He was also delving more deeply into the craft of opera, learning to create characters that move through a story with palpable desires and frailties. The Da Ponte operas lay ahead, but he already knew how to write thrilling music for a prima donna, which is to say for a character. You can sense all this in the Great Mass. (Soprano soloists play a major role.) Like the Requiem, it was left unfinished, but not for sad reasons. By 1783 Mozart was in great demand in Vienna; he needed time for other projects. Here’s a taste of the Kyrie, right at the moment where its monumental “Kyrie” (Lord, have mercy) gives way to “Christe” (Christ, have mercy) and C minor turns gracefully to E-flat-major:

Masaaki Suzuki must be having a blast. Having wrapped up his Bach cantata cycle, he’s now playing joyously in other fields. He pairs K427 with an orchestral “motet” for soprano, Exsultate, Jubilate. Carolyn Sampson, who made enormous contributions to the later Bach cantata albums, comes through in Mozart with expressive—and, in the case of Exsultate—exultantly athletic contributions; I don’t think I’ve ever heard her sing better for Suzuki.

*Death and the Maiden.* Saint Paul Chamber Orchestra, Patricia Kopatchinskaja. Alpha Classics ALPHA 265; 24/192 download available. What do you get when you pair up a fiercely independent, scrappy American chamber ensemble with the most creative, free-spirited violinist in Europe today? Here’s what. Music by Schubert—his great Quartet in D Minor D810, arranged for strings by PK herself (there’s an older arrangement by Gustav Mahler)—plus related tracks from Dowland, Gesualdo, György Kurtág, and medieval sources, done up with Kopatchinskaja’s signature blend of wit and intensity. Death has never sounded like so much fun. You can sample sizable chunks of everything here (try Kurtág’s “Ruhelos”). More with PK, not related to the SPCO’s Schubert project:
Michael Daugherty: Tales of Hemingway et al. Zuill Bailey, cello; Paul Jacobs, organ; Nashville SO, Guerrero. Naxos 8.559798. What do you get when a former Mister Smarty-Pants of American classical music decides to play it straight? Here’s the latest gratifying result. I’m old enough to remember when anything Michael Daugherty delivered to us came with a side of snide, a wink, an ironic sneer tucked in somewhere. Two works, his bassoon concerto Dead Elvis and opera Jackie O, stand out in that regard. But since Mount Rushmore and Niagara Falls (and probably before that), he has simply done what he loves: quote, paraphrase, and transform American vernacular music (Daugherty’s jazz bona fides go way back) in order to give us American portraits in sound. Here we get not only Papa but also Grant Wood and the Hearst Castle (or is it Citizen Kane’s Xanadu?). This feel-good music actually is good. Ably performed by the Nashville Symphony; nominated for a Grammy this year. See Daugherty’s Grove Dictionary entry here; the “composer background” essay is also good. And here is video of a complete performance of Tales by Mr. Bailey, the Detroit SO, and conductor Leonard Slatkin.

A couple quickies: (1) Debussy: Images pour orchestre; Jeux; La plus que lente. San Francisco SO, Thomas. SFS Media SFS 0069; SACD and download. (2) Jane Ira Bloom: Early Americans. Outline/Solo Luminus SL Editions SLE-70005; Blu-ray Pure Audio. I put these on the list because they’re the best-sounding records in this pile. You’re probably already aware of the San Francisco Symphony’s outstanding track record for sonics. This ain’t Mahler or even Mason Bates, but it still sounds terrific. Your ears and your equipment will thank you. The music is also well performed. Regarding Jane Ira Bloom: she plays straight horn, i.e., soprano sax, with consummate refinement. This post-mainstream, piano-less trio date heaps responsibility on sidemen Mark Helias (bass) and Bobby Previte (drums). Their rapport is singularly fine, but just wait until you hear the way they assume corporeal presence in your listening room. No kidding! True chamber music.
One of the things that happens to musicians as we evolve is that we say more and more with less and less. On the Annie Stela sessions for Capitol that occurred around the same time we were working on Black Cadillac with Rosanne Cash, there was one song for which we listened to the demo --- and I simply didn’t hear anything I could add to it. Bill Bottrell castigated me for that, saying I wasn’t being paid to NOT play; we put a week into it. And the version of it that made it to the (unreleased) record was just Annie and piano. Of course, I do understand that I’m expected to come up with something, even if I think we shouldn’t come up with anything. We have to work through the process and damn the expense. But as one evolves as a player, one thinks more and more as a producer. Or at least I do. You have the end result in your head.

When you’re younger, you think first about your own part, and it’s easier to come up with parts if you’re listening primarily to yourself. The best example of what I mean can be heard in Paul McCartney’s playing --- his truly great bass parts are almost always on songs that he didn’t write. “Something”, “Come Together”, “Baby You’re A Rich Man” --- when the focus is off of him as a singer or writer, he steps to the front on his bass.

I suffered from the same thing, I think --- generally, I played too assertively. Of course, I say this now; who knows how I’ll see it in five or ten years? No one can really predict how their playing will evolve. All of which is to say, from the perspective of now, Rosanne’s song, “I Was Watching You”, needed me to enter exactly where I did. At some point, the power of not playing got across to me. I
entered well into the song --- and it feels exactly right. And again, as with the title track, the 4th or 5th take and there it was, all of us performing at once.

http://www.youtube.com/watch?v=AdEHjO7rLTI

I can’t remember if I played the song on the couple of gigs I did with Rose in 2007, but we played it on the Tonight Show with the original group (Benmont Tench on keyboards, Bill Bottrell on guitar, Brian McLeod on drums, and me on bass) in early 2006.

http://www.youtube.com/watch?v=S56BXEPUBjU

When I sat down with the record the day before the taping, I felt a long moment of panic and thought: how could we repeat that? We’d essentially played it perfectly once before. We hadn’t played the song since we got the take in 2004, so when we did a run-through in the afternoon, everything was very fresh. And that run-through was remarkable – everyone played it perfectly again. The show’s director was actually moved to tears. It was pure magic.

When we finally did the taping itself, everybody flubbed it slightly in one way or another. And such is life – and art.
It's no secret that 2016 sucked. I've already written about the number of musicians who have recently passed from this earthly vale of tears. I've also written about the passing of two friends and mentors this year: Richard Beers, and Wes Phillips. I'm saddened and deeply pissed-off to say goodbye to another friend/mentor: Ken Furst.

Ken's story mirrored that of many of us in the biz: high-school band, followed by hi-fi sales in the spiff-happy boom years of the '70's. Ken would often talk about his retail days in his gravelly Jersey-accented ex-smoker/late-night DJ voice, a cross between Tom Snyder and Lewis Black. "Oh, man, I sold a ton of those," he'd say when a particular product was mentioned, "...and what a piece of crap THAT was!" His cackling laugh would fade into a hee-hee-hee, as his shoulders shook.

Ken could tell you about pretty much every piece of stereo gear that was on the market back in those days, all based on personal experience. He was often amused by the uncritical adulation of old gear by vintage audio fans, and would set them straight, patiently but unflinchingly.

After his retail days, Ken went on to head marketing at Denon during that brand's glory days in the US, and then went on to head the Home Theater Industry Association (when there was such a thing).

Ken subsequently worked at Philips, Adcom, eTown, and Home Theater magazine---and don't ask me for a chronology, as I'm not sure. I do know that in 2008 he hung out his shingle as Furst Marketing (or more commonly, furstmarketing), where he worked with a broad range of manufacturers and shows.

Ken was revered by two generations of coworkers, colleagues, and acquaintances in the consumer electronics industry. He could always be counted upon to tell anyone who asked what he really thought, not always to the listener's delight. He was a curious combination of the genteel and the Jersey street, dressed in a natty suit, tie, and pocket square while dropping f-bombs. I've never known anyone to speak ill of Ken, a fact that probably would've both amused him and pissed him off.
I've often envied Ken's level of connectedness; without exception, a request for a contact would be met with a laconic, "I know a guy...."

All those guys---and gals--- will miss him. I know I do, and I will.

Here's a clip from the Wes Phillips memorial we hosted at RMAF a few months ago (I'll take the blame for the dark video). This is classic Ken: glass in hand, articulate, emphatic with clear echoes of Jersey throughout. I love that "stuff":

http://www.youtube.com/watch?v=GBDThwbm1CU
PCM encodes audio as a set of samples, each representing as closely as possible the actual amplitude of the audio waveform at some specific instant in time. Recreating the audio is then a matter of using those samples to reconstruct the original waveform, data point by data point, because that’s what the data samples represent, isn’t it? Actually, strictly speaking, it’s more complicated than that.

The reason for this was touched upon in my column a few weeks back, titled “50 Years After”. It is a subtle point, but I think it’s worth understanding, so I’ll try to explain it in more detail. In doing so, please bear in mind that for everything I am going to describe, I assume strict adherence to the Nyquist criterion, so that all waveforms contain no frequencies above one-half of the sampling rate. When this strict criterion is breached, all bets are off.

When you want to recreate a waveform from a file full of samples, you need to ask what the samples actually represent, in isolation. The totality of all of the samples is easily understood in the context of the ensemble, but what is the meaning, mathematically, of any one individual sample? Only by fully understanding that meaning can you fully understand the process of using that sample – and its cohorts – to recreate the original waveform.

Let’s say we have a digitized audio waveform that comprises N samples. We can consider that waveform to be the result of adding together N separate waveforms, each comprising sample values that are all zero, except for one non-zero value. The non-zero values of each separate waveform
each occupy different sample positions, and their values are those of the samples in the equivalent positions in the master waveform. Summed together, all these ‘single-point’ waveforms add up to the original master waveform, as suggested by the diagram below:

![Diagram showing single-point waveforms summing to master waveform]

We have a term that we use to describe a ‘single-point’ waveform. It is called an impulse, and it has a number of interesting properties (most of which I won’t be getting into in this column).

At this point I want to make a brief deviation, for reasons that will only become apparent later, in order to look at the process of extracting one individual sample from a data file. I want to do this by placing a “window” over the entire data file, with a single gap in the window that allows you to view the data file only at the chosen sampling point. This “window” function comprises a set of values that line up precisely with the contents of the data file. Every value in the “window” function determines whether or not I can see through the window and view the sample behind it. To extract just one sample, the window must be “open” at the one position that corresponds to the desired sample, and “closed” everywhere else. In other words, my “window” function has a value of unity where the window is “open”, and zero where the window is “closed”. It is, in fact, a unity-valued impulse function.

Mathematically, the process of applying a window function is called convolution. By convolving an impulse function with a data file, the result is the specific sample at the location in the data file corresponding to the impulse. Clearly, we can individually isolate each sample of the entire data file by convolving the data file with an appropriately aligned unity-valued impulse function. Bear that in mind, and I’ll come back to it again later.

So, what kind of analog waveform does this digital impulse actually represent? Consider the Sin() function (i.e. a sine wave). It oscillates between positive and negative, crossing the x-axis (where it has a value of zero) at regularly-spaced intervals. We’re looking for a function which behaves like the Sin() function, but somehow replaces one – and only one – of those zeros with a +1. It turns out that our solution is a Sinc() function, related to the Sin() function as follows:

\[ \text{Sinc}(x) = \frac{\sin(x)}{x} \]

When \( x=0 \), \( \text{Sinc}(0) \) evaluates to \( \frac{\sin(0)}{0} \), which – surprisingly perhaps – works out be +1. Hallelujah for that! Here is what the central portion of the Sinc() function looks like, with the red dots indicating its value at certain regular sampling intervals:
The oscillations of the Sinc() function go on infinitely in each direction, dying out slowly along the way. From this diagram we can clearly see how our impulse data (the red dots) encode a Sinc() function (the blue curve), and how the samples get to be zero-valued everywhere except in the middle. Therefore, by treating every individual sample in a digital audio file as a separate impulse waveform (as illustrated in my first diagram) every single one of them can be seen to actually encode its own Sinc() function. You can also see from the spacing of the red dots that the particular Sinc() function we require is determined by the sample rate, and, aside from its amplitude, will therefore be the same every time. In fact, the particular Sinc() function we want is $\text{Sinc}(2\pi F_s t)$, where $t$ is time, and $F_s$ is the sample rate.

I can now take a final step – which is very important. It is also perhaps tricky to grasp, so I apologize for that in advance. Earlier, I mentioned convolution, which is using one function as a “window” through which to view another function. We convolved the sampled digital waveform with the digital impulse function, and in doing so isolated an individual sample value. It can easily be shown that the same is therefore true of their analog counterparts. In other words, by convolving the equivalent analog waveform with a Sinc() function, we produce the exact same individual, isolated, sample value. You might want to read that again ...

What this actually shows is that the process of convolving a waveform with the function $\text{Sinc}(2\pi F_s t)$ is the exact mathematical description for sampling that waveform at a sample rate of $F_s$. This is a result of profound importance because it provides the crucial bridge - a lossless transformation - between the analog and digital worlds.

Knowing all this enables us to look at our sampled values, and figure out what we must do to transform them – losslessly - back into their original analog form. The proper mathematical transformation involves taking every single sample value, and recreating its matching Sinc() function. The sum of all those Sinc() functions will be the exact original waveform. Unfortunately, though, recreating and summing Sinc() functions is a practical impossibility. There is just no way to do that in any sort of real-world DAC. Similarly, there is no way to convolve an analog waveform with a Sinc() function in a real-world ADC. All of which brings us back down to earth again with a bump. But it provides us with a framework against which we can measure all the things we can do, and determine how well we are doing them.
In last issue's **Vintage Whine**, I ran through my personal list of the ones that got away---those special pieces of audio gear that I owned in the past and somehow let get away, to my everlasting regret. Judging by the volume and intensity of responses, I’d say that almost every audio enthusiast has a list of gear they wish would magically reappear.

I also threw out the blue-sky topic of "if you could have *any* single piece of audio gear, what would it be?"

I pinged readers, friends, colleagues, and *Copper* contributors for their lists---and here are some of
their responses. You'll notice that once a piece of gear is mentioned, it often provokes an "oh, YEAH!!" response from others. EPI, Audio Research, Conrad-Johnson, and Spica in particular are regarded with fondness:

--I have sold off hundreds of items and can't think of one I regret. I tend to make the decision to sell an item and then wait a few years to see if pre-seller's remorse kicks in before actually letting go. If I could have one item, its a tough choice, it would probably be a Klangfilm Europa Junior Klarton or space permitting (a movie theater?), a Euronor.--Jonathan Halpern, Tone Imports.

--My old CJ PV5, what a little sweetie. Lemme add a Nikko receiver, the 501 I think, with Advent speakers and their single-meter cassette deck. But it's the PV5 I miss... also had a Luxman 1040 that was pleasing.--Jonathan Scull, audio maven/legend, Scull Communications.

--Probably my old Counterpoint SA-5000, though generally absence makes the heart grow fonder in these cases...--John DeVore, DeVore Fidelity.

--My old Counterpoint SA-5000, though generally absence makes the heart grow fonder in these cases...--John Devere Fidelity.

--Tannoy GRF Corner Horns, 15" Monitor Gold units, in Sapele Mahogany. Sold them to help pay the deposit on a house. 😊--Haden Boardman, Audio Classics UK, Copper.

--I wish i had my original Nait amp and NAT tuner back! Wish I could have: Big Western Electric theater horns and 555 drivers.--Beau Ranheim, NY audiophile/chef extraordinaire.

--Leak TL12 plus. The little EL84 mono amps and preamp were just beautifully taken care of and sounded great. Later I had a bunch of the TL12 point one with the KT66 valves which are much better, but those were just beautiful to watch, touch and listen...I cant remember who I sold them to or for how much. Western Electric 18 field coil woofer pair, but I sold those for a lot of money! I did keep my Ampex 350, still have it and absolutely love the stainless steel feel of it, the human size bolts and parts you can grab with your hands, the 3 motor construction, no plastic at all: and it beats almost all Tape machines I have listened to! Had since I was 16, got it for 5 bucks!--Jorge Sadurni, Sadurni Acoustics.

--Not listed among the anointed but I'd go for a pair of Spica TC-50s.--Michael Fremer, Analog Planet, Stereophile.

--An Audio Research SP-11b. Sold it when I wanted to raise some extra cash. Not that I was displeased with what I bought subsequently...an Audible Illusions Modulus 3, which I still have, in fact...but man, I should never have let that SP-11b go.--Frank Doris, ex-TAS, industry veteran. --I'd go for SP 11 too!--Fremer, redux.

--Wright Sound 300B amps, designed by George Wright of Kent, WA. Just insanely beautiful-sounding little amps with Magnequest/Peerless TFA-204 trannies. George was a friend who passed away recently. I’d buy them back in a heartbeat. Wish I could have:Tannoy rectangular GRFs with vintage drive units.--Alex Halberstadt, ex-Listener, pundit, biographer of Doc Pomus.

--Original Snell Type A's.--Walter Schofield, industry veteran, SVS. Always wanted to own a pair, but never did. Even though I have a better vinyl setup now, I still loved how my first "really good" turntable rig showed me how much music is in the grooves of records. Ca. 1979: Rega Planar 3, Grace G707 Mk II, GAS Sleeping Beauty Shibata, Threshold M1 step-up. It was really musical to me.--Dave Kakenmaster, industry veteran, GoldenEar Technology.

--My Epicure 10 speakers. Oh, and my Technics SL-I don't-remember-the-model-number DD turntable. I should add that this was my first "real" stereo gear, purchased in the 1970s in an actual,
brick and mortar stereo store in suburban Philadelphia. Because, of course, you needed all that extra information. --**Steven Folberg, unofficial Rabbi to the audio industry.**

--My old *Acoustat Monitors*. Come to think of it, I would love to get another set of *EPI 180* speakers. Those got me through college and right up until I bought my Acoustats. *Spendor BC-1*. Always wanted a set of those.--**Steve Lefkowicz, Positive Feedback.**

--*Altec 604-8Gs* rescued from a rubbish skip outside Theatre Projects, Covent Garden, London then later reconed and put into Ported enclosures by the late Australian Acoustical Engineer Richard Priddle. Wish I still had them as a reference to compare with my current 'Bouncy' things! --**Graham Craig, painter and audio experimenter/artist.**

--*Celestion Ditton 66*. --**Ronald Neale, Aussie audiophile.**

--My old stash of *JBL* pro horns and drivers, oh man what I could do with those now.......--**Lou Hinkley, industry veteran, Daedalus Audio.**

--No real regrets over things I've sold, but the one vintage thing I still have a lust for would be a super clean pair of *Altec Valencias*. --**Mark Almirall, Cali audiophile.**

--*VAC 90s*. --**Peter Breuninger, AVShowrooms.**

--*Scott 310e* tuner and *Grado* walnut tonearm.--**Clark Johnsen, The Wood Effect, Positive Feedback.**

--For me, *Tandberg 1040* receiver, open reel deck, and *EPI* speakers. Classics.--**Barnaby Fry, industry veteran, Audio Plus Services.**

--*Audio Research SP3A*. --**Doug Henderson, industry veteran, B&W Group USA.**

--*Revox G36* that I stupidly sold at an Audiomart swap meet in NJ many years ago. Then there's the *Naim 32.5/Hicap/135s* I had at the peak of my flat earth period, not to mention the *Marantz 9s*. --**Michael Trei, turntable king, Sound & Vision.**

--Easy. *Conrad-Johnson PV11* preamp. Second would be my *Spica TC 50s*. --**Wil Hinds, audiophile, bass monster.** Yes! Years ago I sold my C-J *PV2ar* for next to nothing, and I wish I still had that, too. The vintage product that I owned but sold and now want back is the *McIntosh* mono FM tuner I owned briefly in the early 70s (I don't remember the model number—MR something). The vintage product I've never owned but would most enjoy having is the *EMT 930*. --**Art Dudley, country squire, Listener, Stereophile.**

--One of my *Sony TC766-2* half track.--**Robert Gaboury, Arteluthe.**

--A *Tandberg Sølvsuper* stereo receiver from 1973 - the first component I opened and managed to short... Not very popular with my step mom who owned it. But it sounded great 😊. --**Knut Skogrand, Skogrand Cables.**

--Duelund *Behemoth* horns.--**Frederik Caroe, Duelund.**

--*Moscode 600* hybrid amp.--**Kemper Holt, Enjoy the Music.**

--My *Marantz 10b* in the wood cabinet I had painted gloss black by my friend Jack Shafton when he was at CWD--- BUT I still have my *Crown SX700* open reel tape machine which I played last night. I
still have a pair of *Quad 57*'s and a pair of *Acoustat Model 3*'s --**David Hardin, industry veteran, Audio Center.**

--I was raised on a pair of *Nelson Reed 804b*’s... i loved those damn loudspeakers ,as that ATC mid dome is to die for.--**Randy Kunin, audio artisan, Randall K.**

--I never owned a pair, but the single most interesting speaker I ever heard was the *Hill Plasmatronics*!! Yes, I really would like to hear one again! Marcel, up at his showroom in Scarsdale had a pair - That Pink Floyd with the helicopter was stupendous, truly.--**Randall Bradley, audiophile.**

--**Audio Research SP10** preamplifier - wait, I still have the one I bought in 1984!--**John Atkinson, man/myth/legend, Hi-Fi News, Stereophile.**

--EAR G88. Gone, to my regret. And: IRS V or an EAR Discmaster.--**Dan Schwartz, bassist extraordinaire, ex-TAS, Copper.**

--Four perfect *Cunningham globe CX250* tubes from 1937. To pay the rent. I'm such an asshole. And a 1955 Esquire.--**jc morrison, legendary designer, Fi/Sequerra/Electro-Harmonix/Silbatone/lab jc.**

--**Audio Research SP3a-1** mk2 improved modified, **REL Precedent Tuner**- both abducted.--**Jeff Joseph, industry veteran, Joseph Audio.**

--**Quad** speakers.--**Dr. Bob Odell, ex-PS Audio.**

--My *Pioneer RT-707* RTR. Loaned it to a friend and never saw it again. Oh, and the *Hovland HP-100* preamp w/phono - had to give it up when they folded. Incredibly transparent.--**Elliot Kallen, shakuhachi demon, industry veteran, The Tweak Shop.**

--A ’68 white *Fender Strat*.--**Michael Lavorgna, artiste, AudioStream.** OK, Guitars - a ’64 SG with factory Bigsby that was mint and for which I got 1/10th its current value and a 65 *strat* that I traded straight across for a Santa Cruz acoustic - I was dumb.--**Steven Stone, TAS, Audiophile Review.** Yup. My ’55 hardtail Strat, too.--**Art Dudley,** again. [I keep telling these guys: musical instruments have NOTHING to do with audio! Sheesh!!--Ed.]

--I really haven’t owned a lot of gear, but I do wish I had held on to my *Vandersteen 2Ce Sigs*.--**Julien Therrien, audiophile.**

--My picks are so easy (but so painful): My RCA-sourced *Ampex 300* RTR (It was used in their red field-recording truck) & my TWO *Fletcher MDC-800* "The Arm" arms. One arm I gave away, the other I sold for like $100, and the Ampex (and all the right tube preamps I sold (ouch) together for $300 . . . woe and perdition. Also wish I had my Acros and the fresh *LS-55*s.--**Herb Reichert, audio poet, Listener, Sound Practices, Stereophile.**

--Miss our *Magneplanar Tympani 1d*. Sold them off when our first born started crawling. Got tired (and concerned) when I was having to fish him out from behind the speakers all the time.--**Dan Muzquiz, industry veteran, Blackbird Audio.**

--*Ohm F.* Although by now if I still had them they prolly wouldn't work. The old joke was you needed 200 Watts to drive them, and 201 to blow them up. Oh! And of course I wish I still had my *Quad 57*. I do not have a proper room for either the Fs or Quads.--**Ken Furst, industry veteran, furstmarketing.**
--NAD 3020. I've still got a pair of Spica TC-50s. The cabinets are rather beat up after three decades of moves, but I couldn't bear to sell them. It would be like selling a faithful and well-loved dog just because it got old.--Rob Doorack, audiophile, ex-Listener.

--Toss up between a Yamaha YST-C11, a JVC PC-V55, and a JVC JR-S301 with the perfectly weighted tuner wheel.--Malachi Kenney, political flak/coder/hacker, ex-PTA, Copper.

--Sansui AU5900 amp - Tannoy Berkeley Speakers- Denon DRM44HX.--Johan Coorg, legendary party animal, industry veteran, KEF.

--I have it: Marantz 2230 driving ESS AMT-1s. Set up in my home office.--Mark Larsen, Esq., keeper of audio industry secrets.
In a previous issue, Jim Langley shared his famous DIY CNC phonostage with us, recommending various component modifications and upgrades. We will soon have CNC PCBs available for purchase directly from PS Audio; this is a non-profit effort from Leebs and me to encourage and support the DIY community.

You will need a soldering iron, solder, and an inexpensive multimeter for checking resistor values or battery voltage (optional but recommended).

We're awaiting final details, but it looks as though the PCBs will cost approximately $15.00, subject to variance. We hope to have the boards available soon, and will provide details in the next issue of Copper. The component values are written on the PCB, making it easy for anyone to populate and know where each component belongs.

The link below will send you to a cart at Digikey.com with all the parts that you’ll need (be patient--it may take a few seconds for the cart to populate). I’ve included various different capacitive loading resistors for you to experiment with (47pF, 100pF, and 180pF). If you are using long RCA cables out of your turntable, you may want to experiment with leaving these capacitors unpopulated. For shorter, low capacitive cables, try 100pF or 180pF.
The cart also includes two different OP amps (2 each) so that you can experiment with different amplifiers and see what sound you prefer. Jim recommends an OPA2134 in position 1 and a LM4562 in position 2.

For indication, I’ve added a red LED and 8.2K bias resistor to the cart. You may choose to go with a different color such as blue or green. Refer to Jim’s previous article for more information on how to wire this.

9V battery contacts and mechanical clips are included in the cart so that you’ll have to do is decide on an enclosure and add some 9V batteries.

Special thanks to muffy.com for the PCB design and my close friends Jim Langley and Bill Ennis for making this DIY project possible for so many.

Enjoy!

-Darren
Blue Christmas

MUSIC TO MY EARS

Written by WL Woodward

My dear wife Diana is one of those that starts buying Christmas presents in June. I know, I know. The worst part is there is a dynamic in a relationship that requires the one partner to show the other what she bought that day for Sandy while you’re trying to watch the NBA Finals. And you are trying, really, to remember who the hell is Sandy while keeping one eye on the game. You girls think we’re not listening. We are. Just winking at the game and waiting for peace.

“Look, I found this adorable (Shaq is at the free throw line behind by a point) candle for Sandy. (Ya know John why wouldn’t you foul this guy..His free throw style looks like a hammer falling out of a tree) found a wonderful blouse but I don’t know her size (boink..yep, don’t you think they’d make this clown practice free throws?). Do you know her size? (Wait..What??!!) That answer is ALWAYS no.

So we get to the week before Christmas. The week before the celebration of the birth. I’m weak. I can’t help it. I get sloshy and keep on my bedside table the plastic Santa we’ve kept all these years that my parents put in my crib my first Christmas. I have wonderful memories from those days but I spend every Christmas veering between joy and sad.

This time of year is a time of joy and despair. In many ways and within too many of our brothers and sisters are hearts suffocating with loss and hopelessness. But this holiday gives you the light, the RIGHT, the singing railroad tie, the sunrise. The chance. The hope. You are never alone. Dude, I am telling you, you are never ever alone.

I spent a short part of my life driving long haul semi’s, mostly meat, to all of the places in this country whats gots to have their meat. Never went to Boulder. Imagine that. In two and a half years I was home for 4 weekends, and one Christmas when my mother-in-law was there. We had to put her up in the next bedroom. Yeah.
On Christmas Eve 2012 I was parked in a truck stop on I-55 on the Missouri/Tennessee border. Snowing bad enough I shouldn’t go anywhere soon, but I will be firing up for a run to Atlanta in the morning. I got a meal and slogged back to the truck. It was Christmas Eve. We were broke enough I had to do this, be away from home. What an amazing experience. I knew I was missing the family getting together, the sounds of everyone cooking, laughing, and farting. Not necessarily in that order. But because of the season, really, I was OK.

I had been thinking about doing a rendition of an Elvis Christmas song I’d heard on the ‘Bob and Tom’ radio show. Diana is a nutzoid Elvis fan so I knew this would be the perfect present for my bride. After pushing my way through the snow back to the truck, I downloaded a free mixer program on my laptop, figured out how to multitrack (it was crazy easy), learned this song and recorded it. There are a couple of places in the recording where you can hear the wind booming the side of the truck. Christmas Eve, howling snowstorm, in the back bunk of a Kenworth T700. GREAT truck by the way.

I apparently missed the mark, because she doesn’t care for this version. Women.

Happy Holidays! And I love you all.
Revenge of Son of Forgotten Artists Strikes Back!

FEATURED

Written by Ken Kessler

No fear of running out of great musicians who may or may not have slipped below your radar ... or never been on it. This bunch brings us up to 50.

41) **Doris Day**

Like too many people not around in the 1940s, I knew Ms Day solely as an actress. My old man soon corrected that misconception with a spin of the original soundtrack LP to *Love Me Or Leave Me*, which I still own and cherish. Goodness, what a voice! What control! Day would drift in and out of my playlists during my lifetime, but an encounter with her version of “I’ll See You In My Dreams”
leapfrogged her over nearly every distaff warbler in my library. Yes, even beyond Ella, Julie and Nancy. “Que Sera, Sera” may be her signature tune, but you owe it to yourself to hear the now-ancient mono material and the staggering stereo releases from the 1960s. Start with *Show Time* from 1960, and pick up one of the bargain sets of her late-1940s work with Les Brown. Apparently, by 1947, she was the highest-paid female vocalist on the planet. Trust me: she was worth every penny.

![Sam & Dave Soul Men](image)

42) **Sam & Dave**

Otis vs Marvin, “James Brown is the Godfather”, Sam Cooke, “Wicked” Wilson Pickett, Isaac Hayes, Solomon Burke - there are so many soul giants with a claim to being the greatest, if a greatest there must be. For me, the quintessential soul act was Sam & Dave, and on so many levels that I don’t have to stretch to make their case: Stax label sound (gutsier than Motown), the greatest backing bands of all time (Booker T & the MGs, The Mar-Keys), material by Porter and Hayes, and their inimitable call-and-response, straight-outta-gospel delivery so clearly from the heart that they live up to the title of their biggest hit, but in plural: “Soul Man.” Among the masterpieces are “Hold On, I’m Comin’”, “You Don’t Know What You Mean to Me”, “I Thank You”, and a dozen more. Along with the Beatles, Buddy Holly, Howard Tate and the Buffalo Springfield, the music I want to be listening to during my last days on earth. How much do I love this duo? Enough to name our son “Samuel David”.

![Kevin Ayers](image)

43) **Kevin Ayers**

An unlikely choice for me, given that I am not predisposed toward any of the genres even remotely
associated with prog-rock, jazz-rock or, especially, Artsy-Fartsy British Eccentric Rock. As Ayers was a founding member of Soft Machine, was part of the “Canterbury Scene” and was an early supporter of Mike Oldfield, pre-\textit{Tubular Bells}, he should have ticked all the wrong boxes. But this is a more personal choice than most because, when I moved to the UK in ’72, I had a room in a B&B in Canterbury next door to his sister, Kate. She introduced me to the hippie answer to Noel Coward and I was hooked immediately, and eventually to Kevin himself - who lived up to the persona with great theatricality. Start with his fourth solo, \textit{Bananamour}, for a taste of British whimsy, with sublime sound quality, too - a no-brainer for those who love the Bonzo Dog Doo-Dah Band, or, indeed, the aforementioned Coward. Nearly all of Ayers’ solo LPs featured musicianship of the highest order, especially the titles on Harvest and Island, and – in the context of this webzine – glorious sound.

Peripherally related to Ayers in sheer Englishness, though writing pop and rock classics rather than dabbling with the avant-garde or “post-modern music hall”, Squeeze also was (and remains) as thoroughly, unapologetically British as the Kinks. Despite emerging during the tail-end of the punk era, Squeeze’s attitude is more closely aligned with 1960s British Invasion brands, British “kitchen sink” drama and the trials and tribulations of the English working class, than with punk \textit{per se}. Channeling the aforementioned Kinks, the Beatles and other maestros from the previous decade, Squeeze added a post-punk vibrancy, while Difford’s and Tilbrook’s compositions have been favorably compared to Lennon and McCartney. Once you’ve listened to the original version of the oft-covered “Tempted”, with the great Paul Carrack on vocals, you’ll know why.
45) **Keely Smith**

Overshadowed by her jokey collaboration with Louis Prima, where she played straight to his clowning, Smith categorically deserves to be grouped with the very best of the interpreters of the Great American Songbook. Respected by no less than Sinatra, Smith is easily recognized by a teeny vestige of her southern accent that came through whenever she had to sing words such as “I” or “my”: they emerge as “Ah” or “mah”. It adds unique character to a school of vocalists who some find almost interchangeable: Smith is as distinctive as Peggy Lee. Even when being teased by Prima and occasionally struggling to keep a straight face, she managed to sing with clarity, authority, feeling and, yes, wit. By all means, wallow in the delight of the Prima-Smith duets, but do not miss her solo releases. You will be staggered.

46) **Willy DeVille and Mink DeVille**

Those of you who read my scribbling in *Hi-Fi News* will know that one of my references for assessing hi-fi is DeVille’s “Assassin of Love”. Produced by Mark Knopfler, it has as much activity in its groove as any a stereo test record, and the reactions to it at this year’s hi-fi shows during my demos were all of the where-can-I-get-a-copy? variety. I first got hooked on DeVille’s rich, soulful vocals when he was fronting Mink DeVille, a group that arrived during the punk era and was as out-of-step with that aberration as was Tom Petty & the Heartbreakers. Mink DeVille paid homage to street-corner music and Latino roots sounds with the same passion as did Zappa with doo-wop, only DeVille played it straight and created a run of albums that sound like an alternate-universe score to *West Side Story*. His solos embraced other genres, while the albums of his final years were imbued with the spirit of New Orleans. Willy, thanks for so many hours of sheer musical bliss. RIP.
47) **Rick Derringer**

Like many baby boomers, I first heard Derringer when he was in the McCoys, and I was in a little band that - yes - just had to cover “Hang On, Sloopy”. As sharp as they were, the McCoys could only contain this incendiary guitarist for so long. Working with the astounding Johnny Winter in Johnny Winter And..., with Johnny’s brother Edgar in White Trash and carving out a varied solo career, Derringer became one of those journeymen guitarists who spices up albums with exceptional playing. His guest spots range from Todd Rundgren to Steely Dan to Alice Cooper to Cyndi Lauper to Kiss to Ringo Starr, and he’s a seasoned producer. But the killer has to be his solo debut, *<All American Boy>*>, worth owning just for the best-ever take of “Rock’n’Roll, Hoochie Koo.” Play it loud.

48) **Roy Wood and the Move**

Another British eccentric, Roy Wood sent out mixed signals. He looked like a freaky, demonic hippie of the Arthur Brown variety, but the music he made owed more to Brian Wilson than to Aleister Crowley. With the Move, he crafted Top 40-friendly hits that undermined the band’s hipness at home, and I didn't realize how disrespected they were until I emigrated to the UK: Rich Colburn had turned me on to them when we were in college in Maine, the band ironically enjoying underground status in the USA. Spinal Tap surely would have admired “Brontosaurus”, while the antics of their management conspired to ruin the band’s finances and credibility. After forming and then leaving ELO, Wood produced a series of eclectic albums – solo and with his other band, Wizzard – that probably never threatened the US charts, but his star shone brightly during the glam era in the UK. He delivered hits that celebrated the rock of the Beach Boys, the Monkees, the Merry-Go-Round and other American purveyors of sunshine pop. Start with *Mustard*, a completely self-performed/recorded masterpiece and wonder how he slipped past your consciousness ... if, that is, you adore well-crafted pop music.
49) **Trudy Richards**

A mystery woman, this torch singer could turn the warmest and fuzziest of Broadway tunes into intense, in-your-face declarations of love. She recorded but one album for Capitol in the 1950s, which apparently enjoys cult status in Japan, before retiring. I discovered her because of track on Capitol Records compilations honoring the composers of the Great American Songbook. It was immediately clear to me that she was of the caliber of Keely Smith. Her version of “Let’s Do It” would surely have had Cole Porter grinning from ear-to-ear, for it is the most salacious take I’ve ever heard of a classic from the Great American Songbook. “A Wonderful Guy”, “Can’t Help Lovin’ That Man” – imagine the devastatingly sexy Julie London without any inhibitions and that’s the sound of Trudy Richards. Redefines “torch singer”.

50) **Wilson Phillips**

Just as the Move was disrespected by the British, so has Wilson Phillips been treated like dirt. Nepotism may have gotten them a few rungs up the ladder, but talent will out, and wow, can these ladies sing! If you can turn off your hip-o-meter for a few minutes and just listen to their interpretations of myriad or their Left Coast rock treasures, as well as their renditions of their parents’ hits and their own original compositions, you’ll find that the trio is as polished and musical as any “girl group” of the genre’s 1960s heyday. No, they don’t challenge the Supremes or the Shirelles, but I’d gladly place them on the same shelf as the Shangri-Las or the Cookies, and they have the added benefit of releases with stellar sound quality rather than AM-radio-friendly compression. If you must, file them under “Guilty Pleasures”, next to the Dave Clark Five, Herman’s Hermits or early Lesley Gore, but try them again with an open mind.
ACK Attack is BACK!!

FEATURED
Written by Jim Smith

ACK Attack for serious listeners, part one -

[You may want to refer to Jim's original piece on the ACK Attack, in issue #12 of Copper---Ed.]

Why you should be sour on a wide “sweetspot”

Hey, we might as well get this topic kicked off with a bang...A “wide sweet spot” is almost like having your own harmonic distortion generator! With stereo sound, there’s simply no way a serious listener should be satisfied to sit more than a foot away from the “equal path length intersection” (center point) of sound from a pair of loudspeakers. Inter-channel phase and timing information has just been badly compromised, especially obvious with instrumental timbres.

How is it that audiophiles will accept only phase and time-aligned loudspeakers and then expect to sit off the acoustic center point, totally destroying the inter-channel phase/time information? Look at it this way...

First, since you probably know this stuff, please forgive the simplified averaged wavelengths, but for purposes of illustration, let’s assume that an 1100 Hz tone (or harmonic) has a length of about 12 inches. Then 550 Hz is almost 2 feet in length (from the top of the sound-wave crest to the top of the...
next). And 2 kHz is almost 6 inches in length, 4 kHz is 3 inches, etc.

Now imagine that a female vocalist is recorded with her image centrally located in the stereo stage. If you sit two feet off-center, that means that any fundamental notes and their harmonics from 500 Hz and above have been altered, some dramatically, some slightly.

_This is audible, and it’s depressingly measurable!_

Before we examine the disastrous effects of stereo comb filtering (what I’m euphemistically calling harmonic distortion), let’s look at what’s happened to our stereo imaging...

OK, let’s say that, by sitting to the left of center, you’re now about two feet closer to the left speaker than you are to the right one. Imagine a centrally recorded image that is reproduced at equal volume (amplitude) from both speakers in order to give the illusion of a precise center image.

Without going too far into recording techniques or speaker dispersion patterns, a panned mono center image (such as is produced in a studio) may appear to have shifted left somewhat, while a center image recorded from a stereo pair of microphones seems to “stay put” a little better. But these are phantom images at best, lacking in the ultimate richness of tone and body. Here’s why...

It’s not the potential “image wander” that’s troublesome. It’s the harmonic distortion! (Technically, it’s not distortion, but the alteration of harmonic relationships.) The positive cycle (top of the wave crest) of an 1100 Hz overtone arrives at your ear from the (closer) left speaker before it does from the right one. Due to phase cancellation, there’ll be an audible—and very measurable—change at that frequency (or harmonic overtone).

Should the distance be equivalent to a half-wavelength further (6 inches), then that particular overtone (harmonic) will arrive exactly out of phase. And you know how your stereo plays less bass when the speakers are out of phase? Well, the effect is exactly the same—a reduction in level at that particular frequency.

_Why is this important?_

You’ve heard of voiceprints? That’s where a recording of your voice can be used to positively identify you, no matter how hard you try to disguise your voice.

_How does it work?_

The unique relationships of vocal overtones are different for each voice. For example, the first overtone (harmonic) may be 87.3% of the fundamental, the second just 48.1%, the third 54.7%, etc.

The exact relationship of these overtones (their relative strength, compared to the fundamental) is the identifying “genetic code” of your voice. It turns out that all instruments and voices have their own particular set of harmonic ratios.

That’s how we know to differentiate two different instruments that are playing exactly the same note—let’s say A (440 Hz). It’s how an original Guarneri will be chosen over a “replica”—it’s all in the “tone”—which is actually the harmonic—or overtone—structure.

So, if you’re sitting where the path lengths are significantly unequal from the left and right speakers, you are absolutely guaranteed to hear unwanted shifts in the harmonics, meaning that an instrument or voice will not sound exactly as it should. This is not just some subjective acoustic theory. It’s not only audible; it’s also shockingly measurable in your room at your listening seat!
The sad fact is, you’ve just altered your system’s harmonic relationships.

So why did you buy all that stuff with “vanishingly low distortion” if you’re going to introduce a far worse version by not sitting in the center point where the path lengths are equal?

Incidentally, this is an incontrovertible law of physics that is part of the good—and the bad—of stereophony. It has no bearing whatsoever upon sitting off-center in the concert hall, because the sound is not being reproduced from a pair of widely spaced loudspeakers which are subject to severe comb-filtering due to varying time arrivals at your head.

From a perfectionist’s standpoint, it doesn’t matter if your loudspeakers produce a smooth response off-axis. Even in an acoustically dead room, the varying wavelengths from two loudspeakers received at a listening position off the acoustic center will always produce uneven response on centrally recorded images (actually all images, but it’s easier to think about the centrally recorded image for the purposes of illustration).

Here’s a simple test for you. Put on a Sheffield or other disk that contains pink noise in both channels (pink noise is best, because it contains equal energy per octave, just like music). If you can, put your preamp in mono.

Whether stereo or mono, what you want is equal amplitude in each channel. Now, as the cut of pink noise is playing, while sitting in the center (equidistant to the speakers) position, slowly move your head to the left or right. That huge change in mid/treble tonal balance is exactly what happens when you sit off axis!

And because the wavelengths vary according to frequency, the varying time arrivals of harmonics also produce an unpredictable cancellation effect (well, it is predictable in that it’s never a good thing). And a ‘wide sweet spot’ isn’t really so sweet...

Now that I’ve told it like it is, I’ll also admit to having absolutely wonderful experiences listening to music while others have occupied the best seat. If a system has dynamics, presence & tone - if it’s effortless, if it at least starts out being pretty accurate tonally, then it can be quite listenable off-axis. I have thought that this technically incorrect listening experience can be so musically involving because – like live music - it’s a shared experience.

Just remember that the phantom image produced off-axis in stereo is only an approximation.

Sweet, it isn’t!

**How to create a wider listening area - NOT a wide sweet spot...**

When a wider listening area is desired, a trick the British introduced years ago may be useful. It’s called Intensity Stereophony (a big name for such a simple idea).

Basically, the idea is to crossfire the speakers in front of your seat, as opposed to a “normal installation,” where you might normally toe them in behind you. In other words, if you expected to have the speakers crossfire two feet behind your head, in this case, it might be two feet in front.

This results in a left side listener hearing increasingly more of the further right speaker’s direct radiation and less of the nearer left speaker’s. And vice versa for the right side listener. The practical effect is that images tend to be a bit more stationary for off-axis listeners. In general this technique works most effectively when the loudspeakers’ off-axis response is smoother than average.
Additionally, you may need to introduce more loudspeaker separation, to avoid the image “bunching up in the center.”

However, sitting off-center still exhibits the same time/phase frequency response roughness we discussed above. The “phantom center” image is simply wider and more forgiving for off-center listeners.

Finally, it must be noted that line source loudspeakers get progressively less loud as you get closer to them, so sometimes a line source speaker will help to provide a larger listening area, especially with Intensity Stereophony.

*Just don’t think of it as a wide sweet spot.* Above copy excerpted and edited from *Get Better Sound.*

You can read Jim’s work at his website. [www.getbettersound.com](http://www.getbettersound.com)
Audio reproduction was of great interest to me ever since, as a teenager, I ventured to Lafayette Radio and heard a marching band emanating from a JBL C34 mono loudspeaker and felt the drum. I immediately realized I could not afford such a ‘HiFi system’. I therefore purchased the least expensive full range 12” loudspeaker along with cabinet construction plans, a Scott amplifier and a Gerrard record player. I built a bass reflex cabinet and began enjoying the music. The sound was not terrible.

In 1973, after many iterations of my original sound system, I finally had the resources to buy my first “manufactured” Stereo System. After auditioning everything out there, I decided on AR LSTs powered by a Phase Linear 700B amplifier and Phase Linear 4000 preamp. Music sources were Thorens turntable, CD player, FM tuner, cassette and reel to reel tape. This system served me well until I retired (for the first time) in 2003.
I decided to explore improving my system and started an on-line search. I stumbled upon Siegfried
Linkwitz’s web site and found a wealth of information on his loudspeaker design concepts. He had developed a relatively diminutive, full range open baffle speaker design (ORION) that intrigued me. His speakers were DIY. You purchased the plans, circuit boards for an analog signal processor (ASP), and a parts list, enabling you to buy and build the system (soldering ability and a wood shop would be helpful).

This system was not in any showroom so one had to venture to CA to hear it in Siegfried’s home. Fortunately I have a cousin (also an audiophile) who lives in CA near Siegfried and he went to audition them. My cousin’s overwhelmingly positive reaction to the ORIONs convinced me as well, to build them. I was never disappointed.
After multiple iterations and upgrades, my ORION system sounds realistic, and is a joy to hear especially with classical, opera and jazz. This computer driven system includes:

Core i7 Samsung laptop running Windows 7 Pro and foobar2000 with KS

2.56 TB of SSD memory for music storage, files are 24/96 and 24/192

USB3 to S/PDIF to DAC

MSB Analog DAC with volume control

Linkwitz ASP (active X-over)

Two ATI 1807 amplifiers; TOTAL 14 - 180w amplifiers, one per driver. One dedicated 20 amp circuit for each 1807 amp and a third for everything else.

7 drivers per speaker (SEAS - 2 T, 1 MR, 2W (10” open baffle), Peerless - 2W (10” sealed enclosure))

Interconnects by Signal Cable; Speaker wire - 14ga by Radio Shack.

This system transports me to the concert hall - goose bumps and all!!!
Have a system you’d like Copper to share with the world? Send us pictures and text through email here.
Colorado State Flower

PARTING SHOT

Taken by Paul McGowan

With winter's white covering our mountainous state it's a distant memory of more verdant days. The summer's warmth sweetens the forest scent, especially in Aspen groves where our state's flower flourishes. The columbine comes in many colors, but this beauty is the classic. Fujichrome 4x5 Arca Swiss