

Rethinking Station Building: A conversation with Tim Duffy, K3LR

When building your station, it's usually good advice to pay attention to what the Big Guns are doing, and how we can learn from their techniques and innovations. But, the state of the art in station building is evolving fast; perhaps even those with high-performing stations would consider doing some things differently now. This time, we'll speak with Tim Duffy, K3LR, whose multi-multi station exploits are familiar to most NCJ readers. His comments do not necessarily reflect those of NCJ or of ARRL.

NCJ: This isn't a totally nostalgic exercise, but I wonder if you would think back for a moment about your contest station in Sharon, Pennsylvania, in the 1970s. What kind of equipment did you have at that station that remains relevant? What has fallen by the wayside?

K3LR: It's tough for me to buttonhole that. We're talking about Drake C Lines and SB-220 amplifiers. We're talking about paper logging. We're talking about 2 meter FM spotting networks, gamma-matched antennas, and no computer modeling programs.

NCJ: But you had concrete and steel.

K3LR: Right. The only thing that survived from that station that I still use today is the high voltage power supply that was once for a single 4-1000 that is now powering the single 8877 amplifier we use on 20 meters in our multi multi, and one of the Hy-Gain HyTowers that is now part of the eight HyTowers we use in a phased array on 80 meters. I guess the HyTower is really the only relevant thing left totally intact. I had all gamma-matched antennas. I had linear-loaded antennas. I wouldn't be caught dead with a gamma match or linear loading now.

NCJ: But in terms of categories of equipment, and not specific equipment, would you agree that a lot of the outdoor hardware, even if it's designed differently and its computer modeled, is still there?

K3LR: Back then I was adjusting VSWR at the feed points with a Palomar noise bridge (in the air with a bucket truck). There was only one single antenna for 20 meters there at 70 feet!

NCJ: What kinds of equipment are at the K3LR station today that the K3LR of 1979 would not even have heard of?

K3LR: Almost all of it. I mean, the WA-3FET OWA antenna was not around in 1979. The single-band amplifiers we didn't have. Computer logging we didn't have.

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Figure 1 — K3LR at the controls of his state-of-the-art contest station (at AF3P) in the late 1970s.

Computer modeled antennas. Everything but that one HyTower. I couldn't imagine a radio as fancy and as good as an Icom IC-7851. Back then I thought the C Line was to die for. And *CW Skimmer*?

NCJ: Sure. But the single-band amplifier, for example, there's nothing 2016-ish about that.

K3LR: No. When I operated at W3AU in 1977, he had single-band amplifiers. So that is not a new thing, but it is different than what I had in Sharon. And back in the 1970s Pat, you know, we ran 1000 W *dc* input. About 600 watts output.

NCJ: And in terms of the equipment design as well. There are probably plenty of *NCJ* readers who have never used anything but a transceiver.

K3LR: You know the C Line was cool in that it acted like a transceiver, but it certainly was not. It was a separate receiver/transmitter. You know that R4C receiver holds its own even today, with the Sherwood mods in it; 85 dB of dynamic range is certainly nothing to sneeze at. And if there was a supply of vacuum tubes it might be something we'd still be using. It had its own issues. It had to have DeOxit [a contact deoxidizing product — *Ed*] all the time. It was really good for its day. But the reliability and the performance of radios today is much better. I couldn't imagine at that time, in the late 1970s, that anything would be better than a C Line.

NCJ: Nothing was at the time, that's for sure. So, what kind of station would you build today if you started from scratch? Would you go with an SDR?

K3LR: If you look at some of the equipment — the Icom IC-7300 is an exciting radio in its price class. You get SDR performance with a front panel that is very conventional — ie, it has a big knob. So, the radio looks like more of a normal, non-SDR radio, but under the hood it has the SDR engine, which makes it a player. The past weekend I sat through the entire presentation that FlexRadio gave. They are all in on the SDR technology, obviously. They are part of several manufactures pushing the envelope on how we look at and enjoy receiver technology, especially — clean transmitters and clean receivers and a lot of flexibility aimed at an op who might start with one radio and then evolve into a SO2R situation. That's some pretty exciting stuff.

I expect the Japanese manufacturers — Yaesu, Icom and Kenwood — to come along with more adaptations toward the SO2R folks. A lot of this new cutting edge stuff is in a very fluid state. So the bugs are being worked out, and so forth. It's not a bed of roses. There's a lot of menu-level detail. You have to think differently about the way those radios operate. The Elecraft K3 is that way, too. You have to get used to the way the radio "talks" and every manufacture is different. But once you get used to it, everything's fine.

For me, given the complex ergonomics of a multi-multi station, the Icom radios are the perfect balance of performance and ease of use.

NCJ: But you can see the future.

K3LR: Yeah. I think as the sunspots continue on the downward slope, the ability to hear stuff on 160 meters and sort it out from all the noise — whether it's atmospheric or locally generated — is really a strong point of the whole SDR/DSP receiver chain. That, hopefully, will continue to get better.

NCJ: Sunspots are going lower, and it's time to be thinking about the low bands certainly. Let me pick your brain a bit to see what thoughts you might share with *NCJ* readers on projects and equipment they should know about.

K3LR: There are a lot of *NCJ* readers in deed-restricted neighborhoods, where it takes a lot of creativity to even get on

the air. So, you're going to see more emphasis on some of these smaller antennas that allow operators at least to get on and work some stations. But it's going to be very tough sledding on 40, 80, and 160 for DXing.

But for those who do have a bit more real estate, the secret now is the short vertical array. It's not so much the Beverages. In a smaller footprint, it can give you a lot of directivity and a lot of performance. They're not as inexpensive as a Beverage antenna, which is still a great receive antenna, but these short vertical arrays — and there's a whole range of them out there, produced by different folks, and you can homebrew them for that matter — they're game changers when it comes to low-band receiving capability.

NCJ: Speaking of the future, and designing a station for the future, especially since we were just discussing your 8877 single-band amplifiers — is this finally the year where we can see the end of these vacuum tube amplifiers? These solid-state amplifiers, are they getting there yet? Or are they still not quite ready for prime time?

K3LR: You know, I'm looking very closely at what is going on with the evolution of solid-state amplifiers, and I think we're getting close. But I don't think we're there yet. Maybe it's only another year or two away.

I would love to get away from the single 8877 tube amplifiers we've got, if I could convince myself that solid-state amps are clean enough in terms of in-band noise. I can take care of the harmonics to the other bands, but the in-band noise performance is still not as good as the 8877 for the multi-multi, in-band operations that we do. But I hope it's not very far away. Solid state devices will continue to evolve and get cleaner, and I would expect that before 2020 we'll have all solid-state amps at K3LR.

NCJ: Thinking about this station of the future that you might hypothetically build if you were to start fresh today — a contest station, of course — there's been so much innovation with station control gadgetry. I am wondering, for example, if you were building today, would you lay copper wire in the ground to your antenna switches, out to your towers?

K3LR: That's an interesting deal. When you look at vendors like Green Heron and Hi-Z, which have wireless accessories for their products, you can make a case that you should control that stuff wirelessly, and I would give serious consideration to that. However, it is one of these "trust-but-verify" situations. I want to insure that wireless controls work well in intense HF/RF environments. I would be careful to ask around of others who have made this stuff work. Or try some things and then test the heck out of it to make sure it would stand up in your situation.

NCJ: Just seeing some of the people



Figure 2 — A short vertical receive array at K3LR. This array is actually for 10 meters (which fits well into a photo).

building this stuff, though, they seem to be pretty savvy. Another thing comes to mind here as well. It seems like remoting your station has really gone mainstream. There are off-the-shelf products. From a design point of view, this seems like it would be part of the station of the future, or really the station of the present, does it not?

K3LR: It does. I would think that, as time goes on, we're going to see a lot more emphasis on remote operation, whether it's in a time share mode, or remote installations. The technology is finally easy enough and within reach of enough people to actually make it work.

An interview I would think would be fascinating to read would be with N5DX, who — I believe it was in WW CW last year — maybe was USA all band high score operating from N2QV [this edition of *NCJ* features a profile of Kevin, N5DX — *Ed*].

NCJ: Yes, but he was physically there during the contest. You are thinking of his high-claimed ARRL CW score from the same station, when he was remote operating, which put him in second.

K3LR: And he almost won. It seems to me that that would be a fascinating interview. You have a guy who travels up in November, and he's there in person. And he decides, all right, let's just see how good I am, I have a mental picture in my mind of all the things that are up there. I'm going to operate the whole thing, including SO2R work, remotely. That, to me says, "Wow!" — that a guy can be a thousand miles away from the station, make all the right moves, and beat people.

NCJ: I am thinking in terms of station design. If you are building your new station from the ground up and you have that in mind, that brings up some decisions about your hardware — about the kind of rotator controller you're going to have, your antenna switching systems, to be able to make full use of that.

K3LR: Yes. I really think if you are building from the ground up that there is a different parts list, a different slant that you put

on the items you purchase, because you have a clear goal in mind. You've got to be able to control everything remotely. A lot of the SO2R technology, it would seem to me, is not as friendly over a remote interface. It's tough enough to remotely control a radio, let alone all the ancillary stuff — two audio chains back, two radios worth of frequency control information. Then layer in receive antennas, multiple antennas on a band, stacking switching, any number of rotators. Think about the overhead to go into the remote game right out of the gate, and you want to be competitive.

Obviously, the whole game is to take advantage of a location. Whether it be that you are limited, say, to an apartment dwelling. Most of those trying to be competitive at remote DX contesting from the USA might want to be "east".

NCJ: Can you share some insights with us about some innovations and gadgets you might know about? I see a few gadgets on my radar screen, both in terms of antennas and switching equipment. The microprocessor controlled antenna switches, for example. What's out there that catches your eye?

K3LR: I'll tell you that one of the things out there that I am really watching is this whole business of feed line radiation and interaction and noise pickup. I've become very inquisitive and intrigued about using common-mode chokes to knock down feed line interaction that's either through antennas or just picking up noise. Or just isolation period. We've been doing a lot of research when it comes to LMR-type cables that have two shields — a foil shield as well as a braid shield with the correct connectors. What does that really mean in terms of keeping noise out of the feed lines? And how about when feedlines run next to each other? How much cross talk is there between standard RG-213 or RG-8 feed lines? How do tower legs place into this?

So, choke technology is something that interests me. I spent some time working with Bill Hider, N3RR, in the last few months, and he has some fascinating ideas about improving these short vertical, active receiving arrays using very high value common mode chokes, to make sure that the system feed lines are absolutely invisible. I think that technology is absolutely fascinating, but there are other things in the noise reduction area, whether they be in the way of speakers or headphones or some of these add-on items, from companies like Phonema and BHI. I think that is fascinating technology. As well as on the other end of it, active noise cancellers that actually phase two antennas together to minimize noise sources. I think some of that technology continues to evolve, as well as some innovative ways of taking out power line noise.

Getting back to a demonstration I saw last weekend. Noise blanker technology —

I saw a video of how one SDR/DSP noise blanker can work — I've got to tell you, I was thoroughly impressed. Each generation — not even generation — each time a new SDR/DSP radio comes out, and I think they have a better shot at handling it (writing good software code) — that whole noise-blanking thing gets better and better and better. I spend a lot of time trying to control my noise environment by working on power pole issues, getting wall warts out of the picture, but the radios get better too.

NCJ: That fits in very well with what we were talking about earlier in terms of the increasing importance of the low bands in the coming years. My casual experience as mostly an appliance operator-contester is that you can imitate others and be pretty competitive on the high bands by just putting up the Yagis at the right heights and designing them right. But low-band receiving is really what separates those who have the technological savvy to bring their station's performance up to a level where it is the W8JIs of the world who are working stuff that the N9RVs of the world just can't hear.

K3LR: That stuff is hard. You know it, and I know it. There is some off-the-shelf technology. But you really need to get down in the weeds to make it work. Let's face it, guys like W8JI have spent their lives trying to figure this stuff out, and they've done a really good job. Some of it ends up as products that we all have access to. Short verticals — I would say that W8JI and a few government agencies were on the leading edge of that and really did a lot of pioneering work there. And add to that people such as K7TJR, W1FV, NO3M, W9RE, N3RR — all have really gone in and added some of their own tweaks along the way and have helped turn these ideas into products. That being said, you just can't buy an off-the-shelf 8-circle or 9-circle or 4-square array and within a few hours put it all together and — *poof!* — you can hear 100 W Europeans on 160. There's a whole lot more that goes into it. You have to pay attention to the "rules" and not take any short cuts.

Some of the other technology is the Top Beam (Horizontal Waller Flag) stuff that N4IS is doing. I've got one of those up now, and I'm still trying to make it work perfectly. It's a whole different beast. You might say its off-the-shelf stuff, and I'd say yes, but you install it and learn that every installation is a little bit different. At K9UWA the Top Beam is shared with a 10 meter beam, so there's a little compromise there. You are talking about an antenna that has minus 40 dB of gain, but you put a 40 dB preamp on it to bring everything back to zero. And that's a whole 'nother can of worms.

So, there is BIG opportunity on the low bands to be able to hear better. Anyone can put up an antenna and work the DR1As of the world or the ON4UNs of the world who have very efficient transmit antennas.

The Holy Grail is working that second and third-tier that hear us fine — they hear our 1500 W signals just fine. But they're running compromise antennas with 100 W or less, and they want to know why we can't hear them. They're there, we just have to figure out the receive antennas system and noise-reduction technology to get there. And that stuff is harder to do.

Fortunately, most of single ops or even the multi-singles at least have the luxury of going to the bands at the various times when there is the peak amount of activity and the signals are the strongest. I don't want someone to be discouraged that you have to have an 8-circle array to be in the game on 80 and 160. That's certainly not the case. The VE3DO loop is testament to that. There's an antenna that costs about \$50 to construct, and it provides excellent receive capability on the low bands. So don't worry that you have to spend a pile of money to hear DX on the low bands.

NCJ: Well, we're going to be going to a different spot for Hamvention this year, and of course, a lot of people especially got to see the new toys and the new gizmos. How do you see things shaping up when we go to Dayton in 2017?

K3LR: I've got a lot of experience over the years with going to Dayton. And Hara Arena is now a memory — not quite a distant memory. I think that the first year at the Greene County Fairgrounds for Hamvention 2017 is going to be different; it's going to be cleaner and a whole lot healthier around there. But it's not going to be Hara, so comparisons to Hara are going to be kind of unfair. Especially for the first few years, we have to give the Hamvention guys a lot of encouragement as they go through this change. They had the same location (Hara) for more than 50 years. It's not going to be perfect out of the box. One thing that I do know from working with the DARA guys, is that they are working their butts off. They're doing the best job possible. They're all volunteers. They're doing this because they love it.

I think we need to cut them a break, give them some encouragement, and make sure we show up in droves next May — come to Contest University on Thursday and hang out in the suites like we always have, and go out to Hamvention and see all the new gear. And go out to the flea market, which won't be in that terrible parking lot, it will be on grass. So, let's hope for good weather. And go out and support the event, and see our friends. That's always been the important part of Hamvention is to see our friends. Radio has always been the vehicle for the most amazing friendships in the world, so let's not lose sight of that.

NCJ: How true. And let's end on that note. Thanks so much for sharing your insights, Tim.

K3LR: You're very welcome.

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