



Publication of the Northern California Contest Club



#607 – February 2023

## NCCC – 52 years of contesting excellence

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**NCCC ZOOM MEETINGS**  
<https://nccc.cc/meetings.html>

#### **Next Meeting**

Tuesday 7 Feb  
Open Chat 6 PM  
Meeting: 6:30 PM – 8:30 PM

*“Operating WPX RTTY”  
Ed, W0YK*

### President's Report WD6T

#### **28 Days to the Finish Line**



February is upon us and that means the race-to-the-finish for the KB contest, with every single weekend a KB contest!

The month kicks off on Feb. 5 with the North American CW Sprint. If you've never tried this contest, it's a blast, but you need to make sure you're clear about the exchange order and the QSY rule; check out the published rules. Or if you'd rather be a spectator, check out the online scoreboard and watch the race. NCCC has some of the hottest Sprint operators around. The URL is: [contestonlinescore.com](http://contestonlinescore.com)

The following weekend (Feb 12) is the CQ WPX RTTY, a 48-hour extravaganza (but you only need to operate 30 as a SO). This is one of the biggest RTTY contests of the year and is one third of the triple-header California WPX plaque (RTTY/CW/Phone), which NCCC sponsors. K6XX was the proud winner in 2022, who is going to win in 2023? Be sure to attend our February Zoom meeting which features Ed, W0YK, giving us tips on operating WPX RTTY. The meeting is early in the month so as to precede the contest.

Next comes ARRL DX CW (Feb 18), aka the "US/VE QSO Party" where the world works us, but we don't work each other. Keep in mind that JA's have been great on 10 m lately so that band has the potential for some JA volume this year for the first time in quite a while. DX send their power,



often with ambiguous cut numbers. With QSB and flutter, we get to differentiate "ATT" (100 watts) from "ATTT" (1000 watts) ... unless the latter is run together, in which case it's "1"... i.e. ONE WATT! Or maybe you'll hear "ETT" for 100 watts. Or is that "AT" for 10 watts?? And every now and then someone sends a "W" with their power, such as "ETT W". Huh?? Then there's the ever popular "NN", for 99 watts, or "NNN" for 999; they must have very accurate watt meters! Of course, "K" is also very popular and much preferable to "ATTT" or "1000" (yawn.) In Europe, "K" has a special meaning ... apparently derived from SMS texting ... it means "OK", as in "OK, crank it up to four or five thousand!" Then there are the ones sending "5." As K6XX would say about them, "more power to you!"

Finally, we close out the month... and the 2022-2023 KB contest... with the NAQP Winter RTTY contest on Feb. 26. 100w only. Again, 10m is your friend, as we have an advantage over the East coast on that band, our skip zone is rather empty and our signal lands squarely in the population centers of the US whereas their signals land in sparsely populated regions. This is also a great contest to try 2BSIQ, if you have separate antennas for a couple of bands (such as 20 vs. 40), and with the limit of 100w, you can often get away without bandpass filters. If the phone and CW contests are any indication, the RTTY contest should be hopping.

And for the whole month of February is the XXXV'th NS CW Sprint Ladder starting on Feb. 3 and ending on March 10, where your four best scores count towards the final standings in a number of categories, including one for NCCC members. You may also want to get on for the NS RTTY Sprint which starts 45 minutes before each NS CW Sprint.

Speaking of the KB contest, where do you stand? As of this writing, it looks like KK6PXT has a solid lead in the Bronze category, WU6P is ahead in Silver, N6KT has all but clinched the Gold, and KA6BIM is way out in front in Platinum. Poor WD6T seems to be perpetually in second place, unless AJ6V who is close behind manages to elbow his way ahead of him. So watch the horses as they approach the finish line by visiting [https://nccc.cc/KBA\\_Rankings\\_Brackets.html](https://nccc.cc/KBA_Rankings_Brackets.html)

I Can't end this column without reiterating the dire fact that in April, my term as President expires and is non-renewable according to the by-laws. Please contact me if you are interested in this position. It can be very rewarding and a chance to give back to the club.

### **About NCCC**

#### **Officers and Directors, 2022-2023 Contest Season**

President: David Jaffe, [WD6T](#)  
 Vice-President/Contest Chairman: Andy Faber, [AE6Y](#)  
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 Past President: Jack Brindle, [W6FB](#)  
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 Director: Ed Radlo, [AJ6V](#)

#### **Volunteers**

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 California QSO Party Chair: Dean Wood, [N6DE](#)  
 QSL Mgr ([K6ZM](#)): vacant  
 QSL Mgr ([K6CQP/N6CQP/W6CQP](#)): Ed Muns [W0YX](#)  
 NAQP Teams: Fred Jensen, [K6DGW](#)  
 NA CW Sprint Teams: Bob Vallio, [W6RGG](#)  
 NCCC Email Reflector Admin: Phil Verinsky, [W6PK](#)  
 Wrkd All CA Counties Award: Fred Jensen, [K6DGW](#)

#### **NCCC Thursday Night Contesting**

NCCC Sprint: Tom Hutton, [N3ZZ](#)  
 NS CW Ladder: Bill Haddon, [N6ZFO](#)  
 NS RTTY Sprint/Ladder: Ed Radlo, [AJ6V](#)

#### **Communications**

Webmaster: John Miller, [K6MM](#)  
 Webinars: Bill Fehring, [W9KKN](#)  
 Membership: Gary Johnson, [NA6O](#)/Ian Parker, [W6TCP](#)

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## VP/CC – Andy, AE6Y

### Some Reflections on Operating in the NAQPs

Last month I mentioned a number of the attractions of the NAQP contests. Having operated in January in both the CW and SSB versions, I thought I'd annotate last month's ideas with comments based on this recent experience. I continue to enjoy the contests and to think that they are great Club/Team events.

This year, the strange propagation and the skills of some of the 2BSIQ operators meant that our CW teams didn't place highly. In fact, N2IC by himself outscored each of our teams! He managed to make 2442 claimed contacts for 752k points. Meanwhile, our Team #1 achieved more normal California results -- leading to a reasonable CA total team score of 733k. I don't think anything like this has happened before.

Anyway, in brackets below are my annotations from last month's list of good features of NAQP:

- 1) *They are low power only. This allows you to turn off the amp (or compete on a level playing field if you don't have one) and also reduces the bedlam caused by lots of high power stations competing for contacts.*

[In fact, that still is an advantage. However, while LP works reasonably well on CW, for most of us it makes SSB pretty tough. It certainly cuts down on QRM and high-power splatter on phone, but I felt that an awful lot of guys CQ'd in my face on phone. There are strange times during the day when there seems almost to be one-way propagation (early in the afternoon on 20 and early in the evening on 40). There were lots of stations I could hear clearly on the East Coast who completely ignored me; this happens for a while both modes but is definitely worse on SSB.]

- 2) *They use all six contest bands 160-10. Because the exchange is invariant, just name and state, if you've worked someone on the high bands, you can also make a contact on 80 or 160 even if you can barely hear them enough to make out the call.*

[This is very true. After working guys on high bands, it gets easier to deal with the weaker signals on the low bands, as you already know their exchange and just have to hear enough to divine the callsign.

Managing your time off strategy and the amount of time allotted to each band is a critical part of NAQP strategy. I had decided for SSB that I'd spend the majority of the contest, say 7 hours or more on 10-15-20, on the assumption that I'd do much better on those bands. That turned out to be wise, as 40 was tough. I could get almost no runs on that band, though I did end up with 40 some mults through second radio work and searching the band for mults. 80 and 160 were virtually non-productive for Qs, and only provided a few mults. 160 was simply horrible. In fact, I was stunned to find out that my puny mult total of five on 160 was exactly the same number that the multi guys worked at NR60. Normally they are hearing many mults that I can't (having no RX antennas at all, and just using my inverted vee for TX and RX). On 80, I called W7WA and he asked me to move to 160. This was the only occasion on which anyone requested a move. We did make the 160 contact, but I have to say that W7WA, who normally has a whopper of a signal on all bands including 160, was absolutely ESP – and I'm sure I was the same at his end.

Of course, this time strategy has to depend on your station and QTH. It was very interesting to read the



3830 comments from stations in other parts of the country. For example, 10 was long for almost all contesters. I noted that I worked no 7s on 10 except for W7RN (thanks, Rich!). And East Coasters similarly couldn't work many of the local mults that make 160 and 80 much more productive for them. The net result was that while from CA, hanging out on 10 and 15 as long as possible was a good strategy, for East Coasters going down to 20 and then to the low bands after getting a reasonable number of mults on 10 and 15 was more fruitful.]

- 3) *They are very good SO2R practice. It's fun to run on one band and look for Qs and mults on another.*

[This is very true, and is the key for my station to maximizing my score by working mults on the second radio. My basic strategy, which I think is the optimum one for a medium-gun station, is to always be running on one radio and searching for mults and contacts on the second radio. This doesn't always work. For example, in prior years when 15 or 10 were not open or productive, and everyone was simply shoehorned into 20, then the second radio simply wasn't useful. But this year there were almost always two bands available. Particularly when both 10 and 15 were open, I'd alternate which band was the run band, so I could look for mults on the other one. By adopting this strategy, I generally am able to get significantly more mults in the log than a non-SO2R station with roughly the same ability to run. For example, in the SSB contest, 20 was not runnable early in the afternoon, but it was possible to call stronger stations for a quick contact. So by the time I was ready to run on 20, I already had 20 mults in the log that I had accumulated while running on 10 or 15.

The second radio is also helpful for moving mults. It's very useful to look for a clear frequency on the new band while running, so that you can pick a good frequency to ask the station to move to. In the SSB contest, I had the unusual experience of moving a mult from the second radio to the first one. Generally, it isn't considered couth to ask a station that is CQ'ing to move to another band (though you can ask a multi if they are active on another band). However, I had worked Steve, KL7SB, early in the contest on 15. Then about 4 ½ hours into the contest, I was running on 10 and heard him CQ'ing on 15 on the second radio. After noting that he seemed not to be getting a pileup, I waited till no one was calling, then called myself and asked for a move to 10. He seemed surprised, but agreed, and we made a very quick Q on 10. This sort of thing is much easier to arrange on phone than on CW, naturally.

One feature of many contests that has never failed to amaze me is that when perusing 3830 reports, there will invariably be stations with high QSO totals that I never worked, or maybe even never heard. In NAQP phone in this category was V31XX, who made 1783 contacts on five bands, finishing second in the contest behind N6KT at W7RN. I worked several other Caribbean stations and was constantly tuning the bands on the second radio looking for guys like that, but somehow never heard him once. Of course, had I been in the assisted category, I'm sure he would have been easy to find work, but somehow he eluded me completely. Same for ZF2PG, who made over 1100 Qs.]

- 4) *They are also good for practicing moving mults, since mults count once per band. This is particularly easy on phone due to the naturalness of phone operation. And because it's low power, for most guys qsy'ing is easy as long as they have an antenna for both bands. One year I tied aggressively moving mults in the phone contest. This does have its risks. As Woody Hayes famously said about the forward pass in football, there are three possible results and two of them are bad. The same is true for moving mults, where the bad results can include losing your run frequency and wasting time on an unsuccessful move.*



*Furthermore, even successful moves may not be helpful in the sense that you work the same mult later from another station on the second band. But it is very satisfying to both stations when the move results in a successful contact on the second band. And it may even be possible to do a double move to two new bands. And after moving about two dozen stations in that contest, I calculated that the net improvement in score was about 5%. That may or may not be worth it depending on your level of seriousness, but it can be very satisfying.*

[I made several successful moves in the contest, mostly while running on 10 and asking for a move to 15. And, as discussed above, there was also my unusual move of KL7SB from his run frequency. In NAQP, stations are not surprised to be asked to move, particularly those in rare sections. Because the contest is low power, moves often can be quite easy and quick, since no amp retuning is necessary. And generally, the bands aren't so crowded that you are likely to lose a run frequency by deserting it for a short while for the move. Again an advantage of SO2R is that you can monitor your original run frequency on one radio while calling the moving station on the other; this allows you to jump back on the run frequency to be able to tell a station suddenly appearing on it that the frequency is in use and would they please QSY.]

- 5) *The contest is friendly, particularly the phone version where it is common to greet and be greeted by name, since that is part of the exchange. This makes it seem less of cut-throat contest than some others.*

[No additional comment is needed. This is very true. I was pleased to make contact with a friend in Oregon whom I had had trouble reaching by email; we were able to have a brief chat during the SSB contest, and I was pleased to learn he was OK.]

- 6) *So sign up for a team with Skip and enjoy the NAQPs.*

[As mentioned above, we did get sign-ups, though many of the Club's usual contributors sat these contests out. We did creditably on CW, though we finished mid-pack (and as stated above, N2IC beat us all by himself on CW). On SSB, fueled by Rich's contest-winning score from Tom, K5RC's superstation, W7RN, we either won or placed second, which is pretty impressive for a regional club. Many teams have ringers from expeditions or other parts of the country, so I always judge our efforts solely against other geographically-confined groups.]

### Upcoming Contests

Feb. 5 NCJ Sprint CW

Feb. 11-12 CQP WPX RTTY

Feb. 18-19 ARRL DX CW

Feb. 24-26 CQ 160m SSB

Feb. 25-26 NAQP RTTY

Mar. 4-5 ARRL DX Phone

Mar. 25-26 CQ WPX Phone (A Focus Contest!)



## Michael Shapiro WA6O SK



Sadly, we report the passing of Mike, WA6O, an Amateur Radio legend known to many in NCCC. As a way to memorialize Mike in the JUG archives, here are several recollections of those who knew him well.

**Dean, N6DE:** “W1SRD nailed it with the phrase “Iron Spirit” to describe Mike WA6O. During the days of the NCCC Sweepstakes HMO efforts, Mike was on the air for both CW and SSB weekends. I believe he operated split-station efforts from the N6XG and K6TD stations for years. While packing for a contest expedition (CQWW CW @ HC8N?), he accidentally slammed his fingers in his luggage while closing it. Most would have sought immediate medical attention and canceled the trip, Mike still went. I believe Mike used the PED CW Pile-up Trainer practically every day, analogous to Stephen Curry deciding to practice shooting 3's for an extra hour per day. NCCC meetings were always better when you got to shake Mike's hand and say 'Hi' to him. They won't be the same without him.”



**Alan, AD6E:** Mike told me about his participation in the almost daily protests against the Soviet government. He referred to himself as one of the “refuse-nicks” who refused to work (ie: strike) plus walking the streets with protest groups and getting arrested. He said the police were with the protesters so after being arrested, they would spend the night in jail playing cards, drinking, smoking with the police, and then let go in the morning only to go on another protest.

**Tom, NW6P:** Mike WA6O was a fabulous person and great CW operator. I met him several years ago at a NCCC meeting. He had a Russian accent so I greeted him in Russian. I knew some Russian from high school. I had a copy of the Cyrillic code and I wanted to speak to Russians in their language using CW. Mike came to my station one day and I demonstrated my Cyrillic CW. He was impressed. One night somebody called me who was speaking Russian. I responded in English and said I don't speak Russian. He said, “Who is operating NW6P?” I said that was me. He said, “But your Russian is very good.” I said, “I only know Russian in Cyrillic code.” I told him I've been doing it for 40 years but only using the code.

See <http://hamgallery.com/Tribute/WA6O/> for many photos and tributes, thanks to K8CX/N6TV



## Awards and Achievements

### Possible NAQP Record!

Tom, K5RC, reports that Rich, N6KT, operating Single Op Unassisted Low Power as W7RN at the Comstock Memorial Station may have bested the all-time record in the SSB North American QSO Party last month, log checking will tell the tale.



Call: **W7RN**  
 Operator(s): N6KT  
 Station: W7RN  
 Class: **Single Op LP**  
 QTH: NV  
 Operating Time (hrs): 10  
 Location: USA  
 OpMode: SO2R

Summary: [Compare Scores](#)

Band	QSOs	Mults
160:	9	5
80:	110	42
40:	213	55
20:	432	63
15:	193	51
10:	817	57
<b>Total:</b>	<b>1774</b>	<b>273</b>

Total Score **484,302**

Braving the results of a series of storms that battered California and left four feet of snow at the CMS, Rich operated the on-site SO2R position and racked up 1,774 QSO's on all six bands with 273 mults for an unaudited score of 484,302 about 9% over the 444,876 record set by N6MJ at W6KP in 2004. The 10 cm SFI was holding fairly constant in the 210 with Kp bouncing between 1 and 2 throughout the contest, and Rich's 10 meter results certainly reflect that! Cycle 25 is shaping up to be better than all the predictions.

#### NAQP Scoring Records

View scoring records for: **NAQP SSB**

Scoring records for the NAQP SSB contest through Aug 2022 are:

Overall Category	Month	Call Sign	Score	QTH	Year	Operators
Single Operator, Low Power	Jan	N6MJ	444,876	CA	2004	@W6KP
	Aug	NN1C	305,200	MA	2020	
Single Operator, QRP	Jan	K5TR	153,400	TX	2014	
	Aug	KE3X	87,120	MD	2014	@N3HBX
Single Operator Assisted, Low Power	Jan	K6LL	259,120	AZ	2022	
	Aug	K9CT	158,769	IL	2022	
Single Operator Assisted, QRP	Jan	WC7S	11,692	WY	2022	
	Aug	N5YT	17,248	MS	2022	
Multioperator, Two Transmitter	Jan	NX5M	941,173	TX	2012	KJ5T,KU5B,N5XJ,NX5M
	Aug	W5WMU	523,980	LA	2009	KI5XP,W5WMU

Rich commented that the low bands were “somewhat” of a slog which is clear from his results. The 10M QSO total will likely stand as a benchmark for some time.

The CMS ([www.w7rn.com](http://www.w7rn.com)) was constructed as a major contest station over the last 15 or so years and is located about 5 miles south of Virginia City NV at about 6,500 ft AMSL. In addition to the 3 K3s transceivers at the on-site position, the station supports 3 remote hosts.

The NAQP's were originated during the period that Tom, still living in Texas, was editor of the National Contest Journal and they provide two contest sets each year on 3 different modes. From the CMS, Jeff, WK6I regularly posts record-breaking scores in RTTY contests, Bob, N6TV, does likewise in the ARRL CW Sweepstakes, and Matt, WX5S, has done similarly in the ARRL SSB Sweepstakes.

***News Flash!* Treasurer David, W6DMW, is now KO6M!**



## W1AW/6

[Ed. Note: From ARRL, lightly edited for space. Designated state weeks and other info can be found at [www.arrl.org/volunteers-on-the-air](http://www.arrl.org/volunteers-on-the-air) CA: 2/15 and 10/11 -- NV: 4/19 and 9/27]

As a part of the , **Year of the Volunteer celebration** W1AW/x will be operating from all corners of land. ARRL members in each state/territory will be approved to operate during two separate weeks using the call sign W1AW/x where x denotes 10 call areas, KL, KH0/2/6/7/8, KP2/3/4 W1AW/6 week is Feb 15, through Feb 21. Each state coordinator will approve time, band, and mode slots throughout the week.

For California, first email the CA VOTA Coordinator, John Litz, NZ6Q, at [nz6q@arrl.org](mailto:nz6q@arrl.org) or call at 209-687-0774. Once approved, you may select any available one-hour operating time slot for the band and mode (SSB, CW, Digital) of your choice. Use an approved logging program to create an ADIF file for emailing to the coordinator. All approved W1AW/x operators must observe all FCC regulations, including operating only on frequencies allocated to their license class and at permitted power levels.

By a toss of the 2023 Toys for Tots US Marine Corp coin, it was decided that Northern CA would primarily sign-up to cover Wed, Fri, and Sun. Southern CA would primarily cover Thu., Sat and, Mon. Tue is open for both.

Minimum station requirements:

100W + yagi or hexbeam or better on 20-15-10M

100W (or more up to Legal Limit) + good vertical or dipole antenna on 80-40M

### Portable W1AW Rules

- Each operator must follow the rules for their own license class.
- Operators may operate anywhere in the state.
- ARRL members that contact the portable W1AW stations will receive 5 points in the VOTA event.
- Each band/mode combination may be activated simultaneously.
- The state weekly assignments in the W1AW/ Schedule area at [www.arrl.org/volunteers-on-the-air](http://www.arrl.org/volunteers-on-the-air) State operations start at 0000z and end at 2359z.
- Operations are not allowed on the 12 M, 17 M, 30 M, 60 M, 630 M, or 2190 M bands.
- Consolidate all logs into one ADIF file and send to the state coordinator to be uploaded to LoTW.
- Each 1 hr time period has three separate “slots” ... CW, Phone, and Digital.
- One operator per time slot band/mode at the same time.
- Use only the band and mode you have selected for the time period you requested. You may request multiple slots throughout the week. Please limit yourself to no more than 4 hours in a row on any band and mode. You are encouraged to select multiple modes (i.e... 2 hours on CW, 2 hours on SSB, 2 hours on RTTY on any band) to give others a chance to participate.
- Check the sign-up sheet often & during the event. If you're operating 20M FT8 for two hours, but the next hour is open and you want to continue, add your call into that 3rd hour and continue

Contact the California State Coordinator John Litz at [nz6q@arrl.org](mailto:nz6q@arrl.org) or by phone 209-687-0774.for information.





## Tube of the Month

Norm, N6JV

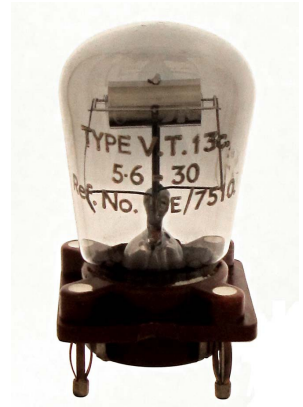
Visit the Tube Museum at [n6jv.com](http://n6jv.com)

### VT13C

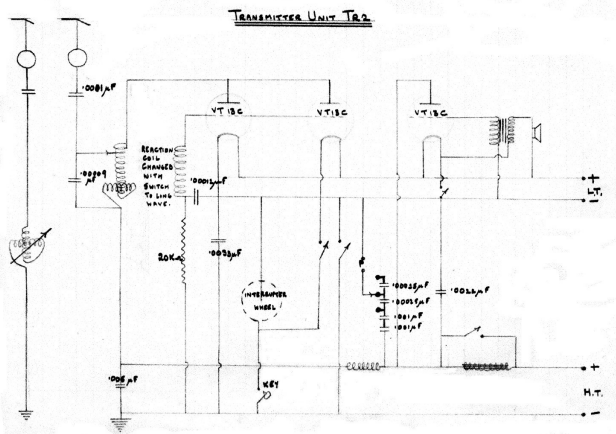


When we see a tube with a VT prefix, it's often assumed that it's a military tube designation for a "Vacuum Tube". Early British military tubes also used the same VT prefix but it means "Valve Transmitting". After WWI, the new Royal Air Force (RAF) continued the development of wireless for aircraft addressing the problems they had encountered during the war when they were the Royal Flying Corps.

WWI aircraft were made of wood and canvas that had been treated with a liquid "dope" that stretched and stiffened the fabric and made it more waterproof. Many of the components of a biplane were especially flammable. The engines on these planes produced a lot of gas fumes so the planes were flying fire bombs. Early spotter planes were equipped with spark transmitters. Even the sparks from the key were dangerous. The large keys were sometimes even mounted to the outside of the fuselage where the fumes would be low. Wet vacuum tubes were a problem as their bases shorted out as some of these tubes used up to 1500 volts on the plates. In 1922, the RAF developed the L4 tube base that was large but had long breakdown paths. One of the first tubes to use the new base was the [VT13c](#).



The VT13c is a 30-watt triode with a mu of 35. The filament uses 5.6 volts at 1.45 amps and up to 1500 volts on the plate. The maximum frequency is 6 MHz. The first transmitter I can find that used the VT13c, was the RAF TR2 which used a VT13c as a modulator and a pair of the tubes as a Hartley oscillator. The 1923 transmitter operated AM, CW and ICW. The AM used Heising modulation and the ICW (Interrupted CW) was generated with a motor driven wheel to modulate the keying of the transmitter. Early transmitters needed to be able to send modulated CW as the simple tube and crystal detectors in common use then, couldn't detect regular CW.



[Ed. Note: Norm also supplied a schematic of the RAF TR2 CW, ICW, and AM transmitter using 3 VT13C tubes. It's sort of quaint, probably hand drawn by a draftsman. You may want to study it carefully, a part of it will be reprised in this issue]



## Antenna Systems For The Little Gun Station

**Jim Brown, K9YC**

### Part 3

*[Ed Note: Figures for Part 3 can be found at the end of this edition starting on page 20, allowing a second window to be opened with them and reducing the amount of scrolling]*

#### Figure of Merit for Height of Horizontal Dipoles



A careful study of Fig 25 suggests that another view of the data might be worthwhile. Fig 32 expands the data set of Fig 25 to 110 Ft. Fig 33 provides another very useful view of the same data. I took data points from each antenna height curve for vertical elevations of 5°, 10°, 15°, and 20°, entered them in a Quattro Pro spreadsheet, and plotted it to produce Fig 33. The slopes of these curves, which are essentially parallel to each other below about 80 ft, allows us to define a “figure of merit” for the height of a horizontal 40M antenna for low radiation angles.

**What is Height Worth On 40M?** Fig 33 clearly shows that, for all angles below about 25 degrees, 10 ft of added height is worth about 1.9 dB on 40M between 20 ft and 70 ft. The advantage of additional height is much less above 70 ft ( $\lambda/2$ ). Raising a 40M dipole from 33 ft ( $\lambda/4$ ) to 67 ft ( $\lambda/2$ ) is worth about 6 dB at vertical angles below about 20 degrees; going up to 120 ft ( $.433\lambda$ ) is good for another 3 dB for radiation angles below about 15 degrees.

**What is Height Worth on 80M?** Figs 34-36 show the corresponding results for 80M. Below a height of about 133 ft ( $\lambda/2$ ), every 10 ft of mounting height increases signal strength by about 0.9 dB at elevation angles below at least 30°. A dipole at 133 ft ( $\lambda/2$ ) is nearly 6 dB louder at low angles than one at 67 ft ( $\lambda/4$ ), and the 67 ft high dipole is 3 dB louder than it would be at 33 ft ( $\lambda/8$ ).

**Debunking The NVIS Myth** Fig 36 clearly shows that you don’t need a ground-hugging dipole for NVIS (high-angle paths to work nearby stations). Indeed, the optimum height for NVIS is  $0.22\lambda$  (60 ft on 80M), and an antenna at  $0.33\lambda$  (90 ft on 80), is only 1 dB less than optimum. And, as we’ve already learned, the higher antenna is 2.5 dB louder at the lower angles needed to work distant stations. Even when the antenna is raised to 120 ft, high angle radiation is only 3 dB below maximum, while the 120 ft antenna is 3 dB louder at low angles than the 90 ft antenna! On 40M, 30 ft is near optimum for NVIS, 45 ft is only 1 dB down, and 60 ft is only 3 dB below optimum. Table 1 summarizes the result by band:

<b>Table 1 – NVIS Performance @ Height</b>			
<b>Band (m)</b>	<b>Max (ft)</b>	<b>-1 dB (ft)</b>	<b>-3 dB (ft)</b>
160	120	180	240
80	60	90	120
40	30	45	60



**Inverse Square Law** Fig 37 shows relative path loss vs distance. Stations we're likely to work by NVIS are in the range of a few hundred miles or less; Fig 37 shows that stations around LAX are 8 dB closer than those in Seattle or Phoenix, and 14 dB closer than those around Chicago. For contesting and DX chasing, we want maximum gain to those distant locations, because inverse square law helps us work the closer ones; the design choices I'll make with horizontal antennas for 40M and 80M will be to get them as high as possible, compromising NVIS performance for maximum DX performance.

**Height Of Horizontal 20M Antennas** Figs 38-41 show the effect of mounting height on a typical 3-el 20M Yagi. This particular design is taken from the ARRL Antenna Book.

**The Value of Height on 20M** Fig 41 shows that for a 20M Yagi at low angles, every 5 ft of mounting height below about 70 ft is good for about 0.9 dB; we get 6 dB by going from 33 ft to 67 ft. At 5 degrees, we get 2 dB by going from 67 ft to 100 ft. Another way of looking at it is that the three sections of Rohn 25 that it takes to go from 30 ft to 60 ft is worth 5.5 dB.

**Lobing of High Horizontal Antennas** Fig 42 shows how the vertical pattern of a 20M dipole varies with mounting height. Lobing begins as the antenna is raised above about  $\lambda/2$  (33 ft on 20M). Lobes appear first at higher vertical angles; nulls move down as the antenna is raised, and a second null develops at a higher angle. Thus, as we raise the antenna we can optimize it for low angles, but degrade performance at higher angles. Propagation to any given station varies with time; at one time, the path may be at a high vertical angle; an hour later it may be at a low angle. Note that while this data is plotted for a dipole, any horizontally polarized antenna will exhibit the same effects.

**How Does This Relate To Terrain Effects? (HFTA)** All of the analysis shown in this report is on the basis of extensive modeling done in NEC, which assumes antennas are in "flatland" – that is, terrain has no effect on propagation. For some of us, this represents the real world, but for many of us it does not. Corresponding models for non-flat terrain should be done using HFTA, simply by setting antennas at various heights and studying the result. In general, the principles outlined here will simply be "superimposed" on the effects of terrain as predicted by the NEC model. That is, increasing the height of a horizontal antenna will tend to concentrate its radiation at a lower angle, which will then interact with the terrain as HFTA predicts.

N6BV's very useful High Frequency Terrain Analysis (HFTA) software is on the CD that comes with the ARRL Antenna Book. HFTA uses terrain data obtained from government sites on the internet, processes it to generate radial data for every five degrees of azimuth, then computes the effect of that terrain for an antenna at specified mounting heights. HFTA comes with statistical data for each HF band for the vertical arrival angles from one part of the world to another, the user then calls up that data and HFTA superimposes it on the modeled data. My QTH is at 2,000 ft; with nearby ridges in the range of 2,550 ft to the NE and about 2,200 ft to the east and NW. Extensive HFTA modeling showed that a tower height in the range of 120 ft was near ideal for the HF bands – to improve on it, I'd need to raise the Yagi to about 300 ft. I stopped at 120 ft.

**A Practical Design Question:** Joe Ham is considering a 2-el Yagi for 40M, which he can put on a 70 ft tower. As an alternative, Joe can hang a pair of horizontal dipoles at right angles to each other in tall redwoods at 120 ft. Which of these two antenna systems would perform best, and by how much?

**Performance Difference:** From Fig 33, a horizontal antenna would be 2 dB louder at 120 ft at low angles than



at 70 ft. If the gain of the 40 Yagi Joe is considering is 3.5 dBd, and we mount it at 70 ft, it will be 1.5 dB louder than the dipoles at 120 ft.

**Cost Difference:** If you have the trees, two dipoles at 120 ft will cost about \$1,400 for climbers, \$600 for antennas (wire, hardware, coax, rope, pulleys), total \$2,000. An Optibeam Moxon on a 70 ft tower (antenna, hardware, coax, rotator, labor) will cost \$5,000 - \$7,500, depending on whether you do your own climbing and whether you can buy hardware used. Bottom line – the 1.5 dB advantage of that Yagi on transmit costs \$2,500 – \$5,000 more than the dipoles. And, of course, the Yagi may hear better by virtue of its directivity. The reader is encouraged to do his own cost estimates for practical installations.

### Summarizing What We Have Learned

**Ground Quality** refers to the nature of the earth around your QTH. It has nothing to do with an electrical connection to the soil. Rocky, sandy soils are very poor grounds; moist, loamy soils are good grounds. If you live in the mountains or in highly developed area like a city, your ground is poor to very poor. If you live in a fertile valley, your ground is pretty good. The ground under our antennas burns transmitter power before it can be radiated; good radial systems minimize that loss. The ground at a distance from our antennas (hundreds of yards) reflects the energy radiated by our antennas, which combines with direct radiation from the antenna to form the vertical pattern.

Horizontal antennas are not affected by ground quality, because the strength of the first reflection does not depend upon ground quality.

Vertical antennas are strongly dependent upon ground quality – the better the quality of the ground, the better they will work because that first reflection is stronger.

Horizontal antennas are strongly affected by height – higher is better.

Vertical antennas work better if elevated above ground. Roof level of a one-story or two-story home is a good mounting height for HF verticals.

**Vertical Antennas on Towers** interact with the tower to distort the vertical pattern of the antenna unless they are effectively isolated from the tower. If not very well isolated, the resulting vertical pattern can be pretty nasty. Isolation is provided by radials and by common mode chokes. See Appendix One of [k9yc.com/RFI-Ham.pdf](http://k9yc.com/RFI-Ham.pdf).

End-fed verticals (verticals that require radials) can work well on towers ONLY if they have effective radial systems for each band on which they will operate. Two resonant radials per band is a minimum. If it's a mono-band antenna, you'll need four. The feedline also requires an effective common mode choke at the feedpoint. The Butternut, Hustler BTV-series, and HyGain AVQ-series are examples.

Verticals that are, in essence, center-fed dipoles must be insulated from a tower, and the feedline must have a common mode choke that is physically located at the point where the antenna is mounted to the tower. The Cushcraft R-series and MA6-series, the HyGain AV-series, Gap Titan, and Force 12 verticals are examples.

**Vertical Antenna Interactions** All antennas interact with surrounding conductors to some extent, but vertical antennas tend to have strong interactions with other vertical conductors that can strongly affect their polar



pattern.

**Ground and Antennas** A connection to earth does not make an antenna work better – the earth is a big resistor, so any current flowing into the ground burns transmitter power. We use radials on vertical antennas to shield the earth from the antenna, so that current and fields from antenna return to the low resistance radials rather than the high resistance earth.

**Earth Connections** are important – we need them for lightning protection. But they do not make antennas work better, and they do not reduce noise or RFI. What does reduce noise and RFI is to bond together all of the equipment in our shacks, and the earth connections in our homes. Bonding is also critical for lightning safety.

**Bonding** simply means a mechanically robust, low impedance connection between grounded objects. The impedance must be low at all frequencies, not just DC. Inductance dominates the impedance above power frequencies, so bonding conductors must be very short to be effective.

### **Getting Practical -- Where *Can I Put Antennas?***

Now that we have a good idea about how various antennas perform, we're back to where we began. We can start looking at the possibilities that our real estate (and the attitudes of XYL and neighbors) permit. Can I sweeten up my XYL so that she'll accept the antenna I really want? Perhaps she'd like a new sewing machine? What do we have for skyhooks? Can we launch a rope into a tree to support one end of a dipole? Will a building support one end of an antenna? Can we safely mount a multiband vertical on the roof of our home or garage? Can we route a feedline from the proposed location to the shack? How close would the proposed antenna be to noise sources? To our neighbor's living room entertainment system? What are the best orientations for horizontal dipoles based on where the QSOs are? Do I need much high angle radiation?

### **References:**

"HF Vertical Performance- Test Methods and Results." H. Ward Silver (N0AX) and Steve Morris, K7LXC, Champion Radio Products, 2000

"Collected tutorials" by Rudy Severns, N6LF. <http://www.antennasbyn6lf.com/> ARRL Antenna Book

"Low Band DXing" by ON4UN. (for 160M, 80M, and 40M), published by ARRL



## Editor Notes



Two of the three winter NAQP's are down, RTTY is 26 Feb. SFI broke 200 for CW and Phone, but the sequence of atmospheric rivers, storms, and extended power outages made it hard for many in both contests. Incidentally, at least one bar in downtown Reno is serving an “Atmospheric River” cocktail – I'm told your power may fail shortly after consumption.

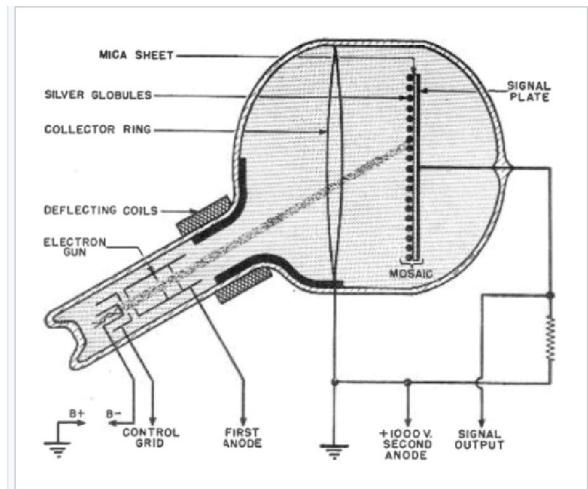
A blank space arose in the Jan edition hence the tube quiz-let. We're a contest club, I'm new to this job, and I'm wondering how much non-contest content is still OK? Opinions solicited.

*New 1Lt, Galena AFS AK Sep 1963/Credit: MSgt Jeff Montgomery*

## I'm An Iconoscope!

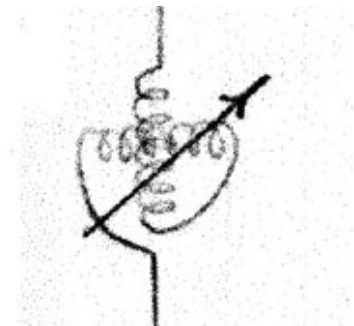
One of the first non-mechanical television camera tube, and affectionately called an “Ike,” was invented by Vladimir Zworykin at RCA in the early 30's, and became the standard in television cameras. It comprised a mica sheet, backed by a metallic coating, and coated in front with silver “pixels” (called the mosaic). The scene being televised would be on the left, projected on the mosaic.

The image scattered electrons off in proportion to the brightness of each pixel [the photoelectric effect] which were collected by a ring. The electron gun scanned that negative “charge image,” replacing the electrons and creating a serial signal from the mosaic's metallic backing. Why the +1kV goes to ground in the schematic remains a mystery.



My iconoscope was given to me by the Chief Engineer and my engineering crew colleagues at KSBY-TV in San Luis Obispo when I graduated Cal Poly in 1962. It might still work if I could find all the supporting electronics. This was near the end of iconoscopes ... they were replaced by image orthicons and then vidicon tubes until the arrival of solid-state photoelectric devices. My Ike currently serves as a decorative item on a shelf in our living room.

And, another “**What Am I?**” is depicted at the right. It's the schematic symbol for a device often found in receivers and transmitters in the 20's and 30's such as Norm's RAF TR2 ... where this image originated. It still is used in some antenna matching circuitry such as for AM broadcast stations, and was used in the very high power LORAN-C stations which were decommissioned around 2012. Unfortunately, there is no prize for naming and describing it. As usual, consultations with Google and/or Wikipedia are like self-spotting and are considered really bad form.





## **NCCC Membership Information**

If you wish to join NCCC, please fill out an application for membership, which will be read and voted upon at our monthly meeting. To join, you must reside within club territory which is defined as everything in California north of the Tehachapi's up to the Oregon state line, and part of northwestern Nevada (anything within our ARRL 175-mile radius circle centered at 10 miles north of Auburn on Highway 49).

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Thanks to W6TCP for helping to set this up. Instructions for purchases from Lands' End NCCC Store

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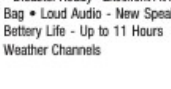
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