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NCJ NATIONAL CONTEST JOURNAL

November/December 2000

Volume 28 Number 6

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- The Sometimes Painful Lessons Indicating Progress
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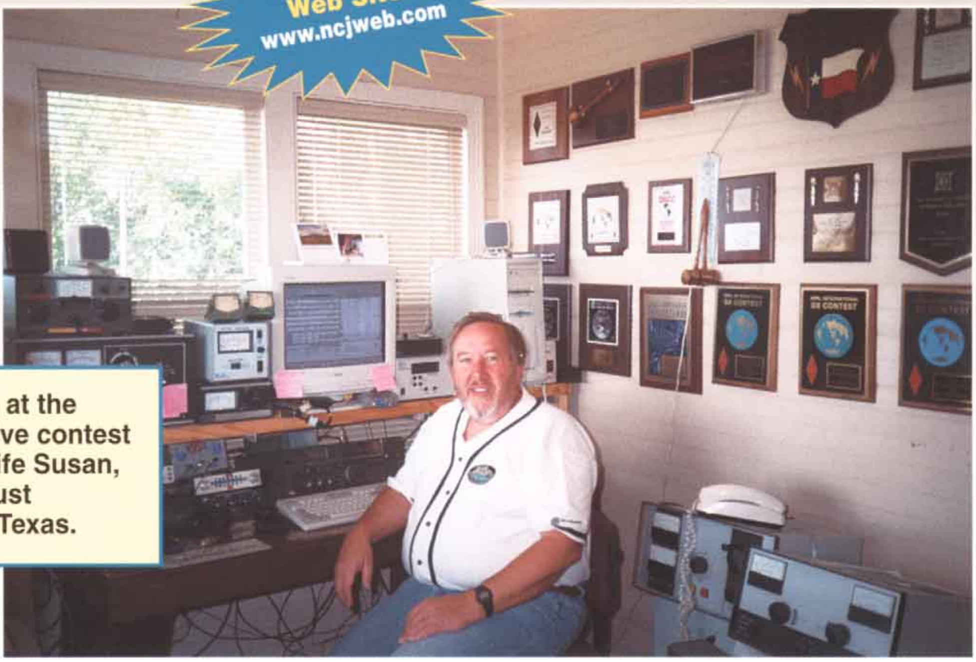

Richard King, K5NA, at the helm of the impressive contest station he and his wife Susan, K5DU, are building just northeast of Austin, Texas.

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Dennis Motschenbacher, K7BV

K7BV

As you read this, some of you have probably already been dealing with snow while others may just now be beginning to experience the cooler temperatures and grayer skies. Of course, our friends on the other side of the Equator are enjoying late spring/early summer weather. No matter where you are though, the "contest season" is in full blossom. We hope you are having a satisfying season and are well on your way to fulfilling your goals for this year.

Contest DXpedition Coverage

We are changing things up a bit to keep this aspect of contesting fresh with new ideas. Kenny, K2KW, has joined the *NCJ* staff and, beginning with this issue, he shares his vast contest DXpedition experience through his new column *Contest Expeditions*. He also has a new Web site (**http://pages.prodigy.net/k2kw/qthlist**) related to the subject that's packed with information useful to any traveler. Welcome Kenny!

Joe, K8JP/V31JP, will continue to provide input from time to time through his *Contest Traveler* column. Joe is trying to stealth his way into retirement. We will find him and his wife Bev spending more and more time at their new digs down in Belize.

I have turned over the *Contest DXpedition Listing* to Steve, KN5H. Steve is full of fire and desire and I am positive that he will keep the listing in the magazine and on the Web site updated with the latest information on who is going where. Keep an eye on that list, and with a little luck you won't accidentally end up sharing some small rock with another contest DXpedition.

I want to thank Sean, KX9X, for his years of service to you and the *NCJ*. His *DXpedition Destination* column has provided information on many interesting places to contest from both inside and outside the USA. Thank you very much for your service, Sean.

Clearing the Air

Speaking of Sean, KX9X... In my eagerness to get the September/October *NCJ* wrapped up, I penned the lead and closing paragraphs that appeared in the *DXpedition Destinations* column under Sean's byline. He has requested that I make it clear to our readers that he did not select, edit or write any of the material that was published in that column.

NCJ Web Site

Keep an eye on the *NCJ* Web site **http://www.ncjweb.com**. Bruce, WA7BNM, continues to expand it—and I'm sure you don't want to miss anything!

Call for Articles

We can always use your stories, technical articles, ideas and operating technique hints. The article bucket isn't empty BUT we can always use new material. I encourage all of you to consider taking a moment to put together an article on a subject you find interesting. If *you* do, certainly others will share your interest!

Cover Photo

Richard, K5NA, and Susan, K5DU, or Manor, Texas, are in the process of assembling an HF contest station that will certainly serve to uphold that state's reputation for applying the concept of "grand scale" to nearly everything.

Through his article "Contest Stations of Central Texas," Ken Harker, WM5R (formerly KM5FA), provides us with a peek over the fences (and up the aluminum-festooned towers) and a quick tour of the shacks of a few of the contest superstations that dot the landscape of greater Austin and the nearby Hill Country—deep in the heart of Texas. ■

The Sometimes Painful Lessons Indicating Progress

John Ragsdale, N0OFR
jragsdale@navix.net

Every contester must begin as a rookie and work his way up towards the top of the score listings one step at a time. There are few short cuts, and only the most determined individuals progress past the various plateaus that seem to exist for all to conquer. The feeling of self-satisfaction that is the reward for measurable progress is what keeps Amateur Radio contesting alive and well.

John, N0OFR, shares the thoughts that crossed his mind before, during and after his first truly committed effort in a contest. Enjoy—you have either already been there and done that—or you will be!—K7BV

John Ragsdale, N0OFR, at K0GND.

When I submitted a Band Restricted (BR) entry for the 1999 WPX Phone Contest, I thought I might be the only entry from Nebraska to obtain a certificate. Imagine my surprise when the March issue of *CQ* showed me as finishing fifth in the nation among band restricted entrants. Of course, only nine or ten of us submitted such an entry.

Nevertheless, making the Top Ten prompted me to consider a serious effort to win the category this year. Several considerations went through my mind as I deliberated whether to try.

This would likely be the last year that I'd enter as band restricted (I have since upgraded). While my own station (an ICOM IC-735 and a Cushcraft R-5) is not a world-beater, the K0GND station (a Yaesu FT-1000D and a 5-element monobander for 10 meters) would be available and could provide more competitive tools.

Attempting to win the category would mean contesting in a manner and at a level where I had little prior experience. I started contesting for points (rather than countries) in the 1999 ARRL DX SSB Contest. My four (yes—and *only* four) other serious contest efforts were last year's phone WPX, the phone CQWW, the ARRL Sweepstakes and the ARRL 10-Meter Contest.

As I thought about whether to make the effort and where I would operate from, I admitted to myself that in those past efforts if conditions became difficult I simply stopped, took a break and returned when I thought the band would be better. I certainly realized that this is not the attitude taken by a successful contester.

I also had to confront the fact that my only experience in running stations had come in two events—Sweepstakes and the ARRL 10-Meter Contest. Those runs, for the most part, produced only stateside contacts.

Another influence was the recognition that new countries are still important to me. I hesitated to operate from someone else's station and consequently give up any "new ones" for DXCC credit—10 meters has been treating DXers very well recently.

One Less Decision to Make

In the end, Nebraska weather made one of my decisions for me. Several days of high winds wreaked havoc with a bracket on my R-5. I would have little opportunity to fix it before the contest weekend. I either operated at 'GND's—or I could forget the contest. Forget the contest? Never!

That decision out of the way, I spent the week before the contest preparing. The Wednesday night before the big event I visited the station and acquainted myself with the equipment—learning things as basic as how to operate the rotator. I also tried to anticipate how I would respond mentally to the rigors of contesting. I found myself wondering if I would have the stamina to operate the entire time 10 meters could be expected to be open.

This familiarization session helped me calm my nerves and settle my anxiety about all the possible perils that could befall me (and, coincidentally, provided me an opportunity to watch my host, an accomplished DXer, bag Chesterfield Island, TX0DX on 15 meters on the first night of their operation).

Friday night approached without the apprehension I had anticipated that comes from operating a station where good scores are expected. Perhaps I had overcome the jitters and successfully developed some degree of self-confidence. In any case, I hoped to focus on operating steadily, without rushing, and was certain *WriteLog* (purchased earlier in the week), the radio and antenna were properly set up and operating correctly.

A Shaky Start

Despite the week's preparation and my sense of optimism, Murphy's Law ruled as the contest began.

The radio and computer simply would not interface. Since trying different ports, polling options, baud rates, and a telephone call to KT0K (a fellow Nebraska contester who uses *WriteLog*) did no good, I hand-logged frequencies. That was not efficient and I hoped that, somehow, the problem could be resolved once 10 meters shut down for the evening.

Except for the interface problem, Friday night was unremarkable. Even the pileups for VP6BR and VK9NS were easily cracked. Forty-two contacts (and 33 multipliers) later the band closed and K0GND and I were left to debug the connection problem. Other worries lingering on my mind included the total absence of JAs in my log and my inability to get any serious runs going.

Friday night's unsettled, shaky start gave way to optimism Saturday morning when a replacement cable had the computer and rig again communicating with one another. Perhaps now I could focus.

Saturday—Just Trying to Settle In

Saturday morning began at 1258Z with me looking for a run frequency. I found one, but I was unsuccessful in getting stations to answer. Impatience led to Search and Pounce until 1423Z. I found several Russians, 3V8BB, and another thirty-five multipliers in that period.

For the next 3½ hours I made repeated attempts at running with little success. For example, between 1423 and 1446 I had a run of thirteen stations. Between 1720 and 1752Z I ran twenty-two.

(During the contest I was certain I was calling "CQ" for at least five minutes before leaving a run frequency. Yet, as I analyzed my log after the contest, I noticed several instances in which I left a run frequency well before five minutes elapsed after my last QSO during the run. How much better could I have done had I been more patient and refused to give up calling "CQ" after such a short time? Perhaps my contesting in the years ahead will provide the answer…)

By 1959Z I could find nothing left to work, so I decided the best thing to do was to break for lunch and regroup.

I resumed operating one hour later and spent the remaining time the band was open working every South American station I heard. When I stopped operating for the day, I had 235 QSOs and 187 multipliers in the log.

Only two of those contacts were with JAs—I continued to wonder why there were so few. The reason I worried about JAs is that I was afraid there would not be any to work Sunday evening. Tips from the Yankee Clipper Contest Club Web site suggest working Japanese stations the first contest evening when they are plentiful because the second evening is Monday morning in Japan and the beginning of their work week. The YCCC tips, which were very helpful to me, can be found at **http://www.yccc.org/Resources/Cookbook/cb95_k1kp.html**.

I also worried about why I had so much trouble establishing and sustaining a run. For example, among the many questions I asked myself was, had I lost contacts because perhaps the recorded message consisting of my call sign was not readily understandable by the stations I wanted to answer my "CQ Contest?"

Certainly, the station could not be faulted. My Search and Pounce success clearly demonstrated I was loud enough to get through to virtually any station I heard on the first call.

Whatever the reasons, I ended the operating day concerned that I would let the station's reputation down. In fact, the only positives I could identify at that point were working 9G5ZW long path at 0047Z and ending the day at 0113Z with a contact with P29NB. But tomorrow would be another—and hopefully better—day.

Sunday—The Home Stretch

The day did not start that way, though. In my enthusiasm to overcome the previous day's results, I overlooked setting latitude and longitude for beam headings and failed to record the needed voice messages. The contacts, however, were coming faster than they had on Saturday and the Europeans were coming through much louder.

I worked EX1GR for a new multiplier eight contacts into the Sunday morning operating. Shortly after that, I finally had a run going. The run started at 1358Z and lasted until 1711Z. The rate was not good though, with only 147 stations worked in that time period. The hourly rates from 1400 to 1800Z were 40, 51, 48 and 22—not World Class, but certainly better than what I had done the day before or, for that matter, anytime in my contest career. In fact, my previous longest run was less than an hour in length. Notable contacts during this run included 9H1DE, C35LJ, TF8GX and two Romanian stations.

The afternoon ebb began near the end of the run and reached its depth with S-7 line noise starting at 1900. The line noise lasted almost an hour. During that time I tried, unsuccessfully, to get runs started—but nothing developed. I gave up that strategy and tuned for any station not yet worked. As I did so, I found myself wondering what does one do on ten once the band takes an afternoon dive. The best answer I could come up with was "keep tuning."

That is what I did until I heard a Japanese station answer a "CQ Contest." With nothing else working and signs of the band fading, I pointed the antenna west and hoped. That hope was rewarded with KL7RA, AH8A, WL7E, HL0O, V73UX and several Japanese stations entering the log. Those contacts allowed me the opportunity to finish the contest with a short run.

The Lessons Learned

I finished with of 490 QSOs, 347 multipliers and a claimed score of 477,125 points. I was also satisfied with operating over ten straight hours (by far my longest stint in front of a radio).

Mentally, the end of the contest led to mixed emotions, much uncertainty and a great sense of having learned much about contesting and competing.

Among the *highs* was the elation of surpassing last year's winning total in the BR category by some 25,000 points. So, too, was the sense of accomplishment that came from holding a frequency for hours. Reading an e-mail to the contest reflector from DL4YAO (who I worked at 1425Z Sunday) ranking my signal higher than or at the same level as that of many well-known contesters was exhilarating, too.

The *lows* included the frustration of not having several hundred more QSOs than I did, making 261 of my contacts from Search and Pounce, a feeling of helplessness at not knowing what to do when contacts become scarce, and having far too many single-digit runs. Much of the post-contest uncertainty I experienced stemmed from having to wait to learn whether my score was good enough to win and, if not, what things should I have done to finish with a larger score.

But this time though, I was determined not to second guess every aspect of my operating as I have done after each previous contest.

Instead, I have focused on my accomplishments—I believe I did my best. I also choose to believe my mistakes, numerous as they were, resulted from my inexperience and that the best answer for inexperience is to keep participating and trying. And that, win or lose, is what I plan to do. ■

Contest Stations of Central Texas —Do Contest Stations Really Grow Bigger in Texas?

Kenneth Harker, WM5R
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There has been an explosive growth in contesting stations in the Central Texas area in the past few years. The Central Texas DX and Contest Club (*CTDXCC*), a small but thriving group of hams in the greater Austin, Texas area, has helped foster this growth. Austin, the capital city of Texas, is located in the center of the state, on the Colorado River, about 600 feet above sea level.

The spectacular Texas Hill Country to the west and north has hills as high as 1,900 feet above sea level, covered in scrub juniper trees, tall grasses and prickly pear cactus. To the east and south are the Texas Blackland Prairies, with very deep, black topsoils. The blacklands are mostly farmland that slowly slopes downhill to the Gulf of Mexico, about 150 miles away. Several competitive contest stations have been built around Austin and the Texas Hill Country recently.

W5KFT

The W5KFT Ranch Station is located on the western shore of Lake Buchanan, a reservoir of the Colorado River, about 70 miles northwest of Austin. Lake Buchanan is a level-controlled reservoir, so the ranch buildings can be built reasonably close to the water. Some of the antenna booms almost turn over the water on the edge of the lake when it is full. The station site is on a 2,200-acre working cattle ranch, owned by Bryan Edwards and his family. The station is designed for single-operator, multi-single, and multi-two HF and VHF contesting.

George Fremin III, K5TR, designed much of the station and did most of the tower work. "In the fall of 1992, I got a phone call from Bryan. He was looking for someone to help him design and build a DX/contest station at his family ranch. When I first visited the ranch, I could see why he had been dreaming of building a station at this beautiful location." The ranch is on a relatively flat peninsula extending out into the lake, and even though the ranch is small by Texas standards, the nearest neighbor is several miles away. The location is very RF quiet.

The station is in a guesthouse, complete with kitchen, bath, and three beds for those multi-operator contests. A custom-designed operating table and shelves hold all of the equipment except for the high-power VHF amplifiers, which are mounted in 19-inch equipment racks. Three operators at a time can easily operate in a multi-op contest. Single-operator, two-radio contesting is also easily accommodated. Because the station is used for such a variety of contests, almost all of the equipment must be arranged and re-connected before each contest.

The station has five towers. The tallest tower is 150 feet tall, with a stack of three Hy-gain 204BA 4-element 20-meter monobanders at 55/105/155 feet, two Cushcraft 40-2CD 2-element 40-meter monobanders at 67/165 feet, and an M^2 7-element 6-meter Yagi at 160 feet. The 6-meter Yagi and the top 20- and 40-meter Yagis rotate—the rest are fixed on Europe. This tower also supports a system of switchable 75-/80-meter vertical dipoles for the northeast, south and northwest directions. An inverted V for 160 meters is also at 155 feet.

The next tallest tower is 135 feet, with a stack of three Hy-gain 155CA 5-element 15-meter monobanders at 45/90/135 feet, four Hy-gain 5-element 105CA 10-meter monobanders at 35/70/105/145 feet, and a Cushcraft 17B2 144 MHz Yagi at 140 feet. Again, the 2-meter Yagi and the top 15-meter and 10-meter monobanders rotate, with the rest fixed on Europe. Ameritron RCS8V switches on both towers allow selection of the top antenna, the lower antennas, or the full stack with the flick of a switch.

A new 70-foot tower is primarily used for working Japan and East Asia in the DX contests, or stateside in domestic contests. It has a pair of stacked Hy-gain TH7 tribanders at 35/70 feet and can be used on 10, 15 and 20 meters. Another Cushcraft 40-2CD 2-element 40- meter beam is located at 80 feet on this tower. The top TH7 and 402BA are rotatable.

Right next to the shack is a 60-foot tower with a Hy-gain TH7DX tribander, an M^2 18XXX 144 MHz Yagi, and a 31-element 432 MHz Yagi, all of which

The W5KFT Ranch Station.

George, K5TR, operating 432 MHz CW in the 1999 ARRL June VHF QSO Party at W5KFT.

are rotatable. The TH7 is used primarily as a multiplier antenna in contests.

Finally, a 40-foot tower at the station holds two Cushcraft 6-element 50 MHz Yagis and a 17-element Yagi on 222 MHz. The lower 6-meter antenna is fixed northeast and the other Yagis can be rotated. An Ameritron RCS8V is used for this stack as well.

For HF contests, the station has a pair of Kenwood TS-850SATs and a pair of Ameritron AL-1500 amplifiers. The station uses *TR Log* for computer logging and CW transmission. ICE band-switching filters prevent inter-station interference. Heil Prosets and W9XT Digital Voice Keyer cards are used for SSB contesting. Ron Stailey, K5DJ, uses the W5KFT station regularly for the big RTTY contests, and brings in HAL Communications modems and *WriteLog* for *Windows*. Ron has won many RTTY contests and set many RTTY contest records from W5KFT.

W5KFT is one of the most potent VHF/UHF contest stations in the central United States. W5KFT won the limited multi-op category of the June VHF QSO Party in 1998, the only Texas station ever to win that category. W5KFT also holds the current 50 MHz QSO record for the ARRL June VHF QSO Party. Radios used for VHF contesting include an ICOM IC-736 (50 MHz,) ICOM IC-275 (144 MHz,) a Kenwood TS-850 and Downeast Microwave transverter (222 MHz) and a Yaesu FT-736R (432 MHz). The station has kW amplifiers for 50 MHz and 144 MHz, 400 W on 222 MHz, and 600 W on 432 MHz.

Bryan, W5KFT, holds an annual "W5 DX Bash" at the station in early October, drawing DXers and DX contesters from all over the United States—and even as far away as New Zealand! See (**http://www.dxer.org/w5bash/**). More photos and a more detailed description of the W5KFT station is online at (**http://www.kkn.net/~w5kft/**).

N5CQ

John Langdon, N5CQ, has found a great hilltop site for his station in southwest Travis County, on the eastern edge of the Texas Hill Country. With a gently downhill slope in all directions, save a little hill to the south-southeast, the location seems to be excellent. John designed his station for DXing, but then got interested in contesting, and has been trying to "retrofit" a few contest-oriented improvements ever since.

The big tower at N5CQ has six Force 12 tribanders on 195 feet of Rohn 55G rotated with K5IU Rotating Tower System components. Three pairs are fed with WX0B Mini StackMatch transformers and a StackMatch control unit on 20, 15 and 10 meters, allowing selection of any pair, any two pairs or all three pairs. Three of the antennas are C-3s (at 35, 95 and 125 feet) and three are C-4XLs (at 65, 125 and 195 feet.) The three C-4XLs also incorporate interlaced 2-element "shorty forty" sections, fed with separate feed lines and another StackMatch. Also on the tower are a Force 12 WARC-7 beam for 30, 17 and 12 meters at about 105 feet, a 2-element, linear-loaded 80-meter Force 12 Magnum 280C Yagi at 185 feet and a 160-meter sloper. A Hy-gain HDR300A rotator mounted at the tower base rotates the tower.

A close-up of the rotor mechanism on the 195-foot rotating tower at N5CQ.

The two towers at N5CQ.

As if this were not enough, John has recently added a 50-foot high, Rohn 55G tower to his station. On this tower, a Force 12 C-3 is fixed on South America and the Caribbean at 30 feet. A Force 12 C-51XR tribander (with two elements on 40 meters,) and a Force 12 50 MHz Yagi at the top of the tower are rotatable.

For receiving antennas, John has two beverages, each about 580 feet long, pointed at Europe and Japan. The beverages work great on 160, 80 and 40 meters, and have reportedly even been useful on 20, 15 and 10 meters on a few occasions.

The "shack" at N5CQ is a converted container ship shipping container. It has had windows cut into it, and the interior is finished with tile, drywall, electrical wiring and indoor plumbing. For extended on-site operation, it has been equipped with a shower, refrigerator, microwave oven and bunk beds. An 8-foot high fence around the station building and each of the tower and guy point bases helps discourage the curious.

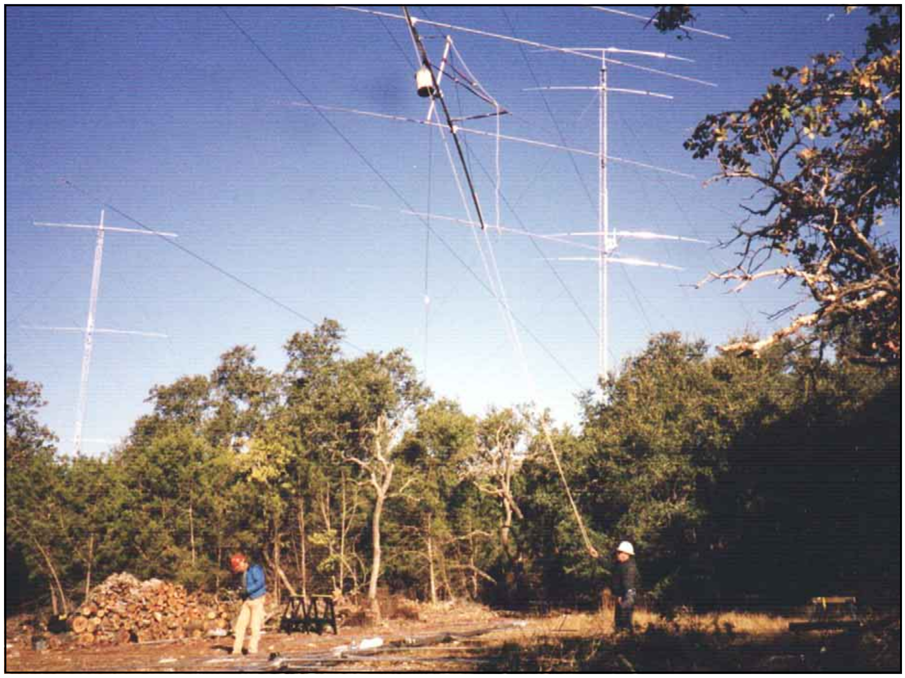
For contest weekends, John uses a Yaesu FT-1000MP transceiver with an Alpha Power 87A amplifier. *TR Log* and Bencher paddles are used for sending CW, and a W9XT Digital Voice Keyer and Heil Proset are used for phone contests. When John is not operating a contest, either as a single-operator, or with a multi-operator team, he frequently uses the station through remote control. John has a Kachina 505 transceiver at the site, and connects to it from home using 56k modems. He can also control the Alpha amplifier and a Kachina rotor controller with the remote system, and has worked many "new ones" while sitting at home, 25 miles away. John's home is in a neighborhood so deed restricted that "you need written permission to paint your shutters a new color." The Kachina remote system has made chasing DX practical.

Because he can not always drive out and disconnect the coax when a sudden storm approaches, John takes lightning protection very seriously. Both towers are grounded with extensive systems of ground radials made from 3-inch copper strap and 8-foot ground rods. Cables are routed underground through PVC conduit between the towers and the shack, where they enter the building through a single bulkhead. Each feedline and control line has Polyphaser lightning/NEMP suppressors inline both at the tower base, and the station entry bulkhead. All other telephone and electrical cables entering the shack are grounded and protected with Polyphaser suppressors. Has the system been worth it? Although he does not have any strike counters installed, John believes he has taken at least one direct hit on the tower with no damage. One of his neighbors heartily approves of the big tower, as she figures she "will never get hit again!"

N5TW

The ham radio bug bit Tom Whiteside, N5TW, in 1995, after decades as an SWL. At his wooded, 7-acre lot in suburban Georgetown, Texas, Tom has built a four-tower station with multi-single and multi-two HF contest operation in mind. "We wanted to be able to do two-transmitter contesting from here, and this really dictates getting transmit antennas spread out physically to minimize interaction. This led to expanding from one tower with tribanders, a 40-meter beam and an 80-meter array, to a total of four towers populated by stacks of monobanders—all independently rotatable."

This ambitious project was recently accomplished with the hard work of Paul Nyland, K7PN. Paul erected the three new towers and installed the antennas in November 1999. Tom's original 100-foot tall tower now has three stacked Force 12 10-meter monoband Yagis, and supports a K8UR design 80-meter phased wire array. For 15 meters, a new 110-foot tall tower has three M^2 6-element 44.5-foot boom monoband Yagis. The 20-meter tower is 130 feet tall and has three large M^2 5-element Yagis. The 40-meter tower is also 130 feet tall, and has two Cushcraft XM240 Yagis. Almost all of the Yagis not at the top of the towers are sidemounted on rotators, and can be pointed in any direction except 180-250 degrees. All stacks use WX0B StackMaster boxes. Tom has an inverted L with elevated radials for 160-meter transmit, and uses several beverages for receiving, pointed at Europe, Japan and South America. Tom's plans for the near future include fixed, small Force 12 monobanders to better cover South America, Africa and the Caribbean for 20, 15 and 10 meters, and making all Beverages switchable two-way.



A 20-meter Yagi on its way up the tower at N5TW.

The 10-meter tower at N5TW, as seen from the top of the 20-meter tower.

N5TW uses a Yaesu FT-1000MP and an Alpha Power 87A amplifier. Tom has used both *Writelog* for *Windows* and *TR Log* for contest operations, and competes in both CW and phone contests. For multi-operator contests, guest operators bring in additional radios and amplifiers. A WX0B SixPak is used for antenna switching to the two radios. Tom is actively studying future improvements to utilize more radios, bandpass filters, and amplifiers for better two-transmitter station performance.

Tom also enjoys QRP operation, and spends a large percentage of his non-contest operating time using various QRP transceivers with his impressive antenna farm.

K5NA and K5DU

Richard and Susan King, K5NA and K5DU, are in the process of building a five-tower, high-power HF contest station in the prairie farmlands just north of Manor, Texas. The Kings own 50 acres, mostly leased to a local farmer for crops. The site is a half-hour drive east and north from downtown Austin, and from the tops of the towers, all of the Austin downtown area and the famous tower at the University of Texas are visible. The station is being designed primarily for multi-operator contest efforts, although most of the contesting to date has been single-operator efforts.

Most of the tower work is complete, with four of the five towers in place. The final goal is to have four towers, each between 140 feet and 195 feet tall, with a shorter 82-foot tower to support an HF tribander and VHF/UHF antennas.

The three tallest towers are already built. A 195-foot tower will support a stack of four Cushcraft XM240 Yagis for 40 meters, a 188-foot tall tower will support a stack of four Cushcraft XM520 Yagis for 20 meters and a 168-foot tower will support a stack of four Cushcraft XM515 Yagis for 15 meters (and a large Yagi for 50 MHz). In early 2000, the rotators and top antennas for the 15- and 40-meter tower have been installed, and several other Yagis have been put up, while more are being constructed on the ground. An 82-foot tower near the house is called "the Heard Island tower," because it was installed just before the big

Richard, K5NA, stands next to a Cushcraft XM520 Yagi for 14 MHz, assembled and ready to go up the tower.

1997 VK0IR DXpedition. It will support a Cushcraft X9 tribander, and monoband Yagis for 50, 144, 222 and 432 MHz. The 10-meter tower will be the last to be installed, after a new house is built and the location of the tower base and guy anchors can be finalized. It will be 140 feet tall, and support a stack of four Cushcraft XM510s. All of the antennas will be switched using the new WX0B StackMaster switching devices.

On 80 and 160 meters, the station currently uses wire arrays, but future plans include four squares or other phased arrays of verticals built from Rohn 25G. Other future improvements in the pipeline include a scattered assortment of 10-, 15-, 20- and 40-meter Yagis available as second station "multiplier" antennas for use during multi-multis. These will mostly be on side-mounted rotators scattered among the towers.

Richard is a self-professed "nut for 160 meters." He has no fewer than four transmit antennas, including full-sized half-wave slopers, a full-sized elevated vertical, and an elevated T. For receiving, the station has had as many as six beverages pointing in different directions, some installed just to work specific DXpeditions or contests. "I am always moving them around as I build up the station. Right now, I have four beverages because I had to move a couple away from the new house construction site."

Inside the station, Richard and Susan have an ICOM IC-765 HF transceiver, and use Ameritron AL-1500, Dentron DTR-2000L, and Henry 2K Classic amplifiers on various bands. They plan to invest in another transceiver "when the right one comes along," and to include provisions in the new station design for serious single-operator, two-radio contesting. The Kings have used both *CT9* and *TR Log* for contest logging, and compete in both CW and phone contests. K5NA is also home to one of three linked packet clusters in the greater Austin area. The many computers in the station and throughout the house are linked with fiber optics.

N3BB

Jim George, N3BB, came to Texas after learning how to do serious contesting with the Frankford Radio Club while he lived in Pennsylvania for eight years. Jim operated with FRC pal Alan, N3AD, in the 2000 World Radiosport Team Championship. Jim enjoys the big CW and SSB DX contests on HF, and operates both as a single-operator and hosts the occasional multi-operator contest effort at his station.

Jim George, N3BB, at his station.

N3BB is located in suburban Hays county, 15 miles southwest of downtown Austin. Jim's station is in a guesthouse at the top of a hill with a great horizon in all directions. The station is designed for single-operator, two-radio, multi/single and multi/two station contesting. Occupying about a third of the guesthouse, the station enjoys the benefits of a full kitchen and bath, a small living room and a separate bedroom, easily handling a large multi-operator crew.

A custom-built table and shelving supports all of the equipment. The radios are a pair of Kenwood TS-940s coupled to Alpha Power 87A and Alpha Power 76PA amplifiers. Top Ten Devices implement a fully automated antenna switching system that allows any antenna to be switched to any radio. Jim has used both *CT9* and *TR Log* for contest logging and sending CW, and uses Heil Prosets for phone contesting.

There are currently four towers at N3BB. The 10-meter tower is a pair of monoband Yagis at 65 feet over 32 feet. The 15-meter tower is a pair of monoband Yagis at 95 feet over 47 feet. The 20-meter tower has a pair of monoband Yagis at 130 feet over 45 feet. There are two 40-meter monoband Yagis, one at the top of the 20-meter tower, at 120 feet, and the other at the top of the 10-meter tower, at 65 feet. A Hy-gain KT34A tribander "multiplier" antenna is on a fourth tower at 60 feet. On 80 and 160 meters, Jim uses inverted V wire antennas. Two 600-foot long beverages pointing at Europe and Japan are used for receive antennas on 160, 80 and 40 meters.

Jim has some future station improvements in mind. On 80 meters, he is considering adding a K8UR design phased wire array made from four slopers. The transmit antenna for 160 meters may become an inverted L or shunt-fed tower. In-shack improvements include plans to upgrade the radios to Yaesu FT-1000MPs, and a complete rework of the dc power system, to eliminate intermittent RFI problems.

Conclusion

Contesting is growing in Central Texas. The Central Texas DX and Contest Club (*CTDXCC*) meets in Austin every fourth Monday of the month, and welcomes newcomers and visitors to the area. To learn more about our club, visit (**http://www.ctdxcc.org/**).

You can contact the author at 927 East 46th St Apt 102, Austin, TX 78751; tel 512-467-8724; **wm5r@arrl.net**; **http://www.cs.utexas.edu/users/kharker/radio/**. ■

LF Bands for Little Pistols

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It seems that the "little pistols" have the most difficulty in being even semi-competitive on 160, and to some extent, on 80 meters. At G3RZP, the antenna installation consists of a 5-element monoband Yagi for 20 at 62 feet, and a 4-element monoband Yagi for 15 at 68 feet, interlaced with a 4-element monoband Yagi for 10 on the same boom. This "little pistol" installation proved to be reasonably competitive with the majority of G and even European stations on these bands, but the LF bands were found to be a problem.

An 80-meter dipole with its center at the top of the tower and ends at about 30 feet and fed with open wire line has proved useful on 40 and is good for local work on 80. But for 80 and 160, something better was needed.

Verticals

Verticals are renowned for radiating equally poorly in all directions, and certainly my previous experience bore this out. However, they do have a reputation for being a good DX antenna, and without possessing a 120-foot tower, it was an option that obviously needed investigation.

The *CQ Vertical Antenna Handbook*, by Paul Lee, N6PL, provided a lot of useful information, and there have been many articles published on shunt feeding towers with gamma matches, omega matches, etc. Early attempts at using these methods failed miserably. Not only was the SWR bandwidth very low, but the effectiveness of the antenna was about zero!

The Folded Unipole

At this stage, perusal of the *Vertical Antenna Handbook* showed a method of feeding parts of a ship's superstructure as a folded unipole. Initial thoughts were that folding the antenna must make it more efficient—it raises the radiation resistance, doesn't it? Well, yes—or NO!!

Radiation Resistance

It all depends on the definition of "Radiation Resistance." A study of professional antenna textbooks produces two definitions:

The real part of the feed impedance of a lossless antenna; and

The real part of the feed impedance of a lossless antenna, measured at the current maximum.

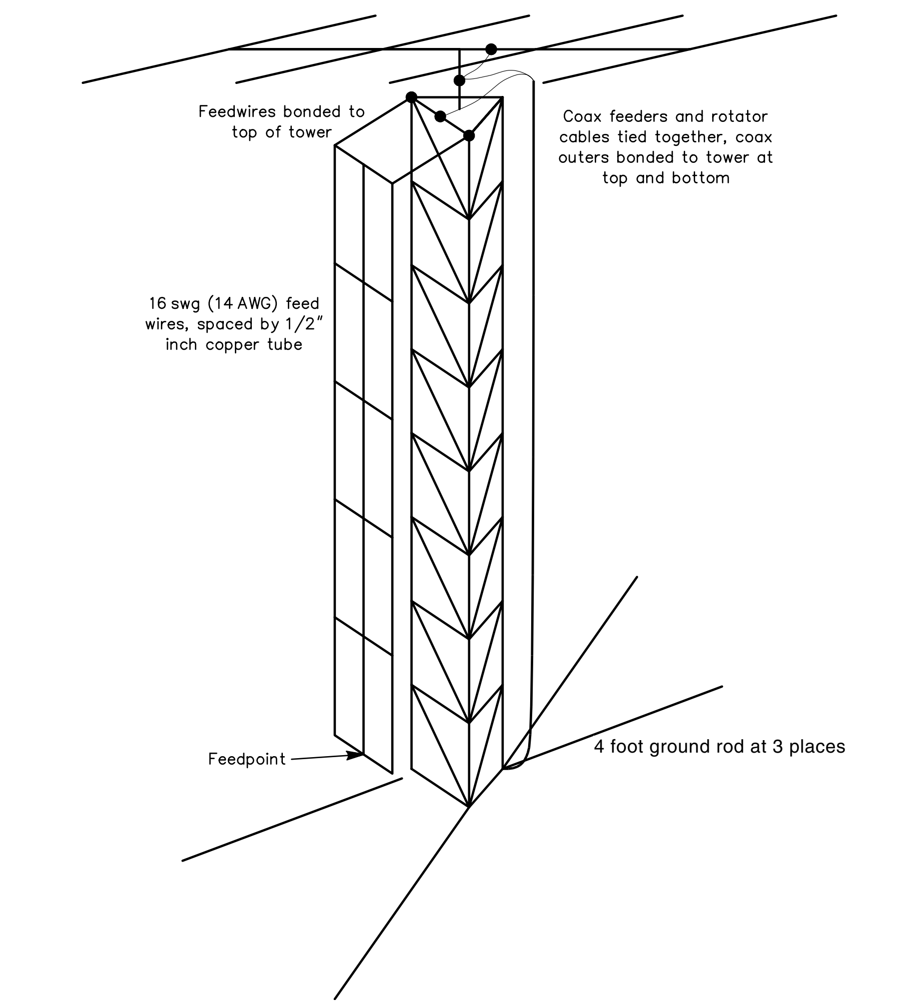
These definitions give very different answers when applied to a folded unipole. As the feed impedance is raised by folding, in the first case so is the radiation resistance; in the second case, this is not so. However, the higher feedpoint impedance can be easier to match, and leads to less losses in the matching network.

Construction

The folded unipole feed consists of three wires in the same horizontal plane, about eight inches apart, all connected together. Spacing is achieved with spreaders of copper water pipe. This feeder runs to the top of the crank up tower, where it is well bonded to the tower structure. The coax feeds for the beams and the VHF antennas are all cabled together; the shields are bonded to the tower at the top and bottom of the cable run, so the dubious RF connections between tower sections are effectively bypassed. Matching is achieved by L networks in the "Antenna Tuning Shed," a 6 × 4-foot wooden structure at the base of the tower, dedicated to antenna tuning and switching—and storage of antenna materials. One difficulty is getting a low enough ground return impedance back to the tuner. I used 6-inch wide aluminum flashing ($10 for a 50-foot roll at Home Depot in Sacramento) to connect from the base of the tower to the tuner in the Tuning Shed.

Electrical Performance

The antenna is a top loaded vertical, and is quarter wave resonant at about 2.5 MHz, because of the large capacity hat that the HF beams provide. An early problem was the failure of the direction indicator potentiometer in the T2X rotator. Whether or not this was fortuitous or caused by the RF current flow through



Shunt fed unipole tower for 80 and 160 at G3RZP.

the rotator is unknown. Remedial steps have involved fitting disc ceramic bypass capacitors in the rotator, and providing an RF "hairspring" to connect the stub mast to the tower structure. The feed impedance is such that an L network of about 750 pF in shunt with the antenna and an 11 mH series inductor provide a better than 2:1 SWR over 1.81 to 2 MHz without any retuning.

On 80 meters, the Q is much higher, and a 150 pF vacuum variable in shunt with a 22 mH series inductor allows tuning for less than a 1.5:1 SWR over the band. For any setting of the variable, the 2:1 SWR bandwidth is about 50 kHz, and so the capacitor is motor driven and controlled from the operating position. On 80, the voltage at the feed point is on the order of 1 kV at 100 W, so the feed point needs to be elevated or otherwise protected against accidental contact.

Radials

Verticals need a good ground. The tower itself is grounded with three 4-foot ground rods sunk into the thick wet blue clay that starts about two inches down. The question was whether to go for elevated radials, or for ground level radials. So one fine Saturday afternoon (we do occasionally get them in G land!), I set up a professional-grade admittance bridge to make measurements.

The great surprise came when adding radials one at a time made less than one-percent change in feed impedance—on both 160 and 80. This minimal change was the case with both elevated radials, and ones lying on the ground. With about 2 A of feed current into the antenna, a 250 mA thermo-ammeter in series with any or all of the radials produced no reading whatsoever. This lack of effect was a puzzle, and led to an abrupt cessation of measurements and recourse to a can of beer and the textbooks! The only reasonable conclusion appears to be that because of the nature of the sub soil, the RF resistance is very low.

Results

So far, this work may seem to have little application to contesting. If you're after winning local contests, it doesn't, but where contesting means working DX on the LF bands, it has application.

Some years ago, the RSGB used to run a 160-meter contest in the summer. K1DG said "Who but the limeys would run a top band contest in the middle of summer?" He came and operated one year and found that for working G stations, the antenna was pretty poor. He did work a PY, though—*on 160 in the middle of summer.*

For 160-meter DXing, the folded unipole has proved very good, with some 80 countries worked, including VK0IR, 9M0C and goodies. In the '87 ARRL 160-Meter Contest, the antenna produced the top single op score outside the US. In the 1999 ARRL 160, a spell on 1832.5 from 0711 to 0727Z produced 27 QSOs—all US stations, of course. K9AY reported the signal as "loud."

Eighty-meter performance is good with DX including the expeditions to ZK2, VK0 (Heard Island) and 9M0C being worked relatively easily. Breaking an East Coast pileup for Central American DX on SSB has proved to be not too difficult on a number of occasions.

Unfortunately, verticals are not good for receiving, and the noise picked up has to be heard to be believed. As a result, a number of receive antennas are employed—a tuned loop, a "EWE" (incredible performance for such a small antenna), while the quietest "all-round antenna" is the 80-meter dipole. Even so, I still get the feeling of being an alligator on 160.

Conclusion

If you've got a tower and an HF beam, but no room for massive LF antennas, try the folded unipole for the LF bands. Radials will probably be needed, but it appears that their effectiveness can be gauged by the change in feed impedance as they are added. If adding them doesn't change anything, then there's a good chance they're not doing anything. If you are lucky enough to live on wet clay, life is easier—but you will need a separate receiving antenna. ■

How to Get the Most from Attenuators and Preamps

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Most amateur transceivers include a preamp and/or attenuator, accessed either by switches on the front panel or via the radio's software menu. Unfortunately, many hams do not make the best use of these features, partly because most radios do not provide a sufficient range of preamp gain or attenuation values to cover all situations. This article will explain why these gain-control functions are important and how to use them (or augment them) to get the maximum performance out of your radio.

Factor #1—Dynamic Range

Receiver dynamic range is an important fundamental performance parameter. It is one of the most thoroughly tested features in technical product reviews like those found in *QST* or *RadCom*. I won't try to explain the intricacies of dynamic range. If you are unclear in your understanding of the concept, I recommend that you read through the material covering this topic in the *ARRL Handbook.*

Basically, your receiver's dynamic range includes signal levels ranging from the noise floor of its own circuitry to the level that causes audible intermodulation distortion (IMD or intermod). For the purposes of illustration, let's assume that your receiver has an optimum dynamic range of 90 dB, starting at an input signal level of –130 dBm. This is diagrammed using the simple bar graph of **Figure 1**. This is a typical intermod-free dynamic range specification for low-cost or mid-range HF transceivers, using ARRL Lab methods. Top-of-the-line radios typically have a dynamic range around 100 dB.

Our objective is to control the incoming signal levels with gain or attenuation, keeping the receiver operating within this optimum range whenever possible. To do this, we need to know the range of levels we can expect for the arriving signals. Figure 1 also shows some of the common situations you will encounter, and how they relate to the receiver's optimum performance range. I have limited this illustration to HF, because VHF and UHF have much lower noise floors that require special attention to preamplification alone. As you can see from the graph, HF communications includes a range of signals that far exceeds the 90 dB dynamic range of our receiver.

Let's start our analysis by looking at the situation on the higher bands of 20 meters and above. On the high bands, atmospheric noise may be 30 dB lower than it is on 160 meters. Especially on 15 and 10 meters, the background noise level can be lower than the bottom of the receiver's dynamic range. (Jansky made the first observations of galactic noise at 21 MHz, so we know it can be very quiet!) At these frequencies, we may need to add preamplification to hear signals that are above the noise level, but below the threshold of our receiver's sensitivity. Most radios offer 10 dB of preamp gain, with a few providing more. This may not be enough, and an external preamp may be needed to raise the level of incoming signals into the receiver's dynamic range.

However, when the high bands are wide open, signal levels can be very strong! If we still have a lot of preamplifier gain turned on when those big signals are present, we will exceed the upper limit of our desired dynamic range and generate signal-covering intermods. The challenge on the high bands is to be aware of the overall range of signals. We want to turn on the preamp when we need to hear weak signals, but turn it off (or even use some attenuation) to avoid filling our receiver with intermod "crud" from strong signals. In other words, the high bands are not "set and forget" when it comes to adding or removing gain from our receiver.

The low bands require special attention to attenuation. The 40-meter band is a unique case, since it can be either quiet or noisy. This band also has the added factor of megawatt international broadcast stations. Like the other low bands, you will never need a preamp on 40 unless you are using an inefficient receiving antenna. On all the low bands, the question is almost always, "How much attenuation do I need?" As noted regarding the high bands, we must consider the range of signal levels. However, those 40-meter broadcasters might force you to add so much attenuation that weak signals are lost—but they might be lost under the intermods anyway without attenuation! Sometimes you must accept some annoying intermods

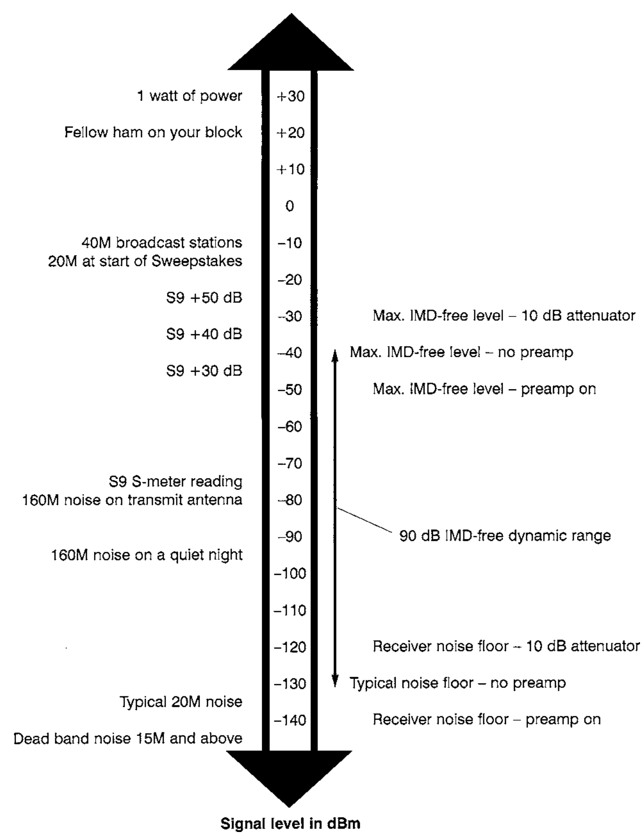

Figure 1—How signal levels relate to receiver performance and real-world conditions.

in order to hear weaker signals.

Factor #2—AGC Action

Eighty and 160 meters have the added dimension of high atmospheric noise levels. The broadband, random nature of noise makes it an insidious foe! When our problem is just strong signals, we can live with some intermods, since they are discrete "phantom signals." Intermod products resulting from the mixing of noise and strong signals are—you guessed it—more noise. To combat the effects of noise, we must not only deal with signal levels; we must also consider our receiver's AGC behavior.

AGC offers some protection against strong signals, but only in a portion of our receiver's circuitry. AGC is designed primarily for our listening comfort, not the preservation of intermod-free dynamic range. When AGC is operating, it reduces the overall gain of our receiver, usually in the IF stages, but sometimes also in front-end RF stages. The methods used for AGC gain reduction almost always reduce the usable dynamic range. If a high noise level hangs your S meter at S-9, half of your receiver's dynamic range is no longer available. If we attenuate the input so that the noise barely activates the AGC, we have nearly all the dynamic range available to handle signals.

There is another problem with the effect of noise on AGC. AGC reduces the *average* signal level with its relatively long recovery time, but AGC detectors have a fast attack which responds to *peaks*. Noise has a disproportionate effect on AGC, since noise has very high peak levels with low average power. As a result, it takes less noise power to activate the AGC than signal power. When noise is reduced ahead of the AGC detector (using your attenuator), the signal-to-noise improvement is larger than the amount of attenuation.

A more down-to-earth way to put this is—if you can add enough attenuation to limit the noise level to S-1 or S-2, you will hear many signals that were previously inaudible because the noise was keeping the AGC unnecessarily high. Try it! Tune to 80 or 160 and listen on your transmit antenna. Now add the 30 dB or more of attenuation it takes to get the S meter down to the low end of its range. You will almost certainly discover that listening with your transmit antenna works a lot better than you expected.

Obtaining Enough Gain or Attenuation

There are two significant problems with implementing the fairly simple principles noted above. First, your receiver may not have enough gain or attenuation available and, second, connecting external devices may not be easy.

Some mid-priced radios have only two gain options: normal gain and a 10 dB preamp. Others may add a 10 dB attenuator. Higher-level radios usually add more attenuation options and may have extra preamp gain. When you use inefficient receiving antennas like short Beverages, EWEs, K9AY loops, flags and pennants, you will almost certainly need to add an external preamp to obtain more gain. If you want to use your transmit antenna on receive, you may need more attenuation than is available in the rig. For additional interference protection, highpass or bandpass filters may also be desirable. How can we accommodate these external devices with the greatest flexibility?

The diagram of **Figure 2** shows the ideal manner for connection of external signal control equipment. A few transceivers are wired this way (my ICOM 765 for example), but not all models are this flexible. Most have a single jack for an external antenna and do not allow you to put anything between the transmit antenna and the receiver circuits. Hams using a directional transmitting array such as a four-square often use it as their primary receiving antenna. They want to have filters, preamps and attenuators available all the time, not just for an external receive-only antenna. If I owned a radio without a "loop through" connection from the transmit/receive relay to the receiver, I would not hesitate to install it—access to the receiver's antenna connection is essential for flexible implementation of external enhancements.

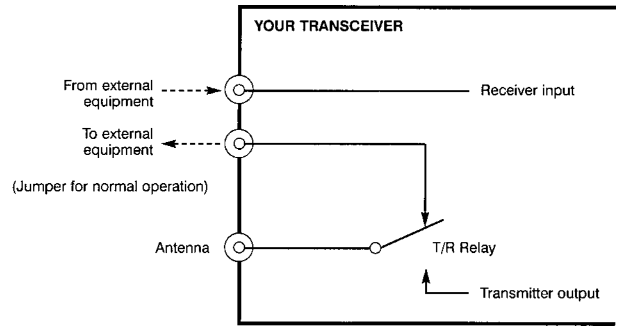

Figure 2—Flexible installation of external preamps, attenuators and filters requires a "loop through" connection between the transmit/receive relay and the receiver input.

Summary

Successful contesting on the HF bands requires us to get the most out of our stations. Nowhere is this need more pronounced than in our receivers. No radio system in the world requires greater ability to handle a wide range of signal levels than HF ham radio (except maybe the intelligence community). The best, most expensive radios on the market do not have enough dynamic range to deal with the entire range of noise and signal levels we encounter between 1.8 and 30 MHz.

We need to be smart about the way we control signal levels with preamplification and attenuation in order to allow our receivers to give us their maximum available performance. Hopefully, these notes on how and why we use preamps and attenuators will result in a few more QSOs in that next contest! ■

"Gull-Wing" Vertical Antennas

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Some time ago I received an inquiry from an engineer in the AM broadcast industry who wanted to know if it was possible to utilize elevated radials in combination with a base-insulated tower mounted at or near ground level. Extensive computer modeling indicated that the answer to this question was "yes," provided that the elevated radials were "bent" in a suitable fashion.[1] This article will describe applications of the same technique to ham radio vertical antennas. Examples will be restricted to the 80-meter band, but the procedure is equally valid at other frequencies.

Reference Antenna

All of the computer modeling shown here was carried out using *EZNEC pro*.[2] This is an improved version of Roy Lewallen's widely-used *ELNEC* software, but it incorporates either *NEC-2* or *NEC-4*[3] as its "calculating engine," rather than *MiniNEC*.[4] With the *NEC-4* engine, *EZNEC pro* can model antennas which touch or even penetrate the ground, and it also handles "real" ground much more accurately than *ELNEC*. My 1988 *QST* article on elevated vertical antennas[5] was derived from computer analysis I had completed using *NEC-GSD*, a special version of *NEC-3* that was configured to efficiently model vertical antennas with large numbers of symmetrically-disposed radials and/or top-hat wires. *NEC-4* is a descendant of *NEC-2* and *NEC-3*, and is similar to them in many ways.

For use as a standard of comparison, I decided to initially construct a model of a conventional ground-mounted vertical antenna with a "broadcast-type" ground system. A quarter-wave vertical monopole (height = 67.368 feet at 3650 kHz) was placed over "real ground" with a conductivity of 0.005 siemens/meter and a dielectric constant of 13. The ground screen consisted of 120 quarter-wave radials buried in the soil to an average depth of 6 inches; these radials are positioned uniformly around the base of the monopole, at three-degree intervals. All of the radials are assumed to be made from #12 AWG copper, while the vertical element is #10 AWG copper. The peak gain of this antenna is 0.55 dBi at a take-off angle of 24 degrees above the horizon, and the computed input impedance is 39.19 + *j*21.67 Ω.

Bent-Radial Verticals

To make a bent-radial antenna, the vertical element is mounted at or near the ground, but its base must be insulated from ground. For AM-broadcast applications, the vertical monopole is generally constructed from tower sections, and the tapered lower end rests upon a large insulator that is placed on a concrete pedestal. As a result, the feedpoint of the tower is usually several feet above the level of the underlying soil. In my *EZNEC* computer models of antennas for the 80-meter band, I placed the bottom of the vertical element at a height of just one foot above the ground.

Dean Straw, N6BV, refers to these bent radials as either "gull-wing" or "turkey-buzzard-wing" (*TBW*) radials.[6] I will utilize the term "gull-wing," since it's shorter. **Figure 1** is a computer-generated drawing that shows a single vertical monopole with four gull-wing radials, while **Figure 2** is a "close-up" of the feedpoint. The inner ends of the radials are adjacent to the base of the vertical element, but must be insulated from it. Normally, these ends would all be connected together via a short piece of wire that is bent into a circular shape. From this junction, or "ring," the radials immediately slope upward at an angle of 45 degrees until reaching a height of 10 feet. At this elevation, they are bent into a horizontal position, where they remain for the rest of their length.

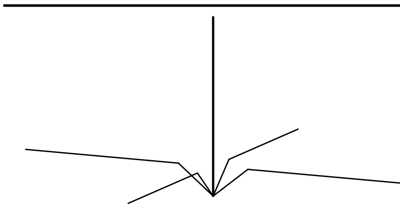

Figure 1—A single vertical monopole with four "gull-wing" elevated radials. The base of the vertical element is one foot above ground, and the horizontal portions of the radials are placed at a height of ten feet. The feed-point is located at the base of the vertical element.

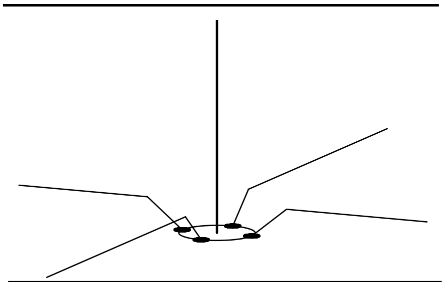

Figure 2—Close-up of the feed-point in a typical installation. The inner ends of the four elevated radials are joined together by a short circular wire that surrounds the insulated base of the vertical element. The center lead of the coax attaches to the bottom of the vertical element, while the coax shield is bonded to the wire circle. (If desired, an un-un may be installed at the feed-point to improve the impedance match.)

As with the reference antenna, the vertical element is #10 AWG copper, while the radials are composed of #12 AWG copper. The length of the vertical monopole was fixed at $^1/_4$-λ, or 67.368 feet at 3650 kHz. But, all four radials were "pruned" simultaneously to achieve resonance (zero reactance) at the operating frequency of 3650 kHz. The resulting antenna has a predicted gain of about 0.16 dBi at 23 degrees take-off angle, with an input resistance of 22.62 Ω at resonance. There is a deep null at the zenith, with no radiation directly overhead. The quoted gain of 0.16 dBi is only correct when measuring directly off the ends of the gull-wing radials. At compass bearings mid-way between the radials however, the gain diminishes to 0.13 dBi at the same elevation angle.

If the base of this antenna were raised to a height of 10 feet and the radials were completely horizontal throughout their length, then the peak gain would rise slightly to 0.22 dBi (0.20 dBi mid-way between radials) at a take-off angle of 22 degrees. Once the radials are again "pruned" to resonance (still 3650 kHz), the input resistance predicted by the computer is much higher than before, at 35.61 Ω. Recall that our reference antenna with 120 buried radials has a gain of 0.55 dBi at an elevation angle of 24 degrees. Thus, the gain of a conventional elevated vertical is about 0.34 dB below the classic 120-buried-radial antenna, while the "gull-wing" ground-mounted vertical is a bit worse, at roughly 0.41 dB behind the reference antenna.

I decided to see what would happen if the "gull-wing" radials were repositioned so that their horizontal portions were higher above the ground, at a height of either 12 or 14 feet, while the bottom of the vertical element and the lower ends of the radials were still at the original one-foot elevation. **Table 1** shows the results for all of the gull-wing antennas *and* for conventional elevated vertical antennas utilizing raised bases and radials that are completely horizontal.

As may be seen, lifting the gull-wing radials higher above the ground yields almost no improvement in performance. All of these antennas have radiation patterns that are within a few hundredths of a decibel of being perfectly circular, even though only four radials are used in each case.

Table 2 provides information on the input impedance for all of the antennas described above. Notice that the values for input resistance remain well below 50 Ω, so an "un-un" or other impedance-matching device should be installed at the antenna terminals to lower the SWR on the transmission line.

As mentioned earlier, the lengths of the radials were always "tweaked" from their original quarter-wave figure (67.368 feet at 3650 kHz) in order to achieve a feed-point impedance that was purely resistive, with zero reactance. For the gull-wing radials, this necessitated increasing their dimensions considerably beyond the normal quarter-wave span. At a height of 10 feet, the overall radial lengths turned out to be 76.8 feet, while 79.3 feet was required at a height of 14 feet.

Doubling the number of gull-wing radials from four to eight led to better performance, in the scenario that was examined. When four more gull-wing radials are added to the earlier antenna (where the horizontal portions of all the radials are at H = 10 feet), then the forward gain increases from 0.16 to 0.28 dBi, while the take-off angle of maximum gain falls from 23 to 22 degrees. Further, the use of eight radials improves the circularity of the radiation pattern in the azimuthal plane.

To obtain resonance once again, the overall length of each radial had to be increased from 76.8 to 83.6 feet. Interestingly, the "standard" elevated vertical antenna, with its feed-point and horizontal radials at a height of ten feet, shows no change in gain whatsoever when the number of radials is doubled from four to eight, once resonance is re-established.

Table 1
Gain and take-off angle for "gull-wing" antennas and conventional elevated verticals with horizontal radials. For the gull-wing antennas, the height shown is that of the horizontal portion of the radials, while the base of the vertical element is fixed at one foot. For the conventional elevated verticals, the base of the monopole and the horizontal radials are positioned at the height shown. (Gains shown in parentheses are for azimuth angles located mid-way between two adjacent elevated radials, rather than directly off the ends of the radials.) The classic vertical monopole with 120 buried radials has a gain of 0.55 dBi at an elevation angle of 24 degrees.

	Gain and Take-off Angle		
Height (in feet)	*Elevated antenna with horizontal radials*	*Ground-mounted antenna with gull-wing radials*	*Difference*
10	0.22 dBi @ 22 deg (0.20 dBi)	0.16 dBi @ 23 deg (0.13 dBi)	0.06 dB (0.07 dB)
12	0.25 dBi @ 22 deg (0.23 dBi)	0.16 dBi @ 22 deg (0.13 dBi)	0.09 dB (0.10 dB)
14	0.27 dBi @ 21 deg (0.25 dBi)	0.17 dBi @ 22 deg (0.13 dBi)	0.10 dB (0.12 dB)

Table 2
Input impedance for "gull-wing" antennas and for conventional elevated verticals with horizontal radials. In every case the length of the radials has been adjusted to achieve a purely-resistive impedance value, with zero reactance. For the gull-wing antennas, the height shown is that of the horizontal portion of the radials, while the base of the vertical element is fixed at one foot. For the conventional elevated verticals, the base of the monopole and the horizontal radials are positioned at the height shown.

	Input Impedance at Resonance	
Height (in feet)	*Elevated antenna with horizontal radials*	*Ground-mounted antenna with gull-wing radials*
10	35.61 Ω	22.62 Ω
12	34.53 Ω	19.53 Ω
14	33.53 Ω	16.71 Ω

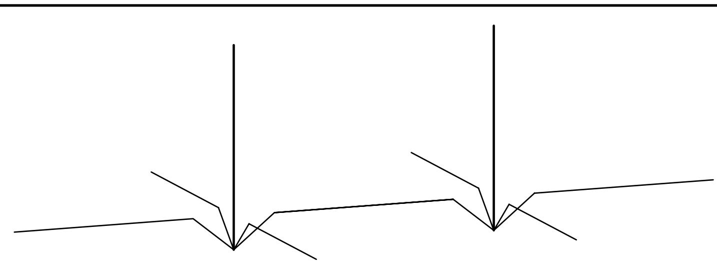

Figure 3—A 2-element cardioid array using "gull-wing" verticals as building blocks. One radial is "shared" by both vertical elements, and this wire must be bent at both ends. Element spacing is 1/4-λ, and the horizontal portion of each radial is ten feet above the ground.

"Gull-Wing" Arrays

Phased arrays can easily be constructed by using gull-wing vertical elements as building blocks. **Figure 3** shows the *EZNEC* depiction for a cardioid array, with the horizontal segments of the radials located ten feet above the ground and the two antennas spaced 1/4-λ apart (67.368 feet at 3650 kHz).

Notice that one of the gull-wing radials is "shared" by both monopoles, so only seven wires are needed for the radial system. The verticals are fed with equal-amplitude currents that are 90 degrees out of phase, and the front element lags the rear one.

The elevation-plane radiation pattern for this array is displayed in **Figure 4**. The peak forward gain is 3.07 dBi at a take-off angle of 23 degrees, which means the array has about 2.9 dB of extra gain, when compared to a single gull-wing vertical. The front-to-back ratio is 20 dB or better at most elevation angles, although there is now some radiation directly overhead. From **Figure 5** we can see that the half-power beamwidth in the azimuthal plane is 173 degrees, which is close to the optimal value of around 180 degrees.

Figure 6 illustrates a "gull-wing" four-square array, which requires only 12 elevated radials. The four "inner" radials are shared by adjacent vertical elements, and are bent downward at both ends. As usual, the horizontal portions of the radials are ten feet above the ground. Each side of the square has a dimension of ¼-λ, and equal-amplitude currents with progressive 90-degree phasing are used. **Figure 7** shows the elevation-plane radiation pattern for the four-square, which has a peak forward gain of 4.45 dBi at an elevation angle of 21 degrees. Doubling the number of elements in the array from two to four has yielded about 1.4 dB of additional gain, and this maximum gain occurs at a take-off angle that is two degrees lower, when compared to the cardioid array described earlier. The rear lobe is not well developed, however, and there is still considerable high-angle radiation. The azimuthal-plane pattern in **Figure 8** reveals a front-to-back ratio of just over 21 dB, and the half-power beamwidth is about 97 degrees, which provides ample coverage of an entire quadrant.

Surprisingly, adding more “gull-wing” radials to either the cardioid or the four-square array actually *reduces* the forward gain, according to the results obtained from *EZNEC4*, when using gull-wing radials whose horizontal sections are ten feet above the ground.

Comparisons

How do these “gull-wing” arrays compare with “standard” elevated vertical antennas that utilize horizontal radials? **Figure 9** shows the elevation-plane radiation patterns for the gull-wing cardioid array discussed earlier, along with that of a conventional elevated cardioid array, where the horizontal radials and the bases of the two vertical monopoles are installed at a height of 10 feet. The “standard” antenna has a bit more forward gain (3.29 dBi at 22 degrees take-off angle) than the gull-wing version, but the front-to-back ratio is inferior, at just 14.28 dB in the elevation plane. Also dis-

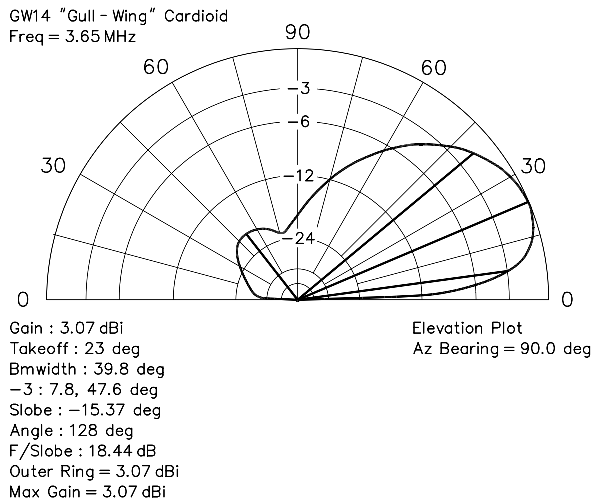

Figure 4—Elevation-plane radiation pattern for the 2-element “gull-wing” cardioid array. Peak gain is 3.07 dBi at a take-off angle of 23 degrees above the horizon. The front-to-back ratio is 18.44 dB, with maximum radiation off the back of the array occurring at an elevation angle of 52 degrees.

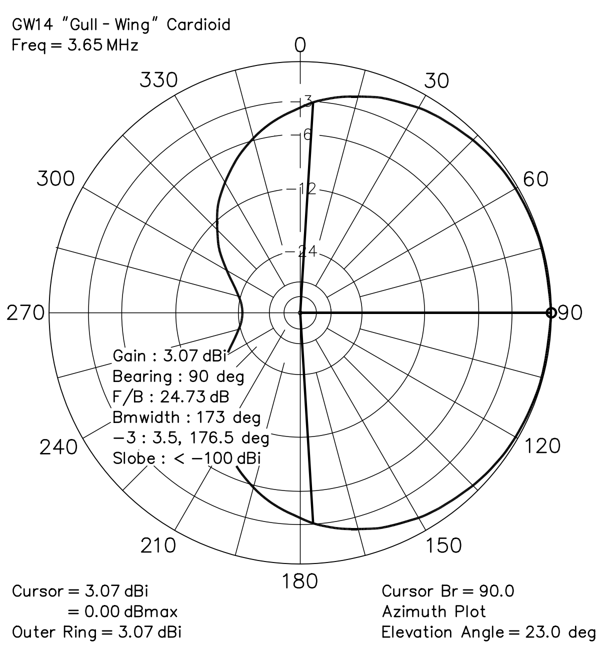

Figure 5—Azimuthal-plane radiation pattern for the two-element “gull-wing” cardioid array, taken at the elevation angle where peak forward gain occurs (23 degrees). The front-to-back ratio here is 24.73 dB, and the half-power beamwidth at this take-off angle is 173 degrees (nearly half the compass).

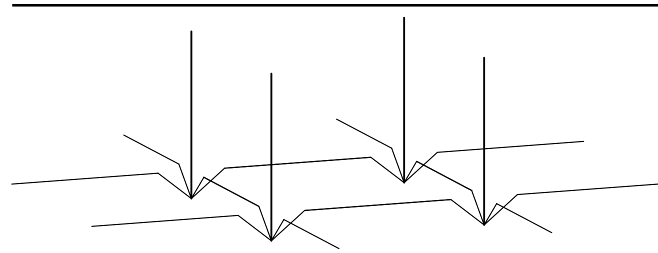

Figure 6—A four-square array using “gull-wing” verticals as building blocks. The radials are arranged in a “tic-tac-toe” pattern, and only twelve wires are needed. Four radials do “double duty” here; since each is “shared” by two adjacent vertical elements, these wires must be bent at both ends. Monopole spacing is ¼-λ, and the horizontal portion of each radial is ten feet above the ground.

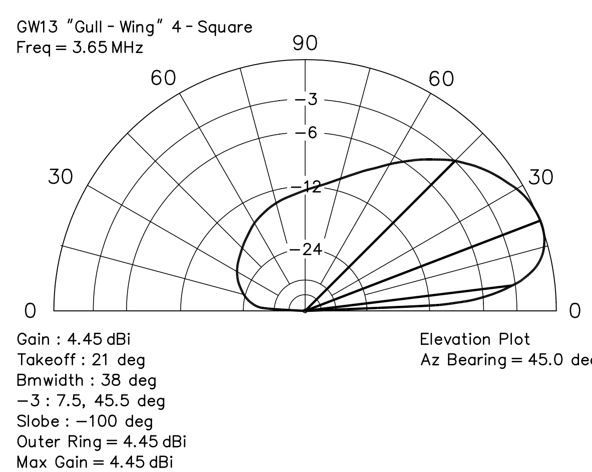

Figure 7—Elevation-plane radiation pattern for the “gull-wing” four-square array. Peak gain is 4.45 dBi at a take-off angle of 21 degrees above the horizon. The front-to-back ratio is impossible to specify, since there is no distinct rear lobe.

played in this figure is the pattern for a full-size half-wave horizontal dipole at a height of $^{1}/_{2}$-λ above the ground (134.74 feet at 3650 kHz). This big dipole has a lot more peak gain, 7.75 dBi at a 28-degree take-off angle; but of course, it has no rejection off the back whatsoever.

Figure 10 includes the elevation-plane radiation patterns for the "gull-wing" 4-square, and for a similar 4-element array using horizontal radials and monopoles whose bases are ten feet off the ground. The conventional elevated four-square has more forward gain (5.23 dBi at 21 degrees take-off angle) and better front-to-back ratio (26.49 dB) than the gull-wing version, making it the obvious winner. Once again, the pattern for a half-wave horizontal dipole a half-wave above the ground is shown for comparison. The full-size dipole has

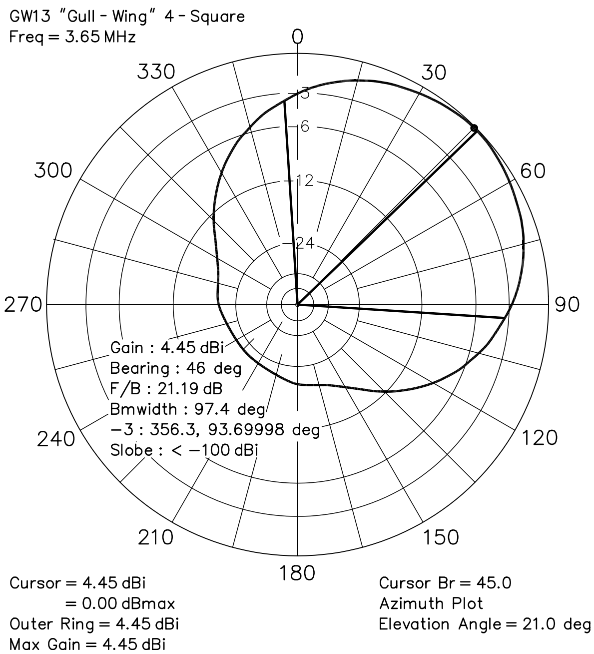

Figure 8—Azimuthal-plane radiation pattern for the "gull-wing" four-square array, taken at the elevation angle where peak forward gain occurs (21 degrees). The front-to-back ratio here is 21.19 dB, and the half-power beamwidth at this take-off angle is 97 degrees (just over one-fourth of the compass).

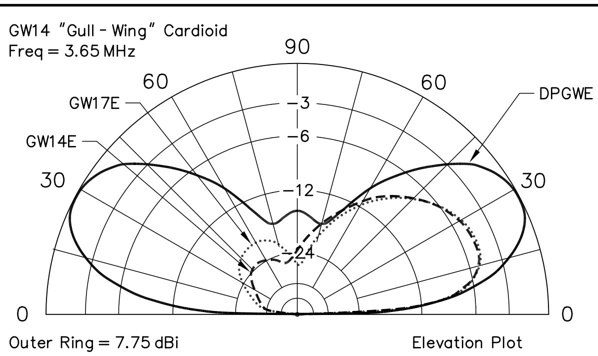

Figure 9—Elevation-plane radiation patterns for the "gull-wing" cardioid array, a conventional cardioid array with horizontal radials at a height of ten feet and a half-wave horizontal dipole at a height of 134.7 feet, which is $^{1}/_{4}$-λ at 3650 kHz.

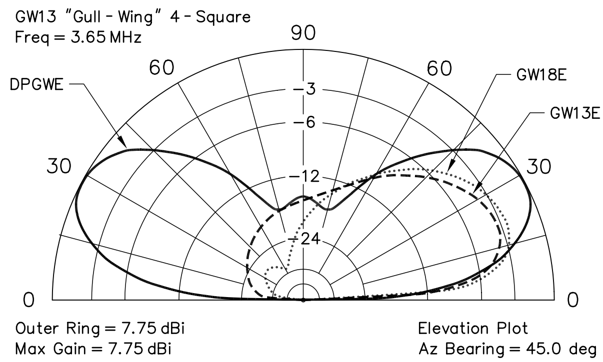

Figure 10—Elevation-plane radiation patterns for the "gull-wing" four-square array, a conventional 4-square array with horizontal radials at a height of ten feet and a half-wave horizontal dipole at a height of 134.7 feet.

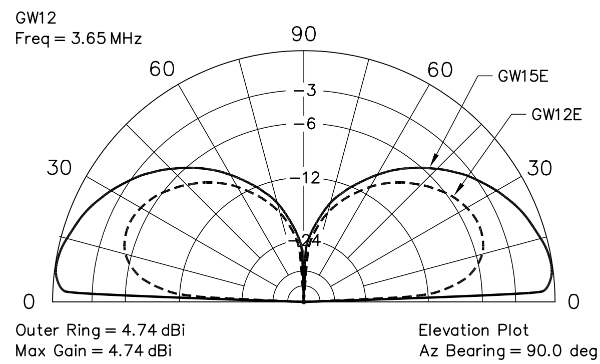

Figure 11—Elevation-plane radiation patterns for a single "gull-wing" antenna when installed over ground and over seawater. The vertical monopole which is mounted over seawater has only two bent radials, versus four for the other. Over ground, the peak gain is 0.16 dBi at 23 degrees take-off angle, while the seawater antenna yields a maximum of 4.77 dBi at 7 degrees above the horizon.

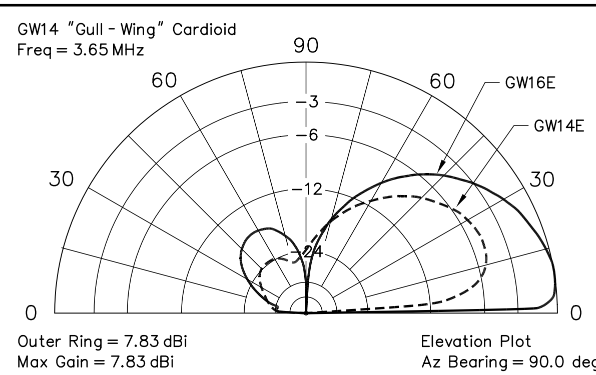

Figure 12—Elevation-plane radiation patterns for a "gull-wing" cardioid array when installed over ground and over seawater. The above-water array has only four radials in all, versus a total of seven for the other antenna. Over ground, the peak gain is 3.07 dBi at 23 degrees take-off angle, while the seawater antenna yields a maximum of 7.83 dBi at 8 degrees above the horizon.

a significant performance edge at elevation angles between 20 and 40 degrees, where it works best, but both of the four-squares are superior at the very lowest take-off angles, from the horizon up to about ten degrees.

When verticals are installed near or over seawater, they work much better, as was proven in dramatic fashion at the 6Y4A and 6Y2A contest stations. **Figure 11** compares the elevation-plane radiation patterns of a single gull-wing vertical over ground (conductivity = 0.005 siemens/meter and dielectric constant = 13), and a similar antenna mounted over seawater (conductivity = 5 siemens/meter and dielectric constant = 80). Like the Jamaican contest verticals, the seawater antenna utilizes just *two* gull-wing radials, which are installed 180 degrees apart, so they extend outward in opposite directions. Despite having only two radials instead of four, the seawater vertical has a maximum gain advantage of about 4.6 dB, at a much lower take-off angle.

Figure 12 shows the same results for a pair of cardioid arrays, one installed over ground and the other over seawater. Each element of the seawater antenna has only two radials, as described above. Now the seawater array has a peak gain margin of about 4.75 dB, and the elevation angle is again very low. The tremendous conductivity of salt water allows vertically-polarized antennas to develop very high signal strengths at take-off angles near the horizon, and this property can be used effectively by those who are fortunate enough to have access to such locations.

Conclusion

This article has described the performance of base-insulated vertical antennas and arrays, when the monopoles are installed just a short distance above the ground and used in combination with "gull-wing" (bent) elevated radials. Computer-modeling studies indicate that good performance may be obtained from such an arrangement, although the maximum gain is lower than that of a more-conventional elevated-radial antenna or a classical ground-mounted monopole with many radials.

A technical-journal article,[7] discussing gull-wing-style radials for vertical antennas in the US standard-broadcast band, served as an inspiration for Tom Schiller, N6BT, which led to their utilization on the 1997 6Y4A CQWW DX CW Contest expedition.[8] Bent radials were again pressed into service during the subsequent 6Y2A operation in 1998, as described by Dean Straw, N6BV, who gave these gull-wing/turkey-buzzard-wing radials their name.[6] Perhaps a gull-wing vertical antenna could find a home at your QTH!

References

[1] Al Christman and Roger Radcliff, "Using Elevated Radials with Ground-Mounted Towers," *IEEE Transactions on Broadcasting*, Vol 37, No 3, Sep 1991.

[2] Several versions of *EZNEC* are available from Roy Lewallen, W7EL, PO Box 6658, Beaverton OR 97007.

[3] G. J. Burke and A. J. Poggio, "Numerical Electromagnetics Code (*NEC*)—Method of Moments," Naval Ocean Systems Center, Jan 1981, San Diego CA 92152.

[4] J. C. Logan and J. W. Rockway, "The New *MiniNEC* (Version 3): A Mini-Numerical Electromagnetic Code," Naval Ocean Systems Center, Sep 1986, San Diego CA 92152.

[5] Al Christman, KB8I, "Elevated Vertical Antenna Systems," *QST*, Aug 1988, pp 35-42.

[6] R. Dean Straw, N6BV, "Antennas Here Are Some Verticals on the Beach," *ARRL Antenna Compendium*, Vol 6, 1999, pp 216-225.

[7] Al Christman, R. Paul Zeineddin, Roger Radcliff, and Jim Breakall, "Using Elevated Radials In Conjunction with Deteriorated Buried-Radial Ground Systems," *IEEE Transactions on Broadcasting*, Vol 39, No 2, Jun 1993.

[8] Kenny Silverman, K2KW, and Tom Schiller, N6BT, "Verticals for Contest Expeditions: Learnings from the 6Y4A CQWW CW Contest," *CQ Contest*, Mar 1998. ■

Some Facts of Life About Modeling 160-Meter Vertical Arrays—Part 1: Some Baseline Data

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For rather obvious reasons, 160 meters shows a higher percentage of vertical antennas and arrays relative to the total number of antennas in use than any other band. With the advent of *NEC* and *MININEC*, the tools that we use for designing and analyzing antennas for 160 have shifted from hand calculations to computer-aided design programs. However, the more I read, the less content I am that we have a full appreciation for what those modeling programs tell us. No where is the absence of understanding more evident than in the treatment of radial systems, whether they are attached to the antenna as part of its structure or simply lie beneath an independent antenna element.

There are two major ways that we might proceed in at least partially correcting this relative vacuum. One is mathematical and has recently been started by Rudy Severns, N6LF, in "Verticals, Ground Systems, and Some History," *QST* July 2000, pp 38-44. An alternative route is to do some systematic modeling related to 160-meter vertical antennas and arrays. By capturing in a reasonably comprehensive way the span of results that antenna modeling systems present to us, we can gain some perspective and reasonable expectations of well-wrought antenna models.

This series will take the latter approach. In this first part, we shall examine some baseline data on $^1/_4$-λ verticals using various types of modeled ground systems available to us within versions of *NEC*. In the second part, we shall seek a more comprehensive view and appreciation of the relative effects of soil conductivity and permittivity (relative dielectric constant) on the performance of our baseline antenna model. Since the project will simultaneously involve some problems associated with using the *MININEC* (no-radial) ground system and with the construction of models of radial systems, we shall tackle both problems in Part 3. The 4th episode will be devoted to a potpourri of models of some common vertically polarized antennas we typically use on 160 meters, as we seek some guidelines for the most adequate modeling possible. In the final installment, we shall look at the suggested use of inner and outer ground qualities to simulate a radial system.

There is some disputation afoot regarding the adequacy of models of just the sort that we shall examine relative to the performance of the physical antennas modeled. This series will not address that cluster of questions, since that larger topic necessarily involves the use of adequate testing methodology upon actual antennas as one side of the coin. Here, we shall be looking at what sorts of things different kinds of models tell us, and the number of variations on radial system modeling alone will more than fill our plate. However, a thorough understanding of what such models tell us is the other side of the coin under discussion, so I shall not be wholly blind to implications of the work done here.

Throughout these episodes, I shall be using both *NEC-2* and *NEC-4* in commercial implementations—*EZNEC*, *GNEC* and *NEC-Win Plus*. These programs have input and output facilities that greatly ease the construction and interpretation of models, such as radial-makers, and the like. I shall indicate which level of *NEC* is used for every model explored. As well, the major output of this study is an array of data presented in tables and graphs. I shall limit text to an amount necessary to take a guided walk through the data, but it would require a book to extract every nuance from the information gathered. You may wish to study the data at length and draw further inferences from them.

The $^1/_4$-λ Vertical Monopole and Its Radial System

Any model of a $^1/_4$-λ vertical monopole must necessarily include several elements, shown in **Figure 1**. Of course, there is the vertical element itself. In all cases, I shall use a 40-meter tall element that is 25 mm in diameter. (Because metrics are so common in 160-meter antenna work, all dimensions will be in metric form—25 mm is just under 1-inch in diameter.) Wherever a radial system is used, it will consist of 2-mm diameter wire (about 0.0787-inch or between AWG #14 and AWG #12). Everything will be copper for simplicity and because changes of material in these models yield changes in results that have no affect on the trends in which we shall be most interested. The test frequency will be 1.83 MHz, and therefore $^1/_4$-λ radials will be 40.96 meters long.

Beneath the antenna will be the ground, as defined by a combination of conductivity and dielectric constant (permittivity). **Table 1** lists the *de facto* standard range of values typically used as a fair sampling of the effects of soil quality on antenna performance. In the next part of our exploration, we shall look at the question of whether this short table represents a fair sampling or not. For the moment, we may content ourselves with these categories. Their origin lies in the table found in *The ARRL Antenna Book* (p 3-6), which is itself an adaptation of the table presented by Terman in *Radio Engineer's Handbook* (p 709), taken from "Standards of

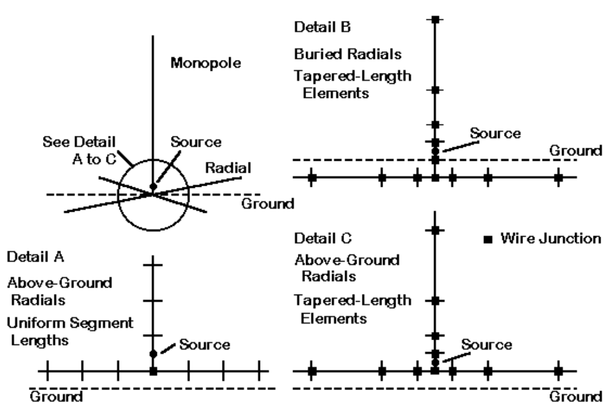

Figure 1—The basic $^1/_4$-λ monopole and variations among models used in this study.

Table 1
Soil types used in the study.

Soil Type	*Conductivity (Siemans/meter)*	*Permittivity (dielectric constant)*
Very Poor	0.001	5
Poor	0.002	13
Good (Average)	0.005	13
Very Good	0.0303	20

Good Engineering Practice Concerning Standard Broadcast Stations," *Federal Register* (July 8, 1939), p 2862.

The four levels of soil quality—Very Poor, Poor, Good, and Very Good—have been a standard set of ground quality models since they were placed into early versions of *ELNEC* by Roy Lewallen, W7EL. Unfortunately, the "Good" category has obtained the alternate label "Average," which may be dubious, even if it is the general default used in most commercial implementations of *NEC*. Hence, we see more antennas modeled over "Average" ground than any other sort. The practice presents no hindrance to the understanding of models of horizontally polarized antennas, but it may create some limitations in our thinking about verticals for the MF and lower HF region.

We shall bypass some inherent limitations of all *NEC* models at MF and lower HF. *NEC* presumes a flat uncluttered terrain and a uniform soil constitution beneath the antenna. Neither condition may be obtained in any given situation. Although we can model important ground clutter with wire grid assemblies, we cannot capture in a *NEC* model the stratified soil that may underlie a given antenna site. Since our work will be limited to comparisons among models, these limitations will not affect the results.

Now to the crux of the problem with modeling vertical arrays on 160 meters: we can use a considerable number of modeling techniques related to the radial system to make comparisons among antennas. Here is the short list of common radial system modeling techniques:

1. Buried radials: available only in versions of *NEC* above 2, which in practical terms of commercial implementations, requires *NEC-4*. Exigencies of modeling wires near the surface usually result in the use of length-tapered elements to yield finite model sizes.

2. Elevated radials, within 0.001-λ of ground to simulate buried radials. This is the standard *NEC-2* method of handling of radial systems, although there are two major versions:

2a. Uniform segmentation of all wires, which results in very large models for adequately segmented antennas with 30 or more radials.

2b. Length-tapered elements, which yield smaller models, often able to be run on segment-limited implementations of *NEC*.

3. Use of the *MININEC* ground (available with the *NEC* core in versions of *EZNEC*) without modeling the radial system itself.

To look at the ways in which these modeling systems converge and diverge, we can take a simple ¹/₄-λ monopole for 1.83 MHz and model it in each system using (where relevant) from 4 to 128 ¹/₄-λ radials over each type of soil quality shown in Table 1. The number of radials will double in each step. This will give us a baseline of data for making some comparisons among the systems. Throughout, I shall list results in more numeric detail than might be significant for practical operation. Since we are interested in the numerical trends internal to modeling, the added precision of recorded results is wholly appropriate.

Elevated and Buried Radial System Results

The notion of elevated and buried radial systems, as used here, is limited to radial systems near the soil surface. (Placing a radial system on or under the soil is not possible in *NEC-2* and placing the radial system at Z=0 in *NEC-4* yields unusable results. Hence, our choices are limited.) For *NEC-2* or *NEC-4*, we may follow a standard practice of placing the radial system at the minimum recommended height above ground. For the frequency in use, the 0.001-λ recommendation translates into a height of 0.164 meters or about 6.5 inches. By simply raising the entire system by this height from its initially modeled ground level, we may use standard uniform segmentation of the elements. However, because a radial system is a complex structure, use of the minimum segmentation levels (about 10 per half-wavelength) will often not yield convergence of the model. The models used here employed 20 segments per quarter wavelength. Remember that this type of model is said to simulate buried radials.

Table 2
40-meter vertical monopole, 25 mm in diameter. 40.96-meter (¹/₄-λ) radials, 2 mm in diameter; uniform segmentation: 20 segments per wire. Radials 0.001-λ above ground.

NEC-4

Soil Type	*Gain (dBi)*	*TO Angle (degrees)*	*Source Impedance (R +/- j X Ω)*
4 radials: 5 wires; 100 segments			
Very Poor	-2.15	27	44.51 + *j* 22.49
Poor	-0.51	25	42.07 + *j* 27.30
Good	0.51	22	42.84 + *j* 29.04
Very Good	2.30	17	43.82 + *j* 25.37
8 radials: 9 wires; 180 segments			
Very Poor	-1.61	27	38.90 + *j* 6.11
Poor	-0.05	24	37.59 + *j* 9.71
Good	0.96	22	38.52 + *j* 11.79
Very Good	2.74	17	39.64 + *j* 12.17
16 radials: 17 wires; 340 segments			
Very Poor	-1.42	27	36.80 + *j* 0.02
Poor	0.08	25	36.29 + *j* 2.88
Good	1.09	22	37.27 + *j* 4.45
Very Good	2.90	16	38.14 + *j* 5.74
32 radials: 33 wires; 660 segments			
Very Poor	-1.38	27	35.93 - *j* 2.20
Poor	0.07	24	35.92 + *j* 0.55
Good	1.09	22	36.96 + *j* 1.89
Very Good	2.93	17	37.87 + *j* 3.15
64 radials: 65 wires; 1300 segments			
Very Poor	-1.31	27	35.19 - *j* 2.92
Poor	0.05	25	35.81 - *j* 0.21
Good	1.02	22	37.09 + *j* 1.22
Very Good	2.91	16	38.02 + *j* 2.57
128 radials: 129 wires; 2580 segments			
Very Poor	-1.18	27	34.43 - *j* 2.57
Poor	0.11	25	35.43 - *j* 0.26
Good	0.98	22	37.07 + *j* 0.99
Very Good	2.86	17	38.25 + *j* 2.52

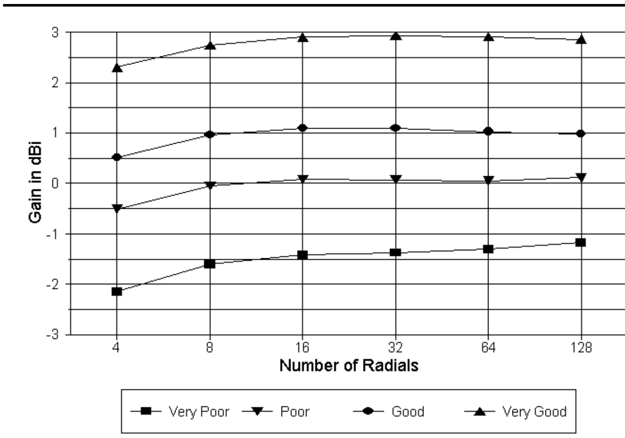

Figure 2—Gain reports of the ¹/₄-λ monopole over various soil qualities for 4 to 128 radials for an above-ground uniformly segmented model.

Although *NEC-2* recommends a limit of about 30 wires to a single junction, the limitation does not apply to *NEC-4*. Therefore, the uniform segmentation models over the various soil types proceeded to 128 radials. Whether *NEC-4* can handle this number of wires at a junction for the models involved is indicated by the results. (Even in *NEC-2*, all of the models easily pass the average gain test, with the highest deviation from a perfect 1.000 appearing with only 4 radials: 1.0397. The 128-radial model produce an average gain test result of 1.0096. However, the average gain test is a necessary but not sufficient test of model adequacy and does not reveal every possible flaw in models.) **Table 2** and **Figure 2** provide the data in different forms. For uniform segmentation, the smooth curves in Figure 2 indicate that nothing erratic happens at the uppermost numbers of radials.

However, the data reported by *NEC-4* are interesting in their own right. The region of 16 to 32 radials is where the curves level off and modeling additional radials produces no further significant increases in the modeled far field gain, with the possible exception of the worst soil qualities. Moreover, the curves are nearly congruent, indicating that for each soil type, increasing the number of radials has a similar effect on gain. The impedance data in Table 2 indicates a similar set of trends for the source resistance. Indeed, from 32 radials upward, the source impedance changes virtually negligibly.

The model sizes listed in Table 2 provide ample incentive to use length tapering on the elements to reduce model size. Thirty-two radials of uniform segmentation at the specified density of 20 per $^1/_4$-λ overrun the 500-segment limitation of some programs. However, by using length tapering of each wire toward the junction, a 32-radial model requires only 397 segments. The standards of length tapering used in the model are based on two factors. First, the buried radial model will require wires as short as 0.001-λ (0.164-meter). Hence, this figure became the lower length limit for tapering, with 0.04-λ selected as the upper limit. Standard length-segmenting features on programs like *EZNEC* begin with a wire of the shortest specified length and add wires of progressively doubled lengths until the maximum segment length is reached. The remaining element length is then segmented at a segment length that does not exceed the limit.

Second, as shown in a detail of Figure 1, the segments on either side of the source segment should be the same length as the source segment. For the above-ground radial system, this stricture required a separate source wire from 0.164-meter to 0.328-meter above ground, with the tapering of the element beginning above that point.

The results from this set of models appear in **Table 3** and **Figure 3**. Impedance values in the table are slightly lower than for the uniformly segmented model simply because the source (which may be pictured as centered in its segment) is located closer to the radial junction. However, the range of values is quite similar, as we would expect from comparable models. The gain curves in Figure 3 are almost clones of those in Figure 2. Once more the region between 16 and 32 radials marks a practical peak beyond which values do not change significantly by any standard.

When we bury radials in a *NEC-4* model, we should adhere to a number of required and advisable modeling practices. The radial junction is 0.164-meter below ground. There must be a segment junction at the Z=0 point. As well, the source should be above ground, and its adjacent segment lengths should be equal. These needs dictate that we once more use 0.001-λ as the shortest wire length in the tapered length elements, as shown in another detail of Figure 1. We can place a wire of this length from the radial junction to the ground level and one more above it as the source junction. The length-tapering process then ensures that all of these conditions are met. The choice of the 25-mm diameter main element in all of these models easily meets recommended length-to-diameter ratio recommendations in all versions of *NEC*. The choice of burying the radials 0.001-λ deep was occasioned by the desire to make the models in this episode as structurally comparable as possible. In a future episode, we shall examine techniques for burying radials closer to the ground surface.

Table 3
40-meter vertical monopole, 25 mm in diameter.
40.96-meter ($^1/_4$-λ) radials, 2 mm in diameter; tapered segmentation: 0.001- to 0.04-λ per wire.
Radials 0.001-λ above ground.

NEC-4

Soil Type	*Gain (dBi)*	*TO Angle (degrees)*	*Source Impedance (R +/- j X Ω)*
4 radials: 31 wires; 61 segments			
Very Poor	-1.90	27	41.91 + *j* 18.38
Poor	-0.33	25	40.27 + *j* 22.38
Good	0.66	22	41.28 + *j* 23.89
Very Good	2.45	17	42.26 + *j* 21.04
8 radials: 55 wires; 109 segments			
Very Poor	-1.47	27	37.49 + *j* 3.69
Poor	0.03	25	36.84 + *j* 6.82
Good	1.01	22	37.99 + *j* 8.78
Very Good	2.81	17	38.89 + *j* 9.56
16 radials: 103 wires; 205 segments			
Very Poor	-1.34	27	35.91 - *j* 1.80
Poor	0.09	25	36.08 + *j* 0.89
Good	1.06	22	37.37 + *j* 2.61
Very Good	2.92	16	37.91 + *j* 4.36
32 radials: 199 wires; 397 segments			
Very Poor	-1.29	27	35.09 - *j* 3.55
Poor	0.09	25	35.69 - *j* 1.05
Good	1.04	22	37.24 + *j* 0.48
Very Good	2.92	16	37.83 + *j* 2.46
64 radials: 391 wires; 781 segments			
Very Poor	-1.23	27	34.36 - *j* 3.63
Poor	0.10	25	35.24 - *j* 1.36
Good	1.02	22	36.97 - *j* 0.10
Very Good	2.91	16	37.91 + *j* 1.99
128 radials: 775 wires; 1549 segments			
Very Poor	-1.12	27	33.81 - *j* 3.04
Poor	0.17	25	34.80 - *j* 0.95
Good	1.03	22	36.51 + *j* 0.04
Very Good	2.87	16	37.97 + *j* 1.89

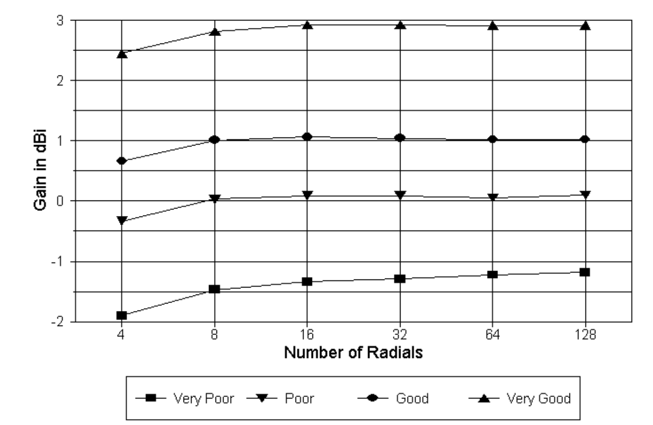

Figure 3—Gain reports of the $^1/_4$-λ monopole over various soil qualities for 4 to 128 radials for an above-ground tapered-length element model.

The results of this model appear in **Table 4** and **Figure 4**. Immediately apparent from the table are the much higher range and higher initial values of source impedance. Only over Very Good soil does the impedance of the 4-radial model approach that shown for the comparable above-ground radial system models. For lesser quality soils, impedances remain higher until we reach the 32-radial models. **Figure 5** compares tapered-length above- and below-ground radials systems in terms of the source resistance—limited to Very Poor and Very Good soils to avoid a graphic grid lock of lines. Although the Very Good soil below- and above-ground curves parallel each other, the Very Poor soil resistance lines dramatically show much wider differences. If we use the premise that the below-ground radial system better reflects the situation of most real installations, then the notion that the above-ground system is adequate for modeling radial systems is thrown into jeopardy.

Table 4
40-meter vertical monopole, 25 mm in diameter.
40.96-meter (1/4-λ) radials, 2 mm in diameter; tapered segmentation: 0.001- to 0.04-λ per wire.
Radials 0.001-λ below ground.

NEC-4

Soil Type	*Gain (dBi)*	*TO Angle (degrees)*	*Source Impedance (R +/- j X W)*
4 radials: 32 wires; 62 segments			
Very Poor	-4.37	27	87.04 + *j* 25.31
Poor	-2.49	25	72.45 + *j* 19.47
Good	-0.71	23	60.96 + *j* 20.42
Very Good	2.10	17	47.34 + *j* 14.52
8 radials: 56 wires; 110 segments			
Very Poor	-3.11	28	65.90 + *j* 18.09
Poor	-1.51	25	58.63 + *j* 15.18
Good	-0.04	23	52.43 + *j* 15.94
Very Good	2.60	17	44.34 + *j* 12.60
16 radials: 104 wires; 206 segments			
Very Poor	-1.61	28	52.71 + *j* 12.43
Poor	-0.16	25	49.71 + *j* 12.18
Good	0.86	23	46.79 + *j* 12.83
Very Good	2.79	16	42.20 + *j* 11.18
32 radials: 200 wires; 398 segments			
Very Poor	-1.32	27	44.89 + *j* 7.54
Poor	0.17	25	43.44 + *j* 9.55
Good	1.12	22	42.67 + *j* 10.46
Very Good	2.94	17	40.48 + *j* 10.03
64 radials: 392 wires; 782 segments			
Very Poor	-1.19	27	40.68 + *j* 4.11
Poor	0.32	25	39.43 + *j* 7.08
Good	1.26	22	39.73 + *j* 8.50
Very Good	3.05	17	39.06 + *j* 9.07
128 radials: 776 wires; 1550 segments			
Very Poor	-1.12	28	38.60 + *j* 2.18
Poor	0.17	25	37.32 + *j* 5.29
Good	1.03	23	37.91 + *j* 6.99
Very Good	2.87	17	37.94 + *j* 8.27

The gain curves, read either from the table or the graph, also show a much wider span of values as we add radials. In general, not unexpectedly, the worse the soil quality, the greater the influence of adding more radials to the radial system. Indeed, the span of gain values and their progression, especially in the Very Poor soil category, tends to reflect better some operational reports than do the above-ground radial system models.

Some Miscellaneous Modeling Issues

In setting up the models for developing some baseline data, I restricted the main element diameter to 25 mm in order to easily meet the length-to-diameter requirements within the tapered length models. **Table 5** tends to show why this move is needed and may serve as a caution about hasty modeling. The first portion of the table shows the results (from 4 to 32 radials) of increasing the element diameter to 0.164-meter (a reasonable but approximate substitute for a standard Rohn tower section). With a length-to-diameter ratio of 1:1, the values—although usable for some purposes—show considerable wandering relative to the progressions in Figure 3, the above-ground tapered length system with a 25-mm element.

Increasing the diameter further to 0.25-meter (a bit less than 10 inches) yields values that continuously decrease as we add radials, suggesting their unreliability. However, for above-ground radial system models, returning to the standard or uniform segmentation corrects the difficulty, since at 20 segments per 1/4-λ, the length-to-diameter relationships are well within limits.

The upshot of this exercise is that it may be very difficult to adequately model some monopole and radial systems where the monopole is very fat and the radials are buried very close to the ground surface. However, in Part 3, we shall show at least one way around this problem.

For those restricted to modeling in *NEC-2*, the natural question to ask is how well *NEC-2* values correspond to

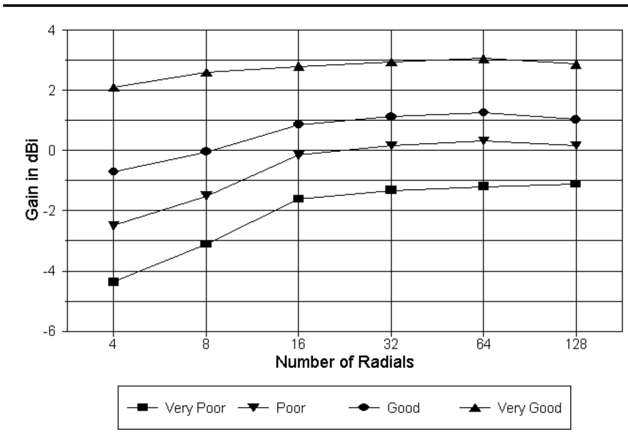

Figure 4—Gain reports of the 1/4-λ monopole over various soil qualities for 4 to 128 radials for a below-ground tapered-length element model.

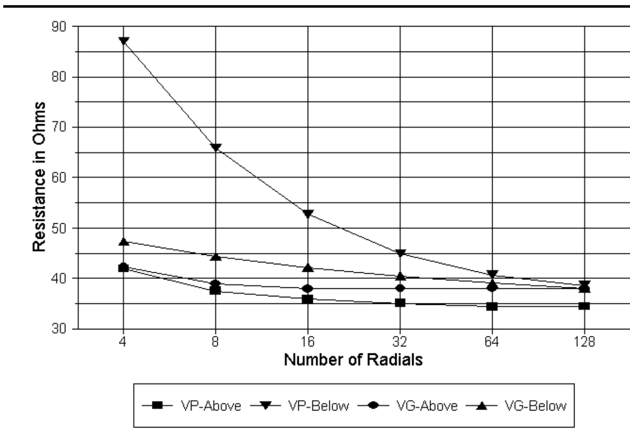

Figure 5—Source resistance reports from two models over Very Poor and Very Good soil: above-ground and below-ground radial systems.

Table 5
Increasing the diameter of the vertical monopole to 0.164-meter and to 0.25-meter.

A. 40-meter vertical monopole, 164 mm (0.001-λ) in diameter. 40.96-meter (¹/₄-λ) radials, 2 mm in diameter; tapered segmentation: 0.001- to 0.04-λ per wire. Radials 0.001-λ below ground.

NEC-4

Soil Type	*Gain (dBi)*	*TO Angle (degrees)*	*Source Impedance (R +/- j X Ω)*
4 radials: 32 wires; 62 segments			
Very Poor	-1.65	27	40.65 + *j* 17.92
Poor	-0.14	25	39.82 + *j* 21.57
Good	0.83	22	41.16 + *j* 23.06
Very Good	2.64	17	42.11 + *j* 21.49
8 radials: 56 wires; 110 segments			
Very Poor	-1.65	27	40.11 + *j* 7.46
Poor	-0.18	24	39.81 + *j* 10.76
Good	0.80	22	41.25 + *j* 12.80
Very Good	2.62	17	42.24 + *j* 14.04
16 radials: 104 wires; 206 segments			
Very Poor	-1.51	27	38.41 + *j* 2.69
Poor	-0.10	24	38.77 + *j* 5.54
Good	0.88	22	40.30 + *j* 7.32
Very Good	2.74	17	41.00 + *j* 9.36
32 radials: 200 wires; 398 segments			
Very Poor	-1.56	27	38.33 + *j* 1.12
Poor	-0.18	25	39.15 + *j* 3.76
Good	0.77	22	40.95 + *j* 5.31
Very Good	2.66	17	41.76 + *j* 7.61

B. 40-meter vertical monopole, 250 mm (0.001-λ) in diameter. 40.96-meter (¹/₄-λ) radials, 2 mm in diameter; tapered segmentation: 0.001- to 0.04-λ per wire. Radials 0.001-λ below ground.

NEC-4

Soil Type	*Gain (dBi)*	*TO Angle (degrees)*	*Source Impedance (R +/- j X Ω)*
4 radials: 32 wires; 62 segments			
Very Poor	-1.19	27	36.97 + *j* 17.53
Poor	0.32	25	36.26 + *j* 20.92
Good	1.29	23	37.53 + *j* 22.29
Very Good	3.10	17	38.47 + *j* 20.82
8 radials: 56 wires; 110 segments			
Very Poor	-1.26	28	37.07 + *j* 8.09
Poor	0.21	24	36.84 + *j* 11.19
Good	1.19	22	38.22 + *j* 13.05
Very Good	3.01	17	39.21 + *j* 14.20
16 radials: 104 wires; 206 segments			
Very Poor	-1.42	27	37.94 + *j* 3.78
Poor	0.00	25	38.36 + *j* 6.58
Good	0.98	22	39.91 + *j* 8.29
Very Good	2.84	17	40.67 + *j* 10.35
32 radials: 200 wires; 398 segments			
Very Poor	-1.52	27	38.33 + *j* 2.31
Poor	-0.14	25	39.21 + *j* 4.93
Good	0.82	22	41.05 + *j* 6.46
Very Good	2.70	16	41.94 + *j* 8.77

C. 40-meter vertical monopole, 250 mm in diameter. 40.96-meter (¹/₄-λ) radials, 2 mm in diameter; uniform segmentation: 20 segments per wire. Radials 0.001-λ above ground.

NEC-4

Soil Type	*Gain (dBi)*	*TO Angle (degrees)*	*Source Impedance (R +/- j X Ω)*
4 radials: 5 wires; 100 segments			
Very Poor	-1.97	27	44.41 + *j* 24.37
Poor	-0.39	24	42.67 + *j* 28.77
Good	0.62	22	43.72 + *j* 30.49
Very Good	2.43	17	44.73 + *j* 28.03
8 radials: 9 wires; 180 segments			
Very Poor	-1.57	27	40.01 + j 10.70
Poor	-0.04	25	39.17 + *j* 14.23
Good	0.96	22	40.34 + *j* 16.30
Very Good	2.76	16	41.41 + *j* 17.24
16 radials: 17 wires; 340 segments			
Very Poor	-1.42	27	38.24 + *j* 5.37
Poor	0.04	25	38.18 + *j* 8.34
Good	1.04	22	39.46 + *j* 10.06
Very Good	2.89	17	40.27 + *j* 11.87
32 radials: 33 wires; 660 segments			
Very Poor	-1.36	27	37.20 + *j* 3.45
Poor	0.04	24	37.72 + *j* 6.23
Good	1.03	22	39.23 + *j* 7.75
Very Good	2.90	17	40.09 + *j* 9.72

those we have so far viewed from *NEC-4*. Only the figures from Tables 2 and 3 are relevant, since *NEC-2* does not permit buried radials. **Table 6** shows the results of running the Table 2 and Table 3 models in *NEC-2*, up to 32 radials to remain within the recommended junction limitations. The figures are well within usable agreement, although the *NEC-2* gain numbers tend to run a bit higher and the resistance figures a bit lower than those yielded by *NEC-4*. **Figure 6** compares *NEC-2* and *NEC-4* standard and tapered-length values for gain, while **Figure 7** does the same for the source resistance—both over Very Good Soil. The high degree of parallelism among the curves suggests that *NEC-2* is as usable as *NEC-4* with respect to these types of modeled radial systems.

We have not so far looked at the use of the *MININEC* ground as a means of simplifying models of vertical antennas. In this system, we simply connect the base of the vertical to ground and omit the ground radials. **Table 7** corrects this absence in quick order. Note that the source impedance of a model using the *MININEC* ground calculation system is

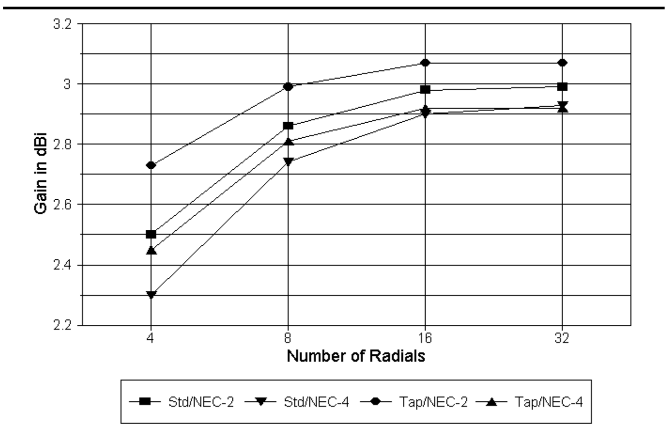

Figure 6—*NEC-2* and *NEC-4* gain reports over Very Good soil for uniformly segmented and tapered-length element models.

Table 6
***NEC-2* values for Table 2 and Table 3 models (to 32 radials only).**

A. 40-meter vertical monopole, 25 mm in diameter. 40.96-meter (1/4-λ) radials, 2 mm in diameter; uniform segmentation: 20 segments per wire. Radials 0.001-λ above ground.

NEC-4

Soil Type	*Gain (dBi)*	*TO Angle (degrees)*	*Source Impedance (R +/- j X Ω)*
4 radials: 5 wires; 100 segments			
Very Poor	-2.09	27	43.91 + *j* 20.92
Poor	-0.50	25	42.00 + *j* 25.72
Good	0.53	23	42.60 + *j* 27.69
Very Good	2.50	17	41.87 + *j* 26.15
8 radials: 9 wires; 180 segments			
Very Poor	-1.56	27	38.48 + *j* 4.94
Poor	-0.06	25	37.74 + *j* 8.53
Good	0.95	23	38.58 + *j* 10.80
Very Good	2.86	17	38.53 + *j* 12.81
16 radials: 17 wires; 340 segments			
Very Poor	-1.37	27	36.36 - *j* 1.40
Poor	0.05	25	36.56 + *j* 1.78
Good	1.05	23	37.59 + *j* 3.69
Very Good	2.98	17	37.49 + *j* 6.51
32 radials: 33 wires; 660 segments			
Very Poor	-1.29	27	35.19 - *j* 3.20
Poor	0.06	25	36.04 - *j* 0.51
Good	1.04	23	37.38 + *j* 1.24
Very Good	2.99	17	37.39 + *j* 4.25

B. 40-meter vertical monopole, 25 mm in diameter. 40.96-meter (1/4-λ) radials, 2 mm in diameter; tapered segmentation: 0.001- to 0.04-λ per wire. Radials 0.001-λ above ground.

NEC-4

Soil Type	*Gain (dBi)*	*TO Angle (degrees)*	*Source Impedance (R +/- j X Ω)*
4 radials: 31 wires; 61 segments			
Very Poor	-1.74	27	40.38 + *j* 16.41
Poor	-0.22	25	39.26 + *j* 20.34
Good	0.79	23	40.12 + *j* 22.01
Very Good	2.73	17	39.71 + *j* 21.23
8 radials: 55 wires; 109 segments			
Very Poor	-1.36	27	36.57 + *j* 3.14
Poor	0.09	25	36.31 + *j* 6.29
Good	1.08	23	37.34 + *j* 8.39
Very Good	2.99	17	37.39 + *j* 10.58
16 radials: 103 wires; 205 segments			
Very Poor	-1.23	27	35.06 - *j* 2.01
Poor	0.15	25	35.56 + *j* 0.73
Good	1.14	23	36.75 + *j* 2.60
Very Good	3.07	17	36.69 + *j* 5.49
32 radials: 199 wires; 397 segments			
Very Poor	-1.18	27	34.17 - *j* 3.63
Poor	0.15	25	35.15 - *j* 1.13
Good	1.12	23	36.57 + *j* 0.55
Very Good	3.07	17	36.64 + *j* 3.52

invariant for the 25-mm and the 250-mm diameter models, since it is calculated by reference to perfect ground and not to the particular soil type specified for the other output figures.

How we should characterize the gain reports of the *MININEC* ground simplification might be initially puzzling. However, there is one condition under which the three *NEC*-based ground systems converge—at 32 radials. For the examples used in this baseline exploration, the gain values for each of the soil types are very close indeed for the two above-ground systems and the buried system. **Figure 8** shows the convergence, with the *MININEC* no-radial values shown in the separate higher line. In general, *MININEC* ground system gain values tend to be overly optimistic relative to those yielded by ground systems using radials.

Although the *MININEC* no-radial modeling system might be a usable substitute for the above-ground radial systems, it is certainly no substitute for the *NEC-4* buried radial system. Simplified *MININEC*-ground models are wholly insensitive to the variations in source resistance exhibited by the buried-radial system. Moreover, the buried-radial system itself varies from other *NEC* radial systems by showing

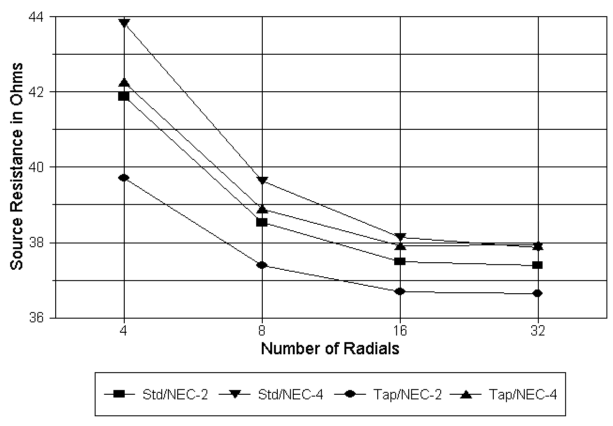

Figure 7—*NEC-2* and *NEC-4* source resistance reports over Very Good soil for uniformly segmented and tapered-length element models.

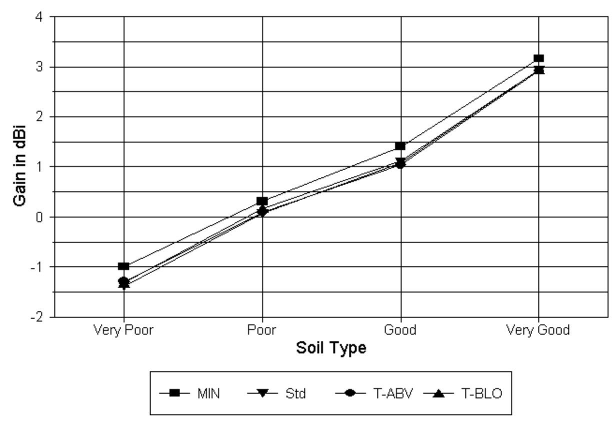

Figure 8—32-radial system gain reports over various soil types for all models, with *MININEC*-ground (no-radials) added.

performance increases beyond the 32-radial level. As we shall see in Part 3, there are some possible illicit uses of the *MININEC* no-radial system that can result in significant antenna analysis errors.

In general, then, the most sensitive method of modeling $^1/_4$-λ monopoles is to use a buried radial system (assuming the actual or proposed antenna will place the radials either on or below ground). However, this technique is available only in *NEC-4* among currently available commercial implementations of *NEC*. Second choice among those restricted to *NEC-2* is to use 32-radial models, and to use length tapering if there is a 500-segment limitation in the program. However, above-ground radial system models will not approach the sensitivity of more adequate methods, especially over Poor to Very Poor soils, if these models are substitutes for a buried radial system.

There are contexts in which one should not replace the most sensitive modeling methods with substitutes that are not fully consistent in output with the best techniques. Casual modeling for personal satisfaction is one matter, but serious work is quite another. For modeling which others might treat as authoritative for antenna design, analysis or selection, only the most sensitive techniques will do, even if reaching this level involves upgrading software or being patient while very large (2500-segment) models run.

Although we have established a kind of baseline for 160-meter vertical antenna systems, we have only spot-checked the possible values of conductivity and permittivity that characterize the soils over which we model antennas. To appreciate the ways in which these two parameters affect the outcome of modeling efforts, we shall do a more thorough survey next time. ■

Table 7

***MININEC* values: 40-meter vertical monopole, direct connection to ground (no radials), fed at the lowest segment; *NEC-4*.**

A. 25 mm diameter

Soil Type	*Gain (dBi)*	*TO Angle (degrees)*	*Source Impedance (R +/- j X Ω))*
Perfect			$37.08 + j\,6.12$
Very Poor	-1.00	27	
Poor	0.31	25	
Good	1.41	23	
Very Good	3.16	17	

B. 250 mm diameter

Soil Type	*Gain (dBi)*	*TO Angle (degrees)*	*Source Impedance (R +/- j X Ω))*
Perfect			$39.01 + j\,12.67$
Very Poor	-0.99	27	
Poor	0.32	25	
Good	1.42	23	
Very Good	3.17	17	

NCJ Profiles—A Man on the Move —Martin Huml, OK1FUA/OL5Y

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At WRTC2000, I was fortunate to become friends with one of the up-and-coming members of the Czech Republic's contest community, Martin Huml, OK1FUA. While OK1FUA may not ring a bell, I'm sure that OL5Y—Martin's contest call—certainly will. And it will be ringing louder in the years to come, too.

Like Martin, there are many, many contesters in Europe whose individual call signs may never appear in your log. They are team, club and multi-op participants and are the ones responsible for making those big, big signals so easy to work. Have you ever wondered who it is behind the key or mike or keyboard at 9A** or HG** or OK**? OK1FUA is one such call.

"In Europe, most people live in old cities where it is not easy to build competitive stations. In an apartment house it is almost impossible. Where I live there is no way that I can put up ANY serious antennas for contesting. Therefore I have participated either as a guest operator at Jiri's, OK2RZ, from the OL1A club station, or from 'Field Day style' stations set up just for a contest."

These don't just involve a quick trip down the highway to the local multi-multi station with a rig and PC in the trunk. "The driving time from my home to OK2RZ is almost five hours. I operate from Pantelleria Island (IH9) Field Day style three times a year. This requires 30 hours of driving (1,350 miles), 6 hours on a ferry, 3 to 5 days of hard work in volcanic terrain, 2 days of fun, 1 or 2 days of station disassembly and finally the return trip. But I like it very much." Yes, Martin's crazy—aren't we all?

"The down side is that operating is only a small part—bigger efforts require more and more sophisticated systems—especially for antennas—to reduce the necessary time. There is not enough time to enjoy before the contest to relax and prepare the psyche for the competition. Also, Mother Nature can create problems for us—especially in November. Often a destructive windstorm hits us before or during the contest." Maybe we should make the contests a week long like in the old days!

What does Martin's "Super Field Day Kit" look like? "Presently I have constructed a system for a two-member team that takes 3 to 4 days to erect. There are three 12-meter poles for 3- to 6-element beams with rotators, 4-squares for 40 and 80 meters, three 200-meter beverages and the field interconnections to use them." That doesn't

Martin Huml, OK1FU/OL5Y

include the radios, PC's and power sources. How many teams in the world can transport that much gear that far that frequently. Pshew! I resolve never to complain about having to fix my antennas in the rain before Sweepstakes ever again.

After the WRTC in which he and Jan, OK1QM, participated as the Czech Republic team, Martin " ...was invited by the OL5T team to join them for the IOTA contest off the Croatian coast and I was VERY enthused! Even before the contest we experienced huge pileups. In the contest we made more than 2,500 Qs. Not bad, considering 10 meters was closed for DX. The contest has a both-modes feature, 24- and 12-hour entry classes and a huge amount of stations." The IOTA contest is very popular in Europe but has yet to attract a North American and Japanese following.

In his early thirties, Martin's history should sound familiar to many *NCJ* readers. "When I was 12 I attended a 'bee' for young electronic hobbyists with a classmate. After several lessons I found that there was also 'something better'—one of instructors told me about 'people who talk to one another, not only in Czechoslovakia, but all over the world, by radio(!!!)' I wanted to meet these 'people.'

"After passing my exams I got permission to operate in the OK1OAZ club under the supervision of a license holder. I earned my first call sign—OL1BLN—at 15 (Czechoslovakia has a youth license for ages 15 to 19) and I could make QSOs on VHF and 160 meters. I lived downtown so I could only put up a long-wire antenna, but it worked fine for me.

"I was invited by a club member—Franta, OK1DFP (now OK1DF/LZ1DFP)—to have a look at 'contest' operating during the RTTY SARTG contest. I immediately realized that contesting is what I MUST do. When I was 18, I got the call OK1FUA and then, in 1997, as co-founder of the Czech Contest Club, I secured the special call sign OL5Y for use in international contests."

Notice how it's important that the new hams be tutored by experienced club members. "I learned the basics on contesting from OK1DFP—he taught me that if I want to be on top I have to do much more than operate. We did a special contest expedition for the CQWW 160-Meter DX Contest in 1984 and finished number 4 in Europe. I was 16 and it was really a big thrill!

"I remember reading an old Czech ham radio magazine from 1984 and finding a very long article 'Contesting on Short Waves' written by OK2RZ. I was fascinated! It covered everything—preparation, traffic, food, logging, multiplier-view, tactics, etc. From then on Jiri, OK2RZ, was my idol. But I didn't meet him personally until 1995! He was a GENUINE CONTESTER—something different than I."

Given that OK-land has no seacoast, it must be tough to be competitive there. "Our only advantage is that we can work small stations from Europe on the low bands, HI! It is hard to compete with stations in the southern part of Europe because propagation is completely different, especially on the higher bands. Western European stations are closer to the US.

"My friend OK1QM and I are looking for a nice location to build a competitive single-op contest station. Our goal is to find a benefactor, who is living on an optimal site, has an adequate piece of land, is not interested in contesting and would appreciate receiving some rent. I would like to participate in building a fixed station in Pantelleria with my Italian friends."

Activity from Europe has increased dramatically over the past few years—is it sunspots or a long-term trend? "Yes, activity in contests is increasing. Rates go up and it's fun. It's not possible anymore to win a contest by just sitting on one frequency and calling CQ. More and more people are using kW+ amplifiers and bigger antennas. The bands are more and more crowded and many stations feel that the only way to compete is to use more power. This is a vicious cycle.

"Some techniques demolish the fun for others however. For example, artificial 'widening' of CW and SSB signals to keep the frequency clear. Power levels in the tens of kWs are also hard to compete with by fair methods. But contesting is a hobby and it is not possible to compare it with other sports, where the level of the playing field is the same for everyone.

"Another phenomenon that is killing the original style of contesting is the packet cluster. Listen to who always calls first after rare mults are spotted and then look at the European Top Ten results in the non-assisted categories. I've thought about this problem many, many times. One very encouraging development is improved log checking. It is a very welcome trend and is another way to ensure that everyone can compete under similar conditions.

"I had a very nice experience recently. I participated for 8 hours in the ARRL International DX Contest (SSB) from my home operating QRP on 10 meters using a simple vertical. Propagation was fantastic. I made 203 Qs, got 47 mults and had as much fun as I do with high power and beams!" Another QRP convert maybe?

The important thing is to keep a sense of humor about the whole thing, though. "I ask myself very often: '*What am I doing?*' That is very funny, especially for non-contesters. I calculate that every QSO costs me about 12 cents. But seriously—There are two reasons why I like our hobby and the sport of radio contesting. First, it is a combination of many skills—electronic knowledge, mechanics, efficiency, tenacity, resourcefulness and quickness. Second, our hobby allows competition at the same level for a man, his wife, their children, parents and grandparents. It is something fascinating and very unique." How true—wouldn't it be fun to say, "Hey, Grandma, get offa my frequency!" ■

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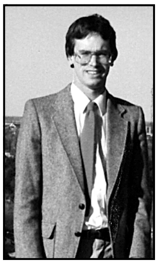
Big Record Breaking Tropo Opening in the September 2000 ARRL VHF QSO Party—NOT!



N0JK

On September 6th widespread tropo occurred from the Gulf Coast north to Minnesota and east to Michigan. W8MIL in EN74 reported K5SW (EM25) on 2 meters at 0319Z. K5MQ in EM31 worked NJ0M in EN34! Hundreds of 2-meter and 70-cm contacts were reported over 500- to 800-mile paths. The following morning K8TQK in EM89 worked KM5ES in EM25 at 1246Z. The best was yet to come.

The high-pressure system continued to build and some really long DX paths opened that evening. At 0023Z September 7th, N8PUM in EN66 worked W0EKZ in EM17 on 2 meters. Your humble scribe operated QRP portable from "The Cattle Pens" in the heart of the Flint Hills—EM18. I ran a string of loud Minnesota and Wisconsin stations on 2-meter SSB.

Around 0215Z W0EKZ worked W1COT in FN31 on 2 meters—a path of over 1,300 miles! Hearing this, I turned the 2-meter Yagi to the northeast and could hear both W1COT and K1UHF in FN31! In over 25 years of VHF operating this is the first time I have ever heard New England stations on 2-meter tropo into Kansas! I could not break the pileups on the New England stations with 10 W.

At 0304*Z* K8TQK in EM89 went into the log, and then NQ2O in FN13 (1,100 miles) at 0320Z. But the big tropo opening occurred *3 days before* the contest… then *one week* after the contest, on Sunday evening, there was strong aurora and 6-meter F_2. K7KYZ in DN13 (Idaho) was heard for over an hour in Kansas on 2 meters. Six meters broke wide open between much of the US and eastern Canada to South America and the Caribbean starting around 0030Z September 18th with WB8XX in EM79 reporting "the band is crazy!" and KA9CFD spotting "South America across the band!" Brazilian stations reported making hundreds of stateside contacts. I worked 9Y4AT on 6 meters with a mobile whip and 50 W. Stations in Colorado and western Kansas worked into Australia with K0GU in DN70 logging 10 VK4s around 0100Z!

What a difference a few days make. Had the tropo opening occurred a few days later or had the aurora occurred a week earlier the September 2000 ARRL VHF QSO Party would have been an all time record-breaking contest. Instead there was little extended tropo reported this year and little E_s. Still, there were some enhanced conditions in some parts of the country and contacts to be made.

Good 6-meter scatter signals were reported by K0HA in EN10 from K3MQH in FM19, W2SZ/1 in FN32, N2XTX in FN02, NC1I in FN32 and AA4ZZ in EM95. Sam, K5SW, in EM25 worked K4QI in FM06 on 2 meters at 0358Z September 10th on a meteor burst.

I worked WA0I in EM47 on 2 meters—300 miles with 10 W on Sunday morning. That evening I picked up W8CM in EM13 on 2 meters—nearly 400 miles away.

HC8GR 6-Meter Beacon Heard Widely During the Contest Sunday Afternoon

Sunday afternoon things became interesting when the HC8GR 6-meter beacon boomed in for over 2 hours but no live ops. Many contest participants including KD5HPT in EM32, K5CM in EM25, K0ETC in EM27, N0JK in EM18 and N5PYK in EM13 were among the many who reported hearing the beacon 599+. At 2119Z, WA4HFN reported that "HC8GR/B is 20 over 9 in EM55."

K5CM reported loud backscatter during this period and could hear his own echoes on 6 meters. Guido, HC8GR, finally appeared at 2219Z on 50.110 MHz and worked a few lucky Arizona stations including AA7A, but the band had closed to the rest of the US. If Guido had showed up earlier he may have made a couple of hundred contacts! AA5XE reported LW5DX in GF05 at 2244Z.

"Rules Change" Concerns

A recent change in the wording of the rules for ARRL VHF contests means some DX can log DX contacts for contest points while others can not.

Pacific Division stations in Hawaii active during the September VHF QSO Party included K6MIO/KH6 and AH6TM. They found some interesting 6-meter DX during the contest including TI5BX, VK4CP, XE, PY, V73JK and HC5K. Don, KH8/N5OLS was monitoring 6 meters and heard the XE1KK beacon. W0AH operated the contest from Cancun as XE3/W0AH and reported working 15 South American stations on 6-meter TEP, but no statesiders. Unlike the Hawaiians, however, XE3/W0AH could not log the South American stations for contest credit.

The reason for this is a rules "clarification" that was incorporated in a rewrite of the ARRL VHF contest rules back in 1997-98.

Dan Henderson, N1ND, ARRL Contest Branch Manager, made the following comments on the VHF Reflector regarding this matter:

"*The ARRL VHF/UHF contests are domestic in nature and designed to promote VHF/UHF/Microwave activity in the US and Canada. I have been told that DX to DX contacts for contest credit have never been permissible, but perhaps in the past they may not have been closely monitored… I have reviewed the rules for this event back to 1988. This point was not specifically included in that year's rules. [The rewrite] happened before my taking over the Contest Branch and discussions with parties involved at that time haven't given me an indication as to why it was finally formally included in the rules announcement.*"

This creates an interesting situation. While the ARRL VHF contests are now "domestic in nature," KP2, KP4, KH6 and KL7 may work DX for contest credit since they are in the ARRL Field Organization. KP2 and KP4 are in the Southeast Division, KL7 is in the Northwest Division, and KH6 is in the Pacific Division. A KP4 can log South Americans and Africans on 6-meter TEP for contest points while hams in nearby Cuba or St Martin can not. The KP4 can also work his buddies in San Juan on 2-meter FM and 10 GHz to submit a sizeable score while not making a single "domestic stateside" QSO during the contest.

Joe Lynch, N6CL, discussed this issue at length in his "VHF Plus" column in the August 2000 issue of *CQ*. Joe had traveled to Cuba with a group of US hams in 1994 for a joint Cuban/US entry in the June VHF QSO Party—CO0FRC.

"With the understanding that the June VHF QSO Party was not a domestic contest, we who organized the operations of the joint Cuban/US efforts (both Cuban and US amateurs) proceeded to

participate successfully in the contest… Prior to the rules change in 1997 there was no prohibition of DX to DX contacts. Thanks to that, the DX to DX contacts supported the scores of all the Cuban contest stations. But now that the rules changes have been pointed out, our Cuban friends feel a strong lack of incentive to participate in the June VHF QSO Party."

Many of us have worked CO0FRC over the last few years both for a new country and grid square. In the 1998 June VHF QSO Party CO0FRC worked widely across the US on E_s and along the Gulf Coast on tropo. They also logged Cuban rovers and fixed stations. CO0FRC was notably absent in the June 2000 VHF QSO Party.

Arnie Coro, CO2KK observes:

"*There is really no incentive now to participate in the June VHF QSO Party…I think that the ARRL must be made to understand that by changing the rules of the June VHF QSO Party they are doing little service to Amateur Radio!"*

In a post to the VHF Reflector, Oscar Morales, CO2OJ stated:

"*In my humble opinion, the June VHF QSO Party loses much of its old importance in the area to become another 'only for NA stations' contest. It's something like telling everyone outside North America, 'Work only me or do not participate.' Or 'In this contest I may contact anyone, anywhere, but you can only contact me.' …but I feel that the ham radio spirit may have lost something in this side of the world."*

I propose the following rules change for consideration:

ARRL VHF contests: *Stations in North America (including the Caribbean and Central America) and the ARRL Field Organization (including all VE sections and the Pacific Division KH6, KH8) may log for contest points stations located in North America as defined and the ARRL Field Division* ***and*** *all other stations. Stations located outside of North America and the ARRL Field Organization, defined as "**DX,**" may only count QSOs with stations located in North America and the ARRL Field Organization for contest points.*

I believe this would be a positive step in fostering VHF activity in North America, Central America and the Caribbean as well as people-to-people good will. It would maintain the "regional" emphasis of the ARRL VHF contests.

If you have any thoughts on this issue write to the ARRL Contest Advisory Committee. ■

Contest Tips, Tricks & Techniques

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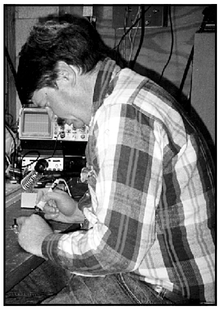
Attracting Young Contesters



W9XT

Attracting younger people into Amateur Radio has been a big concern of the ham community in recent years. The Internet and computer games are attracting the attention of technically inclined youth who in the past would turn to Amateur Radio. As contesters, how do we turn those who do become hams into contesters?

N4ZR thinks we need to do a better job in marketing contesting to young hams. Pete has noticed that kids are interested in "extreme this and that," such as the X-Games. He thinks we should emphasize the extreme aspect of radio contesting such as staying up 48 hours straight, working massive rates, etc.

Going one step further, Pete notes a lot of youthful interest in clothing and promotional paraphernalia. He suggested a line of *NCJ* clothing, decals for windows, etc, directed at younger hams.

Glenn, K3PP, also brought up the concept of "Extreme Sports." He suggests we minimize the radio aspect and sell the sport aspects. According to Glenn, "Ham radio has connotations of an old fogey activity, but the thrill of competition and high rate of conquest and defeat is a youthful pursuit."

K9NW thinks we need to make ham radio itself more interesting. Mike feels that we convince someone to get a license, and then tell them how much fun it is to get an H-T and talk to friends across town. He goes on to say that there are probably a lot of hams who have dropped out of the hobby before they have been exposed to contesting. Vitor, PY2NY, thinks we need to show the younger hams that contesting is another kind of activity inside Amateur Radio.

Contesting in Europe seems to be on an upswing. K9NW suggests we see what they are doing over there to get new contesters. Any European readers who would care to comment? Send me a letter or an e-mail and I will do a follow-up in a future column.

It was a QSL that got K4BEV interested in contesting. New to radio, Don could not understand what all the QRM was about, and why everyone was "testing" their radios at the same time! After he figured it out, he started to make some contacts. One was with KE4OAR, and Chuck sent him a QSL that included an invitation to join the Tennessee Contest Group.

Since then, whenever he works someone in a contest that is obviously a beginner, K4BEV sends a QSL encouraging him in contesting. Don suggests we do the same.

As for operating events, N0AX suggests more short time categories. Not many high school students can spend an entire weekend, Ward reasons. K3PP thinks that Kid's Day is a great way to interest kids in radio and contesting in particular. Glenn used it to get his 10-year-old nephew interested. The bug bit him, and he is now working on getting his license.

N0AX suggests young hams get together and do a multi-op. Ward suggests they order a pizza and not worry about the score—just have a lot of fun. I remember one of my first contests was a Sweepstakes phone effort with some of my high school friends. We were all beginning contesters and did a lot of things wrong, but we operated the contest, ate pizza and had a great time!

Similarly, K1IR notes the importance of peer level interaction to keep younger hams interested. Jim acknowledges the importance of older contesters as role models and mentors, but they need each other to generate excitement and keep it going. Jim feels that we need to find ways to get young hams together to operate together and to compete against each other. Jim says "contesting should be the source of lifelong relationships with peers, as it has been for us oldsters."

K5ZD agrees with this. Randy said he fell in love with contesting as soon as he heard about it. He can't explain it but he was attracted to the competition and the number of stations that could be worked.

Randy found that having a close rival really made contesting much more fun. He and K5GN had similar stations and competed against each other. They spent a lot of time before and after contests talking about strategy and other aspects of contesting.

A common suggestion for encouraging younger contesters is to let them operate bigger stations. The idea is that the bigger rates and higher scores that can be made from such stations will really get them hooked on contesting. Randy, K5ZD, thinks this may not necessarily be a good idea.

Randy remembers that he enjoyed contesting with 50 W, crystal controlled, and liked it when he moved up to bigger stations. It was operating a small station that forced him to develop his skills. Randy contends that skipping that step may not be the best way to keep them interested or make them successful in contesting.

Operating a small station between contests is also good for developing important skills says K9ZO. Developing operating skills and learning propagation patterns during the week will pay dividends when operating contests.

Several respondents, including K9ZO and K4OJ, suggested inviting younger ops to join contest clubs and multi-op efforts. To youngsters getting invited to a multi-op, N0AX cautions against being insulted or depressed if they don't get the prime operating bands and times at first. Ward suggests they take their assignments with enthusiasm and work hard. Also, they should make every effort to talk to off-duty operators to learn all they can.

N7UJJ is in a good position to know what interests kids today. Allan is a high school teacher. He has found that contests are a good motivator for the kids already in the school ham club and to attract other students to it. The ARRL Sweepstakes, School Club Roundup and Field Day are on the "must participate" list. They also invite a Girl Scout troop to the school for the JOTA weekend.

Allan passed along a copy of an article he wrote for the *1999 Proceeding of the National Educational Workshop*. The article describes how his school participates in the School Club Roundup. He then gives a list of suggestions to help make the event successful. Many of the suggestions would be familiar to any experienced contester: reviewing the rules, making a band plan, setting goals, etc. Others are geared to beginning contesters—such as creating cheat sheets for standard phonetics and state abbreviations.

The rest of the items on the list were suggestions to increase the excitement and interest in the event. Allan suggested taking pictures, videos and sound clips to be used to increase interest the following year. They also posted lists of

(Continued on page 34)

Contesting for Fun

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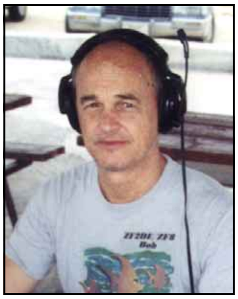


N4BP

When Ron, KU7Y, handed over this column to me early in the year, I was given the leeway to include QRO events as well as the QRP ones that the column was originally created to showcase. Fact is, though, we QRPers just have too doggoned much fun to not share our experiences with the rest of the contesting community! Many of the QRP clubs sponsor 4- to 6-hour sprints, and many of these encourage outdoor activity.

One such club is the Adventure Radio Society (*ARS*) and one of their popular events is the "Flight of the Bumblebees," a 4-hour sprint held each year on the last Sunday of July. ARS also holds monthly 2-hour "Spartan Sprints" to add to the fun. With the permission of the editor, the material that follows is from the Adventure Radio Society's Web magazine, the *ARS Sojourner*. Dee Hester, K7UD's, Bumblebee adventure is featured along with other soapbox comments from this year's event. The *Sojourner* is available on-line from their Web site **http://www.natworld.com/ars**.

The Adventure Radio Society

What is the Adventure Radio Society? ARS is a membership organization of more than 700 Amateur Radio operators in the United States and many other parts of the world. They are 3½ years old and growing steadily. They sponsor uncommon, interesting events and support the development of imaginative equipment and antennas. The *ARS Sojourner* is the monthly magazine and information center. The Internet is used extensively as a means of exchanging information with their members. Membership is free. The membership Chairman is Richard Fisher, KI6SN (**KI6SN@aol.com**).

The Purpose and Philosophy

The Adventure Radio Society promotes a sense of adventure by supporting radio operation from beautiful and remarkable places. They sponsor events that encourage the use of human-powered travel, in its myriad forms, to reach outdoor operating sites and support the development of imaginative equipment and antennas.

Flight of the Bumblebees Soapbox

The logo designed by Dee, K7UD, for Bee Hive #27's operation in the Flight of the Bumblebees.

From Ken, VE3ELA... I was traveling on vacation. For this event I operated from Bic Provincial Park, on the south shore of the mighty St Lawrence River in the province of Quebec. It's a beautiful setting with hiking and biking trails crisscrossing the interior, and a protected marine wilderness bay.

I chose to hike up to Pic Champlain with my heavily laden backpack. About three-quarters of the way to the top I located a sitting (more like resting!) bench. It served me well as an operating table. From this vantage point I could gaze below and observe tiny sailboats enjoying the excellent sailing conditions on the St Lawrence.

Surprisingly, the other Bumblebee stations were not hearing my signal very well. Although I made a few contacts during the contest, I spent some time talking with others trekking this trail. Many spoke French and didn't understand English very well—and my French is not very good—but we still managed to communicate.

Many were curious about my antenna and gear and the dits and dahs they overheard. One passerby commented, "You're doing it the hard way, have you not heard of the Internet?" To which I replied "Yeah, but it's not nearly as much fun!"

From Dee, K7UD... This was my first Flight of the Bumblebees. My pal and fellow ham, Lee Love, KD7EBO, and I made a sojourn to the south rim of the Grand Canyon.

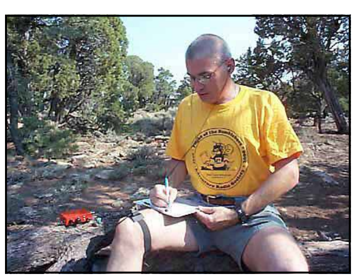
The Flight of the Bumblebees event is on the same weekend as one of the biggest ham gatherings in our area, the Fort Tuthill Hamfest. Happily, the hamfest is a three-day affair. Lee and I took to the road early on Friday morning, enabling us to spend a few hours at Fort Tuthill before pressing on to the Grand Canyon National Park. We arrived in the park around 5 PM.

The weather was perfect and good luck was with us—the fire restrictions in the Kaibab National Forest "lifted" long enough for us to enter and secure our campsite. Seven hours later the fire restrictions went back into place, closing a lot of the adjoining forest area. We were very lucky indeed.

We got to our campsite with enough time to get the tent pitched and to do a second survey of the radio site—a short hike from camp. Instead of perching right out on the south rim of the canyon, we hiked into the nearby woods to make use of the trees for supporting our antennas. We were able to deploy a half-wave 80-meter dipole and enjoyed two days of pre-FOBB hamming.

Radio conditions were excellent and the evenings were surprisingly devoid of

Bob, N4BP's, 'K2 and Poqet computer set up for operating the FOBB from the Florida Keys. This probably well represents the typical setup used in the field.



Dee, K7UD, in the woods on the rim of the Grand Canyon keying a DSW-20 with a paddle strapped to his leg.

the "monsoon season" electrical storms that are fairly common in Arizona in the summer.

I used my Small Wonder Labs DSW-20 and my Elecraft K2 for two nights and one day before the contest. All the equipment worked perfectly and we were raring to go for the FOBB. After breakfast on the morning of the 30th of July, Lee and I donned our special-event tee shirts. I'd designed a FOBB logo and tee shirt for us. The two of us were hard to miss in those bright yellow shirts.

We lugged along the complete, portable HF station (including a multiband vertical antenna—W6MMA's PW-1), a solar array and even a compact lightweight operating table and chair. (OK, I like to be comfortable... even in the woods—*especially* in the woods!) We had everything set up and ready to go with about 20 minutes to spare before the official starting time. Since Lee is still working toward his General ticket and currently holds a Technician Class license without HF privileges, yours truly was the only op for the Flight of the Bumblebee from Bee Hive #27.

I've got to be the slowest op to ever handle a paddle. Add to it the fact that CW flat makes me nervous and you have the makings of a torture test. But, I have to admit this contest was really fun. In fact, the patience and general camaraderie of the Adventure Radio Society hams and the other QRPers who frequent our events have opened a whole new world for me in the guise of CW. It's beginning to be my favorite mode. After 28 years of hamming, I never thought I'd say that!

At 1800Z, K7UD/BB was on the air. As I said, folks, I'm slow. I didn't work a lot of stations but I was absolutely amazed at how well 5 W will work into a well-matched antenna at an altitude of 7,500 feet. I worked the West Coast—of course—logging CA, OR and WA. In the middle US, I worked ND, MN and WI. The East Coast was jumping, especially on 15 meters. I logged NJ, CT, VA, NC, SC, GA, FL and even ME (thanks to K0ZK). My biggest surprise was working Jim Larsen, AL7FS, in Anchorage, Alaska! (Bob, N4BP—I never did figure out precisely where you were, but I did copy your N4BP/VY2. Thanks for the 599!)

I managed 30 QSOs in all—12 on 20 meters and 18 on 15 meters. I only worked eight Bumblebees. In total, if I've done the math correctly, I think that works out to be 1,440 points. So this bee did just a bit of bumbling. (Now I know why ARS chose this particular insect after which to name the event.) But, what fun!

I was (and still am) pretty jazzed about those 30 QSOs. When the event ended, Lee and I tore down the antennas, packed up the gear and hiked back to camp. We managed to get the stuff stowed away just in time. Although we'd been treated to pristine weather during the previous two days, and right through the contest, a summer storm front moved in from the north.

Back under the camp tarp, we watched the clouds build and darken. We were treated to quite a lightning show as we sipped a cool drink and toasted our good fortune and our first Flight of the Bumblebees. It was hard to say goodbye to the cooler temperatures at the top of the Grand Canyon, but after breakfast the next morning, we headed back to Phoenix and the 113-degree heat that awaited.

On the route home, we were awestruck by the majesty of the four high crests comprising the San Francisco Peaks. Located well north of Flagstaff in the Coconino National Forest, the tallest of the four is Humphrey's Peak at 12,633 feet. We couldn't help thinking, Gee, if 7,500 feet netted 30 QSOs, how many could we expect from the San Francisco Peaks? There's always next year...

From Harvey, N6MM... I finally had a QSO on 10 meters during the Bumblebee thanks to Cam, N6GA, who completed his 10-meter module for his Sierra in time for the event. I worked him on all four bands and K6VNX on three. K6VNX and I could not stretch the groundwave enough to complete a contact on 10.

Fifteen meters did not really show much activity until the last hour (2000Z) of the event. Last year 15 was open at the beginning. Not too many East Coast stations were worked this year compared to previous years.

The rig was a modified Sierra putting out 4 or 5 W and the antennas were dipoles for 40, 20 and 10 meters (the 40-meter dipole was also used on 15). Power was supplied by a 4 Ah gel cell with a flexible solar panel that I can easily carry on my backpack. Filtering added to the solar panel's charger module successfully eliminated the interference that I experienced last year.

I operated from Mt Pinos, CA at a little over 8,000 feet above sea level with a 360 degree view.

73 and thanks to the Adventure Radio Society for another great QRP activity.
Bob, N4BP ■

Carl Luetzelschwab, K9LA
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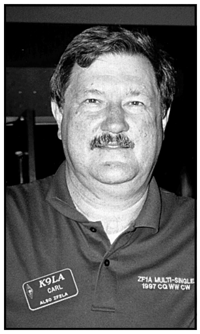
Multi-Multi Propagation Planning



K9LA

In the July/August 1998 issue of *NCJ* I described a way to use propagation prediction programs to determine what the best band would be for the run station in a multi-single effort from the Caribbean in a CQWW DX Contest. The result was a band change strategy for the entire contest period that's designed to maximize 3-pointers.

But what if you're a multi-multi operation? With a station on each band going hot and heavy, there's no "which band should I be on?" question. So that means there's no reason to do any propagation planning, right?

Wrong. That column only addressed a band-change strategy—it did not address the bigger issue of how to use propagation software to put out the best signal you can on each band. When Dan, K1TO; Joe, W5ASP; Mike, K9MK; and I did our ZF1A multi-single effort in CQWW CW in 1997, we operated from an existing station with existing antennas. We would have loved to make some antenna changes to improve our signals on the various bands, but we had our hands full just getting the existing antennas in tip-top shape for the contest.

So how do you use propagation software to improve the effectiveness of a multi-multi effort? Let's take a look at what the 6Y2A team did in 1998 for their multi-multi effort.

Their plan for 1998 was an extension of their "verticals on the beach" strategy that they used the previous year as 6Y4A. Wanting to do better in 1998, they applied some propagation science. The following is a summary of this effort. It's based on information from N6BV's two articles that appear in *The ARRL Antenna Compendium Volume 6*.[1,2]

The first goal of the 6Y2A team was to be competitive with stations on the US East Coast into Europe. If they were as loud or louder into Europe than the East Coast gang, then they would be better able to attract what Europe has to offer—3-pointers and many multipliers.

Their second goal was to be louder in Europe than other Europeans. The concern here was that when they came back to someone, they needed to be heard by that station and not get trampled by the others still calling. In other words, this was a pileup control issue.

These two goals set the stage for their propagation planning. Using the elevation angle data for 6Y to Europe that's included in *The ARRL Antenna Book CD Version 1.0*, they determined the range of elevation angles needed on each band to maximize their signals into Europe. **Figure 1** (a reproduction of Figure 3 in reference 2) shows the data for 40 meters—the elevation angle data is presented in histogram format.

Knowing the elevation angles then allows various antennas to be plotted on the same graph to see how well they cover the required angles. Figure 1 also includes a comparison between a 2-element Yagi at 100 feet and a phased array of two verticals over salt water. It's not hard to see that most of the angles are best served by the two verticals over salt water. What this means in terms of signal strength is shown in **Figure 2** (from Figure 7 of reference 1). It's pretty obvious that the verticals of the 6Y2A team were very competitive into Europe when compared to East Coast stations using dipoles.

Thus using verticals on the beach right on salt water, in lieu of high horizontal antennas, was again the strategy of the 6Y2A team in 1998 to fulfill their first goal. This gave them the needed energy at the low elevation angles to be competitive with the East Coast into Europe. This strategy also addressed their second goal.

How well did their strategy work? Very well—the 6Y2A team won the World in their multi-multi class and set (at the time) the new World record. I'm sure the propagation planning and choice of antennas played an important role in this, as did their team of excellent CW contest operators.

I encourage you to read both of N6BV's articles in *The Antenna Compendium Volume 6*. My summary here is just intended to be a general outline. All of the bands are discussed in detail in the two articles, along with other pertinent information.

References

[1]Straw, R.D., "Using HF Propagation Predictions," *The ARRL Antenna Compendium Volume 6*, pp 101-111, The American Radio Relay League, 1999.

[2]Straw, R.D., "Antennas Here Are Some Verticals on the Beach," *The ARRL Antenna Compendium Volume 6*, pp 216-225, The American Radio Relay League, 1999. ■

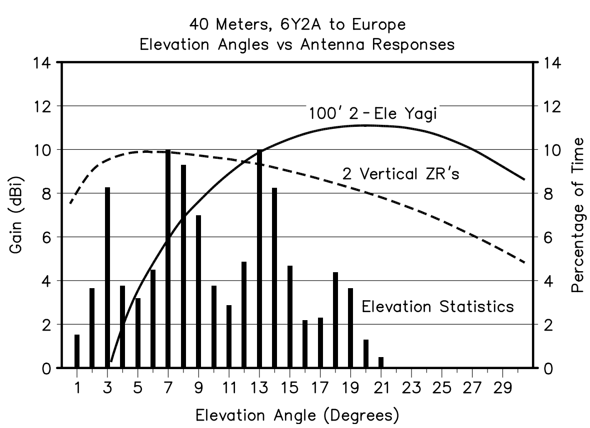


Figure 1—Comparison of needed elevation angles and typical antenna elevation-plane responses on 40-meters from 6Y to EU.

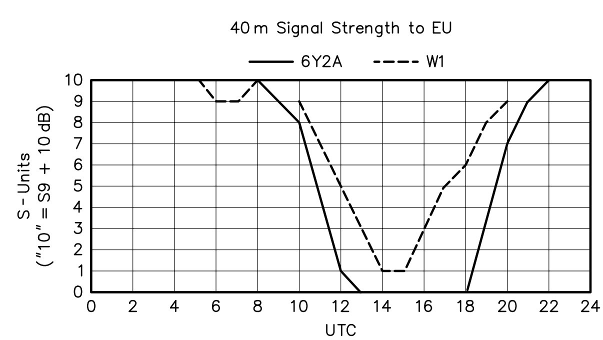


Figure 2—Comparison of signal strength predictions for 6Y (2 phased verticals) and W1 (dipole at 100 feet) to EU.

Contest Expeditions

Kenny Silverman, K2KW
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Did you ever dream of being DX during a contest? Even if you have actually experienced it, do you remember the excitement you felt when your buddy first invited you on the trip!

K2KW

Every time I head off on a contest expedition, I feel like a little kid again. I get excited just thinking about those pileups! While the pre-trip planning is exciting in itself, I really start getting wound up the moment I cross the customs line at the foreign DX location. At that point I know it won't be very long before I'm on the air and hitting the pileups! I've got to admit I'm a certifiable pileup junkie.

Not too long ago, some of my fellow pileup junkies—K3UOC and K7BV—founded Pileups Anonymous (*PA*). They hoped to help others like themselves kick their pileup habits. It's a sad day when contesting has dragged its followers to these murky depths, but alas, such are the risks of contesting in the new millennium. Personally, I've had many relapses—I've bounced in and out of PA's "rehab" program—but I still find I need to get my contest expedition pileup fix at least once a year. On the positive side, they tell me that recognizing my pileup addiction is the first step on the long road to recovery.

As K7BV knows, I have a special form of the affliction—I am a "Contest Expedition" pileup junkie. He has asked me to take the reins of this column as a therapeutic avenue to help myself and others find their way through the particularly intoxicating world of Contest Expeditioning.

Before we start this new chapter for the *NCJ*, I would like to acknowledge the fine work of Sean, KX9X, who authored the *DXpedition Destinations* column. *Contest Expeditions* will replace Sean's column. I will still be focusing on expedition locations, but I'll be adding a specific twist on contesting. The *Contest Traveler* column by Joe Pontek, K8JP, will still be a regular feature in the *NCJ*.

Ahh, contest expeditions… I have many fond memories of my recent expeditions, but unfortunately I find it difficult to adequately describe in words the experience of having hordes of mosquitoes bite every part of your body (exposed or otherwise). I also can't fully relate the feeling of the intense sunburn pain you feel on the tops of your feet when you wear sandals and forget to put suntan lotion there. Nor could I ever prepare you for what a "real" pileup sounds like on the other end. But it will be my goal to discuss contest expedition locations, and share some "how to" information that will hopefully make your contest expedition experience more enjoyable.

For those of you who don't know me very well, I've been contest expeditioning every year for the past 15 years or so, and most recently you may have heard of my role as team leader for "Team Vertical," which has operated as 6Y2A, 6Y4A, 6Y8A, 4MIX, 4M7X and VP5TT. I have traveled to well over 30 DXCC countries, lived on 5 continents and gotten into my fair share of trouble.

As my experience continues to grow, so do the number of questions from fellow contesters—many along the lines of "where should I operate from in the Caribbean?" Somehow, people have found out that I have accumulated a fair amount of information on contest expeditioning there, so they seek me out for my ideas.

About two months ago I had a few hours to kill, so I decided to teach myself the *MS Publisher* software. I noticed that it was capable of creating Web sites, so on a lark I made a list of all the places that I had collected information on. Well, one thing led to another, and I ended up developing a fairly comprehensive Web site called *DX Holiday*, which I hope will serve as a collection spot for DXpedition locations and "how to" expedition information. So far, I've got information on nearly 100 DXCC countries posted! For the time being, *DX Holiday* can be found at **http://pages.prodigy.net/k2kw/qthlist**—I suspect I will move the site in the next few months.

As most contesters do before a contest, I have put together a band plan for this column. But as we all know, you often need to change your strategy as conditions merit. So for now, here's what I propose this column will do:

- Provide continental overviews of promising contest expedition locations
- Spotlight the changing status of operating locations (new locations, places that are no longer available, station upgrades, etc)
- Discuss in-depth "how-to" DXpedition information on specific countries
- Offer contest expedition operating strategy on a continental/regional basis
- Address IOTA DXpeditioning
- Highlight Web-based resources that every contest expeditioner should know about

I hope that my column stirs up your contest expedition enthusiasm! If you haven't been DX during a contest, then you haven't experienced one of the most thrilling contest experiences out there!

73, Kenny, K2KW

P.S. Mosquitoes really do bite you "there"…

(*Kenny is still on Step One—he has admitted that he is a pileup addict. Sadly, I must report that he has yet to show any inclination whatsoever toward moving any further along in our recovery program.—K7BV*) ■

Contest Tips, Tricks & Techniques

(Continued from page 30)

states and countries worked. The excitement of working a WAS "sweep" and new country multipliers is as exciting to the students as it is to big gun contesters. Another of Allan's suggestions was to serve food—the pizza effect again!

Hopefully the suggestions in this installment of CTT&T will encourage you to sell Amateur Radio and contesting to our youth. Thanks as usual go out to readers, in this case K1IR, K3PP, K4BEV, K4OJ, K5ZD, K9NW, K9ZO, N0AX, N4ZR, N7UJJ and PY2NY who took time to send in their comments on for this month's topic. Thanks also to Greg, K4NO, for suggesting this topic.

Topic for January-February 2001 (deadline November 4, 2000)

A Contest Rating System.

Should contesting have a rating system for participants as other activities such as chess have? Should we have Masters and Grand Masters of Contesting? If so, how should such a system be set up?

Send in your ideas on these subjects or suggestions for future topics. You can use the following routes: Mail—3310 Bonnie Lane, Slinger, WI 53086. Internet—**w9xt@qth.com**. Be sure to get them to me by the deadline. ■

Contest Calendar

Compiled by Bruce Horn, WA7BNM
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Here's the list of major contests to help you plan your contesting activity through February 2001. The Web version of this calendar is updated more frequently and lists contests for the next 12 months. It can be found at **http://www.hornucopia.com/contestcal**.

As usual, please notify me of any corrections or additions to this calendar. I can be contacted at my callbook address or via e-mail at **bhorn@hornucopia.com**. Good luck and have fun!

November 2000

IPA Contest, CW	0600Z-1000Z and 1400Z-1800Z, Nov 4
Ukrainian DX Contest	1200Z, Nov 4 to 1200Z, Nov 5
ARRL Sweepstakes Contest, CW	2100Z, Nov 4 to 0300Z, Nov 6
NA Collegiate ARC Championship, CW	2100Z, Nov 4 to 0300Z, Nov 6
IPA Contest, SSB	0600Z-1000Z and 1400Z-1800Z, Nov 5
High Speed Club CW Contest	0900Z-1100Z and 1500Z-1700Z, Nov 5
Japan Int. DX Contest, Phone	2300Z, Nov 10 to 2300Z, Nov 12
WAE DX Contest, RTTY	0000Z, Nov 11 to 2400Z, Nov 12
ALARA Contest	0001Z-2359Z, Nov 11
OK/OM DX Contest, CW	1200Z, Nov 11 to 1200Z, Nov 12
LZ DX Contest, CW	1200Z, Nov 18 to 1200Z, Nov 19
IARU Region 1 160-Meter Contest, CW	1400Z, Nov 18 to 0800Z, Nov 19
LI/NJ QRP Doghouse Operation Sprint	1700Z-2100Z, Nov 18
ARRL Sweepstakes Contest, SSB	2100Z, Nov 18 to 0300Z, Nov 20
NA Collegiate ARC Championship, SSB	2100Z, Nov 18 to 0300Z, Nov 20
RSGB 1.8 MHz Contest, CW	2100Z, Nov 18 to 0100Z, Nov 19
CQ Worldwide DX Contest, CW	0000Z, Nov 25 to 2400Z, Nov 26
2000 6-Meter Activity Contest	1800Z-2200Z, Nov 28

December 2000

ARRL 160-Meter Contest	2200Z, Dec 1 to 1600Z, Dec 3
TARA RTTY Sprint	1800Z, Dec 2 to 0200Z, Dec 3
QRP ARCI Holiday Spirits Sprint	2000Z-2400Z, Dec 3
ARRL 10-Meter Contest	0000Z, Dec 9 to 2400Z, Dec 10
AGB Party Contest	2100Z-2300Z, Dec 15
OK DX RTTY Contest	0000Z-2400Z, Dec 16
Croatian CW Contest	1400Z, Dec 16 to 1400Z, Dec 17
DARC Christmas Contest	0830Z-1059Z, Dec 26
2000 6-Meter Activity Contest	1800Z-2200Z, Dec 26
RAC Winter Contest	0000Z-2400Z, Dec 30
Stew Perry Topband Challenge	1500Z, Dec 30 to 1500Z, Dec 31

January 2001

AGB NYSB Contest	0000Z-0100Z, Jan 1
ARRL RTTY Roundup	1800Z, Jan 6 to 2400Z, Jan 7
Kid's Day Contest	1800Z-2400Z, Jan 6
Japan Int. DX Contest, 160-40 meters	2200Z, Jan 12 to 2200Z, Jan 14
Midwinter Contest, CW	1400Z-2000Z, Jan 13
North American QSO Party, CW	1800Z, Jan 13 to 0600Z, Jan 14
NRAU-Baltic Contest, CW	0530Z-0730Z, Jan 14
NRAU-Baltic Contest, SSB	0800Z-1000Z, Jan 14
Midwinter Contest, Phone	0800Z-1400Z, Jan 14
LZ Open Contest, CW	1200Z-2000Z, Jan 20
MI QRP CW Contest	1200Z, Jan 20 to 2359Z, Jan 21
North American QSO Party, SSB	1800Z, Jan 20 to 0600Z, Jan 21
ARRL January VHF Sweepstakes	1900Z, Jan 20 to 0400Z, Jan 22
CQ 160-Meter Contest, CW	2200Z, Jan 26 to 1600Z, Jan 28
YL-ISSB QSO Party, CW	0000Z, Jan 27 to 2400Z, Jan 28
REF Contest, CW	0600Z, Jan 27 to 1800Z, Jan 28
BARTG RTTY Sprint	1200Z, Jan 27 to 1159Z, Jan 28
UBA Contest, Phone	1300Z, Jan 27 to 1300Z, Jan 28
Kansas QSO Party	1800Z, Jan 27 to 1800Z, Jan 28

February 2001

Vermont QSO Party	0000Z, Feb 3 to 2400Z, Feb 4
New Hampshire QSO Party	0000Z, Feb 3 to 2400Z, Feb 4
10-10 Int. Winter Contest, SSB	0001Z, Feb 3 to 2400Z, Feb 4
Minnesota QSO Party	1400Z-2400Z, Feb 3
YL-OM Contest, CW	1400Z, Feb 3 to 0200Z, Feb 5
Delaware QSO Party	1700Z, Feb 3 to 0500Z, Feb 4 and 1300Z, Feb 4 to 0100Z, Feb 5
Mexico RTTY International Contest	1800Z, Feb 3 to 2400Z, Feb 4
North American Sprint, Phone	0000Z-0400Z, Feb 4
CQ/RJ WW RTTY WPX Contest	0000Z, Feb 10 to 2400Z, Feb 11
Asia-Pacific Sprint, CW	1100Z-1300Z, Feb 10
Dutch PACC Contest	1200Z, Feb 10 to 1200Z, Feb 11
YL-OM Contest, SSB	1400Z, Feb 10 to 0200Z, Feb 12
RSGB 1.8 MHz Contest, CW	2100Z, Feb 10 to 0100Z, Feb 11
North American Sprint, CW	0000Z-0400Z, Feb 11
QRP ARCI Winter Fireside SSB Sprint	2000Z-2400Z, Feb 11
ARRL International DX Contest, CW	0000Z, Feb 17 to 2400Z, Feb 18
CQ 160-Meter Contest, SSB	2200Z, Feb 23 to 1600Z, Feb 25
YL-ISSB QSO Party, SSB	0000Z, Feb 24 to 2400Z, Feb 25
REF Contest, SSB	0600Z, Feb 24 to 1800Z, Feb 25
North Carolina QSO Party	1200Z-2359Z, Feb 24 and 1200Z-2359Z, Feb 25
UBA Contest, CW	1300Z, Feb 24 to 1300Z, Feb 25
RSGB 7 MHz DX Contest, CW	1500Z, Feb 24 to 0900Z, Feb 25
High Speed Club CW Contest	0900Z-1100Z and 1500Z-1700Z, Feb 25
CQC Winter QSO Party	2200Z, Feb 25 to 0359Z, Feb 26

Contest DXpedition List

Steve Nace, KN5H
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Hello fellow Contesters!

Has the bug bitten you yet? Not just the contesting bug, but the contest-DXpedition bug.

In my case it started during an ARRL International DX CW contest. As I operated from a stateside QTH, I wondered how much fun it would be to be on the other side. Sure, I had been on other contest DXpeditions with the Texas DX Society, but never on one 100% on my own. After that contest I began to piece it all together, and by Thanksgiving I was having a blast operating the CQWW CW Contest from the Caribbean.

Personally, I did not want to travel to a QTH that had a 6-station multi-multi there at the same time! I found the *NCJ*'s DXpedition list on their Web page and used it to narrow down my list of target destinations.

Now I have the privilege of assuming the responsibility of maintaining that same list. My goal is to update it often and as soon as a new contest-pedition is announced. This way everyone can make "informed" decisions while they are still in the planning stages of their trip.

Please let me know of your plans or any that you may hear or read about.

See you in the pileups,

73, Steve, KN5H

2000 CQWW SSB

8P9	SOABHP	W2SC	Firm
A5	???	JA1PCY, JF1PJK, JH1NBN, JK1AFI, JR7TEQ	Plan
CN8WW	M/M	Bavarian CC	Firm
E3	???	Bavarian CC	Firm
FG5BG	M/S	KR4DA, N2WB, W4WX, W9AAZ	Firm
FM5BH	M/S	FM5BH, FM5FJ, FM5DS, FM5WD, FM5DN, OH2RF	Firm
FS/K4ZA	SOABHP	K4ZA	Firm
FS/K7ZUM	M/S?	K7ZUM family	Firm
GS2MP-Shetland Is.	M/M	North of Scotland CG	Firm
HB0/DK7ZL	M/S	DOK Contesters	Firm
HC8A	SOABHP	N6KT	Firm
IG9A	M/M	MCC Contest Club	Firm
IH9P	M/M	IT9BLB+Intl team	Firm
J3A	M/M	YCCC	Firm
J8?	???	WA2VUY, NO2R, W2EN, W2XT	Firm
LX/DF6QC	M/M	Rhein Ruhr DX Assoc	Firm
MJ/N0KV	???	N0KV	Firm
OH0Z	SOABHP	OH1EH	Firm
P4	SOABLP	KK9A	Firm
P40W	SOABQRP	W2GD	Firm
PJ8/N4ZC	SOABHP	N4ZC	Firm
PJ8/N7KG	SB160	N7KG	Firm
PJ9B	M/M	N3ED +	Firm
V26B	M/M	Team Antigua	Firm
V63DX	SOAB	JA7HMZ	Firm
VB2R	M/M	VE3SRE++	Firm
VP5L	M/S	LA4DCA, LA5KO, LA9HW	Firm
VP5T	M/M	WA2VYA, K2WB, N2VW, WA3RHW	Firm
WP2Z	SOABHP	K6RO	Firm
YM3LZ	M/S	TA & LZ ops	Firm
ZB2X	M/S	OH2KI, W6NV	Firm
ZF2MC	SB75	N7MQ	Firm
ZF2RV	SB10	WJ7R	Firm
ZK1NDK	???	JI1NJC, JR2KDN	Firm

2000 CQWW CW Contest

6Y7A	SOABHP	KN5H	Firm
8P9Z	SOABHP	K4BAI	Firm
C6AKP	SO	N4RP	Firm
CN8WW	M/M	Bavarian CC	Firm
HC8N	M/M	N5KO++	Firm
IH9P	SB40	OL5Y	Firm
J3A	M/M	YCCC	Firm
NH0S	M/S	NH0S, NH0V, KD6CJF, JQ1UKK	Firm
OH0Z	SOABHP	OH1JT	Firm
OJ0	M/S	OH1VR, OH1MM, OH6LS	Firm
PJ9B	M/M	N3ED +	Firm
TI5N	SOABHP	K9NW	Firm
TS7N	M/S	???	Firm
VP5GN	SOABHP	K5GN	Firm
VU2WAP	SOAB	W1NN	Firm
WP2Z	SOABHP	WD5N	Firm
YJ0	M/M	Prairie DX Group	Firm
ZF2NT	M/S	N6NT, K2VUI, W9VNE	Firm

2000 ARRL 10-Meter Contest

8P9Z	M	K4FJ, K3KG	Firm
C9	SO	LW9EUJ	Plan
ZF2NT	SOHPCW	N6NT	Firm

2001 ARRL DX CW Contest

8P9	SOABHP	W2SC	Firm
ZF2NT	SOABQRP	N6NT	Plan

2001 ARRL DX SSB Contest

8P9	M/S	AA4NC, K4MA	Firm
ZF2NT	SOABQRP	N6NT	Plan

(Revised Sept 26, 2000) ■

International Contests

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Contest QSLs

W5ASP

For some time now those of us who thrive within the contest community have been asking what can be done to attract new blood into the sport. Though there have been a number of options suggested and efforts made, the results are modest at best. We all seem to agree that times have changed, and that there is good reason to believe future growth will require more innovative ideas as well as an increased effort on the part of individual contesters.

As with all contesters who have had the good fortune to operate from sought after DX locations, I receive a regular influx of QSL cards. While the majority of these cards are for contests I've done from outside the states, a few show up now and then for domestic contest operations. Recently there has been a marked increase in the number of cards in this latter category. In fact I've already gotten a bunch of stateside cards from the last NAQPs, particularly the phone weekend.

The call signs on these QSLs, as well as occasional notes on the cards themselves, indicate that they are very likely from newly active licensees just getting into contesting. Some cards include an SASE, some don't. Often it isn't clear whether or not they need the state, or my prefix (W5s are getting a bit harder to find), or if, just possibly, they are truly a courteous "confirmation of the QSO." Whatever the motivation, the appearance of these cards has provoked some "what if" sort of thinking on my part.

Of course we ALL answer every incoming card, regardless of the circumstances. Right?

Well at least most… some… occasionally…

Whatever our practice has been, the arrival of a QSL from such a source should be viewed as an opportunity to link up with a "hot prospect" for contest recruitment. By all means respond promptly with your card. Enclose a brief note of welcome and encouragement. Include a picture of your station and antenna, especially if you have a "modest" setup. (Stacked Alphas and monobanders might scare off a promis-

1999 WAE CW Contest

Call	*Points*	*QSOs*	*QTCs*	*Mults*
Canada				
K1ZZ/VY2	162324	501	501	162
VE2AWR	118296	318	318	186
VE2FFE	5880	53	52	56
VE3EJ (op UT4UZ)	1529743	1714	1693	449
VE3RZ	114560	320	320	179
VE3ZT	6566	55	43	67
VE4YU	27456	134	130	104
VE5CPU	27234	135	132	102
VE5MX	8978	69	65	67
VE9DX	238590	500	490	241
USA				
W1MK	265408	832	0	319
KR1G	193104	454	440	216
AA1SU	155250	376	374	207
KQ2M/1	105431	297	292	179
W1MA	84836	336	332	127
N4CW/1	66066	219	210	154
KC1F	26728	167	90	104
WR1P	13685	84	77	85
AB1BX	9207	99	0	93
W1CSM	6580	72	68	47
W2YC	376148	704	684	271
WK2G	349392	757	749	232
K2SX	220500	526	524	210
W2EN	210152	483	481	218
W2YR	118450	258	257	230
W2OX	101430	315	315	161
W2EZ	39600	180	180	110
K2UA	35360	172	168	104
W2TO	11130	80	79	70
AA3B	941924	1317	1285	362
K9GY/3	856260	1279	1277	335
K3WW	682730	1028	1010	335
N3BNA	468754	825	814	286
KQ3F	329130	716	715	230
W3BGN	262372	490	489	268
KB3MM	44330	155	155	143
KB3TS/QRP	42612	161	157	134
K3WWP/QRP	10578	123	0	86
W3FQE	2288	44	8	44
W4MYA	1014468	1404	1383	364

Call	*Points*	*QSOs*	*QTCs*	*Mults*
N4BP	628055	1067	1062	295
N8LM/4	164775	490	485	169
WA4TT	101192	278	278	182
WC4E	87500	250	250	175
WO4O	73670	265	265	139
K0EJ/4	65860	226	219	148
KN4Y	16400	108	97	80
K4IU	7808	65	57	64
W4NTI	7548	102	0	74
K5VG/4	3596	32	30	58
N4MM	528	22	0	24
K5YAA	263120	633	632	208
WD5K	157872	572	572	138
N5ZK	146718	521	505	143
K5KLA	73720	246	239	152
N6ZZ/5	73128	284	270	132
W5NR	40	5	0	8
AD6DO	574040	1130	1130	254
W6EEN (op N6RT)	540345	1060	1059	255
W6NKR	34450	165	160	106
W6FA	27612	234	0	118
N6JM	23520	124	121	96
KI6T	22962	134	133	86
K6DB	15312	118	114	66
K4XU/7	54366	269	264	102
W7YS	52140	200	195	132
W7GB	9600	80	80	60
W7/JR1NKN	8	2	0	4
AA8U	617880	1084	1084	285
KE8M	229596	504	503	228
WZ8A	143100	479	475	150
K8CV	11628	77	76	76
W9/DJ3KR	403636	896	890	226
K9QVB	251532	622	611	204
W9RE	174182	400	399	218
N9RV	148520	475	465	158
W9ILY	80808	259	259	156
K9OSH	8250	63	62	66
K9CJ	1064	28	0	38
KG0UA	55380	195	195	142
N9HDE/0	1672	44	0	38
K0COP	1600	40	0	40

1999 WAE SSB Contest

Call	*Points*	*QSOs*	*QTCs*	*Mults*
Canada				
VE2AWR	71346	257	249	141
VE3EJ (op UT4UZ)	1779354	1916	1657	498
VE3OI	481290	920	910	263
VE3BUC	32857	169	150	103
VE3SYB	6102	59	54	54
VE3RGG	240	12		20
VE4YU	4176	49	38	48
VE5CPU	62622	253	244	126
USA				
KQ2M/1	122544	464	364	148
AA1SU	23320	133	132	88
K1PLX	12556	83	63	86
KC1F	2400	38	37	32
K2NG	1541603	1655	1632	469
W2YR	371280	555	550	336
N2VW	182475	412	399	225
WB2OSM	176475	494	481	181
N1EU/2	145469	370	361	199
W2YC	131625	298	287	225
N2LQQ	12312	86	85	72
NW2J	2484	36	33	36

Call	*Points*	*QSOs*	*QTCs*	*Mults*
WA2UDT	1836	34	20	34
K3WW	734850	1038	1032	355
W2OX/3	520260	886	854	299
KQ3F	301833	803	794	189
KB3TS	279786	669	657	211
W3FQE	6534	84	15	66
W4LC	63720	246	226	135
W4WS (op N4VHK)	52920	167	148	168
K4IU	15200	98	92	80
N4MM	14040	97	83	78
K0EJ/4	12432	78	70	84
N4UH	5740	52	30	70
KD4RHT	2646	49		54
K5VG/4	1680	25	23	35
K4BAI	756	22	20	18
WD5K	75884	315	307	122
N5RXF	27632	160	154	88
W7/JR1NKN	18	3		6
N9RV	9520	71	65	70
K0DAT	11016	83	70	72
WB0YJT	5215	78	71	35
N0XW	2120	43	10	40
N9HDE/0	700	25		28

1999 LZ DX Contest CW

Call	Cat	QSOs	Points	Mults	Score
USA					
N3JT	A	120	448	13	5824
W2CVW	A	50	191	15	2865
K6EID	B28	19	114	1	114
Canada					
VE3QAA	A	468	1676	44	73744
VA3UZ	B21	42	147	9	1773

ing rookie.) Point out that you'll be looking for his call in the coming contests. Offer to help with questions and provide your e-mail address. Above all be friendly and personal.

This may take a few extra moments of your valuable time, but if your effort results in one more dependable Q per band in each future contest, isn't it worth it?

The more enterprising contester might want to consider doing a scan of his log to identify possible neophytes whose calls can be traced to nearby QTHs. Initiating a QSL card might work wonders in getting the call in the log next time out, as well as soliciting a new member for the local contest/DX club.

These are things that each of us can do without a great deal of hassle. Though it may not be a novel idea, it's probably a good one.

73, Joe, W5ASP ■

1999 RAC Canada Winter Contest

Call	Score	CDN	Qs	RAC Qs	DX Qs	Mults	Total Qs
AA1CA	450,138	A	422	30	177	87	629
AA3RC	368,830	A	386	22	245	77	653
AA9KH	310,570	A	352	10	529	65	891
K0COP/4	1,808	A	15	2	18	8	35
K0LWV	1,530	A	15		10	9	25
K0MLH	1,512	A	19		31	6	50
K3WWP	812	A	11		3	7	14
K4BAI	780	A	9	2		6	11
K4UK	470	A	7		12	5	19
K5ZTY	404	A	1	1	86	2	88
K7RE	180	A	6			3	6
KA6BIM	831,402	L	692	24	499	99	1215
KF6YUD	570,942	L	480	28	263	97	868
KM1Z	525,420	L	469	18	394	90	881
LY1DR	429,052	L	451	23	414	74	888
N0AC @ WA0RO	395,590	L	371	26	212	85	609
N0MSB	377,872	L	326	35	167	88	528
N2NO	314,500	L	287	21	205	85	513
N3KCJ	289,224	L	312	19	104	78	435
N3PUR	270,600	L	322	23	210	66	555
N4CW	265,160	L	310	14	204	70	528
N4MM	261,198	L	343	10	258	63	611
N6RO	230,620	L	302	13	134	65	449
N8WTH	221,700	L	229	20	133	75	382
N9SD	189,072	L	201	21	98	72	320
N9VOK	159,840	L	194	19	172	60	385
NY4T	123,000	L	199	20	35	50	254
W1END	288,162	M	380	15	237	63	632
W2EZ	283,272	M	304	27	124	74	455
W3/VA3UZ	213,248	M	286	13	344	56	643
W4LC	201,144	M	237	19	104	68	360
W4YE	190,336	M	220	8	307	64	535
W5GCX	174,020	M	249	13	207	55	469
W6AFA	152,020	M	227	7	177	55	411
W7DA	140,116	M	226	15	243	46	484
W7LQU	118,588	M	215	13	84	46	312
W8IQ	112,090	M	164	15	49	55	228
W9BZP	85,176	M	206	8	73	36	287
WA0OTV	67,518	M	181	6	58	33	245
WA2BMH	40,176	M	147	2	82	24	255
WA3HAE	34,408	M	77	6	61	34	144
WB0IWG/3	192	M	4		4	4	8
WB2LOS	180	C	2	2		3	4

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PS Form **3526,** October 1999 *(Reverse)*

RTTY Contesting

Wayne Matlock, K7WM
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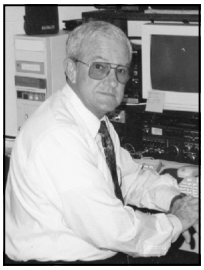
K7WM

Contesting—the very word conjures up thoughts of preparation. One spends hours, days, weeks—and sometimes months and years—preparing for a contest.

You might spend considerable time planning a DXpedition to coincide with a particular contest or purchasing, assembling and installing a new antenna. There are coax fittings to be soldered on and feedline runs to be made. Radios and amplifiers must be tested and computers and software checked for glitches. Time must be budgeted for checking all the DX Web sites to see who is going where and what strange call signs will be showing up. A final look at the propagation forecasts for the best paths and times to point all of those antennas in the proper directions—and the CONTEST begins.

That contest can last for 4, 8, 12, 24, 30, 36 or 48 hours, depending on the particular event and the class that you are entering in. And then it's all over...

The adrenaline flow slows down, rigor mortis sets in, your eyes become kind of vacant. If you are a single operator, you pat yourself on the back and sit wishing you had just one more radio/amp/tower/antenna. If you are part of a multi team at a big multi station, everybody begins trying to figure out how the team did. Everyone pats everyone else on the back. At about this point in time, somebody brings up log submittal and who is going to do it.

Sooooo, it's not really over yet. Someone has got to do the logs and send them in. If you're a single op, pat yourself on the back *because you have been elected*. If you are part of a multi team, there may be room for negotiation.

There are a myriad of contests and numerous logging software programs that generate logs in various submittal formats. The various contests have different log submittal requirements. There are even some very popular contests that are *just now* starting to accept e-mail log submissions.

Some of the more popular contests are in the process of switching over to the *Cabrillo* format. Most are in a "grace period" right now accepting plain ASCII text files and paper logs. Those grace periods will be ending very shortly and the contester will soon be faced with only being able to submit their log in *Cabrillo* format.

Foreseeing the problems, Bruce, WT4I, has written a program called *Cabrillo Converter*. It takes just about any ASCII text log in column format and converts it into *Cabrillo* format. The converter already covers most contests and more are being added. The program has been under beta testing for several months and is almost ready for release.

Bruce has written two other programs: *CabrilloLogChecker* and *MasterCall*. *CabrilloLogChecker* checks *Cabrillo* logs and automatically scores them. *MasterCall* generates and maintains a Master.cal file that the *CabrilloLogChecker* uses to compare the log being checked against.

Using the *MasterCall* program, one can quickly load all call signs from the received logs into the program, filter the list of calls to include only those worked by multiple stations, and then create a new Master.cal file. This way a real time Master.cal file consisting of calls actually in the contest can be used to check logs instead of using a huge database of known operators to compare calls against.

CabrilloLogChecker and *MasterCall* were written primarily for contest managers and their assistant log checkers. But an individual contester will have an interest in the *CabrilloLogChecker* program to help them quickly validate their log and find obvious typos. All the beta testers of the programs are extremely impressed. One beta tester put it this way; "This is the best thing for contesters and contest managers since pockets on a shirt," Keep an eye out for their release.

Our guest columnist this month needs no introduction. Ron, K5DJ, is a well-known contester and contest manager for several of the more popular RTTY contests. One of these is the RTTY *NCJ* NAQP Contest. The 2000 contest suffered from some of the most horrific propagation experienced in a long time. Ron consented to write a short article in spite of the problems and to provide the results.

That's all for this issue. Hope to see you in the frays.

73, Wayne, K7WM

Results, July 2000 NAQP RTTY Contest

Ron Stailey, K5DJ
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This was the fifth running of the North American RTTY QSO Party. Conditions were very much like the second running back in 1997—almost as horrible as they can get. Very few records were broken. Most ops worked very hard just to keep going with conditions as they were.

The good news is that the team competition category gained one team this year over last year, with only one team not sending in any logs. Naturally it was a DX team and conditions were as horrible for them as it was for us in North America.

I still feel the RTTY NAQP Contest is growing, however this year was the first year we received fewer logs than the last few years. With the amount of contacts that were made many didn't send in their logs. Only 114 logs were submitted. Only six DX logs were received.

Single Operator Category

Only entrants from W0, W3, W4, W5 and W7 made the Top Ten. At the end of the contest, it came down to K5DJ, AA5AU and WT4I turning in the highest scores. The race for first and second place was—as usual—very close.

Ron, K5DJ, narrowly came out on top over last year's champ Don, AA5AU. K5DJ finished with 436 QSOs and 149 multipliers for a score of 64,964. AA5AU finished with 427 QSOs and 50 mults, scoring 64,050. This was the closest finish between first and second place in the five-year history of the RTTY NAQP Contest. Bruce, WT4I, finished third with 391 QSOs and 142 mults for a score of 55,552. We better keep an eye on Bruce, he seems to be making a move toward the spotlight after his second place finish in the Roundup and now third in NAQP RTTY Contest.

Again this year 40, 20 and 15 meters were the bands of choice during the RTTY NAQP 'test. K5DJ posted the highest point total on 10 meters with only 15 QSOs and 9 mults. Next was K3MM with 15 QSOs and 8 mults followed by AA5AU with 11 QSO and 5 mults. Several operators that finished in the Top Ten didn't have any QSOs on 10 meters. Ten meters wasn't exactly a hot bed of activity this time around, to say the least…

On 15 meters WT4I managed to collect the most QSOs and multipliers with 97 and 41. AA5AU picked up 78 QSOs and 34 mults and K5DJ had 75 QSOs with 36 mults.

On 20 meters K5DJ had the most QSOs

and mults with 199 and 47. AF4Z gathered up 180 QSOs and 43 mults. Next was AA5AU with 175 QSOs and 45 mults.

On 40 meters WT4I scooped up the highest amount of QSOs and multipliers with 119 and 42. K5DJ had 116 QSOs and 37 mults and AA5AU had 110 QSOs with 40 mults.

On 80 meters N5ZM lead the pack with 61 QSOs and 30 mults while AA5AU was next with 53 QSOs and 26 mults. K3MM was third highest with 46 QSOs and 28 mults.

Multi/Two Category

The Multi/Two category saw slim participation with just five logs received. The top dog was W6YX with 305 QSOs and 114 multipliers for a score of 34,770.

Team Competition

Team competition was up a little this year. It's nice to see something going up with conditions as they were. The Big Dogs took the team category and set a new record for team competition. This was the only record broken this year in any category.

The above pretty well describes the horrible conditions the participants encountered in this year's NAQP RTTY Contest. As the old saying goes "Oh well, there's always next year."

73, Ron, K5DJ

Soapbox

My first RTTY 'test, didn't spend much time in the contest because I was learning new software.—*N5RM* Glad it wasn't a 48-hour contest.—*AF4Z* No problem with the 'MP running at 75 W, Guess I could have run 100 W but I decided to play it safe.—*N5ZM* Oh well, there's always next year.—*WN1E* Many thanks to the contest sponsors.—*WB2UEF* The Digital Porch Dogs never intended to run with the Big Dogs, but we never thought Ol' Sol would chain us to the damn porch.—*KI6DY* Between thunderstorms, lighting strikes, ponies getting into the neighbors yard—I thinking it best for some Big Dogs to stay on the porch!—*K3MM* I'd hate to see us lose anyone because of this rule. I will include a comment on my summary sheet asking the powers to be to remove the "no external amplifier" rule for next year's contest.—*AA5AU* The bands were very poor never seen them that bad.—*VA6MM* I have read that some ops will not operate future NAQP RTTY contests because they are concerned about burning up their radio running 100 W in RTTY mode.—*AE9D* My first big effort in RTTY NAQP 'test—a nightmare. I never heard such fluttery signals.—*N4VHK* We thought we would surround North America with RF. Mother Nature had other plans.—*W1ZT* Early in the contest I knew this was going to be tough.—*N0IDT* Tough going at times, but the points were there if one had the perseverance to hang tough.—*KR6E*

US State Winners

CT	N1XS (op KB1H)	NM	WA0SXV
MA	W1ZT	OK	KB5BOB
ME	K1US	TX	K5DJ
NJ	NO2T	CA	KR6E
NY	K2QMF	AZ	K7WM
MD	K3MM	ID	N7UVH
PA	W2UP	WA	WS7I
AL	W4/KL7Q	OH	K3GP
FL	WT4I	IL	AE9D
KY	K4WW	IN	WA9ALS
NC	W4WS (op N4VHK)	WI	AA9RR
SC	AF4OX	CO	W0DET
TN	W4GKM	IA	K3ETC
VA	W4JLS	KS	KI6DY/0
AR	N5ZM	MN	W0HW
LA	AA5AU	MO	KS0M
MS	KK5OQ	NE	N0IDT
		HI	AH6OZ

Canadian Province Winners

AB	VE6RAJ
BC	VA7SW
SK	VE5CPU

Team Scores

The Big Dogs		*The Flo Bo's*		*The Porch Dogs*		*The 7 Full*	
K5DJ	64,964	AF4Z	33,063	KI6DT	34,270	K7WM	33,588
AA5AU	64,050	KC4HW	28,254	W4OX	27,775	K4WW	17,835
WT4I	55,522	WB4EQS	13,193	N6OJ	18,690	W4LC	11,534
K3MM	37,873	K4PX	17,091	VE6RAJ	2,505	WS7I	3,744
W2UP	6,188	WA4HDS	11,178	N0IT	1,350	AD7U	1,947
	228,597		94,779		83,590		68,648

5. The 9 to 5ers: KB5BOB, AE9D, W9OL, AA9RR, WA9ALS 63,275
6. The Radio Ticks: KR6E, WA0SXV, 8P6SH, W1ZT 63,083
7. The TCG-#1: W4GKM, KK5OQ, K4BEV 61,621
8. D-CAT TX: N5ZM, KK5CA, VA6MM 32,683
9. The TCG-#3: W4WS, VA7SW 16,954
10. The TCG-#2: W7WW, W9WI, W4AUI, N4JN 7,120

Single Op Top Ten Breakdowns

Call	*Score*	*QSOs*	*Mults*	*10*	*15*	*20*	*40*	*80*
K5DJ	64,964	436	149	15/9	75/36	199/47	116/37	31/20
AA5AU	64,050	427	150	11/5	78/34	175/45	110/40	53/26
WT4I	55,552	391	142	4/2	97/41	153/44	119/42	18/13
K5NZ	40,192	315	128	9/5	51/26	121/39	89/36	43/22
K3MM	37,873	313	121	15/8	43/18	104/30	105/37	46/28
KI6DY/0	34,270	298	115	0/0	37/18	117/36	97/33	48/28
K7WM	33,558	282	119	4/2	52/31	124/40	91/39	11/7
AF4Z	33,063	309	107	2/1	30/18	180/43	84/34	13/11
KK5OQ	31,993	299	107	3/1	27/15	166/42	72/33	31/16
N5ZM	29,267	259	113	0/0	26/16	94/33	78/34	61/30

Single Operator
North America and DX
(by score)

Call	*QSOs*	*Mults*	*Score*	*State*	*Team*
K5DJ	436	149	64,964	TX	Big Dogs
AA5AU	427	150	64,050	LA	Big Dogs
WT4I	391	142	55,552	FL	Big Dogs
K5NZ	315	128	40,192	TX	
K3MM	313	121	37,873	MD	Big Dogs
KI6DY/0	298	115	34,270	KS	Porch Dogs
K7WM	282	119	33,558	AZ	7 Full
AF4Z	309	107	33,063	FL	Flo Bo
KK5OQ	299	107	31,993	MS	TGC
N5ZM	259	113	29,267	AR	
W4OX	255	105	26,775	FL	
W4GKM	252	94	26,688	TN	TGC #1
KR6E	235	98	23,030	CA	Radio Ticks
KB5BOB	237	94	22,278	OK	
W4/KL7Q	228	89	20,292	AL	
KC4HW	247	82	20,254	FL	
WA0SXV	225	87	19,575	NM	Radio Ticks
N6OJ	210	89	18,690	CA	Porch Dogs
K4WW	205	87	17,835	KY	7 Full
K4PX	211	81	17,091	FL	Flo Bo's
AC5SU	196	84	16,464	MS	
W1ZT	172	91	15,652	MA	
W4WS (op N4VHK)	175	85	14,875	NC	TGC #3
K3ETC	175	87	14,790	IA	
AE9D	163	89	14,507	IL	
WB4EQS	167	79	13,193	FL	Flo Bo's
W4LC	158	84	11,534	KY	7 Full
K5AM	150	75	11,250	NM	
WA4HDS	162	69	11,178	FL	Flo Bo's
NO2T	135	80	10,800	NJ	
W9OL	132	79	10,428	IL	
K1DW	131	74	9,694	LA	
W4EYJ	140	67	9,380	TN	
AK0A	142	59	8,378	KS	
AA9RR	132	63	8,316	WI	9 to 5ers
AF4OX	137	60	8,220	SC	
WA9ALS	125	62	7,750	IN	

Call	*QSOs*	*Mults*	*Score*	*State*	*Team*
K3GP	108	66	7,128	OH	
W7TI	129	55	7,095	CA	
N7UVH	122	57	6,954	ID	
W2UP	119	52	6,188	PA	Big Dogs
K4BEV	119	50	5,940	TN	TCG #1
8P6SH	94	59	5,546		Radio Ticks
AJ3M	111	49	5,439	MD	
N0IDT	103	51	5,356	NE	
K5PI	95	55	5,225	TX	
W0DET	100	51	5,100	CO	
W5LA	95	49	4,655	LA	
K5QQ	95	44	4,180	NM	
K6EP	83	50	4,150	CA	
KS0M	94	44	4,136	MO	
K6BIR	86	48	4,128	CA	
WS7I	72	52	3,744	WA	7 Full
KF4SIR	104	35	3,640	FL	
WB2UEF/4	80	42	3,360	NC	
WA9AFM	77	42	3,234	OK	
WA6BOB	70	43	3,010	CA	
N4PQV	73	40	2,920	TN	
K7ON	67	42	2,814	AZ	
N4CW	75	37	2,775	NC	
WA8RPK	71	36	2,556	OH	
K0XU	67	38	2,546	NE	
VE6RAJ	66	38	2,505	AB	Porch Dogs
W7WW	74	32	2,368	WA	
K8IR	70	30	2,109	WI	
VA7SW	63	33	2,079	BC	
W0HW	53	31	2,067	MN	
KJ5X	58	35	2,030	TX	
VE5CPU	59	34	2,006	SK	
AD7U	59	33	1,947	WA	7 Full
W9WI	56	33	1,848	TN	
KK5CA	56	33	1,848	TX	
N5RN	52	32	1,664	AR	
N7GC	52	31	1,612	WA	
N1XS	51	33	1,683	CT	
VA6MM	49	32	1,568	AB	D-Cat TX
LU3DSI	48	31	1,488		
K6HGF	45	33	1,485	CA	
N0IT	50	27	1,350	MO	Porch Dogs
LW9EOC	46	28	1,288		
K2QMF	52	24	1,248	NY	
K1US	45	27	1,215	ME	
(op KB1H)					
CX7BF	48	24	1,152		
KI7NW	42	26	1,092	AZ	
N4JN	44	24	1,056	TN	TCG #2
N0IBT	39	25	975	CO	
K4BX	35	22	770	TN	
N3NZ	38	19	722	PA	
W3ZF	31	21	651	PA	
K6XT	31	16	496	CA	
AH6OZ	22	17	374	HI	Radio Ticks
W4JLS	26	12	312	VA	
N8TW	10	5	50	OH	
K9PG	1	1	1	IL	

Single Operator
North America

KI6DY/0	298	115	34,270	KS	Porch Dogs
K3ETC	175	87	14,790	IA	
AK0A	142	59	8,378	KS	
N0IDT	103	51	5,356	NE	
W0DET	100	51	5,100	CO	
KS0M	94	44	4,136	MO	
K0XU	67	38	2,546	NE	
W0HW	53	31	2,067	MN	
N0IT	50	27	1,350	MO	Porch Dogs
N0IBT	39	25	975	CO	

W1ZT	172	91	15,652	MA	
N1XS	51	33	1,683	CT	
K1US	45	27	1,215	ME	
(op KB1H)					

NO2T	135	80	10,800	NJ	
K2QMF	52	24	1,248	NY	
K3MM	313	121	37,873	MD	Big Dogs
W2UP	119	52	6,188	PA	Big Dogs
AJ3M	111	49	5,439	MD	
N3NZ	38	19	722	PA	
W3ZF	31	21	651	PA	

Call	*QSOs*	*Mults*	*Score*	*State*	*Team*
WT4I	391	142	55,552	FL	Big Dogs
AF4Z	309	107	33,063	FL	Flo Bo
W4OX	255	105	26,775	FL	
W4GKM	252	94	26,688	TN	TGC #1
W4/KL7Q	228	89	20,292	AL	
KC4HW	247	82	20,254	FL	
K4WW	205	87	17,835	KY	7 Full
K4PX	211	81	17,091	FL	Flo Bo's
W4WS	175	85	14,875	NC	TGC #3
(op N4VHK)					
WB4EQS	167	79	13,193	FL	Flo Bo's
W4LC	158	84	11,534	KY	7 Full
WA4HDS	162	69	11,178	FL	Flo Bo's
W4EYJ	140	67	9,380	TN	
AF4OX	137	60	8,220	SC	
K4BEV	119	50	5,940	TN	TCG #1
KF4SIR	104	35	3,640	FL	
WB2UEF/4	80	42	3,360	NC	
N4PQV	73	40	2,920	TN	
N4CW	75	37	2,775	NC	
W9WI	56	33	1,848	TN	
N4JN	44	24	1,056	TN	TCG #2
K4BX	35	22	770	TN	
W4JLS	26	12	312	VA	

K5DJ	436	149	64,964	TX	Big Dogs
AA5AU	427	150	64,050	LA	Big Dogs
K5NZ	315	128	40,192	TX	
KK5OQ	299	107	31,993	MS	TGC
N5ZM	259	113	29,267	AR	
KB5BOB	237	94	22,278	OK	
WA0SXV	225	87	19,575	NM	Radio Ticks
AC5SU	196	84	16,464	MS	
K5AM	150	75	11,250	NM	
K1DW	131	74	9,694	LA	
K5PI	95	55	5,225	TX	
W5LA	95	49	4,655	LA	
K5QQ	95	44	4,180	NM	
WA9AFM	77	42	3,234	OK	
KJ5X	58	35	2,030	TX	
KK5CA	56	33	1,848	TX	
N5RN	52	32	1,664	AR	

KR6E	235	98	23,030	CA	Radio Ticks
N6OJ	210	89	18,690	CA	Porch Dogs
W7TI	129	55	7,095	CA	
K6EP	83	50	4,150	CA	
K6BIR	86	48	4,128	CA	
WA6BOB	70	43	3,010	CA	
K6HGF	45	33	1,485	CA	
K6XT	31	16	496	CA	

K7WM	282	119	33,558	AZ	7 Full
N7UVH	122	57	6,954	ID	
WS7I	72	52	3,744	WA	7 Full
K7ON	67	42	2,814	AZ	
W7WW	74	32	2,368	WA	
AD7U	59	33	1,947	WA	7 Full
N7GC	52	31	1,612	WA	
KI7NW	42	26	1,092	AZ	

K3GP	108	66	7,128	OH	
WA8RPK	71	36	2,556	OH	
N8TW	10	5	50	OH	

AE9D	163	89	14,507	IL	
W9OL	132	79	10,428	IL	
AA9RR	132	63	8,316	WI	9 to 5ers
WA9ALS	125	62	7,750	IN	
K8IR	70	30	2,109	WI	
K9PG	1	1	1	IL	

VE5CPU	59	34	2,006	SK	
VE6RAJ	66	38	2,505	AB	Porch Dogs
VA6MM	49	32	1,568	AB	D-Cat TX
VA7SW	63	33	2,079	BC	

Multi/Two Scores
North America

Call	*Points*	*Mults*	*Score*	*State*
W6YX	305	114	34,770	CA
WN1E	90	54	4,860	VT

DX

Call	*Points*	*Mults*	*Score*
SP5ZCC	7	6	42

Multi-Op Team Members

W6YX: K6ENT, N6DE
WN1E: N1MGO, AA1MM, WN1E
SP5ZCC: N/A

Check Logs

AF4RK, W6/G0AZT, W4TDB, DJ7AA, W4JLS, AA5RF, N5LUQ, AA1SU, W0ETC ■

2001 *NCJ* Sprints
Rules for CW, SSB and RTTY

Contest Managers:
CW—Boring Amateur Radio Club,
cwsprint@ncjweb.com
SSB—Rick Niswander, K7GM,
ssbsprint@ncjweb.com
RTTY—Wayne Matlock, K7WM,
rttysprint@ncjweb.com

1. Eligibility: Any licensed radio amateur may enter.

2. Object: To work as many North American stations (and/or other stations if you are in North America) as possible during the contest.

3. Entry Classification: Single operator only. Use of helpers or spotting nets is not permitted.

4. Contest Periods:

February/March 2001 Contests:
SSB: 0000Z-0400Z February 4, 2001
CW: 0000Z - 0400Z February 11, 2001
RTTY: 0000Z - 0400Z March 11, 2001

September/October 2001 Contests:
CW: 0000Z - 0400Z September 9, 2001
SSB: 0000Z - 0400Z September 16, 2001
RTTY: 0000Z - 0400Z October 14, 2001

These are entirely separate four-hour Sprints. An entrant may submit scores for one or more Sprints, but he may not combine his scores. Note that the CW Sprint is first in September and second in February.

5. Mode: CW only in CW Sprints, Phone only in Phone Sprints, RTTY only in RTTY Sprints.

6. Bands: 80, 40 and 20 meters only. Suggested frequencies are around 3540, 7040 and 14040 kHz on CW; 3850, 7225 and 14275 kHz on Phone; and 3580, 7080 and 14080 kHz on RTTY. You may work the same station once per band.

Note: For RTTY only, the same station can be worked multiple times provided 3 contacts separate the contact in both logs, regardless of band.

7. Exchange: To have a valid exchange, you must send all of the following information: the other station's call, your call, your serial number, your name and your location (State, Province or Country). For example:

N6TR DE K7GM 154 RICK NC K
K7GM NR 122 TREE OR DE N6TR K

8. Valid Contact: A valid contact consists of a complete, correctly copied and logged two-way exchange between a North American station and another station. Proper logging requires including the time of each contact. Serial numbers must begin with serial number one (1) and must be sequential thereafter. Regardless of the number of licensed call signs issued to a given operator, one and only one call sign shall be utilized during the contest by that operator.

9. North American Station: Defined by the rules of the CQWW DX Contests.

10. Scoring: Multiply total valid contacts by the sum of US States, Canadian Provinces and other North American Countries to get final score (do not count USA and Canada as countries). KH6 is not counted as a State and is not a North American country (but counts for QSO credit). The eight Canadian multipliers are Maritime (VE1, VO1 and VO2), VE2 through VE7, and Yukon-NWT (VY1 and VE8). Non-North American countries do not count as multipliers, but do count for QSO credit for North American stations.

11. Special QSY Rule: If any station solicits a call (by sending CQ, QRZ?, "going up 5 kHz," or any other means of soliciting a response), he is permitted to work only one station in response to that solicitation. He must thereafter move at least 1 kHz before he works any other station, or at least 5 kHz before he again solicits other calls. Once a station is required to QSY, that station is not allowed to make another QSO on the vacated frequency until or unless at least one subsequent QSO is made on a new frequency at least 1 kHz or 5 kHz (as appropriate) from the vacated frequency.

12. Additional Rules: Simultaneous transmission on more than one frequency is prohibited. All contacts must be sent and received using means requiring real-time human intervention, detection and initiation.

13. Reporting:

Send CW logs to: Boring Amateur Radio Club, 15125 Bartell Rd, Boring, OR 97009 USA; **cwsprint@ncjweb.com**.

Send phone logs to: Rick Niswander, K7GM, PO Box 2701, Greenville, NC 27836 USA; **ssbsprint@ncjweb.com.**

Send RTTY logs to: Wayne Matlock, K7WM, Rt 2, Box 102, Cibola, AZ 85328 USA; **rttysprint@ncjweb.com**.

Entries must be received no later than 30 days after the Sprint to be eligible for trophies and awards. All logs containing more than 50 QSOs, which were generated with a computer program, must be submitted on a 3.5-inch floppy disk or via e-mail.

An entry consists of (1) a summary sheet showing the number of valid contacts by band, total contacts, total multipliers, total score, name, call sign and address of the operator, station call sign and station location, whether low power (150 W or less) was used, and name used; (2) a complete legible log of all contacts (including dupes marked as such) with indication by numbered sequence of each multiplier claimed. Logs, summary sheets and check sheets may be homemade or patterned after those published periodically in the *NCJ* or available from the contest coordinators listed above.

You are encouraged to send your log in computer readable form, either by diskette or by e-mail. If your log is submitted by diskette, the output from any of the popular logging programs is appropriate. Electronic summary sheets are required in case of electronic submission. If you are submitting your log by e-mail, send your logs to the addresses given above.

14. Team Competition: Team competition is limited to a maximum of 10 operators as a single entry unit. Groups having more than ten team members may submit more than one team entry. Pre-Contest Requirement: To qualify as a team entry, the name, call sign of each operator, and call sign of the station operated (if the operator is a guest at a station other than his own, eg W6AQ operated by WA6OTU), must be registered with the BARC for the CW Sprints, K7GM for the Phone Sprints, or K7WM for the RTTY Sprints. The team registration information must be in written, telegraphic, spoken or electronic form, and must be received before the start of the Sprint.

Submission by e-mail to the appropriate address listed above is a valid means of submission, as is a telephone call. There are neither distance limitations nor meeting requirements for a team entry. The only requirement is pre-registration of the team.

15. Penalties and Disqualification: For each unmarked duplicate QSO, you lose that contact plus an additional three contacts. For each QSO for which you are not in the other station's log, you lose that QSO plus an additional one contact. For each QSO for which the log data is incorrectly copied in any respect, you lose that contact. Entries with score reductions in excess of 5 percent may be disqualified. Any entry also may be disqualified for illegibility, illegal or unethical operation. Such disqualification is at the discretion of the *NCJ* Contest Review Committee.

16. Awards: A trophy or plaque will be awarded to the highest scoring entrant. Certificates of merit will be awarded to the highest scoring entrant from each USA or Canadian call district and other country, to each of the ten highest scoring entrants, to each member of the winning team, and to the highest scoring entrant on each team. ■

2001 North American QSO Party (NAQP) Rules for SSB, CW and RTTY

Contest Managers:

CW—Bob Selbrede, K6ZZ, cwnaqp@ncjweb.com
SSB—Bruce Horn, WA7BNM, ssbnaqp@ncjweb.com
RTTY—Ron Stailey, K5DJ, rttynaqp@ncjweb.com

1. Eligibility: Any licensed radio amateur may enter.

2. Object: To work as many North American stations as possible during the contest period.

3. North American Station: Defined by the rules of the CQWW DX Contests with the addition of KH6.

4. Contest periods:

January 2001 Contests:

CW: Second full weekend in January (1800Z January 13 to 0600Z January 14, 2001)

SSB: Third full weekend in January (1800Z January 20 to 0600Z January 21, 2001)

July 2001 Contests:

RTTY: Third full weekend in July (1800Z July 21 to 0600Z July 22, 2001)

August 2001 Contests:

CW: First full weekend in August (1800Z August 4 to 0600Z August 5, 2001)

SSB: Third full weekend in August (1800Z August 18 to 0600Z August 19, 2001)

5. Entry Classification:

a. Single Operator:

i. One person performs all transmitting, receiving, spotting and logging functions as well as equipment and antenna adjustments.

ii. Use of helpers or spotting nets is not permitted.

iii. Only one transmitted signal allowed at a time.

iv. May operate 10 out of the 12 hours of the contest. Off times must be at least 30 minutes in length.

b. Multi-Operator Two-Transmitter:

i. More than one person performs transmitting, receiving and logging functions, etc.

ii. A maximum of two transmitted signals at any given time, each on a different band. Both transmitters may work any and all stations.

iii. Shall keep a separate log for each transmitter.

iv. Each transmitter must have at least 10 minutes between band changes.

v. May operate for the entire 12 hours of the contest.

6. Output Power: Output power must be limited to 100 W for eligible entries. Use of external amplifiers capable of more than 100 W output is not allowed.

7. Mode: CW only in CW parties, SSB only in phone parties, RTTY only in RTTY parties.

8. Bands: 160, 80, 40, 20, 15, 10 meters only, except no 160 meters for the RTTY contest. You may work a station once per band. Suggested frequencies are 1815, 3535, 7035, 14035, 21035 and 28035 kHz (35 kHz up from band edge for Novice/Tech) on CW and 1865, 3850, 7225, 14250, 21300, 28500 kHz (28450 for Novice/Tech) on SSB.

9. Exchange: Operator name and station location (State, Province or Country) for North American stations; operator name only for non-North American stations. If the name sent is changed during the contest, as sometimes happens with multi-operator stations, the name used for each QSO must be clearly identified in the log.

10. Multipliers: US States (including KH6 and KL7), Canadian Provinces/Territories (British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, Nova Scotia, PEI, Labrador, Yukon, NWT and Nunavut) and other North American countries. Newfoundland counts as Labrador, and District of Columbia counts as Maryland.

Non-North American countries, maritime mobiles and aeronautical mobiles do not count as multipliers, but may be worked for QSO credit.

11. Valid Contact: A valid contact consists of a complete, correctly copied and legibly logged two-way exchange between a North American station and any other station.

Proper logging requires including the time in UTC and band for each contact. Regardless of the number of licensed call signs issued to a given operator, one and only one call sign shall be utilized during the contest by that operator.

12. Scoring: Multiply total valid contacts by the sum of the number of multipliers worked on each band.

13. Team Competition: You may wish to form a team with fellow NAQP participants. If so, your team must consist of 2 to 5 single operator stations whose individual scores are combined to produce a team score. Although clubs or other groups having more than 5 members may form multiple teams, there is no distance or meeting requirements for a team entry.

Teams must be registered with the appropriate contest manager prior to the start of the contest. Team registration information must be in written form (mail or e-mail) and must include the name, call sign of the operator, and the call sign of the station operated if the operator is a guest at a station other than his own (eg WF1B op at K1NG). Use the log submission addresses given below for team registration notification.

14. Log Submission: Entries must be postmarked no later than 30 days after the contest to be eligible for awards. All logs containing more than 200 QSOs, which were generated with a computer program, must be submitted on a 3.5-inch floppy disk or via e-mail. If paper logs are submitted, please submit originals. Sample log sheets and a summary sheet may be obtained with an SASE to the appropriate contest manager. These forms are also available on the *NCJ* Web site.

A proper entry consists of: (1) a summary sheet showing the number of valid contacts and multipliers by band, total contacts and multipliers, total score, team name (if applicable), power output, name, call sign and address of the operator, station call sign and exchange (name and location) sent during the contest; and (2) a complete legible log of all contacts.

Logs and summary sheets submitted

Mode	*Category*	*Sponsor*
CW	Single Op, North America	Florida Contest Group
CW	Multi-Op, North America	Texas DX Society
SSB	Single Op, North America	South East Contest Club
SSB	Multi-Op, North America	Tennessee Contest Group
Combined (CW/SSB)	Single Op, North America	Southern California Contest Club
RTTY	Single Op, North America	Glenn Vinson, W6OTC
RTTY	Single Op, DX	Will Angenent, K6NDV
RTTY	Multi-Op, North America	*RTTY* by WF1B
RTTY	Multi-Op, DX	*Writelog* for *Windows*
RTTY	Best name in North America (name must be rated PG and contain no more than 10 letters)	Eddie Schneider, W6/G0AZT

on floppy disk or via e-mail must be in ASCII text format. Name your files with your call sign (ie yourcall.SUM and yourcall.LOG). Please do not send binary files produced by a contest logging program (ie yourcall.BIN, yourcall.QDF, etc.). Use of the *Cabrillo* log format for electronic log submissions is encouraged and may be required in the future.

Send CW logs to: Bob Selbrede, K6ZZ, 6200 Natoma Ave, Mojave, CA 93501 USA; **cwnaqp@ncjweb.com**

Send SSB logs to: Bruce Horn, WA7BNM, 4225 Farmdale Ave, Studio City, CA 91604 USA; **ssbnaqp@ncjweb.com**

Send RTTY logs to: Ron Stailey, K5DJ, 504 Dove Haven Dr, Round Rock, TX 78664 USA; **rttynaqp@ncjweb.com**

15. Disqualifications: Entries with score reductions greater than 5 percent may be disqualified. Any entry may be disqualified for illegibility, illegal or unethical operation. Such disqualification is at the discretion of the contest manager.

16. Awards: Plaques will be awarded for the high score in each of the categories given below. If a plaque is not sponsored, the winner may purchase it. Certificates of merit will be awarded to the highest scoring entrant with at least 200 QSOs from each state, province or North American country. Certificates of merit will also be awarded to the overall second and third place finishers in the multi-operator category for each mode. ■

Letters

Dear *NCJ*,

N5TJ and K1TO win WRTC again! So, where are the groupies?

Wow! What Jeff (N5TJ) and Dan (K1TO) just did at WRTC truly puts them at star status in the circles of contesting. So I ask, where are the groupies? These guys should have cheering crowds waiting for autographs, scantily clad screaming girls holding up signs saying, "Run 'Em' Dan and Jeff" or "Get the Rate Up!" But no, they just achieved the biggest thing in our hobby and no one is burning cars in the streets or looting. What gives?

I can remember winning a race in Mexico City once and they had to post armed Federales around our pits to keep the fans off. I think what they have accomplished is right up there with winning Wimbledon, a gold medal in the Olympics, or the US Open. The only difference? The masses don't contest.

So I hope most of you in our somewhat lonely hobby make some noise to these guys and let them know how you feel about them reaching the pinnacle of this game we enjoy playing. As in most sports, most of us will never make the top, but we sure can enjoy cheering for those who possess the skills, desire and commitment to reach the top. I'm fired up that I have had the chance to meet and speak to both of these guys. I've cheered on the Dallas Cowboys since I was 12 and have never had a chance to meet a player. We are very lucky that "our" stars are very approachable and even enjoy helping us learn how to become better at this hobby we share!

Hats off to all the stars that made this year's Super Bowl of contesting, and to Dan and Jeff, Let's make it a three-peat!

Mike Hance, K5NZ

To the Editor of *NCJ*

There's no worse feeling in contesting—opening the magazine and finding your big score absent from the results. In my case, a record-setting CW Sprint score was AWOL from the January 2000 affair. The first reaction is that somehow you've missed it—you read the scores backwards and forwards, check the phone write-up, you're not even in the checklog or (horrors) the DQ column. Sigh. So you write the contest manager and you find out that the log was never received. Bartender, make that a double...

This letter is NOT to complain about the contest managers—they put in a lot of work to keep a high-quality contest going and generate insightful and complete results. This letter is to remind every contester not to get lazy and let those precious log submissions slip away. In my case, I got busy at work and "assumed" that I'd sent in the log—I probably saw the acknowledgement for my NAQP log and didn't notice that I hadn't gotten the same for my Sprint log. Nor did I follow up by checking the Web page provided. I was just too busy. So it's MY fault that the log didn't get submitted—not the manager's.

I'm instituting a little "Quality Control" for N0AX logs from now on. First, the log submission deadline gets entered into my calendar. When the log is sent, a sticky note goes up on the PC monitor that a submission acknowledgement is pending. When the acknowledgement comes in, I will immediately go to the Web site and be sure that the log is there. On the deadline date, I will check the Web site again. All of this takes seconds.

If you're a paper log or diskette submitter, include a 20-cent self-addressed postcard with your submission. All it has to say is "I got your contest log" with a space for the manager to initial and drop in the mail. Easy on you, easy on them. And check the Web site!

I also have an easy-to-implement suggestion for contest managers. Since WA7BNM and N7WA are doing us a huge favor with the 3830 score reporting system, the top logs are easy to identify. It should be straightforward to tell if one of them is missing from the submissions. At or near the log submission deadline, it would be "nice" if the contest manager would post a note to 3830 and the contest reflector if he or she thinks some important logs have not been submitted. In my case, it might have been just the thing to catch my eye and get the log in. There's no reason to request that the managers pretend they're your mother and pester you to submit your log by individual e-mails, but a summary status posted in the internet equivalent of the town square would be handy.

Once again—the negligence was mine and mine alone. Don't fall into that trap!

73, Ward, N0AX

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