NCJ

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September/October 2003

Volume 31 Number 5

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- How much is a dB?
- Antenna Interactions—Part 2
- What Does It Take to Win the World?
- Dayton Contest Dinner 2003
- Results: August 2002 NAQP CW

If you're going to be contest DX, you might as well do it from a gorgeous tropical locale. **Bill Smith, W9VA**, chose the lush paradise of Fernando de Noronha as his destination for the 2003 ARRL CW DX contest.

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Array Solutions Announces

The ZS4TX Super Combo Keyer Version II

A Full-Featured SO2R Controller with CW and Voice Message Memories – and Much, Much More – All in One Compact Accessory!

The Super Combo Keyer II is a dual-mode (Phone and CW) multi-purpose single operator/two radio (SO2R) controller/keyer that's intended for Contesters, DXers, DXpeditioners and casual operators. It reduces the amount of wiring and external switching devices required for a contemporary dual-transceiver operating environment.

All of the major contesting software programs – *TRLog*, *Writelog*, *CT*, *NA*, etc – offer the user the ability to easily switch back and forth between two radios. To take full advantage of this feature, however, the user must wire up a fairly sophisticated switching arrangement to automatically toggle the mike, paddle, receive audio and PTT lines between the two transceivers. The Super Combo Keyer II integrates nearly all of the switching functions required for efficient automation of SO2R operation, in a single compact unit!

The SCK II also incorporates a CMOS SuperKeyer III chip for CW keying, and retains the popular user interface of that device for CW operation. An analog voice storage chip from ISD serves as the heart of the SCK II's Phone memory keyer system. CW and Phone message memory contents may be easily accessed by pressing one of the SCK II's six top-mounted buttons, or via PC keyboard input when using popular logging/contesting software.

Notable Super Combo Keyer II Features Include:

- Full Transmit and Receive Switching for SO2R
- Six CW and Six Phone Message Memories
- Built-in CI-V Interface for PC Control of Icom Radios
- SSB and CW Beacon Functions with Delay
- Dual Mode Contesting Feature (CW and SSB)
- Built In Multi-Function Voice and CW Keyers
- Works with All Solid State and Most Tube Rigs
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- *TRLog*, *WriteLog*, *CT* and *NA* Compatible
- RTTY Operation Via a PC Soundcard (AFSK and FSK)
- Optional Prefabricated Cables are Available for Most Kenwood, Yaesu, Icom and Ten-Tec Transceivers
- Dimensions (approx): 2 $^{5}/_{8}$ X 7 $^{1}/_{8}$ X 6 $^{3}/_{4}$ inches (HWD)
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The Built-In Super Keyer III CW Chip Provides:

- Fully iambic keyer operation; it can emulate most keying including Curtis "A" and "Accukeyer"
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Editorial

Carl Luetzelschwab, K9LA

Increasing Participation in Contests

The March/April 2003 *NCJ* had an interesting article by KØAD about the revitalization of the Minnesota Wireless Association (MWA). Over the years, some of the members strayed from contesting. A focused effort brought them back, and now many scores with an MWA affiliation again show up in the contest results.

This issue contains a similar article by K9IR telling of the rejuvenation of the Society of Midwest Contesters (SMC). Tied to this article is another article (also in this issue) about the Recognition Award given to K9PG by the SMC membership for his efforts in bringing the SMC back into prominence.

The common thread here is a conscious effort by contest clubs to increase their contest activity: either getting contesters who've slacked off back into contesting (like the MWA) or introducing newcomers to contesting (like the SMC). It doesn't matter which way you go—both accomplish the goal of more people participating in contests.

Is anyone else out there going through this exercise with their contest club? If so, I'd love to hear the results of your effort. Hopefully your story, plus the MWA and SMC stories, will encourage others to follow suit. That will be good for contesting as a whole.

Contest Activities at Ham Gatherings

NØWBV checks in with the contest activities at HAMCON in Colorado (not to be confused with HamCom in the Dallas/Fort Worth area). It's good to see that contesting forums flourish at ham gatherings other than Dayton and Visalia. My guess is there's more out there, so drop me a note and let's see if we can advertise these activities more.

And I'm happy to report that K3LR's Dayton Contest Dinner article is in this issue. I badgered Tim to get this done by the July/August deadline, but then when I sent in the articles for the July/August issue I forgot to send his. Sorry about that, Tim.

Is it a Dupe?

No, you're not seeing a dupe—OE5CWL's article in this issue is "How Much Is a dB?" It follows from his "How Much Is an S-Unit?" article in the July/August issue. It's more about using statistical methods to evaluate your station, so you math oriented contesters should enjoy this one, too.

Speaking of OE5CWL's article, there's an interesting comment at the end of his article. OE5CWL says "Nevertheless, calculating the regression and really winning the contest will be different, as you cannot calculate the human factor and that extra dB from the operator."

The human factor is an interesting topic that I've wondered about for several years. I've seen many station owners put up more and more antennas, but I've always felt there was a limit to the benefit from doing this (in fact, there may be some detrimental effects as explained by K3NA in "Antenna Interactions Part 2" in this issue). It seems to me that at some point you have to concentrate on making the operators better. It's like we're trying to make up for operator ability with aluminum—and I just don't think that's the best solution. Does anyone have any comments on this topic? How does one go about making himself a better operator?

Errata

K9PG's *NCJ Profiles* column in the January/February 2003 issue was about Bill, K5GA. We didn't have a picture of Bill at the time, but now we have one. It's included with this month's *NCJ Profiles* column.

Grid Map

Jon, NØJK (our VHF/UHF Contesting columnist), passes along the following. The ARRL just released a new laminated grid map of North America (product # 8977). Prepared by VHF contest operator K9AKS and USC (University of Southern California), it is a big improvement over the old grid map the ARRL sold. This one covers almost all of North America, part of northern South America, and the Caribbean. The whole state of Alaska with grids is shown as an inset. Since it is laminated, one can use a "dry erase" pen to plot E hops and bearings. It is a useful addition to the shack for the serious VHF contest operator or DXer.

NCJ

Antenna Interactions–Part 2 Twisting Stacks

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Part 1 of this article introduced meta-tools, which give a more comprehensive view of an antenna system's radiation pattern, and which generate statistics about the system's performance towards certain target zones in the sky.[1] Available information about propagation elevation angles can assist in the proper selection of target zones. Now let's apply these tools to stacked Yagi systems as they might be used (or abused) in contests.

Note—The tables and text in this part refer to over 60 figures containing pattern maps, most of which are not included here. All figures and a complete copy of this article, as well as PowerPoint *animations mentioned in the text, are available from the* NCJ *Web site at* **www.ncjweb.com**.

Choosing statistics

Before launching into analysis of specific antenna systems, we should make a careful selection of the statistics used to characterize the performance of a system. To describe the overall gain of an antenna system across a range of elevation angles and azimuths, one might simply average the power across this space. Technically this is the "mean power" (expressed in dBi in our case). But a simple arithmetic mean can easily be shifted up (or down) by a significant amount if a few points have extremely high or low values.

A better statistic might be the "median," a number where half of the samples have values above the median and half have values below the median. In my meta-tools, a target zone between 2-24° elevation and 22-70° azimuth (covering 99.9% of European openings on 20 meters in undisturbed conditions from the Washington, DC area) contains 1026 patches of sky. A median power gain of +11.7 dBi means 513 patches have power levels above +11.7 dBi and 513 have power levels below +11.7 dBi. A relatively small number of points with dramatically larger or smaller gain will not influence the median very much.

To understand how much the antenna pattern wanders above and below the median, the antenna pattern maps included with this article include the average difference of power above and below the median. For this article, we won't need this statistic. But we will be looking at the location and value of maximum and minimum power gain within the target zone and their impact on contesting performance.

The *NCJ* Web site contains an updated version of the meta-tool *noutrim.awk* which calculates median power, mean difference of power above and below the median and corrects a few minor bugs.

Reference Points for Stacks of Two and Three Yagis

Let's apply these new tools to specific antenna systems used in contesting stations around the Washington, DC area. K4JA's large antenna farm includes a three-Yagi stack for 20 meters. The Yagis are identical: 6-element OWA designs on 48-foot booms. The Yagis are mounted at 50, 100 and 150 feet—typical mounting heights for 20-meter stacked Yagi systems.

Europe is the most critical target for K4JA. Table 1 shows the performance statistics of this system toward Europe. Each possible combination of bottom, middle, and top Yagis using in phase, equal current levels has been included in the Table. The maps and statistics provided by the meta-tools (see Figure 1 through Figure 12) expand the understanding of these combinations. In addition to the individual figures, the Web site contains a *PowerPoint* presentation *stack reference patterns.ppt* with the figures on separate slides. By jumping back and forth between slides on your computer screen, you can clearly see how two patterns compare.

When only the bottom Yagi antenna is fed, the median gain towards Europe is +12.5 dBi. However, at low elevation angles in the corners of the target zone (signals toward Scandinavia, Russia, Spain and Portugal) the gain falls to –0.5 dBi—not a very compelling signal when the band is first opening or closing to these parts of Europe! In general, much of the power is being radiated at elevation angles too high for the Europe zone.

Bottom + middle results in a better fit to the target zone. Median gain is +13.6 dBi, and minimum gain has improved to +3.1 dBi. The minimum gain occurs in the upper right and left corners of the zone—higher angles toward Scandinavia, Russia, Spain and Portugal. During the mature phase of the European opening on undisturbed days, when signals to the northeast US are typically at higher elevation angles, the operator might drop down to the bottom Yagi alone to improve signals by 10 dB to these parts of Europe. Note that just rotating the bottom + middle stack towards Spain (for instance) does not achieve the same level of improvement at elevations above 17° as switching to the bottom Yagi alone.

The combination of all three Yagis has a median gain of +12.8 dBi – less than the bottom + middle configuration. A quick glance at Figure 3 shows that elevation angles above 17° are not cov-

Table 1

Reference results for the 20-meter stack of 6-element OWA Yagis on 48-foot booms near Washington, DC. Yagi heights are 50, 100 and 150 feet above good ground (s =13.0 and conductivity = 5 mS/m). The stack is fed in phase with equal current. Median, maximum and minimum gain (dBi) are across the Europe target zone in the indicated range of elevation angles. "% open" is percent of all band openings covered by the specified elevation angle range.

			Europe 2-24° elev			Best Elevation Range					
configuration			*median*	*max*	*min*	*elev*	*% open*	*median*	*max*	*min*	
bot			12.5	14.5	-0.5	*main lobe > elev range for 99.5% open*					Figure 1
bot	**mid**		13.6	16.7	3.1	*main lobe = elev range for 99.5% open*					Figure 2
bot	**mid**	**top**	12.8	18.2	-11.1	1-17°	95.2%	15.1	18.2	5.2	Figure 3, Figure 4
	mid		11.2	15.4	-6.3	2-18°	95.7%	12.8	15.4	5.2	Figure 5, Figure 6
		top	12.3	15.6	-8.9	1-12°	80.1%	12.9	15.6	4.5	Figure 7, Figure 8
bot		**top**	10.3	16.4	-24.2	2-16°	91.7%	13.5	16.4	3.7	Figure 9, Figure 10
	mid	**top**	11.8	17.7	-5.7	1-15°	88.9%	14.5	17.7	4.3	Figure 11, Figure 12

ered by this configuration. But at the very beginning and end of European openings, in disturbed conditions, and at certain points in the sunspot cycle the useable elevation angles are often quite low. Upon recalculating the statistics for a target zone of 1-17° elevation (Figure 4), the median gain jumps to +15.1 dBi—the highest of any combination of three Yagis. Within this narrower target, the minimum gain is +5.2 dBi at just 1° elevation in the lower left and right corners. This range of elevation angles covers 95% of all hours when 20 meters is open to Europe from the Washington, DC area.

The remaining five permutations of 3-Yagi stack feeds provide patterns less attractive than the three discussed above. Median gains are lower and there are serious holes in the patterns at various parts of the target zone.

Conclusions about this European Stack in the Washington, DC area on 20 Meters

- Only three feed configurations are needed for a 3-Yagi stack: bottom, bottom + middle, and bottom + middle + top. All other in-phase equal-current feed combinations have inferior performance.
- Based on N6BV's propagation statistics, the contester can expect to have best performance from the bottom + middle + top feed configuration for about 85% of the hours over the course of the entire sunspot cycle when 20m is open to Europe, when elevation angles of ≤15° are used. Perhaps 5% of the time the operator will use the bottom + middle combination, and the remainder of the time the bottom-only feed appears best.
- Signals to northeastern Europe (Scandinavia, Russia) and southwestern Europe (Spain, Portugal) will be as much as –13 to –15 dB below the peak gain of the stack (depending on elevation angle required for the current conditions), when the stack is centered on Europe—not much better than a dipole at a suitable height! The stack must either be rotated to increase signal strength in one or the other of these regions, or the bottom antenna alone must be used.
- The last bullet raises an important point. Reports of relative signal strength between stations during the contest can be quite misleading. A report that states "I tuned the 20-meter band at 1345Z on Saturday here in Oslo. KC1XX was the same signal strength as K3LR, but one S unit louder than W3LPL…" is providing only part of the story. One needs to know what antenna configuration was in use, and where it was pointed, at the various stations in order to draw conclusions about system performance!

Filling the Target Zone

With the dramatic variation in signal strength across the target zone, the antenna system designer is drawn to investigate potential improvements in coverage.

Could matters be improved if a smaller Yagi was used? As a quick test, the models were recalculated omitting the front director (probably less than optimal design for a 5-element OWA Yagi). Table 2 compares the resulting pattern statistics. The *PowerPoint* presentation *filling target.ppt* animates various possibilities for easy comparison.

Surprisingly, within the Europe target zone, the median gains for the non-optimized 5-element OWA stack are just -0.2 to -0.4 dB below that 6-element OWA stack. Yes, the 5-element OWA Yagi stack has a wider beam, but the overall gain within the Europe target is about the same. This becomes much clearer if you use the *PowerPoint* file on the Web site to flick between the 6- and 5-element versions.

Minimum gains within the zone occurred in the same places and were sometimes better and sometimes worse than the 6-element OWA stack. None of these variations are operationally significant on the spot frequency analyzed.

Outside the target zone, median gain improved with the 5-element OWA Yagis (ie, the system was less sensitive to signals outside of Europe). The rear lobe is smaller in azimuth, leading to a quieter system. These statistics suggest that an optimized 5-element OWA Yagi on a boom of about 33 feet could have equivalent performance to a 6-element OWA Yagi in a stack system for coverage of Europe from the Mid-Atlantic States, with a big reduction in cost!

Unfortunately, I do not have a 4-element OWA design to model. However, on a spot frequency analysis, a 4-element OWA design equates approximately to a 3-element conventional Yagi. Figure 15 shows a two-Yagi stack of 3-element Yagis. Median gain is +12.4 dBi, down –1.2 dBi from the 6-element OWA. Variation from the median is smaller, but no significant improvement in actual power at the corners of the pattern occurred. The 3-element conventional Yagi stack seems to be an unnecessary sacrifice of peak and overall gain without any better fill of the corners of the target zone.

What if we point the Yagis in slightly different directions in an attempt to smear out the pattern in azimuth to better fill the zone?

Table 3 compares the two-Yagi 6-element OWA stack performance when the stack is twisted open by various amounts. For this analysis, I assumed that polar propagation paths (toward northeast Europe) are more likely to require lower takeoff angles than paths to the remainder of the continent. Therefore, I twisted the higher Yagi towards the north. The configurations at the top of the table remain centered on 46° azimuth; the configurations at the bottom of the table twist only the top antenna to point more towards northeast Europe. For reference, the first line of the table contains pattern statistics for an untwisted stack. The *PowerPoint* file *Europe twist open.ppt*, when started as a slide show, will automatically step through the cases in order as an animation, allowing you to see the impact of increasing twist on the pattern.

The table reveals that the pattern to northeast Europe improves only very slightly at the lowest elevation angles, and degrades significantly at 24° elevation, as the stack is twisted open while keeping it centered on Europe. If the stack is twisted open and shifted slightly towards the north, gain at lower elevation angles improves about a 1/2 dB, but with a -2.7-dBi reduction at the highest elevation. At the opposite edge, toward

Table 2

Comparison of pattern statistics for a 3-Yagi stack of 6- and 5-element OWA Yagis. The 5-element OWA Yagi is identical to the 6-element with the front director deleted.

					Europe				Other		
configuration			*Yagi*	*elev*	*median*	*mean dev*	*max*	*min*	*median*	*mean dev*	
bot			6-el	2-24°	12.5	+1.1 –2.9	14.5	-0.5	-8.5	+10.9 –4.2	Figure 1
			5-el		12.1	+1.1 –3.0	14.0	-0.9	-10.1	+12.8 –3.7	Figure 13
bot	**mid**		6-el	2-24°	13.6	+1.7 –3.1	16.7	3.2	-11.1	+12.1 –3.2	Figure 2
			5-el		13.4	+1.7 –3.0	16.4	3.3	-13.6	+15.0 –1.3	Figure 14
bot	**mid**	**top**	6-el	1-17°	15.1	+1.8 –3.2	18.2	5.2	-13.7	+14.8 –1.2	Figure 4
			5-el		14.8	+1.7 –3.2	17.7	5.1	-14.3	+16.1 –0.7	Figure 16

southwest Europe, pattern impairments are at most –1/2 dB and no operationally important improvements occur at any elevation angle. The trends, as the stack is twisted increasingly open, are generally unfavorable.

Conclusions:

• Sacrificing peak gain to increase performance at the corners and edges of the target area doesn't appear to pay off. While a stack of 5-element OWA Yagis fills the target almost as well as a stack of 6-element OWA Yagis, there is no improvement in the edges and corners. Even a stack of 3-element Yagis does not improve gain at the edges.

• Twisting open a stack by as much as 10° in azimuth does not improve the fill of the Europe target zone and, in many respects, degrades coverage of the target. The trends suggest that continuing to twist open the stack by more than 10° will do more harm than good.

Covering Two Separated Targets

At various times during the contest 20m opens to several continents simultaneously, or even to all continents. Contesters blessed with stacked Yagi systems sometimes attempt to manage these situations by splitting the stack open with each Yagi pointing in different directions. Beware: twisted stacks may contain unexpected and unpleasant surprises that can damage contest performance!

Let's begin with a benign case, again using a two-Yagi stack of 6-element OWA Yagis in the Washington DC area. The band is open to South America and Australia/New Zealand late at night in November. The operator responds by pointing the bottom antenna to South America and the top antenna to VK/ZL. N6BV's propagation statistics bear out the operator's assumption that the longer path to VK/ZL requires lower elevation angles.

Figure 22 shows the pattern meets expectations: two well-defined, separated beams focused on the targets. Gain to VK/ZL peaks at +12.5 dBi, and to South America at +11.7 dBi. These values are –3.1 and -2.8 dB below the peak for each antenna operated alone, reflecting the equal split of power. Median gains in the target zones are identical at +9.1 dBi. Median gain for areas outside of the two targets is –7.0 dBi, not nearly as quiet as the situation of untwisted Yagi stacks but a small price to pay for dual continent coverage.

If the operator had access to a three-Yagi stack, using the top two Yagis on VK/ZL would lower the main lobe to 7° elevation, a better fit for the VK/ZL target. But using a conventional three-Yagi power feed would result in double the power towards VK/ZL. Figure 23 shows the VK/ZL target with a peak gain of +15.9 dBi and a median of +13.5 dBi. The South America target has declined to a peak of +9.9 dBi and median of +7.4 dBi.

If the operator didn't like that power distribution, the bottom and middle Yagis could be pointed to South America and the top alone pointed to VK/ZL. Figure 24 shows the VK/ZL lobe still squeezes under the top edge of the target zone with a peak of +11.2 dBi and median of +8.6 dBi. The South American target has a well-centered lobe of +15.0 dBi peak and +11.4 dBi median.

The *PowerPoint* presentation *VK ZL and SA.ppt* allows you to compare these two power distributions. Armed with precise knowledge, the operator can

Table 3

Two-Yagi European stack twisted open to varying degrees. Gain at the bottom and top corners of the target zone and peak gain along the left and right edges of the target zone are listed in the middle columns.

Yagi az		Europe			NE Eu 22° az			SW Eu 70° az			other	
bot	*top*	*median*	*max*	*min*	*el: 2°*	*peak*	*24°*	*el: 2°*	*peak*	*24°*	*24°*	*median*
46°	46°	13.6	16.7	3.2	5.4	14.3 @ 13°	5.3	5.4	14.3 @ 13°	5.3	-11.1	Figure 2
44°	48°	13.6	16.7	2.2	5.5	14.5 @ 12°	1.9	5.2	14.4 @ 13°	5.0	-10.9	Figure 17
42°	50°	13.6	16.6	1.0	5.6	14.5 @ 12°	1.0	5.1	14.3 @ 13°	4.6	-10.5	Figure 18
41°	51°	13.5	16.6	0.3	5.6	14.5 @ 12°	0.3	5.0	14.2 @ 13°	5.1	-10.2	Figure 19
40°	52°	13.5	16.6	-0.4	5.7	14.5 @ 12°	-0.4	4.9	14.0 @ 14°	5.5	-9.9	Figure 20
42°	46°	13.6	16.7	2.6	5.9	14.9 @ 13°	2.6	4.8	13.9 @ 12°	3.7	-10.9	Figure 21

Table 4

Stack of two Yagis as described in the reference configurations of Table 1. The top antenna is twisted to extend pattern coverage into Asia. "Elsewhere" is the median gain in the untargeted directions. "mean Asia + Europe" is an equal-weighted average of the power to the Europe target zone and to the Asia target zone (converted to gain in dBi). Best values in key categories have been highlighted.

azimuth		Europe 2-24° elev			Asia 1-9° elev			elsewhere	mean As + Eu		
bot	*top*	*median*	*max*	*min*	*median*	*max*	*min*		*median*	*min*	
46°	46°	13.6	16.7	3.1	-0.8	13.7	-28.0	-11.2			Figure 2
41°	1°	10.4	15.2	-4.1	9.2	14.7	-4.1	-6.6	9.82	-4.09	Figure 26
41°	356°	10.1	14.7	-4.7	**9.9**	14.3	-2.8	-6.3	9.99	-3.64	Figure 27
41°	351°	9.9	14.1	-5.0	**10.1**	13.9	-1.8	-6.1	9.99	-3.08	Figure 28
41°	346°	9.8	13.5	-5.0	**9.9**	13.5	**-1.0**	-6.0	9.84	-2.54	Figure 29
46°	1°	**10.5**	14.8	-3.1	9.0	14.3	-4.2	-6.3	9.89	-3.59	Figure 30
46°	356°	10.4	14.3	-3.6	9.6	13.9	-2.9	-6.1	**10.03**	-3.22	Figure 31
46°	351°	10.2	13.7	-3.8	**9.8**	13.5	-1.9	-6.0	9.98	-2.72	Figure 32
46°	346°	10.0	13.1	-3.8	9.6	13.1	**-1.0**	-6.1	9.80	**-2.22**	Figure 33
51°	1°	**10.8**	14.4	-2.3	8.8	13.9	-4.2	-6.1	9.90	-3.12	Figure 34
51°	356°	**10.5**	13.9	-2.7	9.5	13.5	-2.9	-6.1	**10.04**	-2.79	Figure 35
51°	351°	10.4	13.2	-2.9	9.5	13.1	-1.9	-6.1	9.94	-2.35	Figure 36
51°	346°	10.2	12.5	-2.9	9.3	12.7	**-1.1**	-6.2	9.77	**-1.89**	Figure 37
56°	1°	**10.9**	13.9	**-1.6**	8.7	13.5	-4.2	-6.0	9.91	-2.71	Figure 38
56°	356°	**10.6**	13.4	**-2.0**	9.3	13.1	-2.9	-6.1	**10.01**	-2.43	Figure 39
56°	351°	10.4	12.7	-2.2	9.2	12.7	-1.8	-6.2	9.88	-2.02	Figure 40
56°	346°	10.3	11.9	-2.2	9.0	12.4	-1.5	-6.2	9.69	**-1.83**	Figure 41
56°	341°	10.0	11.4	-2.2	8.8	12.2	-2.5	-6.2	9.46	-2.33	Figure 42

choose which power distribution best fits his contest strategy now.

More generally:

• Splitting stacks into directions that are more that 90° apart yields independent, well-defined lobes.

• Stacks with more than two Yagis provide the operator an opportunity to favor one target over another, although Yagis of the correct height must be chosen for each target.

Covering Two Adjacent Targets

Late on a Sunday morning, during the middle of the European run, the 20-meter operator discovers a Botswana multiplier with a huge pileup. Not wanting to sacrifice his running frequency, the operator rotates the top Yagi of his two-Yagi stack to 90°, the azimuth to Botswana from his Virginia home. Between CQs on his run frequency, the operator attempts to crack the pileup. After many frustrating attempts, the operator notes his European run rate has dwindled significantly. With a sigh, he abandons his attempt to bag a valuable multiplier.

Figure 25 illustrates the operator's problem. By splitting his stack, his strongest signal was neither pointed toward Europe nor toward Botswana: peak gain is at 87° azimuth. Median gain to Europe is +10.1 dBi, down –3.5 dB from an untwisted stack. Likewise, signals over the range of elevation angles that might be working to Botswana are down –3.4 dB from what a stack could produce, if focused purely on Botswana. With that big pileup, the operator will want all the gain he can obtain to get in and out quickly.

More generally, whenever Yagis in a stack are pointed in directions separated by <90° azimuth, the main lobes of each individual antenna are sucked together into a single beam, hovering between the azimuths of the Yagis. This single beam can be stretched out across the horizon. The animated *PowerPoint* files *twisting open 2 yagis.ppt* and *twisting 3 yagis.ppt* show a two- and three-Yagi

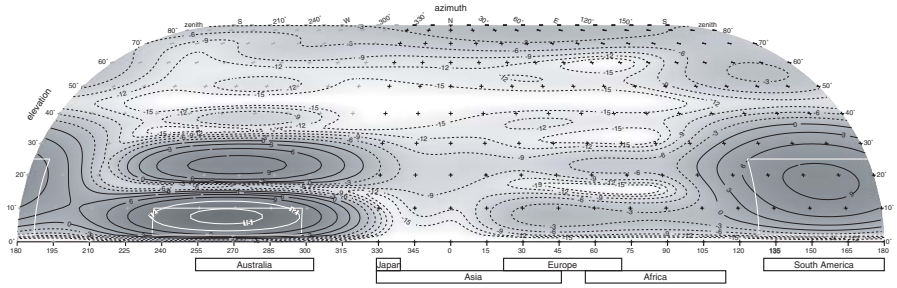

Figure 23—Split stack of three 6-element OWA Yagis. The top two Yagis at 100 and 150 feet are pointed towards Australia and New Zealand; the bottom Yagi at 50 feet is pointed toward South America.

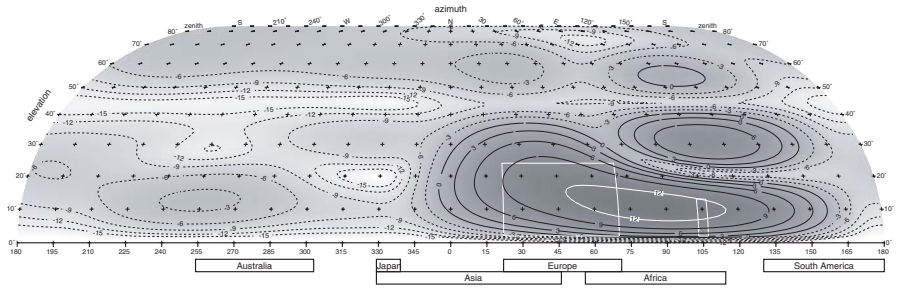

Figure 25—The two-Yagi stack split between Europe (low antenna) and Botswana (high antenna).

Table 5

Stack of three Yagis as described in the reference configurations of Table 1. Only top antenna is twisted to extend pattern coverage into Asia.

azimuth		Europe 2-24° elev			Asia 1-9° elev			elsewhere	mean As + Eu		
bot+mid	*top*	*median*	*max*	*min*	*median*	*max*	*min*		*median*	*min*	
46°	unused	13.6	16.7	3.1	-0.8	13.7	-28.0	-11.2			Figure 2
41°	1°	11.7	16.8	-9.1	10.7	16.7	-2.3	-10.0	11.24	-4.60	Figure 43
41°	356°	11.7	16.4	-8.3	**11.1**	16.3	-1.1	-9.5	**11.41**	-3.39	Figure 44
41°	351°	11.6	16.0	-7.7	**11.3**	16.0	-0.1	-9.1	**11.46**	-2.41	Figure 45
41°	346°	11.6	15.7	-6.7	**11.2**	15.5	0.7	-8.8	**11.42**	-1.58	Figure 46
41°	341°	11.7	15.3	-4.7	**11.1**	15.1	1.3	-8.6	**11.39**	-0.74	Figure 47
41°	336°	11.6	15.1	-2.7	**11.1**	14.6	**1.7**	-8.4	**11.36**	0.04	Figure 48
41°	331°	11.7	15.0	-1.1	**10.9**	14.2	**1.9**	-8.2	**11.28**	**0.66**	Figure 49
41°	326°	11.7	14.9	**0.2**	10.3	13.8	**1.8**	-8.1	11.06	**1.03**	Figure 50
41°	321°	11.7	14.9	**0.2**	9.9	13.4	0.9	-8.0	10.87	0.55	Figure 51
46°	1°	**12.1**	16.4	-8.3	10.1	16.1	-2.6	-9.5	11.23	-4.59	Figure 52
46°	356°	**12.0**	16.0	-7.6	10.5	15.7	-1.3	-9.1	**11.33**	-3.40	Figure 53
46°	351°	**12.1**	15.7	-7.1	10.7	15.4	-0.2	-8.8	**11.44**	-2.44	Figure 54
46°	346°	**12.0**	15.3	-6.8	10.7	14.9	0.6	-8.6	**11.35**	-1.69	Figure 55
46°	341°	**11.9**	15.1	-5.5	10.7	14.4	1.2	-8.4	**11.35**	-0.98	Figure 56
46°	336°	12.0	15.0	-3.7	10.6	13.9	**1.6**	-8.2	**11.36**	-0.30	Figure 57
46°	331°	**11.9**	14.9	-2.1	10.2	13.5	**1.8**	-8.1	11.14	**0.25**	Figure 58
46°	326°	**11.9**	14.9	-0.8	9.7	13.0	0.9	-8.0	10.90	0.12	Figure 59
51°	1°	**12.2**	16.0	-7.7	9.6	15.4	-2.7	-9.1	11.09	-4.48	Figure 60
51°	356°	**12.2**	15.7	-7.2	10.0	15.0	-1.3	-8.8	11.23	-3.33	Figure 61
51°	351°	**12.1**	15.3	-6.8	10.3	14.6	-0.3	-8.6	**11.27**	-2.40	Figure 62
51°	346°	**12.0**	15.1	-6.5	10.2	14.1	0.6	-8.4	11.17	-1.68	Figure 63
51°	341°	**12.0**	15.0	-6.1	10.3	13.6	1.2	-8.2	**11.27**	-1.11	Figure 64
51°	336°	**11.9**	14.9	-4.9	10.1	13.1	**1.6**	-8.1	11.09	-0.57	Figure 65
51°	331°	**11.8**	14.9	-3.3	9.7	12.5	0.9	-8.0	10.88	-0.73	Figure 66

stack being twisted apart in 5° increments of azimuth until its beams finally separate at a twist of 90°.

This "sticky" characteristic of twisted stacks can be used to advantage in contests. For example, during the morning 20-meter European opening in the Washington, DC area, central and Southeast Asia stations may also be available on arctic polar paths—a source of valuable multipliers, especially as casual operators in that part of the world get on the air during their local evening hours. Elevation angles to this target are quite low: 1 to 9°, so the top antenna is the one to twist away from Europe. Table 4 and Table 5 summarize stack performance to Europe and Asia at various combinations of azimuths for two- and three-Yagi stacks.

For two-Yagi stacks, the variations in overall gain into the target zones over a large range of azimuth pairs are small: <1 dB. Median gain to Asia improves by +9½ to +11 dB. Median gain to Europe degrades by -2¾ to -4 dB. More significant are the responses at the edges and corners of the zones. Gain at some elevation angles to southwest Europe degrades -5 to -8 dB, making a 1.5 kW signal into Spain weaker than a guy running 750 W into a dipole at an appropriate height. Notice that the point of peak gain of the array slides off towards the north, away from Europe, and a bit too high to propagate into central Asia. The operator will have to exercise good judgment in deciding if the reduced signal strength into Europe, especially southwest Europe, is worth the potential for attracting Asian multipliers with a louder signal.

The three-Yagi stack offers fewer compromises. Leaving the bottom two Yagis towards Europe while diverting power via the top Yagi to Asia keeps the Europe target zone covered with signals just -1½ to -2 dB down from the "two-Yagis on Europe only" case. Coverage of the Asia target zone improves by +11 to +12 dB. Signals in untargeted directions are reduced by about -2½ dB compared to the two-Yagi twisted stack. The point of peak gain in the array moves slightly but remains in the Europe target zone. The overall pattern shape fits the Europe and Asia target zones much better than with the two-Yagi stack.

But there is an important danger! Figure 52 has the top Yagi twisted to 1°, e.g., to work a 9V1 multiplier. The low and middle Yagis are still pointing to Europe at 46°. Here that twisted top Yagi has taken a –8 to –13 dB bite out of signal strength to Scandinavia and western Russia in the upper right corner of the Europe target zone! This cancellation trough could have an unfavorable impact on QSO rate.

This cancellation troughs can be worked around, if the operator knows the situation. One workaround is to *over-twist* the stack: in this case, to move the top antenna an extra amount to the left, and the bottom antennas an extra amount to the right. Figure 64 twists the top antenna an extra 20° left, and the bottom two Yagis 5° right. Median gain to Europe and to Asia are practically identical, but the cancellation trough that was killing signals into Scandinavia and western Russia has moved out of the way.

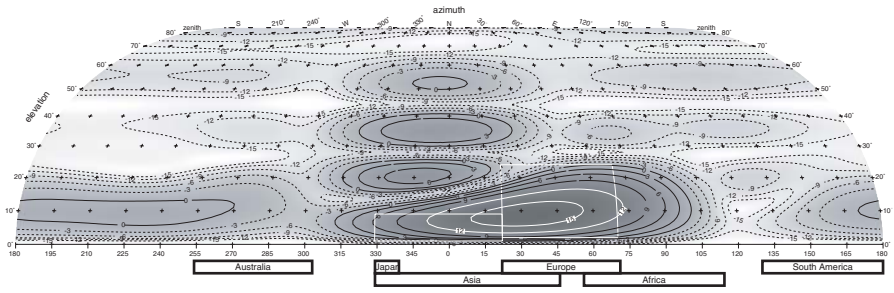

Figure 52—Stack of three 6-element OWA Yagis, split to cover Europe and Asia. Top points to 1° and bottom two Yagis to 46° azimuth. Note the deep pattern cancellation trough, up to –12 dB, at the left edge of the Europe target, affecting signals to Scandinavia and western Russia.

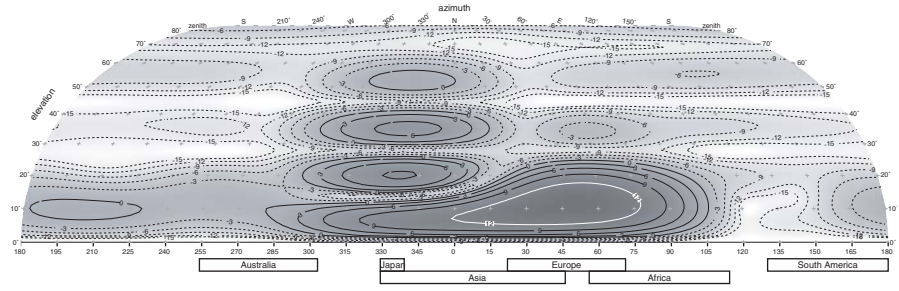

Figure 64—Impact of pattern cancellation trough to Scandinavia and western Russia in Figure 52 has been reduced to about –6 dB by over-twisting the top Yagi –20° to the left and the bottom Yagis +5° to the right in azimuth.

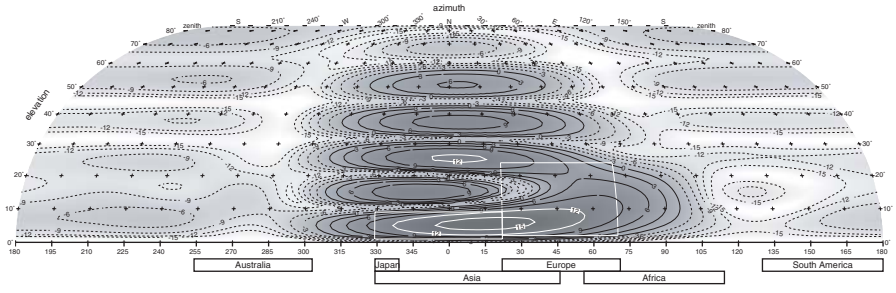

Figure 67—W3LPL 5-element rotatable Yagi at 200 feet pointed to 1° azimuth. A European stack on the same tower contains two 5-element Yagis at 50 and 100 feet. Half the transmitted power goes to the high rotatable Yagi. All antennas are assumed to be fed in-phase. A severe pattern cancellation occurs towards Europe, reducing signals by as much as –18 dB.

Conclusions:

• While stacked Yagis twisted apart by more than 90° in azimuth have independent lobes, a twist of <90° causes lobes to merge together with a signal peak in the direction *between* the twisted Yagis. As a result, the uninformed operator may believe he is loud in two directions when in fact his peak signal is loudest only in *one, wrong* direction.

• Stacks of three or more Yagis, when twisted, may contain signal cancellations exceeding –10 dB. These cancellations may lie in operationally important azimuths and elevations, resulting in lower QSO rates and missed multi-

pliers. The skilled contester must understand these patterns and take steps to avoid compromising his signal, eg, by over-twisting the stack.

To reinforce this last point, examine a final scenario: W3LPL's main 20-meter tower contains a stack of 5-element (conventional, not OWA) Yagis at 50 and 100 feet fixed on Europe. At the top of the tower is a 5-element rotatable Yagi at 200 feet for chasing multipliers. The operator can feed the stack alone, or the stack plus the high rotatable. This model assumes 50% of the power goes to the high antenna and the remaining 50% is divided into the two Yagis of the stack…and that all the antennas are fed in phase.

Figure 67 shows the result: a severe pattern cancellation in the middle of the Europe target zone when the multiplier antenna is pointing to 9V1 at 1° azimuth. Compared to the two-Yagi stack fed alone, signals in parts of Europe are cut by over –18 dB to levels below –3 dBi! Over-twisting cannot correct this problem.

But another technique will fix pattern cancellations like this one. We'll explore it in Part 3.

Notes:
[1]Scace, Eric; "Antenna Interactions—Part 1: Stop Squinting! Get the Big Picture," *National Contest Journal*, 2003 Jul/Aug; ARRL, Newington, CT USA.

How Much Is A dB?

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[The long version of this article, with the figures in color, is on the *NCJ* Web site at **www.ncjweb.com/**as a pdf file—*Ed*]

Have you ever wondered how those big guns get their tremendous scores? Do you want to know how much you have to improve your station to get those QSO rates you are dreaming of? Or would you like to find out if that extra dB from a new antenna will be worth the effort? Well, then read on. This article will show you how you can find out the answers to your questions and even find out which category you should enter.

The Contest

We choose the CQ WW WPX Contest for our analysis. In this contest, it is not so important to search for new multipliers since they tend to come by themselves. Dr Sylvan Katz, VE5KZ, has done an extensive study on contest scores.[1] Analyzing the WPX CW Contest in 2000 for the single-operator all-band category, he found that the score is mainly determined by the number of QSOs, although the relationship between the score and number of contacts is not linear.

Therefore, we can assume that achieving a reasonable score in the WPX contest is mainly a result of the ability to have a reasonable QSO rate. For our investigation we will try to determine to what degree the QSO rate depends upon the effective radiated power.

There is one other way in which the WPX contest differs from most other contests: Operating time is limited for single operators to 36 hours. This is important for our investigation as we can assume that top-scoring stations really worked 36 hours, while in other contests you can not be that sure that the entire contest period—48 hours—was actual operating time.

For these reasons, I chose the WPX contest to analyze the influence of output power to the score or the QSO rate.

Analyzing Contest Results

We will try to find out if there is some correlation between output power and the QSO rate. We analyzed the WPX results for 2001, using the single-operator, all-band entries. There are three possible power levels for SOAB in this contest. In the QRP category, output shall not exceed 5 W; in the low-power category the maximum is100 W, and in the high-power category the maximum output is 1500 W.

We took the continental leaders for each of these categories (see Table 1) and divided their total QSOs by 36 hours to calculate the average QSO rate for the entire contest. When we are comparing QSO rates, it is essential to keep in mind over which period the QSO rate is determined. You can calculate the QSO rate for your best hour, the best 10 minutes, or the entire contest period. In our example, the QSO rate is observed over the entire 36 hours. We will use other values later.

In this first step, we are comparing different stations with different operators, different antennas and different locations within the same continent. There are many possible influences to the score and QSO rate that are not under our control. But we assume that every station that is a continental winner uses the best antennas he can afford and runs the power level as defined by the rules of the contest.

We first analyzed the SSB part of the WPX contest. In Table 1 you see that for Europe, North America, South America, and Asia we have an entry in all three possible power categories. For Africa and Oceania there was no entry in the QRP-category. To find out if there is any correlation of the QSO rate with the output power, it is convenient to show the data graphically as done in Figure 1. As we are using power as a variable, we use a logarithmic scale for the power level. We then see that a straight line,

Table 1

Continental Leaders in the WPX SSB Contest 2001

High Power	Call	Score	QSO	Prefix	QSO/h	Pts/QSO
Europe	OK1RI	10844592	3787	1034	105.2	2.77
S. America	HC8A	25180199	6537	1199	181.6	3.21
Africa	CN2R	20530495	5831	1115	162	3.16
Oceania	KH6ND	15498798	4528	1029	125.8	3.33
Asia	JY9NX	15463485	4980	1017	138.3	3.05
N. America	KQ2M	9668020	3547	1055	98.5	2.58
Low Power						
Europe	GW7X	6225688	2718	856	75.5	2.68
S. America	P4ØA	12547872	4287	927	119.1	3.16
Africa	SU9ZZ	9411864	3615	847	100.4	3.07
Oceania	KHØ/JM1LRQ	6685416	3084	724	85.7	3
Asia	ZC4BS	3690756	2096	653	58.2	2.7
N. America	VA3UZ	7994840	2867	980	79.6	2.85
QRP						
Europe	LY5A	1971592	1393	646	38.7	2.19
S. America	PQ2Q	1801785	1135	565	31.5	2.81
Africa						
Oceania						
Asia	JR4DAH	286425	363	285	10.1	2.77
N. America	K3WW	1091168	863	488	24	2.59

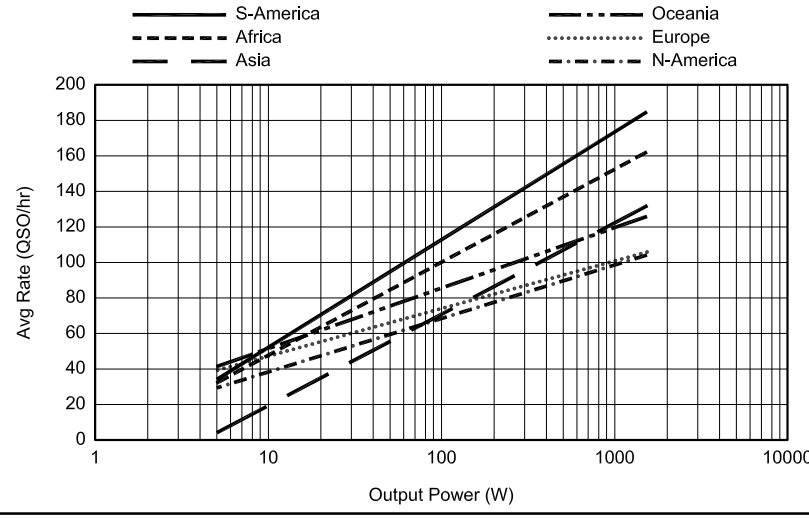

Figure 1—Average QSO Rate vs. Power for Continental Leaders in WPX SSB 2001.

which means a logarithmic trend, fits the data quite well. In Figure 1 we find this trend for each continent. The equation that fits that data is:

$$Q = a + b * \log P \qquad \text{(Eq 1)}$$

Q is average QSO rate [QSO/h]
a and b are coefficients describing the regression: a = intercept, b = slope
P is output power [W]

You can use any spreadsheet program or scientific calculator to analyze such a correlation. If you use a calculator, you have to enter the logarithm of power (logP) as the x-value and the corresponding rate (QSO per hour) as the y-value. The program will do everything else. As Table 2 shows, the coefficients a and b are somewhat different per continent. The coefficient a is the intercept to the y-axis and is the value of Q when the second term (b times logP) equals zero. It defines the elevation of the line. The coefficient b quantifies the steepness of the line. It equals the change in the QSO rate (Q) for each unit change in power (P).

As we use a logarithmic scale, the coefficient b is the number of QSOs we get when we change the power by a factor of 10 (which equals 10 dB). If the slope is positive, Q increases as P increases. If the slope is negative, Q decreases as P increases. As we can see from Table 2 the slope is in all cases positive, so the QSO rate increases with power. Of course, we expected this, but what may be interesting is that there is a remarkable difference for the slope, depending on which continent you live. While for Europe, Oceania and North America the slope is between 26 and 34, the value for the slope for Africa, Asia and South America is between 51 and 61, almost twice as high as for the other continents.

Thus it seems that increasing power will much more improve your QSO rate if you are on one of the rarer continents (AF, AS, SA) than if you are in Europe or in North America. For those continents where we have three values (for 5, 100 and 1500 W) you find the correlation coefficient in Table 2. This correlation coefficient indicates how good the data fit the regression line. As you can see, this coefficient is pretty close to one, which means that our regression fits the data very well.

There is another interpretation of this data that may be more likely than the determination by the continent: for a rare location (call sign) like HC8, P4 or SU you get more QSO per extra watt than for a common location like GW, VE or the USA. We will see one further possible explanation a bit later.

To see if we get similar results for another contest and in another mode, we also analyzed the WPX 2001 CW Contest. Figure 2, Table 3 and Table 4 give you the results. The results are somewhat different from those for the SSB part of the contest. The winners for North America in the QRP and high-power category do not come from USA/Canada, but are from rather rare spots (VP5 and TI9).

The results on CW are certainly different from what we saw while investigating the top SSB scores. The steepness of the QSO rate generally ranges from between 18 and 29. Only for South America do we get a coefficient of 47.95, but you must remember we have only two values for South America, so this

Table 2

Intercept (A), Slope (B) And Correlation Coefficient (R) For SSB Using Equation 2

Continent	*r*	*b*	*a*
Europe	0.99947	26.87	20.5064
S America	0.99776	60.69	–8.1296
N America	0.96932	30.32	7.9996
Asia	0.98523	51.51	–32.0013
Africa		52.339	–4.2615
Oceania		34.1	17.4563

Figure 2—Average QSO Rate vs. Output Power for Continental Leaders CQ WW WPX 2001 CW.

Table 3

Continental Leaders in the WPX CW Contest 2001

High Power	*Call*	*Score*	*QSO*	*Prefix*	*QSO/h*	*Pts/QSO*
Europe	OHØZ	6514996	3199	862	88.86	2.36
S. America	P4ØT	11726388	4029	849	111.92	3.43
Africa	3V8BB	13639976	4134	908	114.83	3.63
Oceania	KH6ND	7768297	2959	823	82.19	3.19
Asia	P3A	10723620	3696	870	102.67	3.33
N. America	VP5MM	11035570	3671	905	101.97	3.32
USA/VE	AJ1I	8213226	3352	849	93.11	2.89
Low Power						
Europe	AN7GTF	2946548	2506	697	69.61	1.69
S. America	LQØF	3910400	1999	650	55.53	3.01
Africa	SU9ZZ	7799260	3061	812	85.03	3.14
Oceania	ZK1EFD	3366927	1747	591	48.53	3.26
Asia	ZC4DW	5314681	2584	673	71.78	3.06
N. America	WE1USA	3956437	2052	713	57.00	2.70
USA/VE	WE1USA	3956437	2052	713	57.00	2.70
QRP						
Europe	LY5A	2331414	1591	646	44.19	2.27
S. America						
Africa						
Oceania						
Asia	UN4L	1751703	1127	479	31.31	3.24
N. America	TI5X	2568470	1597	615	44.36	2.62
USA/VE	K3WW	1662210	1133	506	31.47	2.90

Table 4

Intercept (a), slope (b) and correlation coefficient (r) for CW using Equation 2

Continent	*r*	*b*	*a*
Europe	0.9987	18.06	32.19
S-America		47.95	–40.36
N-America	0.9419	23.02	22.7
Asia	0.9988	28.85	12.09
Africa		25.34	34.35
Oceania		28.62	–8.71
USA/VE	0.9918	24.79	11.98

result is not very reliable. For those groups of data where we have three values, we see that the correlation coefficient is very close to one, except for North America. But here we see the influence of the value for the low-power category comes from a US station, while the other values come from stations in rather rare locations.

On CW, the influence of power is not as pronounced as on phone. In both modes Europe gets the lowest benefit from increasing power, followed by North America. And in both modes it seems that increasing power really helps in South America.

Some Words Of Caution

Although our regression fits the data quite well, we do not have data for power levels above 1500 W or below 5 W. Therefore we cannot be sure that the regression would be the same beyond those limits. When analyzing data like this, you always should consider what could happen at the maximum and minimum possible values. The minimum possible level would be zero output. It's obvious that with no output you will not make any QSO and the rate is zero. Our regression fits this condition very well as the corresponding value of power is, in most cases, just a few milliwatts. Nevertheless, we should not use our regression for possible QSO rates for very low output below 5 W.

The other end of the curve reflects infinite power. Here it is not that easy to find a reliable value for the rate. Of course you could work any station as far as propagation permits, but your rate will be limited by the activity in the contest, your ability to handle a pileup and, most of all, by the time you need to exchange reports. Therefore, there will be some sort of saturation in your QSO rate. Here our regression is not true, because with power approaching infinity the rate approaches infinity. We have to keep this in mind when we are going to use our data, as our regression will not apply to stations already near saturation.

Before we show how we can find the slope for our own station, let's first take a look on what we could do with a reliable correlation.

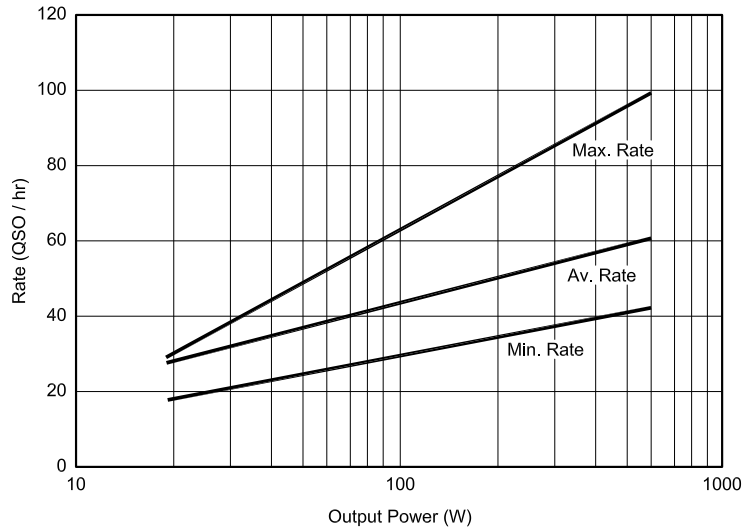

Figure 3—Rate vs. Power for CQ WW WPX 2002 SSB.

How Much Power Do I Need?

With our investigation we have found that there seems to be a correlation between the QSO rate and the output power. Equation 1 describes this. You might wonder what you can expect by increasing your output. The relationship between two power-levels is determined by the relative power unit called the decibel (dB). When we know how much gain in dB we get from our improved (antenna, linear, etc), and when we know the slope (b) of our QSO rate, we will be able to estimate how much our QSO rate will increase. This is described by Equation 2, where you get the additional QSOs per hour for a given amount of gain in dB:

$$\Delta Q = b * \frac{dB}{10} \qquad \text{(Eq 2)}$$

You can also put this equation in another way:

$$dB = 10 * \frac{\Delta Q}{b} \qquad \text{(Eq 3)}$$

…where you now have a formula that gives you how many dB you have to improve your signal to get the improvement in the QSO rate (ΔQ in QSO per hour) you would like to have.

Let's look how we can use these formulas for our own benefit. We assume that for a European station we have found a slope (coefficient b) of 18, and the average rate this station gets with an output of 100 W is 35 QSO/hr. What can this station expect from improving his station by 3 dB? Using Equation 2 we find that the rate will be raised (ΔQ) by 18*3/10 = 5.4 QSO/hr to an average rate of 40.4 QSO/hr (35 + 5.4). This may seem to be not that much, but over the entire contest period of 36 hours the difference is almost 200 QSOs. Now what would the same station have to do to double his rate and get an average rate of 70 QSO/hr? Using Equation (3) we find that we would have to improve the station by 10*35/18 = 19.4 dB.

There are some points that we have to consider using these formulas. First, as you have seen above, the formula is only true for a certain part of our curve. When you are already at a high QSO rate, you might get in an area of the curve where you notice some saturation. Increasing power does not necessarily mean that your QSO rate will improve the same way. Of course, you cannot run much more than maybe 300 QSO/hr.

On the other hand, we have evaluated the steepness in the rate by using different output power levels. Improving your output power by 10 dB may be different compared to improving your antenna by 10 dB. Of course, for the strength of your signal there will be no difference for 10 dB from a linear or a better antenna. But with the better antenna your receiving capabilities will also increase by 10 dB, while with the linear they stay the same. Therefore you will be able to work weaker stations with the better antenna and your rate may improve more than just with the big linear.

There is one further point we have to consider: the data we have analyzed so far are from the continental leaders in the WPX 2001 contest. These are top operators, using the best equipment and antennas affordable. The situation for them might be different from yours. Not everybody will be able to manage a pile-

up at a high rate.

The situation may also be different for various contests. Maybe in the CQ WW DX power is more important than in the WPX. The influence of power may even vary with conditions.

So, if you want to know how much your own QSO rate can be increased by that extra dB, it's necessary to find out what the slope in the rate (the coefficient b) for your own station is.

Playing The Power Lottery

We are facing some problems when we try to find the slope in our QSO rate. We have to get comparable results for different power levels for our station. But we only can compare the results if they are made under the same situation. What changes our situation? Or putting the question differently, what may have an influence on our QSO rate?

As we have seen above, the location and/or call sign used may have some influence. That is easy to control, as we only have to compare results with the same call sign and from the same location. The same is true for the next influence on the rate. The equipment used, the antennas and the operator have to be the same for the results we will compare. But there are some other influences that are not that easy to control: changing conditions and changing participation for different contests.

The only solution for this problem is to analyze your QSO rate within the same contest. For the weekend of one specific contest, you are at a comparable part of the solar cycle and, presumably, a comparable activity level. Nevertheless, conditions will change during the contest and activity will vary as well. We cannot control these factors, so we will try to minimize their influence to get reliable data. Remember what we learned during our analysis of S-unit reports ("How Much Is An S-Unit," July/August 2003 *NCJ*). If we have a reasonable sample, we will be able to minimize the effects of participation and propagation. Our sample size should be as high as possible, but there must be no influence from the operator on sampling. We need random sampling for our test.

Therefore, we used the following procedure for our evaluation: we divided one specific contest into many sub-contests, each one being 30 minutes. For each of these 30-minute periods, we used a different output power in 3 dB steps between 19 and 600 W. We couldn't allow the choice of which power to use in a given time segment to be determined by the operator, so it was done randomly. For this we had a big opaque container with 6 identical paper tickets, each one marked with a specific power level between 19 and 600 W. The ticket the operator drew decided the power level for the next time segment. That's why we called it the "power lottery."

To keep the operator from knowing which power level will be next, the drawing was only done shortly after the previous time segment had ended. Between two time segments there was a short break and the frequency had to be changed. This was to avoid keeping a clear frequency after a high power segment.

By this means we tried to keep the "uncontrollable" influences as low as possible. We used this technique during WPX 2002 in the SSB part as well as in the CW part, both in the all-band category. The object was to work as many stations as possible during each time segment. In the SSB part, we were not able to operate the full 36-hour period because of other obligations. Operation was nevertheless on both days. So for each of the six power levels we got 5 values. On CW, we had some more time and got 9 values per power level.

For each time segment we obtain a specific rate. Here it is important to clarify the value "rate." For our analysis of continental leaders above, we have used an average rate over the entire contest period of 36 hours. We are not able to do this here. The rate we are using now is the rate in QSO/hr over a 30-minute period. Of course, this is completely different from a 36-hr-rate. From the data we got for each mode, we display in Table 5 the maximum and the minimum rate achieved per power level, as well as an average rate.

Figures 3 and 4 give you the graphical representation of our rate on phone and CW, again versus a logarithmic power scale. It is interesting to see the correlation between power and QSO rate, not only for the average rate, but also for the minimum and maximum rate. In Table 6, you find the data for the regression line as we did above for the continental leaders. The correlation coefficient for the average rate is above 0.9, which indicates the curve still fits the data quite well. Even so, it would be interesting to gather a larger sample. This could be done by operating the entire contest and possibly by limiting the number of power levels.

What are the conclusions from this data? First, we see that the steepness of our rate (the coefficient b indicating the slope) is higher for the average and maximum rate than that for the minimum rate. This means you get much more for your power during the good hours than you do during the low hours. This is more pronounced on phone than in CW, but remember this is only true for the linear part of the curve and therefore applies for the average amateur. It may be different for a big-gun station in a rare location, which in good hours is already

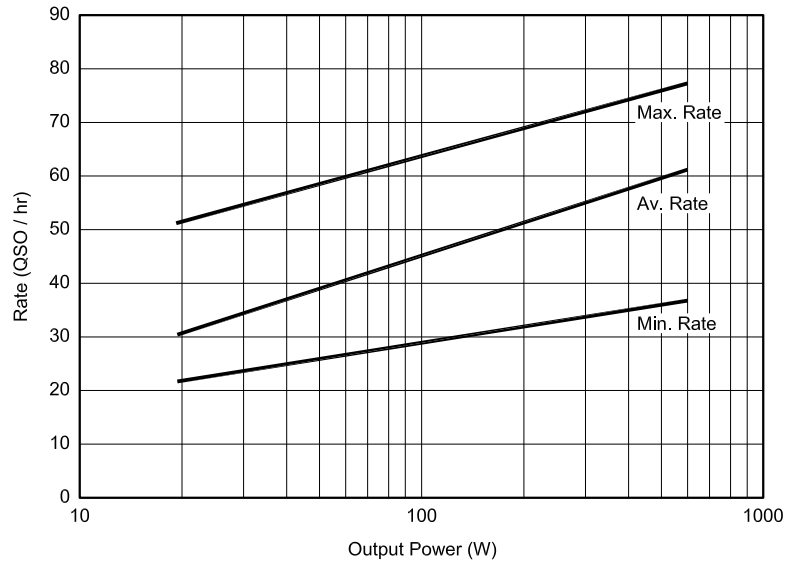

Figure 4—Rate vs. Power for CQ WW WPX 2002 CW.

Table 5

Minimum, maximum and average rate for different power levels in the CQ WW WPX Contest 2002 for OE5XWM (OE5CWL op)

Power (W)	*Min. Rate (QSO/hr)*	*Max. Rate (QSO/hr)*	*Av. Rate (QSO/hr)*	*Min. Rate (QSO/hr)*	*Max. Rate (QSO/hr)*	*Av. Rate (QSO/hr)*
19	19.20	32.00	27.4	22.00	49.09	31.17
37.5	20.63	39.31	33.99	20.63	69.68	41.02
75	27.27	55.86	43.94	30.00	50.00	38.52
150	32.73	60.00	40.68	32.00	61.94	43.52
300	38.00	104.62	59.44	34.00	74.59	54.08
600	42.00	91.30	59.95	35.17	79.35	65.40

Table 6

Intercept (a), slope (b) and correlation coefficient (r) for club station OE5XWM (op OE5CWL) in WPX 2002

Rate	*r*	*b*	*a*
Minimum SSB	0.99	16.34	–3.13
Maximum SSB	0.93	47.27	–31.95
Average SSB	0.95	22.52	–1.43
Minimum CW	0.93	10.27	8.13
Maximum CW	0.75	16.93	29.79
Average CW	0.94	20.50	4.08

Table 7

Improvement (gain) and corresponding output necessary at OE5XWM to get a winning rate for the possible SOAB categories in WPX

	EU Winner 2001	*Rate Winner*	*OE5XWM Rate at Contest Power Limit*	*Gain (dB)*	*Power Limit (W)*	*Necessary Power at OE5XWM (W)*
SSB						
QRP	S54AA	34.3	14.3	8.9	5.0	38.6
low power	YL/RZ3BY	48.9	43.6	2.4	100.0	172.0
high power	S50A	85.7	70.1	6.9	1500.0	7370.0
tribander	HA8JV	80.2	70.1	4.5	1500.0	4200.0
CW						
QRP	HG5Z	42.3	18.4	11.7	5.0	73.3
low power	OK2PP	59.9	45.1	7.2	100.0	525.0
high power	SN7Q	84.4	69.2	7.4	1500.0	8270.0
tribander	HA8JV	69.6	69.2	0.2	1500.0	1570.0

nearing rate saturation. This also may be a possible explanation for what we experienced while analyzing the continental leaders. Stations close to the equator will have more good hours than those more up in the North. This may be the reason why we found an increasing influence of power for locations in South America and Africa.

The second conclusion from our test is that you seem to get more for your power on phone than on CW. This confirms what we have found analyzing the results of the continental winners.

As we now know, the relationship between output power and our rate, using Equation 3 we can calculate which improvement we have to make to achieve results comparable to the winners. For this purpose, you find in Table 7 the necessary gain in dB for our club station OE5XWM.

We cannot change the station antennas to improve performance, so our first thought was to see what might happen if we increased the output power beyond its current 600 W. Look at Table 7 and you'll see the comparable output we would need for a winning rate. Of course, the corresponding output is far beyond the power limits in each category. Just as an example, in the high-power category we would need an output of 7.4 kW on phone and 8.3 kW in CW to get the same rate as the winner!

As the demand for OE seems to be the same as for S5, YL, HA or OK, we cannot assume that his better score comes from a more rare location. Improving our output from 600 to 1000 W (the legal limit for club stations in Austria) will net us only 2.2 dB improvement. The only remaining area of possible improvement is in the operators themselves. We are convinced that much of the difference in "decibels" that the winners have over OE5XWM comes from better operators.

There is one more interesting item to note in Table 7. The necessary gain at OE5XWM is the lowest for SSB in the low-power category. There we "only" need to improve by 2.4 dB, while we would need 8.9 dB in the QRP category. I have to admit that since we have a linear amplifier at the club station we never even thought about entering the 100-W category, especially on phone. We usually enter the tribander category, where we would need 4.5 dB based on an output of 1500 W. Because of the legal situation in Austria, we are only able to run 1000 watts, so we need a further 1.8 dB at that power level. It's surprising that our chances are much better in the low-power category.

In CW, we are rather close to a winning score in the tribander category, based on an output of 1500 W. When running the Austrian legal limit of 1000 watts, we are only 2 dB from the winner, HA8JV. Actually, the score achieved in 2002 placed us 11th place in Europe and 17th place worldwide, although we did not operate the full 36 hours and the average output power was only about 200 W. So, perhaps it's time to make a serious effort in that category.

Comparing the results in the tribander category for both modes shows that we are closer to the winning score in CW. I always thought I was a poor CW operator, but quite good on phone. It's astonishing to see that the analyzed data seem to indicate the contrary.

Conclusion

Our study shows that there is a clear (logarithmic) relationship between radiated power and your QSO rate, except for some saturation at the upper limit of the curve. In CW, the influence of power is not as pronounced as on phone. In both modes, Europe gets the lowest benefit from increasing power, followed by North America. And in both modes, it seems that the influence of increased output power is the highest in South America. Again, this seems to be less pronounced in CW.

By a simple test, which we called the "power lottery," you can evaluate how much your rate will increase with power. Based on the data from this test, you can find out how much gain you will need for a winning score. In doing such a test you may get some interesting results.

With our test, you may also determine which category and mode give you the best odds of success. Doing this analysis per band will also show you which band may be optimum for a single-band entry. Be aware that calculating the regression and winning the contest will be different, as you cannot calculate the human factor and that extra dB from the operator!

It would be interesting to see the results for this test from other stations. Please feel free to contact me at **weigl+info@magnet.at**.

Notes

[1]Katz, S., A novel perspective of amateur radio contesting, **www.dynamicforesight.com/~ve5zx**

NCJ

The 11th Annual Dayton Contest Dinner

By Tim Duffy, K3LR
K3lr@k3lr.com; www.k3lr.com

Wow, 11 years go by fast! The North Coast Contesters have hosted contesters from all over the world who made their way to spend a weekend talking about their favorite hobby, radio contesting. It seems like yesterday Scott, N3RA, and I were lining up John, K1AR, Bob, K3EST and Joe Rudi, NK7U, for the first dinner. Back in 1993 we had 250 contesters attending. This year 350 contesters enjoyed a prime rib dinner together at the Crowne Plaza Hotel in downtown Dayton, Ohio. Every year gets bigger and better.

The dinner is home to the yearly induction of fellow contesters into the CQ Contest Hall of Fame. During the past years, over 40 contesters have been inducted. We were honored to have Ken, N6RO, and Dan, K1TO, join the Hall of Fame this year. The Contest Hall of Fame is the top honor a contester can ever receive. It just doesn't get any better than being recognized by your peers as an ambassador to our sport. The award does not come about by winning contests. The award is bestowed on those who give something back to amateur radio contesting. The first member into the hall was Buzz Reeves, K2GL (SK). Buzz received his award at his own restaurant during a birthday party, where I along with many other K2GL operators attended.

In the Company of Friends

Glenn, WØGJ, gave the pre-dinner invocation for 2003. In years past it was prepared and delivered by our own reverend of contesting, Paul, WØAIH.

Our dinner speaker this year was Rich Strand, KL7RA. Rich has not missed many Dayton hamfests and you will always find him in the contest suites for all three nights. Rich really loves contesting and he is a formidable competitor who overcomes the worst adversity from his station in north Alaska, very close to the Arctic Circle. Rich spoke about hosting multioperator contests, his successes and his failures. He gave tribute to Dan, KL7Y, who became a silent key just after operating the CQ WW DX Phone contest from KH6. Rich is retiring soon and has committed to building a new large station in Alaska. However, it will be much further south than his present location.

Bob Cox, K3EST, who is the director of the CQ WorldWide Contest, chairman of the CQ Contest Hall of fame and a member of the hall himself, gave out three awards during the dinner.

Leif, OZ1LO, was elected into the hall last year, but could not attend in person. He attended the dinner this year and received his award. He also spoke about what the award meant to him and thanked the members of his OZ club for the nomination.

Ken, N6RO, has been contesting for 50 years. He has inspired many young contesters, hosted many operators at the large multi-multi station he built and remains active in most every major contest. Steve, K6AW, spoke on Ken's behalf and welcomed Ken to Dayton for the first time.

Dan, K1TO, has been contesting for 30 years, has given much of his time to encouraging others to contest and is the current president of the very active Florida Contest Group. Dan, along with his partner, Jeff, N5TJ, have won the gold medal at the last three World Radio Team Championships. Jim, K4OJ, John, K1ZA, and Rus, K2UA, all spoke on Dan's behalf.

The prize list was extensive this year. Almost eighty prizes were given to those in attendance. These prizes came from companies who consider contesters to be a substantial part of their business. I'd like to thank the following companies who donated great prizes: Force12, M2 Antennas, Ten-Tec, American Radio Relay League, RF Applications, Sherwood Engineering, Bencher, Array Solutions, KØXG Antenna Rotation Equipment, CAL-AV Labs, ACE-HF, TIC Ring, The Dailey DX, Alpha Power, QRZ DX, Champion Radio Products, Nittany Scientific, *Writelog*, *CQ Magazine*, AN Wireless Tower Company, Idiom Press, AY Technologies, Comtek Systems, W1WEF CW Interfaces, International Radio INRAD, *The Weekly DX*, W4MPY QSL Man, *The DX Magazine*, Radio Bookstore, Radio Ware, Top Ten Devices, DX Engineering, Alpha Radio, Cushcraft and Ed Hammond, WN1I.

North Coast Contesters, Frankford Radio Club, The Mad River Radio Club and RF Applications all sponsored the "Contest Super Suite," now in its 15th year at Dayton. Members of the Yankee Clipper Contest Club hosted a pizza party in the super suite at midnight on Friday night and the Florida Contest Group honored W1CW, W3AU and K1TO during the midnight Saturday night pizza party that they sponsored.

Tim, K3LR, moderating the Contest Dinner.

Rich, KL7RA, the featured speaker at this year's Contest Dinner.

Contest Hall of Fame inductees (from left to right) Leif, OZ1LO, Ken, N6RO, and Dan, K1TO, all listening to KL7RA.

Plan to Attend!

Preparations are already underway for the 12th annual Dayton Contest Dinner. Small changes will be made next year to encourage additional participation by contest clubs. Interest is building in organizing a contester golf outing next year to be held Thursday morning prior to Dayton. There is also interest in having a pizza party at the Super Suite on Thursday night.

Make your plans now to attend Dayton 2004 and enjoy the company of some of your best friends. Watch for announcements in this magazine, its Web site, the *ARRL Contest Rate Sheet*, as well as the **cq-contest@contesting.com** reflector. Suggestions are always welcome. Send them to **k3lr@k3lr.com**.

All photos by K8CX.

ARRL CW DX Contest 2003 from Fernando de Noronha

By Bill Smith, W9VA/PYØZFO
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It is hard to believe that I have been doing these radio things for more than 50 years. I was originally licensed in high school in 1952 as WN9VBV, and soon thereafter dropped the "N," becoming W9VA in April 1977. Although I had competed some in Sweepstakes and in the CD QSO Parties, and used the various DX contests to find new countries, I never thought of myself as a contester. But having opportunities to operate contests from the DX side certainly made contesting more interesting. Here is the story about how W9VA became a contester.

The 7-over-7 10-meter array used in the contest.

Setting the Stage

My first job out of college was with Kemper Insurance in Chicago. At first thinking that this would be a temporary job before being drafted into the armed services, over 20 years later I was still there. I was aware that Kemper had some operations in South America, and in 1980 my business career took an international flavour with a series of trips to Kemper's operations in Brazil. Our main office in Brazil was in Rio de Janeiro, and the first ham I met in Rio was Hal Harris, PY1ZAE. Hal took me down to LABRE, the Brazilian Amateur Radio organization and, to my amazement, I ended up with a Brazilian license a few days later—PY1ZFO.

On a quarterly visit to Brazil in July 1981, I had my first contesting opportunity from the DX side in the IARU Championship. Hal had a friend (Paulo PY1MAG, now a Silent Key) with a shack out in the countryside with decent antennas and a big amp, and I was able to use this station for the contest. I had no significant DX contest experience at this point, and was inclined to just look around and call the stations I could hear. Well, Hal put a stop to that right away, pointing out that I should be CQing. When nobody came back he said, "CQ again, and again, and again." Finally I got the hang of it, and learned to "run." It never occurred to me at the time, but did this coaching put me in the Multi-Op category? Anyway, PY1ZFO had quite a decent score in this contest, and my interest in contests from the DX side was born.

Through Hal I met Rolf Rasp, PY1RO. Rolf was one of the local DXers who would stop by Paulo's shack in the country on weekends. Hal mentioned that Rolf had a 60-meter tower and was a big gun on 160. Well, I thought maybe there was some confusion here between meters and feet. I didn't know then that anyone could have a 60-meter tower, especially in Brazil. A subsequent visit to Rolf's home confirmed that. Yes indeed, it was a 60-meter tower and it supported probably the largest 160-meter antenna in the world at that time.

Much later, Rolf and I had made plans to go on a little DXpedition to Fernando De Noronha Island in March 1988. The island is slightly south of the equator where Brazil bulges out towards Africa, about 215 miles east of the mainland. Still very unspoiled with less than 2500 inhabitants, it is an ideal and unusual vacation destination.

An Island with a History

Noronha appeared on maps of the South Atlantic as early as 1500, and was first visited in 1503. Before becoming Brazilian territory as a result of Brazil's independence from Portugal in 1822, Noronha had been occupied by the French, English, Dutch, and, of course, the Portuguese. Brazil used it as a penal colony for a while. After that the United States built bases during World War II, primarily for missile tracking on the South Atlantic range. Some of the Quonset huts remain today and are used for assorted purposes.

Surfing is good enough to warrant a stop on the "Hang Loose" Surfboarding World Tour. The symbol of Noronha is the dolphin, and there are opportunities to go swimming with these and the many other tropical water creatures in the warm sea. But best of all are the quiet beautiful beaches, particularly for a Chicago guy in February.

Getting to the island would be relatively easy because Noronha now had its first resident ham, Andre Sampaio, PYØFF. Andre had moved from Recife to Noronha only a few months before, having a position with the government, and Rolf had coaxed an invitation to the island from Andre. Rolf had to back out because of business, but I plunged ahead.

The date that we picked happened to include the SSB weekend of the ARRL International DX contest. I remember this as being a coincidence, but knowing in advance about the contest, I brought along the necessary forms. This all went well, but remember that in 1988 Fernando de Noronha was still a rare DXCC entity. To have it appear in a contest was truly an event, and the pile-ups were awesome. Yes, I was reduced to going by call areas at times to be able to sort things out. I had chosen the Single-Band 20 category—almost 2000 QSOs later I emerged in third place in the world and first in South America. I should mention that this was when Andre's station consisted of a Drake C-Line and a hand-turned Brazilian tribander at about 8 meters.

Back to the Island in 2003

Let's fast-forward to February 2003. This would be my tenth visit to Fernando de Noronha. Many years ago, Andre had left the government position and turned his original home on the island into a *posada*, equivalent in most respects to a "Bed and Breakfast." The posada has expanded over the years, and recently a restaurant has been added to the facilities. Andre's *Posada da Morena* is listed in guidebooks as one of the top places to stay on the island.

The PYØFF hamshack has also expanded and improved over the years, now being one of the top contest sites in South America. Many of the improvements resulted from interest in Noronha by Atilano Oms, PY5EG, the founder of Brazil's Araucaria DX Group and a member of the CQ Contest Hall of Fame. Atilano already had a very serious contest station at his home in Curitiba, in the south of Brazil, but saw the potential in an island contest station much closer to the major ham population centers. As a result, towers sprouted on the island, and antennas and other equipment quickly followed. ZXØF was born, and quickly began a long string of Multi-Single contest successes, particularly in CQ WW and CQ WPX phone contests. Sometimes other call signs are used, but the source of a loud signal with the "ØF" suffix is very likely to be at the *Posada da Morena*.

The Journey

My starting point for Brazil 2003 was Rio de Janeiro. Rolf met me at the airport and I spent 24 hours at his new home in Niteroi, across Guanabara Bay from Rio. Rolf had been inactive for many years, but has recently become interested in 6 meters. If Rolf does anything at all, he does it big, so I was not surprised to see a 7-over-7 6-meter

PYØ beach—the volcanic peak is just behind PYØFF's house.

Andre, PYØFF, (l) and Bill, W9VA, (r).

stack in place and a huge 6-meter amplifier under construction.

After Rio I travelled to Recife, the jumping off city for Noronha. There I enjoyed a great dinner with Jim PY7XC, Fred PY7ZZ, and Ciro, PY7ZY. These three (and others) had been with me on the PWØT DXpedition to Trindade Island in 2002, so it was a great reunion opportunity. The next day Jim drove me out to the airport for flight to Noronha.

Each time the airplane on this flight gets bigger and faster. In 1988 it was a nine-passenger twice-weekly prop plane. Now we are up to a twice-daily Boeing 737. Virtually unheard of outside of Brazil, ordinary (nonham) people go to the island for surfing, diving, fishing and just laying around on beautiful uncrowded beaches. Much of the island is classified as a national park where commercial activity is not allowed, and with still a limited infrastructure, the tourist arrivals are closely controlled.

Jumping into the Fire

I arrived on Wednesday and spent some time exploring the bands as PYØZFO, my permanent Brazilian license. I had not decided on what category to enter in the ARRL CW contest, but had looked at the propagation programs and was thinking about single band 10 meters. Even in the decline of the sunspot cycle it appeared that there would be strong daytime openings from PYØ to W/VE, and looking at the 2002 scores there were no South Americans in the top ten for this category. Well, certainly in 2003 the Europeans would have shorter and weaker openings to W/VE than the previous year, and it looked like a great opportunity for a first place finish. I also liked the idea of daytime operating.

Checking 10 meters at 0000Z (10 PM local) on Thursday and Friday revealed only South Americans, no signals from W/VE, not even beacons. It looked like for me the contest would not even begin until Saturday morning, so Friday evening I had a leisurely dinner at Andre's wonderful restaurant and returned to the shack a couple minutes after 10.

Oh-oh! The band was open with lots of signals from the southern tier of the US. The rig was ready to go, but I had lost a few minutes of operating time. The next two hours produced a surprising 106 contacts, with the band finally dying at 0200Z, six hours after local sunset.

Saturday morning was typical Noronha, warm and sunny. At 1100Z the band was full of Europeans calling, but they were not getting replies, and no W/VE was heard until 1130Z. The pace started slowly, but picked up throughout the day, with 650 Qs in the log at 1630Z. I took a short lunch break that somehow stretched out to 30 minutes.

Back in the chair at 1700Z, I picked up where I had left off with the band continuing hot until 2200Z and dead by 2300Z—much earlier than the previous night. I still heard other South Americans calling CQ Test, so I knew that there would be serious competition in the SB10 category from SA this year. I would not know until later just how serious. But at the halfway point I had 1227 QSOs and 59 mults, missing only the ones that I would never get—VO2, VY1, VE8 and VYØ. Time for a great late dinner with Andre and his wife Morena, and a good night's sleep for the finale on Sunday.

Sunday morning the band opened at 1200Z, a little later than Saturday. The rate was down quite a bit because I had already worked the serious competitors and the casual guys were still in bed. I made the wise decision to skip lunch, but it still took until 1730Z to reach 1500 QSOs, which was EI4BZ's category winning total in 2002. I was well ahead of last year's winner in points since I had an additional two mults as well. The rate held up at 100 per hour until 2100Z, slowing considerably until 2200Z, when the band collapsed.

At this point I had 1860 QSOs and it was tempting to break out the beer and the final "savelog." But the other South Americans were relentlessly calling CQ Test—I had to stick with it. Another 70 stations called me in those final two hours. Those contacts to be the margin of an apparent victory. My claimed score was 341,000 consisting of 1930 QSOs and 59 mults. I was surprised to learn well after the contest that this would be a new continental record, well above the 306K achieved at HC2G in 1989.

Post Contest

Five South American stations exceeded by a wide margin the 2002 winning score in the SB 10 meters category. In addition to PYØFF, PT5T at the big Araucaria station in Curitiba claimed 1914 Qs and 58 mults, with PY3DX at the other big Araucaria station in Santa Catarina (ZX5J) close behind with 1,847 Qs and 59 mults. Two LUs completed the top five. One of the LUs mentioned being called by VY1JA in the closing minutes of the contest, but I was not so lucky, or more likely had lost propagation to VY1 before the stations to my south and west. The LU also had 59 mults so that made me wonder which one I had picked up that he and others had missed.

Both of the south Brazil stations have more aluminium in the air on 10 meters than PYØFF, but I am sure it was helpful to be a unique multiplier. It was probably a good decision to use the well-known PYØFF call in the contest. It avoided most, but not all, of the "QTH?" inquiries. On the other hand, it was probably *not* a good decision to use 5NN7TT as my exchange in the contest. My thinking was that it would make my signal distinctive from all of the 5NNK guys, making it easier for the searchers and pouncers. But the anticipated 5NNK may have been better—not too many, but a few requested repeats on my power. Of course I actually was running 700 W, but perhaps I was too much of a purist!

Just a couple comments on operating practice. While trying to pull a weak one out of the noise there would be the inevitable "QRL?" on my frequency followed a nanosecond later by a long string of CQ Test. When informed that the frequency is indeed "QRL," most of these were resolved quickly. Having a big signal helps in these situations!

Not so easily resolved was the call from one of the big US multi-multi operations Sunday afternoon requesting that I go to 15 meters for a QSO, never mind that I was in the middle of a run and obviously operating single band. He wouldn't take no for an answer and, of course, he was too strong to ignore. Eventually he went away, but my run had gone away too, so it was back to CQ Test. It would have taken less time to actually QSY and work him, but in my opinion that would have been rewarding rudeness.

Another amusing incident on Sunday afternoon was when an orderly run of stations suddenly became a huge pile-up. Well-known stations that I had worked early Saturday morning were franticly calling me. There must have been five or six "QSO B4" exchanges before the pileup subsided. Later I learned that A35RK had inaccurately been spotted on my run frequency, and many who should know better were calling without bothering to listen for my call sign. I would like to think that contesting is a gentlemen's pastime, but these incidents have to make one wonder.

After the contest, I had the pleasure of a couple more days on Noronha, help-

ing the deserving DXers with PYØF contacts on 12, 17 and 30 meters. Then I went up to Fortaleza for a couple days with Eli, PT7BZ, another member of the PWØT team. Eli and other members of the Fortaleza DX Club are putting together a serious contest station in that city, so together with the contest stations in the south, Brazil will be well represented in future contesting.

ARRL International DX Contest note: This contest has never been particularly interesting to many DX participants because they can only work W/VE stations. In addition, since club competition is limited to ARRL affiliated clubs, there is no incentive for foreign DX club members to submit their scores as a club and have interesting competition against other non-W/VE clubs. The initiation of club competition for foreign DX groups clubs would certainly generate more interest abroad. I have suggested this to the honchos in Newington; a few more voices expressing this idea would be appreciated.

Equipment note: The rig used at PYØFF for the contest was an ICOM IC756 PRO II driving an Alpha 89 amplifier into a 7/7 array. The PRO II was one of three that had been loaned by ICOM to the PWØT Trindade DXpedition in February 2002, subsequently purchased, and now residing in Brazil. I am a nontechnical person who has very little idea what is going on inside the ICOM box, but I was impressed at how well I was able to reject adjacent channel interference. Very strong stations could and did move in very close to me and begin running, but the bandpass filters did a great job with minimum slop over, considerably reducing what I call "contest stress."

Noronha note: For more information about Fernando de Noronha check out the Web site at **www.noronha.com.br**.

NCJ

Eli, PT7BZ, (left) and Bill, W9VA, (right) at Eli's shack in Fortaleza.

Contesting from the Other Side —My First DX Experience

Jim Cassidy, KI7Y

I have been a ham for more than 40 years, involved in nearly all aspects of the hobby with an emphasis on contesting. Most of that contesting has been from my modest home station, but some has included operating at several West Coast Big-Gun stations (at W7RM principally), and a couple of contests at W7GG's station.

I had been thinking of trying some operating from a DX location, and I was able to follow that dream when I was asked to join the Cinco Nueve Contest Group (a small group of hams from the Portland and Eugene, Oregon areas) for their operation in Costa Rica at TI5N. This is the station of Carlos Diez, TI5KD, for the 2003 ARRL DX CW Contest. The operators for the trip were to be Al, K7AR; Mark, N7MQ; Ron, WJ7R and myself.

Preparations

The preparations were complicated: getting a passport, arranging airline tickets, selecting equipment, working on propagation and band plans and on and on. Still, the time seemed to drag until it was just a few days before I was to leave for the trip.

Then, the week before we were to leave, Ron injured his shoulder and was unable to join the crew. And the weekend before departure, while confirming flights, I learned that my airline tickets were not for the same flights as shown on my itinerary from the travel agent. Instead of a leisurely daytime flight with the others on Monday before the contest, my flights started with a red eye to Atlanta that evening. I would spend the pre-dawn hours at the Atlanta airport until I could board the connecting flight with the rest of the team. I was learning about the patience required for international travel! I met Al and Mark at the Atlanta airport when they arrived, and we went to our gate to wait for our flight to San Jose, Costa Rica.

Arrival in San Jose

This being my first trip out of the country, I was a little nervous about what I would encounter in terms of security and customs when we arrived in San Jose. No worries; we breezed right through with no difficulties at all. I had been wondering what, if any, problems I would have when the security agents found that I was carrying an FT-890 transceiver, its power supply, and a computer. As it turned out, my equipment only raised a moderate amount of curiosity.

We arrived in San Jose in the afternoon that Tuesday and found Keko, TI5KD, waiting for us as we left the airport. We split into two groups, one piling in Keko's small car with the bags, and the others in another car with his wife, Sophia, TI2IY.

Mark, N7MQ (front) and Al, K7AR (rear), operating during the contest.

Jim, KI7Y (front) and Will, TI2WGO (rear), in action.

Our host Keko, TI5KD, in his shack.

Their house is a very short distance from the San Jose airport in Guacima. We left cold, overcast weather in Atlanta and arrived in the warm sunshine of Costa Rica. At least that part of what I expected was coming true—DX travel was simply fabulous.

Keko and Sophia have a very nice place, in a walled compound surrounded by fruit trees. The property not only includes their own ham station, but it also has two separate apartments for their guests, and a terrific contest station in one of the apartments. Keko, Sophia, their children and their terrier, Brescia, made us feel at home immediately.

Keko talked us through the antennas, and showed us around the contest station. We quickly felt at home and that evening began some operating. Keko has a nice antenna farm with towers, beams, quads, wire beams, etc—just every type of antenna you could want, and more effective than what I have to chose from at home.

Enjoying Costa Rica—and Amateur Radio

My first contact from the station was made with a single CQ at 100 W on 40-meter CW as TI5/KI7Y. That started a pileup that could have lasted all night. Although warned of what would happen when I was spotted on the European PacketCluster, I was initially frustrated with the depth of the pileup, and with my operating. I seemed like a novice when it came to sending CW. I felt a little better about it as time progressed, especially when I realized I had been up over 30 hours with virtually no sleep.

Being the DX was intriguing, and I had to operate accordingly. It was fascinating to observe the techniques that others used to break the pileups and get my attention. I learned a few tricks to take home with me.

Wednesday, the second day in Costa Rica, we visited downtown San Jose with Keko. We visited several electronic parts houses as Keko searched for items he needed. We cashed some travelers checks (watched by armed guards) and strolled through the city. San Jose is quite modern, and yet they have preserved the beauty of their old colonial buildings.

We also visited the site of the TI2NA 6-meter beacon transmitter. It has been in service for many years and was recently replaced with a modern solid-state unit.

The following day we toured some of the Costa Rican countryside. Keko loves his country, is very knowledgeable and the tour was great fun.

As the week went by, we spent more time on the air, checking out the antennas, the propagation characteristics and arranging the contest shack. We were to enter the ARRL DX CW Contest as a multi-op, but with only three operators. The operating plan was going to be a killer, as it soon became obvious that we would be in for some long hours at

the operating positions.

Fortunately, Keko had found that Will, TI2WGO/VA6WGO, was in San Jose and we invited him to operate with us. Will agreed, and his prowess as one of the operators at the VE6JY super station was a huge help, but he could not join us until Saturday morning, some 14 hours into the contest. So, the three of us started the contest without Will. We were very tired by the time Will joined us Saturday morning.

In the Thick of It

Things went well with our contest effort. I did have some initial difficulties learning how to make the best of the TS-570 transceivers. Also, both Will and I had to scale a learning curve with *Writelog*. Both Will and I had done almost all of our contesting with *TR-Log*.

We finished with about 6600 QSOs, 333 total multipliers and a final claimed score of 6.4 million points. It was an exciting contest, especially for me.

Following the contest, we went out for dinner at a pleasant local restaurant. It was open-air dining on a warm evening with good company. This was the perfect ending to a great weekend of contesting.

The TI5N Team (left to right): Jim KI7Y, Al K7AR, Will, TI2WGO, Mark N7MQ.

Reluctant Departure

We were to stay a few days after the contest and did some more sightseeing and lots of operating, especially on the low bands and on 30, 17 and 12 meters. Too quickly, it was time to go home. We returned through Atlanta overnight and back to our homes in the Northwest.

To sum it all up, I have to admit that everyone who predicted that I would become totally hooked on this kind of operation was correct. In fact, I have already decided to try it again next year, and our Cinco Nueve Contest Group (CNCG) has arranged with Keko to go again for the ARRL DX CW contest in 2004.

QSLs go to the respective home calls for /TI5 before and after the contest, and to W3HNK for TI5N.

Acknowledgements

I would like to extend a special thanks to the CNCG for inviting me to participate. And to anyone interested in a great experience in Costa Rica, they should check out the information about Keko. His information can be found at **www.qsl.net/ti5kd**. You might also want to visit the Cinco Nueve Contest Group Web Site at **www/qsl.net/k7ar**. After this experience from the other side of the pileup, I now have to be content to operate from home!

A special thanks goes to Mark for his editing help with this article and to Al for providing the pictures. See you again next year from TI5N.

NCJ

NCJ Reviews — Managing Interstation Interference: Coaxial Stubs and Filters

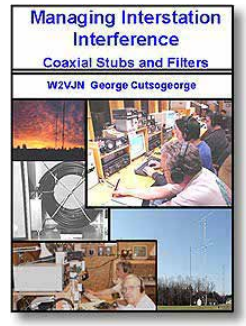
Available from International Radio, 13620 Tyee Rd, Umpqua, OR 97486; tel 541-459-5623 (1600-2000 UTC Tuesday through Saturday); **INRAD@rosenet.net**; **www.QTH.com/inrad**. *$15 plus shipping.*

Reviewed by Terry Zivney, N4TZ/9

I consider my annual pilgrimage to the Dayton Hamvention to be incomplete without the purchase of at least one new book. This year's most interesting book (to a contester, anyway) was not at the usual booksellers' booths, but at the booth belonging to International Radio, purveyor of crystal filters to many of us. Its title is *Managing Interstation Interference: Coaxial Stubs and Filters* by George Cutsogeorge, W2VJN. Fifteen dollars quickly changed hands, and I had something to read while waiting for the Contest Dinner.

The first thing I noticed is that this is not simply a glorified reprinting of George's very informative *NCJ* articles on using stubs to reduce interference. Neither is it a cookbook packed with tables spelling out stub lengths in feet and inches for every conceivable problem. Finally, there are no extensive plugs for either the stubs or the antenna switching solutions sold by Top Ten Devices (another of George's ventures). Although some of the products are briefly mentioned as examples of ways in which particular problems could be solved, *Managing Interstation Interference: Coaxial Stubs and Filters* is not an advertisement for the products. If anything, the biggest fault of the book is the understated way in which the author discusses the merits of alternative implementations. In general, the author stays away from identifying products by name. For example, the section on bandpass filters, while containing several frequency sweeps of a commercial bandswitching filter, doesn't tell us the particular brand nor are we told whether it is better or worse than a competing brand.

After returning home from Dayton, I gave the book a more thorough read. *Managing Interstation Interference: Coaxial Stubs and Filters* starts with an overview of the various problems faced when trying to receive on one band while simultaneously transmitting on another. In addition to annoying problems like intermodulation distortion and phase noise, the possibility of physical receiver damage is considered. The book's Figure 1 shows the degree of isolation needed to a-chieve various objectives. Next, actual isolation measurements between various antennas at the author's contest station are given, suggesting that anyone running more than QRP is likely to need extensive filtering help.



The third section provides a discussion on coaxial stubs. The author goes far beyond the basic variations of open and shorted quarter-wave and half-wave stubs so often prescribed on the Internet. Interesting variations include the combined open and shorted eighth-wave stubs described in his 1998 *NCJ* article (January/February, page 7), a circular full wavelength stub, and variations of the compensating stub system introduced to contesters in K2TR's 1984 *NCJ* article (May/June, page 18) for nulling out 15 meters on the 40-meter transmitter. These variations, as far as I can tell, are unique to this book. They will be useful when attempting to null WARC bands, which do not have harmonic relationship, to the normal contesting bands. Admittedly, this is not particularly interesting to contesters, but it may be to DXpedition operators. Finally, George provides theory for a triple-stub combo that nulls 40 meters while operating on 15 meters. This last beauty was very effective at my local club's Field Day exercise where a tribander with 40-meter add-on was only a few feet from the 40/80-meter dipole. This combo set of stubs is not priced on International Radio's Web site.

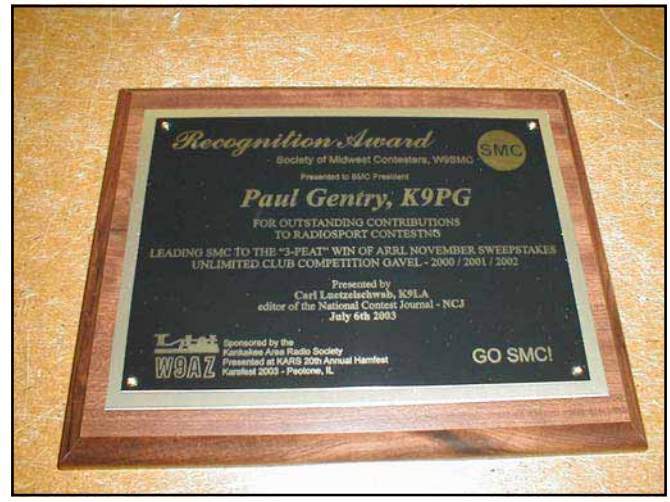
Managing Interstation Interference: Coaxial Stubs and Filters also provides information on increasing attenuation by using multiple stubs, suggesting that neither quarter wavelength at the fundamental nor the second harmonic is likely to be the optimal choice for the feedline connecting the stubs. Measured data on tuning stubs with inductors and capacitors is provided, in case one wants to change tuning for CW and SSB operation. The section on bandpass filters is rather sketchy in comparison. In my own station, I found that while stubs adequately protected the receiver from inhaling lots of watts from the other transmitter (I have 57 HF elements on my one-and-only tower), they do not keep me from having the IFs of the two identical radios talk with each other. Although I can hear the external noise floor while transmitting on the other radio, I could also clearly hear my CW and SSB signals at S0 when I don't use bandpass filters. Since the passband attenuation on the filters is greater than with stubs, I only use the filters when running an amplifier, where the reduced power output from the exciter is irrelevant.

I hope the book will evolve, as has ON4UN's *Low Band DXing*, into an even more comprehensive work in the future. For example, why is the ultimate null depth deeper for 20-meter stubs than for 80-meter stubs (page 30-31)? Is the –20 dB null bandwidth affected by the choice of cable type (RG8x versus RG8), or is it just the ultimate null depth, and why? What could I expect with CATV hardline stubs; is the extra mechanical complexity worthwhile? And what other new interference-fighting innovation will W2VJN come up with? In summary, I found the 71-page book to be an excellent investment. For less than the price of buying one of his manufactured stubs, George teaches us how to make a smorgasbord of interference reducing devices. NCJ

Society of Midwest Contesters Recognizes K9PG

At the Kankakee, Illinois Area Radio Society "Karsfest 2003" in Peotone (just south of Chicago), Paul Gentry, K9PG, was given a Recognition Award from the Society of Midwest Contesters for his efforts in recruiting new members to allow the SMC to win the ARRL November Sweepstakes Unlimited Club Competition gavel in 2000, 2001 and 2002. Presenting the award to Paul on behalf of the SMC was *NCJ* Editor Carl Luetzelschwab, K9LA.

K9PG receiving the SMC Recognition Award from *NCJ* Editor K9LA.



The SMC Recognition Award presented to K9PG.

Midwest "Antz" Invade Contests!

Paula Uscian, K9IR
K9ir@arrl.net

Air travelers refer to the part of their journey over the midwestern US as "The Big Flyover." Radio waves, especially the DX variety, also have treated the heartland this way since Marconi's first transmission.

Within this bleak RF environment, however, several outstanding radio contest operators have been nurtured. NT1N (ex-NU9R), K4JA (ex-KS9K) and W4AN (ex-KM9P) each developed successful contest skills operating from the Midwest before moving to the relatively easier pickings available from being closer to either coast.

Many hardy souls, however, continue to contest from the central states. In early 1985, a group of them formed the Society of Midwest Contesters (SMC) "with the goal of uniting Midwest contesters into a competitive group, and to further the idea of radiosporting in the Midwest.... The intent is to make the society competitive with the best big clubs in America," wrote Steve Dubberstein, K9WO (then NA9D), the club's first president, in the June 1985 newsletter.

Steve named the newsletter *The Black Hole* and explained "those who have contested from the Midwest realize that we have not been blessed with the same propagation as our fellow citizens in other parts of the country. At times, it is actually like being in a 'black hole' of propagation. Being at somewhat of a disadvantage is no excuse; however, and we must try that much harder in order to do better than those elsewhere. Hopefully, the name of the newsletter will be a constant reminder of this."

By September 1985, the club had 51 members from Indiana, Illinois and Wisconsin, and gained ARRL affiliation. K9WO set as one of the first goals "to submit more than 50 entries in the SS for the Society. By doing this we will appear 'out of the blue' in the UNLIMITED category—an impressive move, to say the least." Impressive and ambitious, as it would require nearly every club member at the time to participate. The membership responded by *winning* the ARRL Sweepstakes Unlimited class in both 1985 *and* 1986.

A Star is Born

Paul Gentry, K9PG, recognized it later as one of those life-defining moments, the spring day in 1981 when his father brought home a CB radio. Five years later, after running down the car's battery talking for nearly six hours to every "good buddy" from Channels 1 to 23, Paul became licensed as KA9VAK. By 1987, he had upgraded to Technician, and met Scott Pederson, N9FZO (now KI5DR), and his roommate Dave Patton, then NU9R, while at college.

K9PG acknowledging the SMC Recognition Award.

In October 1988, Dave invited Paul and Scott on a contester's road trip to Hannibal, Missouri, to operate CQ WW SSB from the home of CQ Contest Hall of Fame member Lew Gordon, K4VX. Paul didn't make any contacts on that visit, but returned twice more to operate before running the 1989 ARRL 10 Meter contest from K4VX as Single-Operator SSB. Motivated by the contesting bug, Paul had upgraded by then to Amateur Extra and joined SMC.

The St Charles Epiphany

Over the years, SMC members had continued to promote contesting, often assembling teams to win NAQP or Sprints. By 2000, membership had grown to 120. The club's early Sweepstakes successes, however, had not been duplicated. It was against this backdrop that Paul became SMC president in 2000.

For a time, K9PG's e-mails had ended with the line "People said I couldn't do it...so I did it." Never was this attitude more evident than in August 2000 at an SMC dinner in St Charles, Illinois, when the subject of Sweepstakes came up.

As Paul describes the moment, "I got this crazy idea in my head for the SMC to go for the Unlimited title. I remember K9NW looking at me like I was crazy…then someone else said that it's impossible…can't be done. That was all the motivation that I needed."

Paul proceeded to spend at least four hours a day, seven days a week, for the next two months spreading the word about SMC, signing up new members, sending out and answering literally thousands of e-mails, and generally getting everyone pumped up to win Sweepstakes. Membership tripled to over 300 members.

The result was what Paul described as his "most memorable moment in contesting" when he received on behalf of SMC the 2000 Sweepstakes championship gavel at the following year's Dayton Contest forum. The club not only won Sweepstakes Unlimited that year; it broke the 1997 Unlimited Club score record held by the Potomac Valley Radio Club (PVRC).

Repeat

SMC's 2000 Sweepstakes win surprised the contest world and the club's score nudged out the nearest contender, the Northern California Contest Club (NCCC), by less than 500,000 points. Both NCCC and PVRC pledged to topple SMC in 2001. K9PG and the gang were just as determined to show their previous win was no fluke. A galvanized SMC membership joined Paul to further augment their ranks and participation level. The result was a repeat Sweepstakes win, this time by a convincing margin of over 4 million points.

The ARRLWeb summary of the 2001 competition, however, rained a bit on the SMC parade when it stated "Club competitions in contests are a bit like political leadership conventions: the competitor who sells the most party memberships wins. So it should surprise nobody that the Society of Midwest Contesters (SMC), emerged victorious" with 342 entries, versus 159 from NCCC, the nearest competitor. The article characterized the 2001 results as "quantity vs. quality," and noted the call signs of several prominent NCCC contest operators while mentioning not one from SMC (*see* **www.arrl.org/members-only/contests/results/2001/SS-PH/clubs.html**).

This commentary prompted SMC member Mike Kasrich, AJ9C, to compare the club's outstanding member participation to an army of ants—or "antz" as he phrased it. "Antz!" became the rallying cry for the next year's effort, and graced e-mails and a limited-edition pin in a show of club solidarity. Given concerns over the future of Amateur Radio, SMC should have been applauded, if not rewarded, for successfully encouraging greater contest participation and overall interest in the hobby.

Three-Peat

The momentum from the previous years' wins, plus some lingering irritation over the League's comments, propelled SMC's planning efforts for the 2002 Sweepstakes such that K9PG no longer had to spearhead the effort. To encourage increased participation *and* QSOs per log, many SMC members recruited new members, encouraged their colleagues to pledge contest QSO goals on the club Web site, and offered prizes for the highest mode scores and largest percentage increases over last year's score. The heat was on, as PVRC and NCCC vowed that *this* was the year they

would take back the gavel.

The result was a third consecutive SMC victory by an even greater margin. Again, the ARRLWeb commented, "That SMC has such a large lead (22.4 million points to 15.6 million) is in no small way related to the lead it has in contesters (387 vs 183). But on an average basis, Mad River [Radio Club] comes out on top, with 103.5k points per team club member vs. 57.8k for SMC.... Just like party leadership conventions, it's the club with the most points, SMC, that wins, regardless of membership." (*see* **www.arrl.org/members-only/contests/results/2002/Nov-Phone-SS/index.html**).

K9PG addressed this debate by first recalculating SMC's score using only the top SMC CW and SSB logs up to the same number of logs submitted by NCCC and PVRC for each mode. The results didn't change—SMC remained the winner.

Paul then recalculated scores based on the required number of logs to enter the Sweepstakes club Unlimited category. Using the top 50 logs from each mode (100 total), SMC scores again topped both NCCC and PVRC. Only calculations using 25 logs per mode (50 total) put NCCC on top, but as Paul noted "in my mind that doesn't mean much since 50 logs puts you in the medium category, and that's not what we're competing in." Case closed.

How'd They Do It?

For K9PG, it's all about having fun. He takes his inspiration from a comment by Bill Fisher, W4AN: "Imagine how many more people we would have to work if each one of us got just one other person involved in contesting!" That statement is at the core of Paul's success in resuscitating SMC.

Numerous club members mention his tireless efforts at recruiting new participants to the contest ranks. Paul has convinced people from all walks of amateur life—DXers, VHFers, rag chewers—to give contesting a try.

For example, Clay Melhorn, N9IO, is a self-described "dyed in the wool rag chewer and occasional DXer." In 1999, he and his daughter Crystal, W9IOU, worked multi-op as their first effort in Sweepstakes Phone. Paul saw the published results, contacted N9IO and invited his family to submit the next logs as SMC members. Clay, his wife and kids have competed in Sweepstakes since then, encouraged by SMC camaraderie in which "The big guns are more than willing to share their tips and secrets, to the benefit of the group."

Even more important, K9PG brings a personal touch. Sam Effinger, K9SD, observes that "Paul talks to almost everyone. That makes it personal, not just a generic e-mail, and encouraged us to help each other. We enjoy a feeling of being a part of something, with no 'cliques' but everyone working as part of a team. If you have wires and 100 watts, you are just as important as any Big Gun. Paul made it fun."

This reaching out to each individual doesn't stop once the contest starts. Chuck, KI9A, notes that "During a contest, [Paul] will stop me several times during the weekend,...ask how I am doing, [and] suggest I need more mults, QSOs, different band, etc. He has no doubt made me a better contester." "[Paul] always has time to say 'Hi Gary' when I work him in a contest" recalls Gary Hext, K4UU.

Brian Maves, K9QQ/KH6, emphasizes a key characteristic of SMC that Paul's leadership has reinforced. "From the first year, we always stressed that we were a club for all contesters, not a 'big gun' or 'prestige' oriented club. Everyone has always felt comfortable as part of the group and we've successfully avoided developing rifts and some of the other self-destructive behavior that tends to ruin clubs."

K9QQ/KH6 also points out how the Internet and e-mail have helped. "Even though we're geographically spread out, it allows us to come together as a group and keep everybody involved and informed." Hardly a day goes by without an e-mail posting on the SMC reflector, regardless of any scheduled contest.

Added to that is Paul's motto that "Every QSO counts," which motivates members like Mike Brown, K9MI, to "fire up the rig and get as many Qs in as I can."

Relentless recruiting, infectious enthusiasm, the personal touch, an inclusive membership that recognizes each member's contribution is vital to the team, sharing ideas, taking advantage of enabling technologies and most of all *keeping it fun*—these are the elements that K9PG has brought, encouraged or leveraged to rebuild a successful contest club. Regular in-person gatherings at hamfests and an outstanding hospitality suite at Dayton also have helped sustain the buzz. And don't forget those antz!

It also is worth observing what Paul and SMC haven't done to rejuvenate the club. No newsletters have been issued for the last few years, and the "President's Corner" on the Web site is blank. Dues requirements resemble Montana speed laws—whatever one feels is appropriate.

Paul is as modest as his colleagues are effusive, however, regarding what he has done for SMC and how much they appreciate it. He views his efforts as nothing anyone else couldn't have done.

What's Next?

For SMC, a Sweepstakes four-peat is the obvious goal. Ratcheting their game a notch would be to capture Sweepstakes and the ARRL 160- and 10-Meter competitions in the same season. Propagation on the "Gentleman's Band" actually favors the heartland, and SMC has won this contest in the past. Ten meters is another story, however, and would require the score doubling that results from mixed mode participation to nail the hat trick. Unfortunately, the physics of the Black Hole won't allow for a serious club run at a CQ WW title.

SMC membership is over 500, and K9PG sees no reason why it can't double in the next year. With many members sharing the tasks of keeping the club strong and competitive, Paul has no concerns SMC has grown too reliant on his contributions.

In the midst of his intense activity on behalf of SMC, Paul won both the 2003 ARRL DX Phone and CW contests operating as WP3R in the Single Operator-All Band-High Power category. He also appears to have set a new world record in March with 460 phone QSOs in one hour, breaking the previous mark of 457 set by N5TJ in the 1993 CQ WW Phone contest. His next goal—a single op CQ WW win.

K9PG has been successful in both team and solo contest operations, but as reflected in his work with SMC, Paul most enjoys the team aspects of working with friends in multi-operator contesting. And the contest achievement of which he's most proud is organizing the effort to lead SMC to its surprise Unlimited title in the 2000 Sweepstakes. NCJ

What Does It Take to Win the World?

By Tom Baugh, AE9B
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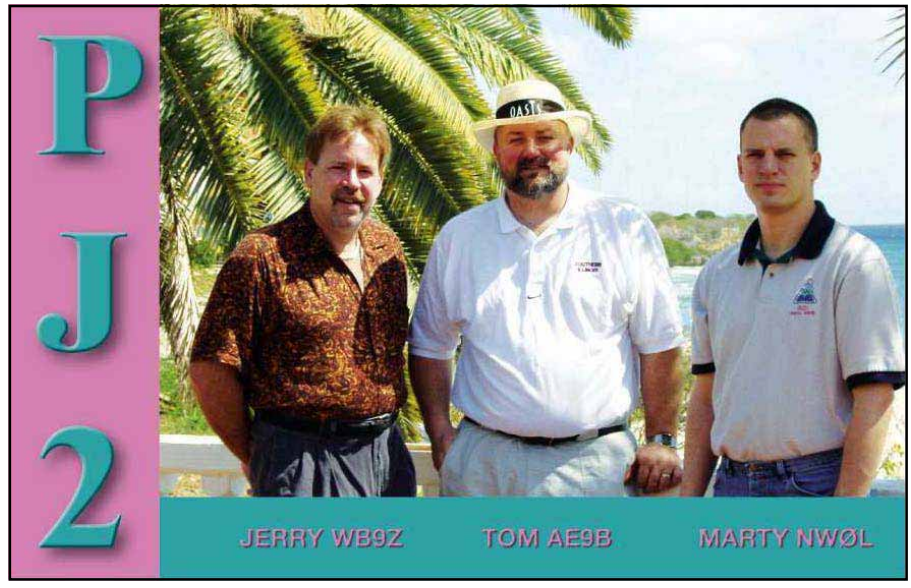
With the contest complete, our PJ2T ARRL DX SSB multi-2 effort appears to have been successful. A gauge for success is always relative. I have been involved in a few efforts in which "success" was defined as getting several new hams to operate. But this was different. This was an effort to put us on the map, to place our names and call signs among the world's top operators. The following is the complete story from the Midwest guys who have apparently "Won the World."



The PJ2T Team.

KEY ELEMENT #1: Team Selection

Marty Tippin, NWØL, is a young Anti-CW bigot. He actually earned his stripes as a competitive RTTY operator and fast talker (SSB runner) having coined the phrase "Adolescent Chipmunk." Marty is a naturally competitive, slightly hyperactive computer programmer from the Ozarks of Missouri. A self-starter and excellent team player, Marty excels in computer networking and everything associated with the technical aspects of software and hardware integration. He's an excellent high-band running operator with a great understanding of efficiency.

Jerry Rosalius, WB9Z, is a well-known low band operator and consistent "Top Op" from the Midwest. I first met Jerry (more than just casually) just weeks prior to the contest at his well-stocked antenna farm outside of Kankakee, Illinois. The purpose of my visit was to see how he did so well in all the low-band contests. I was particularly interested in his Beverage and other listening antennas. I got to know Jerry and his wife Lori pretty well and enjoyed their open and inviting personalities, typical of Midwest country folk. Jerry has more experience than both Marty and I combined. It is his experience and tireless endurance that we relied upon to propel us through the tough times. His endurance is second to none and became a driving force in our effort.

Tom Baugh, AE9B (that's me), is a middle aged, fat, bald guy typical of many hams, but with a burning desire for competition. I'm not sure what drives other people, but I'm driven by competition. Although not nearly as competitive as when I was physically propelling myself into opponents in the NFL, I still like a good battle. Perhaps one of my assets (it's hard to talk about your own) is the ability to diagnose, compare and evaluate statistics and probability in order to position myself or the team for the best chance of success (kind of like a good coach).

As with all competitions, the measure of success is victory. In the world of radio sport, winning requires more than desire, more than good equipment, more than good operators. It is typical of many sports, where combining preparation, ability and study of the conditions and opponents provides an improved chance of success. But unlike most sports, not everyone shows up at the same playing field for this competition. In fact, your selection of playing field is just as important if not more important than any of the other factors affecting the results. Selection of the playing field becomes part of the game plan.

KEY ELEMENT #2: Site Selection

Marty asked me a while back if I was interested in going with him to PJ2T for this contest and I had committed very early along with another friend Rick, WØZAP. When Rick had to bow out due to a conflict, Marty and I asked around within the Kansas City DX Club and expanded our selective invitations to members in other contesting clubs. Marty and I were actually considering doing two separate single band competitions when Jerry signed on as our third team member. All three of us had been to Signal Point before and were all looking forward to a return visit to the improved site. I was particularly excited about the addition of a new 160-meter Beverage to Europe and spent every off-contest evening making contacts with the appreciative Europeans and off-contest daylight hours working everyone who was interested. Arriving on the island a little early and meeting with Geoff Howard, WØCG, at the house, we discussed the work recently completed and the success of the PJ2T club and the station in recent months.

KEY ELEMENT #3: Planning

After some prodding by Jerry, the three teammates sat down to discuss our plans for the contest. I had looked at the results from the prior two years. It seems that the Multi-two class had not become popular outside of the US. I also noted that in prior years the M/S scores were comparable to and in some cases better than the Multi-two scores.

It was obvious that we all wanted to operate as much as possible and we would have the best opportunity to score high with two radios instead of one. But with only three operators, we knew this would be a challenge to our endurance. We were fortunate to have Mr Endurance (WB9Z) on our team. Marty and I compliment each other, as he stays up late and I get up early—but Jerry just keeps on going.

Armed with propagation predictions and prior contest logs, I had previewed what is really an easy game plan for those operating from the Caribbean: Point all antennas north and run, run, run! So, our first day plans were based on those pre-game arrangements. We

PJ2T Breakdown—ARRL DX SSB 2003

Day	*Hour*	*160M*	*80M*	*40M*	*20M*	*15M*	*10M*	*Total*	*Cumulative*
1	0000Z	——	——	——	273/50	273/51	——	546/101	546/101
1	0100Z	——	——	112/30	226/6	——	——	338/36	884/137
1	0200Z	——	——	101/11	251/0	——	——	352/11	1236/148
1	0300Z	——	——	161/6	244/1	——	——	405/7	1641/155
1	0400Z	——	192/46	161/6	14/0	——	——	367/52	2008/207
1	0500Z	84/33	20/1	101/0	——	——	——	205/34	2213/241
1	0600Z	33/6	32/3	124/1	——	——	——	189/10	2402/251
1	0700Z	47/5	85/1	45/0	——	——	——	177/6	2579/257
1	0800Z	30/3	39/2	53/0	——	——	——	122/5	2701/262
1	0900Z	1/1	52/2	31/0	——	——	——	84/3	2785/265
1	1000Z	1/0	50/0	29/0	——	———	——	80/0	2865/265
1	1100Z	——	22/0	27/0	31/1	20/1	——	100/2	2965/267
1	1200Z	——	——	——	66/1	119/1	93/27	278/29	3243/296
1	1300Z	——	——	——	——	178/3	131/7	309/10	3552/306
1	1400Z	——	——	——	——	156/1	192/12	348/13	3900/319
1	1500Z	——	——	——	——	138/2	199/5	337/7	4237/326
1	1600Z	——	——	——	——	159/0	259/1	418/1	4655/327
1	1700Z	——	——	——	——	210/0	270/3	480/3	5135/330
1	1800Z	——	——	——	——	184/1	230/2	414/3	5549/333
1	1900Z	——	——	——	——	200/1	189/2	389/3	5938/336
1	2000Z	——	——	——	——	269/0	199/0	468/0	6406/336
1	2100Z	——	——	——	72/0	187/0	76/0	335/0	6741/336
1	2200Z	——	——	——	176/1	219/0	——	395/1	7136/337
1	2300Z	——	——	——	204/0	111/0	——	315/0	7451/337
2	0000Z	——	——	——	167/0	131/0	——	298/0	7749/337
2	0100Z	——	——	——	251/0	167/0	——	418/0	8167/337
2	0200Z	——	98/0	150/1	17/0	——	——	265/1	8432/338
2	0300Z	6/1	94/2	116/2	——	——	——	216/5	8648/343
2	0400Z	81/1	46/0	111/1	——	——	——	238/2	8886/345
2	0500Z	31/1	37/1	90/1	——	——	——	158/3	9044/348
2	0600Z	11/0	89/0	76/0	——	——	——	176/0	9220/348
2	0700Z	15/0	32/0	45/0	——	——	——	92/0	9312/348
2	0800Z	5/1	20/0	25/0	——	——	——	50/1	9362/349
2	0900Z	——	30/0	19/0	3/0	——	——	52/0	9414/349
2	1000Z	——	17/0	19/1	3/0	——	——	39/1	9453/350
2	1100Z	——	——	15/0	37/0	——	——	52/0	9505/350
2	1200Z	——	——	——	91/1	37/0	——	128/1	9633/351
2	1300Z	——	——	——	89/0	40/0	40/0	169/0	9802/351
2	1400Z	——	——	——	125/0	——	169/0	294/0	10096/351
2	1500Z	——	——	——	36/0	42/0	177/0	255/0	10351/351
2	1600Z	——	——	——	——	64/0	143/0	207/0	10558/351
2	1700Z	——	——	——	——	73/0	178/0	251/0	10809/351
2	1800Z	——	——	——	25/0	14/0	121/0	160/0	10969/351
2	1900Z	——	——	——	——	144/0	169/0	313/0	11282/351
2	2000Z	——	——	——	——	146/0	155/0	301/0	11583/351
2	2100Z	——	——	——	——	178/0	153/0	331/0	11914/351
2	2200Z	——	——	——	61/0	141/0	59/0	261/0	12175/351
2	2300Z	——	——	——	201/0	134/0	——	335/0	**12510/351**
Band Totals:		345/52	955/58	1611/60	2663/61	3734/61	3202/59		

would run Multi-two, with WB9Z and NWØL starting the show, and AE9B taking over for NWØL in the middle of the first night. Just prior to the contest, we found that one of the main radios was down. Fortunately, the PJ2T group had a spare Yaesu 1000MP locked away for "emergency" use. After some creative locksmithing, it was installed and ready to go.

KEY ELEMENT #4: Teamwork

Marty and I had been through this before: The contest starts, a problem creeps up and the guy who's supposed to be resting needs to get up and resolve the problem. In this case, the #2 computer was having sound card problems and Jerry was less familiar with the intricacies of *Writelog*. I get up periodically to assure that simple things (those that I can do) are done before bothering Marty on the main run station.

We lose a few QSOs on # 2, but 15 meters keeps cranking away. Several times, I jumped into Marty's chair while he troubleshot (and resolved) the computer issues with Jerry. Finally, after having a few too many problems with a particular computer sound card, Marty just swaps out a complete computer and sets *Writelog* back up on the network without skipping a beat. Fantastic! Team selection is only as good as those who are *team* members willing to work together to complete whatever is needed, whether you want to or not. This was truly a *team* effort.

KEY ELEMENT #5: Operating

With our game plan in place, Marty and Jerry ran 15 and 20 meters to start with, planning to switch over to 40 meters when 15 died. Jerry "the low band guy" would switch to 40 putting Marty "the run guy" back on the rate radio. Jerry, we later found, could run them just as well, but we knew that Jerry would be our best 40-meter operator, having had many years of experience working the split band. Jerry kept plug-

ging away on 40 meters through the night while Marty switched over to 80 meters for some fresh running.

By the time I got to sleep, it was time to wake up. With my energy level not exactly refreshed by the night's events, I prepared to run 160 and 80 meters while NWØL got some well-deserved rest. The total QSOs to this point appeared to be very good. I was thinking, "I can't let the team down." This thought went through each of our heads several times during the contest.

We were committed to each other and to the effort. Our original plans were for eight hours of run time followed by four hours of off time. And for the most part this worked, primarily because Jerry was capable of making it through the tough times both nights. I enjoyed working the low bands, pulling out the weak ones, giving that "little pistol" his contest contact with PJ2. I'm sure I missed a few, but if there was a mouse sneezing in North Dakota, I was trying to understand his message.

KEY ELEMENT #6: A Little Bit of Luck

Daylight brought new and stronger signals. As propagation, we hoped that we would have good signal strength into the States while most of their beams would surely be pointed to the East for the European opening. While we were able to hear many of the "Big Gun" east-coast stations talking to Europeans, we were able to work them easily. We found out later that even East-Coast-to-Europe contacts were difficult, and beams needed to be pointed south to get through to Europe. That meant *all beams point south!* This was the exactly the advantage we needed. Nobody could have predicted what happened that weekend. We were truly in the right place at the right time.

KEY ELEMENT #7: Half-Time Adjustments

After what seemed to be a great start, we discussed strategy every chance we had during the course of the contest. Marty had looked at prior years' scores and compared them to where we were now. We hoped, like all contesters, that what we had done during the first day would be good enough to give us a chance to win. Up to this point, we were still competing against ourselves, doing our best for each other. We had already made more QSOs in the first day than the PJ2T multi-single team had made in the entire ARRL DX CW contest a few weeks earlier! Would there be enough casual operators available in the US to continue the rate?

Many questions entered our heads as we began our second day. One thing that kept creeping up was our level of fatigue. I noticed, as I'm sure Marty and Jerry did that every time a new operator took over the rate seemed to increase. Was this a change in conditions? No, it was a change in operators. A fresh operator came in with new enthusiasm and energy, and was able to log more contacts. Because of this, it made sense that we change our plans for day 2. Our 8 hours on and 4 hours off plan worked for the first day, but with fatigue now entering the equation, we needed to adjust the plan to fit our new picture. So, after each of us received one more extended 2-, 3- or 4-hour rest period, it would be 2 hours *on* with 1-hour rest. This provided a fresh operator every 2 hours.

KEY ELEMENT #9: Persistence

During the course of the second night, rates reached painfully low marks, but the boredom and frustration were lightened with words of encouragement from other contesters stopping by for a quick chat. KØXM, K5NZ, K9PG and others stopped by for humorous interactions, which provided encouragement and motivation.

It was during this time that Jerry mentioned how "plugging away," or successfully enduring these tough times, is often the difference between success and second place. Looking back, I can't agree more. This is what makes those top guys the ones to beat. Several times in my young 4-year contesting career I "wished" I had tried a little harder, stayed up a little longer, etc. The difference is in the effort during the tough times, as I experienced first hand while operating next to Jerry. He was a figure of consistency, a diesel engine just continuing with the somewhat monotonous task of working one tough station after another. "Kilo Alpha Seven again….", "Kay Ay Seven Whiskey.... what's the last letter?" "Thanks for hanging in there" "QRZ, this is Papa Japan 2 Tango?" In a later discussion, we all noted that those of us living in the Midwest are used to digging out the tough ones. Even when times are good we have to do that.

KEY ELEMENT #10: A Push to the Finish

Daylight came again, and with it, some renewed enthusiasm. Marty awoke from his rest and after making some calculations wrote a "Post It" note at each computer listing the number of QSOs needed to make it to various benchmarks: 10 Million Points = X QSOs, 12 Million = Y QSOs, 13 Million = Z QSOs. These were good targets, something that I usually do at the Multi-Multi's at my house. Now we could see what it would take, and it became a race to see who would be the operator to turn the point total over the 10 million mark.

By now, fatigue was almost comical, with each of us struggling at some point to speak the same words repeatedly. Many call signs other than PJ2T were spoken inadvertently, needing correction. Anyone who has been to this level before understands what I'm speaking of. Even with 2-hour operating schedules, we struggled. The schedule was working, though.

Marty's voice was beginning to fail and he considered (after 10 million points were secured) taking an extended time off. Even so, he was back in the chair operating after a short rest. With about an hour left and a brief discussion of beer (Marty offering free beer for those who would join us after the contest), I reached into the refrigerator and opened a couple of Amstels (the local favorite) and placed them in front of Marty and Jerry (just a little more encouragement!).

A few more contacts and we reached a new goal: 12,500 QSOs. We had held off moving to 20 meters because the rates on 10 and 15 meters remained good. With the move to 20 meters, the final pileup on an extremely crowded band was incredible. There was no problem working them as fast as we could speak.

Both 15 and 20 meters kept us going to the final total of 12,510 QSOs and a score far beyond our original goals, but not beyond our ambition. We had, after all, made the effort to assemble a good team, in a good location, with good equipment, good planning, and we operated with persistence and determination. Success comes to those who are prepared when the opportunity arises. I'm sure glad the Propagation Gods shined on PJ2T that weekend. Thanks to each of you who logged a QSO with us. NCJ

Reflector Ramblings

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Comments on the IC-756 Pro II

…from the Central Texas DX and Contest Club reflector

I got a chance to use K5TWJ's IC-756 Pro II transceiver this weekend in the VHF contest (the June 2003 VHF QSO Party—*Ed*) and it was a real champ. We had a lot of slow time, and I got to twiddle a lot of knobs. The receiver performance was excellent, and I really liked how configurable it is. There are at least a dozen configuration settings that are extremely useful.

With the soft filter skirt setting, the IF cut controls were about as good as on the TS-850. (There's also a hard filter skirt setting, but I didn't figure out how to switch it in until later.) The FT-1000D is still the best I've heard in this regard, but I never saw the AGC pump from a nearby strong signal. When they'd beam our way, K5TR was sometimes 40 over. Within 5 kHz or so, they would still make it through the filters just a bit. If we moved 7-8 kHz away, they were gone.

The noise blanker was good, but nearby some jet skis (S6 buzz saw!) overwhelmed it. The DSP did a good job of smoothing out some noise without making the audio sound too weird.

I *loved* that all the buttons would work even while in transmit. I could poke around in menus and change all sorts of things while still calling CQ.

I like the fact that the CW sidetone and SSB monitor levels follow the main AF gain. But in addition to that, you have two options on each to tweak. One is a basic level set, and the other is a limit level. This means that if you crank up the volume to hear a weak one, your sidetone/monitor won't deafen you.

There's a great little feature that was handy when moving between SSB and CW. Say you've been working 6-meter SSB and decide to check out what's happening on CW. You slide down and hear a signal. As soon as you hit the CW mode button, though, the signal jumps out of the passband and you have to find him again. There's a menu setting to adjust the frequency when you change modes so that doesn't happen.

The dual VFOs are very flexible. Not only do you have controls to equalize the VFOs (A=B) and swap them, but you also have a Main/Sub button that lets you spin your second VFO off somewhere with the main knob while still working on your main frequency. There's a **Quick Split** function that lets you define a default split (say, up 5 kHz), so that when you hit the split button you're immediately set up to transmit up 5. When you hit the split button, the second VFO is active so when you grab the tuning knob, you're ready to move your transmit frequency. Finally, there's a **Split Lock** that keeps you from accidentally moving your main VFO (tuned to the DX station) while you're twiddling the second VFO (TX frequency), even if your finger slips off the XFC (listen-to-TX-frequency) button.

There's a nice "delta scanning" feature that we used a bit. It lets you select a width (say, 50 kHz) and initiate a scan of that width from the current frequency. I find that much more versatile than the standard band edge scanning (which is also included). That, together with the spectrum scope, made it hard for anything to get by us.

The only thing that disappointed me a bit was the **Dual Watch** function. You can listen to two frequencies in the same band simultaneously, and there's a balance control to set the mix of the two audio streams, but the audio output is mono only. Unlike the Yaesu FT-1000 MP transceiver, you can't hear the two VFOs in different ears. NCJ

The Simplest Sound Card Interface

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Like many contesters, I use a PC sound card as a "voice keyer" in phone contests. After trying the expensive RIGBlaster solution (which had a lot more capability than I needed) and wrestling for a while with RadioShack cable solutions, I hit on a simple circuit that seems to work really well. See Figure 1.

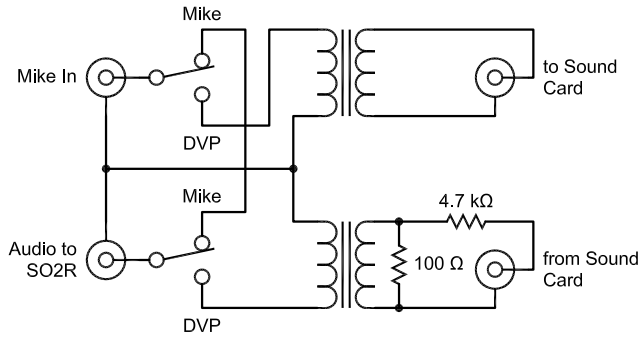

Figure 1—The N4ZR simple interface.

The transformers are 600-Ω RadioShack isolation transformers and the toggle switch is an ordinary DPDT. The whole thing is mounted in a plastic RadioShack project box. The sound card must be able to work full duplex (most are), which enables me to feed the mike through the sound card and back into the rig when using the voice keyer. I use an old ISA Sound Blaster 16 in my contest computer.

The isolation transformers prevent ground loop hum, which has been a bugaboo in my station for years. The only grounds in the circuit are on the sound card end of the two cables. The line to the sound card goes to its mike input, while the sound card audio comes from the line output. The voltage divider reduces the audio level to match the input level of my transceivers; with the switch in the DVP position, it feeds the sound card audio into the microphone input of my SO2R switchbox. I use the sound card software mixers to set levels—there is plenty of flexibility there.

If your shack is "hot" with RF, bypassing the to/from sound card jacks would probably be a good idea. You could also add a normally closed pushbutton to serve as a "cough switch", since the microphone is always on. I use a foot switch and software control rather than VOX, so this isn't a problem. NCJ

Contesting At HAMCON Colorado

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HAMCON Colorado was a great event for contesters to visit! Held May 30-June 1, 2003, there were contesting forums, a contesting suite, a DX/Contesting Breakfast and events to test contesting skill.

The Contesting Suite, sponsored by the Mile High DX Association (MHDXA), the Rocky Mountain DX Cluster, Western Wireless Contest Club and The Grand Mesa Contesters was open until the wee hours of the night both Friday and Saturday. There you could test your code skill with the CW Pileup Contest (audio by NØSS) or your left-footed keying skill with the QLF Contest (key designed by WØZA), as well as talk to other contesters.

The top score for the CW Pileup Contest was 50 calls by Steve London, N2IC, followed by Wayne Mills, N7NG/1, with 49. On their heels were K4UEE, WØCP and W7UT respectively. The QLF contest was won by Wayne Mills, N7NG/1, with the most error-free CW sent on a straight key with his left foot followed by Walt Stinson, WØCP, in second. W7UT, NØBN and KVØL rounded out the top five positions. The Grand Mesa Contesters also held the unofficial RUFZI contest in the vendor area with scores reaching over 25,000 points.

Saturday and Sunday Forums

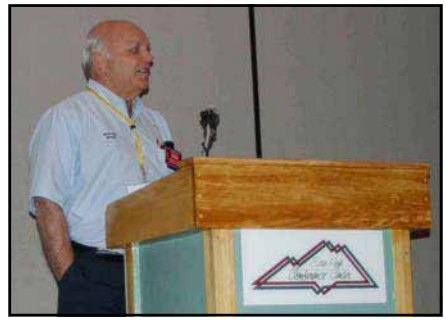
Forums were held all day Saturday as well as Sunday morning. Ross Harrell, NØZA, led the forum on "Getting Started in Contesting." This was the perfect forum for people who had never tried or were new to contesting. Ross pointed out that "backups are a good thing" because Murphy's Law can hit any and everyone.

He also suggested many useful tools for getting started in contesting including magazines such as the *National Contest Journal*. Another good way to get started is to contest with a club. If you like to collect QSL cards, contesting is a great way to find those missing states or countries.

Ross also discussed logging and dupe sheets. Now, many contesters have gone to computer programs such as *Writelog*. He also gave this reminder, "Set a goal such as 100 QSOs. Even small goals are a good way to get started."

Another well-attended forum that morning was "Choosing a QTH for Contesting and DXing" by Steve London, N2IC. Steve explained how when he decided to move he wanted to find the perfect contest location. By examining the terrain of your chosen location and a bit of work on the Internet, a contester can find out exactly how an antenna will work by both position and height before a single piece of metal has been raised.

Even contesting rivals were happy to see each other and enjoy a few gentle digs during HAMCON Colorado. During the WPX SSB Contest earlier this year, rival teams WØGU and KØDU fought a big battle for Colorado dominance. The teams consisted of Steve, N2IC and Bob, KØKR for the WØGU team vs Jerry, KØDU, Chris, KCØDKX, Don, KØDET and Larry, KØCL for the KØDU team. Though KØDU's team won, the members of both teams congratulated each other at HAMCON Colorado and both teams said they looked forward to the next matchup. They even managed to pose for a picture.



Wayne Mills, N7NG/1, speaking at the DX/Contesting Forum.

Saturday also held the ARRL DX/Contesting Forum with Wayne Mills, N7NG/1 as the moderator. The discussion included countries that aren't issuing new licenses and the ARRL Logbook of the World project. Wayne loves to contest and he talked about the kinds of stations that encourage the hobby in contesting including kid's stations and Multi-Multi stations.

Sunday morning Bill Leahy, KØMP, introduced three avid DX/Contesters at the DX/Contesting Breakfast. Wayne Mills, N7NG/1, Bob Allphin, K4UEE and Rick Dougherty, NQ4I, are all known for their contesting and DXing skills. In fact, they have all three enjoyed contesting while on various DXpeditions.

QRP Contest Tips

Sunday also brought more forums including the "QRP Contesting Forum" led by Al Dawkins, KØFRP, president of the Colorado QRP Club. Al has dedicated his operation to total QRP (5 W or less) for the last eight years. One question many QRPers are asked is "Why QRP?" Al explained there are a number of reasons, including the challenge of it, no interference and no neighbor problems at 5 W or less.

Al pointed out that "You can still paper chase while running QRP and there is competitive contesting." Contests are a great way to test out your QRP equipment as well. There are three types of QRP Contesting: casual, goal oriented and all out. "Power is not the big thing in contesting," he says. "The receiver is key to contesting. High,

Greg Dunn, WØZA (designer of the left-footed key) with Bob Peterson, W7UT, who placed third in the QLF Contest.

The two rival teams: Left to right Don, KØDET; Larry, KØCL; Chris, KCØDKX; Bob, KØKR (back); and Steve, N2IC.

Steve, N2IC and Jerry, KØDU.

Connie Schaffer, KØGAS, speaking at the YL Forum.

Al Dawkins, KØFRP, led the "QRP Contesting Forum."

Phil, NØKE, at the QRP Contesting Forum.

efficient antennas are also necessary. Full-sized antennas equal true competitive power, not watts."

Tools to help the QRP contester reduce the fatigue factor include CW and voice keyers, memory keyers and log programs so that the contester can be more competitive. "Preparation also helps," says Al. "Know the contest rules." It is also a good idea to test out equipment ahead of time for serious contesting and test *everything*. Know propagation and direction. "You are at the mercy of the propagation gods!"

Another important thing is to know when to run, when to hunt and pounce, and how many times to call a station. "When stations are piled up on you it feels like DX," he comments, "And QRP stations *can* hold a frequency in a major contest."

Another tip is to learn the contest abbreviations such as 5NN for 599 in code. Also, stay hydrated. Don't try to crack a huge pileup at the beginning of a contest. Put the frequency in memory if possible or write it down and keep checking. "After two or three calls with no luck, move on!"

Phil, NØKE, operates QRP from a number of places. He adds, "A DX call sign can be worth 30 dB to a QRP station.

YL Forum

Even the YL Forum had a section on contesting. Connie Schaeffer, KØGAS, says she "Has operated Field Day for 40 of the last 45 years." Other than the Novice Roundup Contest in her first year licensed and various Field Days, she didn't do any contesting until she took early retirement in 1980. Now she and her husband, Bob, KJØG, contest as often as possible. He usually does the CW contests and Connie does the SSB where a Lady's voice can often get through quickly. Still there are some contests such as the ARRL 10-Meter contest where they can operate together as a team.

HAMCON Colorado was a wonderful experience for both the experienced contester and the novice interested in getting into contesting with all levels of enjoyment and no experience required.

NCJ

Pete Smith, N4ZR
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MultiNEC 2.0

The most useful program I use for both antenna modeling and propagation prediction is not a program at all. It's also the only shareware for which I eagerly paid the registration fee the very first day I had it, but it's still not a program. What?

MultiNEC 2.0, by Dan Maguire, AC6LA, is a Microsoft *Excel*[1] application—that is, an extensive and integrated set of "macros" (pre-programmed *Excel* routines) that are run on top of *Excel* (97 or any later version). That means you must have *Excel* already on your PC, as well as some other freeware programs. But when you do, the fun begins.

Ease of Use

For those of you who have spent a lot of time with the amateur versions of various antenna modeling software, my reasons for recommending *MultiNEC* will ring bells, I think. It combines the ease of use of a standard *Windows* graphical interface with the full power of the underlying *NEC* modeling software, and adds the ability to easily do multiple simulation runs of an antenna while changing one or more aspects of the model in each run, viewing the results in a number of formats. And as frosting on the cake, there is a whole module devoted to linking *MultiNEC* with the *VOACAP* propagation prediction software, making it a snap to model propagation using real antennas under ham radio conditions.

To use *MultiNEC*, you start *Excel* and then load the workbook titled *MultiNEC.xls*. You'll probably spend most of your time at the nerve center of *MultiNEC*, the "calculate" worksheet. See Figure 1.

To build a model, you go to the "wires" worksheet, where you can either load modeling files produced by a number of other programs (*NEC*-2 or –4, *EZNEC*, *ELNEC*, *NEC-WIN* and its variants, *MMANA*, *AO*, *NEC-Wires*, and *Antenna Model*), or type in your own. Sources, Loads and Transmission Lines are specified on the Src-Ld-TL worksheet. If you want to use variables to specify a model so that you can easily change one or more and see the effects, you then go to the Equations worksheet and enter simple or complex variables. You use *Excel*'s "formula" function to enter the variables in your model.

Once all this is done, *MultiNEC* is ready to go. In the example shown in Figure 1, I was modeling a 4-high stack of 6-element OWA Yagis on 20 meters. I wanted to explore, given the classic 1X/2X/3X/4X height and spacing, which spacing would be best, and how performance of such a stack would vary across the band. To do this, I set the height of the lowest antenna and the spacing between antennas equal to the variable J. Then, by clicking on the **Generate Test Cases** button on the Calculate worksheet, I told *MultiNEC* to try each potential spacing from 40 to 60 feet across the entire band, and report the results.

You can readily view the results of a modeling run in a number of formats. FF Plot lets you examine the pattern in detail under each set of modeling conditions. Rect Plots graphs the data in a variety of useful ways, with the horizontal axis always being the last variable specified on the Calculate page. The Smith worksheet plots the feedpoint data on a Smith chart, and lets you add real-world feedlines to examine the effect on the VSWR at the other end of the line. Custom permits you to graph parts of the data or select various variables to graph against each other.

Powerful Flexibility

So far, most of the functions I've described are also in one or another modeling program (except the **Generate Test Cases** button, which I believe is uniquely useful). Maguire acknowledges, for example, that the modeling by equation function in *MultiNEC* is very similar to the excellent capability of *NEC-Win Plus+* in that respect. So why bother? Well, for one thing, *MultiNEC* permits using public-domain *NEC*-2 engines that are available free and can handle up to 5000 segments, where the most-popular amateur modeling program is limited to just 500, and even the most accommodating only allows 1500.

If you have ever tried to model your entire station, looking for interaction among antennas and structures at relatively high frequencies, you can appreciate what this means. For example, my relatively simple single-tower station requires 2806 segments for reasonable modeling accuracy at 28 MHz. I could not

[1] *Excel* is a registered trademark of Microsoft Corporation. *EZNEC* is a registered trademark of Roy W. Lewallen, W7EL. *NEC-Win Plus+*, *NEC*-Win *Pro*, and G*NEC* are trademarks of Nittany Scientific, Inc. *Antenna Model* is a trademark of Teri Software.

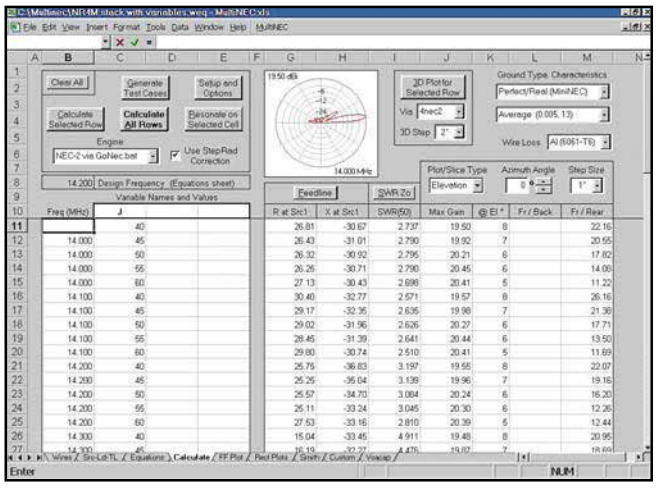

Figure 1—The nerve center of *MultiNEC*: the Calculate worksheet. You'll probably spend most of your time here.

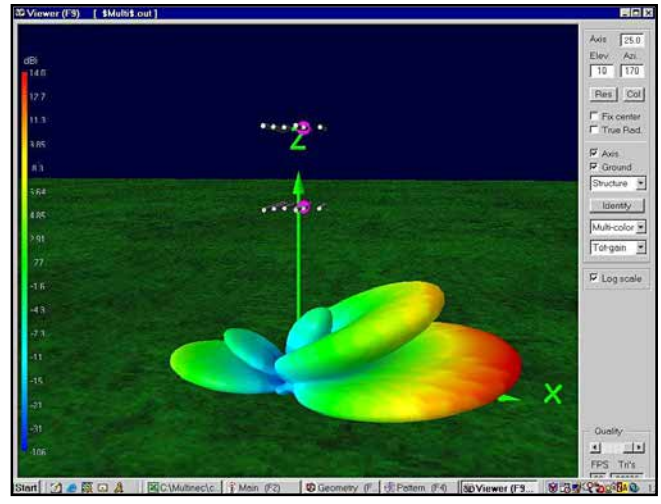

Figure 2—*MultiNEC*'s viewer for antenna geometry, 3-D antenna patterns and currents.

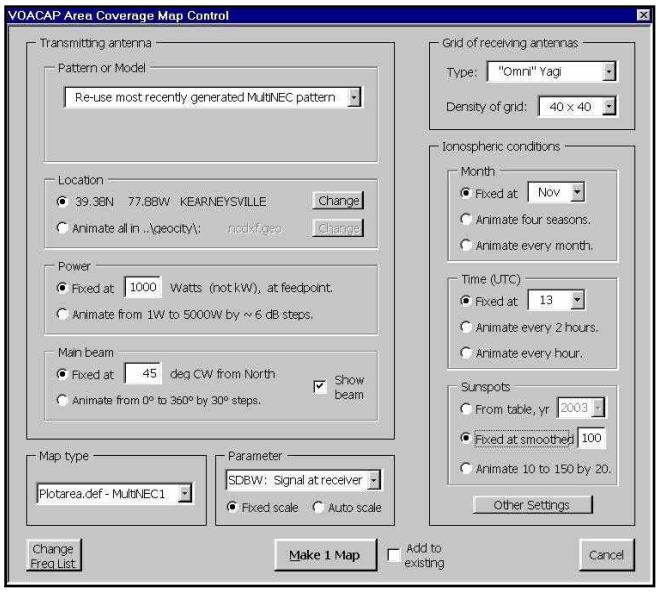

Figure 3—*MultiNEC*'s *MultiProp* module screen.

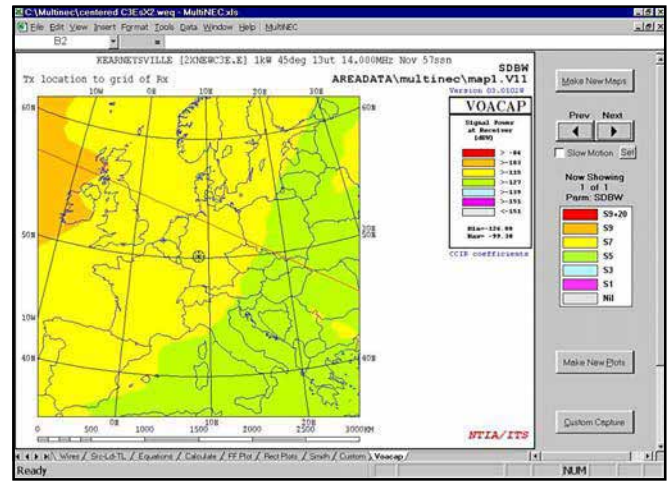

Figure 4—*MultiNEC*'s area coverage map from *VOACAP*.

model this before *MultiNEC* came along. While only a 1500-segment version of *NEC*-2 ships with *MultiNEC*, you can get all the bigger versions as freeware at **www.qsl.net/wb6tpu/swindex.html**, the Unofficial *NEC*-2 Archives. Be aware, however, that some *NEC*-2 executables do not use virtual (disk) memory; the 5000-segment version of one of these will probably require 512 MB of RAM.

MultiNEC also uses the power of *Excel* to automate many functions that are uniquely useful and were not available before. For example, you can simulate turning one antenna in a stack relative to the other(s) simply by specifying the degree of relative rotation as a variable, then running a series of simulations with different values of that variable, specified through the **Generate Test Case** function.

So It's Not Really a "Program." So What?

I began this review by saying that *MultiNEC* isn't really a program. In practical terms, that matters very little. You need to get used to using the function buttons within *MultiNEC*, rather than using the *Excel* menu functions that are arrayed across the top of the screen. For example, instead of using *Excel*'s **File|Open** command, you need to use *MultiNEC*'s **Open Model File** button. I found I very quickly became accustomed to this. Even if you screw up *MultiNEC*, since it is "just" a worksheet file and a bunch of *Excel* macros, you can readily restore it from the download and be back in business quickly.

In his introduction to *MultiNEC*, Maguire makes the point that it is not a stand-alone modeling program. For example, it does not include its own 3-D viewer for visualizing model geometry and antenna patterns. If you have any *Windows* version of *EZNEC*, any of the Nittany Scientific *NEC*-based programs, or *Antenna Model*, you can use their viewer seamlessly with *MultiNEC*. But even if you don't have any of these, you're not in trouble, because *MultiNEC* can also use the viewers that are part of an excellent *NEC*-2 "front-end" called *4NEC*2, which is distributed as freeware by Arie Voors and available (along with the "big" *NEC*-2 engines and various other goodies) from the Unofficial *NEC*-2 Archives.

Similar caveats apply to geometry checking, and to current visualization; you need another program for those. However, I find *4NEC*2 very easy to use with *MultiNEC*, and its viewers for antenna geometry, 3-D antenna patterns and currents are very well done, so there's really no problem. Figure 2 is an example of what I mean (it looks a lot better in color).

Another feature not included in *MultiNEC* is stepped-diameter correction, which is used to enable modeling of antennas built from telescoping aluminum tubing, a situation that *NEC*-2 doesn't handle accurately. *EZNEC* automatically applies the Leeson correction regardless of antenna pointing. If you have *EZNEC* but are using *MultiNEC*, you can use the *EZNEC* calculating engine (which imposes the 500-segment limitation) and get these automatic corrections. An alternative is to use the StepRad module that is supplied with the demo version of *NEC-Win Plus+*. This module's corrections are only accurate when the antenna is pointed directly along the x or y axes, but most modeling is done under those conditions anyway.

The *MultiProp* Module

Finally, let's turn to a truly unique feature of *MultiNEC*, what Dan Maguire calls the *MultiProp* module. While working in *MultiNEC*, click the *VOACAP* tab at the bottom of the screen, and you are transported into what is virtually a separate program. Dan has simplified and automated the user interface of the popular freeware *VOACAP* propagation program to offer a wide range of fascinating and convenient propagation modeling capabilities. See Figure 3.

Once you have downloaded *VOACAP* from **elbert.its.bldrdoc.gov/hf.html** and installed it on your PC, you can map MUF worldwide, visualize the predicted strength of your signal in a target area such as Europe through an entire opening, and even plot signal strength versus time and propagation mode to see the sunrise peak on the low bands with your own eyes. There are so many possibilities that Dan has produced an entire manual just for *MultiProp*. One of the best parts is that you can easily use the pattern of your real antenna, calculated by *MultiNEC*, as an input to *VOACAP*.

Figure 4 is an example of the sort of output you can get from *MultiProp*. It's looking at how well my tribander stack will get into Europe on 20 meters next November, during the CQWW CW contest. Again, color makes things stand out much better than on a black and white page.

Conclusion

MultiNEC is available by download (with an extensive manual) from **www.qsl.net/ac6la**. The free demo version is complete in every respect, so you can try all the features of the package before you register. Registration is $39, payable by credit card via the PayPal service. It's quite a bargain, when you consider everything it does. Registering will encourage Dan to keep adding features and capabilities, so *MultiNEC* can get even better. NCJ

Contesting for Fun

Brian Kassel, K7RE
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The Things We Did Last Summer

For contesters, summer can mean many things. Usually the ARRL Field Day and antenna work are both at the top of the list. Field Day 2003 was a blast for me, even though my QRP entry was hard pressed to compete with those low-band QRO signals. With the 10 and 15-meter bands all but closed, QRP becomes a lot tougher to compete.

This year, Todd Fonstad, N9NE, joined me. Todd is a great operator, a fellow QRP enthusiast, and, as I found out later, his humor is well matched to mine. That alone has to be scary! He drove straight through from Oshkosh, Wisconsin to join me in our Wyoming 2B effort. We used our well-loved Elecraft K2s at 5W, 99% CW.

We arrived at the Wyoming site on the Wednesday before Field Day, armed with some wonderful Wisconsin cheese, brats and a case of some great Wisconsin local beer. We wanted to enjoy the 5000-foot elevation, do some serious campfire chatting and play around with antennas. The antennas that we used in the event were going to be different than the ones that we had intended to play with, so no rules were broken. More about antennas later.

Unique Visitors

As I was operating outside on a picnic table, I felt a hand touch my shoulder. As I turned, I faced a tall biker, fully dressed in leather. He was tall, had a chest the size of a large beer barrel and not one female hormone in his entire body. Immediately he thrust his hand into his black leather jacket and withdrew a…QSL card! He was a ham with a WL7 call sign, his name was Bill and he was a track coach out on very long cruise, called an Iron Bottom Ride. Todd left his tent to join us and we chatted for some time. Wyoming hams are great, but there are just not enough of them when contests roll around.

While we were enjoying ourselves, an ancient, battered Winnebago drove by and began to set up camp about 100 yards away. All of a sudden, things started going bad for us. Clouds formed and bolts of lightning began flashing. The wind came up, higher and higher. We had to act quickly to keep the tents from blowing over. We used rocks, logs and every tent stake that I had in my portable operating arsenal. My "tie-wrap Special" antenna separated in several places.

We noticed that the mysterious Winnebago had left during the excitement. While we were erecting our antennas on Friday afternoon for Field Day, the Winnebago returned to the same spot. Curiosity got the better of us. As we slowly walked toward the vehicle, we noticed a cat, then another and still more. As we approached the door, a sight that seemed to be out of a medieval King Arthur's tale greeted us. A middle-aged lady with long, dark hair dangling from her shoulders peered from the interior gloom as a black cat darted between the vehicle and us.

The lady's head emerged, very cautiously. Before we could introduce ourselves, she began explaining how she had "around" 12 cats, several of which were black—her favorite kind. She also noted that she was being stalked by a pick up truck that has been seen around the campsite.

Now, folks, a pickup truck in Wyoming is no oddity, trust me. Just to keep the conversation going in a neighborly manner, we asked her for a description. It was green, had writing on the side, and the driver was wearing a brown hat—a perfect description of a US Forest Service person! We attempted to calm this lady, and to reassure her that the Forest Service truck was indeed simply doing his job. None of this washed with her completely, but she did seem to be a bit calmer. Of course, about this time, the weather began to clear, the wind died down, and 6 meters even opened up.

Todd and I decided, after several beers around the Friday night campfire, to call the lady in question the "Sorceress." She did fit the bill perfectly. Later that evening she approached us in the flickering light of our dying campfire with a pot of stew and asked if we would like to share.

"Uh, no. We don't think so. We are just *so* full of supper we just couldn't manage another bite." The answer would have been the same if we had been stranded on a desert island for weeks. After the Sorceress left, in good cheer I might add, we wondered what she had planned for desert—an enchanted apple perhaps? Sometime during the night, the Sorceress disappeared, never to return. Or did she? As we broke camp on Sunday afternoon, we saw a black cat dart past our spots and toward the place where the ancient Winnebago had been parked. Hmmmm…

Cheapskates

Another summer event in my "diary" was the opportunity to speak about wire antennas at the Sioux City, Iowa Hamboree. The title of the presentation was "Wire Antennas for Cheapskates." It must have been okay because I was asked to re-present the talk later the same day by some who had missed it.

Well, summer is all but gone, and perhaps we all are thinking of the upcoming contest season, which is right around the corner. Have all of those antenna-refurbishing plans come to fruition, or have other, more pressing tasks put them on the back burner? If so, what to do? Maybe if those plans were scaled back a bit, some additional performance could still be had without breaking the bank and without causing too much pressure on those last minute honey-do chores. How about some simple wire antennas? They are cheap, easy to put up and if they don't work to your specifications or expectations, they are completely reusable for another noble antenna experiment later.

Fun, Easy and Cheap—the 44- or 88-foot Doublet

Why 88 or 44 feet? Well, it turns out that the 88-foot length has a broad horizontal beamwidth, and on the 80, 40 and 20 meter bands, those two lobes remain constantly broadside to the antenna. That means the antenna can be erected broadside to the geographical area of interest and your signal will be always aligned correctly as you change bands. The 44-foot version performs the same way, but on 40 through 10 meters. The length is uncritical as the antenna is not resonant. There is several dB gain over inverted dipole. The disadvantage is that it requires a tuner and ladder line on all frequencies.

If you happen to own an automatic antenna tuner that will match a wide range, you can use a choke type balun and feed the balun with coax. This is the arrangement that we used during Field Day and it was effective. We actually used two 88-foot doublets, fed with 300-Ω balanced line, at right angles to each other and made it switchable. This allowed some amount of directional control. The K-2s automatic tuner remembered the settings for the various bands, so bandswitching during the contest was instantaneous. NCJ

Scott Robbins, W4PA

Since we last met, and it has been a while (sorry about that), we've lost some good friends. Dan Robbins, KL7Y, tragically lost his life on Halloween 2002 while on vacation on the Big Island of Hawaii. I was fortunate enough to a part of his last contest at KH7R for CQWW SSB just a few days before. October 31, 2002 was a very sad day indeed and will be a day that I never forget. The contest world lost one of the Great Ones on that day. Others that have left us too soon include Jim Maxwell, W6CF, who died February 6, 2003, and Sandy Lynch, W7BX, who passed away just a day later. And just a week prior to that, Cathy, the wife of Mark Obermann, AG9A, Cathy lost a short battle with cancer and passed away on January 31, 2003. During the February 2003 running of the CW Sprint, the bands were filled with, JIMs, SANDYs and a ton of CATs, a fitting tribute for our friends. W8OK also left us recently. Frank "Reverend" Schwab passed away on May 30, 2003 at the age of 77. And most recently, Steve Miller, N8SM, lost his life much too soon on June 15, 2003—Father's day. He was only 38 and was in the midst of building his dream contest station at his home north of Dallas. RIP everyone! Let's all remember to be good to each other and take good care of ourselves…and never forget our friends that have passed on!

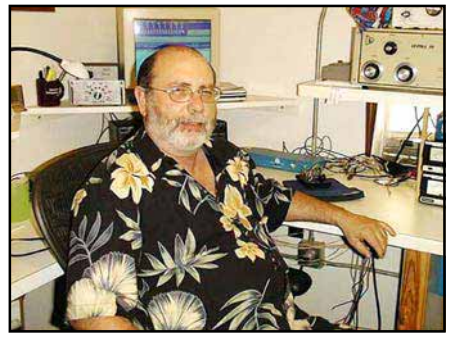
Moving along to happier topics, the last profile was on K5GA and boneheaded me got his last name wrong! Bob's last name is actually Hance, not McCarthy. Just kidding! K5GA was, is and always will be Bill Bradford. My apologies for that, Bill. They don't call me the King Lid for nothing!

This month we're going the land of W4, my first trip down there. If there's a CW contest on any given weekend, chances are that you'll hear this guy on the air hammering out the Qs. With the exception of a short stint of inactivity in the late '80s, Scott has been quite active over the past 20 years. He's been in the Top 10 in Sprint, NAQP, SS, ARRL DX and CQWW (all CW) more times in the past 5 years than I'll ever be in my life! He's also the only person to ever win SS CW in the QRP category more than two times in a row, winning it 4 times in a row between 1998 and 2001.

Here's more from Scott Robbins, W4PA…

A Contester from the Start

My Dad, W2DR, has been a ham since 1971. Growing up, we always had ham



Bill Bradford, K5GA, from the January/February *NCJ* Profiles column.

gear in the house and I really wanted to learn CW. So, he taught me the code and I passed the Novice exam in December 1981. I upgraded to General in 1982 and then Extra in January 1983 and got KY2P as my call sign then.

My first contact was during the Novice Roundup contest. My Novice ticket arrived on February 6, 1982 during the Roundup and I made 250 contacts that weekend. I upgraded to General in the summer of '82 and then my first all-out contest effort was the 1982 CW SS. I operated all 24 hours, made 660 contacts running 100 W to wire antennas and won the NNJ section, low power. I was totally hooked.

Over the next two years, I operated every contest I could think of, both modes, and in 1984 managed to place in the Top 10, LP, in the CW SS from NNJ. I finished in the LP top 10 for 4 years in a row from NNJ, twice losing the section because W2GD beat me and finished higher. I even managed to squeak out a low-power Top-10 finish in the 1985 SSB SS.

My contest Elmer, aside from my Dad, was W2GD, aka P4ØW. John lived in a neighboring town in New Jersey. He knew me and my Dad from the Cherryville Repeater Association and began encouraging me to get on the air for contests. After a couple of good finishes in SS CW and doing some local multi-ops, W2GD invited me down to W2REH to do a three-operator multi-2 in the 1986 ARRL DX CW. We won, and set a score record that stood for the next five years. This led to an invitation later that year from Gene, N2AA, to operate both modes of 1986 CQ WW M/M at the K2GL/N2AA superstation in Tuxedo Park, New York.

My interest in contesting began to wane in '87 after being at it for 5 years. There were a couple of people in the contest community in the Northeast who, to put it charitably, were not interested in seeing a younger, relatively new contester beat them and began to say as much to my face. I ended up moving to North Carolina in '88, and the radio was tucked away. I would manage to string up an antenna each place I lived, but aside from getting on each year for CW SS, I was essentially off the air for the next 5 years.

Back in the Saddle

Fast forward to '94—I was living in Atlanta and was working for Ham Radio Outlet, though I was still inactive except for 2 meters. Dave Fischer, WØMHS (now W7FB), came into the store one day and we began talking about contesting. Dave he put me in touch with Rick, NQ4I, who was going begging for operators at his multi-ops. A phone call led to an invitation to operate M/M at his house for the '94 CQ WW CW contest. I went over, intending to operate for a few hours and ended up staying the whole weekend. A light bulb went off in my head—I've been missing this! What a new world, though. When I stopped in '87, there was little packet spotting and computer logging was a myth. NQ4I was running *CT* with packet spots and integrated radio control. In short, I had a lot to re-learn besides copying the code.

I slowly got back into contesting over the next two years, operating at Rick's house a couple more times and operating some from my Dad's house in suburban Atlanta. I broke 1000 QSOs in CW SS for the first time in 1995 and the very next week moved to Tennessee to go to

work for Ten-Tec in their sales department. In 1997, I was promoted to my present position, Product Manager for Amateur Radio equipment for Ten-Tec.

I really got back into the swing of contesting in 1996, thanks to a group of people that later would form the Tennessee Contest Group. I started out operating from the visitor's radio room at Ten-Tec, then a home station in 1997-98. I started contesting full time from K4JNY in 1999. I ended up as a charter member of TCG in '97 and served as club president in '99.

Discovering SO2R

In '96, I also discovered the CQ-Contest Internet reflector and some of the people there were discussing techniques for operating SO2R. Having been out of contesting for years, I mistakenly thought that everyone was doing this. I decided I wanted to be competitive and, to do so, I'd better darn well learn how to operate two rigs. I devoted the next two years to learning how to do SO2R operation. I also decided that the time required to contest seriously on two modes was more than I had available. I made a decision to focus on CW. That's still where I am today. I found out that I was kind of an early adopter of SO2R and got a good jump on many other people.

SO2R began to pay off in 1998. In the '98 ARRL DX CW contest I was able to crack the Top 10 for the first time and finish #8 from Tennessee running a 20-meter beam, a tribander, wire on the low bands and two radios. Top 10 in the IARU (M/S), August NAQP CW and a win in the QRP category in SS CW rounded out the year.

The W4PA/K4JNY Station

A friendship that developed between Jeff, K4JNY, and me (via the Tennessee Contest Group) led to the creation of a mutual contest station at his new house in 1999. Jeff only operates SSB, I only do CW, so it seemed like a natural for us to combine resources to build a world-class contest station at his home.

We presently have four towers with stacked monobanders on 10, 15 and 20 meters, four elements on 40 meters at 120 feet, wire arrays for the low bands and several Beverages. Jeff lives in an extremely quiet rural area about 80 miles from my home in Knoxville and the results we have achieved in a short time from his location have proven that it's a winner. We look forward to more, better and higher in the future.

Personal

I don't have a competitive type-A personality at all. The mental challenge of contesting appeals to me more than the competitive aspect. I like to win and do well, but I am more interested in decoding the methodology used to operate the contest rather than doing it to beat other people.

My biggest thrill in contesting: Winning the 2002 ARRL DX CW contest. However, I think the first time I made the Top 10 in the CW Sprint I was beside myself for weeks afterward. I never thought I would make it that far; it meant a lot to me.

Dedicated Rocker

I began attending local rock concerts in the mid-'80s in high school, and started traveling to them when I entered college in 1986. I've seen the Grateful Dead more than 100 times.

My current favorites are jambands like Phish and Widespread Panic. I spend a considerable amount of my free time trading audio recordings of live shows over the Internet. I still do a lot of traveling to concerts; in a typical year I'll drive about 10,000 miles to go to shows.

Contesting has led to friendships outside of ham radio. K4RO and I have spent more time hanging out at concerts than we have talking and doing ham radio. To date, my travels to see live music have taken me to 45 of the contiguous 48 states. Good thing that contest season doesn't coincide with the music festival season! (What would Scott do if the Grateful Dead were playing in Knoxville the first weekend in November? That'd be a tough choice!—*Ed*)

Scott's Recent Achievements

- Win, 2002 ARRL DX CW at K5ZD. Top 10 in '98 (8th), '01 (2nd), '02 (1st), '03 (4th-claimed).
- Win and SO/HP/CW record, ARRL 10-Meter Contest at W4AN, '99. #2 in '00.
- Win, SO/HP/CW IARU HF 2000 at WXØB. Top 5 in '01 (4th) and '02 (3rd). #7 multi-single in '98.
- Four consecutive wins in the QRP category, SS CW, 1998-2001, #7 high power in '02.
- Top 10 in the CW Sprint, eight out of the last nine runnings. Best finish so far was #2 in September '02 behind W4AN and just ahead of N5TJ.
- NAQP CW: Top 10 in seven of the last nine, including Top 5 the last 4 in a row and a win (claimed) for Aug '02.

Contest season is here again! How about inviting some locals over and introducing them to contesting? Just imagine how much more fun this sport would be if each one of us got just one new person involved! No more Sunday doldrums in Sweepstakes… or any other contest for that matter! See everyone next time.

NCJ

Contest Tips, Tricks & Techniques

By Gary Sutcliffe, W9XT

Annual Station Maintenance

Autumn is right around the corner for readers in the Northern Hemisphere, and readers of this column are no doubt thinking about the upcoming fall contest season. Giving your station, especially your antenna system, a good check out now can save a great deal of grief later. A corollary of Murphy's Law says that equipment will fail at the worst possible time. For a contester that time is in the middle of a contest when the weather is very cold, or during a snowstorm. This installment of "Contesting Tips, Tricks & Techniques" covers some of the things our readers do for their annual maintenance work.

Tower and Antenna Supports

K4ZA suggests starting at the top of the tower and working your way down. He and Billy, AA4NU, tell us to check everything, and to really *look*. Ralph, K9ZO, brings a can of aluminum-colored paint. On his way down, he touches up areas of the tower that need it.

The obvious things to check include tower bolts and ground connections. Tighten the nuts on the boom clamps, rotator **U**-bolts and any antenna element clamps you can reach. Secure any loose cables. Check the tension of the guys as well as the hardware securing them. Verify that the tower is still plumb after working on the guys.

K4ZA and K1TTT recommend cutting any brush that might have grown up around the tower. I learned that lesson the hard way a few years ago when I started a grass fire thanks to an arc in a tuning section. I was tuning the amp at the time, and it only took a few hundred watts to set everything ablaze. Four fire trucks and about 20 firefighters put out the fire, but not before about an acre and a half of grass burned off. This was right before a contest, and I pretty much lost interest in operating. Fortunately, the only real damage was some melted coax near the base of the tower.

Rotators can also be a weak link in an antenna system. KB1H recommends checking the mounting bolts on the bottom of the rotor. Last year he lost a rotor when the bolts came loose and actually fell out. The twisting sheared off the quick-disconnect connector. Dick suggests using Locktite or similar product to keep the bolts in place. He says he has heard some people recommend bee's wax or paraffin for securing bolts, but suggests this may not work in warmer climates.

The control cable connections are another failure point that should be inspected. VE3PN suggests putting a protective coating over them. If you want to put connectors on the control cables near the rotator, look at automotive trailer connectors. They can handle the current, and are designed to be reliable in rough environments.

Turn your rotators through their full rotation, advises K1TTT. David also suggests having someone listen to the rotator when it turns. Bad sounds indicate something is going wrong. If the indicator meter jumps around, the internal pot is likely going bad, notes K9ZO.

Feed Lines

Connector failure is probably the most common problem in antenna systems, so this is one thing that you will want to check carefully. Look for signs of water contamination or corrosion.

Check your feed lines and control cables for nicks, cuts, abrasion or evidence of rodent damage. The loops around the rotor are the only moving part in a feed line, so take a careful look for abrasion, suggests KB1H.

Finally, N4ZR and K4SB suggest that you measure the feed line loss. If the loss has increased, it is time to replace the coax.

While you are inspecting the feed lines and other cables, label them if you have not already done so, advises Jim, K4OJ.

Antenna

Checking the SWR and resonant frequencies of every antenna is important according to several readers. If the SWR has changed, or the resonant frequency has moved, that's a sign that something may be bad or going bad, notes N4ZR. Pete goes on to say that it is important to write all this down so when you do it the following year you will know what has changed.

K1TTT echoes N4ZR's comments on checking and recording antenna SWR. David also notes that an *improving* SWR can mean your coax is getting *lossy*. The attenuation of bad coax will reduce the amount of reflected power making it back to the SWR bridge in the shack, making the reading look better than it really is.

Inside the Shack

Peter, VE3PN, suggests checking the audio and control cables and connectors. Peter notes that RCA-type connectors will sometimes spread out and not make good connection on the shield part. Unplug them and when you plug them back in make sure they are snug.

Another area I have had trouble in the past with is in the high voltage sections of the amplifier. Dust and other contaminants can cause high voltage arcing. It may not be very high current. I spent half of an ARRL 10-Meter Contest listening to what I thought was S7 line noise. It turned out to be very low current arcing across a section of the bridge rectifier section**.** *Be absolutely sure there are no dangerous voltages present when you clean these areas!* While I have the amplifier open, I also clean the contacts of the antenna relays.

Another thing to consider are the capacitors in the high-voltage section of your amplifier power supply. If you are not active during the summer months, turn the amplifier on for a half hour or so every month. This will keep the capacitors from deforming their electrolytic film. The heat will also help to dry out the amplifier, which is useful if the shack is in a damp basement.

Ed, K4SB, sends his transceivers back to the factory for a thorough review, alignment and such. Ed says this practice is a little on the expensive side, but they always find something wrong.

K1TTT suggests checking out any new electronic equipment recently acquired. Check for birdies and other noise these devices might generate. Also, run the station at full power to make sure you are not interfering with the new stereo or cordless phone.

While inspection is worthwhile, Bob, W9LO repeats the old advice "Don't fix it if it ain't broke."

Thanks

Thanks go out to the following readers who contributed their suggestions to this topic, including AA4LR, AA4NU, K1TTT, K4OJ, K4SB, K4ZA, K9ZO, KB1H, N4ZR, VE3PN and W9LO.

The next column will mark the 100th installment of "Contest Tips, Tricks and Techniques." We will do something a little different for that one, and I will not be looking for reader comments. In the meantime, please send me your ideas for the topic for the 101st installment. After all this time I am running out of fresh topics to cover!

Send in your suggestions for future topics by postal mail to 3310 Bonnie Lane, Slinger, WI 53086. E-mail me at **w9xt@qth.com**. NCJ

DX Contest Activity Announcements

Bill Feidt, NG3K
bill@ng3k.com

If you want to appear in the November/December issue, the deadline is September 18. You can submit your data using the form you'll find at **www.ng3k.com/Contest/consub.html**. If you prefer to e-mail your information, please include:

- Call sign to be used
- DXCC entity
- CQ Zone (for the CQ WW contests)
- Entry class
- QSL Route
- Your call sign and e-mail address
- Operators and other information of interest

Send your information to **bill@ng3k.com**. You can review what has been received to date at **www.ng3k.com/contest/conasc.html**. This Web page is continually updated as new announcements are received.

CQ Worldwide DX Contest, RTTY (September 27-28, 2003)

Call	*Entity*	*Class*	*Operators*
IG9A	Italian Africa	MO	IT9GSF + others
MD1LCR/P	Isle of Man	SO	M1LCR
VE3EXY/2	Canada	?	VE3EXY

Thanks to: IT9GSF, M1LCR, VE3EXY

CQ World Wide DX SSB Contest (October 25-26, 2003)

Call	*Entity*	*Class*	*Operators*
5JØX	San Andres	M/?	K4QD, W4WX, K9MDO, N1WON, N5VL, W9AAZ, W1LR, N2WB
CE4Y	Chile	SOSB 10M	CE4FXY
CN2R	Morocco	SOAB	W7EJ
D44TD	Cape Verde	SOAB	I4UFH
FS/AH8DX	St Martin	SOAB	AH8DX
HQ9R	Honduras	SOAB	WQ7R
IG9A	Italian Africa	M/	IT9GSF + others
IH9P	Italian Africa	M/2	IT9BLB + international team
J49Z	Crete	M/S	I2WIJ, IK8HCG, IK8UND
JW5E	Svalbard	M/?	JW5NM, JW7FD + others
KH6	Hawaii	?	KA0PGQ as KH6/KAØPGQ
LZ9W	Bulgaria	M/M	LZ1ZD, LZ1UQ, LZ1PM, LZ2HM, LZ2CJ, LZ2FV, LZ2PO, LZ2JE, LZ2UU, LZ3FN
P4ØA	Aruba	SOSB 20M	KK9A
PJ2T	Netherlands Antilles	M/2	K1AR, W1MD, WC4E, N8BJQ, K8NZ, WØCG
PZ5A	Surinam	M/2	KD5CQT, K2FF, W5UE, PZ5RA
TI5N	Costa Rica	M/M	AC8G, KA7KUZ, WA8LOW, W8ILC, VE3RZ, K1EP
TO5A	Martinique	SOAB	NH7A
VK9XD	Christmas Island	SOAB	VK2CZ
XU7ACE	Cambodia	SOAB HP	ES1FB
YJØX	Vanuatu	M/S	VK4TI, VK2IR, VK3FY, VK3WA
YN2EJ	Nicaragua	M/S	W5GCX, K5LBU + others

Thanks to: AC8G, AH8DX, CE4USW, ES1FB, I4UFH, IK8UND, IT9BLB, IT9GSF, JW5NM, K3HZ, K5LBU, KA0PGQ, KK9A, LZ2CJ, NH7A, VK4TI, WØCG, W4WX, W5UE, W7EJ, WQ7R NCJ

VHF-UHF Contesting!

Jon K. Jones, NØJK
n0jk@hotmail.com

A Tale of Two June VHF QSO Party DXpeditions (+TI5KD)

There were two major contest DXpeditions in the 2003 June VHF QSO Party. Kevin Bishop operated from Antigua at V25XX. Yours truly stayed at Ed Kelly, VP9GE's, Tarafal Apartments and represented Bermuda as VP9/NØJK. Many other DX stations were also active this year including V31MD, HK4BKB, TI5BX, TI2NA, HP2CWB, numerous KP4s, two KP2s, HH7PV, TG9NX, VP5KE, 9Y4TL, HI8ROX, YV1DIG, HR1RMG, FM5WD, FJ5DX, XE2TD, PJ7/K2GSJ, CO8DM, FG5FR, 6Y5/YO3YB, N4BQW/KH9, plus many others. This was one of the best June contests in years for DX.

The Contestants

Both V25XX and VP9/NØJK used the M^2 6M5X Yagi. I ran 100 W and Kevin used an amplifier. Keko, TI5KD, ran a kW to a large Yagi. Kevin was able to put his antenna high on the hotel roof where he is staying. My 6M5X beam was on a 20-foot tall mast, though it is on a high hill with a nice downhill shot to the States.

Perhaps the biggest difference between V25XX, TI5KD and VP9/NØJK is location. Operating from the east Caribbean, Kevin's single hop E-skip from Antigua reaches only to Florida. Everything else in W/VE is double or triple hop E_s for him. That's about the same situation for Keko in Costa Rica, although he can reach Texas and the Gulf Coast on a single hop. VP9 is located in FM72, which is within a single E-skip hop of the high concentrations of amateurs in W1, W2, W3, W4 and some of the W5, W8 and W9 call areas. Based on this, Bermuda should be a "sure bet" for the top scoring DX station in the June ARRL VHF QSO Party, right?

Before the Contest

Kevin and I both arrived prior to the contest to set up our stations and check things out. Kevin worked a great E_s opening to Europe on June 12. I arrived in Bermuda on the 12th and Ed, VP9GE, reported that he had not heard any Europeans. Hmmm…

I began setting up early morning on Friday, June 13. I put up a temporary 2-element Yagi on a 10-foot mast to monitor 6 meters while I put the 6M5X together. N4SC/8 was the first station in the VP9/NØJK log at 1303 UTC. At 1352 UTC, CT1EEB in Portugal was worked on both SSB and CW. Later EH7KW and CT1EPC were logged. The DX was interfering with me putting the 6M5X together!

Finally, I got the big Yagi built and installed on Ed's mast at 2230 UTC June 13. Friday evening there was a tremendous E_s opening on 6 meters from VP9 to W1, W2, W3, W4, W5, W7, W9 and even California. I logged 18 W6s on double-hop E_s. Most of the contacts were made while running the 10-W MFJ-9406 transceiver.

The Contest

Saturday morning Kevin at V25XX had E_s to the Midwest and even to K6IPF in CN80 in California. From Bermuda, I enjoyed only some single-hop E_s to Florida. About 10 minutes before the start of the contest, I found Kevin and we chatted briefly about band conditions. After the QSO, he was back to CQing and establishing a run frequency. Right before the contest, KP2/K2ZZ popped up on 50.100 MHz. I figured KP2 might be a tough one to find in the contest. I worked him and kept him talking. I hoped the E_s to his area would last until the start of the contest at 1800 UTC. It does… and KP2/K2ZZ in FK78 became June 2003 VHF QSO Party contest QSO #1 for VP9/NØJK.

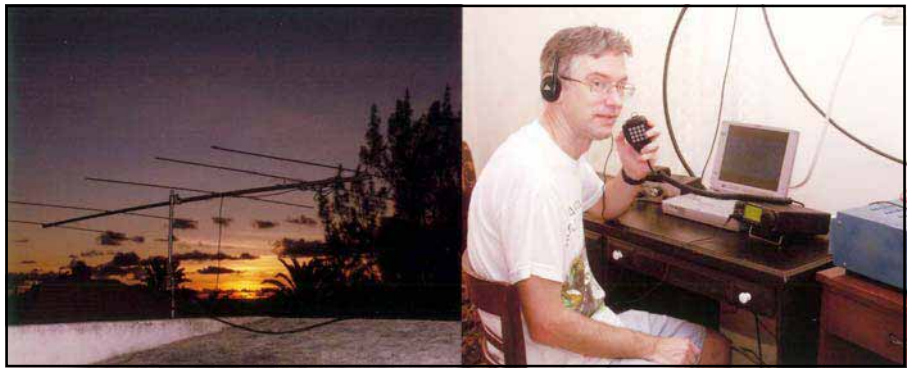
I swung the Yagi toward the States and began CQing on 50.102 MHz. There were weak single-hop scatter/E_s to W4, W8, W9 and WØ. Some of the QSOs were beyond the normal single-hop E_s maximum range of 2200 km—to what is known as the "E_s void." This is usually a difficult distance to work because it is between the normal single- and double-hop range for E_s. I worked KØAZ in EM37 at 1821 UTC and K1MOD in EN40 (for his country #100 on 6 meters) at 1830 UTC. I could not get much of a rate going, but I managed to make QSOs via CW every couple of minutes. There were no takers on SSB, though. Meanwhile, Keko had a big pileup to Florida. Kevin worked many stations in W4, W5, W8, W9 and WØ and everything else in between including KØMN at 1844 UTC. I was beginning to fall behind. At 1900 UTC, Kevin logged FY1FL, but this was a zero pointer for him.

Starting around 2000 UTC, KF2HC/KP2 had an opening to Europe. He worked into France, Italy and other countries. F6HRP spotted KF2HC/KP2 "599" at 2027 UTC. KF2HC/KP2 could count all his European contacts for QSO credit in the contest. But other DX stations like Kevin, Keko and me could not. More on this later.

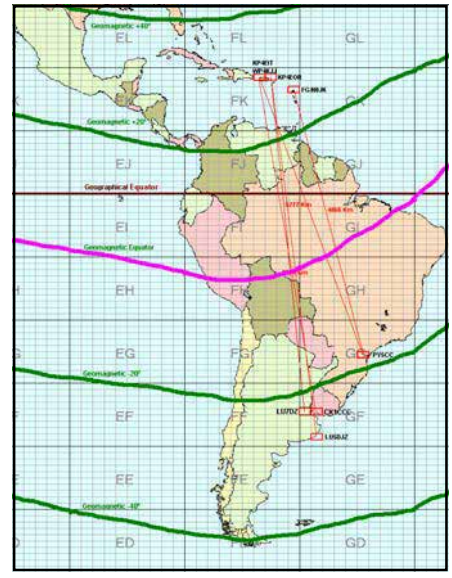
As Saturday afternoon wore on, I had a short opening to W1 land, working

V25XX's Yagi.

VP9/NØJK



VP9/NØJK Yagi and station.



Trans-equatorial propagation and the geomagnetic equator.

FN25, FN43 and FN44. Sam, W5VHF in EM25 was logged at 2100 UTC. V25XX continued to work double-hop E_s until 2257 UTC on the 14th. It was nice run for Kevin. Late Saturday afternoon K5AM in New Mexico suddenly appeared at 2257 UTC for my best DX (that I can count for the contest). K5AM was booming into Bermuda and he was the only signal on an otherwise dead band. After K5AM faded out, the band opened to Florida and Texas.

Most of Saturday evening was a real struggle for me to make contacts. Seems most ops were either pointing their antennas away from me (W4) or I was covered up by strong single-hop stations they (W5s) were working. K5TR was heard with a good signal for about 10 minutes, but I couldn't break the pileup on George. AE5B in EMØ2 heard me and went into the log. I couldn't get any kind of run going and had to call every station I heard many times to get their attention. Some had trouble with the call, and one station didn't know what Bermuda was or where it was located.

I finally shut down at 0200 UTC, disappointed and depressed. My score stood at 9000 points. I grabbed a Heineken and drank it while stewing over my log. V25XX, meanwhile, enjoyed a great triple-hop E_s opening to California at 0205 UTC and worked all the way to San Francisco. This was outstanding stuff, as San Francisco is about as far from Antigua as Paris, France. Even with the great F2 from the solar cycle peak, many need V2 and VP9, especially out on the West Coast. During this time frame the central US had a wild 6-meter E_s opening and even some 2-meter E_s.

Sunday June 15

I was up early Sunday morning and heard a number of stations coming through on scatter on 6 meters. Bermuda is in the Atlantic Standard Time zone. The band sounded a lot like what I hear from Kansas in the June contest, with W1, W2, W3, W4 and W8s coming through as I made coffee, but it was 0900 UTC and the Yagi was pointed to the northwest. I worked N2PA, and K1TEO on scatter. K8GP had a great scatter signal. Almost get W2SZ/1 logged, but the operator had trouble with my call. Running only 100 W made it tough to complete scatter QSOs.

E_s began to Florida around 1745 UTC. This time I had Florida's "undivided" attention and I worked many stations up and down the state over the next two hours. Signals were strong and the band was stable. I logged 5-W rovers in Orlando running whips and halos! V25XX had weak E_s to Florida around this time as well. TI5KD reported strong single-hop E_s to Florida all morning Sunday.

DX Land in the Caribbean

Early Sunday afternoon I began to hear many of the regional DX stations. None of these are worth any QSO points to work, but I logged a few including a loud FM5WD, PJ7/K2GSJ, TI5KD, FP5BU and V25XX. Kevin told that he had 240 QSOs and 97 grids so far in the contest. Kevin was my QSO number 185. I heard YV1DIG and 9Y4TL working into W1.

It was interesting to listen to the DX stations work each other on E_s. I did not realize how much E_s is present in this region, and the DX stations here work each other on 6 meters routinely. It is like Kansas working Ohio and Florida on E_s. I managed to find KF2HC/KP2 FK77 for a new QSO and grid multiplier. KF2HC/KP2 had a second opening to Europe Sunday and was spotted in DL, G, ISØ, ON and PA.

Europe into VP9!

Loud video carriers from Europe started at 2010 UTC. I worked VE1YX at 2011, then pointed the Yagi to England. I CQed on 50.122 MHz and a pileup of Gs, ONs and a PAØ began calling. Over the next 30 minutes I logged G, GW, and ON stations (the PAØ disappeared). Many Europeans need VP9 and my QSO with GW3LEW was a "6 Meter First" between Wales and Bermuda! MW1MFY spotted me "599" at 2041 UTC! It was a fun and exciting opening, but none of these contacts would help my score. I worked the European opening for the sheer joy of VHF DXing and to give out a rare "new one."

About this time, V25XX began a multi-hop E_s opening to VE1, VE2, VE9, W1, W2, W3, W8 and W9. It looked like a sure victory for V25XX, or maybe KP2/KF2HC.

The "Mother Lode"

Late Sunday afternoon I finally got a decent E_s opening to the "mother lode"—the high-population-density W1, W2, W3, W4 and W8 call areas, starting at 2200 UTC. Over the next couple of hours I made over 250 QSOs and the tide turned for me in the contest. The *CT* rate meter hit 199 at 2216 UTC! Most of the contacts were to W4, but a number of W1, W2, W3 and W8s got into the log. I got some dupes, but work them anyway. I guess some wanted an insurance QSO.

At 2343 UTC, I worked Bernie, W3UR's, daughter, KB3JIU. Bernie says it was her first DX contact ever. I am proud of that contact. The band closed for V25XX at 0020 UTC, but remained open for over another hour in Bermuda. I checked 2 meters every so often, but no E_s or tropo was noted. It was fun to call K8CC and give Dave a new multiplier. The last station I heard on 6 meters was K8GP CQing at 0140 UTC June 16. I finished with 371 QSOs on 6 meters, including the DX.

TI5KD made 332 QSOs in the contest. V25XX had 294 QSOs, 116 grids with DX QSOs included. After culling out the DX contacts and dupes, I ended up with about 355 contacts. Operating the ARRL June VHF QSO Party from Bermuda was an interesting experience, though not quite what I had anticipated.

Analysis

The 6-meter E_s opening Friday evening was outstanding in Bermuda. If the contest had started one day earlier…oh, well! Saturday afternoon

was interesting, but Saturday evening was a disaster for me. Kevin at V25XX experienced a much better Saturday from Antigua. TI5KD had a good Saturday to most of the US, and a long-duration E_s opening Sunday to Florida. On Sunday afternoon and evening, things finally picked up for me in Bermuda. Here is why this may have happened.

The geomagnetic field was active with minor and even major storm levels during Saturday. The K index went to 6 at 2100 UTC on July 14. Some experts believe high geomagnetic activity suppresses mid-latitude E_s formation. Others feel E_s still occur, but it is pushed south of where it would normally form (Dr Sheila Kirkwood, 1999). The E_s propagation observed in the 2003 contest would tend to support the latter theory. Reviewing spots for US stations, they heard many DX stations in Central America, the Caribbean and the north part of South America on Saturday and Sunday in the contest. V25XX in Antigua was located further south than Bermuda, and experienced better E_s to the States than I did Saturday. The high geomagnetic activity favored Kevin with suitably located E_s clouds for much of the contest. Though he is a double hop from most of the US, he had E_s that supported long double-hop openings on 6 meters.

What about the great results for the Texas stations? Austin and San Antonio are located about 40 degrees north of the geomagnetic equator. This is the same geomagnetic latitude as south Florida. Bermuda is quite a bit farther north from the geomagnetic equator. So, the E_s would tend to form farther south when the geomagnetic field is active and favor Florida, Texas, New Mexico, Arizona and southern California. Look at where the big QSO totals on 6 meters came from in this year's contest.

The K index dropped Sunday afternoon, and E_s conditions improved in Bermuda. Not that I would make too much of this. No one including the "experts" knows for sure why E_s occurs. E_s by definition is "sporadic," but recent studies tend to show an inverse relationship between geomagnetic activity and where E_s forms.

The June 2003 VHF QSO Party had great E_s propagation. Many are considering it one of the best contest years of all time. It certainly was outstanding for the W5s in Texas Saturday evening. But for others, Saturday was not so good. Unlike what I consider the all-time "best" years of 1987 and 1992, 2003 had one good day (Saturday) and one mediocre day for most (Sunday). The 1987 and 1992 June VHF QSO Parties had great E_s conditions *both* days of the contest. Oddly, for me in Bermuda in 2003, Sunday was the better day.

DX Stations in the ARRL VHF Contests

While calling stations in frustration Saturday evening, it dawned on me that the ARRL VHF QSO Parties are not "DX user friendly." Unlike the ARRL DX Contests, where DX stations are sought after, or the CQ WW contests, where DX stations can work each other, in the ARRL VHF QSO Parties the DX stations are at a significant disadvantage.

Many stateside stations encroach and operate in the DX window on 6 meters, making it difficult for a DX station to be heard. When there is strong single-hop E_s in the States, the weaker DX stations are often covered up. The current scoring gives no "bonus" for working DX. My FM72 grid is just as rare as EMØ8 in Kansas, and worth the same points. So why chase after a DX station when they are worth the same points and multipliers as the EMØ8 in Kansas? This is one of the nice features of the grid scoring system—that one can drive to a rare grid and be DX in the contest. But for those expending time, money and effort to operate from a rare country in the contest, there seems to be no incentive. That said, for many contest operators, working a rare DX station during the contest is a real thrill. It adds spice and excitement.

It was disappointing for Kevin and me to not to count our DX contacts for contest credit, while a station operating in the Virgin Islands or Puerto Rico can. To top it off, I found out the ARRL will not be awarding any plaques to the top scoring DX stations in the June VHF QSO Party this year.

There has been much discussion about how to increase activity and log submissions in the ARRL VHF Contests. There were many DX stations active this year in the contest, but one wonders how many will bother to send in a log? Having the DX stations active in the contest stimulates activity and made the contest more interesting for many of the W/VE contestants. Many worked new countries for their DXCC (K1MOD completed his 6-meterDXCC) and rare grids for VUCC. It would seem a few simple rule changes would make the VHF QSO Parties much better for the DX stations, which in turn would benefit many others in the contest, and increase log submissions. These could be allowing DX-to-DX contacts in the contest if the DX stations have made some W/VE QSOs (or DX-to-DX if one of the DX is in North/South America and worked W/VE), and plaques and certificates for top scoring DX stations and perhaps a bonus to W/VE stations for working DX stations. If these changes are not made, I can see DX participation in the June VHF QSO Party dropping over the next few years.

Many of the major summer VHF DXpeditions already avoid scheduling their operations during the June VHF QSO Party. Why should a DX station fight to be heard through the contest interference when after the contest you have the band all to yourself and everyone is looking for you? I believe DX stations *do* want to participate in the June VHF QSO Party. They also want a contest that is more fair and interesting for them. I hope their requests will be heard.

I plan to operate the September VHF QSO Party from Bermuda again as VP9/NØJK. I also hope there may be an E_s opening, and will be looking for tropo on the higher bands. I plan to have *JT6M* and *WSJT* software this time for digital contacts. I also will be active n the CQ VHF Contest portable from the rare grid of EMØ8. I plan to cover the CQ VHF Contest in an upcoming column.

NCJ

John Fleming, WA9ALS

PSK63—SO24R?

The newcomer on the digital block is PSK63—I call it PSK31 with *attitude!* Although PSK63 has twice the bandwidth of PSK31, it's blazingly fast at 100 WPM and has other features that are attractive to a digital contester. Although PSK31's slow speed is attractive to keyboarders for casual ragchewing and DXing, it has enjoyed limited success in contesting. With PSK31, you just can't expect the fast-rate mayhem that RTTY contesters presently enjoy.

Skip Teller, KH6TY, started looking for a suitable variation of PSK31 that might better fit a contester's libido. None of the existing PSK variants or other modes seemed any better fitted for contesting. They were either too slow or too wide. Enter PSK63—fast, only twice the bandwidth of PSK31 and, interestingly, not present in any other digital programming thus far. Skip's brainstorming got a big boost when Moe Wheatley, AE4JY, introduced *PSKCORE.DLL*, a software component that allows software authors to easily build a PSK31 program without understanding the details of DSP, etc. Moe agreed to modify *PSKCORE.DLL* to accommodate PSK63, and in that breathtaking moment, the ability to include PSK63 was realized for all software authors!

For existing PSK31 authors, all they had to do was replace the old *PSKCORE.DLL* with the new one and their program was ready for PSK63. In fact, we could do it ourselves! On May 24, Skip announced to the RTTY reflector that a fast new digital contesting mode was available, and posted instructions for using Moe's *WinPSK* (**www.qsl.net/ae4jy/winpsk.htm**) to operate PSK63 on his Web site at **www.qsl.net/kh6ty/psk63**. All we had to do was make two folders of *WinPSK*—one with the older PSK31 *PSKCORE.DLL* and another with the newer *PSKCORE.DLL* that accommodates PSK63. Then we just made the appropriate shortcuts for our desktops, and operating *WinPSK* in either PSK31 or PSK61 became a double-click away! Now *WinPSK* v2.13 supports both PSK63 and PSK31 in a single program folder using an even newer version *PSKCORE.DLL*, v1.17.

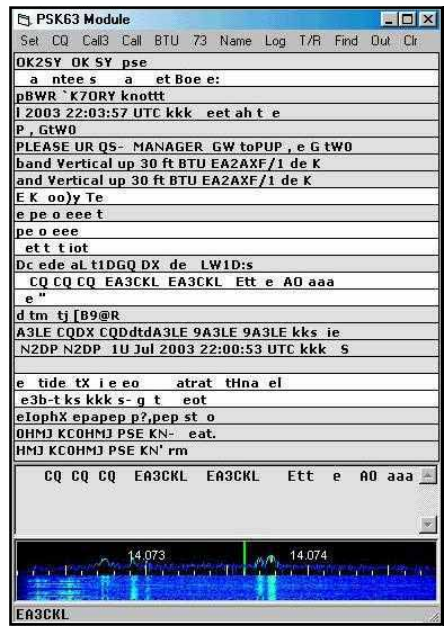
Increasing Momentum

With Moe's advent of the PSK63-capable *PSKCORE.DLL*, any program utilizing the software component was immediately able to use PSK63. The momentum further increased due to Dave Cook's (WAØTTN) ActiveX-packaging software component (**www.netdave.com/wa0ttn/WinPSKX21.asp**), which allows easy incorporation of Moe's *PSKCORE.DLL* into any *Visual Basic* program. Thus, anyone with knowledge of *Visual Basic* could now write a PSK63/31 program! Furthermore, since ActiveX was designed to work with either *Visual Basic* or *C++*, *C++* programmers can also easily use ActiveX to incorporate *PSKCORE.DLL* into their existing contesting software and afford PSK63 functionality.

Multi-Channel Decoding

QuickPSK and other PSK31/63 programs are not contesting programs, and thus it became desirable for PSK63 to be incorporated into a veteran contesting program. What does all this have to do with SO24R? Well, fasten your seatbelts and hold on—you haven't heard anything yet!

Narrow bandwidth PSK modes are suitable for multi-channel decoding, and Joe Farina's *W1SQLPSK* program (**www.faria.net/w1sql/psk31.htm**) braved the multiple-channel decoding waters. Skip took this concept a step further with the introduction of *QuickPSK*, which is capable of decoding 24 channels of PSK63 (or PSK31) simultaneously! Left-click a waterfall trace and decode PSK63, right-click and decode



Screenshot of *PSK63 Module* showing its 24-channel display and dual-mode tuning indicator (waterfall and spectrum).

PSK31. Now that we had a multi-channel decoder for the fast PSK63 mode, contesters' blood started warming to the possibilities!

Skip now has a functional beta program (called *PSK63 Module* for now) that could afford 24-channel print to the likes of *WriteLog* (**www.writelog.com**), *N1MM Logger* (**pages.cthome.net/n1mm/**) and others. Skip's program would replace the normal RTTY print window with a resizable window with 24 rows of print from 100-Hz wide band segments. At the bottom of the window are both waterfall and spectrum displays, with frequency references. See Figure 1.

Clicking a call sign would capture it and place the transmitter on the correct frequency. Thus, the ability to print 24 channels and transmit on any of them is equivalent to SO24R!

But wait, it gets better. What if your contesting program allowed opening of two instances of Skip's 24-channel *PSK63 Module*, and you could be decoding 24-channels from each of two radios, each on a different band? SO48R! The possibilities become overwhelming. Even with 24 channels, Don, AA5AU, said, "Wow, this 24-channel deal is a little mind blowing. Right now, there are 14 channels printing on 20 meters (PSK31). I haven't made any contacts, but the possibilities for contesting seem immense even for a multi-tasking guy like me."

We can already use two instances of *MMTTY* (**www.qsl.net/mmhamsoft/**) with *WriteLog* to decode RTTY from two radios (SO2R) on a single computer (see **www.qsl.net/wa9als/so2r-mmttyx2.htm**). To use two instances of Skip's 24-channel PSK63 program, we only need the functionality to direct each to a distinct soundcard, analogous to *MMTTY's* "Device ID" selection. Shortly after I asked Skip about this, he introduced soundcard choices to his *PSK63 Module,* so SO48R is already within reach!

A Downside?

Is there a downside? Where is the "catch?" I'm not sure there are any serious catches, but let's explore a couple of concerns that have come up on the RTTY reflector shortly after the announcement of PSK63. Earlier on, we had the critics of PSK31 saying it was too slow for contesting. Now we have critics saying that PSK63 might be too *fast!* It *is* fast at 100 WPM—an advantage to the operator with 24-channels (or more) of printing call

signs. It will certainly stretch the current crop of SO2R ops to keep interleaved QSOs going on two radios at 100 WPM, but I'll bet we see it.

What about "AGC-capture?" When a strong signal appears in the passband, it captures the AGC, and you can lose print of a weaker signal. Using a narrow filter or other DSP options available in some rigs might allow you to move an offending strong signal out of the passband and eliminate the AGC capture. However, to print the most signals possible, it might make sense to use a 2.4-kHz passband instead of the narrow 250-500 Hz filters we are used to using for RTTY contesting.

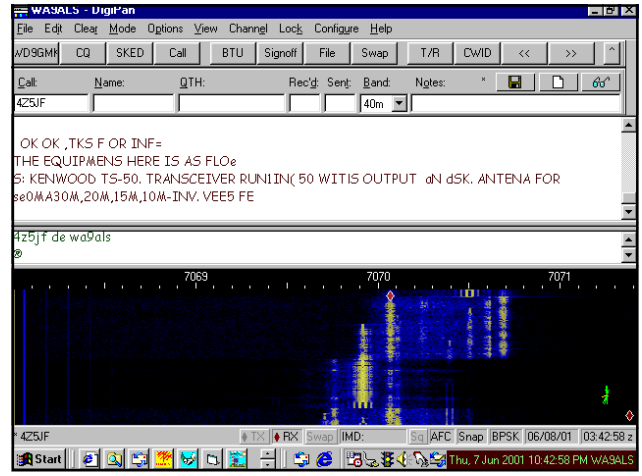
Although we experience AGC-capture in other modes, digital modes that utilize a waterfall display can demonstrate this effect visually. Figure 2 shows what happens when a strong PSK31 signal appears in the passband of a 500 Hz filter while printing a weaker signal—the stronger signal nearly wipes out the weaker signal and print is lost. However, using DSP features in the rig, the offending signal was moved out of the passband, thus restoring the weaker signal and its print.

Since several PSK63 or PSK31 signals can fit in the passband of even narrow traditional filters, AGC capture is a real consideration. This can happen even with very narrow filtering, e.g. that available in the IC-756PROII transceiver.

In summary, until software is further developed, operators will have to find a happy medium between using narrow filters and having fewer channels printing and using wider filters and having more channels, but increased chance of AGC-capture problems. Of course, AGC-capture would be dependent on propagation, ERP in use, individual rigs and filtering, and a host of other variables. Similar examples can be found on my website at **www.qsl.net/wa9als/passband.htm**.

"What about tuning? Tuning PSK is hard!" In fact, tuning PSK (31 or 63) manually is difficult with a waterfall display and easy with a spectrum display, whereas tuning using a mouse is easy with a waterfall display and more difficult with a spectrum display. Skip's *PSK63 Module* displays both types, and thus tuning really isn't a challenge anymore.

So when is the action going to start and who is going to be operating? In addition to present PSK ops, I think it's important for experienced RTTY ops to participate in the evaluation of any new digital contesting mode. They have the most experience with fast-paced operating and therefore are the most demanding of speed and operability for any features that increase the number of Qs and overall score. The first PSK63 contest has already been announced—the "Quick PSK63" sponsored by the Digital Radio Reflector, to be run on September 6 (**www.netsync.net/users/obrienaj/quickpsk.htm**). The "Grid Dip PSK-RTTY Shindig" included all forms of RTTY and PSK on August 2 (**www.n2ty.org/seasons/tara_grid_rules.html**). Early results from these contests and further discussion of PSK63's performance should be available by the time you read this column.



Screenshot of the *Digipan* waterfall printing a signal at 7070.08 kHz. The printing trace is the one marked by the diamond near the frequency display.

The Future of PSK63

Will PSK63 ever replace RTTY as the premier digital contesting mode? My emotions doubt it, but then again, I'm a little prejudiced. A lot will depend on participation and overall performance of the mode.

Although PSK modes perform relatively well with low power and modest antennas, all bets are off during a contest. Witness the first RTTY Roundup PSK plaque being won in 2000 by Barry, W2UP, with no less than 1000 W of power and phased Yagis! However, some of us have been impressed with the 24-channel decoding possibilities and intend to participate in the evaluation of this new mode. PSK63 deserves evaluation by the demanding RTTY crowd.

Watch out when a major contesting program incorporates the new *PSKCORE/DLL* and Skip's *PSK63 Module*. *RCKRTTY* (**www.rckrtty.de/**) already supports PSK63. (Hello *WriteLog?*) Thanks to the new DLL and Moe's ActiveX component, it's only a matter of time until one of the major contesting software authors steps out in front using Skip's *PSK63 Module* with 24-channel print capability. Close your eyes and try to imagine your favorite RTTY program with a 24-channel *PSK63 Module* window replacing the traditional RTTY print window—with full dupe-checking, Super Check Partial, call sign grab, etc, that we are used to in a full-featured RTTY program. Please grab the latest software and try PSK63 during the next contest that supports it. Let the fun begin! NCJ

Contest Calendar

Compiled by Bruce Horn, WA7BNM

Here's the list of major contests to help you plan your contesting activity through November 2003. The Web version of this calendar is updated more frequently and lists contests for the next 12 months. It can be found at **www.hornucopia.com/contestcal/**

Please note that there is a PSK63 contest on September 6 and a new South Carolina QSO Party on September 20, as well as all of the usual major Fall contests.

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!

September 2003

MI QRP Labor Day CW Sprint	2300Z, Sep 1 to 0300Z, Sep 2
All Asian DX Contest, SSB	0000Z, Sep 6 to 2400Z, Sep 7
Quick PSK63 Contest	0000Z-2359Z, Sep 6
IARU Region 1 Field Day, SSB	1300Z, Sep 6 to 1300Z, Sep 7
North American Sprint, CW	0000Z-0400Z, Sep 7
DARC 10-Meter Digital Contest	1100Z-1700Z, Sep 7
YLRL Howdy Days	1400Z, Sep 10 to 0200Z, Sep 12
WAE DX Contest, SSB	0000Z, Sep 13 to 2359Z, Sep 14
PNG Independence Day Scramble	0000Z, Sep 13 to 2400Z, Sep 14
Louisiana QSO Party	1400Z, Sep 13 to 0200Z, Sep 14 and 1400Z-2000Z, Sep 14
ARRL September VHF QSO Party	1800Z, Sep 13 to 0300Z, Sep 14
North American Sprint, SSB	0000Z-0400Z, Sep 14
FISTS Coast to Coast Contest	0000Z-2400Z, Sep 14
Tennessee QSO Party	1800Z, Sep 14 to 0100Z, Sep 15
QRP ARCI End Summer PSK31 Sprint	2000Z-2400Z, Sep 14
AGB NEMIGA Contest	2100Z-2400Z, Sep 19
ARRL 10 GHz Cumulative Contest	0600-2400 local, Sep 20 and 0600-2400 local, Sep 21
SARL VHF/UHF Contest	1000Z, Sep 20 to 1000Z, Sep 21
Scandinavian Activity Contest, CW	1200Z, Sep 20 to 1200Z, Sep 21
Collegiate QSO Party	1200Z, Sep 20 to 0400Z, Sep 21
South Carolina QSO Party	1300Z, Sep 20 to 2100Z, Sep 21
QRP Afield	1500Z, Sep 20 to 0300Z, Sep 21
Washington State Salmon Run	1600Z, Sep 20 to 0700Z, Sep 21 and 1600Z-2400Z, Sep 21
Panama Anniversary Contest	1200Z-2359Z, Sep 21
Fall QRP Homebrewer Sprint	0000Z-0400Z, Sep 22
CQ Worldwide DX Contest, RTTY	0000Z, Sep 27 to 2400Z, Sep 28
Scandinavian Activity Contest, SSB	1200Z, Sep 27 to 1200Z, Sep 28
Texas QSO Party	1400Z, Sep 27 to 0200Z, Sep 28 AND 1400Z-2000Z, Sep 28
Alabama QSO Party	1800Z-2400Z, Sep 27

October 2003

SARL 80-Meter QSO Party	1700Z-2000Z, Oct 2
TARA PSK31 Rumble	0000Z-2400Z, Oct 4
Oceania DX Contest, Phone	0800Z, Oct 4 to 0800Z, Oct 5
EU Autumn Sprint, SSB	1500Z-1859Z, Oct 4
California QSO Party	1600Z, Oct 4 to 2200Z, Oct 5
QCWA QSO Party	1800Z, Oct 4 to 1800Z, Oct 5
RSGB 21/28 MHz Contest, SSB	0700Z-1900Z, Oct 5
YLRL Anniversary Party, CW	1400Z, Oct 8 to 0200Z, Oct 10
10-10 Day Sprint	0001Z-2400Z, Oct 10
Oceania DX Contest, CW	0800Z, Oct 11 to 0800Z, Oct 12
EU Autumn Sprint, CW	1500Z-1859Z, Oct 11
Pennsylvania QSO Party	1600Z, Oct 11 to 0500Z, Oct 12 and 1300Z-2200Z, Oct 12
FISTS Fall Sprint	1700Z-2100Z, Oct 11
Iberoamericano Contest	2000Z, Oct 11 to 2000Z, Oct 12
North American Sprint, RTTY	0000Z-0400Z, Oct 12
YLRL Anniversary Party, SSB	1400Z, Oct 15 to 0200Z, Oct 17
JARTS WW RTTY Contest	0000Z, Oct 18 to 2400Z, Oct 19
QRP ARCI Fall QSO Party	1200Z, Oct 18 to 2400Z, Oct 19
Worked All Germany Contest	1500Z, Oct 18 to 1459Z, Oct 19
W/VE Islands QSO Party	1600Z, Oct 18 to 2359Z, Oct 19
Asia-Pacific Sprint, CW	0000Z-0200Z, Oct 19
RSGB 21/28 Mhz Contest, CW	0700Z-1900Z, Oct 19
Illinois QSO Party	1800Z, Oct 19 to 0200Z, Oct 20
CQ Worldwide DX Contest, SSB	0000Z, Oct 25 to 2400Z, Oct 26
10-10 Int. Fall Contest, CW	0001Z, Oct 25 to 2400Z, Oct 26

November 2003

IPA Contest, CW	0600Z-1000Z, Nov 1 and 1400Z-1800Z, Nov 1
Ukrainian DX Contest	1200Z, Nov 1 to 1200Z, Nov 2
ARRL Sweepstakes Contest, CW	2100Z, Nov 1 to 0300Z, Nov 3
NA Collegiate ARC Championship, CW	2100Z, Nov 1 to 0300Z, Nov 3
IPA Contest, SSB	0600Z-1000Z, Nov 2 and 1400Z-1800Z, Nov 2
High Speed Club CW Contest	0900Z-1100Z, Nov 2 and 1500Z-1700Z, Nov 2
DARC 10-Meter Digital Contest	1100Z-1700Z, Nov 2
WAE DX Contest, RTTY	0000Z, Nov 8 to 2359Z, Nov 9
Japan Int. DX Contest, Phone	0700Z, Nov 8 to 1300Z, Nov 9
SARL Field Day Contest	1000Z, Nov 8 to 1000Z, Nov 9
OK/OM DX Contest, CW	1200Z, Nov 8 to 1200Z, Nov 9
Anatolian ATA PSK31 Contest	1800Z-2400Z, Nov 8
LZ DX Contest, CW	1200Z, Nov 15 to 1200Z, Nov 16
All Austrian 160-Meter Contest	1600Z, Nov 15 to 0700Z, Nov 16
ARRL Sweepstakes Contest, SSB	2100Z, Nov 15 to 0300Z, Nov 17
NA Collegiate ARC Championship, SSB	2100Z, Nov 15 to 0300Z, Nov 17
RSGB 1.8 MHz Contest, CW	2100Z, Nov 15 to 0100Z, Nov 16
CQ Worldwide DX Contest, CW	0000Z, Nov 29 to 2400Z, Nov 30

NCJ

Contesting on a Budget

Paul Schaffenberger, K5AF

Powerful Low-Cost Software

Once again, the contest community has provided some very interesting responses to the call for information on free and low-cost software. The information age is providing us with some amazing software capabilities at a price that fits within the stingiest of budgets.

Bargain vs Value

Jim George, N3BB, was the first of several to point out the difference between a software bargain and a software value. He notes that there is a lot of free and/or low-cost software out there at bargain prices, but it has little or no value if it is not well-documented, if it's awkward to use, or requires a steep learning curve. He notes that bargain software that takes hours or days to configure and use may not be such a bargain after all—it all depends on the value of one's time.

Another concept that was noted was that of relative value. Dick, KB1H, notes that spending $100 on antenna modeling software that saves us from spending hours on the tower and buying additional hardware is certainly a great value. Dick notes, "You may spend $29 on the *ARRL Antenna Book* and find that 30 more feet of tower will provide no additional gain, as we found on our 20-meter tower. Ninety feet was just as good and probably better than 120 feet." Think about it—spending $29 vs buying and installing three more sections of Rohn 45.

Antenna Modeling Taken to New Heights

Antenna modeling software is clearly the best bang for the buck software out there today. It is getting incredibly sophisticated and allows us to visualize antenna patterns and interactions more clearly than ever. The cover of the recent July-August *NCJ* shows us a vivid example.

Pete, N4ZR, sent me the link to his presentation at Dayton this year, and it is indeed impressive. We can now incorporate antenna gain combined with interactions with various antennas, guys and antenna structures, and terrain effects, and find out how all this plays to specific parts of the globe.

Pete's presentation focused on *HFTA* (coming this fall with the new *ARRL Antenna Book*), which is the latest evolution of the *YT* line of software, and *MultiNEC*, which is shareware available from AC6LA. While Pete's presentation is too robust to discuss in detail here, the implications of the software's capabilities are enormous. With a total software investment of less than $100, we can design and build virtual antenna farms that are customized to our location and optimized to targeted areas of the globe. Pete's presentation can be found on the PVRC Web site at **www.pvrc.org/**.

The point here is that we are able to predict, with ever-increasing accuracy, the results of antenna work before ever setting foot on the tower. The opportunities for hardware cost savings over the "cut and try" approach are huge. On the other hand, modeling may encourage us to buy that stack or put up that new vertical array. At least we will be spending wisely!

Logging Programs

Logging programs seem to be the staple of budget software. Two stand out as "honorable mentions" as freebies with real power and flexibility. The first is the *DOS*-based *CT*, which has recently become freeware (as noted by VE4XT and KB1H). The second is the *N1MM* logging program for *Windows* operating systems.

If neither of these meet your needs, there are a wide array of low-cost *DOS*- and *Windows*-based programs for contesting including, but not limited to, *TR*, *Writelog*, and *NA*. Scott, KI5DR, mentioned N3FJP's low-cost *Windows* logging program which works well in a networked environment and easily generates Cabrillo files. *DXLab* was mentioned by Glenn, N3PP, as a good freeware general logging program.

Propagation

Propagation software is a powerful tool for contest planning. Andrew, ZS1AN, recommends *Propview*, a simple, free *IONCAP*-based software. If you want to spend a few bucks for a more powerful program, he recommends you try *ACE-HF*, which provides animated map displays and reduces preparation time over *Propview*. Glenn, N3PP, uses VOA's *VOACAP* program, which although a bit cumbersome, provides very usable information on band openings. He notes that there is a new version available on the Elbert Web site at **elbert.its.bldrdoc.gov/hf.html**.

Other Items of Interest

Tim, EI8IC, gave me a "scoop" on his just-released *Global Overlay Mapper* software, which contains 34 world-coverage maps that contain 12 overlays each and allows users to create a view customized to their immediate needs, including personalized distance and bearing information and grid locator information. The demo version, a freebie, contains the most comprehensive set of prefix maps ever released, along with 4 other overlays. The full version contains the world's first set of global IOTA maps and is very reasonably priced. You'll find more information on the Web at **www.qsl.net/ei8ic/index.html**.

Randy, K5ZD's, shack contains low-cost/free clock software: **Geoclock** and **Nisttime** 32 for time synchronization.

Sylvan, VE5ZX, uses a free programming language, *Perl*. He finds it easy and flexible to use on almost any platform, including *Windows* and Mac. He's used it in a variety of applications: to track wind speed and then rotate antennas if needed, process logs and retrieve spots. Go to **www.perl.com** to download this programming language.

Thanks to EI8IC, VE4XT, VE5SX, ZS1AN, KB1H, N3BB, N3PP, N4ZR, K5ZD and NI5DR for inputs.

Topic for November-December *NCJ*: Wire of all sizes and flavors, from hardline to hookup wire, from antenna wire to guy wire and rope. Tell us where you find bargains, tell us about innovative and cost-saving wire-use ideas and tell us what you buy and what you avoid. This is sure to be a fun topic for your author, who never met a spool of wire he didn't like! NCJ

Results, March 2003 *NCJ* RTTY Sprint

Douglas McDuff, W4OX
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As a newcomer both to the Sprint, as well as to scoring logs, two things jumped out at this contest manager.

The first was the number of logs submitted versus the actual number of operators that participated. Sixty-three logs were submitted, yet the master log revealed 128 different calls, or less than 50% of those that operated in the contest submitted a log. The entries in the master log would seem to suggest that some of those that did not submit would have had very competitive scores. At least one of these had registered as part of a team. No doubt, some of this was attributable to the unique nature of the "3 QSO rule," and the lack, until recently, of software to support it. However, there are now several software packages that do support this great contest. Also, WA7BNM was kind enough to devise a log submission process available at the *NCJ* Web site that produced logs in Cabrillo format. In any event, and before anyone thinks that everyone's participation was not appreciated if you did not submit a log, please accept this manager's thanks.

The second thing that stood out was how close in number most of the logs submitted were to the number of multipliers. The number of QSOs was the deciding factor. After the Sprint, there were soapbox comments, as well as reflector comments, for and against a continuation of the "3 QSO rule." In light of the fact that the number of QSOs was important in terms of scoring, and in an effort to foster greater participation in the next Sprint, it was decided to leave intact the "3 QSO rule" until at least next spring.

One soapbox comment really summed up the sprint. It simply read "As always, a fast and furious four hours." So why not join us for the next one scheduled for October 12, 2003, from 0000Z–0400Z? Let's see if we can't break the 100 barrier for logs submitted! The complete rules, team registration and log submission online program can be found on our Web site at **www.ncjweb.com**.

Scores

Call	*Score*	*QSOs*	*Mults*
AA5AU	11,973	307	39
N9CK	9,760	244	40
K6LL	9,287	251	37
K5NZ	8,640	240	36
K4RO	8,307	213	39
W7WW	8,103	219	37
WØETC	7,812	217	36
K2PS	7,752	204	38
K7WM	7,560	216	35
WW3S	7,236	201	36
K5AM	6,768	188	36
AI9T	6,615	189	35
K4WW	6,264	174	36
KE4OAR	6,120	180	34
K9DJ	5,775	165	35
KE9S	5,577	169	33
KI6DY	5,472	171	32
W9WI	5,202	153	34
W4GKM	5,016	152	33
KØFG	4,686	142	33
N2DBI	4,653	141	33
NØAT	4,588	148	31
K9JS	4,572	127	36
W7TI	4,480	140	32
VE7FO	4,445	127	35
W4BCG	4,416	138	32
VE3GSI	4,386	129	34
W4OX	4,375	125	35
N6EU	4,192	131	32
W8WTS	4,012	118	34
WA9AFM/5	3,993	121	33
W9HLY	3,740	110	34
W2GR	3,300	110	30
WAØSXV	3,300	110	30
WK6I	3,204	89	36
WØBR/1	3,162	93	34
K6UFO	2,790	90	31
VE7ASK	2,727	101	27
W5RW	2,635	85	31
K7JJ	2,628	73	36
W1TO	2,449	79	31
K7GS	2,436	84	29
K6BIR	2,349	87	27
WA9ALS	2,190	73	30
VE6YR	2,184	78	28
K6OWL	2,116	92	23
N4CW	1,984	64	31
KØXU	1,632	68	24
K5ZD	1,575	63	25
W6ZZZ	1,357	59	23
K9TA	1,326	51	26
WA6BOB	1,239	59	21
VE2SB	968	44	22
KJ7NO	851	37	23
AE8U	493	29	17
AAØCY	312	26	12
WS7I	108	12	9
WØRY	90	10	9
OH4BB	48	8	6
VE3RCN	42	7	6
K7VIT	36	6	6
EA4WC	4	2	2

Check Log: HG4I

NCJ

California QSO Party (CQP) 2003

1600Z October 4, 2003—2200Z October 5, 2003

Sponsored by the Northern California Contest Club (NCCC), **www.cqp.org**.

Start your contest season with a big bang in CQP 2003. Participation was up a whopping 21% in CQP 2002. Come join us and win awards (plaques and wine), earn a certificate, get a T-shirt and most importantly *have fun* in the largest state QSO party.

Object

Stations outside of California work as many California stations in as many California counties as possible (CW and phone, 160, 80, 40, 20, 15, 10, 6 and 2 meters). Stations in California work everyone.

- 2 points for SSB, 3 points for CW times number of California counties or USA/VE areas (58 max)
- Updated Multi-Single rule for 2003 allows unlimited band changes!
- Complete rules and other information at **www.cqp.org/.**
- Free logging software CQPW available at **www.cqp.org/Software.html.**

Awards

The most plaques and awards in any state QSO party…

- 34 Plaques (wood and metal, not mere wallpaper!)
- 40 Bottles of California wine (commemorative CQP labels with your call sign)
- Certificates to the top Single-Operator in every state, province, country and California county
- Certificates to each entrant who makes at least 100 QSOs

Contact

Send logs to Alan Maenchen, AD6E, 3330 Farthing Way, San Jose, CA 95132 or e-mail to **cqp@contesting.com**.

NCJ

Results: August 2002 NAQP CW Contest

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Activity is typically much lower in the summer NAQPs and the August 2002 contests were no exception. Lower summer time activity combined with declining band conditions takes it's toll on the Top Ten Score Box! Scott, W4PA wound up on top of the pack this time with a decent lead over Dave, N2NL. Finishing number 3, by less than a one QSO difference, was Bill, W4AN.

There were only four Multi-Two entries this time with K5KA edging out W5NN and NØNI for the top spot. It is nice to see the "M2 regulars" always plugging away in each of the contests. The Top Combined Score went to Don, K4WX. Don had found his way into the top spot many times as N4ZZ. Dan, N6MJ a previous winner and Tom, N6NF picked up the number 2 and 3 spots behind Don. The SSB scores tended to dominate the placement of the Top Combined Single Operators this time around.

The Team competition continues to be very popular with 43 pre-registered teams. Taking top honors again was Team #1 from the Tennessee Contest Group. Great job as always guys. Close behind in the number two spot was a team from the Southern States Sprint Coalition, more frequently known as the South East

Top Ten Operator Combined Scores

Operator	*SSB Points*	*CW Points*	*Total Points*
K4WX	477	378	855
N6MJ	500	198	698
N6NF	400	266	666
K4AB	361	305	666
NØAV	338	246	583
W5WMU	307	246	553
K5RC	279	257	536
NF4A	289	245	534
N5DO	238	258	496
N4GN	124	360	485

CW Team Scores

1. Tennessee Contest Group Team #1

W4PA	216,534
K4WX	163,777
K4RO	150,380
K1KY	146,000
NA4K	109,727
Total	786,418

2. Southern States Sprint Coalition Team #4

W4AN	195,858
N4AF	177,003
W4OC	133,000
K4AB	132,225
K4BAI	123,648
Total	761,461

3. Southern California Contest Club Team #1

W6EEN	186,303
K6LL	143,206
K6LA	117,302
K6NA	116,820
XE2MX	56,810
Total	620,441

4. NCCC #1 (N6RO, N6TV, K5RC, K2KW, K7NV) 557,193
5. SMC #1 (W9RE, KØOU, NØAV, K9NR, WA9IRV) 521,317
6. Austin Powers (W5KFT, N3BB, K5TR, AC5AA) 421,134
7. SSSC #5 (K4NO, N4CW, WQ5L, KU8E, N4AA) 357,109
8. FCG Killer D's #1 (N2NL, K4FCG, W4SAA) 352,248
9. Thunderdodgers (N6ZZ, K5OT, WAØSXV) 305,180
10. TCG #2 (WO4O, K3WU, K4LTA, K4BEV) 294,110
11. SCCC #2 (N6MJ, N6BM, WN6K, NN6X, W6RW) 289,517
12. NCCC #2 (W6EU, AE6Y, K6LRN, N6ZFO, NT6K) 254,170
13. TDXS (AD5Q, K5XR, KG5U, N5RP) 229,333
14. SMC #2 (WØUY, WØMTL, WA1UJU, KX9DX, W9TN) 220,740
15. SSSC #6 (W4ATL, KN4Y, K2YWE, AD4J, AE4Y) 209,387
16. FCG Killer D's #3 (NP4Z, KB4N, K4LW) 190,717
17. KCG (N4GN, W4EEX, K4WW) 189,652
18. GMC Pikes Peak (NØHF, WØETT, WØZA, WAØRSX) 188,713
19. GMC Pyramid Peak (N4VI, KØRI, AEØQ, KIØII) 185,566
20. TCG #3 (W4NZ, K3CQ, NY4N, W4TYU) 184,694
21. FCG Killer D's #4 (NF4A, WC4H, KB4ET) 181,308
22. SMC #4 (KJ9C, N9RV, K9IJ, N9GUN) 169,846
23. MRRC #1 (N8EA, K8GU, K5IID) 169,089
24. NCC Team Gizmo (VE3EJ, KL7WV) 150,830
25. MWA #1 (KØAD, KTØR, NAØN, KØPC, KNØV) 149,107
26. SSSC #2 (WA4TT, W4NTI, AA4GA, WB6BWZ) 141,048
27. GMC Crestone Needle (WØTM, KØUK, WØQE, W1XE) 136,666
28. FCG Killer D's #5 (W4AA, NU4Y, K1PT, KE1F) 128,860
29. FCG Killer D's #2 (N4AO, K4LQ, N4GI) 117,564
30. SSSC #1 (K2UFT, K4WA, K4WI, K4MX) 109,670
31. TCG #4 (N4DW, K4AMC, KA1DWX, NN4T, W4RK) 108,962
32. TCG #5 (WD4K, N5NW, KF4TJE) 105,056
33. SSSC #3 (K4IQJ, AK4XX, KO7X) 98,228
34. FCG Killer D's #7 (N4IG, ND4AA, NA4CW) 80,780
35. SCCC #3 (W6UE, N6WIN) 65,097
36. MRRC #3 (W8MJ) 60,480
37. FCG Killer D's #6 (K1TO, K4PB, W4ZW, K4LOG) 60,175
38. SMC #3 (K9WX, K9ZO, K9GY) 45,590
39. TCG #6 (KE4OAR) 16,456
40. SMC #5 (N9KO, W9YK, K9MI) 15,168
41. NCCC #3 (ND2T) 12,719
42. MRRC #2 (WX3M, K9NW) 2,054
43. MWA #2 (ACØW) 270

Single Op Top Ten Breakdowns

Call	*Score*	*QSOs*	*Mults*	*160M*	*80M*	*40M*	*20M*	*15M*	*10M*	*Team*
W4PA	216,534	906	239	62/30	173/39	256/53	243/53	133/45	39/19	TCG #1
N2NL	195,624	858	228	45/20	122/40	244/50	254/52	148/46	45/20	FCG Killer D's #1
W4AN	195,585	767	255	50/27	103/40	222/52	205/53	118/49	69/34	SSSC #4
W6EEN (N6RT)	186,303	843	221	20/9	85/38	226/53	302/56	163/46	47/19	SCCC #1
N6ZZ	182,532	861	212	38/17	86/34	160/42	286/51	183/39	108/29	Thunderdodgers
N4AF	177,003	831	213	50/25	111/34	280/51	254/49	109/38	27/16	SSSC #4
KI1G	176,679	879	201	39/21	88/31	255/51	279/48	176/36	42/14	
NP4Z	172,260	783	220	4/4	62/31	130/45	284/54	226/51	77/35	FCG Killer D's #3
W9RE	169,416	724	234	70/33	149/45	183/52	173/51	108/38	41/15	SMC #1
K4WX	163,777	823	199	42/19	201/47	253/49	189/40	111/34	27/10	TCG #1
NØNI	199,234	931	214	66/27	157/46	248/53	288/43	152/33	20/12	

Contest Club. Frequent winners in the past, the Southern California Contest Club, picked up the number three spot.

Well, that's a wrap for this issue of the NAQP Report. Be sure to check the NCJ Web site for updates to the NAQP Rules and other information such as NAQP Records and past NAQP Results. Bruce, WA7BNM has done a great job of developing the Web Site and filling it with useful information. I would also like to thank Bruce for checking the logs for the August 2002 running of the NAQP CW Contest. It's a big task. Hope to work you all in the next NAQP.

Multi Op Top Two Breakdowns

Call	*Score*	*QSOs*	*Mults*	*160M*	*80M*	*40M*	*20M*	*15M*	*10M*
K5KA	327,294	1254	261	95/35	239/52	351/54	332/52	172/41	65/27
W5NN	297,920	1216	245	58/24	175/43	325/55	380/55	194/44	84/24

Single Operator Scores

Call	*Score*	*QSOs*	*Mults*	*Section*	*Team*
KI1G	176,679	879	201	RI	
K1VUT	108,160	676	160	MA	
W1FJ	99,994	578	173	MA	
K5ZD	67,815	411	165	MA	
NY1S	52,992	414	128	ME	
N1XS	34,730	302	115	CT	
W0BR	14,678	179	82	CT	
WA1Z	12,628	154	82	NH	
K1YA	9,943	163	61	MA	
W1VET	2,088	58	36	RI	
W1EBI	1,856	58	32	MA	
KA1EZE	609	29	21	RI	
N1MD	360	24	15	CT	
N2ED	29,340	326	90	NJ	
N2JNZ	2,244	66	34	NY	
WA2BMH	240	20	12	NJ	
AA3B	138,866	763	182	PA	
K3WU	89,900	580	155	PA	TCG #2
N4GG	88,228	548	161	MD	
WF3M	42,680	388	110	PA	
K2YWE	41,412	348	119	MD	SSSC #6
W3CP	3,276	84	39	MD	
N3NZ	1,196	52	23	PA	
AA3II	1,075	43	25	PA	
W4PA	216,534	906	239	TN	TCG #1
N2NL	195,624	858	228	FL	FCG Killer Ds #1
W4AN	195,585	767	255	GA	SSSC #4
N4AF	177,003	831	213	NC	SSSC #4
K4WX	163,777	823	199	TN	TCG #1
N4GN	156,000	750	208	KY	KCG
K4RO	150,380	730	206	TN	TCG #1
K1KY	146,000	730	200	TN	TCG #1
W4OC	133,000	665	200	SC	SSSC #4
K4AB	132,225	645	205	AL	SSSC #4
K4BAI	123,648	644	192	GA	SSSC #4
K4FCG (K4OJ)	112,784	532	212	FL	FCG Killer Ds #1
K4NO	111,321	589	189	AL	SSSC #5
NA4K	109,727	613	179	TN	TCG #1
NF4A	105,952	602	176	FL	FCG Killer Ds #4
N4CW	99,624	593	168	NC	SSSC #5
WD4K (K0EJ)	98,525	563	175	TN	TCG #5
WO4O	91,184	556	164	TN	TCG #2
W4NZ	74,592	504	148	TN	TCG #3
W4AA	72,228	463	156	FL	FCG Killer Ds #5
K2UFT	72,000	450	160	GA	SSSC #1
K4LTA	71,446	514	139	TN	TCG #2
WC4H	68,976	479	144	FL	FCG Killer Ds #4
KU8E	66,780	477	140	GA	SSSC #5
W4ATL	64,079	461	139	GA	SSSC #6
N4IG	61,028	418	146	FL	FCG Killer Ds #7
WA4TT	59,888	394	152	GA	SSSC #2
K3CQ	57,477	391	147	TN	TCG #3
N4DW	52,668	418	126	TN	TCG #4
K4IQJ	50,715	345	147	AL	SSSC #3
N4AO	44,064	324	136	FL	FCG Killer Ds #2
W4SAA	43,840	320	137	FL	FCG Killer Ds #1
KN4Y	42,368	331	128	FL	SSSC #6
K4BEV	41,580	308	135	TN	TCG #2
K4LQ	41,580	297	140	FL	FCG Killer Ds #2
W4NTI	41,296	356	116	AL	SSSC #2
AD4J	39,440	340	116	GA	SSSC #6
NU4Y	38,610	297	130	FL	FCG Killer Ds #5
NY4N	38,357	317	121	TN	TCG #3
AK4XX	37,147	307	121	GA	SSSC #3
AA4GA	35,160	293	120	GA	SSSC #2
K4WA	34,224	276	124	FL	SSSC #1
K4AMC	32,760	315	104	TN	TCG #4
N4GI	31,920	304	105	FL	FCG Killer Ds #2
K1TO	29,150	265	110	FL	FCG Killer Ds #6
W4EEX	25,938	262	99	KY	KCG
AE4Y	22,088	251	88	GA	SSSC #6
K4PB	22,000	200	110	FL	FCG Killer Ds #6
KC3QU	16,740	186	90	AL	
KE4OAR	16,456	187	88	TN	TCG #6
KA1DWX	16,020	180	89	TN	TCG #4
W4TYU	14,268	174	82	TN	TCG #3
ND4AA	14,240	160	89	FL	FCG Killer Ds #7
KB4N	11,808	144	82	FL	FCG Killer Ds #3
K1PT	10,582	143	74	FL	FCG Killer Ds #5
KO7X	10,366	146	71	NC	SSSC #3
W4ZW	9,016	184	49	FL	FCG Killer Ds #6
K4OGG	8,775	135	65	GA	
K4WW	7,714	133	58	KY	KCG
KE1F	7,440	120	62	FL	FCG Killer Ds #5
W4IDX	7,250	145	50	NC	
K4LW	6,649	109	61	FL	FCG Killer Ds #3
KB4ET	6,380	116	55	FL	FCG Killer Ds #4
NA4CW	5,512	104	53	FL	FCG Killer Ds #7
WB6BWZ	4,704	96	49	GA	SSSC #2
N4AA	4,600	100	46	NC	SSSC #5
NN4T	4,214	86	49	TN	TCG #4
W4BCG	4,080	85	48	TN	
N4BP	3,663	99	37	FL	
W4RK	3,300	100	33	TN	TCG #4
K4WI	2,242	59	38	AL	SSSC #1
K4MX	1,204	43	28	VA	SSSC #1
K0COP	260	20	13	NC	
KF4TJE	90	10	9	TN	TCG #5
K4LOG	9	3	3	FL	FCG Killer Ds #6
N6ZZ	182,532	861	212	NM	Thunderdodgers
W5KFT (K5PI)	163,608	802	204	TX	Austin Powers
N5YA (N5UM)	152,478	774	197	TX	
N3BB	145,107	701	207	TX	Austin Powers
AD5Q	123,690	651	190	TX	TDXS
KZ5D	119,364	588	203	LA	
W0UO	115,737	669	173	TX	
W5FO	113,928	606	188	TX	
N5RG	112,800	600	188	TX	
N5DO	111,748	614	182	TX	
AA5AU	106,622	599	178	LA	
W5WMU	106,577	541	197	LA	
K5TR (KE5C)	89,739	531	169	TX	Austin Powers
WQ5L	74,784	492	152	MS	SSSC #5
K5XR (W5ASP)	72,988	514	142	TX	TDXS
K1NT	65,631	501	131	TX	
W5UE	61,625	425	145	MS	
W5MK	31,696	283	112	AR	
KB5NJD	26,790	235	114	TX	
NO5W	23,560	248	95	TX	
AC5AA	22,680	216	105	TX	Austin Powers
KG5U	18,785	221	85	TX	TDXS
N5RP	13,870	190	73	TX	TDXS
WA5VBE	7,866	114	69	AR	
K0CIE	7,616	136	56	OK	
WR5O	3,870	86	45	TX	
KI5UD	2,622	69	38	TX	
W6TER	2,412	67	36	NM	
N0QT	1,708	61	28	NM	
W5WZ	110	11	10	LA	
W0ZW	36	6	6	NM	
W6EEN (N6RT)	186,303	843	221	CA	SCCC #1
N6RO	145,754	718	203	CA	NCCC #1
K6LA	117,302	659	178	CA	SCCC #1

Call	Score	QSOs	Mults	Section	Team
K6NA	116,820	660	177	CA	SCCC #1
N6NF	115,188	662	174	CA	
N6TV	111,412	644	173	CA	NCCC #1
K2KW	108,350	550	197	CA	NCCC #1
W6EU	96,642	546	177	CA	NCCC #2
K6AM	93,062	589	158	CA	
N6MJ	85,692	579	148	CA	SCCC #2
N6BM	77,080	470	164	CA	SCCC #2
AE6Y	76,255	505	151	CA	NCCC #2
W6UE(N6AN)	59,079	419	141	CA	SCCC #3
N3ZZ	58,499	427	137	CA	
WN6K	51,084	387	132	CA	SCCC #2
K6LRN	46,440	360	129	CA	NCCC #2
NN6X	41,736	376	111	CA	SCCC #2
K6CTA	39,900	350	114	CA	
K6RIM	35,708	316	113	CA	
W6RW	33,925	295	115	CA	SCCC #2
N6TW	19,314	222	87	CA	
N6ZFO	19,125	225	85	CA	NCCC #2
W6OAT	16,544	188	88	CA	
NT6K	15,708	187	84	CA	NCCC #2
ND2T	12,719	161	79	CA	NCCC #3
AD6TF	11,753	161	73	CA	
K6DGW	11,247	163	69	CA	
W6AQ	10,800	135	80	CA	
N6EU	9,729	141	69	CA	
K6EP	8,520	120	71	CA	
W6ZL	7,434	126	59	CA	
N6PE	7,316	118	62	CA	
K6UFO	6,720	112	60	CA	
K6CSL	6,372	118	54	CA	
N6WIN	6,018	102	59	CA	SCCC #3
KE6ZSN	5,450	109	50	CA	
WA6PXU	5,150	103	50	CA	
WA6BOB	3,713	79	47	CA	
KE6QR	3,160	79	40	CA	
NC6K	2,067	53	39	CA	
N6GL	1,215	45	27	CA	
KA6MAL	1,160	40	29	CA	
W6MVW	858	39	22	CA	
W6YL (W6CT)	510	30	17	CA	
K6ST	400	25	16	CA	
K6LL	143,206	742	193	AZ	SCCC #1
K5RC	111,136	604	184	NV	NCCC #1
K7NV	80,541	513	157	NV	NCCC #1
W7ZR	76,111	581	131	AZ	
N7LOX	57,120	420	136	WA	
W7HS	19,594	194	101	UT	
KL7WV (W3YQ)	11,570	178	65	AK	NCC Team Gizmo
W7CT	5,382	117	46	UT	
NG7Z	4,472	104	43	WA	
WC7S	3,358	73	46	WY	
W7YS	2,183	59	37	AZ	
N8BJQ	94,690	557	170	OH	
N8EA	92,852	556	167	MI	MRRC #1
W8MJ	60,480	432	140	MI	MRRC #3
K8GU	59,605	455	131	OH	MRRC #1
K8AJS	44,346	389	114	OH	
WB8RTJ	31,824	306	104	OH	
K8CV	23,520	245	96	MI	
NU8Z	17,199	189	91	MI	
K5IID	16,632	198	84	WV	MRRC #1
K8JQ	15,552	243	64	WV	
KC8LTL	8,580	143	60	MI	
N5NW	6,441	113	57	OH	TCG #5
N8IE	3,157	77	41	OH	
KB8PGW	1,815	55	33	MI	
WX3M	1,595	55	29	MI	MRRC #2
W8IDM	1,150	50	23	OH	
K9NW	459	27	17	OH	MRRC #2
W9RE	169,416	724	234	IN	SMC #1
KJ9C	95,842	554	173	IN	SMC #4
K5OT	85,800	550	156	WI	Thunderdodgers
K9NR	73,179	519	141	IL	SMC #1
WA9IRV	56,440	415	136	WI	SMC #1
N9RV	56,244	436	129	IN	SMC #4
N9NE	52,138	398	131	WI	
WA1UJU	42,672	336	127	WI	SMC #2
K9MMS	41,640	347	120	IL	
KX9DX	31,610	290	109	IL	SMC #2
K9WX	28,710	290	99	IN	SMC #3
K9IJ	16,590	210	79	IL	SMC #4
K9JWI	15,642	198	79	IN	
K9ZO	14,480	181	80	IL	SMC #3
W9TN	12,144	184	66	IN	SMC #2
KE9V	9,834	149	66	IN	
N9KO	6,804	126	54	IL	SMC #5
W9YK	5,439	111	49	IL	SMC #5
K9UQN	3,910	85	46	IL	
K9MI	2,925	75	39	IN	SMC #5
K9GY	2,400	75	32	IL	SMC #3
K9AHH	1,560	60	26	IL	
N9GUN	1,170	45	26	IL	SMC #4
K0RF	153,465	787	195	CO	
N4VI	136,900	740	185	CO	GMC Pyramid Peak
K0OU	115,920	644	180	MO	SMC #1
N0AV	106,362	622	171	IA	SMC #1
W0UY	89,544	533	168	KS	SMC #2
N0HF	73,500	500	147	CO	GMC Pikes Peak
KU1CW	69,224	509	136	MO	
W0ETT	65,562	446	147	MI	GMC Pikes Peak
K0AD	64,856	484	134	MN	MWA #1
WB0O	62,568	474	132	ND	
KA0GGI	60,444	438	138	MO	
W0TM	52,029	423	123	KS	GMC Crestone Needle
K0UK	50,750	406	125	CO	GMC Crestone Needle
W0MTL (N9JF)	44,770	370	121	MO	SMC #2
W0ZA	43,927	403	109	CO	GMC Pikes Peak
KT0R	38,961	351	111	MN	MWA #1
WA0SXV	36,848	329	112	MO	Thunderdodgers
K7RE	36,464	344	106	SD	
K0RI	34,578	339	102	CO	GMC Pyramid Peak
K0JPL	33,600	300	112	MO	
W0QE	28,106	299	94	CO	GMC Crestone Needle
N0UR	25,474	271	94	MN	
NA0N	24,510	285	86	MN	MWA #1
W0TY	16,254	189	86	MO	
K0PC	16,160	202	80	MN	MWA #1
AE0Q	7,952	142	56	CO	GMC Pyramid Peak
K0RAY	7,896	141	56	MO	
KI0II	6,136	104	59	CO	GMC Pyramid Peak
W1XE	5,781	123	47	CO	GMC Crestone Needle
WA0RSX	5,724	106	54	CO	GMC Pikes Peak
KN0V	4,620	105	44	MN	MWA #1
KC0IOX	1,815	55	33	SD	
K4IU	1,014	39	26	MN	
WV0H	338	26	13	CO	
AC0W	270	18	15	MN	MWA #2
K0UD	130	13	10	ND	
VE3EJ	139,260	660	211	ON	NCC Team Gizmo
VE3XAX	65,250	450	145	ON	
VE3KP	63,945	435	147	ON	
VE5ZX	53,040	442	120	SK	
VE2AWR	46,740	380	123	PQ	
VE3NE	42,840	340	126	ON	
VE5SF	36,050	350	103	SK	
VE3DZ	23,460	255	92	ON	
VA3WN	19,712	224	88	ON	
VE3BUC	19,694	229	86	ON	
VE4YU	18,900	210	90	MB	
VA3NR	15,990	205	78	ON	
VE9DX	15,394	179	86	NB	
VE7ASK	13,392	186	72	BC	
VA7LC	11,408	184	62	BC	
VA3XRZ	7,524	132	57	ON	
VE3WZ	3,696	88	42	ON	
VE7XLH	3,608	82	44	BC	
VE3EY	855	45	19	ON	
VE3IGJ	72	9	8	ON	
NP4Z	172,260	783	220	PR	FCG Killer Ds #3
XE2MX (N6KI)	56,810	437	130		SCCC #1
XE1KK	18,473	203	91		
HP1AC	782	34	23		
SP9KRT	1,196	46	26		
OK1FCA	532	28	19		
UA6JD	150	15	10		

Multi-Two Scores

Call	Score	QSOs	Mults	Section
K5KA (N5RZ, W0UA, K5KA)	327,294	1254	261	OK
W5NN (N5TU, N1LN, K1OJ, K5GA, K5NZ)	297,920	1216	245	TX
N0NI (N0AC, N0NI, K0KD)	199,234	931	214	IA
W7WIK (W7WIK, NC7W)	49,280	440	112	UT

Check Logs: W8UE, W8KW, M0SDX, KF0U

SAVE BIG ON ANTENNAS, TOWERS & CABLE

TELESCOPING ALUMINUM TUBING

DRAWN 6063-T832	1.250" .. $1.55/ft
.375 ..... $.70/ft	1.375" .. $1.75/ft
.500" ..... $.80/ft	1.500" .. $1.95/ft
.625" ..... $.90/ft	1.625" .. $2.25/ft
.750" $1.00/ft	1.750" .. $2.50/ft
.875" $1.10/ft	1.875" .. $2.75/ft
1.000" ... $1.20/ft	2.000" .. $3.00/ft
1.125" ... $1.35/ft	2.125" .. $3.50/ft

In 6' or 12' lengths, 6' lengths ship UPS. Call for 3/16"& 1/4" rod, bar stock, and extruded tubing.

CUSHCRAFT ANTENNAS

13B2/A148-10S	$149/85
A270-6S/A270-10S	$79/99
A3S/A4S	$449/539
A50-3S/5S/6S	$95/169/259
A627013S	$189
AR2/ARX2B	$49/69
AR270/AR270B	$85/99
R6000/R8	$319/449
X7/X740	$679/289
XM240	$719

Please call for more Cushcraft items

FORCE 12–MULTIBAND

C3	10/12/15/17/20m, 7 el	$599
C3E	10/12/15/17/20m, 8 el	$649
C3S	10/12/15/17/20m, 6 el	$539
C3SS	10/12/15/17/20m, 6 el	$559
C4	10/12/15/17/20/40m, 8 el	$759
C4S	10/12/15/17/20/40m, 7 el	$679
C4SXL	10/12/15/17/20/40m, 8 el	$979
C4XL	10/12/15/17/20/40m, 9 el	$1119
C19XR	10/15/20m, 11 el	$959
C31XR	10/15/20m, 14 el	$1299

Please call for more Force 12 items

TRYLON "TITAN" TOWERS

SELF-SUPPORTING STEEL TOWERS

T200-64	64', 15 square feet	$1099
T200-72	72', 15 square feet	$1299
T200-80	80', 15 square feet	$1499
T200-88	88', 15 square feet	$1769
T200-96	96', 15 square feet	$2049
T300-88	88', 22 square feet	$1989
T400-80	80', 34 square feet	$1899
T500-72	72', 45 square feet	$1799
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Many more Trylon towers in stock!

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Skyhawk, Triband Beam	$1129
HF2V, 2 Band Vertical	$239
HF5B, 5 Band Minibeam	$349
HF6VX, 6 Band Vertical	$329
HF9VX, 9 Band Vertical	$349
A1712, 12/17m Kit	$54
CPK, Counterpoise Kit	$129
RMKII, Roof Mount Kit	$159
STRII, Roof Radial Kit	$125
TBR160S, 160m Kit	$119

More Bencher/Butternut–call

M2 VHF/UHF ANTENNAS

144–148 MHz

2M4/2M7/2M9	$95/115/125
2M12/2M5WL	$159/209
2M5-440XP, 2m/70cm	$169

420–450 MHz

440-70-5W/420-50-11	$135/93
432-9WL/432-13WL	$175/229
440-18/440-21ATV	$125/145

Satellite Antennas

2MCP14/2MCP22	$175/229
436CP30/436CP42UG	$229/269

ROHN TOWER

25G/45G/55G	$89/189/239
25AG2/3/4	$109/109/139
45AG2/4	$209/225
AS25G/AS455G	$39/89
BPC25G/45G/55G	$75/99/110
BPL25G/45G/55G	$85/109/125
GA25GD/45/55	$68/89/115
GAR30/GAS604	$35/24
SB25G/45/55	$39/89/109
TB3/TB4	$85/99

Please call for more Rohn prices

US TOWER

MA40/MA550	$849/1399
MA770/MA850	$2359/3649
TMM433SS/HD	$1139/1379
TMM541SS	$1499
TX438/TX455	$979/1579
TX472/TX489	$2459/4579
HDX538/HDX555	$1269/2269
HDX572MDPL	$5899

Please call for help selecting a US Tower for your needs. Shipped factory direct to save you money!

COMET ANTENNAS

GP15, 6m/2m/70cm Vertical	$149
GP6, 2m/70cm Vertical	$139
GP9, 2m/70cm Vertical	$179
B10NMO, 2m/70cm Mobile	$36
SBB224NMO, 2m/220/70cm	$69
SBB2NMO, 2m/70cm Mobile	$39
SBB5NMO, 2m/70cm Mobile	$55
SBB7NMO, 2m/70cm Mobile	$75
Z750, 2m/70cm Mobile	$55
Z780, 2m/70cm Mobile	$69

Much more Comet in stock–call

M2 ANTENNAS

50–54 MHz

6M5X/6M7	$209/299
6M7JHV/6M9KHW	$259/469

HO LOOPS

6M/2M/222/432	$95/45/45/45

HF ANTENNAS

10/15M4DX, 4 Element	$389/439
20M4DX, 4 Element 20m	529
KT36XA, Triband Beam	$1249

More M2 models in stock–please call

GLEN MARTIN ENGINEERING

Hazer Elevators for 25G

H2, Aluminum Hazer, 12 sq ft	$359
H3, Aluminum Hazer, 8 sq ft	$269
H4, HD Steel Hazer, 16 sq ft	$339

Aluminum Roof Towers

RT424, 4 Foot, 6 sq ft	$159
RT832, 8 Foot, 8 sq ft	$239
RT936, 9 Foot, 18 sq ft	$389
RT1832, 17 Foot, 12 sq ft	$519
RT2632, 26 Foot, 9 sq ft	$869

UNIVERSAL ALUMINUM TOWERS

4-40'/50'/60'	$539/769/1089
7-50'/60'/70'	$979/1429/1869
9-40'/50'/60'	$759/1089/1529
12-30'/40'	$579/899
15-40'/50'	$1019/1449
23-30'/40'	$899/1339
35-30'/40'	$1019/1569

Bold in part number indicates windload capacity. Please call for other Universal models. Shipped factory direct to save you money!

DIAMOND ANTENNAS

D130J/DPGH62	$79/139
F22A/F23A	$89/119
NR72BNMO/NR73BNMO	$39/54
NR770HBNMO/NR770RA	$55/49
X200A/X3200A	$129/210
X500HNA/X700HNA	$229/369
X510MA/X510NA	$189/189
X50A/V2000A	$99/149
CR627B/SG2000HD	$99/79
SG7500NMO/SG7900A	$75/112

More Diamond antennas in stock

MFJ

259B, Antenna Analyzer	$219
269, Antenna Analyzer	$299
941E, 300W Antenna Tuner	$109
945E, 300W Antenna Tuner	$99
949E, 300W Antenna Tuner	$139
969, 300W Antenna Tuner	$169
986, 3KW Antenna Tuner	$289
989C, 3KW Antenna Tuner	$309
1798, 80–2m Vertical	$249
1796, 40/20/15/10/6/2m Vert.	$189

Big MFJ inventory–please call

COAX CABLE

RG-213/U, (#8267 Equiv.)	$.36/ft
8X-MINI, Mini RG-8 Foam	$.19/ft
RG-213/U Jumpers	Please Call
RG-8X Jumpers	Please Call

Please call for more coax/connectors

TOWER HARDWARE

3/8"EE / EJ Turnbuckle	$11/12
1/2"x9"EE / EJ Turnbuckle	$16/17
1/2"x12"EE / EJ Turnbuckle	$18/19
3/16" / 1/4" Preformed Grips	$5/6

Please call for more hardware items

TIMES MICROWAVE LMR® COAX

LMR-400	$.59/ft
LMR-400 Ultraflex	$.89/ft
LMR-600	$1.19/ft
LMR600 Ultraflex	$1.95/ft

HIGH CARBON STEEL MASTS

5 FT x .12" / 5 FT x .18"	$35/59
10 FT x .18" / 11 FT x .12"	$129/80
16 FT x .12" / 16 FT x .18"	$119/179
20 FT x .25	$315
22 FT x .12" / 21 FT x .18"	$149/235

GAP ANTENNAS

Challenger DX	$289
Challenger Counterpoise	$29
Challenger Guy Kit	$19
Eagle DX	$299
Eagle Guy Kit	$29
Titan DX	$329
Titan Guy Kit	$29
Voyager DX	$409
Voyager Counterpoise	$49
Voyager Guy Kit	$45
Quick Tilt Ground Mount	$75

LAKEVIEW HAMSTICKS

9106 ..... 6m	9115 ... 15m	9130 ... 30m
9110 ... 10m	9117 ... 17m	9140 ... 40m
9112 ... 12m	9120 ... 20m	9175 ... 75m

All handle 600W, 7' approximate length, 2:1 typical VSWR ... $24.95

HUSTLER ANTENNAS

4BTV/5BTV/6BTV	$129/169/199
G6-270R, 2m/70cm Vertical	$169
G6-144B/G7-144	$109/179

Hustler Resonators in stock–call

ANTENNA ROTATORS

M2 OR-2800PDC	$1249
Yaesu G-450A	$249
Yaesu G-800SA/DXA	$329/409
Yaesu G-1000DXA	$499
Yaesu G-2800SDX	$1089
Yaesu G-550/G-5500	$299/599

ROTATOR CABLE

R62 (6, #18)	$.32/ft.
R81/82	$.25/.39
R84	$.85/ft

PHILSTRAN GUY CABLE

HPTG1200I	$.45/ft
HPTG2100I	$.59/ft
PLP2738 Big Grip (2100)	$6.00
HPTG4000I	$.89/ft
PLP2739 Big Grip (4000)	$8.50
HPTG6700I	$1.29/ft
PLP2755 Big Grip (6700)	$12.00
HPTG11200	$1.89/ft
PLP2758 Big Grip (11200)	$18.00

Please call for more info or help selecting the Phillystran size you need.

WEEKDAY HOURS:
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9 AM–12 NOON CST

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