Yankee Clipper Contest Club

Scuttlebutt

No. 62 March 1986

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Captain's Cabin

Bill Santelmann, N1AU

I've got some good news and some bad news. Let's start with the good news. Packet radio was a smashing success in its first trials as a spotting net during the recent ARRL DX contests! This net operated from my station in Lexington to K2TR through K1EA, KM1C, and KY1H for the entire CW weekend. We had trouble finding a clear frequency in the "packet subband" and finally staked a claim on 147.495 MHz. The "UNPROTO" mode was used which does not expect acknowledgments. Messages going west were sent as "YCCC VIA K1EA, KM1C, KY1H, K2TR", while K2TR sent his in a reverse sequence. Initially, traffic from KM1C sent westward were not copied here, but soon Bill solved that problem by sending his packets as "YCCC VIA K1EA, KM1C, KY1H, K2TR", first to the east and then back through his own station to the west.

We ran a multi-two at N1AU for the phone weekend, with K1AR, KC1F, W1FJ, and myself. I found that all hands enjoyed and used the packet facility frequently, and that really hot spotting data was processed accurately and promptly without diverting the operator from his pursuits. K1AR said he enjoyed the packet net as much as the contest itself, and I think all of us who participated would agree. It gave us far more than just the latest DX data. We knew when operators changed or went to bed and returned, what problems were developing, what their QSO and multiplier totals were, and even shared those occasional moments of triumph. In short, we were not contesting alone, even in the long, slow hours of the night, and it felt good!

I saved both weekends of packet traffic to disc with my Packratt-64 and have printed them out to bring to the April 5 meeting. The $\frac{3}{8}$" thick printout attests to the usefulness of packet during these contests.

Those who did not have packet were also included through K1OX/R. Several of us maintained contact between 2-meter voice and packet so that traffic passed both ways during the CW weekend. Unfortunately, K1OX/R was off the air during the phone weekend, and K2TR chose not to packet with us to preserve single-op status, but NB1H did join us on packet through KM1C.

Since the ARRL DX tests, several more YCCC stations have added packet, including K1GQ and AK1A, who is planning a YCCC Bulletin Board System (BBS). K1XM is planning to be on by the next meeting, with some ambitious plans for contest- and DX-based programming. What we need now are some links down into Connecticut, Rhode Island, and New York. K1KI is on packet also and is a target for net expansion. Packet spotting is a concept that seems to have "gone critical" now and will soon be seen in most every serious contest station.

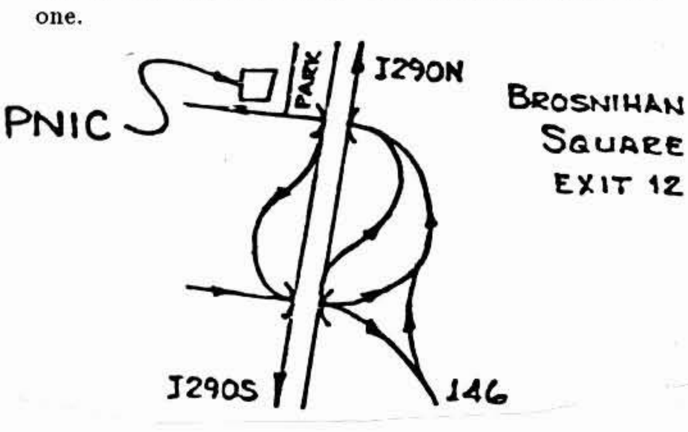
My hope is that packet spotting, perhaps with local connections to voice repeaters, will add a new dimension of fun to contesting and improve our club participation.

Which brings me now to the bad news. At the last meeting, the proposal made by K2VV to require at least two contest logs per year for YCCC membership was defeated by secret ballot. Apparently, most of the eastern New York members have taken this as a rejection of their efforts to build YCCC into a contest-winning club, and they have responded by withholding their ARRL DX scores from YCCC with the intention of not renewing their memberships. This is a serious blow to the YCCC, since the rest of us cannot hope to win anything without them. While I and many others understand and sympathize with the 2-landers' objective, the means were not acceptable to the 1-landers. Is there no basis for compromise?

Yankee Clipper Contest Club April Meeting

The next meeting of the Yankee Clipper Contest Club will be on 5 April 1986, at 1:00 PM at the PNIC in Worcester.

This is an election meeting - Come and nominate someone.



Famous Directions to the PNIC:

From the Massachusetts Turnpike (I-90):

Get on I-290 North. Take exit 12 to Brosnihan Square. Go around the rotary under I-290, then take an immediate right and park in the lot on the right. PNIC is across the street.

From I-290 Heading South: Take exit 12. Go around the rotary passing under I-290 twice, then turn right as above.

From Route 146 (RI. etc.) Follow 146 into the rotary at I-290. Go around and under I-290. Turn right as above.

SECRETARY'S REPORT YANKEE CLIPPER CONTEST CLUB

The February YCCC meeting was held on 2 February 1986 at the Quality Inn in Chicopee, Massachusetts, with 58 members attending.

The club welcomed five new members:

David Berthiaume	KA1GQW
Don DeZarn	KB1KE
Marty Durham	NB1H
Hugh Masterman	NC1M
Susan Tannenbaum	KU2Q

ARRL DX test log sheets, summary sheets, dupe sheets, etc. were available.

The club discussed both of K2VV's (John) proposed By-Laws changes at length. See the January **Butt** for the text of the proposed amendments. Of the 58 members in good standing present and voting, a $\frac{2}{3}$ majority (39) was required for passage. Both amendments failed.

Ken, K1EA, discussed the proposed packet radio spotting network for the multi-op stations for the DX Tests. YCCC may be looking into a quantity discount for packet equipment.

Doug, K1DG, reported on the latest ARRL Contest Advisory Committee activity. Doug is the New England Division representative, while N2LT represents the Hudson Division. Randy, K5ZD, resigned as the chairman of the committee, which Doug now heads. The CAC turned in a recommendation to the Awards Committee and the Board of Directors to not allow contest QSOs arranged by non-radio means, but the Board has not yet acted on this. The ARRL QSO parties were discontinued by the Board of Directors, with no input asked from the CAC. The IARU has modified the Radiosport contest: the contest is now only 24 hours, and the headquarters stations of IARU member societies (for example, W1AW) now count as separate multipliers. It is not yet clear how you will be able to identify these headquarters stations.

Several topics are currently under consideration by the CAC. There is a proposal for VE8/VY1 to count as separate multipliers in ARRL contests where the multipliers are states and as one multiplier in those contests where the multipliers are sections (Sweepstakes, for instance); this will eliminate having different rules for the 10m and 160m contests. There are several proposals for changing the club competition rules. For example, should the ARRL change the meeting attendance requirement to include members living inside "local" territory? Should they change how the three types of clubs are defined, perhaps basing it on the number of members operating rather than on the number of members? They are also considering how to change the DX Tests to make them more popular with DX operators, perhaps by allowing DX-to-DX QSOs, sending copies of the rules translated into the correct languages to DX IARU member societies, or by having club competition for DX clubs. The ARRL band plan changes for 160m will be published soon. The 160m Contest may be changed to disqualify operations in the DX window. There is still on-going discussion of **QST** contents and the amount of contest coverage. There is also still discussion about allowing spotting nets for single-operator stations.

Doug needs immediate input on proposed changes to the June VHF contest. The proposal is to allow a QRP category for VHF contests, to motivate people to activate rare grid squares on "DXpeditions".

There were several CAC member changes.

See Doug for Dayton rooms, too - and soon!

Doug, K1DG, also proposed that the club president nominate a committee to encourage club participation, to report at the next club meeting. Paul, K1XM, pointed at that the club constitution already gives the president the authority to do this. Bill, N1AU, asked John, K2VV, to chair such a committee, but John declined. Bill promised to appoint such a committee. Later, Bill, KM1C, volunteered.

Ed, KA2MXO, had reprints of several packet radio articles from **Ham Radio** for interested members.

Tom, K1KI, reported on activities at the ARRL Directors Meeting. The Board voted to change the ARRL 160m band plan to cw and rtty from 1800 to 1840, and SSB and other wideband modes above 1840, with the segment from 1830 to 1850 reserved for intercontinental QSOs. They will not request this of the FCC, so the bandplan will be voluntary. The Board voted to change the policy for awards on 24 MHz. This band now counts for DXCC (but not for 5BDXCC or 5BWAS). Field Day will use 24 MHz. These rules will also apply to 18 MHz when it becomes available, but not to 10 MHz. The ARRL has filed a petition with the FCC to label home entertainment devices that are susceptible to RF (especially VCRs), noting that the voluntary rules are not working. PRB 1 has been successfully tested in court. The ARRL is proposing to change reciprocal license identification requirements to follow the convention used by most other countries now: the reciprocal designation before the home call, for example, W2/VE3BMV. Tom thinks that perhaps the various ARRL newsletters should be combined; many of the mailing lists for them show great overlap. One member suggested that the combined newsletter be called "**QST** Classic".

Don, W3AZD, reported on DXCC matters. The main controversy here is the status of Aruba, now P4. The DX Advisory Committee is being asked for their recommendations. The P4 prefix is now used only by Aruba, not by any of the other 5 islands of the Netherlands Antilles. Final independence from the Dutch is scheduled for January 1, 1996. Separate administration is no longer a DXCC criteria. There is no change on the Pribilofs. Extraterritorial outposts, such as United Nations offices, embassies, etc., no longer qualify as separate DXCC countries, so 4U1VIC will not be a separate country. There is talk of an FCC banned-countries list again, to consist of countries where amateur radio is outlawed. Peter I Island meets current DXCC criteria and will count as a separate DXCC country if anyone ever activates it. The backlog of DXCC updates is now down to 11 weeks, with the addition of more manpower. Mount Athos does not currently allow amateur radio.

N4ZC at G.I.S.M.O. reportedly is selling radio equipment at 5% above cost if you identify yourself as a YCCC member.

John, K1AR, is working on getting club QSL cards again. The price will probably be $44/2000. See John for details.

KB1T, John, has contest calendars for $8. $1 of the price goes to the club treasury. This year's calendar has a page for each month, with black and white pictures of well-known contest operators and operations.

The **Scuttlebutt** will return to blue paper, by popular demand. W1GG reported that his wife did not recognize the white **Butt** and threw it out. NOTE: there is currently no price difference between blue paper and white paper.

Ken, K1EA, Bob, KQ2M, and Mark, K1RX showed slides of the CQ WW SSB DXpedition to VP2VCW. They reported many problems with the insect population, and twelve thousand Qs.

This was followed by N1CQ (Bill) showing slides of his damaged tower from last fall's Hurricane Gloria, which has since been repaired by Bill and the fearless Ron, K1BW, who climbed the Rohn 25 to the level where the tower broke to secure the damaged sections in place for removal (because, according to N1CQ, Ron weighs less!). For those who were wondering, Bill also reported that, no, his guy anchors did not fail! The damage occurred when a large tree limb blew into a guy wire, pulling the top of the tower over.

After all this activity, the hungry crew retired to a local deli for much-needed refreshments.

Respectfully submitted,

Charlotte L. Richardson, KQ1F
Secretary/Treasurer
4 February 1986

Vibration Effects Upon Antenna Structures

Bill Shaheen, N1CQ

Vibration-induced problems have been encountered by most hams at one time or another. Such problems may occur as premature antenna failure or as excessive tower vibration, for example. It is well-known that 15 meter beam elements fail due to metal fatigue much more often than beam elements for other frequencies.

This paper will present the basic underlying concepts of vibration theory and steps that can be taken to reduce effects of harmful vibration. Failure due to metal fatigue will be treated in a separate article at a later date.

Structures vibrate in forms that can be explained mathematically. In this article, we shall consider the theory of vibration from a qualitative viewpoint. Consider the simple oscillating system shown below in Figure 1. It consists of a mass (M) and a spring (with stiffness K). K is in units such as pounds per inch of deflection. Analyzing this simple model, it can be shown[1] that the natural mechanical oscillatory frequency is:

$F = \frac{1}{2\pi}\sqrt{\frac{K}{M}}$, where F is the frequency in Hz.

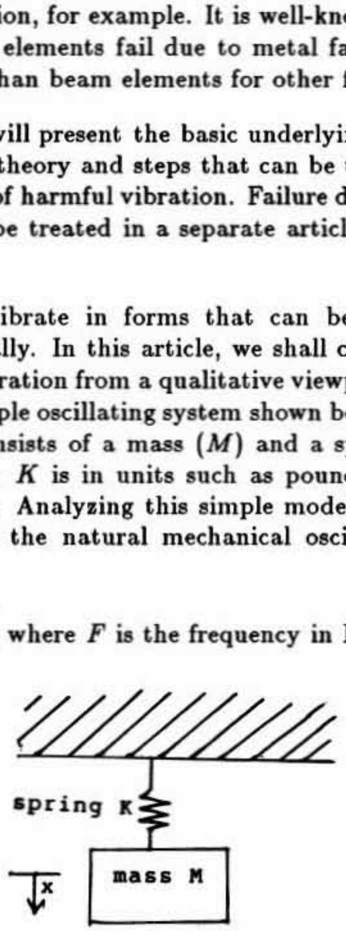


Figure 1.

From this simple model, a model may be developed using an "equivalent" K and an "equivalent" M to model a system with *many* masses and spring-like components.

An antenna element is a case in point. Tap it with a hammer while holding it in your hand. Note that it vibrates. Try the same experiment with a shorter piece of the same tubing and note that the vibration frequency seems higher.

The resonant frequency is a function of K and M. K and M, on the other hand, are a function of other parameters such as geometric properties of the structure (for example, I, the moment of inertia; the cross-sectional area; and the length, from the last article), the modulus of elasticity of the metal, mass distribution along the structure, among others.

Therefore, one can conclude that any structure has a determinable "natural" mechanical frequency which is analogous to the familiar electrical resonant frequency.

A structure cannot vibrate on its own; it requires excitation. Wind and ground movements are two common means of exciting a structural element. Ground movements (earthquakes) have frequencies on the order of 1 to 10 Hz, while wind produces tiny vortices that break away from the downstream side of the element at a regular rate. This rate is a function of the wind velocity. When the wind velocity causes this vortex-shedding rate to be equal to the natural frequency of the element, mechanical resonance occurs. If one notes the behavior of a 15 meter beam, for instance, during a wind of about 15 mph, one will notice large element deflections. These deflections, incidentally, are sinusoidal in nature. One can not this if he/she climbs the tower and watches the element move.

When this excitation frequency coincides with the natural frequency of the structure, a condition of resonance occurs and the amplitude of structural deflection becomes very high, theoretically approaching infinity. It does not, of course, because of internal damping caused by energy dissipation within the element. The greater the damping, the less the amplitude. This is why putting rope within your 15 meter beam elements often cures the vibration problem. Though damping is one method to control vibrations, it is often better done by actually changing the natural frequency of the structure. This is because amplitude and frequency are related to each other in a very Hi-Q type relationship. Changing the natural frequency just a little will effect the amplitude greatly; often much more than by increasing the damping.

One can employ a scheme of changing both parameters if necessary, by roping the elements *and* placing concentrated masses at certain points along the element to move away from resonance.

Numerical methods are available to predict vibration behavior of structures. They consist of solving simultaneous linear equations for all but the simple one mass – one spring problem. The basic principle to solve the 15 meter beam problem, for example, would be to subdivide the antenna element into many small pieces and consider each separately while observing conditions of continuity (compatible displacements) and equations of static equilibrium. Oh, by the way, the natural mechanical frequency of a Hy-gain 155BA is about 27 Hz.

Resonance (high amplitude deflections) will occur at a wind speed of about 17 mph.

[1] N. T. Thomson, *Theory of Vibrations with Applications*, Prentice-Hall (1981), Englewood Cliffs, N.J., p. 15.

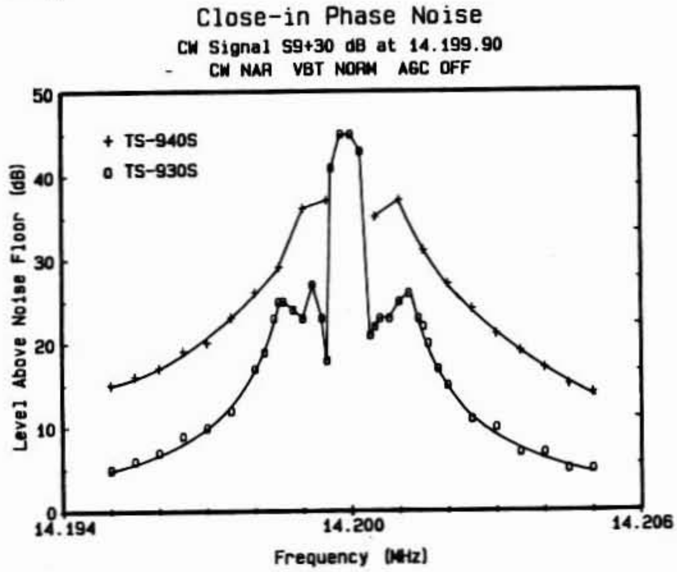
Should I buy a TS-940S?
Bill Myers, K1GQ

In a word, **NO.** John (W1FV) and I just finished comparing the phase noise performance of his TS-940S with my TS-930S, and we determined that the '940 is significantly inferior to the '930. The rumors are true – the noise generated inside the '940 receiver is roughly 10 dB larger than for the '930. Now, you may decide that some other features of the TS-940S are more important to you than receiver performance, but I still don't want you to buy one, because the '940 transmitter is just as much inferior as the receiver. As a result, you will be trashing all your neighbors on the band – and I'm one of them. There is nothing I can do to reject the noise that you transmit in my passband, so please don't!

I don't think there are any adjustments or simple component changes which can improve this state of affairs. The only hope is convince Kenwood (and all other radio manufacturers) that the problem is important enough to redesign their synthesizers. Unfortunately, recent discussions with the Kenwood service people indicate that they will not even admit that the problem exists – never mind that their latest and greatest radio is a step backward. [Note that I'm not claiming that the TS-930S has adequate phase noise performance – it doesn't. But as far as I've been able to determine, the '930 has the lowest phase noise of any radio currently in production that is suitable for CW contesting.]

None of the manufacturers of amateur gear supply any data on phase noise characteristics, yet it is the dominant factor limiting HF (and VHF) radio performance today. I intend to politely harass Kenwood, and I hope you will do the same.

Here's how John and I measured the phase noise performance – non-technical types can stop reading now. Both radios were tested in CW mode, with the narrow filter position selected and the VBT set at NORMAL. The AGC was turned off. First, we set the two receivers to show the same audio output level with no signal input, at 14.2 MHz (using a true RMS voltmeter). Next, I set up a crystal oscillator (which has very low noise sidebands) to generate a 30 dB over S9 signal at 14.2 MHz (the same signal level produced the same S meter reading in both radios!). Then we measured the audio output levels relative to the reference level, every 50 Hz from 5 kHz below the signal to 5 kHz above the signal. The results are plotted in the figure (I have added extra points very close in for the '930).



Close-in Phase Noise

The measurements were surprisingly consistent: they were repeatable with 1 dB, and appear to fit smooth curves quite nicely except within 1.5 kHz from the signal. I suspect that the apparent compression of the interference level near the signal is caused by nonlinearity – remember that the AGC is OFF, so stages downstream from the filters get whacked with a huge voltage when the signal isn't suppressed by the filter stopband selectivity. The transition to this region is probably established by the response of the first IF filter. My radio has a stock Kenwood filter, while John's has the IRI filter.

The difference in transmitted phase noise will be the same as shown in the figure if the receiver noise floors are the same. I failed to acquire a reliable measurement for the '940, but W2VJN's results suggest that the TS-940S is a few dB more sensitive than the TS-930S. This would reduce the difference; however, a quick qualitative test with a 75S-3C monitoring each transmitter confirmed that the '940 transmits significantly more noise than the '930.

Floating

Paul Young, K1XM

At the last YCCC meeting I said I believed that if everyone worked as hard as I did for the club that we could win contests. Well, the ARRL DX contest proved that wrong. Even if everyone from YCCC who was on submitted for the club we still could not have made up for the 15 meter advantage the 3-land stations had. Oh well, there will always be another contest...

We are in the process of updating the YCCC dupe sheets. We already know about the problem with the G0s. If you have any other suggested changes, please send them to me. We will try to have the preliminary update at the meeting so people can make suggestions.

It is not possible for me to tell who has earned an Editor's Award simply by reading **QST** and **CQ**. If you have earned one, please tell me at the next meeting or send me a postcard.

Because of the large number of scores we have gone to a smaller type size for them. Also, by popular demand I am returning to the blue paper for the **Butt**.

By the next meeting I will be active on packet. In addition to its advantages for contest spotting, I can use it to get scores and articles from members. Also, it is ideal for DX spotting. I plan to program my computer to look at any DX spotting announcements and to compare the call against my needs list. If a brand new one shows up, I can have it wake me up at night, or call me at work during the day!

Results of the YCCC Packet Net

Ed Landry, WA1ZAM

ARRL DX Contest 1.8 MHz cw:

4U1UN	G3WPF	KH6AT	SM7BIC
9Y4AA	G3WVZ	KH6XX	UQ1GWW
CX8DT	GD4BFG	KL7Y	V2AD
DL6FB	GM3LYY	N5AW/NP2	V3DA
EI9J	GM3WIA	N6EA/C6A	V47A
FG/W2KN/FS	J34Z	NP4Z	VP2VA
FG6AM	J37Z	P40M	W2ZZ/CT3
FM5WD	K3UOC/YV4	PJ9J	WP4L
G3BDQ	K4GW/V4	SM6EHY	YU7AU

ARRL DX Contest 3.5 MHz cw:

4N2X	HA1IE	NP4Z	UZ2FWA
4U1UN	HC2SL	OA4ZV	V3DA
8R1Y	HP1AC	OK3TJI	V47A
C6ADR	IO3AIY	ON5WL	VP2VA
CO1HJ	J34Z	P40M	VP9GD
CU2AK	K3UOC/YV4	PA0LOU	WP4K
CU3AA	KH6XX	PJ9J	XE2MX
DF2PI	KX6DX	SK6TW	YV3AGI
EA3AQS	LA1EE	SM6BGG	YV5ANE
EA6GP	LA2EG	SP5PBE	ZF2IZ
EA8BIE	LZ2DF	TI2PZ	ZL1AMO
FM5HL	N5AU/KP2	UP2BEI	ZL3GQ
GD4BEG	N5AW/NP2	UP2BO	ZS6USA
GM3YOR	N6EK/C6A	UP2BZZ	

ARRL DX Contest 7 MHz cw:

4U1UN	FP5HL	K0GCB/C6A	VK2APK
5T5RG	GI3OQR	KH6XX	VK2GW
9Y4AA	GU3HFN	LU4HUN	VP2VA
A35WZ	H44IA	LZ2CC	VQ9LD
AH6AZ	HC2SL	OE1XTU	W2ZZ/CT3
CO2OM	HZ1HZ	P40M	W6QL/Z2
CX7BY	J34Z	PJ9J	XE2HQ
EA2OP	JA2YKA	PY1OL	YV5ANE
EA8ZS	JA7YAA	PZ1AR	Z22JS
FG/W2KN/FS	JE2YRD	TI2CCC	ZL3GQ
FO8JP	JG1FVZ/5N0	V47A	ZS6USA

ARRL DX Contest 14 MHz cw:

3V8PS	FP5HL	K3UOC/YV4	V3DA
4U1UN	G3WPF	K4GW/V4	V47A
4X6IF	GI3OQR	K7SS/KH6	VK3BHK
5H3ZO	GU3HFN	KH6IJ	VK3XB
5Z4DE	HB9BFQ	KP4FI	VK4XA
6W1PC	HC2SL	LX1WC	VK6HQ
6Y5MJ	HK3RQ	N5AW/NP2	VP9GD
9H1FQ	HK6DG	NL7GP	VQ9LD
9H1IF	HP1AC	OY3H	W6QL/Z2
AH6AZ	HZ1HZ	OZ7HT	WL7E
C6ADR	IS0OMY	P40M	XE2MX
CP6JX	J28EG	PJ9J	ZL8OY
CX7CO	J34Z	PZ1DV	ZP3KJ
EA6MR	JA7YAA	UA1OT	ZS6USA
FM5CW	JG1FVZ/5N0	UZ0QW	ZX0ECF

ARRL DX Contest 21 MHz cw:

6Y5MJ	FM5CI	NP4A	VS6DO
9Y4AA	FO8JP	OA4QZ	W2ZZ/CT3
A35WZ	GU3HFN	P40M	W6QL/Z2
AH6AZ	HC2SL	PA0RE/CT1	WL7E
E3DDP	HK1HHX	PY2UJJ	XE2MX
CP8HD	HK1IU	T77C	YU4EBL
CT1APP	HP1AC	TE6T	ZF2AD
CX1BZ	IO3FIY	TI2CCC	ZK1CG
CX7CO	J34Z	UQ1GWW	ZL3GQ
EA6MR	JG1FVZ/5N0	V3DA	ZP5XDW
EA8AVW	K4GW /V4	V47A	
ED1CI	KH6XX	VK2BQQ	
FG5DL/FS	KP2N	VK4XA	

ARRL DX Contest 28 MHz cw:

4U1UN	HP1AC	P40M	TU2LN
5T5CJ	J34Z	PA0VDV/PJ2	ZS6USA
9Y4AA	K3UOC/YV4	PJ9J	
HK1BAU	LU4EH	PY2MER	
HK1KSK	LU8AHW	PY7ZZ	

ARRL DX Contest 1.8 MHz SSB:

6Y5IC	KP4BZ	PJ0B	ZF2HI
I3EVK	NP4P	ZF2HE	

ARRL DX Contest 3.8 MHz SSB:

4U1UN	HB9AMO	ON4ALL	YU1AAO
6Y5IC	HB9CXZ	PJ0B	YU1EXY
A35WZ	HC1OT	PP2ZDD	YU3EXA
AH6AZ	HG7B	PZ1AR	YV5ANF

CO2QP	HI3AMF	TI2DNL	YV6BXN
CP1BA	HJ3LMR	V47M	ZF2HI
CU2AK	HK1ALW	VK2FAE	ZL1AAG
EA7ALL	HK4EB	VP2MDB	ZL1ANJ
EA7BB	I5NPH	VP5Z	ZL2BT
EA9IE	J34Z	VP9GD	ZL4BO
F6HMQ/FM	J6LMK	WB6FCR/KH6	ZL4DO
FM5CD	OA4ZV	XE1OX	
HA5KDQ	OK1ALW	XE2XGY	

ARRL DX Contest 7 MHz SSB:

4U1UN	D44BC	HK3KRU	V47M
6Y5IC	EA8XS	I4AVG	VK5MS
A22BW	F6ARC	J34Z	VP2MU
A35EA	F6HMQ/FM	JE2YRD	W8KKF/C6A
AH6FL	FG5BW	OK3CEM	YT2C
CE3BFZ	HA3KMA	TG9VT	YV6BXN
CT3BM	HC1OT	UZ6LWZ	ZL1AGO
CT4KQ	HC5EA	V3DG	ZY5TT

ARRL DX Contest 14 MHz SSB:

4X4BO	EA8ANV	KT5B/YV1	VP5Z
7X2LS	FG5CB/FS	OA4ZV	VU2ZAP
9H4M	GD4PTV	PJ7ARL	W2KW/KV4
9U5JB	GD5UG	PT2TF	W6QL/Z2
A22BW	GW4ZQV	T77C	WB2PSD/KH2
AL7CQ	HC1HC	TI2CCC	XE2XGY
BV2B	HI60RCD	TI2LCR	ZF2HI
C31LBL	HP1XAW	TR8JLD	ZS1SL
CN8EA	J34Z	TU4BR	ZS3GB
CN8LX	JA1YWX	UA1I	ZS6USA
CO7GC	JW0A	UB4QWW	KG4PS
CU2CR	K8MN/OH0	V47M	
D44BC	KD5VD/HR5	VP2MU	

ARRL DX Contest 21 MHz SSB:

5X5GK	EC9HR	LU1FOW	VP8JC
5Z4DU	EC9IR	LU4MEE	VP8MU
6Y5IC	F6HMQ/FM	N7NR/KH6	VQ9SK
7X2SL	FG5CB/FS	OD5??	VU2ZAP
9Q5MA	GW3NNF	PJ0B	W2ZZ/CT3
9Q5PA	HC1EA	PP1ZCP	W6QL/Z2
9U5JB	HH2RJ	SM2EKM	W8KKF/C6A
9X5WP	HH2SD	SV0AC/9	WA1TAE/TI2
A22BW	HI3JJL	SV0DK	XE1DXA
CN8EA	HI8FAH	SV5TS	XE2XGY
CN8LG	HK3MAE	T32AB	YO9HT
CO5RCD	HP1XRL	T77V	YO7APA
CO7GC	I0JX	TG9VT	ZD7CW
CP6NU	J34Z	TR8JLD	ZD9CI
CT3BM	JG1FVG/5N0	TR8RAL	ZF1RC
CU2CE	JG1FVZ/5N0	TU2JJ	ZL2SO
D44BC	K1AT/KJ6	TU4BR	ZP5FGS
DJ2ST/EA8	K2KTT/PJ7	V3DG	ZS1SL
EA6MR	K3UOC/YV4	V47M	ZS6USA
EA6RF	KH6XX	VP2MU	
EA9IB	KP4BZ	VP5Y	

ARRL DX Contest 28 MHz SSB:

5Z4DU	HK2HCN	LU6FAZ	ZD7CW
6Y5IC	J34Z	PJ0B	ZP5JAL
CE0ERY	J88BK	PY1NEZ	ZP5XKL
CP6NU	K0OSN/J3	PY2ZK	ZY5TT
CX2AAL	LU1BR	W1BIH/PJ2	
F6HMQ/FM	LU1E	WA8FSK/J3	
HC5KA	LU3MCO	WB0NAA/YN1	

N.O.S.C. Scientist Predicts Sunspot Activity

R. M. Hillyer

Dr. Adolph K. Paul has written a scholarly paper, "Analysis and Prediction of Sunspot Numbers", that appears in the December 1985 issue of *Geophysical Research Letters.* The paper presents both data and a methodology that may affect the scheduling of future shortwave transmissions and manned space activities.

In his paper, Dr. Paul predicts the number of sunspots that will appear annually through the year 2040 (see figure). He does so after employing an iterative procedure that involves, as a first step, a spectrum analysis of the monthly means number of sunspots observed since 1840. Secondly, he extends the data set by using those results for a first order of prediction. After comparing his prediction of sunspot activity with the number of sunspots observed, Dr. Paul revises his formulation to lessen discrepancies between prediction and observation. He repeats the process numerous times, getting, in each instance, a better fit between theory and fact over longer periods of time. He does this until his model satisfactorily accounts for the entire pattern of past sunspot activity. At this point, Dr. Paul uses his model as a predictive tool for the years 1986 through 2040. He realizes, of course, that future observations will necessitate adjustments in his model, but this activity is consonant with the nature of his enterprise, an iterative one.

Dr. Paul's mathematical treatment employs anharmonic frequency analysis, a transform and deals with data that do not consist solely of discrete multiples of a basic unit frequency.

By constructing a methodology that fits past data and promises to make predictions highly accurate, Dr. Paul has provided planners with an effective aid. Knowledge of future solar activity can facilitate effective long-term scheduling of projects requiring either extensive use of shortwave transmission or manned space activity. Intense ultraviolet and X-ray radiation associated with high sunspot activity affects shortwave transmission and may harm people building platforms in space.

Dr. Paul works in the Ocean and Atmospheric Sciences Division of the Marine Sciences and Technology Department. His current research focuses upon ionospheric variability and high frequency propagation.

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Dr. Adolph K. Paul
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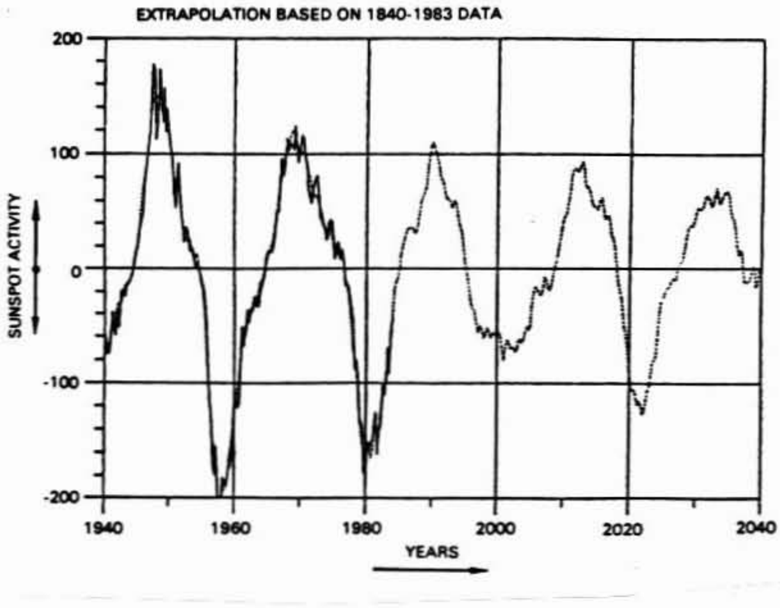

Dr. Paul's model (the graph composed of dashed lines) closely approximates sunspot occurrences (the solid curve) for the years 1940 through 1983. Greatest sunspot activity occurs at highest positive and lowest negative readings on the curve. Positive values indicate one orientation of the sun's magnetic field whereas negative values indicate the other orientation.

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N.O.S.C. is Naval Ocean Systems Center

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Antenna Construction

Bill Pedersen, KM1C

Two winters ago, I experienced one of those defeats in Amateur Radio that almost caused me to look for another hobby. One week after carefully installing a 4-element 20 meter Cushcraft Skywalker at 100', a windstorm left the forward director angled about 40 degrees one way and the reflector about 30 degrees the other. Not to mention the performance degradation, the beam looked terrible. With all the work that had gone into this project, it was a very frustrating situation. I concluded that there had to be a better way of constructing beams so that element rotation such as had occurred would not happen again. I came up with a 2-fold solution as follows:

1. For any beam that does not employ a rigid, one-piece boom, convert it to one! Pin the boom sections together with stainless-steel thru-bolts. Do not rely strictly on hose-clamps or hose-clamps plus "set" screws. (The "set" screws that had been installed on the above beam sheared off in the strong gusts.) Your goal should be to prevent any torque forces from being able to rotate sections of the boom.

2. Certain styles of element-to-boom clamps will also allow slippage under high-wind conditions. The fix employed here also has many other applications. It involves the use of an epoxy-paste called PC-7, available at most hardware stores. (It comes in two cans: the $8.95 version will do two or three beams.) This compound has a cure time of about 24 to 72 hours depending on temperature, but, with its use, you have the capability of "welding" various components together. I use it to permanently attach the element-to-boom clamps directly to the boom. Do this by liberally applying the PC-7 to the clamp U-bolts that surround the boom and also those portions of the clamp that are in contact with the boom. (Not the element, if you wish to be able to remove it!)

The above procedures have been used in building 10 and 15 meter 4-element Skywalkers with excellent success. They have survived a number of winter storms plus hurricane "Gloria" with no element shifting whatsoever.

The actual construction steps employed are as follows:

1. Boom is built per specs and set up on a "Work-Mate" vise-bench. Boom sections are then drilled and stainless-steel thru-bolts installed.

2. Once boom is made rigid per above, fasten middle portion of each element to the boom with the element-to-boom clamps and set up per beam specs, i.e., proper spacing between elements and all elements parallel to the ground. (Use a carpenter level.) Torque all hardware and recheck spacing and parallel. Now you can apply the PC-7. Allow it to cure fully before moving anything on the array. When cured (compound will be rock-hard), detach middle portion of elements, leaving the clamps (which are now an integral part of the boom).

3. Element construction can now be completed. I prefer to use small stainless-steel nuts and bolts (in addition to the hose-clamps) to pin the element sections together. I also run a piece of rope through the full length of each element and knot it off at the ends. (Add the rope during construction of the element, running it through one section at a time.) Purpose of the rope is to dampen oscillation and hold on to any part of an element that might break off in an ice storm.

4. I also install the boom-to-mast bracket to the boom,

align it vertically to the elements, and PC-7 it in place. This bracket thus also becomes an integral part of the boom.

Since I seem to be able to build and install antennas only during the middle of winter, I use the basement of our home for all of the initial beam construction. The warmer you can make the work area, the more quickly the PC-7 compound will cure.

Although these procedures take additional time, the extra effort has proven to be worthwhile. In addition to "wind-proofing" your antennas, assembly of the beam at the top of the tower becomes a simple matter of fastening the elements into place on the boom and attaching the boom to the mast. Since all alignment was accomplished at ground level, all you have to do is hook up the coax and start running Europeans! The whole array should hold together for many maintenance-free years.

YCCC Prize for 1986 CQ WPX CW

Paul Young, K1XM

This year, YCCC will be donating a prize to the winner of the CQ WPX CW Contest, in the all band single operator category.

The major part of the prize will be a Kenwood TS-830S transciever, donated by YCCC.

Charlotte and I will donate a keyer and paddle to go with the rig.

Ken, K1EA will donate an amplifier (if it is legal in the winner's country!).

We are soliciting donations from the members for additional equipment, perhaps an antenna or rotor.

Restrictions:

- The winner must be able to receive the prize. YCCC will pay shipping, but not duty.
- American and Canadian hams are not eligible for this prize.
- The winner of the 1984 and 1985 YCCC prizes are not eligible again this year.

If the contest is won by an ineligible operator, the highest eligible score will win.

Score Rumors:

More CQ WW SSB:

CALL	QSOs	Zs	Cs	SCORE
KY1H	672	76	183	455840

More CQ WW CW:

CALL	QSOs	Zs	Cs	SCORE
KY1H m/s	1138	89	226	1024380

ARRL 10m Contest:

CALL	QSOs	Ms	HR	SCORE
KY1H	59	21	7	2478

73 75m SSB Championship:

CALL	QSOs	Ms	SCORE
KY1H	330	58	98310
K8HVT	415	74	159840

73 160m SSB Championship:

CALL	QSOs	Ms	SCORE
K8HVT	156	45	35550

SS SSB:

CALL	SCORE	QSOs	MT	HR	P	SEC
KY1H	114756	786	73	20	B	WMA

CQ 160m CW:

CALL	QSOs	Ms	SCORE
KA1DWX	274	71	60563
KY1H multi	650	77	154385
AK1L (+KA1X)	452	61	68869
W1YK (KM1P op)	121	43	12470
K8HVT	191	47	20774

KY1H ops: W1BS. KB1W. WB1EYL. KS1N. K1RQ. KY1H

CQ 160m SSB:

CALL	QSOs	Ms	SCORE	
AK1L (+KA1X)	524	45	8	64K
K8HVT	283	56	36344	

Sprint CW:

CALL	QSOs	Ms	SCORE
K8HVT	130	31	4030

Sprint SSB:

CALL	QSOs	Ms	SCORE
K8HVT	171	30	5130

ARRL DX CW S/O:

CALL	QSOs	Cs	Score
K1AR	1600	290	
K1BW	1420	250	
KA1CI	780	164	
K1DG	1481	256	
KC1F	1640	286	
W1GG	467	119	166K
W1WEF	1283	227	
KU2M	340	75	
KA2MXO	750	69	
W2RQ	330	110	
K2OY	115	95	
AI3E	302	127	115K
W3GRF (K0DQ op)	1780	285	
K3ZO	1750	268	
K5ZD/1	1272	235	
K8HVT	494	161	238K
WD8IXE	615	227	
WA0TKJ	365	180	
C6ADR (N1EE)	1950	?	

ARRL DX CW S/O S/B:

CALL	Band	QSOs	Cs	Score
KV8Q	15	185	61	
KP4BZ (NP4Z op)	15	1695	56	
W1IHN	20	712	69	
KA2MXO	20	750	69	155K
K2VV	20	1326	92	
K3LR	20	1165	95	
KS8S	20	823	77	
KR2J	40	604	89	
K2SX	40	19	9	
KS8S	40	295	73	
W1FV	80	457	74	
W8LT	80	123	52	
N8UM/4	80	221	60	

ARRL DX CW M/S:

CALL	QSOs	Cs	Score
KM1C	1341	274	
K1IU	1279	253	
KA1X (+AK1L)	759	166	377K
K1YR	1630	270	
N2MM	1350	302	
P40M	5232	300	4.709M
4U1UN	3700	269	

ARRL DX CW M/2:

CALL	QSOs	Cs	Score
KY1H	1203	232	837K
K1RX	974	191	
K1XM	1264	260	1M
N5AU	1867	337	1.88M

KY1H ops: KY1H, KB1W, K1RQ, WB1EYL, KS1N, KB1KE, WB2VLM, KJ1K, WA1ZAM, and packet net.

ARRL DX CW M/M:

CALL	QSOs	Cs	Score
K1EA	1050	230	
N2ME (at K3JLP)	2510	412	3.1M
K2TR (9 ops)	2353	380	2.68M
W3LPL	2429	395	2.86M

ARRL DX SSB S/O:

CALL	QSOs	Cs	Score
K1AR	4	3	
N1CPC	49	?	
K1DG	1488	280	
W1GG	726	165	359K
K1IU	1000	244	
K1KI	1969	329	
K1MEM	50	40	
K1RQ	100	61	
K1VR	1255	248	
K1VSJ	464	148	206K
KQ2M	562	216	
W2RQ	1235	210	
AI3E	154	93	
KT3M	1590	280	
K3NA	159	62	
K3ZO	1650	299	
WX4G	1449	282	
K4VX	1080	321	
K5ZD/1	1299	291	
K8HVT	241	108	78K
W9RE	1300	?	
WA0TKJ	400	200	

ARRL DX SSB S/O S/B:

CALL	Band	QSOs	Cs	Score
KS8S	10	9	8	
K1MM	20	49	20	
W1WEF	20	1084	102	
N2AA	20	1450	107	
N2AU	20	1240	103	
KR2J	20	1500	103	
K2VV	20	1800	116	
KS8S	20	1064	113	
W4PZV	40	62	37	
AD8C	40	117	52	
KA1GQW	75	60	31	
KM1H	75	230	67	
KM1R	75	112	54	
KA1SR	75	153	54	
KA1XN	75	191	73	
K2EK	75	260	71	
WB2ITR	75	149	64	
WA4SVO	75	158	65	
KS8S	75	140	62	
N8UM	75	148	64	
K1ZM	160	72	40	

ARRL DX SSB M/S:

CALL	QSOs	Cs	Score
NB1H	891	230	
KS1N	470	164	
(+WB1EYL, KB1KG)			
	1400	280	
AK1L (+KA1X)	1007	196	592K
KA2MXO	516	144	222K
WB2ULI	1400	280	
WB8JBM	1280	308	
KP4BZ	6906	301	
ZF2HI	7159	301	6.5M

ARRL DX SSB M/2:

CALL	QSOs	Cs	Score
N1AU	1688	298	
(+K1AR, KC1F)			
KQ1F	844	219	554K
(+K1XM, KM1P)			

ARRL DX SSB M/M:

CALL	QSOs	Cs	Score
KM1C	1069	281	
K1EA	1005	302	
KY1H	657	194	382K

KY1H ops: KY1H, WA1ZAM, packet net.

KM1C ops: WB8BTH, W1PH, KB1T, KM1C, packet net.

ARRL DX SSB Breakdowns:

K2BU:

Band	Qs	Cs	
160:	64	40	
75:	280	77	
40:	222	75	=3.75M
20:	1507	121	
15:	606	107	
10:	86	32	
TOTAL:	2765	452	

N5AU M/2:

160:	52	32	
75:	167	67	
40:	404	67	
20:	638	109	=2.3M
15:	473	104	
10:	113	35	
TOTAL:	1856	414	

High Claimed Scores

Billy Lunt, KR1R

SS CW S/O:

CALL	SCORE	QSOs	MT	HR	P	SEC
K6LL	174936	1182	74	24	B	AZ
K4VX	172864	1168	74	24	B	MO
N5JJ	172568	1166	74	24	B	STX
W5WMU	170940	1155	74	24	B	LA
KY7M	170052	1149	74	24	B	AZ
K5LZO	168276	1137	74	24	B	STX
W6AQ	167388	1131	74	24	B	LAX
K5GO	166500	1125	74	24	B	AR
WA7NIN	166204	1123	74	24	B	NV
K5GN	165760	1120	74	24	B	STX
N5AU	163392	1104	74	24	B	NTX
N5DU	162948	1101	74	24	B	STX
N6TR/7	162356	1097	74	24	B	OR
W3LPL	162060	1095	74	24	B	MDC
N6RO	161468	1091	74	24	B	EB
N4WW	161320	1090	74	24	B	NFL
K7OX	160016	1096	73	23	B	AZ
K5MM/7	159544	1078	74	23	B	OR
K6NA	158656	1072	74	24	B	SDG
K4JPD	157768	1066	74	24	A	GA
K5ZD/1	156880	1060	74	24	B	NH
W2RQ	154956	1047	74	24	B	NNJ
N8II	154906	1061	73	24	B	WV
K1ZM	153328	1036	74	24	B	ENY
N6OP	153300	1050	73	24	B	EB
N6NF	150812	1019	74	24	B	SCV
K4BAI	150664	1018	74	24	B	GA
K5MR	150368	1016	74	24	B	NTX
N4BP	149650	1025	73	24	B	SFL
W1WEF	149184	1008	74	24	B	CT
WC6H	146584	1004	73	24	B	SJV
VE7CC	146224	988	74	23	B	BC
K3ZO	146000	1000	73	24	B	MDC
KB7G	144300	975	74	24	B	WA
N0GA	143708	971	74	24	B	IA
K7QD	142560	990	72	23	B	ID
KM0L	141636	957	74	24	B	MO
KF0H	139120	940	74	24	B	IA
KC0D	137344	928	74	24	B	CO
K9KM	136752	924	74	24	B	IL

SS CW M/O:

CALL	SCORE	QSOs	MT	HR	P	SEC
AA5B	162504	1098	74	24	B	NM
KJ9D	161616	1092	74	24	B	IN
N5CG	153180	1035	74	23	B	OK
W0AIH	145336	982	74	24	B	WI
K7LXC	144300	975	74	24	B	WA
N4KG	140896	952	74	24	B	AL
K5RR	139564	943	74	24	B	NTX
N0IN	134620	915	74	24	B	OK
KE7C	131572	889	74	24	B	WA
K0WA	129210	885	73	24	B	KS
W0AA	124172	839	74	24	B	MN
K0VVY	119288	806	74	24	B	SD
NW5E	113368	766	74	24	B	NTX
KS9O	102120	690	74	24	B	IL
W8LT	99718	683	73	21	B	OH
W2CXM	96768	672	72	24	B	WNY
W2OW	91494	663	69	22	B	WNY
KS1N	79660	569	70	19	B	WMA
KW2D	76896	534	72	21	A	ENY
W0EEE	74880	520	72	19	B	MO
WA6FSF	72846	513	71	20	B	LAX
W8UMD	60852	461	66	12	B	OH
W4RV	55760	410	68	19	A	VA
KW2J	54648	396	69	24	A	WNY
K3WW	49580	335	74	10	B	EPA
KG9Z	45288	333	68	23	A	IL
W1OP	42496	332	64	24	A	RI
NI0U	42372	321	66	12	B	KS
NE9U	40602	303	67	21	A	WI
W7GV	39000	300	65	24	A	AZ
AF9M	33152	259	64	15	A	IL
K1KI	31752	252	63	9	B	NH
W0AK	26400	220	60	15	A	IA
W1MX	24852	218	57	10	B	EMA
WA2UKP	24600	205	60	16	B	ENY
K2GQ	18354	161	57	22	B	NNJ
KF4GZ	13892	151	46	14	A	NFL
N4JEO	12550	123	51	7	A	NC
KB8FJ	11662	119	49	5	B	WV
WN4KKN	5740	82	35	1	B	STX

SS SSB S/O:

CALL	SCORE	QSOs	MT	HR	P	SEC
WA7NIN	275872	1864	74	24	B	NV
N6BV	271580	1835	74	24	B	EB
N2IC	268916	1817	74	24	B	CO
K6NA	265808	1796	74	24	B	SDG
K4VX	263736	1782	74	24	B	MO
WS4Q	260480	1760	74	24	B	STX
N5AU	256632	1734	74	24	B	NTX
WC6H	254708	1721	74	24	B	SJV
N5DU	253524	1713	74	24	B	STX
NR5M	248640	1680	74	24	B	STX
K5RR	240500	1625	74	24	B	NTX
K7OX	239908	1621	74	23	B	AZ
K5LZO	231916	1567	74	24	B	STX
W1WEF	223036	1507	74	24	B	CT
KY7M	223036	1507	74	24	B	AZ
K5RX	222888	1506	74	24	B	NTX
AC9C	218744	1478	74	24	B	IL
K3ZO	217264	1468	74	24	B	MDC
KF0H	214304	1448	74	24	B	IA
N4KG	211492	1429	74	24	B	AL
K4XS	210386	1441	73	24	B	NFL
WA3PWL	209124	1413	74	24	B	ND
N6BT	207200	1400	74	24	B	SCV
WB9HAD	206608	1396	74	24	B	IL
WB1GQR	206312	1394	74	24	B	VT
W3LPL	203648	1376	74	24	B	MDC
AI6V	199208	1346	74	24	B	SV
K5GO	196840	1330	74	24	B	AR
N7TT	194028	1311	74	24	B	WA
KE5FI	193880	1310	74	24	B	STX
N5DD	192696	1302	74	23	B	NTX
KI3L	190032	1284	74	24	B	NM
N4EEB	187960	1270	74	24	B	NFL
K9ZO	186480	1260	74	24	B	IL
N4ZC	185000	1250	74	23	B	NC
K4BAI	182632	1234	74	24	B	GA
AH2U	182336	1232	74	20	B	IL
K5MR	176712	1194	74	20	B	NTX
KM1C	176564	1193	74	24	B	NH
N6NF	175784	1204	73	23	B	SCV

SS SSB M/O:

CALL	SCORE	QSOs	MT	HR	P	SEC
AA5B	262848	1776	74	24	B	NM
N5KW	256484	1733	74	24	B	OK
WB8JBM	255744	1728	74	24	B	OH
K0GU	244792	1654	74	24	B	CO
NK7U	234728	1586	74	24	B	OR
KN8M/5	230584	1558	74	24	B	NTX
NI0E	225404	1523	74	24	B	CO
N4WW	217412	1469	74	24	B	NFL
KK9V	213564	1443	74	24	B	IN
K0VVV	199208	1346	74	24	B	CO
K7LXC	196544	1328	74	24	B	WA
W6BIP	195656	1322	74	24	B	SF
KE7C	193288	1306	74	24	B	WA
AB0S	190822	1307	73	24	B	KS
K5QY	186442	1277	73	24	B	NTX
KA5W	184704	1248	74	24	B	NTX
W8SH	176860	1195	74	24	B	MI
W0AIH/9	168128	1136	74	24	B	WI
K5RVX	165272	1132	73	24	B	STX
W3GNQ	162800	1100	74	24	B	MDC
K5NA	161764	1093	74	24	B	ENY
WB8JKR	158360	1070	74	23	B	OH
K6SG	155252	1049	74	20	B	SV
W5EW	155104	1048	74	22	B	LA
KB9S	150380	1030	73	24	B	WI
NW5E	148296	1002	74	24	B	NTX
KF6OG	147752	1012	73	24	B	ORG
W9YT	147312	1023	72	24	B	WI
W0QQQ	146372	989	74	24	B	KS
NC9L	141636	957	74	24	B	IN
WA2UKP	140160	960	73	24	B	ENY
K5GB	136800	950	72	24	B	STX
KC4DY	123840	860	72	23	B	VA
W8UM	122494	839	73	24	B	MI
W2OW	119880	810	74	20	B	WNY
K0VVY	119088	827	72	16	B	SD
W6JTI	116476	787	74	24	A	SF
N0DDS	113664	768	74	24	B	ND
W0EEE	111024	771	72	22	B	MO
WB6YPX	110704	748	74	23	B	ORG

ARRL 160m S/O:

CALL	SCORE	QSO	MLTS
N5DU	232,024	796	92
K5NA	207,264	920	102
K1ZM	194,324	848	101
N4PN	179,124	915	92
W1CF (WA2SPL opr)	161,100	806	90
K4VX/0 (KM9P opr)	140,630	828	82
AA4S	135,450	738	86
WB8JBM (KW8N opr)	135,372	733	87
WA8MAZ	120,666	745	78
N4KG	118,766	641	86
N2MM	114,426	703	78
K4FU	110,600	682	79
W8TU	110,495	704	77
KC5DX	109,575	717	75
W8FN	105,145	584	85
W0JX	100,548	654	76
WB1GQR	97,980	657	71
N5JB	96,558	597	77
N0SM	93,862	655	71
KF9D	93,600	612	75

ARRL 160m M/O:

CALL	SCORE	QSO	MLTS
AA1K	202,500	933	100
W8JI	181,170	869	99
KS8S	172,304	926	89
W9RE	171,780	994	84
W8LT	142,641	858	81
W7FG	142,641	854	81
W0AIH/9	140,250	926	75
WM4T	135,756	805	81
K9RS	134,596	872	76
W9AZ	120,659	767	77

ARRL 10m Mixed:

CALL	SCORE	QSO	MLTS	SEC
WC4E	308800	1523	80	NFL
NU4Y	270450	1389	75	NFL
N2RM	235500	1169	75	SNJ
N4ZC (WA8MAZ, op)	185400	1011	75	NC
N5JJ	137472	698	64	STX
N5UD	137456	795	71	NTX
KM1H	135450	746	63	NH
K3ZJ	125692	833	67	MDC
K1VUT	119536	707	62	EMA
W7EJ	96287	612	73	OR
KQ1V	92748	669	59	EMA
WI4R	92400	601	56	GA
WB7FDQ	87000	478	75	AZ
KC5CP	86194	605	71	STX
W9XT	84672	543	56	WI
ZS6USA	83376	426	72	ZS6
N6HC	79430	516	65	LAX
AA4M	77966	448	62	SDG
K3EW	74816	445	56	ENY
KE1C	73728	382	72	CT

ARRL 10m CW:

CALL	SCORE	QSO	MLTS	SEC
KZ5M (KN5H, op)	198268	675	73	STX
N4BP	115168	472	61	SFL
N4VZ	112896	441	64	GA
K6HNZ	100344	678	74	SCV
KN4B	100064	242	59	GA
WD4AHZ	96672	411	57	SFL
K7QQ	95760	399	60	WA
W5HUQ	58600	293	50	NFL
KU2Q	52400	259	50	ENY
W9VA	46736	253	46	IL
KN0V	45936	261	44	MN
W9WAQ	43680	210	52	WI
NJ5N	40964	209	49	NTX
W6KZV/7	37260	200	45	WA
KB9S	37036	197	47	WI
WA4QBX	36960	215	42	AL
K4BAI	35948	209	43	GA
NI8L	33120	184	45	IN
VE3KP	33120	184	45	ON
KV1L	32528	208	38	EMA

ARRL 10m SSB:

CALL	SCORE	QSO	MLTS	SEC
KE5FI	270048	1392	97	STX
NR5M	263488	1432	92	STX
KE5JA	162180	954	85	STX
CE3BFZ	154800	900	86	CE
K4JPD	148896	1034	72	GA
W9OEH	144744	978	74	IN
K5FUV	123970	805	77	AR
AA4JI	100168	659	76	NFL
K1IU	94080	735	64	RI
W0XK	93240	630	74	MO

N2BJ	81120	624	65	ENY
W1WEF	79800	700	57	CT
K7IDX	75504	572	66	WA
WB5SKQ	74328	652	57	LA
AA4LE	72618	637	57	AL
PP2ZDD	68408	503	68	PY
N4BSN	67662	537	63	TN
ZL1ANJ	63512	467	68	ZL
W2FCR	62272	556	56	NNJ
K8XR	60634	497	61	SNJ

ARRL 10m Multis:

CALL	SCORE	QSO	MLTS	SEC
K5LZO	339528	1531	94	STX
W0AIH/9	209020	1124	70	WI
K5RVK	208980	1041	81	STX
W4WWW	182754	1156	71	SFL
N4EJW	151996	766	74	SFL
N2EOC	132864	846	64	NNJ
KB4HF	113540	1622	70	SFL
KE7C	80160	474	60	WA
KA5DLM	78520	604	65	LA
WD5ABC	76038	434	57	NTX
WB8BUQ	75480	560	60	MI
KC0AT	75344	478	68	CO
KF4YH	68900	418	65	VA
N8APA	67588	554	61	WV
KP4BO	65514	461	61	KP4
WA2JQK	59800	407	52	ENY
WD4CRG	50976	432	59	KY
W3KHQ	48450	353	57	WPA
VE7RCN	47040	420	56	BC
KI6T	39538	297	53	SV

CQ WW 160 CW From W1CF A Comparison

Fred Hopengarten, K1VR
Joe Krone, WA2SPL

Comparison of 1985 and 1986 activity in the CQ WW 160 cw contest from W1CF (WA2SPL, operator):

	1985	1986	Change
Total Qs	848	1084	+27.8%
Dupes	20	79	+39.5%
Valid Qs	828	1005	+21.5%
2 pt. Qs	615	686	+11.5%
5 pt. Qs	50	66	+32.0%
10 pt. Qs	163	253	+55.2%
Total Pts.	3110	4232	+36.1%
Mults	104	121	+16.3%
Score	317K	512078	+61.5%
States	49	50	+2.0%
Provs.	9	11	+22.2%
Countries	46	60	+30.4%

Vertical Antennas for the Low Bands Part II

John Kaufmann, W1FV

Part I of this series discussed the design and operation of single-element vertical antennas for use on the low bands (80 and 160 meters). In Part II, we tackle the problem of designing phased-vertical arrays, showing why it is usually done incorrectly and what it takes to do it right.

Why Phased-Vertical Arrays?

Phased-vertical arrays have the same desirable operational characteristics as single-element verticals in DX work, with the obvious additional advantages of gain and directivity. A properly designed array is capable of providing deep nulls in the radiation pattern. When my 80-meter array s switched on Europe, stateside interference off the back of the array drops by as much as 20 to 30 dB. Furthermore, there is a significant reduction in pickup of atmospheric and man-made noise by virtue of this same directivity. With the flip of a switch, I often find a stateside rag-chew can be replaced by a DX station on the same frequency. The instantaneous direction-switching capability is also an asset to the contester.

From a practical viewpoint, the construction and maintenance of vertical antennas can be considerably easier than for some of the monster antennas used on the bands today.

However, proper design of phased-vertical arrays is not as simple as is commonly believed and here we will discuss why.

Design Overview

The principles of phased-array operation are straightforward. Using a two-element vertical array as a design example here, the object is to drive each element with currents of the proper relative amplitude and phase to achieve the desired directivity and/or gain. If the currents in each element are of equal amplitude and are in phase, then broadside bi-directional operation is obtained. On the other hand, uni-directional end-fire operation results by altering the phase in one element so as to cancel radiation in one direction.

The amount of gain depends upon the element spacing and the phase difference of the currents in each element. Maximum forward gain does not usually coincide with maximum front-to-back. However, phased-arrays are usually designed for the best front-to-back because enhancement in receiving capability usually outweighs the small additional gain obtained in a maximum-gain design. The largest gain for a two-element system – over 5 dB – occurs in end-fire operation with very close element spacing, but the drive-point impedances are very low, making the actual array performance very dependent upon loss resistance (particularly ground loss) in the system.

The objective in a phased-array design is to deliver currents of the correct amplitude and phase to each element, and to minimize system losses, principally ground loss. For most of the commonly used array configurations, the currents in each element should have equal amplitudes, although there are some exceptions in systems with larger numbers of elements.

Mutual Coupling

The design problem becomes complicated by the well known phenomenon of mutual coupling between elements in an array. Briefly, the amplitude and phase of the current flowing in one element is affected by the currents flowing in other elements of the array. Changing the parameters of the current in one element causes the amplitudes and phases of currents in all the other elements to also be altered. As a result, the drive-point impedance of each element will not only be different than its natural self-resonance (nominally 36 ohms or so for quarter-wave verticals with zero loss resistance), but will depend specifically on what currents are flowing in the other elements. Generally speaking, mutual coupling increases as the element-to-element spacing is decreased.

The following effects can occur: (1) The impedance of each element can differ substantially from its self-impedance. In my 80-meter array, which uses eighth-wave element spacing, impedances under 10 ohms occur in phased operation, along with significant amounts of capacitive or inductive reactance. (2) The impedances can differ from element to element. This is a natural consequence of mutual coupling – the differing current phases between elements causes the effects of mutual coupling to differ in terms of the drive-point impedances resulting at each element. (3) Close-spaced arrays are attractive because of their physically compact dimensions and, as indicated above, their high theoretical gain. However, in practice, strong mutual coupling makes them very sensitive to mistuning and other effects.

The theory of mutual coupling and how to design phased arrays in the presence of this effect were worked out in the 1930's for application in the AM broadcast industry. Basically, proper design procedure calls for calculating the impedances of each element, taking the mutual coupling into account in the desired configuration, and designing an electrical network to drive currents of the proper amplitudes and phases into these impedances. Further discussions on this subject follows below.

Why Conventional Phasing Lines Don't Work

It has been common practice in amateur phased-array design to employ phasing lines, usually made of coaxial cable. However, these lines almost never produce the desired current phases or amplitudes, and the reason is mutual coupling.

As a result, with incorrect drive conditions, there is a degradation in both the forward gain and the front-to-back performance of an array. It is hard to generalize on how much loss results because the effects can vary widely, depending upon the particular parameters of a given installation. Usually the front-to-back is more sensitive to current-drive errors than forward gain.

The key fact, usually overlooked in many designs, is that a transmission line must be terminated in an impedance equal to its characteristic impedance in order to produce a phase shift at the load which corresponds to the electrical length of the line. There are some exceptions to this rule – for example, a half-wave line always produces a 180-degree phase shift, regardless of termination impedance, and there are some other instances which do not usually occur in practice. Therefore, a 50-ohm coaxial delay line should be terminated in a 50-ohm antenna to produce the desired phasing. At this point it is tempting to think that the solution is to first individually match each element of the array to 50 ohms and then connect the phasing lines. However, the proceeding discussion on mutual coupling shows why this won't work: a single element which is matched to 50 ohms while the other elements are not driven will almost certainly not look like 50 ohms when the elements are driven in array operation.

A Design Solution

As we discussed, the theory of phased-array antennas was developed years ago. The only problem is that because the theory is rather mathematical, it has not found its way into the amateur literature until recently. In 1983-1984, *Ham Radio* magazine ran a series of articles by K2BT on phased-vertical arrays (Ref. 1). In my opinion, these articles provide the most accurate and comprehensive treatment of the subject available in any amateur journal or handbook. Some recent work by W7EL (Ref. 2) also treats the subject, but does not appear to be widely available. The K2BT series should be required reading for any amateur attempting to design and construct a vertical phased array. It is rather technical but does provide a complete procedure for designing an array. My 80-meter array was designed in accordance with the principles given in the articles and it worked the first time it was fired up. A complete discussion of the material is beyond the scope of this article, but I will try to summarize the main results here.

First an array configuration (number of elements, the overall geometry, etc.) must be selected. Guidelines for this selection can be found in the articles. Then a series of impedance measurements are made on each vertical in the array. The results are used to calculate the mutual coupling and, in turn, the actual drive-point impedances which will result in phased operation. Knowing the element impedances, a phasing network which uses L-C (inductor and capacitor) elements can be designed to drive the elements with the correct currents. Unfortunately, the impedance measurements require the use of a laboratory-grade impedance bridge, which is an instrument not usually available to the average amateur. Commonly used inexpensive noise bridges do not have the required accuracy in most situations. Also, the mutual coupling and L-C network calculations can involve a lot of tedious math, which is best left to a computer.

The topology of the resulting system (using a 2-element array as an example) is shown in Figure 1. Note that the elements are all fed through equal-length coaxial lines. No phasing lines are used since the phasing is achieved in the L-C networks. These networks are comprised of simple L and pi (or T) type networks which accomplish the following functions: (1) the impedances at the inputs of each coax feeder are transformed by the L networks to a value which insures that the antenna currents divide in the correct ratio for each element, (2) the pi (or T) networks provide the phase correction to achieve the proper relative current phasing in the elements, and (3) these same networks also provide a 50-ohm match to the transmitter end of the system.

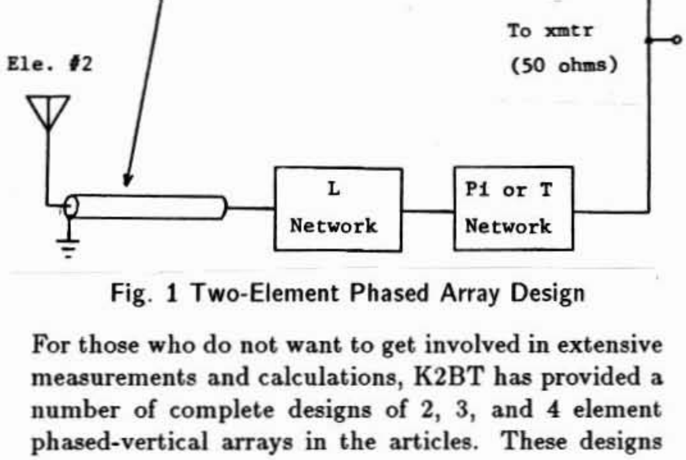

Fig. 1 Two-Element Phased Array Design

For those who do not want to get involved in extensive measurements and calculations, K2BT has provided a number of complete designs of 2, 3, and 4 element phased-vertical arrays in the articles. These designs are based on textbook theory and in practice, real antennas in non-ideal environments may not confirm exactly to the theoretical results. Nonetheless, using one of these design examples may be a good starting point for building a working system, provided one is careful about the construction and is willing to do some fine-tuning of the final product to optimize performance.

Radial Systems for Phased-Vertical Arrays

Part I of this series discussed the importance of a low-loss ground radial system for vertical antennas. Efficient antenna operation will result only when enough radials have been installed to drive the ground-loss resistance to a value which is much smaller than the radiation resistances of the individual elements. These same principles apply to phased-vertical arrays. However, as indicated above, the effects of mutual coupling in a phased array can cause the impedances to differ substantially from that of a single vertical. Hypothetically, if the radiation resistances of each array element in phased-array operation are around 10 ohms (as they are in my system) and 10 ohms of ground loss exists at each element, the overall system radiation efficiency (calculated from the expression given in Part I of this series) is only 50%. An effective gain reduction of 3 dB results for this array. On the other hand, a 10-ohm ground loss with a single-element vertical (which has a 36-ohm radiation resistance) results in nearly 80% efficiency. These numbers point to the important conclusion that low-loss radial systems can be more vital to efficient operation of phased arrays (particularly close-spaced arrays) than for single-element systems. That is why I do not consider the use of over 100 radials per element in my close-spaced array to be overkill.

Finally, since a radial system is required under each element of an array, the question arises as to what to do with the radials where they overlap each other. Figure 2 gives the answer for the 2-element example. A bus wire is laid between the elements. The radial wires from the adjoining systems are not allowed to overlap, but are electrically fastened to the bus wire.

In conclusion, it should be apparent that properly designing a vertical phased-array can be more complicated than is usually realized because of widespread misconceptions about phased-array design, and, in particular, about use of phasing lines. (Unfortunately, the amateur literature, until recently, has tended to contribute to the misinformation). Because it is impossible to completely cover the subject in this short series of **Scuttlebutt** articles, serious would-be array designers should consult the references given in the two articles of this series.

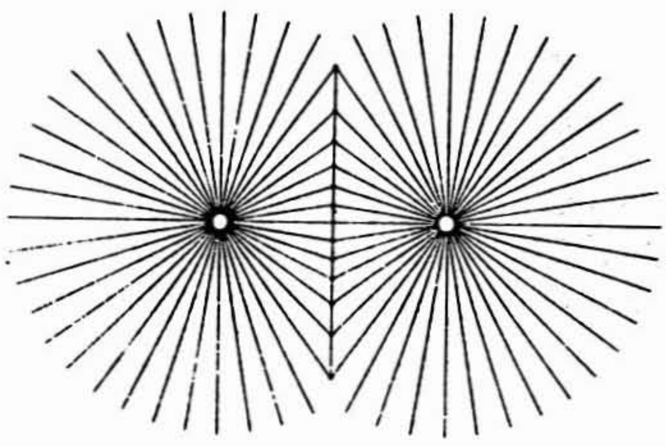

Fig. 2 Radial System for Phased Array

References

1. F. Gehre (K2BT), "Vertical Phased Arrays", 6-part series, *Ham Radio* Magazine, May, June, July, October, and December 1983, May 1984.
2. R. W. Lewallen (W7EL), "Understanding Phased Arrays", unpublished, 1982.

By-Law Change Proposal

Bill Pedersen, KM1C

Dear YCCC,

A meeting was held at my home on Friday, March 21st, 1986, attending by the following amateurs: K1GQ, WB8BTH, K1AR, N1AU, W1PH, AK1L, KA1X, AK1A, K1FWE, W1RR, K1GW, and K5ZD. Much discussion was held concerning recent YCCC happenings with most of the time spent searching for ways to improve the club.

Based on that discussion, I wish to offer comments on the currently-perceived problems within the club, along with proposed solutions. This will be followed by a proposed change to the By-Laws:

1. The club presently meets four times per year with only approximate dates known in advance. The time between meetings is too long to maintain any degree of continuity or follow-through on ideas or changes. Changing the number of meetings to six per year, specifically on the first Saturday of every even month, would allow every member to plan well in advance. The large time gaps would be closed, and we would start performing much more like the true club we would all like the YCCC to be. Note that these particular meeting dates interfere with very few contests.

2. The meeting places, particularly the P.N.I.C., are dingy, poorly-lit, have bad acoustics, no provisions for screens, etc. In general, they are rather depressing places to attempt to hold "up-beat" and efficient meetings. We very much need to find better places to meet (more on this below).

3. The club is basically hampered by the ARRL 50% meeting rule and mileage zones. These rules, in essence, have killed the spirit of the club. They cause us to hold too few meetings, which are often filled with bitter discussion about club purpose, rules, and too much club business. Not enough time is spent on a good program, and, in general, just plain fun through meeting old and new friends alike and a chance to socialize with them (not to mention time we should be spending with new members). Our club philosophy toward the ARRL eligibility rules should be that it is all up to individual choice. Those who wish to be eligible will probably make the required number of meetings. We should be going to club meetings for the enjoyment of it, for the new knowledge we can gain, etc. We should not be going to the meetings solely to meet ARRL eligibility rules!

4. The constant changing of the meeting location does not help the membership to any great degree, but it does cause significant time and effort problems for the club leadership. This time could be better spent if it were directed toward club programs, i.e., meeting presentations, club business, awards programs, etc. A fixed meeting place, of good quality, could become a "home" for the YCCC and a place to which we would enjoy traveling. I would personally rather drive further to a good place, than to have a shorter drive to a dump. Also, a fixed meeting place, reasonably located for the majority of the club membership, can probably be had for a reasonable price. If necessary, we should be willing to contribute one or two dollars at sign-in to help defray the cost of the meeting place.

5. A meeting from 1 PM to 4 PM essentially "kills" an entire Saturday and does not offer nearly enough time for a good club meeting. Thes meetings could be vastly improved if they began informally at 11 AM as a sort of "brunch", followed by the official meeting from 1 to 4, and then topped off with an "organized" outing to dinner for those who wish to remain, as many have in the past. N1AU has even proposed that, at some point in the meeting day, we could even have our own mini-flea market, bringing that stuff that should be cluttering someone else's shack! The whole point here is that we can organize a day that is truly enjoyable and productive.

Based on the above, I propose the following By-Law change, to be voted on at the meeting on April 5th 1986:

By-Law 3. MEETINGS. Regular meetings shall be held six times each calendar year on the first Saturday of every even month at such places as the President shall order, persuant to Article 5 of the Constitution.

Letter to the Editor
Bob Wilson, KA1XN

The following are my observations during the ARRL DX CW test. Although I was not "in the contest" due to other commitments, I was awakened in the middle of the night as a result of some chili consumed earlier Saturday evening! Like any true blue contester/DXer, I decided to check the bands, and 160 seemed a likely place to start. Tuning up into "the window" I came across V47A on 1.826. The signal was S9+ (even with my puny antenna) as they called their heart out "...CQ test..V47A..QSX 24..."! So, I called, worked them and decided to listen for awhile. There were 2 stations answering on his freq and no one calling on 1.824. After about 6 minutes of this, V47A QSYed to 1.824 and worked the two callers on frequency. Know what? Those 2 stations were YCCC members.

Oh, well, let's give a listen on 80. Now, as every savvy cw contester knows, "time is money", or more to the point, "time is Qs". Techniques such as never using "BK" when "K" will do, or not sending the exchange 2-3 times when the signal is 30 over 9, are commonplace. One YCCCer I heard has come up with another one. He has apparently reduced "QRL?" to just "?", sends it at 40 wpm within 100 Hz of another station's freq - WHILE THAT STATION IS TRANSMITTING, and upon getting no reply within microseconds is off and running, "CQ CQ test...". In the ensuing scuffle for supremacy of the frequency, neither station made a single contact over the next 5 minutes. I stopped listening at this point, so for all I know they are still at it. I could go on, but I think you get the idea.

John, K2VV, recently made us all take a long hard look at ourselves by pointing out that lack of activity was hurting the club score and morale. Although his proposal did not culminate in the manner in which he intended, John can take pride in the fact that repercussions will be far reaching and, I think, beneficial to the club as a whole. So, what is my point, you say? Just this... John stresses quantity and that's fine – BUT NOT AT THE EXPENSE OF QUALITY. Time-wasting procedures such as the ones I mentioned will hurt the club just as surely...and not just our score but our reputation as well!

I have my own ideas as to what can be done. But rather than express them here I hope instead this will serve as a catalyst for others to let their thoughts be known.

Excess Cargo

For sale: Drake R4C with cw filters (250, 500, Sherwood cwf), xtals for 160, 10, factory mods. Excellent. $200. Greg, W1KM, (617)428-4205.

Electro Space Systems 2-element 40/80 meter phased vertical array, with phasing box and manual. New $500. Asking $350, or a desk-top amp (on the order of a 3-500Z or better). Interested parties can call Joel, K1CQ, evenings or weekends at (802)527-0294. (de Joe Krone, WA2SPL/1)

Ops Needed

Dave, KY1H, indicates that his station is available for any cw contests which do not conflict with a major SSB contest. He plans to operate multi-singles for the CQ WW 160 cw and the ARRL DX cw. Dave reports that he does not operate cw himself, but does put on a good feed bag and has plenty of spare beds for the late-night crews. Interested? Contact Dave at (413)655-2714.

Errata

Bill, N1CQ, reports that a typo crept into his last article. The formulas for the moments of inertia should read:

$$I_x = I_y = \frac{\pi}{64}(d_o - d_i)^4$$

That is, the formula uses the *diameter*, not the radius.

The **Scuttlebutt** is the newsletter of the **Yankee Clipper Contest Club** and is mailed about nine times per year to all paid up members. Dues are $10 per year, payable 1 April with a grace period through 30 June. Non-members may subscribe to the **Scuttlebutt** by sending $10 to the Treasurer: Charlotte Richardson, KQ1F, 11 Michigan Drive, Hudson, MA 01749. Subscribers who subsequently become members will be credited as having paid dues.

The **Yankee Clipper Contest Club** (an ARRL Affiliated Club) holds four official meetings per year, on Saturday afternoons in March/April, October (at the New England Division Convention when possible), November/December, and January/February. The next meeting will be in the Worcester area on 5 April 1986. Attendance at an official meeting is *required* in order to become a member. Club members congregate on 3830 Khz or 1900 Khz Monday evenings; many routinely monitor these frequencies other evenings as well.

Rosters are mailed to all paid members each summer. For more information and/or assistance, contact the area manager nearest you on the following list:

Area	Call	Name	Home	Work
CT/RI	K1RX	Mark Pride	(203) 271-2076	(203) 265-8825
EMass	W1FJ	Al Rousseau	(617) 598-3744	(617) 599-7500 x 173
WMass	KY1H	Dave Robbins	(413) 655-2714	(413) 494-5618
VT/NH	KM1C	Bill Pedersen	(603) 673-1678	
ME	K1SA	Bernie Cohen	(207) 773-6589	(207) 797-3585
NNY	K2RD	Ira Stoler	(518) 439-5804	(518) 445-8474
SNY/NJ	K2EK	Bill Gioia	(914) 221-1672	(212) 888-2102

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