July 1994

The Pileup

Newsletter of the CDXA

Carolina DX Association

WD4R	Joe Simpkins	President
K2SD	Scott Douglass	Vice-President
W4UNP	Bill Jennings	Secretary-Treasurer
WZ3Q	Don Daso	Editor
AG4L	Bruce Gragg	Net Manager

The President's Column

Welcome to our July issue.

Gosh, what an active summer so far! New country rumblings from efforts at Scarborough Reef & Seborga, antenna work, hamfests & then there's the lawn to mow. Lots of DX on the air, even with the low sunspot count. 1AØKM op I2UIY will be in Charlotte later this month, staying with N4ZC. Check the details below.

Summer also means storms, which bring lightning. Please be extra careful & mindful of this uniquely powerful weather event. Trim any deadwood away from your antennas & towers--being extra careful here, too. It is better to cut or trim this deadwood away now, rather than have it come down during a storm. And don't forget that telephone connection to your modem or computer.

On the PacketCluster front, there's lots of interference news. The WD4R node's user frequency 145.09 is experiencing lots of heavy interference. A test on July 9-10 proved we need relief; in this case, relief is spelled 144.91. Testing on this frequency may become a permanent change.

Hamfests? Charlotte ARC Hamfest is Sunday, August 14 from 8-4 at the Roll-A-Round Skate Center. Talk-in on 147.06 & 444.85. Shelby Hamfest is September 3 & 4. Talk-in on 146.28. Full Shelby details from N4GOQ @ 704-482-4507.

Hopefully you did not miss the excellent program "Oscilloscopes in Ham Radio" by KØSD, WA4UNZ & KI4TZ at our recent meeting. Great job, guys!

See you in the pileups. And at our up-coming meeting, and at the Wednesday luncheons.

73 de Joe WD4R

WHO?	CDXA members & XYLs
WHAT?	meeting
WHEN?	11 August 1994 Thursday evening (6:30 social half-hour with 7:00 PM dinner)
WHERE?	Woodshed Restaurant 210 South Main Stanley, NC
WHY?	**Special Guest I2UIY of 1AØKM fame...**

Cost? $17.50 per person including tax/tip for a 10-oz. rib eye dinner. Please bring correct change or a check made out to Roger Burt. N4ZC will have paid the total bill & collect from each person attending. (Stanley is dry, but a brown bag is okay should you need it.)

Paulo is a big DX & contest operator in Italy. He'll show video of his 1AØKM effort as well as his May HV4 operation. He will have logs for both operations & HV4 cards if you need them. He leaves Italy 28 July; if the 1AØ cards are ready, he will bring these as well.

You must notify N4ZC if you plan to attend! The room seats only 56 people. If you are not one of the lucky ones "on the list" you won't get in. Notify Roger via PacketCluster, or 147.18 or the landline @ 704-263-1133. The restaurant must know our total attendance the morning of the 11th, so please let Roger know your plans ASAP.

EDITORIAL

Here we are, easing into summer. Field Day's over, temperatures are rising, folks are headed for the beach or the mountains, the sunspots continue their inexorable decline, family & social obligations intrude into the "normal" ham radio world view. This is not necessarily a bad thing.

But I digress...it's time for yet another plea to the membership of this club for some sort of response. Some indication you're reading, enjoying (or hating), thinking about, whatever--this newsletter. And of course it's also a plea for some input in terms of articles or news or ideas. Again, whatever. I enjoy editing it, but pretty soon we're gonna just call this the WZ3Q club paper & be done with it.

In keeping with the schedule outlined in May, we're focused on antennas this issue. Next month, we need Heathkit stories. The two I have are swell, but they don't make an article--yet. Send YOUR Benton Harbor story today! And surely you have some ideas or tale about QSLing for September? Deadline is the 10th of the month. Enjoy....

--WZ3Q

BIBLIOGRAPHY

Academic research often begins with the lowly bibliography--a collection of the published research on a particular topic or author. I've always been surprised to encounter hams deep into projects with little knowledge of previous efforts or publications. In short, with little research to back up their labor. I've mentioned the K2RR bibliography here before; it's now out-of-print. Here's a short list of articles designed to support research (& generate some) on verticals, in keeping with the overall theme of this issue. This list is NOT meant to be complete or final. Rather, these articles have helped me & others achieve some level of success in design & construction of low band antennas.

Al Christman, KB8I, "Elevated Vertical Antenna Systems," *QST*, Aug., 1988.
Archibold Doty, K8CFU, et al, "Efficient Ground Systems for Vertical Antennas," *CQ*, Feb., 1983.
Carl Drumeller, W5JJ, "Using Your Tower as an Antenna," *CQ*, Dec., 1977.
Doug DeMaw, W1FB, "Shunt Fed Towers...," *QST*, Oct., 1982.
Earl Cunningham, W5RTQ, "Shunt Feeding Towers...," *QST*, Oct., 1975.
Eugene Baldwin, WØRUG, "Some Notes on the Care & Feeding of Grounded Verticals," *QST*, Oct., 1963.
Forrest Gehrke, K2BT, "Vertical Phased Arrays," *ham radio*, May, Jun., Jul., Oct., Dec., 1983.
Gene Hubbell, W9ERU, "Feeding Grounded Towers as Radiators," *QST*, Jun., 1960.
J. A. Frey, W3ESU, "The Minipoise," *CQ*, Aug., 1985.
James Rautio, AJ3K, "The Effects of Real Ground on Antennas," *QST*, Feb., Apr., June, Aug., Nov., 1984.
Jerry Sevick, W2FMI, "The Ground Image Vertical Antenna," *QST*, Jul., 1971.
Jerry Sevick, W2FMI, "Measuring Soil Conductivity," *QST*, Mar., 1981.
John True, W4OQ, "Shunt Fed Vertical Antennas," *ham radio*, May, 1975.
John True, W4OQ, "Vertical Tower Antenna System," *ham radio*, May, 1973.
John Stanley, K4ERO/HC1, "Optimum Ground System for Vertical Antennas," *QST*, Dec., 1976.
John Belrose, VE2CV, "Top Loaded Folded Umbrella Vertical," *ham radio*, Sep., 1982.
Paul Lee, K6TS, *Vertical Antenna Handbook*, CQ Publishing Inc.
Robert Myers, W1FBY, et al, "Phased Verticals...," *QST*, Aug., 1972.
Robert Leo, W7LR, "vertical Antenna Radiation Patterns," *ham radio*, April, 1974.
Robert Leo, W7LR, "Vertical Antenna Characteristics," *ham radio*, Mar., 1974.
Robert Sherwood, WBØJGP, "Ground Screen Alternative to Radials," *ham radio*, May, 1977.
W. J. Byron, W7HDH, "Short Vertical Antennas for the Low Bands," *ham radio*, May, Jun., 1983.

Jack Jackson, N4JJ, made a presentation at the Birminghamfest in May. Here are some excerpts from his talk.

Low Band Antennas

I feel the low bands are one of the last challenges left to us. The problems they exhibit include: QRM (you hear everybody!); QRN (face it--you listen to lots of noise); ready-made solutions are not generally available (you can still build stuff); and signal strengths sure aren't reciprocal.

I believe anyone interested in solving these problems should do three things. And they are: read, read, and read. Specifically, read and jot down some notes about propagation & other low band information. Read & take notes on antenna designs for the low bands. Read & take notes & decide which antennas really appeal to you, & which designs can be applied to your own physical layout--which means you'll have taken the time to sketch out your property. Pay particular attention to your existing tower, trees, your house, the actual property lines, etc. A special antenna tip involves an idea that's very simple, very basic, but often forgotten: DON'T BE AFRAID TO TRY SOMETHING!

A separate article could be devoted to tools, but it suffices to say make sure you have good ones. And the proper ones for the job. Don't scimp on essentials, like good quality wire, support rope, pulleys, & covers for all parts like matching caps & switchboxes.

Now, for the antennas themselves...the dipole is probably the most basic--the antennas we're all already familiar with. It's a good dependable antenna. The trick, for these bands, is getting it up high enough to do some good, which means a quarter wavelength or better. But if you can't get a dipole high, don't be afraid to try it. (I worked 9M2AX the winter after Hugo--with a dipole height of 25 feet.) And don't be afraid to try using insulated wire; it helps cut down on precipitation static.

Verticals are now in a special class all by themselves. What we thought was true back in the 60s has been proven, if not wrong, at least different. Just read through ON4UN's books *(or check out the bibliography in this* Pileup, *--Ed.)* for some ideas on how vertical performance has been improved over the past few years. Radial systems for verticals, both buried & above ground, remain an area where the home builder can gain impressive results with simple sweat equity.

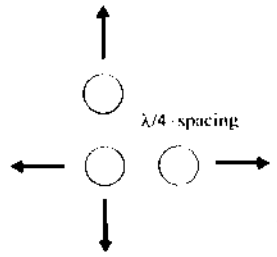
Loop antennas, which came to prominence in the 70s, are as controversial today as verticals once were. Horizontal vs. vertical, fed on the side vs. bottom feed, what shape, & how high? are all relevant questions for today's DXer looking to use this design. Here are some facts:

1) A closed loop is generally quiet;
2) A closed loop is bi-directional;
3) A closed loop provides a few dB of gain;
4) A closed loop requires no ground system;
5) Closed loops can be phased.

Considering these facts, & that it generally requires only one tall support for a triangle configuration, the loop becomes an attractive antenna, especially for 80M.

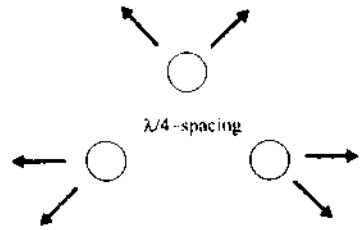
Slopers are another low band antenna which remain controversial. Their ease of construction, coupled with the fact that so many of us already had at least one support (a tower) from which to hang them, many of us began to use slopers in the late 60s. Designs more-or-less began on 40M, then went to 80M, & then 160M. No gain, but directivity was the usual claim. Arrays of slopers, with sloping reflectors and relay boxes came next, seeming to add some gain. Finally, the so-called quarter wave sloper appeared, which, if you look at it closely, resembles the top-fed sloping vertical. Which leads us right into the shunt feed tower, a currently popular vertical variation.

Again, if you think about it, the shunt-fed tower is simply a variation of the ever-popular gamma match we've all probably used on our beams--a capacitive matching network to isolate a DC ground. Just switch radials (or ground) for half of the driven element, turn it vertical, & you'll see what I mean. How do you determine the effect of the beam already up there? W4OQ's article in *ham radio* for May, 1975 included a simple graph comparing various Yagi & Quad configurations. Determining the true electrical length of the tower was ON4UN's contribution in his earlier *Low Band Dxing* book. Shunt feeding enjoys significant popularity today. It's easy to see why. You've already got the tower; why not use it as a vertical? *(N4KG's idea in last month's QST is especially intruiging. --Ed.)* Verticals, & vertical arrays, are popular today. They can be self-supporting. They work well when placed over an effective ground system, & they're fairly easy to tune. My first system used this design:



Three antennas with 1/4-wave spacing provide 4-switched directions

As you can see, with quarter wave spacing, I had these three verticals giving me four directions. I worked Zones 23 & 26 with this array, made from 300 ohm open wire line strung in the trees. Hugo made it disappear, along with the supporting trees. And my 90 foot tower came down, too. I put up 108 feet of Rohn 25 with a 40-2CD & TA-33, as well as an inverted vee at 105 feet. But that simple vertical system kept tugging at me. So, using a tall oak & gum trees across my lot, I put together this system:



Three antennas with 1/4-wave spacing provide 6-switched directions

Obviously, these vertical arrays impressed me. I suggest you read the literature. And then, don't be afraid to try something similar. Or a variation of something you've seen. For instance, my property used to be a sleepy place with a big bunch of school land behind me. Beverages meant simply stringing out wire. They complimented the deer stands in trees where I hunted. Today, the stands are still in those trees, but it's now my neighbor's yard. And that school lot's filled with 90-some homes. The hedge dividing me from my new neighbor is 130 feet long. I hung a wire in there. Surprisingly, it works. Maybe not well, but the signal-to-noise ratio goes a long way toward helping me hear better. (Remember that comment about reciprocal signal strengths...?)

You get the idea. The whole process is a lot like fishing--you throw out a bunch of things hoping to find something that works. Give various ideas a chance. Diversity is the key word: the more choices you have to select from, the better off you'll be. Read, study, plan, & then work. You'll find that's the key to antenna success on the low bands.

--N4JJ

A Few Words About Verticals

We've probably all used them at one time or another. We've probably all read about them in various articles. Mostly, we've probably all decided the old song is right--they radiate equally poorly in all directions. And have moved on--to towers & beams, to installations we think of as more sophisticated or successful. Which they probably are, compared to those verticals. But, in keeping with last month's editorial, remember you should compare oranges to oranges. And that simple vertical was probably not installed "correctly" & shouldn't be compared to a tower & beam.

It's that single, simple word "correctly" which causes the disappointment in vertical antenna performance. The effect of the ground on verticals--in determining their efficiency--is often misunderstood. It's a complex issue. The issue is often confusing because the idea that the ground is a part of the antenna seems somehow confusing. With verticals, you make the ground with radials, yet their efficiency, installation, & function are closely related to the actual physical earth itself. Thus the complexity.

You need a good ground near the base of the antenna to collect return currents without losses. (What the literature refers to as "the near field.") Moving out from the base (to "the far field"), you encounter reflections from the ground which make up the low angle radiation component of the wave, with some of the energy being absorbed. (How much is absorbed is a function of the ground itself and the incident angle.) Without these factors, tiny--meaning physically short verticals--would work as well as big, full-sized ones.

When we speak of verticals, we usually think of a pole mounted perpendicular to the earth--usually mounted on the ground. What we often forget is that almost any antenna can be made into a vertical. You could, for instance, climb up & mount your TH-6 vertically, although your ham buddies would wonder why you did. You could turn your 80M dipole up on end. Hmmm....suddenly the light goes on over your head--just as it did when someone came up with the idea of the sloper. Equally suddenly, you begin to think about using this concept to solve the perennial problem of getting something efficient up in the air on the low bands. Ta-da...you're now in the midst of the current (pun intended) revolution of vertical antenna use. Or, as I like to call it, the vertical antenna renaissance.

Basically, this resurging interest began with using a vertical radiator (often wire--and why not--who said your antenna had to be tubing like that TH-6?) over an elevated ground screen. This idea has evolved into an array of similar radiators, again erected over an elevated ground screen. The final refinement involves feeding this array (in order to obtain gain & efficiency) through a "black box" to give you the equivalent of that TH-6 on the low bands.

This is, of course, a gross over-simplification, but will serve to introduce you to the vertical antenna use we're encountering today. This once ill-thought-of antenna has become a mainstay in the DXer's arsenal. This once simple antenna has become the cornerstone of sophisticated arrays.

Elsewhere in this newsletter, you can read about KF4HK's involvement with verticals. You can peruse a selected bibliography of vertical antenna articles--designed to get you out in the yard playing with wires or even trying to load up that tower & TH-6 (another popular vertical implementation of the 90s) so you, too, can succeed on the low bands.

--WZ3Q

MEMBER PROFILE

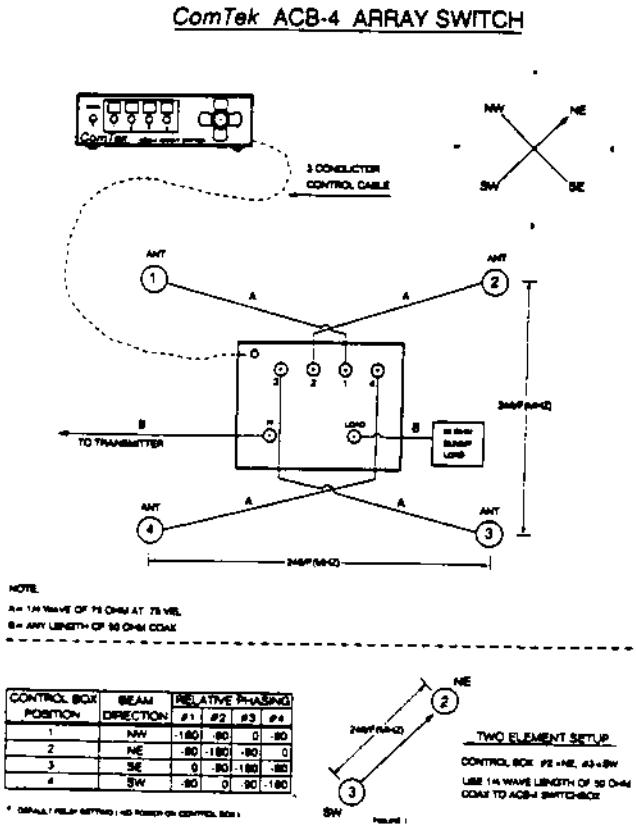
Jim Miller KF4HK

Jim's 51, & originally from the Portsmouth, VA area. He went to the Canal Zone in 1964 straight from the Air Force, on an eight month contract with Lear-Siegler (to modify B-26 bombers, in fact). While there, he learned Canal Zone police were classed as Federal officers, so he took the exam & received an appointment. That turned out to be good for 18 years--until the agency was abolished in 1982, due to treaty regulations.

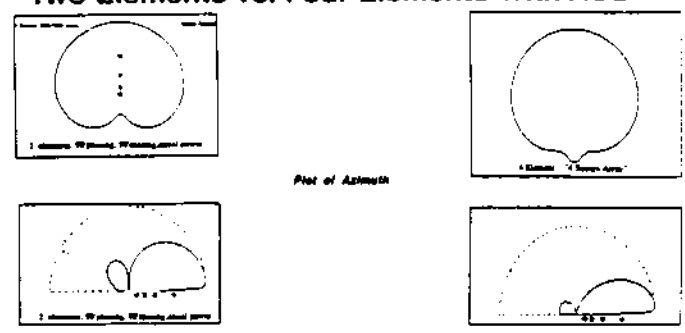
Jim was first licensed in July of 1971, with the Novice call KZ5JMN. He got KZ5JM in March of 1972. In 1973, he began serious DX & contest activity. Jim received his five-band awards (DXCC & WAS) in 1975, which proves what a rare call & some good propagation can provide a good op. In 1977, he received KZØDX for contest operations. In 1979, under provisions of the Panama Canal treaty, he became HP1XRK.

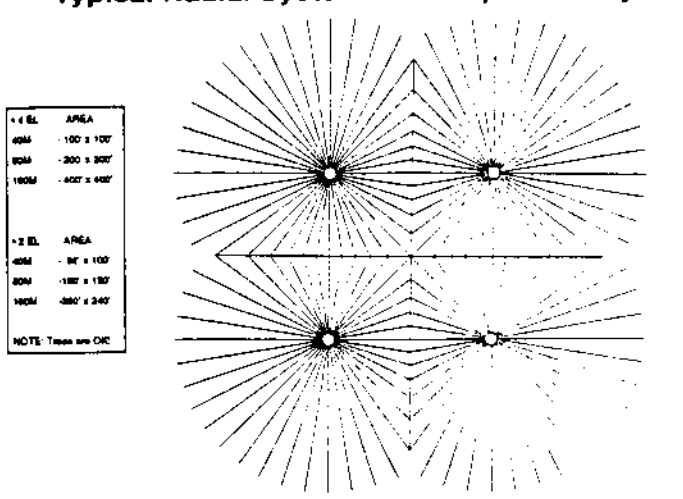
In 1982, Jim & his family (XYL Norma, with sons Jim & Eddie) moved to Charlotte--a location half-way between Portsmouth & Norma's family home on the Eastern shore of Maryland. By 1985, he had phased his towers on 160M using a CoLatchCo hybrid. *(You may already know how important this is...but keep reading.)* By early 1986, he had 5B-DXCC from the USA. Jim didn't mention anything after that date--until 1993, when he bought the ComTek business. Starting a business is serious business, & something ham radio oriented is certainly no different. Buying one, even one that's small, brings with it certain trials & tribulations. Jim has persevered, & today offers quality products at reasonable rates. Indeed, he has made four-square vertical arrays a "plug & play" proposition for anyone interested in a high performance low band system. A recent review in the *Low Band Monitor* described this system as providing "a different realm" of success for the low band operator. That's a strong endorsement for a young company's product, in any field. In a field full of "tire kicker" types--meaning hams--it's very impressive indeed.

ComTek product information



CONTROL BOX POSITION	BEAM DIRECTION	RELATIVE PHASING #1	#2	#3	#4
1	NW	-180	-90	0	-90
2	NE	-90	-180	-90	0
3	SE	0	-90	-180	-90
4	SW	-90	0	-90	-180





PACKETCLUSTER NEWS

Callbook Information

The new CD-ROM is now installed at the N4ZC node. Use the command SH/BUC with the relevant callsign to access the QTH & date of birth for any US ham. The CD also has many other countries. At press time, a complete country list was not available; we will try to have something for the next issue. Try accessing the call--if the info is there, you'll get it. I always use this feature, although I have both *Callbooks*. It beats trying to read the fine print!

W6GO List

We are working to get the "GO List" on the N4ZC computer. A new 14.4 modem was hooked up ready to get the database from W6GO when Zeus called me. Collect, via a thunderbolt! This call cost me a new motherboard, video card & controller card. I had all the AC & coax unhooked but forgot the modem was still hooked to the telephone. Hayes replaced the modem at no charge, fortunately. AG4L will bring it over one day soon for me to use again.

DXYNG

This new netrom digi on Young Mountain is doing a great job for our users to the north. Winston-Salem, Statesville, Taylorsville & Salisbury area users all report full scale signals & quick reaction times. Please pass the DXYNG info to any DX friends you have from Greensboro to Wilkesboro & on up I-77 into southern Virginia.

DXBUD

There will be a new netrom digi at the QTH of Buddy, N4MZL. This should help folks in the Lancaster area connect to the WD4R node. Once software problems are ironed out, this digi will be operational. Users should first C DXBUD. Then, once you've gotten the connect line back, do a C WD4R at which point you treat everything like a normal connect to the WD4R node. If you have a normally good connection to the cluster, there is no need to connect through the digi.

NETROM DIGI NOTES

The advantage of a netrom digi is the fact it cuts out un-needed transmissions. When you do a normal digi through another station, the information is passed in the following way: The node sends the packet info to the digi station which sends it to you. If you do not acknowledge that packet of info, the node station sends it to the digi station again, which sends it to you again. This chain of events must happen again & again until you acknowledge that particular packet of information. Now, if the node or the digi station does not receive your station's acknowledgement, this sequence continues until it does. Many stations connected to a cluster node & all trying to acknowledge their own packets at once can be a real problem. Toss in some QRM & you have a real mess.

The advantage of the netrom digi is the node station sends the packet of data to the netrom digi at which point only the netrom digi repeats the information until you acknowledge it. You acknowledge it only to the netrom station, cutting down on transmissions.

SLOWNESS AT THE WD4R NODE

QRM, mentioned above, can create problems. This has become a very big problem at the WD4R node. KD4IL (the previous node call before moving recently) was the first node in North or South Carolina on 145.09 MHz. The W4DW node in Raleigh is now also using that frequency. W4DW also has some netrom digis using that frequency to feed stations to his node. There is a mountain top digi just across the line in Virginia using that frequency as both a connection to one of the northern nodes & a connection to a BBS in Virginia. Within the last month or so, another BBS in the Sumter, SC area has begun using 145.09. Any inversion allows WD4R & some local area users to hear these other stations.

At times, these signals can play havoc with the system, by making your signals unreadable to WD4R or WD4R to you. Packet signals require a very high signal to noise ratio for correct decoding to occur. This means a signal of less than half your signal strength can cause your packet NOT to be decoded at WD4R. If you were using SSB, there'd probably be no problem. But with packet, if just a tiny part of the transmission is not decoded, the whole packet is rejected.

I think the main problem with the WD4R node slowness is simply the way in which a TNC operates. As long as it hears any signal on frequency, it won't allow a signal to be transmitted by the TNC-conrolled transmitter. This means that even if the distant signal is too weak to cause interference, it will still not allow the WD4R TNC to transmit an answer to some request. Joe has turned his squelch up full to combat this, but this has not taken care of all the signals causing problems. We are also looking into adding attenuation to the node receiver. The downside of this is it may require local users to increase their own signal strength into the node. This may be the price we have to pay in the face of ever-increasing use of limited spectrum space.

Our node was first on the frequency, but we are also looking at the possibility of changing the local user frequency. I doubt we'll have much luck finding a better one at this time. Very few 2M frequencies are available for packet; I suspect we'll find them all in use. We plan to swap the backbone frequency with the WD4R local user frequency as a test. The backbone on 145.75 seems clear. Since we use beams on the backbone, we might be able to null out most of the interference on 145.09 with our beams.

When you consider how many repeaters are in use & how few frequences are available (none, in most cases!), you will begin to realize it's also just a question of time until each packet channel is filled with too many stations trying to use them. I won't forecast five, 10, 15 or more years, but we should begin to consider moving the local user frequencies to 222 MHz or 440 MHz. The N4ZC node frequency seems clear at this point, but I'm sure we will experience problems at some point. Then things will slow down for our local users just at they have for WD4R. I hope the high DXYNG netrom digi will slow new systems to this frequency, but it seems only a matter of time until we have similar problems.

NE CLUSTER SYSTEM

I think most of you have seen we're now connected to the NE cluster system, covering VE, W1, 2, 3 & Virginia. This can be a tenuous path sometimes, running through W4DW/Raleigh through KO4PR/Rocky Mt. to KC4YX/Chesapeake, VA. KC4YX is the node connecting our system to this NE system. If you don't see KC4YX connected, there is no connection to this system. Due to the way we connect, there is NO WAY you can send 1-line messages to anyone in the northern system. DO NOT send ANN/FULL messages telling people to set their home nodes so you can then send them a one-liner. Even if they do this, the information will not make it down to our system. You can send a mail message to the northern system, but it will not automaticaly be sent on to that northern station. None of the SE system nodes has home node info for anyone on the northern system. This means it will just sit on your node until your SYSOP forwards the message to the north. Please don't send a message to the north just to see if it works. If you must send a message, please be 100% certain the station you send it to is a regular user on the NE system.

MESSAGES TO ALL

This addition of the NE system makes it even more important you take extra care in sending a message to ALL. When you send an ALL message it will go to every node from Portland to Paducah. Meaning Maine to Kentucky. If your information or request is only meant for this area, your message should NOT be sent to ALL. It should only be sent to LOCAL. For instance: you can be sure no one will be coming down from NYC to take your VE exam. If you're selling that big amplifier & won't ship it, you needn't send that message to ALL--just send it LOCAL. If you are asking a question about something in this area, don't send it to all. The guys up in Schenectady won't know the answer & it wastes circuit time sending your query up there via ALL.

Please remember if you do send an ALL message asking for some information or if you are selling something, you should cancel the message as soon as you get a reply or sell the item. Use the command DE/F #. For instance: if your original ALL message had the number 327, you would use the command DE/F 327. This generates a procedure message to each connected cluster node which deletes your ALL message from each node. Since your message doesn't appear on any nodes from that time, there's no point in sending an ALL message saying the item has been sold.

JUMPING FROM NODE-TO-NODE.

I still see folks moving from node to node. Without going into all of the problems this may cause, let me just say this: DON'T DO IT! Please pick a node & stay with it. When you see your node listing your callsign as -1 *(WZ3Q-1, for instance)*, you know you've made a packet *faux pas*. That -1 alerts you to the fact two nodes think you are connected. Disconnect & try again. You need a good signal at the node to stay connected. If you don't have a good signal, it causes excessive retries to you, slowing things down for everyone. If you need help putting up your antenna to get a good signal into the node, please let me know. Myself, or someone within CDXA, can make sure you get your antenna up.

If you ever have questions on the operation of our PacketCluster system, please let me know. I listen to 147.18 if I'm in the shack & my telephone # is 704-263-1133, a local call from Charlotte.

--N4ZC

REVIEW

We often talk about the sun when we talk about propagation. Indeed, thinking about the sun & its relentless multi-year cycles is quite common for many hams. Like DXers. As usual, many of us have opinions or ideas about the sun, based on our own observations. This summer, when you come down off the tower & are thinking about your "redneck" tan later, take a minute to decide what you really know about this star we orbit around.

To help you along, there's *Guide To The Sun*, by Kenneth J. H. Phillips. This Cambridge University Press book recently came to my attention & I recommend it without reservation. It's a good read. And for the DXer/contester--or just any curious ham interested in propagation--it's a fascinating way to learn something about the sun.

The Sun has been an object of interest & curiosity since the ancient Greeks. But recent data have led to greatly improved knowledge about the Sun and its physics. This book begins with a history of solar astronomy (which we often forget included solar worship) & ends up with today's space age research. There are also chapters on the sun's surface & atmosphere, the interior of the sun, & how the sun interacts with the rest of the solar system, especially with the earth. How the sun was born, how it relates to other stars, & its eventual fate are also examined. Attention is even given to solar energy, & how its potential is being realized. There's even information of how to observe the sun, for amateur astronomers with small telescopes.

If you've tried to read this sort of thing before (many hams have & have been disappointed), I suggest you search this book out. It's well-written, easy to read, & full of solid information.

--WZ3Q