

### MAY CLUB MEETING

TUESDAY June 13, 1995 7:30 PM

Topic: **Field Day**

Speakers: Bob (KM4DU), Ernie (W2EIU), Brian (KE4HIA)  
National Radio Astronomy Observatory Auditorium  
On the Grounds of the University of Virginia

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### FIELD DAY NOTES- PLEASE READ

#### Field Day Picnic:

Do you enjoy Amateur Radio Competition? Do you like to eat? Well, get the opportunity to enjoy both at Field Day on June 24th and 25th. The club will supply (1) the meet (the place to get together) and the meat (hamburger, hot dogs) and (2) the juice (batteries, generators, and sodas). You are requested to (1) sign up to operate, and (2) to bring a covered dish (enough for you and a few others). Plan to have the evening meal at the Field Day site (Earlsville Fire Station) on field day. The Club has allocated funds to purchase hamburgers, hot dogs, rolls, sodas, plates (utensils) and condiments. So that we will know the approximate number that plan to attend please call me (Jessie, KE4OID) on 146.760 or phone (day 295-2011....night 589-1904). I would like to know how many plan to attend (this will help define the amount of meat to purchase) and what goodies you plan to bring. This so that we will have some idea of what we will be smacking our lips on. Thank you for your cooperation. Jessie (KE4OID)

#### Field Day CW Sign up:

If you would like to operate the CW station for Field Day you need to sign up through me. It would be nice if you had a partner to log or switch off with you but it is not a necessity. We would like you to sign up for one or more 2-hour long slots. Also, to sign up for the phone station operating slots you should contact Kay (KD4CUJ). Brian (KE4HIA) and Joe (KD4RWX)

### THE PRESIDENT SPEAKS

I would like to thank everyone for attending the Open House on May 25, 1995 at Bonanza. This was a wonderful way to celebrate the introduction of our display case. I would like to also thank those that supplied the materials that are now being displayed in the case. There is some neat stuff and we are collecting more to go in there for the next rotation of materials. A special thanks to those that took the

time to construct and mount the display case at Bonanza.

Spring has come, the grass is growing, and we need to meet the obligations of our lease on Carter's Mountain. We need to cut grass on a regular basis. If anyone is interested in helping to cut grass and weed wack on the mountain, please let Mike Duvall-AC4ZQ or LeRoy Sutter-WA4MHP know. We need to schedule a crew to go up there every 3 to 4 weeks, maybe more if the grass grows faster. We could also use assistance in picking up limbs that have fallen off the oaks as well. These limbs make it difficult to cut the grass. So if you feel unsure of using a lawn mower or weed wicker, you could assist with the fallen branches and limbs.

Field Day is on June 24 and June 25. The Field Day Committee is looking for assistance. They are looking for operators and are looking for equipment. If you would like to sign up for an operating time please call one of the following: Bryan Fox (KE4HIA), CW Captain; Kay Brown (KD4CUJ), Phone Captain; Bill Holman (KE4KJB), Novice/Tech Captain. If you have any equipment that you can lend to the cause, please contact the three listed above or Bob Pattison (KM4DU) or Ernie Sardi (W2EIU). Those that would like to assist with the picnic that we will have Saturday evening, please call Jessie Preston (KE4OID).  
73, LeRoy - WA4MHP

### VEEP'S CORNER

We had a really interesting meeting this month with Bud, KB4JNI giving a fascinating talk on deviation and, having brought some equipment, checking some HTs for frequency accuracy. A number of things were discussed, including the idea that the AARC foot the bill for having the September picnic catered by Big Jim. I talked to Big Jim and the cost seemed reasonable. Let me say right here that the efforts of Ron, K4RKA and the recycling committee are responsible for the club having the money to do this. Anyway, the idea of the catered picnic was brought to a vote and was passed, so Big Jim will be doing the picnic on Sept.12. We do need to get an idea of how many people will be coming by the middle of August so we can let Big Jim know how many to prepare for.

The June meeting promises to be an interesting one. First, Brian, KE4HIA and Ernie, W2EIU, and Bob, KM4DU will talk about the upcoming Field Day. The, a real treat, Grote Reber, the "father of radio astronomy" who will be visiting from Tasmania, Australia we hope, with a little pushing from Hein, N4FWA, will talk to us about some of his experiences over the last eighty or so years.

Looking forward to the Manassas Ham Fest on June 4th. Hope to see some of you there. I realize that we have a public service event going on the same day, but that

We are still looking for a volunteer to take over heading up the phone part of field day. This will involve rounding up the equipment and volunteers to operate the phone part of field day. We have people for the Novice/Tech area and the CW area, but no one yet for phone. Come on, step up and volunteer. It can be exciting, and fun and a wealth of experience, with lots of help provided by the more experienced hams, who have done it before. That's about it for this month..73..Rick..KO4WQ  
That's about it for this month.

Rick.(KO4WQ)

**OH, TO BE HF MOBILE AGAIN!**

While glancing through the latest issue of one of our Ham Radio journals, it seemed that the 1995 versions of HF mobile rigs were everywhere. These modern-day marvels of electronic micro-tech features looked sooooo inviting. The Ten-tec Scout, the Kenwood TS-50S, the Yaesu FT-900AT and the Alinco DX-70T, several with removable front panels and all kinds of features to permit these units to be mounted easily in the most modern of today's crowded automobiles... WHAT A SIGHT FOR THESE OLD EYES!

However, therein lies the problem and it's not only the old eyes, but also the tired legs and the fact that HF mobile would be of little use to a guy who goes back and forth to Bonanza one trip a week! Those new rigs brought back memories of the 50's and later when I was mobile on almost all of the HF bands... especially 20, talking to my Dad who had retired to Florida.

My first mobile was in a 1950 Chevy. The rig was a surplus job which consisted of three 6V6's (those were vacuum tubes fellows and gals of the "NOW" generation.) This was the transmitting unit and it was crystal-controlled (that meant only one spot on the band for each crystal!) The receiver was a Gonset converter feeding into the car's broadcast receiver. All of this "stuff" required high (!!) voltage... somewhere between 150 and 250 volts which was obtained in a number of ways. We had vibrator packs, rotary devices and the well-to-do folks had power supplies driven by AC sources.

In later years, the cars changed and the mobile rigs changed also as SSB came upon the scene and 2-meter FM and repeaters emerged from converted public service rigs. I used 20 meter c.w. and SSB to talk to my Dad. The rigs were larger and the power required was increased. You didn't dare turn off the engine and park for fear that the car would never start again since the battery would be crying for peace and quiet and a chance to heal its wounds! Some of those rigs of the 60's and later took as much power to light the vacuum tubes as the present 100 watt output solid-state rigs use in their entirety and you get four to six times the talk power, too!

Yes, we've come a very long way with technical advancement. If you haven't tried HF mobile, give it a go! Take a look and see what is being accomplished today. If you travel beyond the range of some of our repeaters, look at the long distances you can span on the HF bands. Dave, WG4T, and Carol, AA4KP, use c.w. on 40- meters when their travels require. Several of our AARC members are using HF rigs aboard their boats as they sail up and down the Eastern coastal waters. Talk to Bob, WA2MFI, about his QRP mobile operation. He works the world with 5-watts or so from his car. It can be lots of fun! Just wait for ten meters to open someday.

(Thinking to myself... maybe I could make the trip to Bonanza a little longer each week. I wonder if they will have a "special" on those super HF mobile rigs. There you go...wishful thinking!)  
Harry (W2HD)

**WHAT IF?**

Have you ever stopped to think; what would I do if the repeater went down during an active emergency net? During times of hurricanes or tornadoes, this is a good possibility. We rely heavily on the repeater - maybe too much. So, if you are participating in an emergency net, what do you do if the repeater does go down? You move to a simplex

frequency. Adjust your radio to the simplex frequency of the output of the repeater that you were using. If you cannot hear net control on the air, see if you can establish contact with a station between you and net control. The net control operator will work out a route to pass traffic or information to your location. More than likely, the net will remain on that frequency so if the repeater returns everyone would have the advantage of using the repeater again. What if you cannot contact any one on that simplex frequency? The best thing is to remain on that frequency. Net control may shift people to different locations to try to maximize communications with operators that are on the fringes and net will assume that you are still listening to the repeater output frequency.

What is the best way to be prepared for this? You should have the simplex pairs already programmed into your radio. Here is just a suggestion: I have my radio set up so that the simplex frequencies are mirror images of the repeater. They look something like this:

Memory	Frequencies
38	146.895/146.895
39	146.925/146.925
40	146.760/146.760
01	146.160/146.760
02	146.325/146.925
03	146.295/146.895

If you have any additional thoughts on "What If" I would like to hear from you. Being prepared for any emergency is a must and if you have any questions we would like to get them answered.

Thanks,  
LeRoy-WA4MHP-E.C. Fluvanna/Louisa

**MORE NOSTALGIA FROM K4RKA - CALLSIGNS**

Recently I was asked about some of the call signs on certificates in our new display case at the Bonanza Restaurant. This is a small item but the changing suffixes of call signs does present an interesting study in the changing FCC rules (and amateur practice in some cases). I claim to be neither 100% accurate nor 100% complete, but maybe this will help explain some of what people hear, read, or see.

Way back, even before Harry, amateurs used a number to indicate the district or area of the country they were from, plus letters to make them unique. For instance, W2BNX was first just "2BNX". Sometime along the way during the development of radio as a means of communications, various countries of the world agreed on a "letter, number, letter" scheme of assigning call signs to radio stations (note, sometime there is no number and sometimes there is no leading letter, but the concept is the same). The United States was assigned calls beginning with the letters "A", "K", "N" and "W". The U.S. was further divided into areas identified by number. These areas have changed slightly over time, but the concept has remained the same. A new amateur station was assigned a "letter - number based on area of residence - two or three letter" call sign. The southeast was district "4", other areas were "1" through eventually "9" (not all were used at first). So we had calls from "W1AA" through "W9ZZZ". When those ran out, the FCC started with "K" prefix calls. In the days before computers, calls were reissued as they were not renewed. For instance "K4RKA" was reissued to a new ham in 1959 while some of the other teenagers who received licenses only a month or so later

received the new "WA" prefix. As an aside - at that time a Novice received "KN4RKA" or "WN4FKX" and, when he upgraded, the "N" was dropped or changed to another letter as appropriate. By 1970 we were up to "WB" prefix and old calls were no longer being reissued (I don't know if it is true, but I have heard it blamed on the new fangled computers which couldn't figure out how to assign a call out of sequence - i.e. once it was issued, it could never be used again). At any rate, there is the basic layout of call signs.

All these call signs were "Station" call signs which were assigned to a specific geographic location. Since amateurs didn't stay put like a commercial radio station, they were also issued an "Operator's license". This allowed a person to move around and use his call wherever he was in the country. However, he had to identify that he was not at the fixed location specified on his station license and he had to identify whether he (or she - I will use the generic "he" to include both) was "MOBILE" or "PORTABLE". This was spoken as "K4RKA mobile". If a ham was at a fixed location other than his official station, it was "K4RKA portable" and the time period which he could operate at another location was limited. This led to some people having to apply for more than one station license (e.g. WA4UXD/WB4ECW). If the operator was in a call district other than his home district, his call had to be followed by the number of the district which he was in - e.g. "K4RKA mobile 2". We still see this practice between countries with reciprocal license agreements (e.g. KO4EV/TI8). As an aside, if he operated mobile or portable, he could use all the rights of his license class, but if he operated from another assigned station location, he was limited to the rights of that station.

When "REPEATER STATIONS" were recognized as a new class of station in the early 1970s, special call signs were assigned. When the first amateur repeater was put on Carter Mountain, it operated under the "club" call sign of WB4KNX/R to indicate a repeater station. This call was soon changed to WR4ADV and later WR4ATL due to change of trustees and other reasons. Eventually the FCC dropped this special call designation and the repeater call was changed to WA4TFZ/R. Now even the /R is not required.

When the AARC station (the "station" license is now our trustee, NM4R's address) was operating "portable" such as at field day, we had to sign "portable" or "/4" which you will see on some of the certificates. Since this was the original question, I trust the above provides more than you ever wanted to know. It should also clarify some of the identifications you hear on the air, especially from those who learned to identify one way and haven't made it to the modern age where "YOU" are the amateur call and there is no requirement to identify as "mobile" or "portable" unless it is of some other benefit. It may still be desirable to identify as "mobile", particularly when checking into a net to assist the net control station to understand your status, but it is no longer required.

Trivia questions and Quiz:  
Who had the call WN4FKX and what is his present call??  
Who had the call WN4FKX and what is his present call?? Extra credit  
Why did he have two different calls at the same time at the same location??

73, Ron, (K4RKA)

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**BITS AND PIECES**

**NEW MEMBERS**

Fred Newman, KE4ZNO

**NEW CALL**

Chris Stroot, KE4ZXE

**VE SESSION RESULTS**

THE VE SESSION ON SATURDAY MAY 13 IN CHARLOTTESVILLE SERVED 12 CANDIDATES. THE RESULTS WERE SIX NEW OR UPGRADES TO TECHNICIAN PLUS (TECH W/HF) AND TWO NEW TECHNICIANS (NO CODE). TWO OF THE CANDIDATES PASSED AN ELEMENT WHICH DID NOT RESULT IN AN UPGRADE OR NEW LICENSE. EXAMINERS PARTICIPATING WERE W2HD N4FWA KO4WQ AC4ZQ AND W6UZ. THE NEXT SESSION WILL BE IN THE EARLY FALL, THE DATE TO BE DETERMINED LATER. 73.

John (W6UZ)

**VE EXAMS**

**VIRGINIA VE TESTING INFORMATION**

- 06/03/95, A, Virginia Beach,,804-468-9166, Judy Rogers
- 06/09/95, A, Galax,,703-766-3121, Joseph A Kolb
- 06/10/95, A, Richmond,,804-798-5048, Rick Cook
- 06/10/95, A, Tappahannock,,804-443-5092, Sylvia Massie AA4GL
- 06/18/95, A, Roanoke,,703-268-1017, Gordon Garrett
- 07/14/95, A, Galax,,703-766-3121, Joseph A Kolb
- 07/15/95, A, Richmond,,804-222-3436, Samuel Henderson K4YPE
- 07/16/95, A, Roanoke,,703-268-1017, Gordon Garrett
- 07/17/95, A, Coeburn,,703-395-6595, Clinton W Hawkins, Jr
- 07/28/95, A, Stafford,,703-786-8012, Jim McCloud N4LZJ
- 07/29/95, 5, Gloucester,,804-484-2857, Fran Sterling
- 08/11/95, A, Galax,,703-766-3121, Joseph A Kolb
- 08/12/95, A, Richmond,,804-798-5048, Rick Cook
- 08/20/95, A, Roanoke,,703-268-1017, Gordon Garrett
- 08/26/95, 5, Gloucester,,804-484-2857, Fran Sterling
- 08/26/95, A, Spotsylvania,,703-373-7076, Carolyn Cavanagh AC4SK
- 09/08/95, A, Galax,,703-766-3121, Joseph A Kolb
- 09/09/95, A, Culpeper,,703-547-3089, Bill Brown
- 09/17/95, A, Roanoke,,703-268-1017, Gordon Garrett
- 09/18/95, A, Coeburn,,703-395-6595, Clinton W Hawkins, Jr
- 09/23/95, A, Virginia Beach,,804-898-8031, Ed Brummer
- 09/29/95, A, Stafford,,703-786-8012, Jim McCloud N4LZJ
- 09/30/95, 5, Gloucester,,804-484-2857, Fran Sterling
- 06/03/95, A, Virginia Beach,,804-468-9166, Judy Rogers

The following individuals seem to be the regular contact persons for VE Exams in their area. If you wish to check on the availability of future exams in their area, please contact them.

- Culpeper Bill Brown 703 547-3089
- Harrisonburg Marshall Cooper 703 856-8012
- Richmond Rick Cook 804 798-5048
- Lynchburg Charles Beard 804 386-4651
- Roanoke Fred Horton 703 366-6266
- Orange County Kelly Shaw 703 891-5581
- Charlottesville John Gray 804 973-1094 We will always announce the Charlottesville sessions in plenty of time.

**PUBLIC SERVICE EVENTS 1995**  
**CONTACT HEIN (N4FWA) TO SIGN UP FOR EVENTS**

**BKR3** Sunday 04 June, 0900 EDT Bike Race. Start and finish at Walton Middle School.

**MSB1** Saturday 10 June Multiple Sclerosis Bike Tour, first day. Start at Piedmont Community College. Overnight at Longwood College, Farmville.

**MSB2** Sunday 11 June Multiple Sclerosis Bike Tour, second day. Start at Longwood College, Farmville. Finish at Stonewall Vineyards near Concord.

**BKR4** Sunday 18 June, 0730 EDT Bike Race. Start at and Finish at the Wm Monroe High School in Stanardsville, Greene County.

**MSB3** September (CANCELLED) Multiple Sclerosis Harvest Tour (bike). Albemarle County. Start and finish at Broadus Wood School near Earlysville.

**DRL1** Thursday 7 September, Note: Date Change. (1800 EDT) Albemarle/Charlottesville/UVA disaster drill. Scenario will be earthquake and train derailment.

**DIA1** Sunday 01 October, 1000 EDT American Diabetes Association Walk in Charlottesville.

**HRT1** Sunday 08 October American Heart Association Walk in Charlottesville.

**CLUB BUSINESS**

AARC Board Meeting May 2 1995  
 There will NOT be a July Board Meeting. National Holiday.

Moved to change the Board meeting time to 7:30 PM. Approved  
 Approved the appointment of Mike Duvall (AC4ZQ) as Chairperson of the Technical Committee. Rich Bradley (WB3DZC) was approved as Vice-Chair.  
 The Bonanza Open House was reported to have been moved to May 25th due to a conflict of schedules.

AARC Regular Meeting Minutes-- May 9, 1995  
 Minutes of April Meeting were approved.  
 New members approved:  
 Frederick G. Newman, (KE4ZNO)

Hein (N4FWA) mentioned some upcoming events. Martha Jefferson House Drill on May 18th; Bike Race in June, MS Bike Tour; and State Bike Race June 18th.  
 Greenbank trip is scheduled for May 20th  
 July meeting may have a conflict with room usage. Stay tuned.  
 New Hams are encouraged to participate in public service events. Do a ride-a-long with an experienced Ham.  
 Field Day Report- Need a Phone Station Captain  
 V.P. Report- Picnic will be Tuesday, September 11th. W2PVY moved that we have the picnic catered and paid for by the club from surplus sales funds. Approved.  
 Notice given of the appointment of Mike Duvall (AC4ZQ) as Chairperson of the Technical Committee. Rich Bradley (WB3DZC) was approved as Vice-Chair.  
 Notice given of Board Meeting time change to 7:30 PM.  
 Notice given to all, to report all Club equipment to Joe (W2PVY). He will develop an inventory database.  
 An Expanded Treasurer's Report follows.

**ALBEMARLE AMATEUR RADIO CLUB, INC.**  
**TREASURER'S REPORT MONTHLY REPORT**

January 1, 1995 - May 24, 1995  
 Treasurer: Sharon Duvall, KO4OC

(subject to varification of \$37.50 variance in figures)

1995 - INCOME			
DESCRIPTION	AMOUNT	SUB-TOTAL	TOTALS
Income:Dues			
Dues:1995	975.00		
Dues:1996			
Total Income:Dues		\$975.00	
Income:Miscellaneous			
Subscriptions			
Raffles	37.00		
T-Shirt sales			
ID Vests Sold	5.00		
ARRL Renewals-by members	8.00		
Directories			
Sale of class Books:			
Now You're Talking	230.00		
Name badges			
Total Income:Miscellaneous		\$280.00	
Income:Donations			
Sale of Surplus Material	1486.00		
Repeater	140.00		
packet			
cash			
Cnty of Albemarle:ID Vests	200.00		
Total Income:Donations		\$1826.00	
<b>TOTAL INCOME TO DATE</b>			<b>\$3081.00</b>
1995 - EXPENSES			
DESCRIPTION	AMOUNT	SUB-TOTAL	TOTALS
Expenses:Equipment Purchased			
Repeater related	506.12		
Packet related			
Total Expenses:Equipment		\$506.12	
Expenses:Miscellaneous			
Postage and Pub. costs			
Telephone	144.80		
Equipment Insurance			
Meeting Refreshments	102.00		
Picnic Shelter			
Va. State Corporation Fee	25.00		
Winter Dinner Appropriation	248.50		
Books and Tapes for class	205.90		
SERA Membership			
Supplies	49.23		
Total Expenses:Miscellaneous		\$775.43	
Expenses:Special Projects			
ID Vests Purchased	198.55		
T-Shirts for resale			
Bonanza Display case	268.82		
Total Expenses:Special Projects		467.37	
<b>TOTAL EXPENSES TO DATE</b>			<b>\$1748.92</b>
<b>1995 GAIN OR LOSS TO DATE</b>			<b>\$1332.08</b>
1994 Balance Brought Forward (1-1-95)			\$4713.78
<b>CURRENT BALANCE</b>			<b>\$6045.86</b>

The presentation for the meeting was given by Bud (KB4JNI). He provided the following text in support of his talk.

### Frequency Deviation and Packet Standards etc.

1. Deviation is defined as the instantaneous change in frequency with a given input signal, or the peak value of the carrier departure from center. The FCC defines Narrow Band fm as 1.8 kHz deviation. This seems to correspond with my observations of on the air signals that are showing values of 3 to 4 kHz. p to p. Most of the transmitters that I have observed have their limiters set to about 2.0 to 2.5 kHz. The G.E. Royal Execs that are modified for the Ham bands are nominally set for 4.5 kHz with limiters at 5.0 kHz. This is compatible with the receivers bandwidth of about 20 kHz. The discriminator is quite linear over this range and it is DC coupled through a 100k resistor to a test point and in the WA4TFZ 145.61/145.01 unit is available on a terminal strip. This is an excellent point to monitor with a scope since no de-emphasis is present. (use a low cap. probe) The transmitter audio is pre-emphasised the normal 6db per octave between 300 and 3000 Hz. The receiver audio is de-emphasized.

#### 2. Modulation Index and receiver bandwidth.

Modulation Index is defined as deviation divided by the modulating frequency. With the deviation set to 1.8 kHz, the index is 1.5 for the 1200 Hz low tone and 0.82 for the 2200 Hz high tone. Examination of the Bessel functions shows the need to include the 2nd order sidebands in the receivers passband. This requires at least  $4 \times 2.2 = 8.8$  kHz bandwidth. Most of the ham radios are at least this wide and some are over 20 kHz. The need for the wider bandwidths is to accommodate the difference in frequency settings of both transmitters and receivers caused by aging and temperature on xtals. The compromise here is obvious. The higher sensitivity receiver usually has the narrower bandwidth and requires greater attention to frequency tolerance and deviation.

#### 3. Pre-emphasis, De-emphasis :

The use of Pre-emphasis of the transmitted audio stems from the desire to improve the S/N ratio of the high modulation frequencies by De-emphasis of the receiver discriminator output. This works with wide deviation fm and multiple tones. Neither is the case for Packet and no improvement is provided.

#### 4. Conclusions and Recommendations:

In view of all the above, it appears best to transmit equal deviation signals on the air. Local users and PBBS settings should keep deviation settings below the 1.8 kHz level. For Backbone systems, careful attention to frequency and higher deviations should be used to improve throughput seems to be a desirable goal.

#### 5. Measurement of Deviation :

For those Hams who have access to Service Monitors or Spectrum Analyzers, checking deviation is easy. For those who do not, the task can be more difficult. A very good check can be done with the aid of an all mode receiver.

a. Set the packet transmitter to a locally unused frequency and set the TNC to CALIBRATE. Use a dummy load on the TX, if possible.

b. Set the receiver in the CW mode and tune for an audible

beat note of about 500-600 Hz with no modulation on the packet transmitter

c. Turn on the high tone (2200 Hz) and adjust the tnc level till the beat note is minimized.

The modulation index when the carrier is nulled is

2.4 (Bessel J0). With the 2200 Hz tone, this gives a deviation of  $2.4 \times 2.2 = 5.28$  kHz. Using the 1200 Hz tone and the same procedure, the deviation is 2.88 kHz. Do not forget to include the effect of pre-emphasis on the tx audio if present. Setting the deviation by backing off the 2200 tone amplitude to one half will give a peak to peak deviation of less than 3.0 kHz, about right for local use.

-----Bud-----KB4JNI-----

The meeting was adjourned

Joe Fritz (KD4RWX), Secretary

## FOR SALE or WANT

[If you wish to have something printed in this section please contact Joe (KD4RWX) ]

#### WANTED 01A TUBES

I would like to obtain several 01A tubes. I could use about a dozen. If you have any for sale contact me, Carter (WD4AYS) at 804-979-7388 (H) or 804-980-7698 (W)

#### WANTED: 2M RIG & MAG MOUNT ANTENNA 5/25/95

Ernie, W2EIU, is looking for a two meter rig for packet radio. He is also looking for a 2m mag mount antenna. Call him at (804) 985-4180.

#### WANTED TWO METER MOBILE RIG

RICHARD, KO4EV, IS BACK FROM TI8-LAND AND IS LOOKING FOR A TWO METER MOBILE RIG. CALL HIM AT 973-3723.

#### FOR SALE: BUTTERNUT HF BASE ANT. 5/4/95

HI EVERYONE, I HAVE FOR SALE A BUTTERNUT HF6V)X 10 - 80 METER VERTICAL BASE ANTENNA. I PUT IT TOGETHER BUT IT NEVER WAS PUT UP. I ALSO HAVE THE RADIAL KIT AND THE MOUNTING POST KIT WITH IT. I PAID OVER \$225 FOR IT. I'M ASKING \$175. FOR MORE INFORMATION CALL (703) 862-4413 OR HERE ON PACKET@WB4QOJ. 73'S DE JOE, KE4DDM, AND THANKS FOR READING.

#### FOR SALE: TAPE BACKUP UNIT 5/4/95

I have an external tape backup system for sale. If interested leave message or call (804) 286-2993. Bernard, K4PRT.

## Antenna Height and DX on the HF Bands

Most hams believe the “higher is better” rule for HF antennas but don’t know why it is usually true, when it is *not* true, or just how much gain a particular increase in antenna height yields. This article presents simple equations and graphs showing how the gain of a horizontally polarized HF antenna used for DX work from central Virginia varies with height above the ground. It can help you decide whether the effort and expense of increasing your antenna height is worthwhile.

Why should the height  $h$  of an antenna have *any* effect on the strength of signals which are reflected from the ionosphere? After all, even a very low antenna above flat ground has a clear line-of-sight to the ionosphere, and even the tallest tower is much shorter than the altitude of the F layer (about 200 miles). The only reason that antenna height matters is that the Earth’s surface is a good reflector of horizontally polarized radiation at low elevation angles  $\theta$ . (It is a mediocre reflector of vertically polarized radiation at low elevation angles, so this discussion does not apply to verticals.) Acting as a radio mirror, the ground creates a “mirror image” antenna a distance  $h$  below the ground (Figure 1).

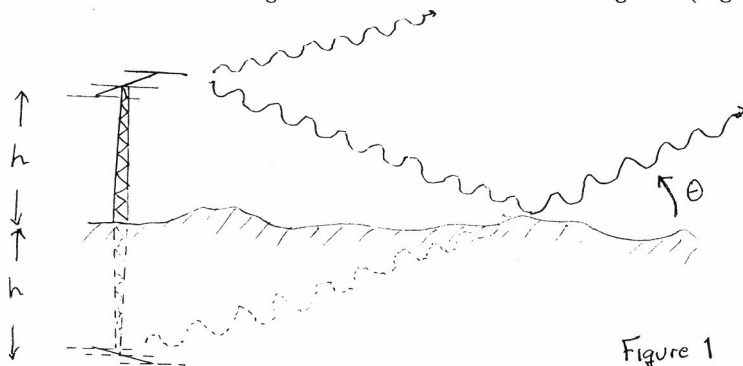


Figure 1

Currents in the real and image antennas have the same amplitude, but they are  $180^\circ$  out of phase.

The field pattern of the real antenna above the reflecting ground is the same as the free-space pattern of the two antennas shown in Figure 1. This pattern can easily be calculated using the principle of pattern multiplication: the elevation (vertical plane) pattern of any horizontally polarized antenna  $h$  feet above the ground is the same as its free-space pattern multiplied by the free-space pattern of a two-element phased array consisting of an isotropic radiator plus its mirror image vertically separated by  $2h$ . At any elevation angle  $\theta$ , the field strength emitted from this virtual array of two isotropic radiators is just the (vector)

sum of their field strengths:

$$g = \cos\left(\frac{2\pi ct}{\lambda} + \frac{2\pi h \sin \theta}{\lambda}\right) - \cos\left(\frac{2\pi ct}{\lambda} - \frac{2\pi h \sin \theta}{\lambda}\right), \quad (1)$$

where  $\lambda$  is the wavelength and  $\theta$  is the elevation angle in radians (1 radian =  $180/\pi$  degrees). Figure 2 shows the elevation pattern for a single isotropic radiator (dotted curve) compared with the patterns of isotropic radiators at heights  $h/\lambda = 1$  (dashed lobes) and  $h/\lambda = 3/2$  (continuous lobes) above a reflecting ground.

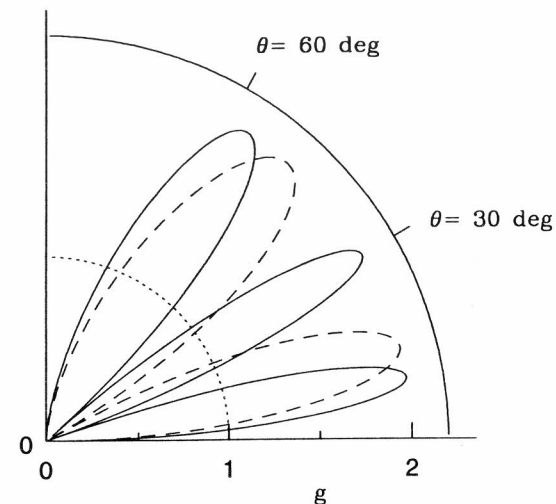


Figure 2

The actual elevation pattern of your antenna will be its free-space pattern multiplied by a lobed pattern similar to those in Figure 2. (Its azimuth pattern is not affected.) Changing antenna height therefore has the *same* effect on the performance of all horizontally polarized antennas—dipoles, yagis, quads, etc. The lobes have a maximum field-strength gain  $g = 2$ , or about 6 dB. The gain is nearly zero near the horizon because the real and image antennas are out of phase. As the antenna height in wavelengths ( $h/\lambda$ ) is increased, the lobes become narrower and the elevation angle of the lowest lobe decreases.

Equation (1) can be simplified and expressed in dB's:

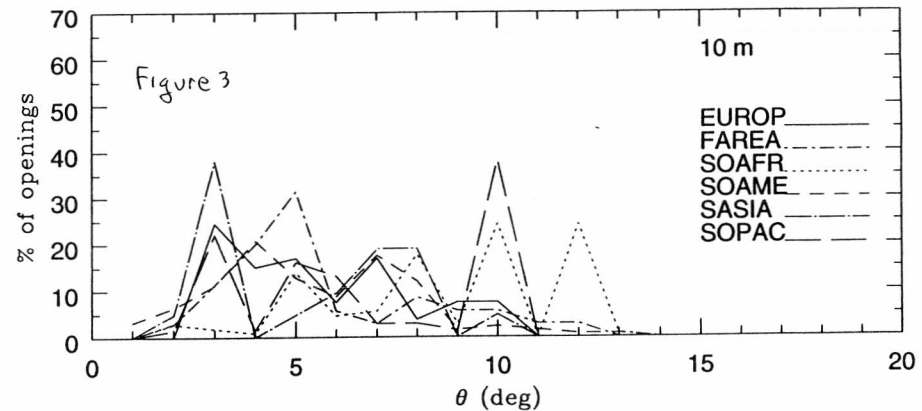
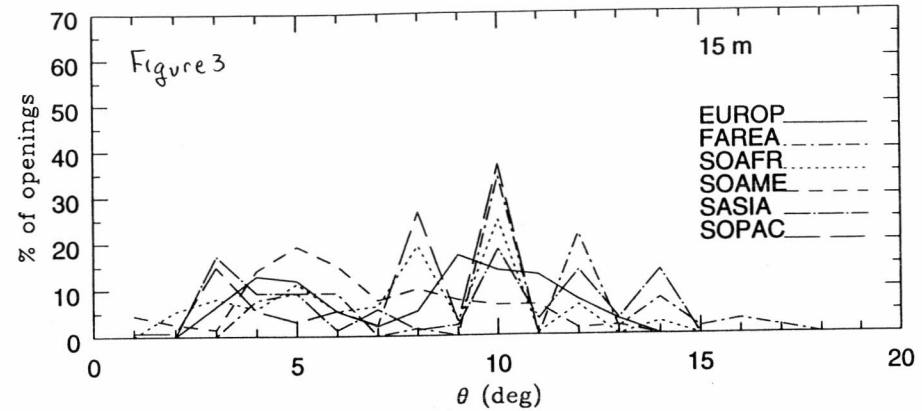
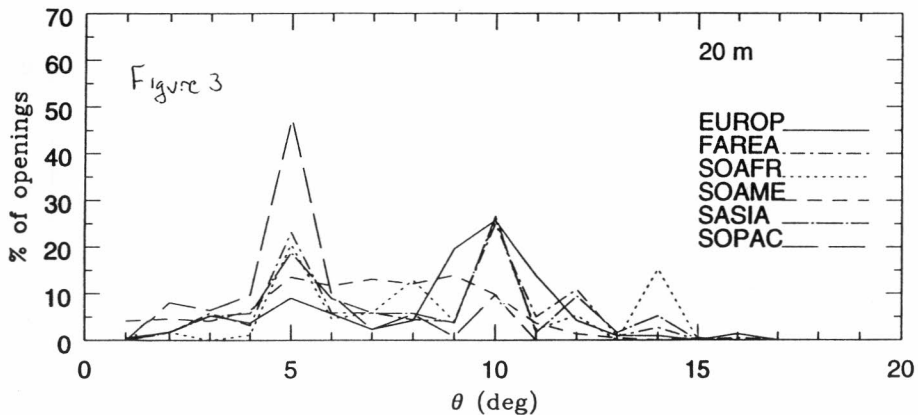
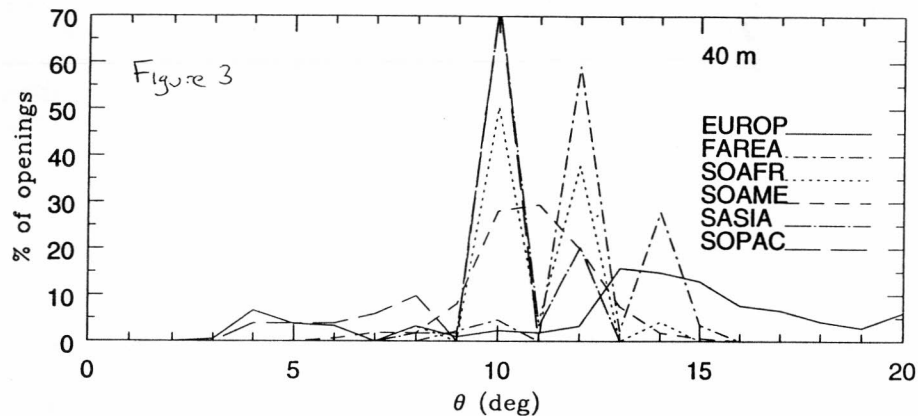
$$g(\text{dB}) = 20 \log \left[ 2 \sin \left( \frac{2\pi h \sin \theta}{\lambda} \right) \right]. \quad (2a)$$

In Equation (2a), all angles are expressed in radians. The corresponding equation for angles in degrees is

$$g(\text{dB}) = 20 \log \left[ 2 \sin \left( \frac{360h \sin \theta}{\lambda} \right) \right]. \quad (2b)$$

Equation (2) implies that the DX performance of a given antenna depends on two factors: (1) its height in wavelengths ( $h/\lambda$ ) and (2) the elevation angle  $\theta$  of the DX signal path. You can control  $h/\lambda$ , but  $\theta$  depends on the ionospheric path between you and the DX station. The optimum antenna height puts the lowest pattern lobe at the same elevation angle as the DX signal.

The 1995 *ARRL Antenna Book* contains a 3.5-inch diskette that gives the percentages of openings between the Washington, DC area and six DX locations (Europe, Far East, South Africa, South America, Southern Asia, and the South Pacific) with different radiation elevation angles. The results for Charlottesville should be very similar because the distance between Charlottesville and Washington, DC (100 miles) is much smaller than a typical F-layer skip distance (1000 to 2000 miles). They represent averages over the whole sunspot cycle, so they are useful for long-term planning of an antenna installation. The DX elevation angles on the 40, 20, 15, and 10 meter bands are plotted in the four graphs below. Note that most DX openings occur at fairly low radiation angles.



The closer the elevation of the lowest lobe to the radiation elevation angle, the better the antenna height. Equation (2) implies that the optimum antenna height is

$$h = \lambda / (4 \sin \theta) \quad (3)$$

For example, Figure 3 indicates that most DX openings on the 40 meter band ( $\lambda \approx 42$  m) are at elevation angles near  $\theta = 12^\circ$ . The optimum height for a 40 meter DX antenna is thus about  $h = 42 \text{ m} / [4 \sin(12^\circ)] = 50$  m, or about 165 feet. Equation (2) can be used to calculate the relative gain of a 40-meter antenna at any height, for signals with elevation angle  $\theta \approx 12$  deg. The results are plotted in Figure 4.

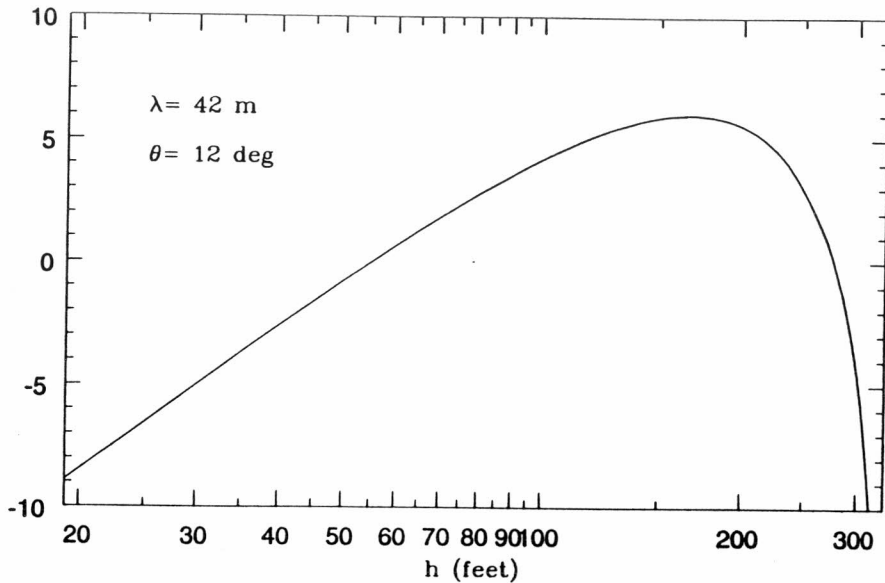
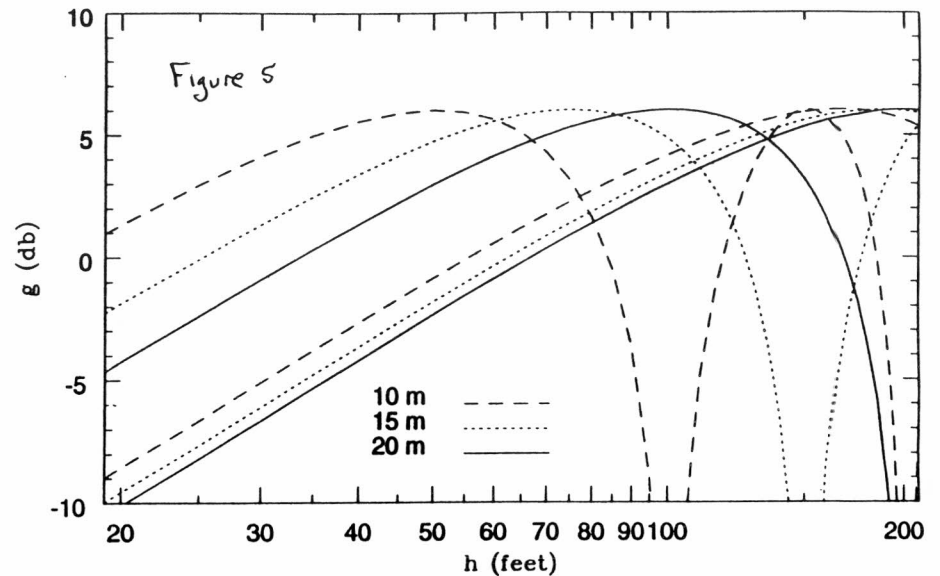


Figure 4

This graph shows that the peak gain (relative to the free-space gain) is 6 dB when the height is about 165 feet. Note that the gain changes very little with height near the peak. An antenna “only” 115 feet high is down by just 1 dB in performance. For antennas much lower than the optimum, height becomes more important. Raising your 40-meter dipole from 35 feet to 50 feet height results in a 3 dB improvement, and raising it to 75 feet would net you a total of 6 dB. Raising your 40-meter dipole from 35 to 75 feet will therefore quadruple your effective radiated power—like adding a 600 watt linear amplifier to your 150 watt transmitter. It also strengthens the received DX signal by 6 dB, so raising your antenna is actually much better than buying the amplifier. In effect, you have bought an amplifier for the DX station, too. Another way to look at this is that a 40-meter dipole at 75 feet will give you about the same signal as a 40-meter yagi at 35 feet.

Figure 5 shows how the gain of a horizontally polarized HF antenna varies with height  $h$  for the  $\lambda = 10, 15,$  and  $20$  meter bands. The top three curves are for radiation with elevation angle  $\theta = 10^\circ$ , and the bottom three curves correspond to the lowest commonly observed radiation angles ( $\theta = 3^\circ, 4^\circ,$  and  $5^\circ$  on 10, 15, and 20 meters, respectively).



Because the radiation elevation angles of DX paths to central Virginia are spread over more than a 2:1 range on 20, 15, and 10 meters, there is no single “optimum” antenna height. Raising a low antenna always helps, especially on 20 meters. However, the choice of antenna heights becomes complicated when the antenna height in wavelengths is more than about  $h/\lambda = 1.5$ . If  $\theta = 10^\circ$ , Equation (3) says that the optimum height is  $h/\lambda \approx 1.5$ , or  $h \approx 50$  feet on the 10 meter band, 75 feet on 15 meters, and 100 feet on 20 meters. Antennas at these heights will give the best possible performance, a gain of 6 dB over their free-space gains. A further increase of antenna height will actually decrease performance at this radiation elevation angle. In fact, going to twice the optimum height will cause signals from the real and image antennas to cancel, so Figure 5 indicates that the performance of an antenna 100 feet up will be very poor indeed on 10 meters when  $\theta = 10^\circ$ . An antenna can be too high for HF work. Very high antennas (100 to 200 feet) are superior when propagation conditions favor the lowest radiation angles normally encountered (the three lower curves in Figure 5). But their pattern lobes (Figure 2) are so narrow that their

performance becomes erratic for signals with moderately high radiation angles ( $\theta \geq 10^\circ$ ), especially on the 10 and 15 meter bands. This is why “big gun” DX stations use stacks of yagis at different heights to optimize performance under all conditions. If you only want to put up one antenna to cover the 10, 15, and 20 meter bands, heights in the range from about 60 to 90 feet will give the most consistent results.



## ARES/RACES Telephone Tree

c = cell phone m = message h = home o = office p = pager

May 27, 1995

<p><b>Instructions:</b></p> <p>When you are called the person should say that, "This call is activating the ARES Telephone Tree. Would you please call the individuals who are in the two boxes to the right of your name."</p> <p>Then you must try to contact an individual who is listed in each of the boxes to the right of your name. Tell them they should get on the radio at 146.760 <b>And/OR</b> Pass on any message given to you.</p> <p><b>NOTE:</b> If you fail to reach any of your assigned individuals then it becomes your responsibility to call the individuals (if any) assigned to them.</p>	<p><b>Kaye</b> <b>ke4ukw</b> 286-2161 h 971-9561 o 286-3979 o 961-3579 p</p> <p>and/or</p> <p><b>Robert</b> <b>ke4aqd</b> 973-2734 h 980-7414 o</p>	<p><b>LeRoy</b> <b>wa4mhp</b> 589-3822 h 295-3101 o 960-3722 c</p> <p><b>Jan</b> <b>ke4nnt</b> 589-3822 h</p>	<p><b>Harry</b> <b>w2hd</b> 974-7388 h</p> <p><b>Ernie</b> <b>w2eiu</b> 985-4180 h</p>	<p><b>Joe</b> <b>kd4rwx</b> 973-1738 h</p> <p><b>John</b> <b>w6uz</b> 973-1094 h</p> <p><b>Brian</b> <b>ke4hia</b> 823-5469 h</p> <p><b>Bob</b> <b>km4du</b> 985-7515 h 977-2732 o</p> <p><b>Sharon</b> <b>ko4oc</b> <b>Mike</b> <b>ac4zq</b> 978-7342 h</p> <p><b>Bill</b> <b>n4zzb</b> 973-6596 h 978-5869 o</p> <p><b>Wil</b> <b>kj4xz</b> 823-5665 h</p> <p><b>Ron</b> <b>k4rka</b> <b>wb4rbw</b> 973-3640 h</p>	<p><b>Rich</b> <b>wb3dzc</b> 985-8525 h <b>Linda</b> <b>kc4myi</b> 985-8525 h</p> <p><b>Tom</b> <b>ad4ad</b> 589-4529 h</p> <p><b>Ken</b> <b>k2aoe</b> 979-7146 h</p> <p><b>Kay</b> <b>kd4cuj</b> 977-5226 h <b>Dave</b> <b>ad4gk</b> 977-5226 h 296-0263 o</p> <p><b>June</b> <b>kd4ath</b> 589-1495 h <b>Joe</b> <b>w2pvy</b> 589-1489 h</p> <p><b>Mike</b> <b>kd4nnl</b> 973-3114 h 924-8607 o</p> <p><b>Steve</b> <b>n2lrv</b> 293-7373 h 977-2732 o</p> <p><b>Richard</b> <b>ko4ev</b> 973-3723 h</p> <p><b>Don</b> <b>ke4ddr</b> 978-1439 h 971-3223 o</p> <p><b>Elwood</b> <b>kb4djn</b> 985-3421 h 978-5309 o</p> <p><b>Bud</b> <b>kb4jni</b> 295-9531 h</p> <p><b>Jon</b> <b>kj4op</b> 985-7002 h</p> <p><b>Gerald</b> <b>kn4fm</b> 973-7391 h</p> <p><b>Bob</b> <b>wb2mva</b> 295-2686 h</p> <p><b>Dick</b> <b>w4ofr</b> 977-8607 h</p> <p><b>Bob</b> <b>kb4yqc</b> 293-9720 h</p>
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**DEADLINE FOR EACH ISSUE**

The 15th-17th of each month should be considered as the last dates to submit information for the NEXT MONTH'S BULLETIN. In some circumstances it may be possible to send information a week later. Check with me. Joe, KD4RWX

**CLUB MEETINGS**

**Regular Meeting:**

Second Tuesday of each month at 7:30 p.m.

**Board and Technical Meetings:**

First Tuesday of each month at 7:30 p.m.

Meetings are held at the National Radio Astronomy Observatory (NRAO)

building, Edgemont Road (UVA area)

**WA4TFZ REPEATERS**

<b>INPUT/OUTPUT</b>	<b>TONE ACCESS (if required, etc.)</b>
146.160/146.760	88.5 Hz (If enabled, DTMF 325* will produce temporary Tone off and 326* will turn Tone back on)
Emergency Autopatch to access the 911 Center.....	DTMF 911*
Emergency Autopatch to access VA State Police.....	DTMF 918*
Autopatch exit.....	DTMF 0*
Time.....	DTMF 10*
Tone status of repeater.....	DTMF 700*

146.325/146.925	no tone	223.160/224.760	no tone
449.250/444.250	151.4 Hz (If enabled)	145.030	MACHO node
145.030	CHO	WA4TFZ	Packet Bulletin Board

**NETS**

**Northern Piedmont Emergency Net**

146.76 repeater Thursday 8:00 p.m.  
 Plus Swap/Trade & Technical sessions  
 Net Control: Morris, NM4R

**Information Net**

146.76 repeater Monday 7:00 p.m.  
 Newline program and general news  
 Net Control: Mark, N4TZE

**Albemarle Amateur Radio Club**  
**P.O. Box 6833**  
**Charlottesville, Virginia 22906**

**AARC BULLETIN**  
**June 1995**



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