

RADIOACTIVITIES

NEWSLETTER OF THE ARGONNE AMATEUR RADIO CLUB



Volume XLVIII, Number 1

January 2007

Club Meeting

Unless otherwise noted, AARC general meetings are the second Tuesday of the month at the Argonne cafeteria at a table on the north end of the room. Any club member is welcome. To arrange for a gate pass contact Bruce Epperson at epperson@aps.anl.gov phone 630-252-3495 or Chuck Doose at doose@aps.anl.gov phone 630-252-6037.

The Treasurer's Report

Members: East 18; Associate 39; Newsletter 6; Retired 13

Balances: Checking \$3,557.01; Cash \$0.00; ANL fund \$30.00

Distributed as: Club \$2,921.14; Repeater \$572.87, Newsline \$63.00

For the period Nov 1, 2006 thru Dec 31, 2006:

Income: Dues \$11.00; Club \$1.89; Rptr \$8.36; Newsline \$8.00; ANL \$0.00

Expenses: Club \$0.00; Rptr \$0.00; Newsline \$0.00

REMINDERS

CLUB BREAKFAST: Always the 2nd Saturday of each month, 8:30 AM at:

Old♦Country Buffet♦

59th Street and LaGrange Road in LaGrange

CLUB NETS: Thru our Club Repeater 145.19.

SKYWARN NET: Mondays in season
at 7 PM with Deni, W9DS.

THE CLUB'S 9PM NET: every Monday with
Jack WA9FVP.

THE NIGHT PATROL: every night at 10:30 PM
with Paul, W9FNM.

THE BREAKFAST CLUB: every morning at 8 AM.

THE NOONTIME NET: every weekday at noon.

Mil's Corner for January

04	KA9PVD	Paul	Downers Grove, IL
08	N9WJI	Raymond	Naperville, IL
14	WA9ZPM	Mike	Crestwood, IL
22	N9GF	Gus	Melrose Park, IL

If you haven't used the new W9ANL repeater yet give it a try!

by Chuck KB9UMF

Here is the latest information on the new Vertex Standard VXR-7000 repeater. Bruce and Chuck installed the repeater and noticed a feedback problem in the transmitted audio. They did some quick diagnosis and determined it was something associated with the feedline/can system. A few weeks after the initial installation, Bruce and Chuck again worked on the system and found that the first can on the transmit line was causing the problem. This is a bandpass can for the output frequency. They removed the can from the system and everything was fine, or so they thought.

Initial reports on the system were mostly favorable. The input sensitivity was vastly improved, but most people saw a reduction in output power. Chuck double checked the ROM programming and determined the default channel was indeed set to high power. Bruce, Torben, Kurt and Chuck then checked the system with Bruce's Bird wattmeter and found the output was 10 watts. 10 watts is the correct power for the low power mode. When all else fails look at the manual right? We found that there was an accessory switch on the front panel, which was in the on position, according to the manual this overrides the programming and sets the unit to low power.

So the new repeater is now operating normally and we have had many favorable reports. This new repeater was made possible by all the AARC members' donations over the years, so give yourself a pat on the back. I know it has been a long time coming, but I'm glad we finally have a reliable system.

The next step is to install a new Diamond antenna, which will give us a few more db gain over the existing antenna. The plan right now is to replace the existing antenna with the Diamond as soon as practical. Bruce has also purchased a controller, which will give us much more flexibility in the repeater operations.

The AARC board has been working diligently to have the repeater moved to the APS 401 building. Much work has been done towards this effort. (Many thanks to Tim Smith N9UEB) We have had wonderful support from the Emergency Operations Center at ANL. An estimate for the cost of the installation of the antenna and power

was prepared. The EOC had pledged financial support for the installation. The 401 building manager was very supportive of the installation; however APS upper management feels the antenna would “significantly reduce the attractiveness of the building” and has voted against the installation. So for right now we are exploring the possibility of using the old packet station site.

To summarize; the functionality of the repeater is much better than the old system and more improvements are on the horizon.

The 40/15 Meter Magic Aerial

by Deni, W9DS

A unique story penned by W8HXR in Ohio tells the tale of Tom Erdman, W7DND of Bremerton, Washington. Tom said him pictures and diagrams of his 65 foot by 20 foot rotatable platform of verticals one pair driven and a pair of reflectors. This all appeared in 1977 73 Magazine. I believe I spoke to Tom in the early 1980s because this aerial was spoken about to me, and, even though I have not been found sketches or anything relating to that contact have been misplaced. I forgot where I put it.

The aerial is current fed at the base of one of the aerial's 32 foot 5 inch the shield attaches to a 65 foot horizontal section which attaches to another 32 foot 5 inch ¼ wave vertical for 40 meters. The parasitic reflector is 20 feet behind the driven element. The reflector element is ¼ wave 35 feet vertical then 35 feet horizontal laid on top of the wooden platform to an insulator then another 70 foot run horizontal 35 feet then vertical ¼ wave 35 feet spaced 20 feet behind the driven element thus current fed. The boom is made of 2 x 4's the array weighs 900 pounds. It is supported from the top of a 32 foot telephone pole by 10 nylon ropes. The platform rests on a bearing keep well greased rotated by hand and has a 12 foot 2" by 3" wooden piece that serves both as a chock to prevent wind rotation and as a handle to raise up and rotate the array.

The half wave connecting wires are a counterpoise for each radiating ¼ wave element completing the array. Tom added six 15 meter elements with 3 element two 15 meter beams vertical ½ λ voltage fed at the bottom using ¼ wave open wire stub. The whole array is off the ground 3 feet. No ground or radials were used only the bottom wire counterpoise system. The gain is about 8db with narrow beam width and low angle of radiation around twenty degrees on 15 meters. On 40 meters the radiation angle is 35 to 30 degrees. The 3 element beams reflector, driven, and director space 6 feet from each other. Directors 20 feet, driven 22 feet, and reflector 23

feet long vertical. The parallel bottom wires are separated 4 inches twisted at ½ λ 22 feet 3 inches. Shorted ¼ stub fed up 11 feet 3 inches and the center of the coax goes to the nearest driven element the other driven element has the shield stub coax connection.

Very Optimized Coaxial Traps

by Deni, W9DS

Bob Summer, N4UU, wrote an article for QST December 1984. Here we find a way to shrink our aerial using high reactance traps with increased bandwidth. A clever concept of using coax cable to form both coil and capacitor of a parallel resonant aerial trap appeared in May QST 1981 by R.H. Johns. These traps are broad banded, not costly, easily built, stable temperature wise, able to withstand high levels of power, and lastly, can be made small and light weight references to Doug DeMaw “Light Weight Trap Antennas”, QST June 1983. And E.D. Carter “Small Light Weight Traps for a 40/80 Dipole”, Potomac Valley Radio Club newsletter Nov. 1983.

An optimum diameter for a trap permits a resonant frequency to be reached with minimum cable length and this reduces losses, weight, and reaches maximum bandwidth over which the parallel resonant impedance remains high.

And now mathematical formulas.

Thickness of cable, the outside diameter is T inches, and that cable is wound on a cylinder from with an outside diameter of d inches in order to make a coil containing N turns. Assume this coil is close wound; no spacing between adjacent turns, to get the highest inductance with a given number of turns.

Assume ½ inch of shielded cable is used at each end of the coil as a pigtail to be tucked into the form. (This last bit has been made better by tying it into the aerial; more about this later. The formulas remain with one change.) The total length is approximated closely by $\pi * N * (d + T) + 1$ inches. If the distributed capacitance of the cable is C pf per foot, then the total cable is $C = \{[Co * (\pi * N * (d + T) + 1)] / 12\}$ pf (Equation 1).

Using the formula for inductance of the coil formed by the coaxial cable as $L = \{[(d + T)^2 * N^2] / [18 * (d + T) + (40 * N * T)]\}$ uH. (Equation 2)

Since the mean diameter of the coil is d + T and length of close wound coil is N * T. When the inner conductor at one end is connected to the braided shield at the other end of the cable as a parallel resonant circuit, the resonant frequency is given by $f_0 = \{1000 / [2\pi * \text{sqr}$

$\sqrt{L * C}$ }} MHz. (Equation 3) Where L is in microhenrys, C is in picofarads. For any set of trap parameters d, T, N, and Co (Equations 1 and 2) are used to get C and L and Equation 3 predicts the resonant frequency very closely.

In real practice, value fo is selected and then the parameters are determined in order to achieve the selected value of fo. This is done by placing the right members of equations 1 and 2 into equation 3 and performing algebraic manipulations to arrive at the cubic Equation 4 $(A3 * N^3) + (A2 * N^2) + (A1 * N) + A0 = 0$ where: $A0 = -216,000,000 * (d + T)$; $A1 = -480,000,000 * T$; $A2 = (2\pi fo)^2 * (d + T)^2 * Co$; $A3 = (2\pi fo)^2 * (d + T)^3 * \pi * Co$.

So, one selects parameters d, T, fo, and Co, computes the coefficients A0, A1, A2, and A3, and then solves Equation 4 to find the proper value of N. Once N is found, the total length of coax cable required can be found from Equation 5: $f = \{\pi * N * (d + T) + 1\}$ inches.

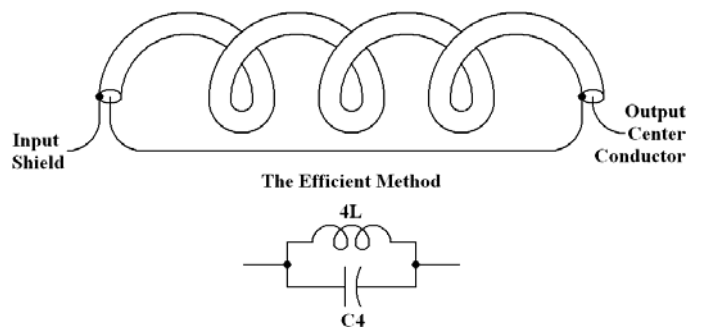
Using RG174U cable and fo = 14175 MHz as an example, Equations 4 and 5 were evaluated for several values of d with results showed required cable length L as a function of the outside diameter of the coil form d and there is a minimum length that creates resonance to be found at the selected resonant frequency. Then a best trap is defined as that which saves cable most to achieve resonance at our frequency. A trap resonant in the 20 meter band using RG174U is best at 1.4 inches in diameter.

The useful bandwidth of a trap is that over which the parallel resonant impedance remains high to isolate or trap the outer sections of the aerial. We can find the parallel resonant circuit can be expressed in Equation 6: $Z = -j * [Xo / ((F / fo) - (fo / F))]$. Where Xo is the reactance of each element (both C and L) at the resonant frequency. It is seen that Z (F) is proportional to Xo, thus a large value of Xo should give a relatively larger bandwidth. Minimum cable length is equal to the maximum Xo. Values for reactance shown in Table 1 are the values of Xo for coaxial cable traps. Based on data traps made of RG174U have greater operational bandwidth that those using RG58U characteristics are in Table 2.

These traps can take up to 1.4 kw before overheating and shorting out while using RG174U. Switch to RG58U for higher levels. Further discussion of traps was printed in August 1985 QST Technical Correspondence by Mason Logan, K4MT. But before we go there let's hear from KA3BLO says he feels conclusions regarding coax trap resonant reactance is misleading on 2 counts. There are 2 ways to connect coaxial traps he feels the best was

printed in Ham Radio "Trapping Mysteries of Trapped Antennas" Oct 1981 by G.E. O'Neil, N3GO. This article shows the trap cable with far end of this coil two leads one the shield called input and the end center conductor is soldered to the shield of the coax near end and the near end center conductor is free to be soldered called output of this trap. So, I figure the input end is soldered nearer the feed point and the other end soldered onto the aerial. Getting back to KA3BLO recommends RG58U for 28MHz trap and using this method a 15 meter trap bandwidth was increased from 300KHz to 1.5MHz by using the preferred just mentioned above method to connect the trap. The resonant impedance was increased from 11K ohms to over 40K ohms.

Now for the comments of KC4MT whom says that the fact that the same current flows through both the central wire and the shield in series. This effects the trap impedance calculations. Because each differential distributed capacitor connected across N turns has the same voltage across it and the same current through it. All elements can be summed into a discrete single capacitor and connected across any N turns. At the ends of the winding, again because of perfect coupling, the autotransformer increases impedance of the capacitor across N turns by a factor of 4. Figure 1 shows C4 across a winding of 4L. This exact equivalent 2 element circuit represents coaxial cable trap at all frequencies. It is evident that the resonant frequency reactance values given in Table 1 of N4UU's article must be multiplied by 4 before use in Equation 6 for the parallel LC circuit reactance.



	RG174U		RG58U	
	(KHz	Reactance	(KHz	Reactance
Freq	inch)	ohms	inch)	ohms
3550	19.5	193.8	16.7	178.7
3950	23.6	189.6	20.2	174.8
7150	68.1	167.7	58.3	154.7
10125	126.4	155.8	108.2	143.8
14175	229.2	145.0	196.6	133.9
21225	466.2	132.7	400.9	122.7
28850	796.2	123.8	686.2	114.7

Table 1

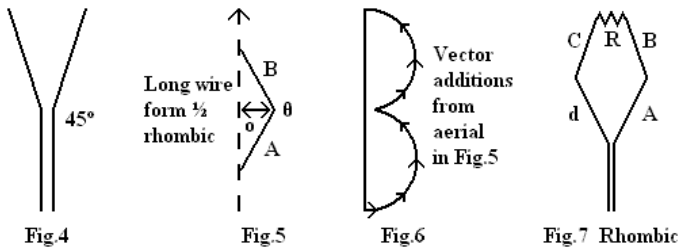
Resonant band	Coil diameter inches	Number of turns	Total weight ounces
75	2.25	11.5	2.7
40	1.50	10.0	1.2
20	1.10	7.75	0.9
10	0.85	5.25	0.5

Table 2

Vs and Rhombics

by Deni, W9DS

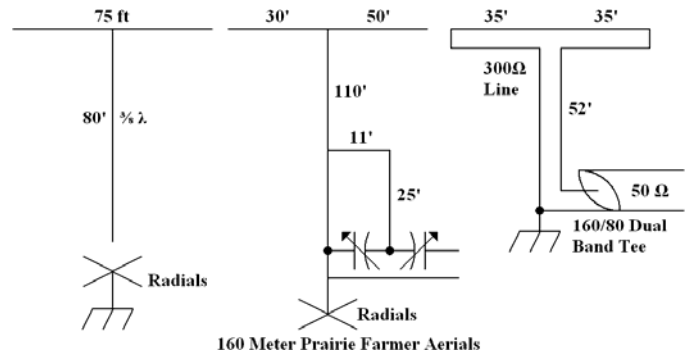
We start with two long wires one running to the left and one to the right slanting and forming an apex with an angle. These wires driven in push-pull their signals will add and we have a Vee aerial. The optimum design by formula 1, 2, 3: 1) $H = \lambda / [4 * \sin(\Delta)]$, 2) $L = \lambda / [2 * \sin(\Delta)2]$, 3) $\theta = \Delta$.



Optimum design is shown in Fig.4 also equations 1, 2, 3 give the optimum design of a rhombic whose sides are each of length L with an angle 2θ between sides at the feed point. In Fig.5 wire A is chosen in accordance with equations 1, 2, 3 and radiations adds to an exact semi-circle. If in Fig.5 wire B is reversed in slope with respect to the line of transmission so all of its vectors that is its radiations are reversed this results in the diagram of Fig.6, which has the sum S twice as large as that from the single wire. We add two more wires C and D with a two-wire line for feed and resistor R connecting the far ends of both sides making rhombic Fig.7.

Now the V impedance is double that of a single wire, since the 2 wires feed in series thus twice as much power is produced a given current in the 2 wires as in one alone. At the receiver point the field doubles thus quadrupling the power. Thus, the V has power gain of 2 over the single wire. Adding element C and d Fig.7 to form the rhombic doesn't change the input impedance. Resistor causes no change because of no reflected wave, so the doubling of the receive field is like quadrupling the power without an increase in actual input. The rhombic has a power gain of four over the V. Results state each wire added to the single wire gives a power gain of two.

The rhombic properly terminated designed for maximum performance is 720 ohms. 720 ohms is just ten times the impedance of a half wave dipole.



Impedance With Your SWR Bridge

by Deni, W9DS

Do you need to know the aerial impedance? Your old Thorotest or Radio Shack Archer SWR meter can be converted to read it. It can't read inductive nor capacitive reactance. We deal with the reflected position only. These bridges use a switch either forward reflected powers are read and shows the SWR by drawing a little power from the aerial circuit just a smidgen. We are going to change the little 100 ohm or 150 ohm resistor on the reflector side to a variable 1,000 ohm pot. Locate the correct side using an ohmmeter. The resistance is varied to find the impedance and the transmission line must balance the bridge for a null to be realized. Any variation will mean changing the pot resistance changes and balances at a new impedance value. Make pot leads as short as possible and ground the shell of the pot very well.

The pot must be calibrated via a dial or device, in ohms on the front panel. It might be better to use a bigger metal box. This is the main problem. Low power from a transceiver is used or low power ham gear about 3 watts is required. We use 5 watt 5% carbon resistors to calibrate use values 5, 27, 47, 75, 100, 150, 220, and 470 ohms. Intermediate values can interpolate your scale.

You are ready to attach one 5 watt resistor at a time across the antenna end coax connector of the bridge. Turn the power on. Bridge sensitivity should start at mid scale reading of meter and 1,000 pot is varied to a null on the meter. Mark value of resistor (impedance) on pot scale (dial). Do the same for all resistors.

If aerial is reactive then your meter will present shallow poorly defined null at the operating frequency and thus resonance. A sharp well-defined null will show pure resistive impedance. Thanks to W2AOO and 73 Magazine September 1973 article for the idea.

<p>ARGONNE AMATEUR RADIO CLUB P.O. Box 741 Lemont, IL 60439</p> <p>Officers</p> <p>PRESIDENT Bruce Epperson KA9H VICE PRESIDENT SECRETARY Kurt Boerste KB9ZFR TREASURER Charles Doose KB9UMF DIRECTOR Dick Konecny K9IB DIRECTOR Torben Lauritsen KF9MI DIRECTOR Charles Doose KB9UMF DIRECTOR Tim Smith N9UEB DIRECTOR Dale Travis AG9H</p> <p>e-mail: w9anl@bigfoot.com www.bigfoot.com/~w9anl</p>	<p>MEMBERSHIP is open to all who are interested in amateur radio. This club is sponsored by Argonne National Laboratory. Employees of ANL or DOE-Chicago are eligible for full membership. Auxiliary membership is available to non-employees.</p> <p>W9ANL/R is an open repeater, coordinated on 145.19 MHz (-600 input). The AARC repeater has been in operation on this frequency pair continuously since February 5, 1982.</p> <p>CLUB NETS: 2 meter fm 1) Regular, every Monday evening at 9:00 and 2) the Night Patrol every night at 10:30, both on W9ANL/R. The Peanut Whistle Net (PWN) every Sunday at 1:30 p.m., and many evenings at 8:30 p.m. on 1932 kHz (cw/am/ssb), QRP.</p>	<p>RADIOACTIVITIES is published monthly by the Argonne Amateur Radio Club as a nonprofit newsletter intended only for the use of its membership. Material appearing here does not represent the official position of Argonne National Laboratory or the U. S. Department of Energy. Please give credit to the author and to Radioactivities or the Argonne Amateur Radio Club, when using original material published here. Deadline for submissions normally is the 20th of the preceding month.</p> <p>EDITOR Dale Travis AG9H EVENTS SKYWARN ACTIVITIES Deni Lamoreaux W9DS</p> <p>Please send club and editorial correspondence to the club address, or to travisdj@bigfoot.com Please include "AARC" in the subject.</p>
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