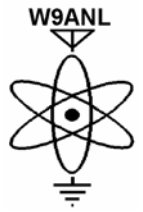


RADIOACTIVITIES

NEWSLETTER OF THE ARGONNE AMATEUR RADIO CLUB



Volume XLVIII, Number 2

February 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

Nothing received.

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

Nothing received.

Wrap Your House in A Giant Loop

by Deni W9DS

Well, something different. We have an article from New Zealand ZL2AMJ wrote about it in June 1980 73 Magazine. Hearing aids with "telephone coils fitted were used as a pick-up loop which can be switched in place of the hearing aid microphone. The loop is held alongside phone so stray energy from induction coil or earpiece can induce a signal into this loop. Which is amplified and fed to the hearing aid earpiece.

Thus a deaf person can hear on the phone better than normal. ZL2GA, Fred's father, Joe Johnson, asked him to feed the audio output from his FT101B to his hearing aid directly to cut out the speaker and go to a hearing aid audible link. Boosting the acoustic quality by eliminating shack noises from the pickup by the hearing aid microphone. This article deals with hearing aids with induction or phone coils.

ZL2AMJ looped 5 turns of 25 gauge wire around, get this, the whole house which was a two story. Wound around the upper floor level outside. Number of turns on the loop isn't critical 5 to 10 will do fine. Loop position isn't critical, anywhere between floor and ceiling is ok. Other houses have been wound and all work well. The wire gauge doesn't seem to matter. You can get a multiple wire cable and connect the individual conductors in series.

The 2 ends of this loop must run through the building and are connected in place of the loud speaker in a FT101B, a tape recorder, CD player, AM-FM radio, or TV set. Set the audio level the same as normal room speaker use. This system won't harm the equipment. It has been used by listening on two meter gear for monitoring a local repeater. You can now walk around the house and listen to hams, music, etc. unhindered as you move around.

Coverage from the wireless induction unit distances inside the loop is fine, but outside the loop signals fall quickly, but heard to about one loop diameter or more away. As always, how much power can you pump into these little wires?

Receiver units are hearing aids with telephone coils make good monitors the spectacle type works well as a induction receiver these hearing aids reject low frequency hum from power lines. So the uses this idea can benefit anyone. Break away from ipod's and the rest of those fancy expensive devices to waste your time and deplete your bank account they are not necessary. What good were last year at New Orleans – nothing, but radio shack family radio units were used for communication. Everything computer was dead, in the water, phone lines were out. Even this tragedy hasn't woke people up. Good luck listening.

The Super Duper of Aerials

by Deni W9DS

The rhomboid was introduced to me in 73 Magazine August 1977. I had no use for it, but thought about it for lower frequencies. It is a parallelogram with no right angles and adjacent sides of unequal length. It is a rhombic variation used for decades to achieve high gain. The gain comes by combining 2 aerials in a way useful. Side lobes are reinforced while not wanted directions are cancelled.

First appearing through Bill Parker, W8DMR, his is scaled for 420 to 890 MHz the gains are 20 to 30 db. A second article deals with 1296 MHz designs for 1100 MHz and useful for 903 and 1296 MHz providing beam widths between 5 and 10 degrees. Gains more than 30db gets you half power beam widths of less than 5 degrees and requires most accurate pointing systems. 20db systems are used on VHF and UHF. These aerials must tower higher above surrounding obstructions. A 26db rhomboid creates an effective radiated power increase of 400 times.

The dual rhomboid with judicious choice of side length and apex angle can cause destructive interference of unwanted side lobes, but designed for a high order of side lobe suppression at one frequency retains this over a wide frequency range. Design principles are the same as for Vee aerials and rhombus aerials. Angles are tilt angles for selected zero radiation from each rhomboid. The length of sides L1 and L2 differ by $\frac{1}{2}$ wavelength. The array radiation pattern is the product of patterns for component sides at all points in space. A single connection between two or four rhomboids is at the common feed points. The dual aerial has 2 rhomboid elements connected in parallel at their common apex where a lanced feed line hooks up. Terminated resistors must be non inductive capable of dissipating $\frac{1}{4}$ of the input power and values 600 to 800 ohms are recommended. The parameters for 435 MHz design side lengths are: $L \text{ feet} = [984 * (N-0.05)] / (\text{freq MHz})$ where N is the number of full waves. L1 and L2 for a design frequency of 435 MHz are 93.5 and 161.5 inches respectfully.

The side lengths are used to get boom length and the 3 cross arms lengths.

Apex angles α and β are given by: $\alpha = 2 * (90 - \Phi_2)$ and $\beta = 2 * (90 - \Phi_1)$ and are 46 and 58 degrees. Tilt angles Φ_1 and Φ_2 were chosen for side lengths of 3.5 and 6.0 wavelengths as well as zero angles radiation.

Dimensions for boom, cross arms, and cross arm spacing is seen in Fig.1. The angle between the diagonal of each

rhomboid is equal to $(\beta - \alpha) / 2 = (58 - 46) / 2 = 6$ degrees.

An isosolies triangle at forward end the beam by the rhomboids crossover and the two terminators. Dimensions for construction of 420 to 890 MHz are in Fig.1. Non metal is the boom or trouble ensues.

Design center frequency: 435MHz:

Side length L1 = 3.5λ , L2 = 6.0λ

Tilt angle $\Phi_1 = 61^\circ$, $\Phi_2 = 67^\circ$

Apex angle $\alpha = 46^\circ$, $\beta = 58^\circ$

Beam width V = 5.8° , H = 9.7°

Termination R = 820Ω , R = 820Ω

Half power level

#L1 - 7.8 feet, L2 = 13.46 feet, wire is 14AWG, feed line is 300Ω .

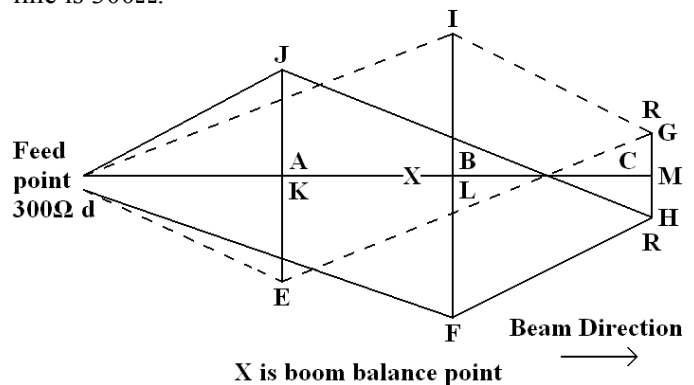


Fig.1

Dual rhomboid 435 - 870 MHz, beam width $\sim 10^\circ$, Hx 6° , gain over DP $\sim 26\text{db}$, boom length: dM = $19' 6''$, dK = $7' 3''$, KL = $5' 6''$, LM = $7'$, support length JE = $7' 3''$, IF = $10' 3''$, GH = $3' 0''$. Rhomboid sides dJ, dE, IG, FR = $7' 9.5''$, dI, dF, JH, EG = $13' 5.5''$, wire needed 14AWG for mvar, $\sim 86' 0''$, boom wood dK, LM, KL = metal. Cross support JE, IF, GH = wood. R1 R2 resistors 600 ohm watts, each dissipating $\frac{1}{4}$ of the input power. Can be made by connecting 5 $3,000\Omega$ 2 watt carbon resistors in parallel. This is good for 40 watts continuous power at the feed point, 80 watts SSB/CW. Leave resistors off and you have a bidirectional and resonant at the design frequency. Rhomboid.

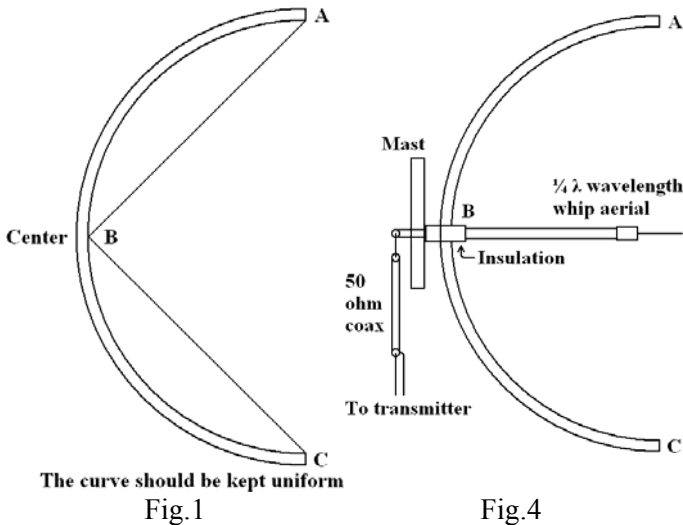
This aerial beats out a 21 foot parabolic dish, long 100 foot yagi, broadside, collinear, and quad arrays.

The Amazing 10, 15, 20 Meter Parabolic Beam

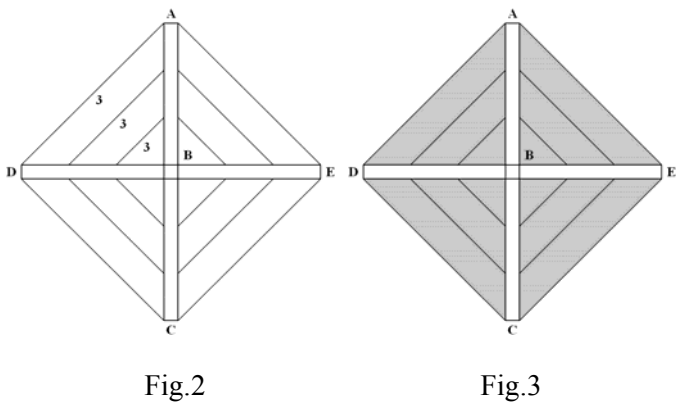
by Deni W9DS

Appearing in January 73 Magazine, 1974, WB2AEB built one. It works like a corner reflector. It takes one inch diameter aluminum tubing shaped like part of a

circle. It is 20 feet long before shaping. It's bent so 100 degrees appears between A, B, and C. Fig.1 and Fig.2 shows another piece of tubing bolted at right angles to the tubing ABC. This added is like Fig.1 and is as a straight line – DBE, and DBE is bent the same as tubing ABC. Now, bare copper wire is used to hold ABC and DBE elements in Fig.2. This wire supports aluminum sheet metal like in Fig.3. The sheet metal is 0.04 inch thick 3 feet wide 80 feet long.



This is our reflector causing a 40db front to back ratio. Fig.4 shows driven element FG, a Hustler Top Whip vertical resonant either on 10, 15, or 20 meters and it must be insulated from the aerial system. Use plastic sheets and tape for this. FG should be kept 1/4 inch or more away from the system at point B of Fig.4.



Feed line is 52 ohms. Feed point F should be bolted and taped. The coax shield connects to non-rotating part of the reflecting section of the aerial system. WB2AEB claims 14db to 25db gain depending on the type of driven element used and the band chosen. 15 and 10 meters will give improved performance. Good DX reports have been given using low power on top of a 20 foot tower.

Other Frequencies With Dipoles

by Deni W9DS

A 1/2 dipole needs 70 ohms transmission line center impedance changes as we go higher in frequency at 2nd harmonic impedance reaches 1,000 ohms about. On the third harmonic, our feed point sees a low resistance impedance, and as we continue this impedance swings between high and low values, and they are very high on even harmonics 2, 4, 6 for example, but the odd harmonics 1, 3, 5 for example are low impedance points.

Facts say 7MHz aerials work on 21MHz and we operate 21MHz the tuner handles the mismatch, but losses are little less on 7MHz than 21MHz. We are talking about adding 20 inches of wire to each end of the 7MHz aerial. A 1/2 on 3.925 119 feet 3 inches and is 2 1/2 waves on 15 meters. Adding more wire extensions hanging down can put you on 3.5 and 28 MHz. $L = [492 * (N - 0.05)] / F$, N = number of half waves in the aerial length, F = frequency, L = length in feet inches.

Did you know a 21 MHz dipole with 18 1/2 wave lengths is near 145 MHz it will radiate at about 18 degrees off the axis of the aerial with 10db gain over 2 meter dipole. Let's see 260 feet of 160 meter 1/2 lambda would must likely not work. Should I try it? Tune into 145.190 and ask me.

The number of 1/2 waves tells us the number of lobes 1/2 wave 1 lobe, 3 1/2 waves 3 lobes, etc we calculate it is 78 1/2 waves for my 160 meter aerial.

Ok I tried it Bolingbrook and Argonne repeaters came up 100 watts FM pumped into 160 meter dipole SWR lowest at Argonne frequency 145.190 and Bolingbrook 147.330 came up ten to 1 SWR but did not raise 145.805 Hazel Crest. A smaller tuner might have worked better. The dips were very hard to dip and lowest coil setting of course was too much inductance. The aerial is up 40 feet the isopole is up 20 feet and so goes the experiments. You can likely load up the rain gutters on two meters, but someone ambitious could load even them onto 2 meters it would be an outdoor aerial made of open line, the 450 ohm kind should work.

Here is your table:

Length	Gain db	Radiation angle degrees	Radiation resistance
1 1/2	0.8	42 & 90	110
2 1/2	1.8	31	120
3 1/2	2.3	26	130
4 1/2	3.5	22	138
5 1/2	4.25	21	145
6 1/2	5	20	150

Using coax feed lines will transpose high impedance to low impedance. Estimate the length of transmission line to reach the aerial is 50 feet $L = 246 * V / \text{freq MHz}$, V is 0.66 for conventional RG cable, 0.8 for poly foam and 0.71 for kilowatt 75 ohm twin lead. So, RG11U at 21.3 MHz is 7 feet 6 inches so we use 7 electrical $\frac{1}{4}$ waves which is 51 $\frac{1}{3}$ feet.

Summer is just beginning we should work on our outdoor aerials now before the snow flies. This idea originated with Herb Brier, W9EGQ, presented June 1971 73 Magazine.

The Impossible QTH

by Deni W9DS

No matter what equipment you borrowed, bought, or stole, nothing works well at the impossible QTH. If you are a renter apartment dweller, my sympathy. We are all different and creative, but one thing is for sure; you passed at the least a written examination. It took studying for hours in your spare time, and you made it, for whatever reason, you stuck it out. It was hard for some, easy for others, but you must be able to communicate. We are the public we must satisfy our beliefs. For whatever reason, you are in the public eye all over the world and so we hams must make friends by communicating and helping one another for the good of all man kind.

In this matter of communicating we must be heard from by using our equipment transceiver and aerial we are able to communicate in many different ways; CW, SSB, FM, PSK, RTTY, and so forth. In order to do this we must be able to make our signals heard. What are the means we use? If we speak into a microphone we can be heard through our loudspeaker, but what about the aerial. Most are not knowledgeable to roll their own. It is easier to buy the commercial aerials. How can we make a small aerial work like the big ones? We make do with small but efficient aerials. We sacrifice one thing for another in order to be heard. How about 20 watts into a small vertical mounted in an attic. We find ways to be heard by using very narrow bandwidths of just a few cycles. PSK31 uses just 31 cycles spread over a ten or twenty KHz band width. You need a computer, software programs, radio feed line, and aerial for indoor which is extremely hard to radiate especially on HF bands under 30 MHz. We must compromise our aerials.

Short dipole $\frac{1}{4}$ or $\frac{1}{8} \lambda$ dipole efficiency 5% to 15% not good. Where are losses the greatest? Let's look at our feed line example. A 30 meter length of RG58U has a ten to one SWR 6.5db is our loss. Less than 25% power would reach radiating. RG8U is our feed line then loss is

2.8db and just a tad over half of our output radiates. RG8U has a 5 to 1 SWR loss is 1.7db two thirds of our power does not reach our aerial. What happens to our aerial with $\frac{1}{4} \lambda$ input impedance of 800 ohms and a $\frac{1}{8} \lambda$ impedance is 1,300 ohms and highly reactive. So we must match our aerial with a tuner! Our impedance rises or falls in line with reactance to resonate the entire circuit to send out all the energy possible. A $\frac{1}{4} \lambda$ has 30 ohm impedance, a $\frac{3}{8}$ aerial has 10 ohms and 5 ohms at $1/16 \lambda$ long.

We can go into loop technology, which requires large size radiators or just thin wires, but they have more resistance losses. Use a thickness you can get away with. Make the aerial so it can be put away fast. Anyhow, 2 meters is a dwellers haven and small size here is 80 inches for a full wave loop. Good luck.

The BiConical Broadband Bowtie

by Deni W9DS

Well, I have found an article in 73 Magazine Oct 1984 by KC3HW, Jim Burtoft, which shows a better picture of a low band biconical. Jim got his idea from Bill Orr's Radio Handbook saying that aerials can be made broadband to cover, for example, the whole 80 meter phone band with low SWR, 1.5:1.

Remember that an aerial resembles a series LC circuit. The resonant frequency depends on the (L) inductive and (C) capacitive values. So, by spreading two wires tied to an insulator per side forming a Vee per side each wire 55 feet each of four and the ends of the Vee 3 feet apart and a 3 foot wire soldered to the bow-tee ends closing the circuit at each end of the dipole. It will perform over the whole phone band this added end wire inductance and shorted the aerial's leg we can use PVC 3 feet long, run wire through it, solder the two legs at each end of the (L1) 55 foot lengths and hoist the whole thing up a pole and run it like an inverted Vee. 110 feet spread as less ground space is taken up. Feed point impedance 50 ohms using a multipole of $\frac{1}{2}$ wave RG8U is 83 feet or use 450 open line and aerial tuner in the shack for multi-band use higher than 80 meters harmonically.

KC3HLN recommends electric-steel fence wire. It comes in $\frac{1}{4}$ mile spools and available in farm supply stores and used to be sold at Sears for ten bucks a roll.

<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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