PROSPECT HILL INTERMOD

THE OFFICIAL NEWSLETTER OF THE WALTHAM AMATEUR RADIO ASSOCIATION
& THE HEAVY HITTERS

www.wara64.org **FALL 2009**

INSIDE THIS ISSUE!

MEETING UPDATE

Meetings are now held on the last TUESDAY each month at 7pm in the Waltham Public Library. *(except July and August)* "Talk-in" on 146.64 MHz. Check for the latest updates in the "Meeting" section on our club web site at **www.wara64.org**

WELCOME NEW MEMBERS

W.A.R.A. would like to welcome all new members to the club! Thank you for joining and we hope to hear you on the air soon!

"Earring" ANTENNA FOR 160 – 40 METERS

Ted Robinson, K1QAR

DESIGN

The challenge was high receive noise from the "electronic sprawl" noticed while operating mobile on the lower HF bands. It appeared that a magnetic loop might offer a practical way to improve mobile reception.

In the June 1993 QST, an article by W1LYQ described a small magnetic loop one foot off the ground that he claims transmitted as well as an inverted "v" at 65 feet on 160 meters. Further analysis using G4FGQ modeling software showed that such a loop had 3 dB of "gain" over a dipole at 30 feet, and that a loop at 25 feet up would have 6 dB "gain", owing to reduced ground current losses. This implied a reasonable chance that a mobile loop would work as well as a whip.

Besides gain, the hanging loop could be rotated to null a noisy power line pole pig two blocks away. The loop's narrow bandwidth eliminated birdies from a 50KW AM broadcaster a half mile up the road, and filtered out alleged aviation band harmonics from an experimental Russian tetrode amplifier on transmit. In addition, the loop's insensitivity to electric fields attenuated the neighborhood's noise from switching power supplies, dimmers and computer monitors. Finally, polar patterns also in the W1LYQ article showed the loop had substantially stronger low angle radiation and a smoother, more isotropic pattern than either vertical or dipole wire antennas.

To get this performance on 160 meters would require attention to construction details to address four challenges. Radiation resistance would typically be far less than a tenth of an ohm, implying antenna currents over 100 amperes at the kilowatt power level. Second, those currents had to be handled with extremely low loss, or efficiency would suffer. Third, to achieve resonance required a high Q variable capacitor capable of handling over 10,000 volts. Finally, bandwidth would be of the order of a few kHz, requiring fine tuning. Experience would show even 10 kHz of frequency change using an antenna tuner would cause 6 dB of loss.

CONSTRUCTION

The initial test loop was made from a 50' roll of 3/8" copper conduit from Home Depot, and was tuned to resonance on 75 meters with a Japanese 300pf 10kV vacuum variable where radiation resistance was calculated to be a whopping three tenths of an ohm. The conduit resistive loss was also two tenths of an ohm, for 50% efficiency. Stabilized by several fiberglass braces, the floppy 15 foot diameter loop of conduit was hoisted so the bottom was 20 feet above ground using a rope over the tree branch.

The 15 foot by 3/8" loop. Note coax feed going to top, and tuning cap at bottom.

Fed by a 6' gamma wire, the SWR was acceptably low, and the capacitor didn't arc over until power hit 900 W. Bandwidth was about 10 kHz, implying high Q and hence acceptable low loss. On transmit it averaged two s-units better than my efficient bugcatcher style mobile whip with the same 500 Watts. One ham even heard it in the next state with his antenna disconnected.

On receive it pulled a 5 watt ham signal from among the steel jungles of NYC, a mobile in California, and aircraft crossing the Atlantic on 5 MHz. that were unreadable from my mobile station in the driveway. It received the 6.5 MHz high seas forecast far more clearly than my maritime mobile 200 miles from the nearest interference at sea, using the same Icom 706.

For 160 meters, since an increase in size was impractical, a new antenna design that would work with a radiation resistance of 1/60th of an ohm was required. Luckily, there was some 3 inch diameter aluminum tubing at the local scrap dealer that would cut this loss sufficiently to make a 25% efficient antenna possible. This would be completely offset by the suspended loop's 6db "gain" from reduced ground currents, so that full size antenna performance was expected.

Using six 8' lengths of this tubing, hose clamped into 120-degree welded elbows, a 16' tall 60 lb hexagon was fabricated. The hexagonal shape was chosen as it had 91% of the area of a same-perimeter circle, only needed two more joints than a square, and it could be easily disassembled into 8' pieces for shipping or transportation by car. The aluminum was cheaper than copper, and made a lighter, more rigid loop. Without having the scrap, and a surplus Soviet capacitor, cost regular jobber prices would have been quite high, $800 at for the aluminum, and about the same again for a 10 KV 20-1000 pf vacuum variable capacitor.

On 160 meters bandwidth from resonance to 2:1 SWR measured 900 cycles, confirming that the Q was high and losses acceptable. Exercising the capacitor tuned the antenna resonance from 1500 to 6900 kHz. The gamma wire feed of the earlier antenna was replaced by a 30" diameter coupling loop made from the 3/8" conduit fed directly with coax. Resonant SWR was below 3:1 across this entire two octave band, and could be lowered to less than 1.5 to 1 by decoupling the drive loop by rotating it out of the plane of the magnetic loop at the higher frequencies. The induced ground currents' effect on feed impedance was pronounced, as it dropped by half as the antenna was raised to its 25 foot height Augmenting the tiny bandwidth by a full size antenna tuner, a range of 20 kHz could be tuned before signal reports deteriorated substantially.

#2 version 15 foot aluminum tubing magnetic loop.

As the picture indicates, the neighbors were treated to the sight of a hanging “sculpture” – a giant hexagonal earring, which was made discreet by a coat of dark spray paint, except during Christmas, when it was lit up by lights to resemble a snowflake. A plastic jerrycan at the bottom of the loop kept the rain off the Russian vacuum variable capacitor. Because its perimeter happens to be within the 50’ antenna size restriction of the FCC’s Travelers Advisory Service, it may be possible to use this design on that AM broadcast sub band. Lowering the antenna's 60 lb weight for tuning and matching was facilitated by using two blocks, one in the tree and one on the top of the antenna, to make a 3:1 hoist.

OPERATION

The loop’s low angle DX potential on 160 meters was confirmed the first night when a station from Scotland’s Orkney Islands answered on the first barefoot call. Also heard was another UK station which none of the other US stations on frequency could copy, while the notorious AM broadcast birdies the Icom 706 normally gets on 160 meters were gone. Subsequent tests with one watt got readable signal reports from as far away as upstate New York, 300 miles distant.

Rotation of the antenna showed 2 “S” units reduction in local line noise . With 500 Watts, signal reports were generally on a par with those of stations using amplifiers and full size antennas. Even better, there were no RFI complaints from any of the three neighbors within 100’, despite the use of a harmonic-rich no-tune 12 volt amplifier.

It was a pleasant surprise to find voice transmission on AM was satisfactory, despite a bandwidth so narrow that tuning up on SSB had to be done 1000 cycles below the transmit frequency to keep the amplifier’s SWR cutoff from tripping. Turning the big Soviet capacitor’s shaft just a few degrees tunes the antenna several KHz, making a full size antenna tuner a handy accessory for changing frequency. At the high end, with the antenna resonant at 6900, the tuner will allow coverage of the 40 meter band.

Half size version of the “earring” on the test stand showing tuning loop and capacitor

A later version of the antenna made with a DC motor drive and 55,000 volt vacuum capacitor. It eliminated a peculiar, mysterious ringing sound that we suspect arose because of the 10KV capacitor being operated near its voltage limit. On AM attenuation of the sidebands containing the audio high frequencies was not objectionable, though the SWR would bounce briefly up to 3 or 4 to 1 on peaks. At the 1.5 KW power level made possible by a tube amplifier, the FCC safe RF dosage distance was 30', so that standing directly below the antenna was not quite safe.

Even at these power levels, no neighborhood electronics were effected, though an electronically controlled vacuum cleaner in our house would run at a speed proportional to carrier power even when switched off, if it was plugged in. A smaller ground mounted loop 40 feet away was apparently able to parasitically couple, as it could be fine tuned across the hanging loop's receive frequency to make a useful further improvement by reducing general noise, and appeared to 'move' the null direction.

TEN FOOT CONDUIT ANTENNAS

Experiments were conducted with a 100 Watt transceiver and a 10 foot length of conduit. Configured as a single turn 3 foot loop near a window inside a metal hangar revealed surprising performance. Its efficiency on 20 meters enabled a half hour sideband QSO with a Paris station, and it was even heard on 75 meters in the next state, despite efficiency on that band cutting the ERP to the order of a watt.

Battery, transmitter and 3' 15-75 meter loop.

Receiving even AM broadcasters was next to impossible with a wire antenna, while the loop was able to get reasonable reception of the stronger ham and short wave weather broadcasts, especially when turned to null the intense hash from the office's WIFI access point.

Four turn receiving loop with the big 1000-20 pf Soviet capacitor

Taking the length of conduit and making a more compact 4 turn antenna gave an improved signal to noise ratio, with tuning now varying with the coil's turn spacing as well as the capacitor's setting. Coverage with the 20-1000 pf variable was an astounding 2-10 MHz.

2 turn 3 foot loop

CAPITAL FUND

We are still in need of more repeater and antenna upgrades. You can help keep *your* repeaters on the air by making a small contribution to the W.A.R.A. Capital Fund.
Go online to:
`www.wara64.org`
(see the membership link) to donate or, Make checks payable to: "Waltham Amateur Radio Association"

Mail to:

W.A.R.A. Capital Fund
Post Office Box 411
Waltham, MA 02454

UMBRELLA ANTENNA

Ed, N1TV

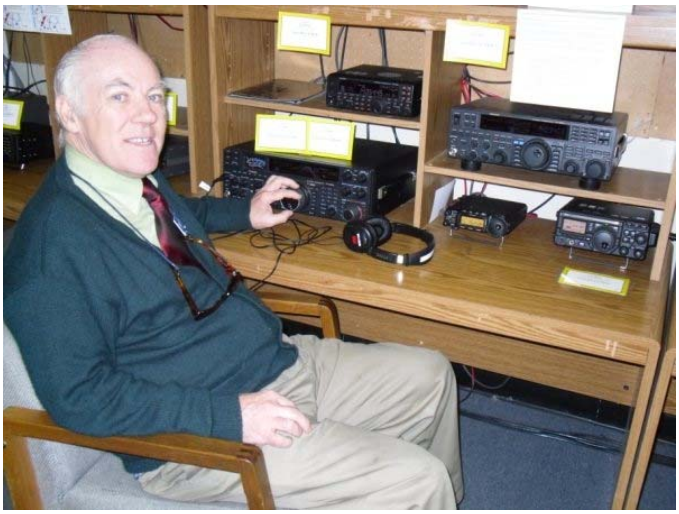
The new original 2meter Umbrella Antenna with a 5/8 wave "Hot Rod" Telescoping Vertical. The Vertical comes out of the top which is attached to a BNC connector on a bracket beneath the umbrella. A 3 foot piece of RG-58 coax cable connects to the 2 meter Handi-Talkie that conveniently may be held in my left shirt pocket. I walk along with the Umbrella Antenna in my left hand and I operate the speaker-mike with my right hand. Sometimes the vertical is adjusted to be only 1/4 wave (19 inches).

The "Model - A" design

The advantage of the Umbrella Antenna is that it puts out a much stronger RF signal into a repeater some distance away than merely only using a short rubber duck antenna that is mounted directly on top of the walkie. The metal spokes of the umbrella act to improve the signal because of their "ground-plane" effect.

.

With this first model, it was necessary to use a screwdriver to undo a clamp inside the umbrella and remove the bracket, otherwise the umbrella will not fold up when needed. A future model may open and close without needing any tools.



WARA Member, Ed, N1TV at his QTH in San Jose, CA

W.A.R.A. WEBSITE

Be sure to visit our W.A.R.A. website where you can find the latest updates on what is going on in the club. In addition, you can buy club merchandise to support W.A.R.A., pay your membership or donate, check Field Day information, view member links and more. Please feel free to submit photos, suggestions and comments. We welcome your input as this is “Your Club Website! Please check back often.

www.wara64.org

TREASURER'S REPORT

Eliot Mayer, W1MJ

The suggestion by Rick Zack, K1RJZ, to add a PayPal membership and donation option has really paid off. The majority our new memberships and renewals are transacted online. Of course, we still support the old-fashioned membership forms and check payments. Click "Membership" on **www.wara64.org** for more information.

Our present balance is $1,116 in the general fund, and $340 in the capital fund.

FIELD DAY 2009

Eliot Mayer, W1MJ

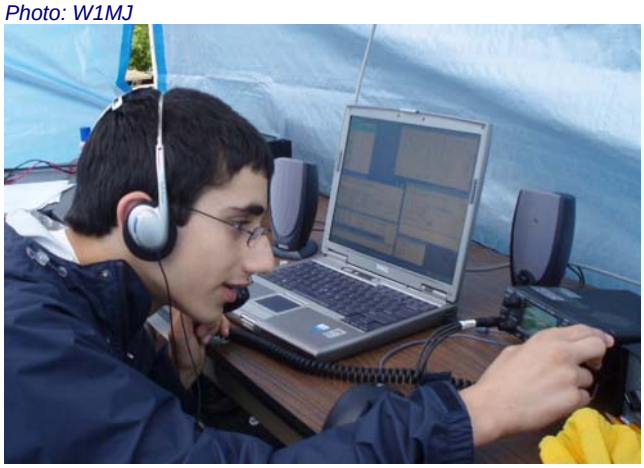
In the last issue of PHI, I wrote about our planned second FD joint venture between WARA and the Clay Center Amateur Radio Club (CC-ARC). I am glad to report that, despite a few setbacks such as an electrical storm, our FD 2009 operation from the grounds of the Dexter-Southfield School in Brookline, MA was a great success.

The success was not our 1001 contacts, because Field Day isn't really a contest. I am referring to the success of getting 15 people on the air who were either (1) not yet licensed, (2) recently licensed, or (3) usually found only on VHF and UHF repeaters.

For full results and photos, visit
www.wara64.org/fd

Interest has been expressed in a third joint venture for FD 2010, so stay tuned.

Photo: W1MJ



Gil KB1QXW discovers wonder of 20M SSB on the "GOTA" station.

CLUB REPEATERS

Prospect Hill, Waltham

Input	Output	PL in	PL out	Call
52.25	53.25	71.9	none	WA1HUD
146.04	146.64	none	136.5*	W1MHL
223.34	224.94	none	103.5	W1MHL
444.075	449.075	none	none	WA1PBU
902.1375	927.1375	131.8	100	W1MHL

*Use PL to mute P25 transmissions.

W.A.R.A. OFFICER WANTED

If you would be interested in taking the position of Clerk, aka Club Secretary, please step forward.

W.A.R.A. OFFICERS

PRESIDENT - Richard Amirault **N1JDU**
V. PRESIDENT - John Flood **KB1FQG**
TREASURER - Eliot Mayer **W1MJ**
ASSISTANT TREASURER - Bob Martinson **K1REM**
SECRETARY- Open

PHI NEWSLETTER STAFF

EDITOR - Mark Bolls **K1KGG**
Submit all articles to mark@k1kgg.net

Thank you to all who have contributed to this issue of PHI. We greatly appreciate the time you took in sharing your knowledge! We are always looking for articles and new material to publish. Please send in your photos, announcements, story or short article (Technical or Non Technical) at any time, for the next issue of PHI !

The Waltham Amateur Radio Association is affiliated with the A.R.R.L.

WALTHAM AMATEUR RADIO ASSOCIATION

MEMBERSHIP FORM

The Waltham Amateur Radio Association operates repeaters on 6 Meters, 2 Meters, 220 MHz, 440 MHz, and 900 MHz. The repeaters are free and open for everyone to use. But repeaters have bills to pay, just as you do. A $20 annual membership would help support these repeater expenses, as well as help to keep you informed about club activities and other aspects of ham radio. If you cannot afford $20, please send what you can. If you are inclined to donate more, we will put it to good use. Please complete this form legibly, and return it to:

Waltham Amateur Radio Association
Post Office Box 411
Waltham, MA 02454

Name _____ Call Sign _____

Street _____

City _____ State _____ Zip _____

Telephone # _(_____)_____ Are you an ARRL member? _____

Email _____

This year's donation enclosed ($20 nominal): $_____

How would you like to receive our club newsletter?
Email ☐
First Class Mail ☐

Check if you would like to get involved in any of the following Waltham ARA activities:

_____ Repeater Maintenance/ Construction
_____ Speaker for Club Meetings
_____ Public Service Activities
_____ Public Relations for W.A.R.A.
_____ Newsletter Writing or Production
_____ Photographer for W.A.R.A. events
_____ Contribute to the W.A.R.A. web site

Visit the W.A.R.A. web site at: http://www.wara64.org

Waltham Amateur Radio Association
P.O. Box 411
Waltham, MA 02454

Please check your membership expiration date on mailing label.