# RADIOACTIVITIES

**NEWSLETTER OF THE ARGONNE AMATEUR RADIO CLUB**

W9ANL

**Volume XLVIII, Number 10** **October 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

by Chuck KB9UMF

Members: East 18; Associate 40; Newsletter 6; Retired 13

Balances: Checking $3,603.87; Cash $0.00; ANL fund $30.00

Distributed as: Club $2,971.99; Repeater $594.88, Newsline $37.00

For the period April 1, 2007 thru July 31, 2007:

Income: Dues $55.00; Club $30.00; Rptr $20.00; Newsline $5.00; ANL $0.00

Expenses: Club $161.85; 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 October

| | | | |
|---|---|---|---|
| 02 | K9FAT | Jim | Crest Hill, IL |
| 06 | W9KJA | Clem | LaGrange Park, IL |
| 07 | WA9TLT | Clarence | Villa Park, IL |
| 11 | W9GBL | Jim | Whitehall, MI |
| 31 | N9JTV | James | Wilmington, IL |

## Sep 18 Board Meeting Minutes

by Kurt KB9ZFR

One Member attendance; I drank a cup of coffee, waited twenty minutes and left.

## Ferrite Catches On

by Deni W9DS

Tired of iron and weight, Detroit carmakers switch to plastics an non-ferrous metals. Electronics also in 1971 switches to silicon chips to eliminate iron inductors replacing them with capacitive feedback techniques.

Hank Olsen, W6GXN, wrote in Ham Radio April 1971 praising them for engineering trick bags. Silicon solves problems by lifting the weight so to speak of conventional transformer and choke. Powdered iron toroids were discovered about 1900 by Oliver Heavyside. It was found this coating of iron filings with insulation could be compressed into a doughnut shape, a closed non-conductive magnetic shape worked, but not for higher frequencies.

Ferrites today are made not of pure metals iron, nickel, or cobalt. Ferrites are made from iron oxide and manganese, which, raised at high temperature, become ceramic hard with low conductivity are ideal core material; low eddy currents loss with high u.

Ferrite beads are useful for a choke simplified to a single turn. You can slip a bead over a wire and the wire becomes a RF choke. It has low Q, thus no parasitic resonant circuits, but ads coupling system. The bead can replace a parasite choke at HF through UHF, suppressing RF oscillations and as a tiny pulse transformer.

Toroid cores are familiar to hams. Hard to wind you need a bobbin. This magnetic structure makes low reluctance with the biggest inductance per turn squared and easily saturated. Ferrites today are useful into the GHz range and powdered iron up to a couple hundred MHz. Hams use toroids for balance-to-unbalance transformer or high frequency ferrite pot cores as RF transformers that match 50 or 70 ohm coax to balanced impedances from 50 to 800 ohms.

A new technique compensating for parasitic effect in low pass filters has been found by the Navel Research Laboratory using compensating winding and capacitor to improve the high frequency performance of low pass power filter. Here a capacitance cancellation of a toriodal filter inductor is done by the adding a compensating winding in series with a compensating capacitor. Cancellation could be achieved by choosing M(1-M) Ccomp = Cp thus M is the ratio between the number of turns in the compensating winding and the main winding. Ccomp is the compensating capacitance and Cp is the parasitic capacitance of the main winding.

This work was done by Timothy C. Neughebauer, Brandon J. Pierquet, and David J. Peqreault of Massachusetts Institute of Technology for the US Naval Research Laboratory down load free white paper at www.defensetechbriefs.com under the Electronics / Computers category. NRL-0003.

## Speaking of Ferrites

by Deni W9DS

Yes, Uncle Sam was very interested in the material. The US Navy got its way and the millions of dollars invested in them paid of ffor every one. What Uncle Sam ordered magnets landed also in the electronics field and the patents went flying all the way to India and Japan. A few India Indians started Silicone Valley believe it or not, but this is another story all together.

In 1966 the year 73 Magazine expanded Walt Rogers Wolfs, no relation to Roy, because remember he changed his name from Leonard Sly, whom wrote a story in the April issue about, yes, by now you have guessed, ferrites and it had to happen that hams would use lots of them. In this case, the ferrite is used in direction finding.

50 radio aids to navigation or radio DF as it was commonly known after daddy's big war, have been used for marine and air operations. This article was the leader in ferrite DFing using a simple unit.

The aerial has to establish a fix or point to get a bearing from two distances after a balance calibration. One direction won't give distance and a bi-directional set up is described with low output compared to more modern times. We get a low signal because of its small size. But efficiency, and how many times have I wrote that about aerials small, but efficient, well our little bugger when tuned to resonance, and how many times have I written that? Oh! We must have a receiver and it has to have enough spare sensitivity to get a good reading.

Now the ferrite DF is made from ferrite rod, bet you guessed that before you read this. The rod is tightly coupled to a short chunk of coax obtaining maximum signal transfer. We want 17 turns close-wound number 24 wire for tuning, this winding is grounded on the bottom of ferrite and at the top goes to a 15 to 130 pf capacitor grounded. The secondary wound close 5 turns over the tuning inductance the top goes to that short piece of coax mentioned before, the center and bottom of this secondary lead attaches to coax shield solder all connections.

It can go into a metal box. The DF bar should be about a foot. The windings in the center of bar. Put a few turns of plastic tape over rod, slide rod to center. Wood was used, pieces to clear the coil turns.

Operation plan to run receiver RF gain full on and finding a signal turn rod broad side to get sharpest null. Turn capacitor for maximum signal, but before this establish true north, not magnetic north! A declination correction has to be made. Find maps that have this correction or find the North Star in relation to your home and use this bearing reference at home. Get bearing from another station, mark a line from him to yours, where they cross is the fix.

When mobile, use road maps getting a reading drive perpendicular to this line (roads permitting) after a while take a reading. After a while take another reading. Crossing of these lines is the fix. For close up readings a field strength meter with sensitivity control could be used.

Who wants to go on a hunt?

## Magnetic Amplifiers

Dept of Navy Bureau of Ships

by Deni W9DS

After writing about EH antennas, I dove into K or H2 propagation. I am still looking, but a book I purchased from the Superintendent of Documents, Washington DC.

I bought all of the military training manuals I thought that would educate this poor soul. Upgrades may be available today on government sites having to do with the Superintendent of Documents.

The list I have follows:

- TM-681 Dept of Army technical manual Dec 1951 "Electrical Fundamentals [Alternating Currents]"
- TM11-661/TO16-1-218 "Electrical Fundamentals [Direct Current]" Department of Army and the Air Force June 1951.
- Air Force manual 100-6 Radio Transmitters
- Air Force manual 100-5 Radio Receivers
- TM11-684 Principals and Mathematics for Communications Electronics Dept of the Army October 1961
- TM11-4000 Troubleshooting and Repair of Radios Equipment Dept of the Army 1958
- TM662/TC16-1-255 "Basic Theory and Applications of Electron Tubes" Dept of Army Tech Manual Feb 1952
- TM-690 "Basic Theory and Applications of Transistors March 1959 Dept of Army Technical Manual
- TM11-666 "Antennas and Radio Propagation" Dept of Army Technical Manual February 1953

These manuals may be upgraded to the present and increase the knowledge of new comers to our hobby. Just as I was in the dark, these manuals were a great help along with the ARRL Radio Handbook of 1959 that Grandma bought for my birthday that year.

Getting back to magnetic amplifiers, it has a long bibliography beginning with the year 624 BC naming Thales of Miletus, discovery of "ferrites", month unknown. The list goes on with publications dating from 1887 giving publications and patient numbers US and foreign. Today I find it surprising just how important the Navy was during this time period after the Second World War.

It was called a rising star in naval electronics from the electronics design and development division, Department of the Navy Bureau of Ships in Washington, DC.

I purchased this booklet because of the title "Magnetic Amplifiers" but it didn't hold anything about high frequency electronics and klystrons, but tiny iron filings and magnets made into different shapes big and little toroids. These were to replace the vacuum tubes aboard all ships and they did.

This is the beginning, study principals and use of saturated core material to control electric machinery dating from 1885. Guess what! Magnetic amplifiers are an American invention, but the Germans improved our crude devices efficiency and response time, reduced bulk, weight, and opened up their applications. Improvement came in processing magnetic material into selenium rectifiers.

The Germans went on to master stabilizer, servo, and frequency systems for long range rockets, blind flying aids, regulation of fuel flow in guided missiles in V2 rockets, further improvements came in devices to computing machines, truck, and locomotive electric breaking and AC streetcar controls for German civil interests.

Germany was first to use these devices to replace electron tubes and the rebirth of the magnetic amplifier along with patents from Sweden, England, and Japan. The Germans spent millions of marks in the performance of magnetic amplifiers obviously rivaled and equaled the electron tube circuits in very critical applications of power regulators.

The US Navy at this time developed contracts for expanding into high speed digital computers, pulse forming, memory and scanning in radio, radar, and sonar equipment.

A magnetic amplifier, circa 1950, uses diodes gains up to several million per stage were measured. The tube and magnetic amplifier differ as the magnetic saturation verses the impedance curve of a tube amplifier are almost the same. For comparison, the tube plate supply of both amplifiers must be AC since magnetic amplifiers will not control direct current.

Amplifiers operate as push-pull class A/B. The carrier can be biased out and plate supply rectified pulses are doubled and smoothed. With magnetic amplifiers using many cascaded stages show outputs of 500 watts with excellent linearity to 7,000 cycles.

One commercial radio firm (Collins Radio or Bendix Radio Company) built a complete broadcast transceiver using magnetic amplifiers for RF-IF and audio system. A germanium crystal transistor used for the oscillator; crystals were used for detectors. A static magnetic converter was used as a frequency multiplier power supply; probably only one was made as a publicity stunt to show an electronic device could replace the vacuum tube.

Aviation placed contracts to build Loran receiver – indicators except for the scope and oscillator tube, and to be designed as a combined heterodyne and HF power supply, thus reducing 34 tubes to only 2 tubes. That proved tubes were becoming obsolete 20 years later.

These past years have placed these magnetic devices into all electronic fields. Look at the donuts of powdered iron or ferites dropping off assembly lines into TVs, ham radios, coax RF attenuation, etc. Rolled core material in May 1954, when this was in its fourth printing, was useful up to a megacycle – today 400 MHz is about the limit. More uses of these ferrites: horizontal sweep tube transformers for TVs, tuning slugs, delay lines, and supersonic signaling at supersonic frequencies.

The push of the Navy back then for reform has been a slam dunk boon to all electronics discoveries of today. The Air Force can't fly without it. Silicone solid state technology has been embraced by all military world wide.

We are the inventors of all this technology and we contract overseas for billions of dollars to import it back to use in the long run we are loosing trillions in the future.

Where have all our brains gone? Why do we contract for brains overseas? Can't the work, both brain and brawn, both reside here in the land of the free!

## My Diamond Aerial

by Deni W9DS

It was January 2007 that I was in a QSO with W9HW. We had many schedules together over the years on 2 meter FM repeaters, switching on and off to simplex. Dave lives in New Lennox 30 some miles due south. I was using an isopole; an aerial with short vertical attached to a 1 ¼ pipe and 2 cones placed lower on that pipe at some distance below the vertical top portion of the aerial. The two cones are separated. Cones are aluminum riveted with a polypropylene donut slide up the pipe to hold the skirt of the cone in place in winds.

The isopole served me well, but it just wasn't good enough for Dave to hear me along some of the trails. So, W9HW talked me into getting another modern professional aerial and new coax with lower losses. The coax, RG8U, was 30 years old and checked good, but I gave it to N9QGU who was happy to get it.

Well, N9QGU, one Thursday evening, and I took the isopole down. The 1 ½ inch 20 foot mast came down with it. I had made errors in the diamond assembly I didn't find the elements easy to screw seemed the middle element was stuck. I looked down the 5 foot middle section and figured that diamond must have another idea and all I had to do was screw everything together. We put it up and it was dark got the coax connectors on the new coax and soldered them N9QGU, Bob, did that.

I flipped power supply to my Yaesu FT2200 put the 2 meter SWR/power bridge onto the diamond feed line and pressed in the mike switch recorded 3 to 1 at 145.190 MHz only 20 watts. Turned the knob up to 147.800 and the bridge recorded 1.6 to one with 30 watts output. Well that's better, but what's wrong? So I decided to talk to Diamond Antenna in Georgia. Spoke with the person that had picked up the phone and he explained the wires had plastic centering spacers that slide and I had to raise the center section up a piece and bring it hard down on my shoe top. Then this wire will naturally come down and then use an Allen wrench to connect the bottom and top sections of copper elements, tighten, and screw the sections together.

So, Bob and I did just that on Friday evening. Everything came out well. Checked the power; 30 watts output from 144 to 148 MHz. The SWR varies mysteriously across the band, but never approaching 1.2 or over. Saturday I got on and checked out how far I could get on the repeaters that I was not able to hit for a few years. I tried Morris repeater and it normally was just busy on the isopole, but now I am getting it on receive and it was S8 to S9. Even K9ILX, Bruce, can hear me on simplex from Mazon, Ilinois.

What an improvement. Diamond has a capacitor and coil in the top section. This phasing works very well as a pretuned performer on two meters. Diamond calls it a 3 element high performance FRP shell gain vertical antenna gain 7.8db, 200 watts max input, 50 ohms impedance, VSWR 1.5 to 1, max wind resistance 40m/sec (112 mph), mast 2 inches to 1 ¼ inches, length 178 inches, and one year warranty. The aerial employs DC ground structure. This aerial also has three radials at the bottom which screw into the base and a lock nut is provided so you can set radials out another 6 inches or so and it has a support pipe to boot.

I recommend using an aerial of this type.

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**An Old Farmer's Advice:**

Lettin' the cat outta the bag is a whole lot easier than puttin' it back in.

ARGONNE AMATEUR RADIO CLUB
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**Officers**

| | |
|---|---|
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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.

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.

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.

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.

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Please send club and editorial correspondence to the club address, or to travisdj@bigfoot.com Please include “AARC” in the subject.