

# HAMATEUR CHATTER

The Milwaukee Radio Amateurs Club

May 2013 Volume 21, Issue 5

One of the World's Oldest Continuously Active Radio Amateur Clubs—since 1917

## Presidents' Letter

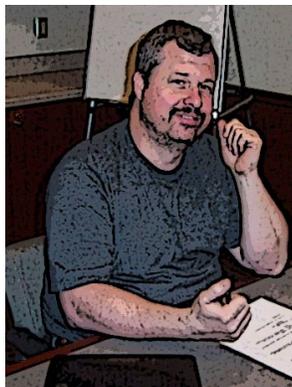
Walking around the Dayton Hamvention is an eye opening experience. In the flea market area you see just about everything you could ever imagine. Then again there are some things you can't imagine see and you find them. One of the things you see in the flea market area is clubs, with groups of members hanging around. They have banners and promote their organization. One thing I started seeing this year was some more young hams.

It was a great site seeing them shopping and looking for parts and pieces for a project. It got me thinking, which is always dangerous. How did they find out about ham radio? I know back in the fifty's and sixties there were radio clubs in the schools. The Milwaukee area doesn't have that many young hams in it. I think we as ham radio operators need to find ways to promote ourselves with young people. I would like to form a multi club committee to discuss this. The Ozaukee club I know does go out to the schools in their county and promotes themselves.

I also started to wonder how an organization like the Dayton Amateur Radio Association pulls off Hamvention. I think the answer is because they do stuff. If you look at their website <http://www.w8bi.org/>. You can see that they are an active group. They have a club house and a club station in which they contest together. It serves as their meeting place. They also have a planning committee. They have even built a new communications van. By doing things they seem to attract members interested in being active. They seem to take pride in their organization and promote it.

While doing my rounds in the buildings on Saturday. I had a chance to talk with Dave Sumner, K1ZZ, Chief Executive Officer and Secretary of the ARRL. I introduced myself as the President of the MRAC. He perked up and asked many questions about how the club is doing. We talked about being the oldest ARRL affiliated club. We also talked about our 100<sup>th</sup> anniversary coming up in 2017. I found it interesting that he instantly knew about the club. I also expressed my interest in finding more people to serve as officers in local organizations. He agreed it is a problem that many across the country face. He also thanked me for being as active as I am to help keep things going.

*Dave Shank*  
KA9WXN



## Board of Director's Minutes

Board of directors meeting called to order at 7:05 pm by Dave Shank, KA9WXN club president.

Director's present: Michael KC9CMT, Dave KA9WXN, Hal, KB9OZN, Joe, N9UX, Al, KC9IJJ. Mark, AB9CD.

Absent: Dan, N9ASA.



### MRAC Officers:

#### Terms Expiring in 2014

- President – Dave, KA9WXN
- V-President– Dan, N9ASA
- Secretary – Mike, KC9CMT
- Treasurer – Joe, N9UX
- Director – Vacant

#### Terms Expiring in 2015

- Director – Al, KC9IJJ
- Director – Hal , KB9OZN

The Club Phone Number is: (414) 332-MRAC or

(414) 332- 6 7 2 2

Visit our website at:

[www.w9rh.org](http://www.w9rh.org)

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## Preliminary discussions:

The Board of Director's minutes were accepted as published in the March Chatter by a motion forwarded by Mark, AB9CD seconded by Joe, N9UX. The Treasurers report was given by Joe, N9UX. The March balance ended with \$19,431.92 in our Club accounts. The phone bill has increased for the year of 2013, the March phone & DSL bill was \$116.13. Dues and other income was deposited to our account on March 4th & 29th.

**Meeting programs:** This months meeting will be the elections for 3 Board of Director's positions & our program will be HR digital modes, presented by Al, KC9IJJ & Joe, N9UX. The band used is scheduled to be 40 meters. Joe will be giving the Hardware side of the presentation. May will be the auction with no business meeting. The club wants to sell the MRAC Kenwood TS-430 radio with power supply. June presentation will be on APRS. No club meetings during July & August. An impromptu meeting has been discussed for sometime during these months. A future meeting could be on radio specifications.

This could be for our September meeting. The November presentation being discussed is about how to use and take measurements with an oscilloscopes. October is still open to suggestions. Jeff Annis, K9BS would be happy to give his an antenna modeling presentation. A presentation on the Bau-feng radio could be coming in the future.

**Field Day:** We may be able to use a radio on loan from AES again this year. Al, KC9IJJ will have the "Disco" tent going again. We will be a block east of our normal location due to the Farmers Market taking our normal area. We will have a 1000ft diameter area east of the farmers market. Pat Hoppe, with his group of students from Kenosha will be joining us at the MRAC field day site this year. They will be bringing their equipment and a van to the event.

## Special Project Committees & Committee reports:

**Repeater Report:** Dave, WB9BWP is the repeater trustee. The club would like more than one repeater trustee. We need to ask for volunteers at the membership meeting. Dave Karr is ready to start moving ahead on phone line issues. We would like to get the club phone bill down to \$80/month. sbcGlobal.net is not a preferred carrier. We want to port our phone line to Google voice. Ideally, we would not want a land line at the repeater site.

**New Business:** Officers for next year. Joe, N9UX and Michael, KC9CMT would like to stay in their present positions. The club needs people to step forward to fill Board of Director positions again this year. Dan, N9ASA has been unanimously reelected to the position of Vice-President of MRAC for another term. This motion was brought forward by Al, KC9IJJ, and Seconded by Joe, N9UX. An annual donation that we would like to send to the ARRL Spectrum Defense fund was deferred until November of 2013. A donation to the church should be made as soon as possible, \$100 is the usual amount. A presentation setup at Discovery World is in the discussion stage.

Doing something at the Robotics competition at the US Cellular Center has been talked about. Dave, KA9WXN will be looking into this.

Ham radio is on the rise numbers wise, with retirees and younger people entering the hobby. The club needs PR and recruitment. Having a ARRL convention in Milwaukee, sponsored by the MRAC in conjunction with the clubs 100th anniversary, would be a big event and draw people from all over the Midwest. It would take 5 years plus to organize a national convention. Our club the MRAC, should also be promoting the 10-10 club which is a nation wide club devoted to the 10 meter band.

The club needs to update all files and documents with the new Post office box number and address field. Joe, N9UX will be discussing the FM simplex contest awards during the upcoming membership meeting. Mark, AB9CD wanted to discuss the differences between various MRAC badge logos that have been used during the last five years or so and should this be standardized? We must decide on a common badge design for the club. Clubs throughout the country need to use the spectrum that they have been given. Both 440 & 220 are not used very often in the Milwaukee area. The club should promote the use of these bands to keep the spectrum alive.

It has been decided that the club will continue to use Milwaukee as its official city of residence. This needs to be change in any future newsletters. Current information needs to be imputed into the state article of incorporation that is due.

**Special Projects:** The club has some equipment it would like to sell, a Kenwood TS-430 plus power supply. We also would like to sell a beam that did not move at the club swapfest. At the club auction, the club will need lots of refreshments. Scanning of documents related to the club is an ongoing project undertaken by Dave, WB9BWP with other Board members assisting.

A motion was made to adjourn the meeting at 8:48 pm by Al, KC9IJJ seconded by Michael, KC9CMT. Meeting adjourned at 8:50 pm. The room was returned to an organized condition as it was when the room was opened.



The MRAC membership meeting was called to order at 7:13 pm by Dave, KA9WXM, club president. The Mic was passed around for introductions. A sign-in sheet was circulated for the recording of membership information and attendance.

### Tonight's Program:

HF digital, given by Al, KC9IJJ, and Joe, N9UX. Sound card interfacing, Three parts of sound card interfacing: Audio in, Audio out, and PTT. The interface is a third party box that acts as a controller between the radio and the computer. Simplest interface (audio only), wire runs from the radio speaker out to the sound card line in, and Radio Aux Mic I/P and the Sound card line out. Each radio manufacturer has its own cabling and pin-out specifications. PTT – RS232 Transformer connection, PTT – Optocoupler connection. USB sound card adapter for laptops without a build-in sound card.

HamRadio deluxe is a popular ham radio digital controller program. It is free for trial usage. This program has most of the Digital modes incorporated into it. It was written to interface with their USB sound card interface, that they also manufacture. Attempting to get this particular program to work with a USB/SERIAL port interface cable has proven in the past to be difficult. There are many other programs that can be searched for on the Web for digital interfacing. JT65 is a newer very slow CQ mode that takes minutes to bring in one letter of a signal.

Dave, KA9WXM called for any election nominations before he called a 10 minute break, then the business meeting part of the night will go on. Joe, N9UX nominated both Al, KC9IJJ and Hal, KA9OZN. Both people accepted their nominations. Pancho, K9OFA attempted to nominate Jerry, N9FI, but Jerry did not accept the nomination.

Dave, KA9WXM, Club president called the meeting to order at 8:45 pm. Dave asked for volunteers again for our field day program this June. We will be East of our normal location due to the establishment this year of a Farmers Market in Konkel Park on the weekends. The club wants to do more educational programs this year, to teach new hams skills and reinforce the skills of our older hams. Learning a skill has to do with the reinforcement of skills that have been learned in the past and new skills to be acquired. The Ozaukee swapfest is a week from this Saturday and the Circle "B" ranch, which is a bowling alley. Very easy to find on Hwy 60 West of Interstate 43 North out of Milwaukee. A ICS training course was announced that will take place in Waukesha on May 4th & 5th at the State Patrol Headquarters building. This is a course to learn coordination between the state disaster elements and the Amateur radio elements of disaster relief.

Joe, N9UX gave the treasurers' report. The club is doing well after a successful swapfest this last February. The club announced that the MRAC PO box has been changed too a different location, necessitating a revision of all club paperwork and templates. New member certificates were available for the new people. Two people joined or renewed at tonight's meeting. The election: a motion was made by Steve and seconded by Joe, N9UX to accept the nominations forwarded.

Both people were elected to a new two year term by the majority voice vote of the membership. The club still needs one more director for its Board. No one volunteered to fill this position.

Pancho is still looking for someone to help out during the club nets on Friday evening. We have a 10 meter and 2 meter net. At 8 and 9 pm respectively. On Tuesday nights there is a on-air class on the Club repeater at 8 pm. The class involves the questions for testing in the General, and Extra class question pool.

### New Business:

On June 22nd & 23rd, the MRAC will be holding field day at Konkel park in Greenfield again this year with the support of the city of Greenfield. It is possible that another organization will be joining our two clubs at field day this year. Dave, KA9WXM asked the club membership for volunteers to help with the field day exercises this June.

Joe, FM simplex results: Mobil station was won by K9IZV, Warren who also won in the 2 meter category. K9HIN, Bill won the HT section. Base, W9GA, bill won this section, and also the 440 MHz section. The club competition was won by the Badger Contesters. Joe would like help running the contest next year, which is not difficult.

**Dave, WB9BWP won the Travis J. Baird award for distinguished service to the MRAC and the Ham Radio community.** Next month, May is the clubs' annual auction.

Everyone is encouraged to bring items to sell for themselves and for donation to the club. Al, KC9IJJ had his field day digital station pictured in the April Issue of CQ magazine. A very good piece of PR for the MRAC.

There will be a food gathering at Denny's with Pancho after the club meeting.

Dave accepted motions to adjourn the meeting at 9:06 pm. Motion made by Joe, N9UX seconded by Pancho, N9OFA. Meeting adjourned at 9:08 pm. The room was then policed of trash and returned to an acceptable condition as found before the meeting commenced. A parts raffle will start immediately after the meeting.



**Dave DeFebo Accepts the Travis J. Baird Award**

## Tornado

A tornado is defined as: A violently rotating column of air, either pendant from a thunderstorm or underneath a thunderstorm, in contact with the ground, and often (but not always) visible as a funnel cloud. Tornadoes come in many sizes, shapes, and colors. They can range in width from several yards to more than a mile. Their lifetimes can be as short as a few seconds or they can last several hours. They can move forward at speeds of up to 70 miles per hour, or stand nearly still.

Research is ongoing as to how tornadoes form and why similar atmospheric conditions may or may not produce tornadoes. We provide some basic information with links to research facilities. Much of the tornado research within the United States is confined to the National Weather Service (and its federal partners) along with academic institutions. There is always emerging information regarding tornadoes. At the 2003 Severe Weather Workshop, new information was provided on how the temperature of rear-flank downdrafts assist or retard tornado-genesis. More information on tornadoes is provided below, courtesy of the National Weather Service.

Tornadoes -

It's easy for most people to recognize the funnel-shaped cloud of a typical tornado, but the funnel can vary considerably in appearance. Some are long and slender while others are wider than they are tall. Some of the worst tornadoes in history, such as the Tri-State tornado family outbreak of March 18, 1925 which killed 740 people in Missouri, Illinois and Indiana, were not recognized as tornadoes since they were so large or were wrapped in rain. Most people reported an area of black skies to the west or a wall of dark clouds - they never saw the tornado coming.

Some tornadoes do not even have a visible funnel, and their presence is indicated only by a swirl of dust near the ground. Other tornadoes are made up of several funnels, with smaller funnels rotating around a central vortex. Colors range from jet black to brown or reddish, when dust is lifted into the funnel, to almost white when sunlight falls on the funnel and dark clouds are in the background.

In addition to having various sizes, shapes, and colors, some tornadoes have distinctive sounds. Those who have been close enough to hear a tornado usually describe the sound as a loud roar like that of a jet aircraft or a freight train. Not all tornadoes have this roar, but at night, this may be one of the few clues that a tornado is approaching.

Why is Oklahoma Tornado Alley? -

While scientists are still trying to understand exactly how a tornado forms, the atmospheric ingredients that lead to supercell thunderstorms - long-lived thunderstorms with rotating updrafts - are fairly well understood. Typically it is with these well organized thunderstorms that the most violent weather occurs, including giant hail, destructive winds and strong and violent tornadoes. Unfortunately, not all tornadoes come from supercell thunderstorms, and not every rotating updraft produces a tornado.

Near the ground lies a layer of warm and humid air along with strong south winds. Colder air and strong west or southwest winds lie in the upper atmosphere. Temperature and moisture differences between the surface and the upper levels create what we call instability, while the change in wind with height is known as wind shear. This shear is linked to the eventual development of storm-scale rotation, which may eventually contribute to a tornado.

A third layer of very warm dry air becomes established between the warm moist air at low levels and the cool dry air aloft. This very warm layer acts as a cap and allows the atmosphere below it to warm further, making the air even more unstable. Things start to happen when a storm system aloft moves east and begins to lift the various layers. Through this lifting process the cap is removed, and sets the stage for explosive thunderstorm development as strong updrafts develop.

Complex interactions between the updraft and the surrounding winds both at storm level and near the surface may cause the updraft to begin rotating, and a supercell thunderstorm is born.

The plains of the central United States are uniquely suited to bring all of these ingredients together, and this region has become known as "tornado alley." The main factors are the Rocky Mountains to the west, the Gulf of Mexico to the south, and a terrain that slopes downward from west to east.

During the spring and summer months southerly winds prevail across the plains. Windy springs and summers are well known to Oklahomans. At the origin of those south winds lie the warm waters of the Gulf of Mexico, which provide the moisture at low levels. Very warm, dry air forms over the higher elevations to the west, and becomes the cap as it spreads eastward over the moist gulf air.

Where the dry air and the gulf air meet the ground, a boundary known as a dry line forms, often in western Oklahoma or the Texas or Oklahoma panhandles. A storm system moving out of the southern plains or Rockies may push the dry line eastward, with severe thunderstorms, possibly producing tornadoes, forming along the dry line or in the moist air ahead of it.

**Tornado Watch and Warning -**

A tornado watch is issued by the [Storms Prediction Center](#) when conditions are favorable for tornadoes. The coverage of a watch can be several counties to two or three states.

A tornado warning is issued by a local National Weather Service Forecast Office (WSFO) when a tornado has been spotted or indicated by RADAR.

Credits - [National Weather Service](#) - Norman, Oklahoma



## Severe Weather Preparedness

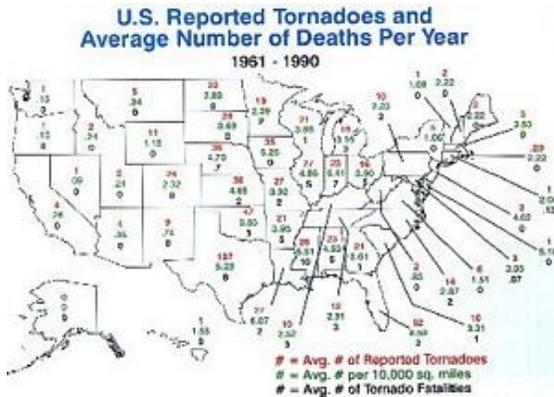
### Severe Weather Awareness - Tornadoes

No other country in the world has more tornadoes than the United States.

In an average year, 800 tornadoes are reported in the United States, resulting in 80 deaths and over 1,500 injuries.

Tornadoes are found most frequently in the United States

east of the Rocky Mountains. Oklahoma has the highest average number of tornadoes with 47 each year. South Carolina has an average of 10 tornadoes each year. Georgia has an average of 21 each year.



Tornadoes are violently rotating columns of air extending from a thunderstorms to the ground.

#### What's the difference between a tornado and a funnel cloud?

Funnel clouds are rotating columns of air **not** in contact with the ground. However, the violently rotating column of air may reach the ground very quickly - becoming a tornado! If there is debris being picked up or blown around by the "funnel cloud" - the rotating column of air has already reached the ground and it's a tornado!

How are tornadoes and waterspouts different?

Waterspouts are weak tornadoes that form over warm water. Waterspouts are most common along the Gulf Coast and southeastern U.S. coastline. Waterspouts occasionally move inland - as soon as the base of the rotating column of air moves over land the waterspout becomes a tornado!

How strong are tornadoes?

While most tornadoes (69%) have winds of less than 100 miles an hour, they can be much much stronger. Violent tornadoes (winds greater than 205 miles an hour) account for only 2% of all tornadoes, they cause 70% of all tornado deaths. In 1931, a tornado in Minnesota lifted an 83-ton railroad train with 117 passengers and carried it more than 80 feet! Once a tornado in Oklahoma carried a motel sign 30 miles and dropped it in Arkansas! In 1975 a Mississippi tornado carried a home freezer more than one mile!

### Tornado Wind and Damage Scale

Tornado Scale	Wind Speeds	Damage	Frequency of Occurrence
F0	40 to 72 MPH	Some damage to chimneys, TV antennas, roof shingles, trees, and windows.	29%
F1	73 to 112 MPH	Automobiles overturned, carports destroyed, trees uprooted	40%
F2	113 to 157 MPH	Roofs blown off homes, sheds and out-buildings demolished, mobile homes overturned.	24%
F3	158 to 206 MPH	Exterior walls and roofs blown off homes. Metal buildings collapsed or are severely damaged. Forests and farmland flattened.	6%
F4	207 to 260 MPH	Few walls, if any, standing in well-built homes. Large steel and concrete missiles thrown far distances.	2%
F5	261 to 318 MPH	Homes leveled with all debris removed. Schools, motels, and other larger structures have considerable damage with exterior walls and roofs gone. Top stories demolished	Less than 1%

#### How big are tornadoes?

- Most tornadoes are less than 1/4 of a mile wide on the ground - but they can also can exceed 1 mile in width! The McColl tornado in March 1984 (moving from the McColl S.C. area into North Carolina) was over 1 1/2 miles on the ground!
- Most tornadoes are on the ground 10 minutes or less - but in 1925 a tornado traveled 219 miles across Missouri, Illinois, and Indiana in 4 hours! In 1924, a tornado that started in Aiken County South Carolina traveled 135 miles into Florence County!

## Severe Weather Preparedness

### How fast can tornadoes move?

The average speed of a tornado is around 35 miles an hour - but they can remain almost stationary or move as fast as 70 miles an hour!

The average tornado moves from southwest to northeast - but they can move in any direction and even change direction!.

### When are tornadoes most likely?

In the southern United States the peak occurrence of tornadoes is March through May - but tornadoes can occur any time of year! Most tornadoes occur between 3 and 9 PM - but tornadoes can occur at any time of day or night!

### Where is the safest place to take shelter from a tornado...

#### In my home?

- Get away from windows - they may shatter and glass may go flying
- Go to the basement and get under a heavy workbench or the stairs
- If you don't have a basement, go to an inside closet, bathroom, or a hall on the lowest level of the house
- Get under a mattress.
- Protect your head
- In my car? Get out of a car and inside a sturdy house or building!
- Don't try to outrun a tornado in a car.
- Tornadoes can pick up a car and throw it through the air

#### At school?

- Follow directions of your teacher
- Go to an inside hall on the lowest floor
- Crouch near the wall. Bend over with your hands on the back of your head
- Keep away from glass and stay out of large rooms like the gym, cafeteria, or auditorium
- Keep a battery radio on and listen for news about the tornado

#### In a mobile home?

- If you live in a mobile home - get out!
- Even if it's tied down a mobile home can be shattered by a tornado. The entire mobile home can be lifted off the ground and dropped
- Get out and into a safe place. If you can't get to a tornado shelter, lie in a ditch and cover your head with your hands.

#### Downtown or shopping?

- Get off the streets
- Go into a building and stay away from windows and doors
- If I'm caught outside?
- Take shelter in a ditch, culvert, or ravine
- Cover your head with your hands.

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## The Experimenters Bench

### Op Amp Input Impedance –Part II in Series on Op Amplifiers

One of the major features of any circuit is its input impedance.

Accordingly the op amp input impedance is a key parameter, both of the basic op amp chip itself and also of a circuit based around an op-amp.

For a circuit, the op amp input impedance for a circuit is important because it determines the loading on the previous stage. In turn this determines many of the aspects of the previous stage and also the inter-stage coupling.

#### Op amp input impedance basics

When referring to the op amp input impedance it is necessary to state whether it is the basic chip itself or the circuit:

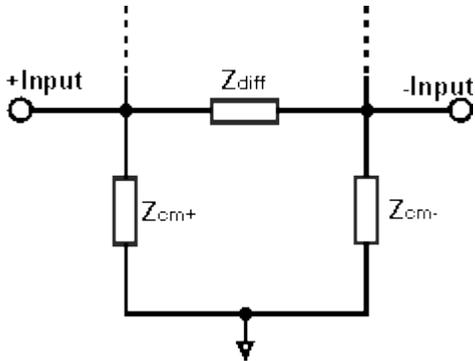
**Op amp chip input impedance:** The input impedance of the basic integrated circuit is just the input impedance of the basic circuitry inside the chip. Some current is required to drive the base junctions of the input transistors, and this is why the input impedance is not infinite.

**Op amp circuit input impedance:** Placing circuitry around an op amp alters its input impedance considerably. Both the external components and the way in which the feedback is applied affect the impedance. This means that dependent upon the way in which the feedback is applied and the components used can vary in overall circuit input impedance from low values up to very high values.

The level of input impedance for the basic chip can be obtained from the data sheets where the input impedance is quoted, often in terms of MΩ. Where very high input impedance levels are required, FET input op-amps may be used.

When looking at the integrated circuit data sheets, it is sometimes seen that the op amp input impedance is stated for differential and common-mode input cases. Typically current feedback op amps normally specify the impedance to ground at each input.

## The Experimenters Bench



Op amp input impedance elements within the chip

From this it can be seen that there are three resistors giving rise to chip input impedance. While for most cases the op amp resistance will be seen, at higher frequencies this may become slightly reactive and is more correctly termed an impedance. Typically the input resistance is of the order of 100 k $\Omega$  to 100 M $\Omega$  or more. The shunt capacitance may only be a few picofarads, often around 20pF or so

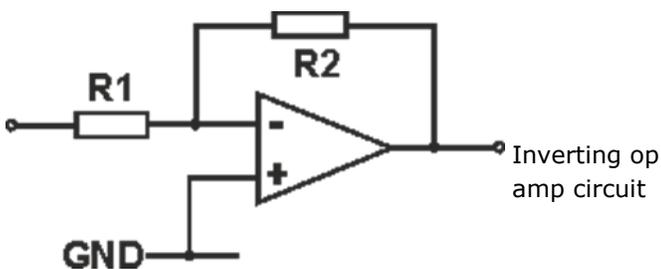
### Effect of feedback on input impedance

The circuit configuration and the level of feedback also have a major impact upon the input impedance of the whole op-amp circuit. It is not just the impedance of the amplifier chip itself. The feedback has different effects, lowering or increasing the overall circuit impedance or resistance dependent upon the way it is applied.

The two main examples of feedback changing the input impedance or input resistance of an op-amp circuit are the inverting and non-inverting op-amp circuits.

Input impedance of inverting op-amp circuit

The inverting amplifier using op-amp chips is a very easy form of amplifier to use. Requiring just two resistors, it provides an easy amplifier circuit to produce.



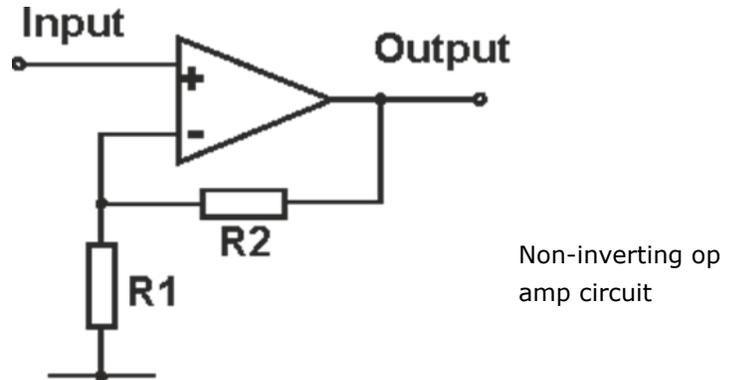
### Inverting op amp circuit

The basic inverting amp circuit is shown above. In order that the circuit can operate correctly, the difference between the inverting and non-inverting inputs must be very small - the gain of the chip is very high and therefore for a small output voltage, the difference between the two inputs is small.

This means that inverting input must be at virtually the same potential as the non-inverting one, i.e. at ground. As a result the input impedance of this op amp circuit is equal to R1. Normally this is relatively low and may be of the order of 1 k $\Omega$  or thereabouts dependent upon the actual circuit values chosen.

### Input impedance of non-inverting op-amp circuit

The non-inverting amplifier offers the opportunity of providing a very high input impedance level.



it is found that the op amp input impedance for the circuit is at least the that between non-inverting and inverting inputs, which is typically 1 M $\Omega$  to 10 T $\Omega$ , plus the impedance of the path from the inverting input to ground i.e., R1 in parallel with R2.

### Op Amp Output Impedance / Resistance

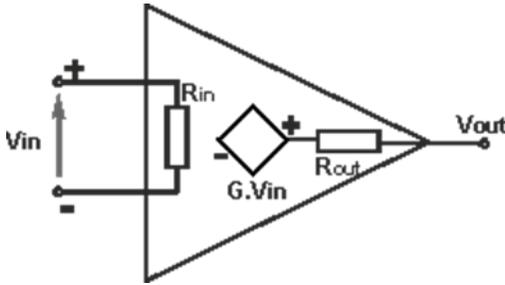
Like the input impedance, the output impedance of an op amp circuit is also important.

The output impedance determines the load that the circuit can drive and the output level delivered to the next stage. If the op amp output impedance is high, and the load has a low impedance, then much of the signal will be dissipated in the source resistance or source impedance of the output circuit.

### Op amp output impedance / output resistance basics

The output impedance of an operational amplifier, often designated  $Z_o$ , arises from the fact that the output driver circuit and the associated connections have a defined impedance. The output impedance can be split for many applications. The resistance element is of primary importance and is the major component of the overall impedance. However for some cases the reactance may also be an issue and this is caused mainly by the series inductance. To be fair, the reactive elements are normally small and are ignored for most op amp applications. Typically the frequencies at which op amps are used, the reactance levels will be small and not affect the circuit operation unduly. However they should not be forgotten as they may have an effect in some instances.

Accordingly the effective equivalent circuit for an op amp with its output resistance can be seen below.



### Op-amp output resistance

As can be seen from the diagram, the op amp output resistance is the DC resistance that appears in series with the output from an ideal amplifier located within the chip. In other words the output resistance can be measured by looking at the voltage drop caused when a defined load is added to the output. In most cases the output resistance is very low and very little drop will be seen. The major issue is normally that if reaching the limit of the current that the op amp will supply.

### Output impedance practical issues

When looking at data sheets to discover the output impedance. Dependent upon the manufacturer, data sheets may list the output impedance under one of two different conditions. Some list closed-loop output impedance while others list open-loop output impedance. Confusingly both tend to use the designation  $Z_o$ .

For many op amps the small signal impedance values fall between from about  $50 \Omega$  and  $200 \Omega$ .

Op amp out impedance can particularly be a design issue when using rail-to-rail output op amps to drive heavy loads. Under these circumstances the op-amp is required to drive a much higher voltage range, and current levels are higher, as well as requiring the output stage to reach voltages very [close](#) to the rails. If the load is mainly resistive, the output impedance will limit how close to the rails the output can go - if voltages very close to the rails are required, this can cause problems. If the load is capacitive, the extra phase shift that this introduces can erode phase margin and lead to instability.

### Op amp output drive capability

Another aspect that is [linked](#) to the output impedance of an op amp is the output drive capability.

Output drive capability is dependent upon a variety of aspects including the internal and external circuit and other conditions. Internal factors include aspects such as the output-stage bias current, drive level, circuit architecture and capability as well as the process on which the chip was made.

External factors also influence the drive capability. However these can be controlled more easily as they are affected by the external circuit, although some are less controllable. External factors for the op amp drive capability include output voltage headroom, i.e. the voltage difference relative to supply rails; input overdrive; total supply voltage; dc- vs. ac-coupled load; and junction temperature.

It is obviously necessary to be able to specify the drive capability. Generally this is achieved by taking the output short-circuit current parameter. In general the manufacturer will specify the level of current that guaranteed to flow when the output is tied to ground. For situations where in a single-supply situation, the output is tied to one-half the supply voltage, called  $V_s/2$ .

Often two figures may be given, one for conditions where the op amp is sourcing current and another for the situation where the op amp is sinking current. Using these figures it is possible to determine the behavior of the op amp where the voltage swing across the load is low, and therefore the internal output-stage is able to maintain a large voltage headroom to the respective supply rails.

### Op Amp Circuits

Operational amplifiers or op amps can be used in a wide variety of different analogue circuits. The basic op amp integrated circuit, makes them an almost ideal circuit building block which can be used to provide exceedingly high levels of performance. Typically an operational amplifier circuit requires a few external components to make a high performance analogue circuit.

It is the high gain of the basic amplifier combined with the use of feedback (most often negative feedback) that enables the final circuits to provide such a high level of performance.

The list below provides links to a variety of commonly used op amp circuits. These circuit range from simple linear amplifiers, to filters, variable gain amplifiers, a-stables and bi-stables and more.

**Inverting amplifier:** The inverting amplifier is one of the most commonly used. It is simple requiring just a few additional resistors to provide a highly effective amplifier. It can also be used as a virtual earth mixer, combining several audio inputs together. The inverting amplifier has a low input impedance and a low output impedance.

**Non-inverting amplifier:** The non-inverting amplifier is another popular circuit. It is often just a little more complicated than the inverting format, but has a very high input impedance while maintaining a low output impedance.

**High pass filter:** High pass filters can be used in many [applications](#). One instance where a high pass filter may be used is to remove unwanted low frequency noise such as mains hum. **Low pass filter:** Low pass filters are very useful and can be used to remove the unwanted high frequency elements of a signal.

**Bandpass filter:** Band pass filters can be made quite easily using op amps. While the upper frequencies can be limited, they are ideal for audio and many other applications. **Variable gain amplifier:** This op amp circuit enables the gain of the amplifier to be controlled using a single [resistor](#).

**Notch filter:** Notch filters are widely used in removing a single frequency from a spectrum.

For op amp notch filters that will tend to be used more within the audio spectrum, these notch filters could be used for removing mains hum, or for removing or accepting specific tones.

**Multivibrator:** Multivibrators are a commonly used in many areas of electronics. An op amp multivibrator may be used where a simple oscillator is needed in an analogue circuit.

**Bistable:** It is sometimes convenient to have a bi-stable made from op amps. This circuit shows how this can be done very easily.

**Comparator:** This circuit shows how a comparator can be made using an op amp. Strictly speaking a comparator chip rather than an op-amp should be used as you will find out.

**Schmitt trigger:** The Schmitt trigger is a very popular circuit. Introducing some hysteresis into the switching, this reduces the effects of noise and enables solid switching to be achieved.

### Op amp circuit design considerations

When designing operational amplifier circuits there are several design considerations that need to be remembered. Various aspects of op amp circuit design are common to most circuits if not all.

#### Basic op amp circuit design:

Some of the basic concepts about basic op-amp design.

**Op-amp gain:** Operational amplifiers have very high levels of gain when operated in open loop. The final level of gain is very much less when negative feedback is applied. Knowing about the gain, and how to use it to obtain the best results is a key factor in op-amp circuit design.

#### Inverting operational amplifier circuit

- circuit and design details for an operational amplifier, op-amp inverting amplifier configuration

Op-amp circuits include:

- Operational amplifier circuits
- Inverting op-amp
- Non-inverting op-amp
- Op-amp high pass filter
- Op-amp low pass filter
- Op-amp bandpass filter
- Op-amp variable gain amplifier
- Op-amp notch filter circuits
- Operational amplifier multivibrator
- Op-amp bistable
- Op-amp comparator

- Op-amp Schmitt trigger
- Op-amp integrator

Operational amplifiers can be used in a wide variety of circuit configurations. One of the most widely used is the inverting amplifier configuration. It offers many advantages from being very simple to use, requiring just the operational amplifier integrated circuit and a few other components.

## Early Radio: Military Communications

### West Of The Ashau

19 June 2006

Gary Linderer

There are a lot of great stories of U.S. long-range recon patrols – other than those of SOG – operating in Laos and Cambodia. Most of them are just that – great stories. But some of them have been substantiated and have been proven true.

Others are officially unsubstantiated but yet the eyewitness testimony of a number of participants indicates that at least they believed they were some place they didn't belong – and didn't want to be.

On 20th October 1969 Sergeant Frank Anderson's recon team from Company L, 75th Rangers, 101st Airborne Division got a warning order for a patrol far out into the western expanses of the Division's area of operations. Their mission was to locate the route of march of enemy replacements being fed into South Vietnam to rebuild the strength of the 5th NVA Regiment operating somewhere in the south western Ashau valley. The 5th NVA Regiment, led by the notorious Colonel Mot, had been a poison thorn in the side of the 101st Airborne Division for nearly two years. Repeatedly bloodied by elements of the Division, remnants of this enemy unit always managed to regroup under Mot's able leadership and quickly reappear to strike again and again at the Screaming Eagles and their allies.

The most disturbing thing about this particular long-range patrol was that the border indices on the AO map didn't match any of the maps the Rangers had ever used before. As a matter of fact, the map of the team's RZ didn't have any names or terrain feature that remotely rang anyone's chimes.

Nothing unusual happened at the pre-mission briefing except that the operations officer who conducted it announced to the Rangers that they would be carrying a newly developed AM radio and a single PRC-25 instead of the usual two PRC-25s. In addition, he stated that the patrol leader would be issued a URC-10 emergency survival radio, good only for transmitting out to aircraft passing overhead. Finally, the team's normal SOP for situation reports had been slightly modified.

Normally, a long range reconnaissance patrol had a minimum of four to six scheduled sit reps per day, sometimes more if the area or the situation merited it. But on this particular patrol the team had been assigned only two scheduled daily sit reps – one at first light and one at last light. These patrol requirements were highly "unusual" to say the least.

The first light insertion on the 22nd went in without an over flight. This bothered Sergeant Anderson almost as much as the one-hour chopper flight out to the team's AO. And to make matters even worse, not one of the Rangers had failed to notice that the insertion aircraft continued flying west on a 270-degree azimuth even "after" they had passed over the Asahu valley. It didn't take a master's degree in geography with a minor in cartography to tell Anderson and his teammates that they had probably brought along the wrong passports. These were not good signs and were most likely responsible for the added sense of anxiety shared by each team member on the patrol.

The five-man team went in on a tiny clearing along the lower tip of a secondary ridge nestled amid towering mountains. It was rugged country and strangely devoid of the normal bomb and artillery craters that so abundant in the Ashau. Anderson's patrol moved off the LZ as quickly as they could and immediately found themselves in the middle of dense layers of lush ground cover.

The team spent the first two days of the four-day mission slipping around the mountains looking for signs of the NVA replacements. But there was no indication that anyone or anything other than a few wild animals had ever set foot anywhere in the AO.

The Rangers experienced commo problems from the very onset of the mission. The [PRC-25](#), usually the team's chief source of commo, was only capable of intra-patrol communications, and the new AM model radio, which operated on two batteries instead of one and was thus heavier than the PRC-25, was also having a difficult time reaching the radio relay team – wherever they were situated.

On the third day Murphy's Law decided to step in and relieve the team's boredom. The weather, still in the midst of the monsoon season, decided to drastically change for the worse. Thick, dark clouds rolled in from the west, and the patrol was soon the unfortunate target of a driving downpour.

On the evening before, the Rangers had moved into an area of double canopy jungle and had set up a night defense position on the crest of a thickly wooded knoll. There was little to no ground cover under the forest, except for a large number of fallen trees scattered about here and there. With a swing set or two, a drinking fountain and some horseshoe pits, the area would have made a passable municipal park.

In the middle of the thunderstorm Anderson ordered his senior RTO to set up the field expedient wire antenna for the AM radio so that the patrol could make its scheduled morning sit rep. They had just completed transmitting and were busy putting away the antenna wire when a column of NVA soldiers suddenly materialized out of the driving rain no more than ten meters from the nearest Ranger.

The enemy platoon had been climbing up the steep side of the knoll, moving in a wedge-shaped formation with a point element out front and flankers to both sides. They were moving fast in the heavy rain, almost as if they were trying to reach shelter somewhere nearby. The enemy soldiers were wearing pith helmets, khaki uniforms and rucksacks, and were carrying their weapons at port arms. However, their initial shock at seeing a five-man Ranger team strewn across their path didn't keep them from responding instantly. The NVA point man opened up, hitting Anderson and another Ranger in the back, and wounding a third in the lower leg.

The Rangers responded a split second later dropping five or six NVA at the front of the column before they could advance or retreat. Anderson himself, though wounded, put at least three of them down with a sustained 18-round burst. The remainder of the NVA recoiled and fell back beyond the military crest of the knoll to regroup. Apparently, they had been just as surprised as the Rangers and needed time to lick their wounds, assess the situation and react properly.

Up on the knoll the Rangers were doing exactly the same. Anderson's wound had fortunately been a grazing wound high on his back near the shoulder. While painful, it would not keep him from performing his duties. The patrol's rear security man, PFC Whitledge, had not been so lucky. Leaning against a fallen log directly in the path of the NVA patrol, he had been the first Ranger hit. A single round had blown out a large piece of his left calf muscle, breaking both bones on the way through. The wound was serious, but the tough young Ranger kept his cool and returned fire immediately, nailing the NVA who had shot him, and also dropping the soldier directly behind him.

The third Ranger hit was the RTO. Like Anderson, he had taken a round in the back. Unlike Anderson, this round had gone in just above the right kidney and had exited through the Ranger's shoulder joint, puncturing a lung on the way out. With 60% of the recon patrol already wounded in the opening seconds of the battle, their odds for survival seemed lower than a private's base pay.

Anderson knew that the enemy was probably preparing to fire and maneuver against the team. He ordered those Rangers who still could to toss frags over the edge of the knoll. The grenades detonated among the NVA just as they were beginning to move back up to the military crest of the knoll, once again breaking up their plan of attack. This gave the Rangers time to act.

With the RTO out of action and the team's next regularly scheduled sit rep still twelve hours away, Anderson suddenly remembered the URC-10 in the cargo pocket of his pants. He reached down with his good arm and extracted the small rectangular survival radio. Anderson prayed that the unfamiliar radio still worked. He quickly transmitted a message identifying the sender as Ranger Team 13, adding that they were in

contact and had casualties. He gave the team's six-digit coordinates, the frequency for the Ranger TOC, and asked the receiver to alert that station upon receipt of the message four more times, then set the beeper device on the transmitter and prayed that someone was listening.

Two hours later a single C-130 flew over the patrol's location and picked up their emergency transmission. The pilot quickly put out a call for help, and alerted the Ranger TOC back at Camp Eagle that it had a patrol in deep trouble.

Two additional hours passed before the Ranger heard the distinctive sounds of Huey helicopters heading their way. Amazingly, the NVA had been quiet for the past four hours, but Anderson knew that they were still out there somewhere. He suspected that they were most likely waiting for reinforcements and the coming of darkness before they moved against the team again. Their first effort had already proven too costly.

A pair of slicks from A Company, 158th Aviation Battalion, "The Phoenix", had arrived from Camp Evans. The lead ship was flown by the battalion commander, a lieutenant colonel, and was equipped with three Maguire rigs. Unfortunately, the two slicks were a long way from home and without gunship support. Anderson realized that they were probably flying into a trap, and not knowing their frequencies, had no way to warn them to abort. Suddenly, the voice of the aircraft commander of the lead ship came in over the team's PRC-25. He asked Anderson to pop a smoke grenade. The Ranger team leader complied and soon the slick pilot had pinpointed the team's position in the double canopy jungle.

When the lead aircraft moved into hover directly over the team, the enemy hiding back just beyond the military crest of the knoll opened fire. Immediately, the second Huey moved in and took up position to one side of the rescue ship and began suppressing the enemy small arms fire with its two M-60s. While the slick turned gunship held the NVA at bay, the crew chief on the lead aircraft kicked out the Maguire rigs directly over Anderson's patrol.

Down on the ground, Anderson helped Whitledge and his nearly unconscious RTO into two of the rigs. He then decided that one of the two Rangers that had not been hit would have to go out with the two wounded men to stabilize them in their rigs. Anderson and the remaining team member would stay behind and wait for the second lift. He knew that it would be almost completely dark before the slicks returned, and he doubted that either of them would still be alive by then.

The lead aircraft took several hits lifting off with the first three Rangers, but managed to get out of range of the enemy guns before they knocked the ship from the sky. The courageous pilot was sure that the two men left behind would never survive until he could drop off his load at Camp Evans, refuel, and return to the AO, so he did the only thing he could think of at the time. Flying approximately five clicks to the east he found an old abandoned crop field and slowly lowered the three Rangers to the ground. He set his bird down beside them and as his door gunner and crew chief got out to re-coil the Maguire rigs, he yelled for the three soldiers to find a place to hide until he returned.

Back at the knoll, Anderson and his comrade were surprised to see two more Hueys arriving overhead so soon. They stared silently as two Maguire rigs dropped through the trees and landed inside their tiny perimeter. Without hesitating his companion helped him into the loop at the bottom of one of the ropes, then turned and climbed into the remaining rig.

Anderson looked up and signaled that they were ready to go. He dreaded leaving the team's equipment and radios behind, but there had been no opportunity to destroy them and there was nothing he could do about it at the moment. Right then, their lives seemed more important than a bunch of easily replaceable gear.

The aircraft commander of the lead Huey began to slowly lift his ship straight up and out of the LZ. Immediately, the aircraft began taking hits from enemy small arms fire coming from the surrounding jungle. Once again the second Huey maneuvered alongside and began laying down a heavy suppressive fire with its two M-60s.

Dangling helplessly exposed at the ends of the ropes, the two Rangers expected at any moment to be shot off the Maguire rigs. Miraculously, the enemy soldiers hidden in the trees below seemed to be concentrating their fire on the helicopters, and totally ignored the two Rangers hanging beneath. Suddenly Anderson found himself hung up on a large tree limb. With his wounded shoulder stiffening up, he was unable to push himself away from the tree and was in immediate danger of being stripped out of his seat by the strain of the aircraft dragging the rigs through the jungle. Just in time, the pilot realized what was happening below him and lowered the aircraft enough for the Ranger team leader to free himself. When Anderson was once again out in the open he signaled the pilot to continue the lift, but he nearly lost his balance and fell as the aircraft commander brought the Huey straight up in a rapid, near vertical climb. Then suddenly, they were above the jungle and moving away from the area.

The Phoenix bird set down minutes later in an overgrown field at the foot of a tall mountain. Anderson and his teammate quickly freed themselves from the Maguire rigs and started for the helicopter, only to spot their three missing comrades moving slowly toward them from a nearby thicket. Realizing for the first time what had transpired, Anderson nodded his approval to the pilot as he joined his four teammates and quickly climbed aboard the helicopter. They were soon on their way back to the rear.



Low on fuel, the two shot-up Hueys finally set down back at Camp Evans. The two badly wounded Rangers were removed from the aircraft and taken directly to the base field hospital to have their wounds treated. There they would be stabilized for a future Medevac flight down to the 22nd Surgical Hospital at Phu Bai.

Anderson and the two remaining Rangers stayed on board as the aircraft refueled, then they too, were flown directly to the 22nd Surg. There they were checked out thoroughly to make sure certain that they hadn't sustained any wounds they were unaware of. While they were at Phu Bai the Ranger Company was informed of their arrival by landline, and a truck was sent to pick them up and return them to the Company L compound at Camp Eagle.

A few days later, Anderson received word from his company commander, Captain Robert Guy, that the 158th Aviation Battalion commander had called him to find out how the five Rangers had fared. Regretfully, Anderson had missed his one opportunity to thank the courageous pilots and their crews. If it were not for them, he and his teammates would have never gotten out of the jungle alive.

Sergeant Frank Anderson and his two teammates soon returned to the company to continue running patrols. Whitledge and the RTO were sent back to the States to recover from their wounds. Their war in Vietnam was over.

This article was originally published in Behind The Lines magazine. The MRAC has reproduced this article with the kind permission of Gary Linderer.



SFC James K. F. Dung



## From the ARRL Newsletter:

### Chinese Amateurs Assist in Earthquake's Aftermath



On the morning of Saturday, April 20, a powerful earthquake measuring 7.0 on the Richter scale struck Ya'an City in China's Sichuan province. The epicenter was near Lushan County. As of Wednesday, April 24, almost 200 people have been killed and more than 11,000 people are injured.

Radio amateurs in Sichuan province took immediate action. Liu Hu, BD8AAA, and BA8DX led a team to the disaster area to provide emergency communication services. Even in the aftermath of the earthquake, the FM repeater in Ya'an City was still functioning; BG8FUW in Lushan County and BG8EYD in Ya'an City used this repeater to coordinate local efforts.

According to IARU Region 3 Disaster Communications Committee Chairman Jim Linton, VK3PC, it has been raining in the earthquake area. "Effective traffic control has been very important to transport tents, water, foods and medicines into the area," he said. "The rural communities around Ya'an City are along the same seismic fault where the Great Sichuan Earthquake killed more than 90,000 people five years ago in one of China's worst natural disasters. The latest earthquake on Saturday left tens of thousands of people in tents or cars, unable to return home or too afraid to go back as aftershocks continued. Badly hit Lushan County is now a large refugee camp, with tents set up and volunteers providing meals."

Immediately after the earthquake, the Chinese Radio Sports Association and Chinese Radio Amateur Club asked all amateurs to avoid 3.855, 7.050 and 14.270 MHz, as these frequencies were being used for disaster relief communications. As of April 22, public communication is back to normal in the disaster area and amateurs are free to once again use these frequencies. -- Thanks to Fan Bin, BA1RB, and Jim Linton, VK3PC, for the information

**PRECAUTIONARY/PREPAREDNESS ACTIONS...**

A TORNADO MAY FORM AT ANY TIME...TAKE COVER NOW. ABANDON MOBILE HOMES AND VEHICLES FOR MORE SUBSTANTIAL SHELTER. AVOID WINDOWS.

THE SAFEST PLACE TO BE DURING A TORNADO IS UNDER A WORKBENCH OR OTHER PIECE OF STURDY FURNITURE. SEEK SHELTER ON THE LOWEST FLOOR OF THE BUILDING IN AN INTERIOR HALLWAY OR ROOM SUCH AS A CLOSET. USE BLANKETS OR PILLOWS TO COVER YOUR BODY AND ALWAYS STAY AWAY FROM WINDOWS.

IF IN MOBILE HOMES OR VEHICLES...EVACUATE THEM AND GET INSIDE A SUBSTANTIAL SHELTER. IF NO SHELTER IS AVAILABLE...LIE FLAT IN THE NEAREST DITCH OR OTHER LOW SPOT AND COVER YOUR HEAD WITH YOUR HANDS.

PLEASE FOLLOW OUR OFFICE ON BOTH FACEBOOK AND TWITTER FOR MORE INFORMATION ON SEVERE WEATHER AND TO RELAY WEATHER REPORTS AND PHOTOS.

**WHEN A TORNADO WARNING IS ISSUED BASED ON DOPPLER RADAR...IT MEANS THAT STRONG ROTATION HAS BEEN DETECTED IN THE STORM. A TORNADO MAY ALREADY BE ON THE GROUND...OR IS EXPECTED TO DEVELOP SHORTLY.**

IF YOU ARE IN THE PATH OF THIS DANGEROUS STORM... IF DRIVING...DO NOT SEEK SHELTER UNDER A HIGHWAY OVERPASS.

**Next Regular Meeting**

The next meeting will be on Thursday, May 30th at 7:00PM. We meet in the Fellowship Hall of Redemption Lutheran Church, 4057 N Mayfair Road. Use the south entrance. Access the MRAC Yahoo group for important details about the February Meeting.

**Meeting Schedule:**

**June 27th, 2013**

**No meetings in July or August**

**Please do not call the church for information!**

**Club Nets**

Please check in to our nets on Friday evenings.

Our ten meter SSB net is at **8:00 p.m.** at **28.490 MHz USB** Our two meter FM net follows at **9:00 p.m.** on our repeater at **145.390 MHz** with a minus offset and a **PL of 127.3 Hz.**

Visit our website at: [www.w9rh.org](http://www.w9rh.org)

Or phone **(414) 332-MRAC** or **332 - 6722**



Name of Net, Frequency, Local Time	Net Manager
<a href="#">Badger Weather Net (BWN)</a>	<a href="#">W9IXG</a>
<a href="#">Badger Emergency Net (BEN)</a>	<a href="#">NX9K</a>
Wisconsin Side Band Net (WSBN)	<a href="#">KB9KEG</a>
Wisconsin Novice Net (WNN)	<a href="#">KB9ROB</a>
Wisconsin Slow Speed Net (WSSN)	<a href="#">NIKSN</a>
Wisconsin Intrastate Net - Early (WIN-E)	<a href="#">WB9ICH</a>
Wisconsin Intrastate Net - Late (WIN-L)	<a href="#">W9RTP</a>
<a href="#">ARES/RACES Net</a>	<a href="#">WB9WKO</a>

\* Net Control Operator needed. Contact Net Manager for infor-

**Chatter Deadline**

The **DEADLINE** for items to be published in the **Chatter** is the **15th of each month**. If you have anything (announcements, stories, articles, photos, projects) for the 'Chatter, please get it to me before then.

You may contact me or Submit articles and materials by e-mail at: [Kc9cmt@earthlink.net](mailto:Kc9cmt@earthlink.net)

**or by Post to:**

Michael B. Harris  
807 Nicholson RD  
South Milwaukee, WI 53172-1447

## VE Testing:

April 27, 2013 - AES - 9:30 AM  
 May 25, 2013 - AES - 9:30 AM  
 No testing in June  
 July 27, 2013 - AES - 9:30 AM

ALL testing takes place at: Amateur Electronic Supply  
 5720 W. Good Hope Rd. Milwaukee, WI 53223

## Area Swapfests

June 2nd, 2013 [Starved Rock Radio Club's \(W9MKS\) 2013 Hamfest](#) Location: Princeton, IL  
 Type: ARRL Hamfest  
 Sponsor: Starved Rock Radio Club  
 Website: <http://www.w9mks.org>

June 16th, 2013 [Six Meter Club of Chicago Hamfest](#)  
 Location: Wheaton, IL Type: ARRL Hamfest  
 Sponsor: Six Meter Club of Chicago  
 Website: <http://k9ona.com>

July 6th, 2013 [Swapfest '13](#) Location:  
 Oak Creek, WI Type: ARRL Hamfest  
 Sponsor: South Milwaukee ARC  
 Website: <http://www.qsl.net/wa9txe>

## MRAC Working Committees

### 95th Anniversary:

- Dave—KA9WXN

### Net Committee:

- Open

### Field Day

Dave—KA9WXN, Al—KC9IJJ

### FM Simplex Contest

- Joe - N9UX
- Jeff - K9VS

### Ticket drum and drawing

- Tom - N9UFJ
- Jackie - No Call

### Newsletter Editor

- Michael-KC9CMT

### Webmaster

- Mark Tellier—AB9CD

### Refreshments

- Hal—KB9OZN



## Membership Information

The Hamateur Chatter is the newsletter of MRAC (Milwaukee Radio Amateurs' Club), a not for profit organization for the advancement of amateur radio and the maintenance of fraternalism and a high standard of conduct. MRAC Membership dues are \$17.00 per year and run on a calendar year starting January 1st. MRAC general membership meetings are normally held at 7:00PM the last Thursday of the month except for November when Thanksgiving falls on the last Thursday when the meeting moves forward 1 week to the 3rd Thursday and December, when the Christmas dinner takes the place of a regular meeting. Club Contact Information

Our website address <http://www.w9rh.org>

Telephone (414) 332-MRAC (6722)

Address correspondence to:

**MRAC, PO Box 26233, Milwaukee, WI 53226-0233**

Email may be sent to: [w9rh@arri.net](mailto:w9rh@arri.net) . Our YAHOO newsgroup:

<http://groups.yahoo.com/group/MRAC-W9RH/>

## CLUB NETS:

- The Six Meter SSB net is Thursday at 8:00PM on 50.160 MHz USB
- Our Ten Meter SSB net is Friday at 8:00PM on 28.490 MHz ± 5 KHz USB.
- Our Two Meter FM net follows the Ten meter net at 9:00PM on our repeater at 145.390MHz - offset (PL 127.3)



The HamChatter is a monthly publication of the Milwaukee Radio Amateurs' Club.

Serving Amateur Radio for Southeastern Wisconsin & Milwaukee County Club Call sign - W9RH

MRAC Website: <http://www.W9RH.org>

Editor: Michael B. Harris, Kc9cmt, [kc9cmt@Earthlink.net](mailto:kc9cmt@Earthlink.net)

# Milwaukee Area Nets

Mon.8:00 PM 3.994 Tech Net

Mon.8:00 PM 146.865- ARRL Newsline

Mon.8:00 PM 146.445 Emergency Net

Mon.8:00 PM 146.865- Walworth County ARES net

Mon.8:45 PM 147.165- ARRL Audio News

Mon. 8:00 PM 442.100+ Railroad net, also on EchoLink

Mon. 8:00 PM 442.975+ WARC W9CQ net also on EchoLink 576754

Mon. 9:15 PM 444.125+ Waukesha ARES Net on the 1st, 3rd, and 5th Monday of each month.

Mon. 9:00 PM 147.165- Milwaukee County ARES Net

Tue.9:00 AM 50.160 6 . Mtr 2nd Shifter's Net

Tues. 8:00 PM 145.390- General Class

Tue. 9:00 PM 145.130 MAARS Hand Shakers Net

Tue. 8:00 PM 7.035 A.F.A.R. (CW)

Wed. 8:00 PM 145.130 MAARS Amateur Radio Newsline

Wed. 8:00 PM 147.045+ West Allis ARC net

Wed. 8:00 PM 147.270+ Racine County ARES net

Wed. 9:00 PM MAARS SwapNet, AllStar link to FM-38

Thur. 8:00 PM 145.130- General Class

Thur. 8:00 PM 50.160, 6 Mtr SSB Net

Thur. 9:00 PM 146.910 Computer Net

**Fri. 8:00 PM 28.490 MRAC W9RH 10 Mtr Net SSB**

**Fri. 9:00 PM 145.390 W9RH 2 Mtr. FM Net**

Sat. 9:00 PM 146.910 Saturday Night Fun Net

Sun 8:30 AM 3.985 QCWA (Chapter 55) SSB net

Sun 9:00 AM 145.565 X-Country Simplex Group

Sun 8:00 PM 146.91 Information Net

Sun 8:00 PM 28.365 10/10 International Net (SSB)

Sun 9:00 PM 146.910 Swap Net

**First Thursday of the month 8:00 PM 442.200+ Round Table Tech Net**

2meter repeaters are offset by 600KHz - - 70 centimeter repeaters are offset by 5 MHz



## Months of Peak Tornado Occurrence 1950 - 1991

