HAMATEUR CHATTER

The Milwaukee Radio Amateurs Club

February 2013 Volume 21, Issue 2

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

President's Letter

Our third annual swapfest has come and gone. It looks like it was another success for MRAC and MAARS.

I look forward to planning next year's fest. Each year we make improvements and make things better. One improvement would be promotion of the event. We really need to work on promoting our club events more. We need to make sure that no one can say they didn't know about our fest or meetings.

This month's meeting will be a pot luck dinner to celebrate the swapfest. Last year it was a good time and we all got to sit around and socialize. I think socializing is a very important activity for our meetings. One of my goals is to give more time for this during meetings. There is not much for club business that really needs to take up most of the meeting.

I am suggesting to the board that we concentrate more on the programs and social aspect of our meetings. We will keep business brief and make sure we keep all informed.

The FM Simplex contest was held on February 10th. I again activated W9RH from the UW Milwaukee dorms where the MAARS repeater is located. I enjoy handing out bonus point for people working W9RH. Activity seemed a little down this year. I was wondering if that had to do with the weather. We again received an email from someone on the east coast saying they were doing the same thing in their area.

The next big event for the club is AES Superfest on April 5&6. We need people to help promote the club at our table. Please take some time out of the day and offer to staff the club table. It will give others a chance to walk around and see what's new. This year we will be back in the club area since we are not doing a special event station. I know it is only February but we need to start thinking about Field Day. This year we really need some help with promotions. We could get extra bonus points if we get media and public officials to show up. If someone would like to help out please let me know. This year we are going to be joined by another club. The Gateway Technical College radio club will join us and run the GOTA station.

We also have purchased a used compact beam antenna for this year. Our goal is to go out and have fun and make some contacts. If you have an antenna idea you want to try out let us know. It might be a good time to see if we can get it to play.

Dave KA9WXN

At about 9:20 a.m. local time (12:20 a.m. EST) Friday, February 15, 2013, a space rock nearly 50 feet (15 meters) in diameter entered Earth's atmosphere and erupted over the Urals region in Russia. The "tiny asteroid," as Paul Chodas, research scientist in the Near-Earth Object Program Office at NASA's Jet Propulsion Laboratory in Pasadena, California, referred to it, weighed some 7,000 metric tons and penetrated the atmosphere at some 40,265 mph (18 kilometers per second).

MRAC Officers:

Terms Expiring in 2014

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

Terms Expiring in 2013

- 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

Mail correspondence to:

M. R. A. C.

P.O. Box 240545

Milwaukee, WI 53223

Board of Director's Minutes

Board of directors meeting called to order at 6:50 pm by Dave Shank, KA9WXN incoming club president.

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

Absent: Dan, K9ASA.

Preliminary discussions:

The Board of Director's minutes were accepted as published in the November Chatter by a motion forwarded by AL, KC9IJJ seconded by Joe, N9UX. The Treasurers report was given by Joe, N9UX. The ending balance on the books at the end of November was $16,326. The December balance was $17,737.52 in our accounts. Dave, KA9WXN brought up the subject of an end of year audit of the general ledger that is normal operating procedure. Our club received a very nice letter from the ARRL spectrum defense fund, to acknowledge our contribution of $200 in December of 2012. The idea was brought up by Dave, KA9WXN to suspend the normal business meeting until enough new business accumulates to warrant announcements.

This issue was discussed within the Board, the business meeting portion of the membership meeting may become less comprehensive in the future. There will be a business meeting in January. Februaries meeting will be a food gathering depending on the success of the upcoming inter-club swapfest.

Meeting programs: January will be Gary, W9XT on the Arduino prototyping board. February's meeting will be a post Hamfest food gathering. Marches meeting program may be Chris Karr on HD radios, the subject of a program on oscilloscopes also came up. April will be the Annual Election of club director's. May will be the club auction. APRS & PSK31 have been mentioned as a program for April's meeting. Field day falls after the membership meeting in June this year. June's meeting will be about setting up a computer sound card to access PSK31 programs, and other digital modes. The club needs to work on topics to educate the membership into electronics and radio topics.

Hamfest: Fliers and complimentary tickets were sent out in December to clubs throughout the general area. A revised floor plan was made up by Dave, KA9WXN and sent to the club secretary. The club wants a list made up of who has what table and this needs to be on site that Friday night prior to the swapfest. How many tables the MRAC/MAARS groups want this year has yet to be decided. There will be a free stuff table again this year. Mark, AB9CD has requested four tables to be next to the MRAC club table. Al, KC9IJJ has volunteered to be at the venue on Friday, the day before to let vendors in and to setup. Signage; the club wants to put directional signs out on 124th street to guide people into the event. Early setup will have to be requested in advance. Mark, AB9CD will be liquidating an estate at one of his tables. A well produced Hamfest does need security. There will be a talk-in on the club repeater, 145.390+ offset, Pl 127.3.

The West Allis Hamfest club table worked out well for our club in that we received some renewals and new memberships.

Special Project Committees & Committee reports: The club will be polled at the membership meeting whether some people can man special committees this year. The club still wants to decide what to do with the storage space and equipment that exist at the pioneer village site. We do need more than one person to handle club affairs and maintain equipment stores. Classes on the air are still being done on the MAARS Tuesday night trivia net. Class seminars are being discussed by the MARC. These can be found on the Internet and downloaded with copyright permission.

Repeater Report: Nothing to report on this subject during this meeting.

New Business:

Ham Radio PR at Malls, Discovery World, ETC. Publish CD with HamChatter Archives. Lots of materials related to club activities and history can be found on the DVD's that Dave, WB9BWP has been producing for the MRAC.

Change to name server domain name. Ours was the only domain that never left GMT. That has now been changed, Dave, KA9WXN now has the domain in his name. The information we needed to change our DNS server was generously provided by our prior president Howard Parks, who now lives in Oklahoma. Howard it has been reported, has been active on one of the Milwaukee area radio yahoo groups off and on during the last year. Mark, AB9CD has asked for a leave of absence from club activities for a indeterminate period. A new Post Office Box will be leased for the club that Joe, N9UX can access easily. On the club website, storage is listed as 5 GB. The club needs someone to take over programming of the club website. A volunteer will be asked for at the next membership meeting. Google voice has be mentioned by Joe, N9UX. More details on this will be forth coming. A Gmail account is required for Google voice service. The FM simplex contest is coming up on February 10th, The Wisconsin QSO partly is coming up very soon, this is an event sponsored by the West Allis Amateur Radio Club. The May board meeting has been changed to the 20th of May in stead of on Memorial day.

A motion was made to adjourn the meeting at 8:17 pm by Al, KC9IJJ seconded by Michael KC9CMT. Meeting adjourned at 8:18 pm. The room was returned to an organized condition as it was when the room was opened.

Membership Minutes

The MRAC membership meeting was called to order at 7:06 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. The Mic was passed for introductions. The February meeting will be a food gathering depending on the success of the upcoming Hamfest on February 16th, 2013. The two club radios that are for sale are being demonstrated at this meeting.

Tonight's Program:

Tonight's program will be on Arduino and the Radio Amateur given by Gary Sutcliffe, W9XT. The Arduino is a microcontroller programming board. It uses free downloadable software under a number of different operating systems. The controller board attaches to your computer for programming through the USB port. It is easily expandable through the use of shields. A Microprocessor differs from a Microcontroller in that the microcontroller is for a single purpose, such as a microwave oven or a TV remote. The Arduino Uno costs about $30. Wiring language is really C/C++ Based, simplified and very fast. It has many built in functions that makes it easy to use peripherals. Data input for the software is called Variables.

Variables are stored in Ram memory, when the power is turned off the variables disappear. Digital Input/output signals are either on or off, 1 or 0. Digital Output Programming. A output line is the same as a switch. Simple I/O circuits: I/O pins read state of switches on board. Gary went into a introduction to the programming language of the Arduino Board (C++). Ham Radio and Arduino Projects, APRS, TNC, Beacons, radio control, Satellite tracking, etc... Easy project, make a CW keyer. A CW paddle is basically two switches that control Dits and Dahs.

Arduino summary: Great learning tool, software development, projects. Gary donated a sound card kit from his company to the MRAC for the club Hamfest.

Dave, KA9WXN called for a 10 minute break, then the business meeting part of the night will go on.

Dave, KA9WXN called the business meeting to order at 8:28 pm. The club needs volunteers for the upcoming Hamfest on February 16th. Many volunteers again this year will come from the ranks of the MAARS club which is co-sponsor of the event. Dave, WB9BWP demonstrated the club radios that will be for sale at the Hamfest; club members will be given first chance at purchasing these excellently maintained units. Announcements; potluck for February's meeting. No raffle at the next meeting. Also, Chris Karr from WHS will be coming in to give a talk about HF radio. The club needs a nomination committee for the April election meeting. May will be the annual club auction; no business meeting.

Joe, N9UX gave a brief treasurers report, it is time to renew your membership if you want to keep receiving the HamChatter newsletter. There is $16,800 + in the general fund as of the last of the November 2012. The club sent a donation into the ARRL spectrum defense fund. The balance as of the last of the year was $17,700+ in the black. The club maintains two Cd's at our bank that is rolled over each year. A motion was made by Al, KC9IJJ and seconded by Darlene, to accept the treasurers report as given. A voice vote of the membership was asked for and given.

The FM Simplex contest is coming up on February 10th, a Sunday afternoon, this is a on going contest that is always a lot of fun. Groups in other parts of the country have copied our FM contest format. Dave, KA9WXN will be using the club call again this year from the top of a building downtown. Swapfest, we are still looking for volunteers. The event opens on Saturday at 6 am for Vendor setup. At 8 am the Swapfest is self starts. Again this year there will be a free stuff table at the Swapfest. The club is looking for a place to store the equipment that is used at the MRAC field day site.

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. The club history book will updated by AES SuperFest and new DVD's are going to be made.

New Business:

It was announced that Mark, AB9CD is stepping down as a director of the club and a replacement will be needed. The Wisconsin QSO party is coming up, and the club would like a good showing form its membership. 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.

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

Dave accepted motions to adjourn the meeting at 9:32 pm. Motion made by Dan seconded by Pancho, N9OFA. Meeting adjourned at 9:34 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.

Welcome to all New Members and First Time Attendees!

The Board of Directors would like to welcome you to the Milwaukee Radio Amateurs' Club and to help you make the most of your membership. We are pleased to have you as members, as you represent the future of our Hobby and our organization.

Ice Jams

Q: How serious are ice jams?
In many northern regions ice covers the rivers and lakes annually. The annual freeze up and breakup commonly occur without major flooding. However, some communities face serious ice jam threats every year, while others experience ice-jam-induced flooding at random intervals. The former often have developed emergency plans to deal with ice jam problems, but the latter are often ill-prepared to cope with a jam event when it occurs.

Q: How much of the United States is affected by ice jams?
The Cold Regions Research and Engineering Laboratory Ice Jam Database (IJDB) contains data for ice events in 43 states. Ice jams have been reported most frequently in Montana and New York, each with more than 1400 ice events. Two additional states have reported more than 1000 ice events (Pennsylvania and Minnesota), and 24 states have reported more than 100 ice events. Even mountainous regions as far south as New Mexico and Arizona experience river ice. Ice jams affect the major navigable inland waterways of the United States including the Great Lakes. A study conducted in Maine, New Hampshire, and Vermont identified over 200 small towns and cities that reported ice jam flooding over a 10-year period (USACE 1980). In March 1992 alone, 62 towns in New Hampshire and Vermont reported ice jam flooding problems after two rainfall events.

In a l992 survey, USACE offices reported ice jam problems within 36 states. Of the 36 states, 63 percent reported that ice jams occur frequently, and 75 percent rated ice jams as being serious to very serious (White 1992).

Q: How quickly does flooding occur from an ice jam?

The rates of water level rise can vary from feet per minute to feet per hour during ice jam flooding. In some instances, communities have many hours of lead time between the time an ice jam forms and the start of flooding. In other cases, the lead time is a little as one hour. For example, in March 1992, an ice jam developed at 7:00 a.m. in Montpelier, VT. By 8:00 a.m. the downtown area was flooded. During the next 11 hours, the business district was covered with an average of 1.2 to 1.5 m (4 to 5 ft) of water. The event occurred so quickly that there was not sufficient time to warn residents so they could protect their goods. Even after water levels dropped, damage related to the flooding continued as cold temperatures caused freeze up of wet objects. Damages of less than one day were estimated at $5 million (FEMA 1992b).

Although the actual time period of flooding may be short compared to open water flood events lasting days to weeks, significant damage can result. The winter weather conditions often prevalent when ice jams occur also add to the risks and damages associated with ice jam flooding.
Q: What kind of problems do ice jams cause?
Ice jam flooding is responsible for loss of life, although the number of fatalities in the United States is considerably less than non-ice jam flooding. In the last 30 years at least seven people have died as a result of ice jam flooding. Six of the deaths were attributed to rescue attempts; the other death occurred from injuries sustained when a basement wall collapsed due to pressure from flood waters and ice.
Ice jams in the United States cause approximately $125 million in damages annually, including an estimated $50 million in personal property damage and $25 million in operation and maintenance costs to USACE navigation, flood control, and channel stabilization structures.

Ice jams suspend or delay commercial navigation causing adverse economic impacts. Although navigational delays are commonly short, they may result in shortages of critical supplies, such as coal and industrial feedstocks and large costs from the operation of idle vessels (USACE 1981). Ice jams sometimes cause damage to navigation lock gates.

Ice jams also affect hydropower operations, causing suspension of hydropower generation due to intake blockage, high tailwater, the necessity to reduce discharge, or damage to intake works. Lost power revenue due to such shutdowns can be substantial.

The presence of an ice jam can result in scouring and river bed and bank erosion that may lead to bridge or river bank failure. Ice jams can damage stream channels and improvements so that overall vulnerability to flooding is increased. Riprap can be undermined or moved out of place.

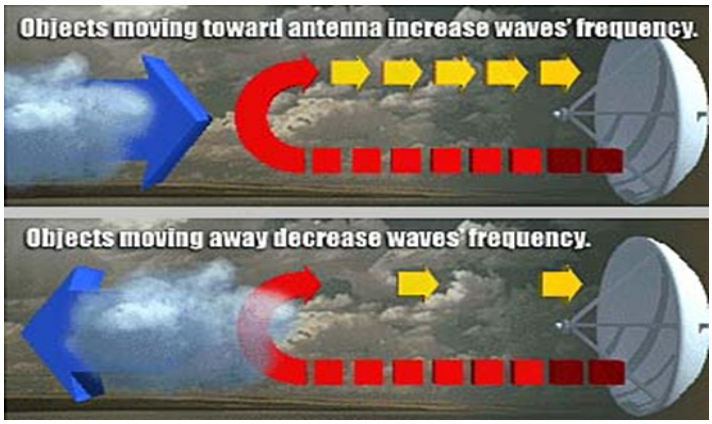
Ice-jam-elated damage to river training structures costs millions of dollars each year. Indirect costs associated with ice jams include loss of fish and wildlife and their habitat. Scour and erosion associated with ice jams may destroy habitat, such as eagle roosting trees, and mobilize toxic materials buried in sediment. Some scouring may, however, be beneficial to wildlife habitat as well. Shallow, vegetation-choked wetlands may become open, allowing for fish and waterfowl spawning and brood habitat.

Severe Weather Preparedness

Doppler radar is a key forecasting tool

As a hurricane approaches the coast or thunderstorms threaten to become severe, you're likely to hear about what Doppler radar shows.
Doppler refers to the principle the Austrian scientist Christian Doppler discovered in 1842. Doppler worked out his ideas using sound waves, long before radio, much less radar, was invented.
But the same principle applies to radar's radio waves and to light arriving from distant stars.
The graphics below show the basic principles behind radar and its Doppler version.

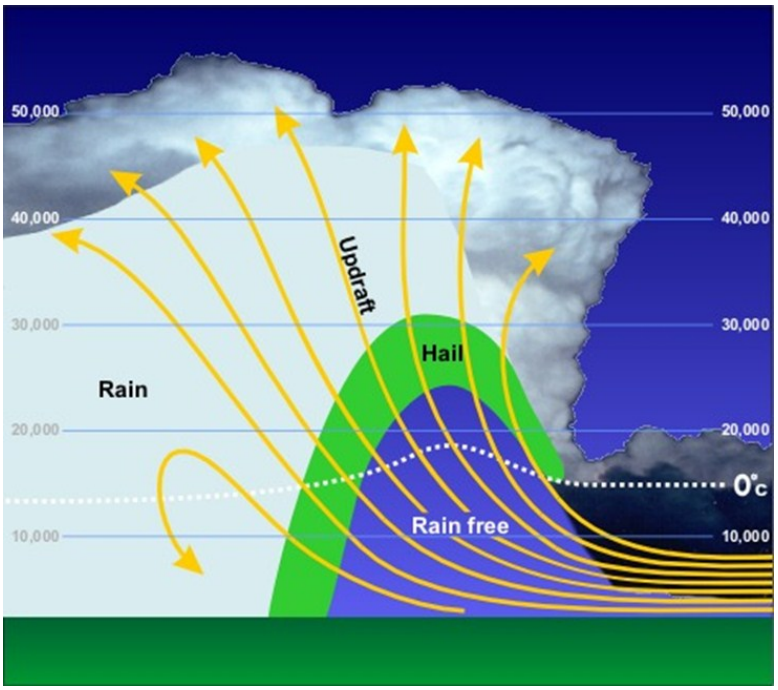
During the 1980s and early 1990s, the National Weather Service installed Doppler radars around the USA. In addition, some television stations have their own Doppler radars, while others use images from the NWS radars.
All weather radars send out radio waves from an antenna. Objects in the air, such as raindrops, snow crystals, hailstones or even insects and dust, scatter or reflect some of the radio waves back to the antenna. All weather radars, including Doppler, electronically convert the reflected radio waves into pictures showing the location and intensity of precipitation.



Doppler radars also measure the frequency change in returning radio waves.
Waves reflected by something moving away from the antenna change to a lower frequency, while waves from an object moving toward the antenna change to a higher frequency.
The computer that's a part of a Doppler radar uses the frequency changes to show directions and speeds of the winds blowing around the raindrops, insects and other objects that reflected the radio waves.
Scientists and forecasters have learned how to use these pictures of wind motions in storms, or even in clear air, to more clearly understand what's happening now and what's likely to happen in the next hour or two.

Thunderstorm Hazards - Hail

Hail is precipitation that is formed when updrafts in thunderstorms carry raindrops upward into extremely cold areas of the atmosphere. Hail can damage aircraft, homes and cars, and can be deadly to livestock and people. One of the people killed during the March 28, 2000 tornado in Fort Worth was killed when struck by grapefruit-size hail.



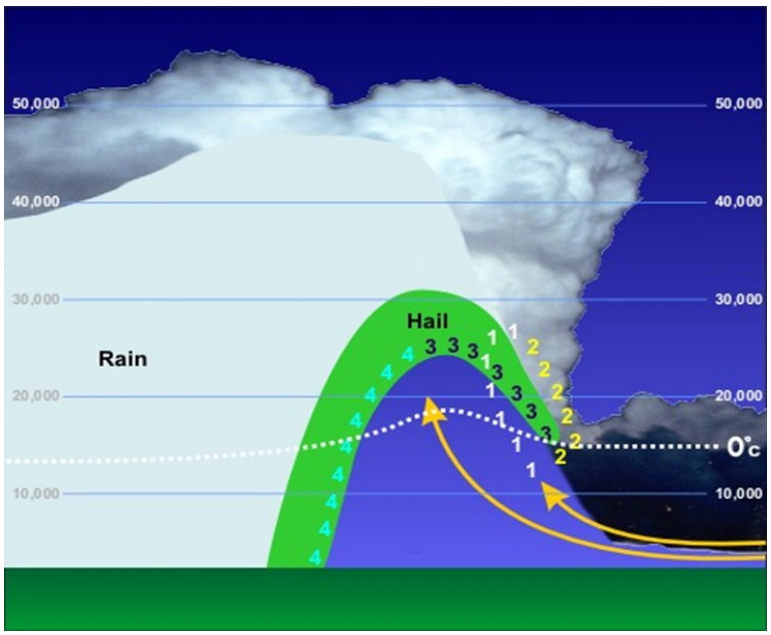
most thunderstorms, New Mexico, Colorado, and Wyoming usually have the most hail storms. Why? The freezing level in the Florida thunderstorms is so high, the hail often melts before reaching the ground.
Hailstones grow by collision with supercooled water drops. (Supercooled drops are liquid drops surrounded by air that is below freezing which is a common occurrence in thunderstorms.) There are two methods by which the hailstone grows, wet growth and dry growth, and which produce the "layered look" of hail.

In wet growth, the hailstone nucleus (a tiny piece of ice) is in a region where the air temperature is below freezing, but not super cold. Upon colliding with a supercooled drop the water does not immediately freeze around the nucleus.
Instead liquid water spreads across tumbling hailstones and slowly freezes. Since the process is slow, air bubbles can escape resulting in a layer of clear ice.

With dry growth, the air temperature is well below freezing and the water droplet immediately freezes as it collides with the nucleus. The air bubbles are "frozen" in place, leaving cloudy ice.

Strong updrafts create a rain-free area in supercell thunderstorms (above right). We call this area a WER which stands for "weak echo region".

Severe Weather Preparedness



This term, WER, comes from an apparently rain free region of a thunderstorm which is bounded on one side AND above by very intense precipitation indicted by a strong echo on radar. This rain-free region is produced by the updraft and is what suspends rain and hail aloft producing the strong radar echo. (right)

1. The hail nucleus, buoyed by the updraft is carried aloft by the updraft and begins to grow in size as it collides with supercooled raindrops and other small pieces of hail.

2. Sometimes the hailstone is blown out of the main updraft and begins to fall to the earth.

3. If the updraft is strong enough it will move the hailstone back into the cloud where it once again collides with water and hail and grows. This process may be repeated several times.

4. In all cases, when the hailstone can no longer be supported by the updraft it falls to the earth. The stronger the updraft, the larger the hailstones that can be produced by the thunderstorm.

Multi-cell thunderstorms produce many hail storms but usually not the largest hailstones. The reason is that the mature stage in the life cycle of the multi-cell is relatively short which decreases the time for growth .
However, the sustained updraft in supercell thunderstorms support large hail formation by repeatedly lifting the hailstones into the very cold air at the top of the thunderstorm cloud.

In all cases, the hail falls when the thunderstorm's updraft can no longer support the weight of the ice. The stronger the updraft the larger the hailstone can grow.
How strong does the updraft need to be for the various sizes of hail? The table (right) provides the approximate speed for each size.

Hailstone size	Measurement		Updraft Speed	
	in.	cm.	mph	km/h
bb	< 1/4	< 0.64	< 24	< 39
pea	1/4	0.64	24	39
marble	1/2	1.3	35	56
dime	7/10	1.8	38	61
penny	3/4	1.9	40	64
nickel	7/8	2.2	46	74
quarter	1	2.5	49	79
half dollar	1 1/4	3.2	54	87
walnut	1 1/2	3.8	60	97
golf ball	1 3/4	4.4	64	103
hen egg	2	5.1	69	111
tennis ball	2 1/2	6.4	77	124
baseball	2 3/4	7.0	81	130
tea cup	3	7.6	84	135
grapefruit	4	10.1	98	158
softball	4 1/2	11.4	103	166

Photo from
National Center for Atmospheric Research

Operational Amplifier / Op Amp Basics, P. 1

Operational amplifiers are one of the workhorses of the analogue electronics scene. Op-amps, as they are also known are widely available in the form of integrated circuits, many costing only a few cents or a few pence for the standard versions. High performance op amp integrated circuits still offer excellent value for money, but obviously cost a little more. In view of their ease of use and low cost, these integrated circuits are used in vast quantities enabling high performance electronics circuits to be developed and designed with a minimum of electronics components.

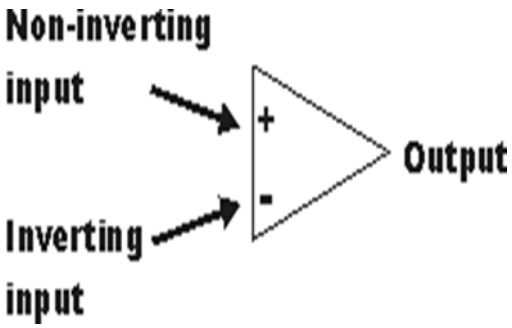
Operational amplifiers are virtually the ideal amplifier. They provide a combination of parameters that are of great use:

- Very high gain
- Very high input impedance
- Very low output impedance

The operational amplifier is what is known as a differential amplifier. The differential amplifier has two inputs and this enables it to be used in a wide number of circuit configurations.

Op-amp basics

The circuit symbol for an operational amplifier consists simply of a triangle as shown below. The two inputs are designated by "**+**" and "**-**" symbols, and the output is at the opposite end of the triangle. Inputs from the "**+**" input appear at the output in the same phase, whereas signals present at the "**-**" input appear at the output inverted or 180 degrees out of phase. This gives rise to the names for the inputs. The "**+**" input is known as the non-inverting input, while the "**-**" input is the inverting input. As the output from the amplifier is dependent upon the difference in voltage between the two inputs, it is known as a differential amplifier.



Op-amp circuit symbol

Often the power supply rails for the operational amplifier are not shown in circuit diagrams and there is no connection for a ground line - often the power rails are assumed to be connected. The power is generally supplied as a positive rail and also a negative rail. Often voltages of +15 V and -15 V are used, although this will vary according to the application and the actual chip used.

The gain of the operational amplifier is very high. While levels of gain may be too high for use on their own, the fact that negative feedback with various characteristics can be used enables them to form the basis of many circuits from very flat amplifiers, to filters, oscillators, switches, and much more.

Gain

The open loop gain of an operational amplifier is exceedingly high - this is the gain when no feedback is applied round the operational amplifier. Gain values may be of the order of 10 000 or higher.

Normally feedback is applied around the op-amp so that the gain of the overall circuit is defined and kept to a figure which is more usable. However the very high level of gain enables considerable levels of feedback to be applied to enable the required performance to be achieved.

The gain of an op amp circuit is important in terms of both the open and closed loop scenarios.

Bandwidth

Another important basic aspect of op amp circuits is the bandwidth. Many op amp circuits provide the high bandwidths, others may be limited to audio frequencies or less. While the open loop gain may fall at a very low frequency - the famous 741 has an open loop break point of just 10 Hz, but with feedback controlling the overall voltage gain, much higher bandwidths are achievable.

Slew rate

The slew rate of a circuit is the maximum rate of change the output can achieve. For example if a large voltage change is required, then the output of the circuit may not be able to deliver the rate of change to move from one voltage to the next in the time available.

The slew rate may be a limiting factor even if the voltage change is within the frequency bandwidth of the circuit. The limiting factor is not the frequency, but the rate of change of voltage for the output, and it obviously becomes more of an issue when for large output levels. The gain of an op amp circuit is important in terms of both the open and closed loop scenarios.

Offset null

The offset null capability is available in many op amp chips. It is used to remove or significantly reduce the small DC offsets that occur.

The offset null is important in circuits where DC coupling is required and where the absolute DC levels are of importance. The small DC offsets that occur in op amps are amplified by the levels of gain of the circuit, and they can create problems for some DC applications.

Op-amp circuits

There is a huge variety of electronic circuits that can be designed using operational amplifiers. These opamp circuits range from amplifiers to multivibrators, integrators to comparators and oscillators to timers. It shows how versatile these op-amp integrated circuits are. All these different circuits tend to use the high input impedance, low output impedance and high gain of the op-amp, combined with the fact that the operational amplifier is a differential amplifier. In most circuits, feedback (usually negative feedback) is placed around the op-amp and the way this is done provides the required function. Only in very few applications is no feedback applied.

Packages

The packages in which electronics components are available is very important. Many electronics components are available in a wide variety of package styles, and the operational amplifier is not exception. Like many other electronics components, a vast number are used as surface mount components in mass produced electronics products. They are available in the SOIC (small outline integrated circuit) package as well as many others. Some are even available in five leaded versions of transistor packages and this makes them ideal to drop into a circuit without using up much board space. However the more traditional style of electronics component packages are also available. They are available in the DIL (dual in line) package, often as a single operational amplifier in an eight pin DIL, or duals in eight pin packages (with no offset null connections) or fourteen or sixteen pin DILs.

Operational amplifiers are in widespread use in analogue electronics design and production. These op amps provide a particularly useful combination of circuit parameters that make them an indispensable tool for the electronics design engineer. While digital electronics is growing, the use of op-amps will nevertheless remain in vast quantities as a result of their cost, performance and ease of use. These electronics components will therefore remain very cheap for many years to come.

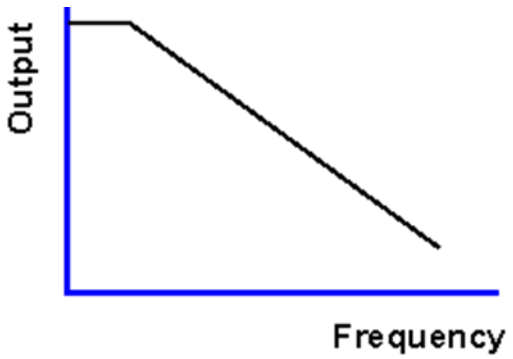
Op Amp Bandwidth & Frequency Response

Operational amplifier bandwidth and frequency response are key parameters for any circuit.
Typically op amps are used for comparatively low frequency circuits, but the performance of these chips is improving all the time, and much higher bandwidth integrated circuits and hence circuits are available.

The bandwidth of the op-amp itself obviously has a bearing on the design of the overall circuit and the frequency response or bandwidth available for the circuit.

Op amp bandwidth basics

The frequency response of a typical integrated circuit will often start to fall at a very low frequency when operated in its open loop mode.



Open loop op amp frequency response

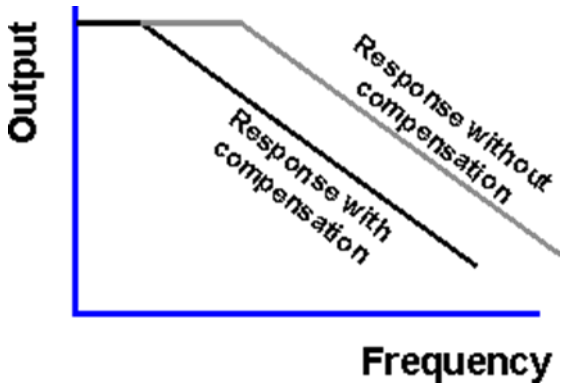
The point at which the frequency starts to roll off is known as the break point [typically the -3dB point is known as the break point].

Most op amps have their bandwidth limited as a result of what is called compensation which is added.

Frequency compensation

Most op amp chips have frequency compensation added to them. It is introduced to ensure they remain stable and do not produce unwanted high frequency spurious oscillations. It is required because stray capacitances in the chip can cause unwanted phase shifts at high frequencies, e.g. 1 MHz and more. While the stray capacitance levels may not be significant at low frequencies, they can cause significant problems at higher frequencies, and they are almost impossible to eliminate in the chip.

Most op amp IC manufacturers solve this problem by intentionally reducing the open-loop gain at high frequencies. This is called compensation and it is normally implemented by bypassing one of the internal amplifier stages with a high-pass filter. The aim is to reduce the gain to less than unity at frequencies where there could be a possibility of oscillation. Very early op amps did not have this frequency compensation built into the chip and external compensation components were required on the pins provided - the 709 was a prime example of this. Later chips such as the 741 had internal compensation making the chips much easier to use. However they also had a low open loop break point. In the case of the 741 it was just 10 Hz. This compensation is now standard in all general purpose op amp chips. Modern chips continue to have it built in a standard.



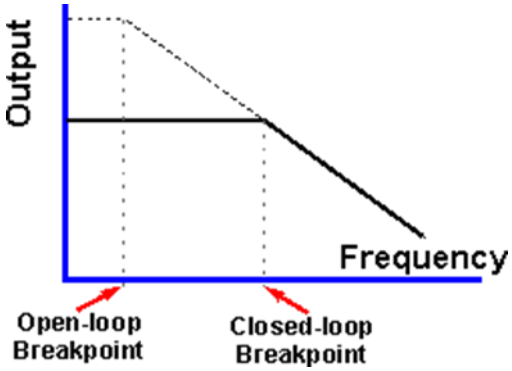
Op amp frequency response with and without frequency compensation

Frequency compensation is the major reason why op-amps are not very fast devices - the higher frequency components of the signals are intentionally attenuated. The frequency at which the Op amp open loop gain falls to unity, is called fT - as for bipolar transistors. This frequency gives a good indication of the speed of the op-amp.

However, comparators, do not use negative feedback and as a result they are designed without compensation and their speed of operation is typically much faster than that of op amps.

Feedback vs. bandwidth

In view of the very high gain of the operational amplifier it is possible to, in effect, exchange some of the open loop gain for bandwidth.
For a circuit like this, applying feedback will reduce the gain but increase the bandwidth.



Closed loop op amp frequency response

Op amp gain bandwidth product
When designing an op amp circuit, a figure known as the op amp gain bandwidth product is important.
The op amp gain bandwidth product is generally specified for a particular op amp type an open loop configuration and the output loaded:

GB = Av • f

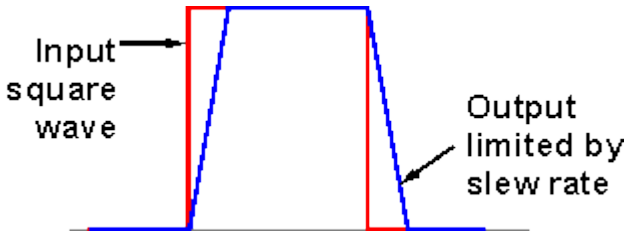
Where:
GB = op amp gain bandwidth product
Av = Voltage gain
f = cut off frequency (Hz)

The op amp gain bandwidth product is constant for voltage-feedback amplifiers. However it is not applicable for current feedback amplifiers because relationship between gain and bandwidth is not linear.
Therefore decreasing the gain by a factor of ten will increase the bandwidth by the same factor.

Op Amp Slew Rate

The slew rate of an operational amplifier may be important in many applications.
The op amp slew rate is particularly important parameter in applications where the output is required to switch from one level to another quickly. In these applications the rate at which the op amp can change between the two levels is important.

Op amp slew rate basics
The slew rate is the rate of change in the output voltage caused by a step change on the input.
It is measured as a voltage change in a given time - typically V / µs or V / ms.



Op amp slew rate illustration

A typical general purpose device may have a slew rate of 10 V / microsecond. This means that when a large step change is placed on the input, the device would be able to provide an output 10 volt change in one microsecond.
The figures for slew rate change are dependent upon the type of operational amplifier being used. Low power op-amps may only have a slew rate of a volt per microsecond, whereas there are fast operational amplifiers capable to providing slew rates of 1000 V / microsecond.
Op amps may have different slew rates for positive and negative going transitions because of the circuit configuration. They have a complementary output to pull the signal up and down and this means the two sides of the circuit cannot be exactly the same. However it is often assumed that they have reasonably symmetrical slew rates.

Op amp slew rate rationale

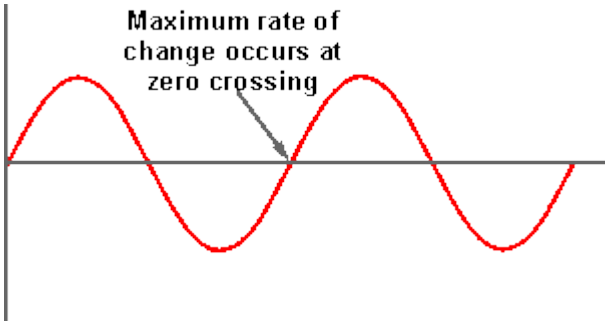
The slew rate issues arise from the internal circuitry within the op amp. There are two main reasons for the slew rate limitations of most chips:

- ***Frequency compensation:*** The capacitors used within the chip to reduce the high frequency response have a marked effect on the slew rate. Limiting the frequency response also limits the rate of change that can occur at the output, and hence it affects the slew rate.

Output driver limitations: Within the chip, and particularly within the output driver, the low current levels limit the rate at which change can occur. This limits the slew rate of the op amp. It is found that this is the area of the performance where rise and fall slew rates may be different. This results from the different ways that the chip increases and decreases the output voltage. For example the output may employ a form of complementary output stage. The slightly different characteristics of each half will cause a small amount on difference between the rise and fall slew rate capabilities.

Slewing distortion

If an op amp is operated above its slew rate limit, signals will become distorted. The easiest way to see this is to look at the example of a sine wave.
The maximum rate of voltage change occurs at the zero crossing point.

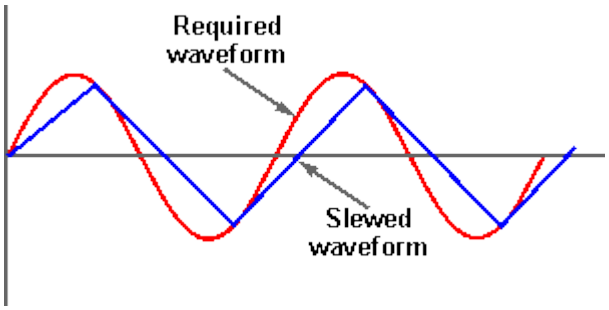


Maximum rate of change of sine wave occurs at zero crossing point

It is possible to find the maximum frequency or voltage that can be accommodated. A sine wave with a frequency of f Hertz and peak voltage V volts requires an operational amplifier with a slew rate of 2 x Π x f x V volts per second.

The Experimenters Bench

This is required to ensure the maximum slew rate requirement which occurs at the zero crossing point can be met.



Op amp slewing distortion (limit)

As can be seen in the diagram, in the limit, the op amp slewing distortion will result in the creation of a triangular waveform. If the frequency is increased the op amp will be even less able to keep up and therefore the amplitude of the output waveform will decrease.

As can be seen in the diagram, in the limit, the op amp slewing distortion will result in the creation of a triangular waveform. If the frequency is increased the op amp will be even less able to keep up and therefore the amplitude of the output waveform will decrease.
The slew rate may also not be linear over the whole range. As a result the waveform may exhibit a faster rise for the first part of the change, then reverting to the more expected slew rate.

Op Amp Offset Null

The op amp offset null capability is one that is available on many op-amp chips.
The offset null capability is used to reduce small DC offsets that can be amplified. These can be important in DC amplifiers where these small voltages can then become significant where large gains are required.

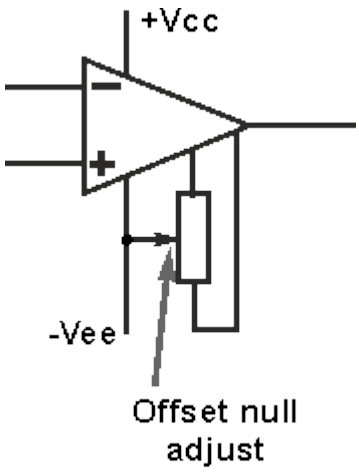
Offset null basics

An op amp is a differential amplifier. This means that when there is no difference between the two inputs, e.g. when the inputs are shorted together, there should be no voltage on the output.

Unfortunately under these circumstances there is always a small offset because these amplifiers are never totally perfect. It typically results from mismatches in the input bias arrangements within the amplifier.

The output can be made completely zero if a small offset voltage is applied to the inputs. This is known as the input offset voltage.

For circuits where it is necessary to remove or null the offset, many op-amp chips provide two pins that enable this to be done. The offset null adjustment requires a potentiometer with its wiper connected to the negative supply with some op amps or to 0 V with others so it is necessary to check the data sheet. The value for the potentiometer may typically be around 100 KΩ but again check the data sheet for the most suitable value.



Op amp offset null adjustment

On op amps with an offset null capability two pins are provided as shown in the diagram.

Early Radio: Military Communications

A Battery Stories

The 1/92nd Field Artillery Association - Vietnam

The Whistling Howitzers Over 62nd Maintenance

By Tom Kanis

OK, this is a War Story, and you all know the difference between a War Story and a fairy tale, right? Well, a fairy tale starts out "once upon a time", and a War Story starts out, "hey this is no bulls**t".

I was working as AXO of A Btry on Artillery Hill in July of 1971. Sgt. Rick Smith had Howitzer Section 2. Rick was a short intense blond-headed guy and really was into being a gun chief. On the particular evening in question we had a fairly light program of night fire scheduled, and it was going to be competed about 2330, which would make for a lighter load than we had been experiencing up until that point. The XO tried to use only two howitzers for these night-fire DT programs, so that the firing battery would get a full night's rest every other night. All was good news until we got a call at about 2300 from one of the Montagnard 'villes to the north of FSB Kelly, asking for sporadic illumination (somehow interpreted to be every hour on the hour) from then until dawn. They were nervous about some Intel estimate and wanted to light up the area to deny it to the bad guys.

The XO, LT Rich Alvino told SGT Smith that his section would be the one to shoot the Illum mission. His guys accepted it with the usual friendly grumbling. On the other hand, I had an idea.

Early Radio: Military Communications

SGT Smith's gun crew could get their gun laid, get the 'joes laid out, fuses installed and time set, powder charges cut and under a tarp, out of the dew. I, being the intrepid Artilleryman that I was, could load, check the lay and fire the gun by myself, and SGT Smith and party could go to bed. In retrospect, the tough part would be to pick up the 95-lb projo and getting it in the breech. The gun crew did as bid and happily went off to bed after firing the midnight round of the program. About 0045, I loaded the second round, and called the FDC to report "Safe and Ready" at 0059 by my watch. LT Shugart in the FDC checked my data read-back and gave me the word to fire. I put down the field phone, snatched at the lanyard and the gun went off and the round sailed out over Buon Ho Lake and popped most satisfactorily---this was going to work just fine! The third and fourth rounds worked just fine, too.

The problem showed up on the fifth round, due out at 0500. I was getting pretty tired, and I had to take two cuts at it to get the 'jo up to the breech. It almost fell back out of the breech before I got the short rammer-staff up behind it. I rammed the 'jo as hard as I could with one hand and stepped back to the gun pit's ammo bunker. I grabbed the charge, stuffed it into the gun and slammed the breech shut. There, that would keep the damn thing from falling out! I primed the firing lock and inserted it, then read back the data to the FDC and got the word to fire. Standing to the right of the breech, I jerked at the lanyard, expecting the usual boom and recoil. Instead, I heard a loud whistling noise that was slowly increasing in pitch. Visions of a dreaded in-bore explosion loomed in my head! We had been shown pictures of these catastrophes at Ft Sill, and it wasn't pretty at all. I dived out of the gun pit, as the noise grew higher in pitch.

At last, there was a "clunk" and the more accustomed boom as the propelling charge ignited and the gun recoiled, although not as much as usual. I stood up and tried to see if the round would pop over the target, but nothing at all could be see. I sat there for a couple of minutes trying to figure out what happened. The only thing I could think of was that the powder was burning and whistling past the not-fully-seated projo. As the gas pressed the 'jo upward into the centering slope, the seal got tighter and the whistle got higher in pitch. At last, the round had clunked into place and the powder had sufficient resistance to develop pressure and the gun fired, albeit at a much lower velocity. The round probably landed in Buon Ho Lake. I picked up the field phone and told the FDC that the last round didn't sound right and that I didn't observe the round illuminate. We agreed that I should shoot the mission again which I did after very thoroughly ramming it home! The next round fired just fine as did the last one at 0600. The sun was a very welcome sight over eastern horizon. And that is the story of the whistling howitzer, and that 's no bulls**t

Tom Kanis
A/1/92
1971

A- in May 1970 LZ Wildcat

By Robert Southern (Captain)

Two platoons from Battery A (-) in support of 4th Infantry operation Bin Try moved to the Plei Djareng air strip by road from Artillery Hill in two moves in May 1970. The Chief of Firing Battery (SSG Max) commanded the first platoon followed a week later by the second platoon (both from Artillery Hill) commanded by myself, CPT Southern.

The moves by road were memorable in that a promised Air Observer never appeared for either movement. In my move, we halted the convoy at the intersection of the main road from Artillery Hill (past 4th Div base camp) and the road west into Cambodia and towards Plei Djareng. We contacted 1/92 TOC Artillery Hill and told them there was no air observer on the frequency given us and no observer aircraft visible. They had answered our first radio call but did not answer that one. After a few minutes, all section chiefs were told we were going in and each vehicle was to keep the vehicle in front in sight at all times. They were told we were to be moving as fast as road conditions would allow and that if we were attacked to return fire. Disabled equipment other than small arms would be abandoned but personnel would be boarded on the remaining vehicles and we would keep moving. There was a radio in my jeep in front and in the rear vehicle. In the back seat of my jeep was a man who said he had made the trip by road once before. We were to turn right some distance down the road (it was shown on the map) and proceed to Plei Djareng airstrip. Hoping not to miss the road and go galumping in Cambodia we took off at as high a speed as the road would permit. After some minutes an Army MP appeared in the middle of the road and waved us to turn right. Thank God for the MP's. Usually can't find one when you need one. Void of air observers cover (promised) and convoy escorts (denied) both platoons made it safely. I understand why the history was incorrectly stated. It simply would not do for the truth to be known.

Each platoon left separately and went by choppers into Cambodia . We stayed at our first locations (your narrative LZ Dragon and Spearhead) only a few days. If they are in order of our departures SSG Max's platoon was at LZ Dragon and we were at LZ Spearhead. On the afternoon of the last day there, we were ordered to load the afternoon/evening of the last day in preparation for the move early the next. That night we were hit Viet Cong/NVA? There were no casualties.

At the second locations (LZ Scott and LZ Wildcat - if your narrative is correct - I presume so - memory fails me on such details) we remained for the same number of days. Not more than four. On the last night there we were attacked once again, this time with sappers. Things got kinda wild.

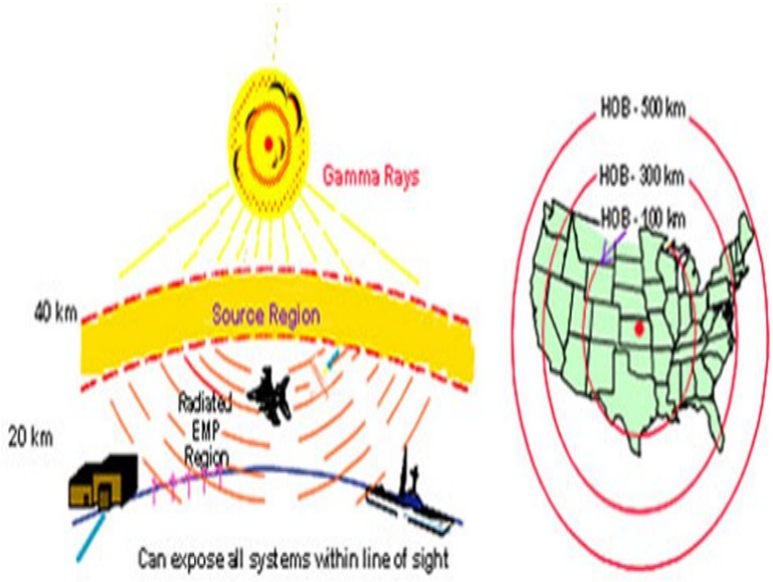
Early Radio: Military Communications

A bunker on the infantry company's perimeter near our two howitzers was blown by sappers killing the three or four infantrymen inside. The LZ (if your chronology is correct - Wildcat) included a 105mm battery from the 4th Inf Div Arty, our two 155mm pigs, an infantry company on the perimeter, and the infantry company's battalion headquarters.
When the attack came we were contacted by land line from the 105mm Btry that we were not to fire self illumination. The Inf Bn Co was fearful of giving away our position. Shit!

The VC/NVA probably had a map made from three or so days we had been there. A sapper ran into one our gun pits across the berm, placed a satchel charge under the tube in front of the equilibrator and ran back over the berm towards the previously blown infantry bunker. The sapper was seen coming into the gun pit by one of the cannoneers who put his M-16 on full auto and splattered everything (except the sapper) in the gun pit. Jock strap and all, the sapper may still be running. Smilingly it was suggested to the cannoneer that the next time he take a good kneeling position and on semi auto, aim carefully, and fire one or two times (maybe more if needed). The howitzer was destroyed. It had been their only reason for the attack. All personnel (I think three maybe four) infantry in the blown bunker were killed. The only casualty among the 1/92 FA was a Vietnamese interpreter. One of our personnel, early in the attack saw him running across the position. Knowing only in the dark the running person was an oriental, the man tried to fire but his rifle jammed. He then grabbed it by the barrel and swinging it as a baseball bat clobbered the interpreter as he went by. The Vietnamese interpreter survived.

The next morning we were informed the 4th Div. ADC Maneuver was coming in to survey the damage, including our destroyed howitzer. When I spoke to the gun chief to tell him of the visit, the gun chief asked me if he could tell the ADC about the marijuana he and other members of his gun crew had smelled coming from the direction of the blown bunker the night before, prior to the attack. I told him he could tell the ADC anything he wished. When asked by the ADC what happened the gun chief told him all, including the marijuana. The ADC maintained eye contact with the Gun Chief all during the telling, as did the gun chief. I had looked only at the eyes of the ADC who glanced in my direction once in the last instant before he left our position. He said nothing.
The Infantry Battalion Commander was relieved of command. We were airlifted from there back to Vietnam during which I had the pleasure of riding in a CV-2 Caribou with the Infantry Battalion Commander. After we landed in Vietnam I went to him, stuck out my hand, and shaking his told him what a distinct pleasure it had been serving with him. We both smiled broadly. The asshole.

After landing I was met by my Bn XO, MAJ Jose Riovo. I was sitting on a log wondering what next when he, driving his own jeep, stopped and asked if I needed a ride. He walked over and handed me a cold beer. I sat on the log and took a long drag. I had been gone over a week, was covered with dirt and dust, and the only clean spot on my body was my face where I taken a swallow of beer. He took a picture. I still have it.



EMP Sky Burst

Next Regular Meeting

The next meeting will be on Thursday, February 28th 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:

February 28th, 2013

***March* 28th, 2013**

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**

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

Name of Net, Frequency, Local Time	Net Manager
Badger Weather Net (BWN)	W9IXG
Badger Emergency Net (BEN)	NX9K
Wisconsin Side Band Net (WSBN)	KB9KEG
Wisconsin Novice Net (WNN)	KB9ROB
Wisconsin Slow Speed Net (WSSN)	N1KSN
Wisconsin Intrastate Net - Early (WIN-E)	WB9ICH
Wisconsin Intrastate Net - Late (WIN-L)	W9RTP
ARES/RACES Net	WB9WKO
* 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**

or by Post to:

Michael B. Harris

807 Nicholson RD

South Milwaukee, WI 53172-1447

VE Testing:

March 30th, 2013

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

Area Swapfests

May 5th, 2013 AES SUPERFEST 2013 Location: Milwaukee, WI Type: ARRL Hamfest
Sponsor: Amateur Electronic Supply
Website: http://www.ashram.com

March 3rd, 2013 SRFARS Hamfest Location: Sterling, IL
Type: ARRL Hamfest
Sponsor: Sterling Rock-Falls ARS
Website: http://w9mep.org

March 9th, 2013 Eau Claire ARC Auction Location: Eau Claire, WI Type: ARRL Hamfest
Sponsor: Eau Claire Amateur Radio Club
Website: http://www.ecarc.org

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, Box 240545, Milwaukee, WI 53223

Email may be sent to: **w9rh@arrl.net .** Our YAHOO newsgroup:

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

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

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

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. 7:00 PM 145.130 MAARS Trivia 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 on 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 8:00 PM 28.365 10/10 International Net (SSB)

Sun 9:00 PM 146.91 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

SSB frequencies below 20 meters are LSB and for 20 Mtr and above are USB.