# MRAC Hamateur Chatter

The Milwaukee Radio Amateurs Club

November 2015 Volume 23, Issue 11

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

## Presidents' Letter

Now that winter is closing in, a reminder that our meeting this month will be Thursday, November 19th.It is a week earlier due to the Thanksgiving holiday. This month, we hope to select a new club logo for our 100th anniversary. Remember that this is a logo contest open to all hams. The winner will get a jacket with new logo and a year's free membership in the club.

We want the new logo to showcase and celebrate the 100 years of the organization. In terms of design, it's important to remember that the new logo also needs to be readable at various sizes (from very small on a business card to very large on a banner). We plan on using this new logo just like the ARRL used their 100th anniversary logo, and all of our promotion and documentation moving forward will use this logo.

You do not need to be a professional artist to enter! Once the final logo is selected, we will work with a professional graphic artist to polish the look for use. So, please bring your designs and ideas on a 8.5 x 11 sheet of paper (in color, if possible) with your name and callsign to the club meeting on November 19th.

One additional reminder: we will have a couple of tables at the West Allis Radio Club Swapfest on January 9, 2016. This is always a good hamfest to promote MRAC, so please consider spending time at the club tables to help with promotion. The more friendly faces at the table, the better. If you have an item you would like to sell, please consider selling it at our tables and consider staffing the table at the same time to help support the club.

*'73 Dave, KA9WXN*

**MRAC Officers:**

***Terms Expiring in 2016***

- President – Dave, KA9WXN
- V-President– Vacant
- Secretary – MBH, KC9CMT
- Treasurer – MBH,,KC9CMT
- Director – Vacant

***Terms Expiring in 2017***

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

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**(414) 332- 6 7 2 2**

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www.w9rh.org

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# Board of Directors' Meeting Minutes



Board of directors meeting called to order at 7:10 pm by Dave Shank, KA9WXN club president.

Director's present: Michael KC9CMT, Dave KA9WXN, Hal, KB9OZN.

Absent: None

**Preliminary Discussion**: The Treasurers report was presented by Michael, KC9CMT. The treasurers report was approved as read by motion a of Al, KC9IJJ, seconded by Hal, KB9OZN. The September balance ended with $19,686.54 in Club accounts. The Board of Directors' meeting minutes were accepted as published in the October chatter by a unanimous vote. We still will be sending the ARRL Spectrum Defense Fund $100 in late 2015. MRAC will be getting a table at the January West Allis Club Swapfest. Will need to talk to Redemption church about present and future reserved space for club meetings. The MAARS group forwarded payment for their half of the yearly phone expense per agreement. The November board meeting will be on the 16th this year due to the Thanksgiving Holiday. The West Allis group Hamfest will be on January 9th in 2016, at the Waukesha Expo center. Our FM simplex contest will be on the 7th of February in 2016. Certificates for the February FM simplex contest still need to be made up and sent out. The Club needs more people to help out with the scoring of the contest.

**Meeting programs**: An October meeting about antenna maintenance in preparation for bad weather months was suggested, and a wrap up of the Makers' Faire event, which was an excellent event for us this year. November meeting will be on the 19th this year due to the Thanksgiving holiday, with a program on Mesh networks; loading software on wireless access points to gain access to radio bands, in addition to voting on a new 100th Anniversary logo design. No meeting in December, January will be a primer on the upcoming FM simplex contest. February will be the Food Gathering that goes along with the MRAC/MARRS swapfest. Getting press on the Ham Nation Podcast would be good press for our 100th Anniversary in 2017. A presentation on the advances in solar power collection would be a good topic for the future. Our April meeting is the annual election, plus a presentation TBD. The May meeting will be the annual auction as in past years.

**Special Project Committees & Committee reports**:

Repeater Report: The Yaesu Fusion repeater that Yaesu gave the club a great deal on, went on-line as of August. The repeater is the DR-1X, and we have had no lockup issues as happened with the demo unit. Dave, WB9BWP is the repeater trustee and a control operator. The club would like more than one repeater control operator. A club repeater control operator should be a extra class operator to have the kind of privileges that are necessary to operate field day to its fullest extent. With the new digital repeater online, the club needs to redo our co-ordination with the Wisconsin repeater association. The new digital repeater does both analog and Digital voice transmissions. The WARAC has requested to use the MRAC repeater for their Wednesday night 8pm net, due to problems with the MATC repeater, they normally use.

**New Business**:

We need to start planning event stations for the entire year of 2016/17. Dave, KA9WXN will attempt to generate interest among the membership in forming a committee to handle planning. Dave, KA9WXN talked to the people from Gold Medal that does embroidery, such as patches, hats, and jackets. A contest to design a new logo for the club for its 100th year celebration. The winner of the contest will get a one year free club membership. New logos will be picked by a blind election by the membership. The winner should be picked by the November meeting. 2017 is the 100th anniversary. The contest will be open to club and non-club people, must hold a Amateur Radio License to be in contest. Copy to be included in the new Logo, ARRL affiliation, Club 100th year, and callsign with Frequency. There has been some talk among the board members regarding a banquet during the 100th anniversary year, around the time of the AES SuperFest. With invitation to ARRL section managers etc.

**Swapfest Committee:** The Clubs' joint swapfest will be on February 16th, 2016. Complimentary tickets for the swapfest should be ready by the November membership meeting. The club would like to promote the 10-10 international radio club. Dan or Dave are going to contact American Science and Surplus, and the Markers' people about having a table at the MRAC swapfest in February of 2016. Tickets will be printed in December, with advanced table sales and ticket orders mailed the last week on January. Photos should be taken of all club activities and uploaded to the club Facebook page and copied to the newsletter editor for insertion into the paper. We will continue to use the Google spreadsheet for the 2016 swapfest.

**Special Projects**: The club needs someone to take over the FM simplex contest for February of 2016. The club really needs PR and recruitment, business cards have been printed and will be handed out at all personal activities. Joe, N9UX has postulated about doing another balloon launch in 2016. Work needs to start on the 100th anniversary celebration that falls in 2017. The MRAC has been placed on a waiting list for the State Adopt A Highway program for our nearby area of Milwaukee County. Will ask about a 20 x 20' area at the 2016 September Makers' Faire. Dave, KA9WXN has started working on a club website using the Wordpress foundation. Dave will be creating accounts for some officers of the club that will need access. Tom P@aesham.com has been talking about having a club sponsored get together at AES on Saturday mornings.
Clubs throughout the country need to use the spectrum that they have been given. The 220mhz and 440mhz bands are not used very often in the Milwaukee area. A Club calendar is a project that the Board of Directors' would like to pursue. Dave, KA9WXN has been working on this idea. A schedule of upcoming events should be printed in the chatter each month.

A motion was made to adjourn the meeting at 8:04 pm by Michael, KC9CMT, seconded by Hal, KB9OZN. Meeting adjourned at 8:25 pm. The Library room will be returned to an orderly condition as it was when we arrived.

## Choosing Ceramic Capacitors

It may seem a bit mundane but choosing ceramic capacitors can cause some problems and confusion. Ceramic capacitors have taken over from aluminum electrolytic capacitors and tantalum electrolytics in a lot of cases and even film capacitors but there are pitfalls. For example, the very low ESR (equivalent series resistance) of ceramic capacitors can cause instability with some voltage regulators, particularly ones with low dropout voltages. The Texas Instruments TPS7350 is unstable with low ESR so you could end up having to add a series resistor to make the ESR of your capacitor higher.

You could use a solid tantalum electrolytic capacitor instead of ceramic, but they are now fairly expensive and you still need to be careful when you choose one – too high an ESR can also result in instability. If you cannot avoid using such regulators then you need to be careful in your capacitor choice and it is always a useful precaution to include the provision for a series resistor when using a ceramic capacitor with a low dropout regulator.

With ceramic capacitors you have a choice of dielectrics. They are usually called low, medium and high K or Class 1, 2 or 3 but nowadays you are more likely to come across notations such as C0G, NP0 or Y5V. These are not actually descriptions of the dielectric but of its characteristics. Low K or Class 1 capacitors are temperature compensating capacitors although the most common is NP0. This is NP zero – the zero denoting the temperature coefficient. So, it is fairly stable with temperature, usually +/-30ppm/C. N220 would have 220ppm/C negative temperature coefficient and P100 would have 100ppm/C positive temperature coefficient but mostly people want a temperature stable capacitor. Absolute tolerances of Class 1 capacitors is also pretty good – down to 2% or even 1%.

Capacitors with low relative permittivity (Class 1) will become physically quite large when you need a high value so higher permittivity helps keep size and cost down – hence the Class 2 and 3 types. These might be described such as Y5V or X7R but these are actually really definitions of the upper and lower temperature range and temperature coefficient. So X7R is for -55 to +125C operation and +/-15% variation over the operating temperature range. Wikipedia has a good description under "Ceramic Capacitor". Some of the capacitors have very poor initial tolerance (as much as +80%/-20%, like some electrolytic capacitors) and very poor temperature stability. Their main use is just to have a large capacitance where you don't care too much about the "quality" of the capacitance such as for a decoupling capacitor. They can have other undesirable characteristics such as dielectric absorption and voltage dependent capacitance. This makes them unsuitable in certain circuits such as filters or high quality amplifiers where they can cause distortion.

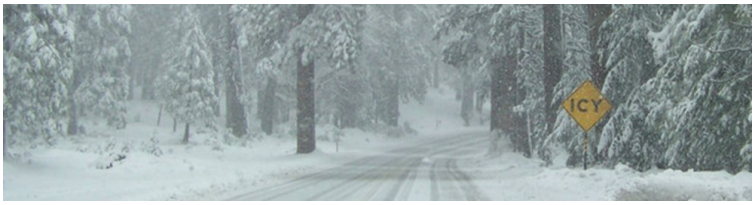
Dielectric absorption can manifest itself as a "bounce back" in a capacitor voltage when it has been discharged. I have also seen it as a drop back in the voltage a capacitor has been charged to when the charging source is removed in a sample and hold. The easiest way to imagine the effect is to consider the capacitor to consist of two (or more) capacitors connected by a resistor. If you simulate such a scenario, you can observe the effect for different circuits.

This simulates the 10uF capacitor as having an extra 200nF connected by a 1k resistor. The capacitor is charged to 5V through the switch which has a 1 ohm ON resistance. When the switch is opened (with a very high OFF resistance) the capacitor voltage drops – red trace. This is because the 200nF capacitor hasn't completely charged (blue trace) so when the charging source is removed the two capacitors balance their voltage through the 1k resistance. Note that this is a simulation of how the effect manifests itself rather than a description of the internal makeup of the capacitor. In fact, more complex models of capacitors involve multiple capacitors and resistors in order to better simulate the actual characteristics.
Here the capacitor is charged to 5V then discharged. The discharge switch is controlled by the blue trace and when that switch is turned off the voltage on the capacitor "bounces back" by 10mV. This is because the 200nF capacitor has not fully discharged so again, the capacitors balance their voltage. Note that the times involved can be very long. A Wima test for dielectric absorption waits for 15 minutes before checking the residual voltage after discharge.

Kemet have an interesting document called "Why that 47 uF capacitor drops to 37 uF, 30 uF, or lower" which has a good description of some of the problems with various capacitor types and dielectrics.

I haven't actually touched on other capacitors such as class X and Y or various film capacitors but that will have to wait for another time. Ceramic capacitors seem to be king for most applications although that is mainly because of cost and size rather than them necessarily being the "best" for some applications.

## Winterize Your Home




Winter storms can range from a brief period of extreme cold temperatures, to days of snow, blowing wind, and white-out conditions. Preparing in advance helps you tackle winter weather before it even begins. Two of the biggest safety issues as the winter season approaches is knowing how to deal with power outages in cold weather, and understanding how to drive (or when not to drive) in snowy conditions. Use these checklists to help beat the cold before it starts, and then head over to the Winter Driving Tips page to learn how to handle the snow.

Winter Storms Home Preparedness Checklist

- Winterize your home to extend the life of your fuel supply by insulating walls and attics, caulking and weather-stripping doors and windows, and installing storm windows or covering windows with plastic
- Winterize your house, barn, shed or any other structure that may provide shelter for your family, neighbors, livestock or equipment
- Clear rain gutters; repair roof leaks and cut away tree branches that could fall on a house or other structure during a storm
- Maintain heating equipment and chimneys by having them cleaned and inspected every year
- Insulate pipes with insulation or newspapers and plastic and allow faucets to drip a little during cold weather to avoid freezing; Running water, even at a trickle, helps prevent pipes from freezing
- All fuel-burning equipment should be vented to the outside and kept clear
- Keep fire extinguishers on hand, and make sure everyone in your house knows how to use them
- Learn how to shut off water valves (in case a pipe bursts)
- Insulate your home by installing storm windows or covering windows with plastic from the inside to keep cold air out

Hire a contractor to check the structural ability of the roof to sustain unusually heavy weight from the accumulation of snow or water, if drains on flat roofs do not work

**Carbon Monoxide Safety**

- Never use a generator, grill, camp stove or other gasoline, propane, natural gas or charcoal—burning devices inside a home, garage, basement, crawlspace or any partially enclosed area. Locate unit away from doors, windows and vents that could allow carbon monoxide to come indoors
- The primary hazards to avoid when using alternate sources for electricity, heating or cooking are carbon monoxide poisoning, electric shock and fire
- Install carbon monoxide alarms in central locations on every level of your home and outside sleeping areas to provide early warning of accumulating carbon monoxide
- If the carbon monoxide alarm sounds, move quickly to a fresh air location outdoors or by an open window or door Call for help from the fresh air location and remain there until emergency personnel arrive to assist you.

Source: NOAA.gov

## Tips for Safe Driving on Snow and Ice

**Expert Advice for Staying in Control**

**How Not to Handle a Skid**

The front tires of this Chevrolet Suburban lost grip and the driver made the common error of continuing to turn the steering wheel. The excessive steering didn't — and couldn't — help. | September 15, 2014 | Michigan Tech Keweenaw Research Center

The best way to survive a skid on a snowy road is to avoid getting in one. Most of this article will be about how to remain in control when you're driving on snow- and ice-plagued highways. That's because teaching drivers to successfully deal with a sliding car can't be done with words. Developing those skills demands many hours behind the wheel.

If you don't (or can't) avoid a skid and your car starts sliding or spinning, and you're not already a near expert, nothing I can say will help. Humans do not rise to the occasion. Rather, we fall to our level of training and experience. But I will offer a few tips on how to gain that training and experience.

To rephrase Lee Greenwood's patriotic country anthem, "God Bless the USA," I've battled snow- and ice-covered roads from the prairie of Minnesota to the hills of Tennessee; across the plains of Colorado, from the U.P. of Michigan down to Dallas. From Connecticut to California, sea to shining sea. I've faced snowy roads behind the wheel of 18-wheelers, cars, pickups and SUVs. I've performed hundreds of tire tests on snow-covered roads, attended snow-driving schools, conducted vehicle comparison tests on snowy roads, and done precision driving in the snow for photos and videos.

From this experience, here are some snow driving tips the average driver can follow to reduce the chances of a crash.

**The Best Tip**

In the face of really bad weather, it's sometimes best to stay home, or, if you're traveling, grab a motel room if it starts to snow.

At the least, remain where you are until snowplows and sanding crews have done their work. If you crash on a snowy or icy road, you'll certainly be late — or worse.
An example: When my wife and I were newlyweds living in Dallas, I was surprised to see her getting ready to go out the door after an overnight winter storm.

"Where are you going?" I asked.
"To work," she said, her tone conveying the fact that she realized she'd married an idiot.
"It snowed last night," I said.
"I'm from Colorado," she said with pride (or arrogance — still hard to tell). "I can drive in snow."
"These folks are from Texas," I said. "They can't."
We turned on the radio to discover the newsperson frantically urging people to stay put: Every freeway in the Metroplex was closed. Sometimes, you have to stay where you are.

**It's (Almost) All About Tires**
Successful race drivers know that tires are often the difference between hero and zero. A fresh set of rubber will allow the 30th-place driver to blow by the leader who has yet to pit for new tires. The same is true in snow.
To have adequate snow traction, a tire (even a winter tire) requires at least 6/32-inch deep tread, according to Tire Rack. New passenger-car tires usually begin life with 10/32-inch of tread. Most winter tires have wear bars, of the type normally found around 3/32nds of an inch, at 6/32nds. Tread-depth gauges are not carried by every parts store but most tire stores will check tread depth for you.
The 6/32nds guidance comes from real-world experience and government rules in some northern countries: The laws there require drivers to start winter with at least 6/32nds tread. With tires, there's always the exception, and some tires will retain good bite down to 5/32nds.
It's my experience, and that of the testers at Tire Rack, that back-of-the-pack winter tires are better in the snow than the best-in-snow all-season tires. Sometimes the difference is small. Sadly, there's no way to tell except for expensive back-to-back testing.

Summer tires should more accurately be known as three-season tires. They are of the type that are often original equipment on high-performance all-wheel-drive cars, and have little to no grip in snow. I've attempted to drive max-performance tires on the snow. In below-zero weather, such tires suffered from what tire engineers call "glass transition temperature," when the rubber becomes rock-hard and can provide little traction. Most such tires offered so little grip that forward motion wasn't guaranteed: One provided more grip in reverse.

**Four or None**
If you opt for winter tires, get a full set or stick with all-season tires. Mounting winter tires on the front of a front-wheel-drive car will make it prone to spinning out in the snow and plowing straight off on wet or dry roads. Putting winter tires only on the back of a rear-drive car will make the car difficult to turn in snow and eager to spin in the dry. Random note: Winter tires, while almost universally terrible on dry roads, may or may not be good on wet or damp roads.

**Where You Live Is a Factor**
If you drive where winter roads are almost always covered with snow, four winter tires are the best choice. Look for the "snowflake on the mountain" symbol on the sidewall: This means the tire meets a tire-industry standard for snow traction.
If you live in a northern city with a good reputation for quickly plowing and sanding roads, all-season tires with plenty of tread depth (and a healthy dose of driver discretion) may be adequate. When I lived in Denver, the city and suburbs usually plowed the roads quickly. The only reason winter tires were mandatory (for me) was that I was an avid snow skier.
"What are the worst conditions you'll have to drive through?" says Woody Rogers of Tire Rack. "If going out is optional, then very good all-season tires are probably adequate. But if you have to go, then go winter."

**Get ESC Magic**
Electronic Stability Control (ESC) is almost magic. Imagine having the ability to pause time when your car starts to slide on snow or ice. With the world clock stopped, Super Driver would instantly appear to take the wheel and save the day. ESC is that good. The bad news: If ESC can't save you, neither could NASCAR star Kyle Busch, Formula 1 champion Lewis Hamilton or whoever you think is the best driver in the world. Getting it is not hard. About one-third of 2006 models, half of 2008 models and all vehicles from 2012 onward come with it.
ESC loses much or all of its magic if you have worn tires, drive 80 mph in a snowstorm or enter an icy corner going 20 mph too fast. ESC doesn't give you diplomatic immunity from the laws of physics.
If you're considering purchasing a used vehicle, definitely choose one with ESC.

**AWD Offers No Miracles**
The primary role of all-wheel drive (AWD) is to provide forward traction. AWD will get you moving and keep you moving in deep snow. It will allow you to climb the steep driveway to the front door of the ski chalet. AWD helps prevent fishtailing under acceleration, which causes many drivers of rear-wheel-drive vehicles to lose control. However, you shouldn't include "increase cornering power" in AWD's job description.
The latest smart AWD can help a vehicle turn on snowy roads — a little. However, the difference is a small fraction of that offered by winter tires or even brand-new all-season tires. Also, since AWD can do nothing to help you stop, be aware that it creates a false sense of security.
The reason: On dry or wet roads, most vehicles can decelerate far better than they can accelerate, while cornering power is closer to stopping ability. This means a lot of drivers' subconscious expectations of braking and cornering power in the snow far exceed what's truly available.

**Make Sure You Can See and Be Seen**
If you can't remember when you replaced your windshield wipers, it's past time for renewal. Those who expect to meet serious snow should fit wiper blades designed for winter driving.
Clean the inside of your windows thoroughly. Apply a water-shedding material (such as Rain-X) to the outside. Make sure your windshield washer system works and is full of an anti-icing fluid. Run the air-conditioner on the "fresh air" option, even if you must use the "hot" setting, to remove condensation and frost from the interior of windows. Many cars automatically do this when you choose the defrost setting.

## Weather Awareness

Truckers are instructed to check the operation of all lights at least once a day: Once a month isn't too much to ask of you, is it? If your headlight covers have become opaque from age or are sand-pitted, use a polishing agent or, better, fit new covers. When driving, use your headlights even at midday so that others will see you. Make sure your headlights and tail-lights are clear of snow.

**Give Yourself a Brake**
Learn how to get maximum efficiency from your brakes before an emergency. Antilock braking systems (ABS) became a popular option long before electronic stability control. Since the 2012 model year, every new car has ABS as part of ESC. It's easy to properly use ABS: Stomp, stay and steer. Stomp on the pedal as if you were trying to snap it off. Stay hard on the pedal and smoothly steer around the obstacle. (A warning: A little bit of steering goes a very long way in an emergency.) As with ESC, ABS does not suspend the laws of physics.

**Learn To Catch a Skid**
If the previous advice comes to naught, you'll need to know how to correct a skid.
A front-tire skid is easy: Smoothly release the accelerator, leave your hands where they are and allow the car to slow down. Turning the steering wheel more or pushing the brake pedal is like using a cancelled credit card: It does nothing good and may do something bad if the traction suddenly returns.
Learning how to catch a rear slide is a different matter. It's like learning how to hit a curveball or play the piano: It takes lots and lots of practice. Even with practice, some people never get it.

To get practice, find a "slick track" go-kart track. After you've become proficient there, go to an indoor kart track: These karts are fast, and mastering them requires all the skills required in racing. Professional car-control schools are available but the price is often steep: perhaps as much as $900 a day. However, even a small amount of auto bodywork will cost $900. Should your own body need work, $900 will buy very little plastic surgery.

If you can't justify the $900 for a pro driving school and are still determined to learn, here's an alternative: The next time it snows, find a place where you can slide your car without danger of damage or police intervention. Head out early and keep your speed low: 25 or 30 mph is plenty to get the feel. And stop before the police show up.

Regardless of your driving skill or vehicle preparation, there are some winter conditions that can't be conquered. That's why you should carry a sleeping bag and other survival equipment in the winter

## The Thought Experiment

### Why is light so fast?

**Light travels at around 300,000 km per second. Why not faster? Why not slower? A new theory inches us closer to an answer**

If you visit the Paris Observatory on the left bank of the Seine, you'll see a plaque on its wall announcing that the speed of light was first measured there in 1676. The odd thing is, this result came about unintentionally. Ole Rømer, a Dane who was working as an assistant to the Italian astronomer Giovanni Domenico Cassini, was trying to account for certain discrepancies in eclipses of one of the moons of Jupiter. Rømer and Cassini discussed the possibility that light has a finite speed (it had typically been thought to move instantaneously). Eventually, following some rough calculations, Rømer concluded that light rays must take 10 or 11 minutes to cross a distance 'equal to the half-diameter of the terrestrial orbit'.

Cassini himself had had second thoughts about the whole idea. He argued that if finite speed was the problem, and light really did take time to get around, the same delay ought to be visible in measurements of Jupiter's other moons – and it wasn't. The ensuing controversy came to an end only in 1728, when the English astronomer James Bradley found an alternative way to take the measurement. And as many subsequent experiments have confirmed, the estimate that came out of Rømer's original observations was about 25 per cent off. We have now fixed the speed of light in a vacuum at exactly 299,792.458 kilometers per second.

**Popular now**

Why is the speed of light the speed of light?
What might we do with the genomics of the entire planet?
Sidney Perkowitz
Why this particular speed and not something else? Or, to put it another way, where does the speed of light come from?

Electromagnetic theory gave a first crucial insight 150 years ago. The Scottish physicist James Clerk Maxwell showed that when electric and magnetic fields change in time, they interact to produce a travelling electromagnetic wave. Maxwell calculated the speed of the wave from his equations and found it to be exactly the known speed of light. This strongly suggested that light *was* an electromagnetic wave – as was soon definitively confirmed.

A further breakthrough came in 1905, when Albert Einstein showed that *c*, the speed of light through a vacuum, is the universal speed limit. According to his special theory of

relativity, nothing can move faster. So, thanks to Maxwell and Einstein, we know that the speed of light is connected with a number of other (on the face of it, quite distinct) phenomena in surprising ways.

But neither theory fully explains what determines that speed. What might? According to new research, the secret of *c* can be found in the nature of empty space.

Until quantum theory came along, electromagnetism was the complete theory of light. It remains tremendously important and useful, but it raises a question. To calculate the speed of light in a vacuum, Maxwell used empirically measured values for two constants that define the electric and magnetic properties of empty space. Call them, respectively, Ɛ0 and μ0.

The thing is, in a vacuum, it's not clear that these numbers should mean anything. After all, electricity and magnetism actually arise from the behavior of charged elementary particles such as electrons. But if we're talking about empty space, there shouldn't be any particles in there, should there?

This is where quantum physics enters. In the advanced version called quantum field theory, a vacuum is never really empty. It is the 'vacuum state', the lowest energy of a quantum system. It is an arena in which quantum fluctuations produce evanescent energies and elementary particles.

What's a quantum fluctuation? Heisenberg's Uncertainty Principle states that there is always some indefiniteness associated with physical measurements. According to classical physics, we can know exactly the position and momentum of, for example, a billiard ball at rest. But this is precisely what the Uncertainty Principle denies. According to Heisenberg, we can't accurately know both at the same time. It's as if the ball quivered or jittered slightly relative to the fixed values we think it has. These fluctuations are too small to make much difference at the human scale; but in a quantum vacuum, they produce tiny bursts of energy or (equivalently) matter, in the form of elementary particles that rapidly pop in and out of existence.

> Leuchs is fascinated by the connection between classical electromagnetism and quantum fluctuations

These short-lived phenomena might seem to be a ghostly form of reality. But they do have measurable effects, including electromagnetic ones. That's because these fleeting excitations of the quantum vacuum appear as pairs of particles and antiparticles with equal and opposite electric charge, such as electrons and positrons. An electric field applied to the vacuum distorts these pairs to produce an electric response, and a magnetic field affects them to create a magnetic response. This behavior gives us a way to *calculate*, not just measure, the electromagnetic properties of the quantum vacuum and, from them, to derive the value of *c*.

In 2010, the physicist Gerd Leuchs and colleagues at the Max Planck Institute for the Science of Light in Germany did just that. They used virtual pairs in the quantum vacuum to calculate the electric constant Ɛ0. Their greatly simplified approach yielded a value within a factor of 10 of the correct value used by Maxwell – an encouraging sign! This inspired Marcel Urban and colleagues at the University of Paris-Sud to calculate *c* from the electromagnetic properties of the quantum vacuum. In 2013, they reported that their approach gave the correct numerical value.

This result is satisfying. But it is not definitive. For one thing, Urban and colleagues had to make some unsupported assumptions. It will take a full analysis and some experiments to prove that *c* can really be derived from the quantum vacuum. Nevertheless, Leuchs tells me that he continues to be fascinated by the connection between classical electromagnetism and quantum fluctuations, and is working on a rigorous analysis under full quantum field theory. At the same time, Urban and colleagues suggest new experiments to test the connection. So it is reasonable to hope that *c* will at last be grounded in a more fundamental theory. And then – mystery solved?

Well, that depends on your point of view.

The speed of light is, of course, just one of several 'fundamental' or 'universal' physical constants. These are believed to apply to the entire universe and to remain fixed over time. The gravitational constant *G,* for example, defines the strength of gravity throughout the Universe. At small scales, Planck's constant *h* sets the size of quantum effects and the tiny charge on the electron *e* is the basic unit of electricity.

The numerical values of these and other constants are known to excruciating precision. For instance, *h* is measured as $6.626070040 \times 10^{-34}$ joule-second (to within $10^{-6}$ per cent!). But all these quantities raise a host of unsettling questions. Are they truly constant? In what way are they 'fundamental'? Why do they have those particular values? What do they really tell us about the physical reality around us?

Whether the 'constants' are really constant throughout the Universe is an ancient philosophical controversy. Aristotle believed that the Earth was differently constituted from the heavens. Copernicus held that our local piece of the Universe is just like any other part of it. Today, science follows the modern Copernican view, assuming that the laws of physics are the same everywhere in spacetime. But an assumption is all this is. It needs to be tested, especially for *G* and *c,* to

make sure we are not misinterpreting what we observe in the distant universe.

It was the Nobel Laureate Paul Dirac who raised the possibility that *G* might vary over time. In 1937, cosmological considerations led him to suggest that it decreases by about one part in 10 billion per year. Was he right? Probably not. Observations of astronomical bodies under gravity do not show this decrease, and so far there is no sign that *G* varies in space. Its measured value accurately describes planetary orbits and spacecraft trajectories throughout the solar system, and distant cosmic events, too. Radio astronomers recently confirmed that *G* as we know it correctly describes the behavior of a pulsar (the rapidly rotating remnant of a supernova) 3,750 light years away. Similarly, there seems to be no credible evidence that *c* varies in space or time.

So, let's assume that these constants really are constant. Are they fundamental? Are some more fundamental than others? What do we even mean by 'fundamental' in this context? One way to approach the issue would be to ask what is the smallest set of constants from which the others can be derived. Sets of two to 10 constants have been proposed, but one useful choice has been just three: *h, c* and *G,* collectively representing relativity and quantum theory.

> only the dimensionless constants are really 'fundamental', because they are independent of any system of measurement

In 1899, Max Planck, who founded quantum physics, examined the relations among *h, c* and *G* and the three basic aspects or dimensions of physical reality: space, time, and mass. Every measured physical quantity is defined by its numerical value and its dimensions. We don't quote *c* simply as 300,000, but as 300,000 kilometers per second, or 186,000 miles per second, or 0.984 feet per nanosecond. The numbers and units are vastly different, but the dimensions are the same: length divided by time. In the same way, *G* and *h* have, respectively, dimensions of [length$^3$/(mass x time$^2$)] and [mass x length$^2$/time]. From these relations, Planck derived 'natural' units, combinations of *h*, c and *G* that yield a Planck length, mass and time of 1.6 x $10^{-35}$ meters, 2.2 x $10^{-8}$ kilograms, and 5.4 x $10^{-44}$ seconds. Among their admirable properties, these Planck units give insights into quantum gravity and the early Universe.

But some constants involve no dimensions at all. These are so-called *dimensionless* constants – pure numbers, such as the ratio of the proton mass to the electron mass. That is simply the number 1836.2 (which is thought to be a little peculiar because we do not know why it is so large). According to the physicist Michael Duff of Imperial College London, only the dimensionless constants are really 'fundamental', because they are independent of any system of measurement.

Dimensional constants, on the other hand, 'are merely human constructs whose number and values differ from one choice of units to the next'.

Perhaps the most intriguing of the dimensionless constants is the fine-structure constant *a.* It was first determined in 1916, when quantum theory was combined with relativity to account for details or 'fine structure' in the atomic spectrum of hydrogen. In the theory, *a* is the speed of the electron orbiting the hydrogen nucleus divided by *c.* It has the value 0.0072973525698, or almost exactly 1/137.

Today, within quantum electrodynamics (the theory of how light and matter interact), *a* defines the strength of the electromagnetic force on an electron. This gives it a huge role. Along with gravity and the strong and weak nuclear forces, electromagnetism defines how the Universe works. But no one has yet explained the value 1/137, a number with no obvious antecedents or meaningful links. The Nobel Prize-winning physicist Richard Feynman wrote that *a* has been 'a mystery ever since it was discovered… a magic number that comes to us with no understanding by man. You might say the "hand of God" wrote that number, and "we don't know how He pushed his pencil".'

Whether it was the 'hand of God' or some truly fundamental physical process that formed the constants, it is their apparent arbitrariness that drives physicists mad. Why these numbers? Couldn't they have been different?

One way to deal with this disquieting sense of contingency is to confront it head-on. This path leads us to the anthropic principle, the philosophical idea that what we observe in the Universe must be compatible with the fact that we humans are here to observe it. A slightly different value for *a* would change the Universe; for instance by making it impossible for stellar processes to produce carbon, meaning that our own carbon-based life would not exist. In short, the reason we see the values that we see is that, if they were very different, we wouldn't be around to see them. QED. Such considerations have been used to limit *a* to between 1/170 and 1/80, since anything outside that range would rule out our own existence.

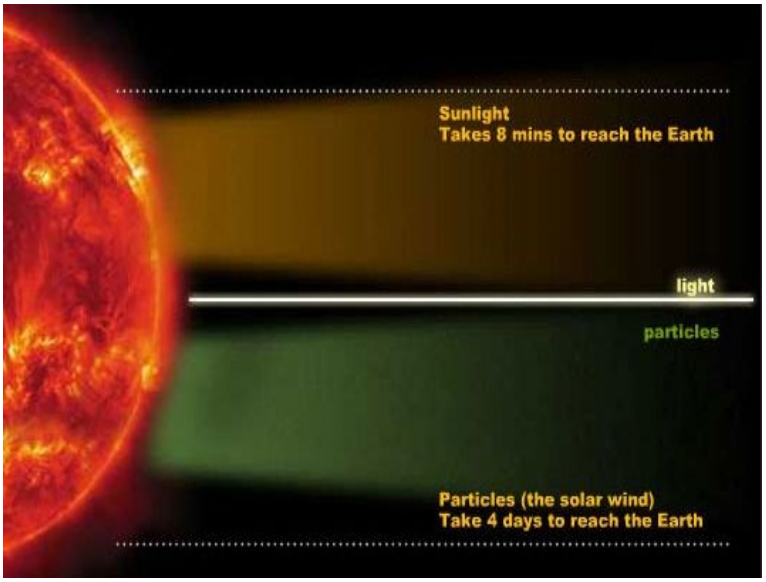
But these arguments also leave open the possibility that there are other universes in which the constants are different. And though it might be the case that those universes are inhospitable to intelligent observers, it's still worth imagining what one would see if one *were* able to visit.

For example, what if *c* were faster? Light seems pretty quick to us, because nothing is quicker. But it still creates significant delays over long distances. Space is so vast that aeons can pass before starlight reaches us. Since our spacecraft are much slower than light, this means that we might never be able to send them to the stars. On the plus side, the time lag turns telescopes into time machines, letting us see distant galaxies as they were billions of years ago.

there's something very intriguing about how tightly constructed the laws of our own Universe appear to be

If *c* were, say, 10 times bigger, a lot of things would change. Earthly communications would improve. We'd cut the time lag for radio signals over big distances in space. NASA would gain better control over its unmanned spacecraft and planetary explorers. On the other hand, the higher speed would mess up our ability to peer back into the history of the Universe.

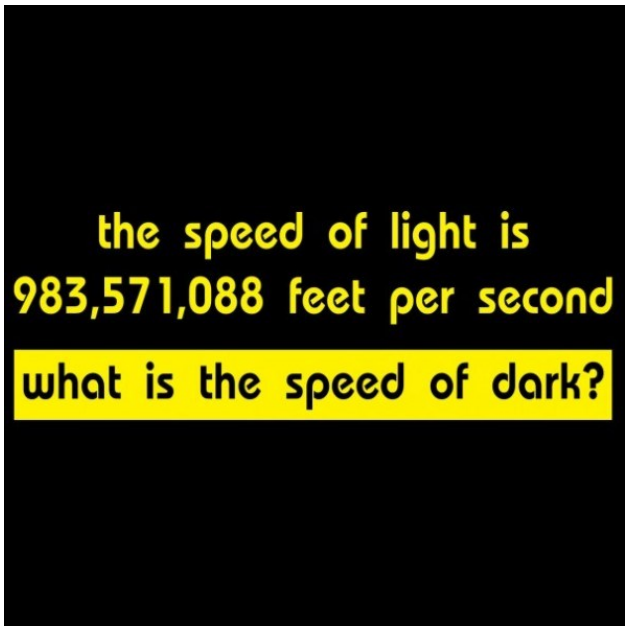
Or imagine slow light, so sluggish that we could watch it slowly creep out of a lamp to fill a room. While it wouldn't be useful for much in everyday life, the saving grace is that our telescopes would carry us back to the Big Bang itself. (In a sense, 'slow light' has been achieved in the lab. In 1999, researchers brought laser light to the speed of a bicycle, and later to a dead stop, by passing it through a cloud of ultracold atoms.)




**Explore Aeon**

Deep Time
Physics
Quantum Theory

These possibilities are entertaining to think about – and they might well be real in adjacent universes. But there's something very intriguing about how tightly constructed the laws of our own Universe appear to be. Leuchs points out that linking *c* to the quantum vacuum would show, remarkably, that quantum fluctuations are 'subtly embedded' in classical electromagnetism, even though electromagnetic theory preceded the discovery of the quantum realm by 35 years. The linkage would also be a shining example of how quantum effects influence the whole Universe.




And if there are multiple universes, unfolding according to different laws, using different constants, anthropic reasoning might well suffice to explain why we observe the particular regularities we find in our own world. In a sense it would just be the luck of the draw. But I'm not sure this would succeed in banishing mystery from the way things are.

***Did something or nothing come before the Big Bang? This is one of the hardest questions our human minds can imagine***

Presumably the different parts of the multiverse would have to connect to one another in specific ways that follow their own laws – and presumably it would in turn be possible to imagine different ways for those universes to relate. Why should the multiverse work like this, and not that? Perhaps it isn't possible for the intellect to overcome a sense of the arbitrariness of things. We are close here to the old philosophical riddle, of why there is something rather than nothing. That's a mystery into which perhaps no light can penetrate.

## Early Radio: Military Communications

### Move Over, I'll Bomb It Myself

Will Stafford

In 1968 I was flying B-model helicopter gunships out of Ninh Hoa for the 48th Assault Helicopter Company (Joker 51). Now, our area in II Corps wasn't exactly the most hotly contested in Vietnam. One of the likely reasons for this was that we supported the 9th Korean Division (White Horse). The VC and NVA seemed to have a great deal of respect for these guys and gave them a pretty wide berth.

During the tour I had heard about Arc Lights, which was the code for a massive B-52 bomb strike, but had never seen one. I had talked to our Forward Air Controller (FAC) who, by any standards, was not an amiable fellow and had asked him what was required to get an Arc Light and would it be possible to get one? At the time I was bugging him about calling in an Arc Light, I was a lowly warrant officer and his response was for me to "f*** off." He gave no explanation of how Arc Lights were called, what the circumstances were, or even that the B-52s were flying out of Thailand. I think he was bitter because he was an Air Force Major flying an OV-1 observation airplane rather than a Thunderbolt or Phantom. I, along with the majority of the pilots and crewmen, got the impression he thought he was superior to us sling wing guys because he had master aviator wings and probably, at some time in his career, had flown the fast movers. Well, that may have been in another life, but right now he was driving an OV-1 and to be quite honest, most of us were not impressed with his flying skills nor his support of the ground troops which after all was what we were suppose to be doing.

One of the missions we liked to fly was called, "first light" and "last light." These missions simply meant that we were airborne with a light fire team (two gunships) and were patrolling the numerous free fire zones at sunrise and sunset. We did pretty good until they figured out what our mode of operation was. Anyway, when we'd take significant enemy fire we'd roll in and shoot up the area and the Korean liaison who rode with us would report it back to the 28th Regiment Headquarters. In order to piss off the FAC, I would also call and ask him for an Arc Light. Sometimes he would be airborne but most of the time he would just be back at our operations tent. I really don't think he liked to fly. His response was always the same, "f*** off."

The only bombs we had seen dropped, and we didn't actually see them dropped was when we were tasked to fly into an area to do a bomb damage assessment after the bombs had already been delivered. It was pretty impressive, but we wanted to see what bombs do while they're impacting. You've got to remember, we're a helicopter gunship with a maximum ordnance load of fourteen 8 pound warhead rockets, (explosion just a little bigger than a hand grenade) four flex mounted M60 machine guns (we hadn't gotten the mini guns yet) and two M60 machine gun door guns. Anything bigger than an AK47 had us outclassed. We wanted to see something that could really kick ass.

So to get some bombs dropped, we came up with a plan. We would do the Arc Light ourselves! Maybe it wouldn't be a big Arc Light, but by God we were going to drop some bombs. I think it was actually the crew chief (Sergeant Chamber) who came up with the idea. We were a pretty close crew. "yes sir" and "no sir" were reserved for when we were at the club or around the CO. On the flight line or in the air it was relaxed. Most things, if they were beyond normal procedures, we did by vote with each vote having equal weight. The only ones that didn't get to vote in this democratic process were the pilots and crew of the trail ship. We sort of figured that when their time came to be "gun-team lead" then they could make the rules. By then we would all probably be back home or..... Anyway, it seemed like we were constantly taking votes because we did quite a bit that wasn't "normal procedure." Most likely that was because the four of us appeared to match in personality, temperament, age, and eagerness. We were, according to the CO, crazy and the gun team most apt to get him relieved of command. We were also the gun team with the best record and I have a feeling he always wished he could be out there with us too.

So, the planning for our Arc Light started to gather steam. Lentz (Lenny), the co-pilot had met an Air Force sergeant during R&R who had something to do with ordnance. He was stationed at Phan Rang Air Base which was about a half hour flight from Ninh Hoa. Lenny got in touch with him and a deal was struck for four 25 pound bombs. In exchange we had to come up with an NVA flag, an AK47 or an SKS, and two survival knives.

We had an NVA flag made up by a local Vietnamese tailor (he was understandably reluctant to make it which cost us a little more than we had anticipated). We took it out and shot some holes in it, got some chicken blood from the mess hall and sprinkled a little of that on it, bleached it out with a solution of ground up heat tabs dissolved in water and then beat it on some rocks to fray the end and bottom out a bit. We also left it in the sun for a couple of weeks. We even made up a story about how we captured it from an NVA battalion headquarters out west of Phan Rang. For a bunch of amateur liars (though I must admit, some of us were nearing professional status) we did a pretty good job. We had the SKS rifle

already but it had a broken stock. There wasn't much we could do about that. The survival knives were no problem since we each had one and they were expendable items anyway.

OK, so they were really expendable but accountable. Don't get picky!

With our supplies ready, we volunteered for a standby mission down in the Phan Rang area and made contact with the Air Force sergeant. When we arrived, he had the four 25 pound bombs for us. They looked exactly like what I had seen in movies, or at least they did when we finally got them assembled. There were some fins which you had to sit in a bracket and screw on. He gave us four threaded detonators which were propeller looking outfits with safety wire holding the propeller from turning. These were to be screwed into the front of the bombs. The bombs weighed more than 25 pounds which we had not expected. I don't know exactly how much they did weigh but it was a good deal more than 25 pounds. Anyway, the sergeant said they were 25 pound bombs because the explosive equivalent was 25 pounds of TNT which made sense to us.

That probably isn't saying much since we tended to believe almost anything someone told us if we were into mischief and it suited our purpose. He said not to put the detonators in before we were ready to drop them because the bomb was armed by the propeller turning. We forgot to ask what altitude we needed to be at to drop them and that caused us some problems later.

The more immediate problem was, the extra weight caused us to have to leave half our rockets and quite a bit of M-60 machine gun ammunition behind because we couldn't get off the ground. The trail ship crew got stubborn and said they weren't going to carry any bombs even if we said we would carry all the detonators. We were stuck with carrying all four and trail ship got the Korean liaison. Well, we figured it would give us some practice since we would have to carry all four when we did our Arc Light anyway.

It took almost a month before everything lined up. Lined up meaning, we needed to find an area where we knew we would get fired on, but not by anything big like a .50 caliber or 37 millimeter, that the FAC would actually be off his lazy ass and in the air at the same time we were, that we would not be on a regular combat assault mission, that we could leave our Korean liaison behind, and finally, that we could get the bombs to the helicopter without too many eyes on us.

After we got the bombs, we began taking every last light flight until we finally got into an area northeast of Ninh Hoa. On three successive evenings we took small arms fire but no hits on either ship. These guys were either lousy shots or there were just a few of them down there. We figured this was just about the best we were going to get. We talked the FAC into going up and hanging around while we went into the area on the fourth night. We got the bombs to the aircraft and put two in each doorway. We had made a bomb ramp out of some 2 x 4's nailed side by side. We needed the ramps so the bombs could be rolled out of each side of the aircraft sort of simultaneously and we also we needed some extension so they would miss the skids.

Now the problem became, how high we needed to be to drop them? We didn't know how many turns the propellers had to make to arm. Our solution was to take the safety wire off and turned them by hand the night before for about half an hour each. Yes, I know that wasn't the smartest thing in the world to do, but in the first place, here we are flying around day after day trying to draw fire, and then flying back into an area we know we're going to get shot at so we can drop bombs from a helicopter. That should give you a clue right away that we weren't the brightest bulbs on the Christmas to start with.

Once in the area it didn't take too long before we drew fire. We rolled in and launched a couple of pair of rockets plus some machine gun fire into the area and trail lit it up pretty good with three pair of HE and two WP rockets. In return we got several positions firing automatic weapons, probably AK47s back at us. We decided that meant they wanted to fight and it also gave the FAC something to think about. I made a call to the FAC and asked if he had seen the fire. He said yes. I asked for an Arc Light or at least some fast movers out of Phan Rang or Tuy Hoa and got the same response as always, "f*** off". Now it was our turn. I told him to get the hell out of our way then and we'd Arc Light it ourselves.

I had the trail ship keep fire on the area while we got a little altitude. As we came over what we thought was about the right place, Chamber and Pot (Pot's real name was Neal, but he had picked up the nickname Pot, for obvious reasons, when he started crewing with sergeant Chamber) rolled the four bombs out the doors. We thought three of them exploded but weren't sure about the fourth.

Did we do any damage? Probably not, but the explosions were bigger than anything we could make with our eight pound warhead rockets. The incoming fire stopped for a few minutes. If we didn't scare 'em, we probably confused 'em, or maybe they were just laughing too hard to return fire.

There is usually a price to pay for these stunts and I did get

in a little trouble over it. The FAC turned me in to the old man and he blistered my ass. I had been offered a battlefield commission and he threatened to have it stopped and to send all of us back to one of the slick platoons. He didn't! During the ass chewing which, I must admit was a good one with lots of colorful language and references to the fact that my father never married my mother, he mentioned that as a crew, the four of us were only wading ankle deep in the gene pool. I thought that was truly original and used it myself a couple of times later in my career when I had occasion to show my displeasure with a platoon leader or two. We were not allowed to do any first light and last light missions for a month and got saddled with a lot of crappy escort stuff, but it was worth it.

Well, if nothing else, we drank a lot of free beer at the club as we told the story and retold it and retold it. When we finally got a new FAC we started the same Arc Light request campaign again. He also told us to "f*** off" but told us what it would take to get one and we understood. We didn't have a ghost of a chance of ever seeing one where we were. He also said the outgoing FAC had told him to watch out for those crazy b**tards. That gave us a warm and happy feeling and we did the "Snoopy dance." You know, if you take war too seriously you'll go crazy or perhaps we were almost there anyway and war just accelerated the process.

I am a GRUNT.
I am bound by an oath;
Taken of my own free will.
I am a willing servant of my nations people.
I will protect, defend and fight in their defense.
I will do what others will not;
I will go where others fear to tread.
I will forego my own safety and comfort;
I will knowingly put myself in harms way.
I will bring down upon my enemy,
The full weight of my nations wrath and resolve.
And though I do know fear and pain,
My commitment to mission will transcend these mental obstacles.
I will be my brother's keeper,
And he will be mine.
I will never surrender,
I will never quit,
I will continue to fight until victory is achieved,
Or I draw my last breath...
I am a GRUNT.

-Doc

## Makers' Faire —Milwaukee

The Milwaukee Radio Amateurs' Club constructed and ran an excellent booth during the recent **Makers faire** in September. Special thanks to Tiff, Dave, KA9WXN, Al, KCIJJ, Joe N9UX and Dave, WB9BWP for making our presence there fun and informative for all who stopped at our booth.


In Remembrance of our county's Veterans on their day, **November 11th, 2015.**

From the Board of Directors' and membership of the Milwaukee Area Amateurs' Radio club, **Welcome Home Men, and Well Done.**


| Name of Net, Frequency, Local Time | Net Manager |
|---|---|
| **Badger Weather Net (BWN)** 3984 kHz, 0500 | W9IXG |
| **Badger Emergency Net (BEN)** 3985 kHz, 1200 | NX9K |
| **Wisconsin Side Band Net (WSBN)** 3985 or 3982.5 kHz, 1700 | KB9KEG |
| **Wisconsin Novice Net (WNN)** 3555 kHz, 1800 | KB9ROB |
| **Wisconsin Slow Speed Net (WSSN)** 3555 kHz, Sn, T, Th, F, 1830 | N1KSN |
| **Wisconsin Intrastate Net - Early (WIN-E)** 3555 kHz, 1900 | WB9ICH |
| **Wisconsin Intrastate Net - Late (WIN-L)** 3555 kHz, 2200 | W9RTP |
| **ARES/RACES Net** 3967.0 kHz, 0800 Sunday | WB9WKO |
| * Net Control Operator needed. Contact Net Manager for information. | |

## Next Regular Meeting

The next meeting will be on **Thursday, November 19th,** 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:***

**January 28th, 2016- 7 pm**

***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)-459-9741**


## 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: W9rhmrac@Gmail.com

**or by Post to:**

Michael B. Harris

807 Nicholson RD

South Milwaukee, WI 53172-1447

## VE Testing:

November 27th, 9am— 11:30am

**No testing: June, July or December**

**Location: Amateur Electronic Supply Time: 9:30 AM (Walk-ins allowed)**

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

## Area Swapfests

Jan 9th, 2016 West Allis Arc's 44th Annual Midwinter Swapfest Location: Waukesha, WI Type: ARRL Hamfest
Sponsor: West Allis Radio Amateur Club (WARAC)
Website: http://www.wares.org

Jan 17th, WCRA 49th ANNUAL MID-WINTER HAMFEST
Location: St. Charles, IL Type: ARRL Hamfest
Sponsor: Wheaton Community Radio Amateurs
Website: http://www.wheatonhamfest.org

**MRAC Working Committees**

**100th Anniversary:**

- Dave—KA9WXN
- Dan—N9ASA

**Net Committee:**

- Open

***Field Day***

Dave—KA9WXN, Al—KC9IJJ

***FM Simplex Contest***

- Joe – N9UX
- Jeff – K9VS

***Ticket drum and drawing***

- Tom – N9UFJ

***Newsletter Editor***

- Michael-KC9CMT

**Webmaster**

- Dave, KA9WXN

**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)-459-9741**

Address correspondence to:

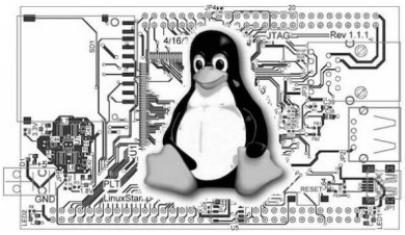
**MRAC, PO Box 26233, Milwaukee, WI 53226-0233**

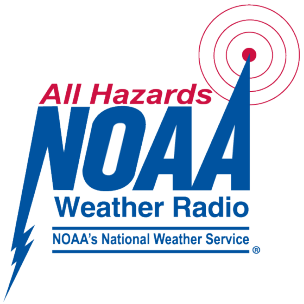
Email may be sent to: **w9rh@arrl.net .** Our YAHOO newsgroup:

**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 MRAC HamChatter is a monthly publication of the Milwaukee Radio Amateurs' Club. Serving Amateur Radio in Southeastern Wisconsin & all of 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. 8:00 PM 442.100+ Railroad net, also on EchoLink**

**Mon. 8:45 PM 147.165- ARRL Audio News**

**Mon. 8:00 PM 442.875+ WIARC net also on EchoLink 576754**

**Mon. 8:30 PM 146.820 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**

**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 28.365Mhz 10/10 International Net**

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

**Wed. 9:00 PM 145.130+MAARS SwapNet, Allstar FM-38**

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

**Thur. 8:00 PM 443.800+ Tech Net**

**Thur. 9:00 PM 146.910+ Computer Net**

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

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

**Sat. 7:30 AM MW Classic Radio Net , Freq.—3885 AM**

**Sat. 8:00 PM 146.910+ YL's Pink HAMsters Net**

**Sat. 9:00 PM 146.910+ Saturday Night Fun Net**

**Sun 8:00 AM, State ARES Net 3967/3977.5/145.470**

**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 146.910+ Information Net**

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

**Sun 9:00 PM 146.910+ Swap Net**

**Daily: Milwaukee — Rag Chew Net: 7:00 AM, 3850 SSB + Florida Net 7 am, 14.290 mhz.**

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.