MRAC Hamateur Chatter

The Milwaukee Radio Amateurs Club

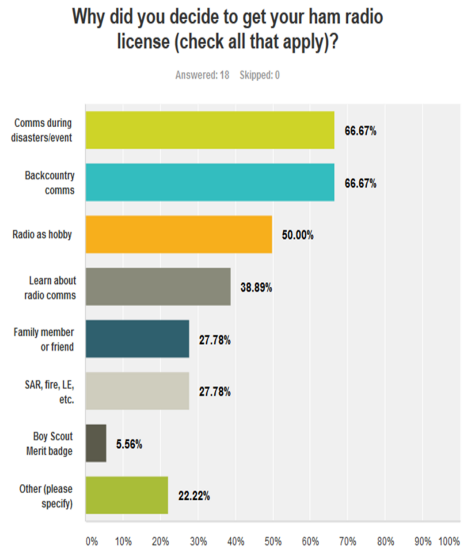
March 2016 Volume 25, Issue 3

100 Years, 1917—2017 The oldest Continuous Ham Radio Club in the Midwest

Where are Those New Hams Coming From?

The Tri-Lakes Monument Radio Association just completed another successful Technician license class resulting in 21 new Technicians plus one person that passed both the Technician and General exams. We survey the class a week or two later to get their feedback and capture some demographic information. In recent years, our Technician class has consistently filled to capacity, causing us to ask the question "Where are those new hams coming from?"

The key relevant question on the survey is:



I've abbreviated the response choices so they read better on the graph. For example, "Comms during disasters/event" actually says "For communications during disasters or other major events" on the survey. These 18 responses represent over half of the students so they are representative of the class. However, it is a small sample size overall, representing just one class at one time at one location in the US. I will add that the surveys from our other classes are similar.

The two highest responses, both with 67%, are *Comms During Disasters/ Event* and *Backcountry Comms.* It was no surprise that communications during a disaster would be a prime motivation for getting a ham radio license. Per FCC Part 97, this is one of the stated purposes of the Amateur Radio Service.

Here in Colorado, many people have had the recent experience of wildfires disrupting communications causing them to look for alternatives. In general, the prepper movement is causing people to think in terms of disaster preparedness. Communications in the backcountry includes hikers, climbers, fishermen, dirt bike riders, four-wheel drive enthusiasts and anyone who spends time in the mountains. There are many locations in Colorado that don't have cellphone coverage, so people are looking for alternative communications. This is likely a regional phenomenon…I don't think you'd see "backcountry communications" on the short list of amateur radio interest is downtown Chicago.

Radio as a hobby gathers 50% of the responses, followed by 39% interested in learning about radio communications. This says that about half of the students are pursuing ham radio as a hobby. I wonder if this is different that the historical average from 20 years ago? I suspect it used to be higher but I don't have any data to support that. This would likely be a leading indicator for how many of these new licensees get deeply involved in ham radio activities. I have seen students start out with a narrow focus on emergency preparedness but then discover there's a lot more to ham radio that they choose to pursue.

What do you think about these results?

73, Bob K0NR

MRAC Officers:

Terms Expiring in 2018

- President – Dave, KA9WXN
- V-President– Dan, N9ASA
- Secretary – MBH, KC9CMT
- Treasurer – MBH,,KC9CMT

Terms Expiring in 2017

- Director – Al, KC9IJJ
- Director – Vacant
- Director – Tom, W9TJP
- Director--Dale, AB9DW

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(414) 332- 6 7 2 2

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Board of Director's Minutes

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

Director's present: Michael KC9CMT, Dave KA9WXN, Dave, KA9FUR, Dale, AB9DW, Tom W9TJP.

Absent: Al, KC9IJJ, one vacancy on the board.

Preliminary Discussion: The Treasurers report for January 2017 was presented by Michael, KC9CMT. The treasurers report was approved as read by KC9CMT, a motion to accept was made by Dan, N9ASA, seconded by Dale, AB9DW. The January balance ended with $19,505.46 in Club accounts. New member certificates will be mailed if not handed out when they become available. The board is discussing sending additional funds to Redemption Lutheran Church for the use of their facilities, perhaps an additional $100.

Meeting Presentations: The January presentation will be conducted by Dave, KA9WXN. February Will be our food meeting. Kermit Carlson will be the guest speaker for our March meeting, along with a discussion of our annual club elections. There should be seven board members. The April meeting will be our annual election, in addition to a presentation on Radio Astronomy. May 2017 will be the annual club auction. June will be a field day wrap up discussion. The people from Milwaukee solar energy have said they would be willing to do another presentation to the club. Another good topic is lightening protection. The Ham Radio Outlet retailer is willing to have a out-of-trunk swapfest May 20th of 2017, 8-1 pm.

Field Day: Field day 2016, went well at the MATC facility. MATC has both port-a-potties and hand wash stations at the location. It's a good location, and should be available in 2017. The board would like to have a working committee for the 2017 field day effort. The LEFROG group has been invited to share the MRAC/MAARS field site with us.

Special Project Committees & Committee reports:

Repeater Report: 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.

New Business: The Board will be having our meeting at the HRO in 2017. Dave, KA9WXN is continuing discussions regarding events for the clubs' 2017 100th anniversary. Tom, W9TJP reports that Ham Radio Outlet is open from 10am-5:30pm, Monday through Saturday. Locations and dates are still being discussed as to the 100th anniversary Banquet. The banquet would have to be catered. Kermit Carlson will be the featured speaker at the banquet, tentative date October 21st, 2017. Meyers is being discussed as the primary location. JOTA is the same day as the banquet.

We need to start planning special event stations for the entire year of 2017. Dave, KA9WXN will attempt to generate interest among the membership in forming a committee to handle planning. Dan, N9ASA has arranged with The House of Harley Davidson to have a special event station during their annual bash on June 17th, 2017. MakersFaire 2017 will be a special event station from the State Fair Park. The board does want to go ahead with planning a banquet during the 100th anniversary year. Time and place to be determined. JOTA coordinator, KC9WW, Fred is helping the club to format an event at the Indian mounds, in Oconomowoc.

Swapfest Committee: The club is looking at April 1st as the new MRAC/MAARS swapfest date. The club has a booking for the Elks lodge, across from HRO. The Elks club is a smaller venue, but will hold as many tables. The Boy scouts of America will be offering food. We expect about 43 tables to be rented to vendors. A May out-of-trunk event at HRO is a possibility, May 20th being the date. The board has moved the Swapfest to April 1st, as a guard against losses due to inclement weather. Name: "Spring Fling" 2017 will be our 7th annual swapfest.

Special Projects: A special event station will be June 1st, at Greenfield House of Harley dealership. The special event will run during the dealerships hours of operations. The club needs someone to take over the FM simplex contest for February of 2018. The club really needs PR and recruitment, business cards have been printed and will be handed out at all club activities. The North Point lighthouse is the property of the Milwaukee Historical Society. The club would like to have a special event station setup there this summer. The lighthouse event in Port Washington is on August 19th. We should attempt not to conflict with this yearly sponsored event. Dave, KA9WXN will be meeting with the board of Discovery World museum during the last week of February. The board of director's has set a tentative date of October 21st, 2017 for the MRAC 100th anniversary banquet, to be catered for a crowd of 200. An August 19th lighthouse event is being worked on. A special event station at the lakefront is being worked on by Dave, KA9WXN. The club will be sending letters to former members asking if they would like to renew for 2017, our 100th anniversary year. This will allow our past members to take part in all the activities being planned. Dave, WB9BWP will be sending anniversary information to Gordon West for his weekly Ham Nation Broadcast. The board wants to compile a VIP list for the banquet and send out invitations.

A special event station at the War Memorial is being discussed. The club will use the club call of W9RH/100 for all our special events. The club would also like to have a membership drive for new members for 2017. There would be a special certificate for any new members of the club. The club needs to have some special QSL cards, or ridged certificates printed up for contacts during the calendar year of 2017. The club would like to query members about working on projects for the 100th anniversary. MakersFaire is on September 23-24th, 2017. JOTA 2017 will be another event the MRAC will be involved in. The club will be putting together a go kit for taking to various events.

Website update: The club has a Wiki page. Dave, KA9WXN has been working on a 100th anniversary page. Two new people have been added as administrators for the WordPress powered club website. Dan, N9ASA, & Dale, AB9DW.

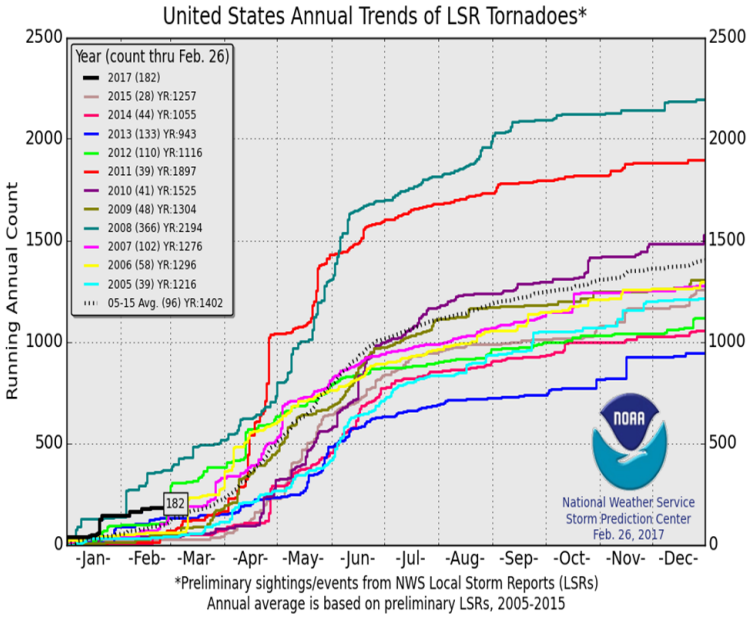
Clubs throughout the country need to use the spectrum that they have been given. The 220mhz band is not used very often in the Milwaukee area. DMR is now becoming a item among Hams'. A Club calendar is a project that the Board of Directors' would like to pursue. Dave, KA9WXN has been working on this idea. A schedule of upcoming events should be printed in the chatter each month.

A motion was made to adjourn the meeting at 8:25 pm by Dan, N9ASA seconded by Michael, KC9CMT. Meeting adjourned at 8:30 pm.

Spring 2017 seasonal tornado outlook

A beastly tornado drills across the landscape near Dodge City, KS on May 24, 2016. Image credit: Ian Livingston.

A much warmer than normal start to the year has led to a relatively active tornado period in January and February. Will March, April, and May see a continuation of this trend, or are we on a path to a quieter than normal climatological spring?



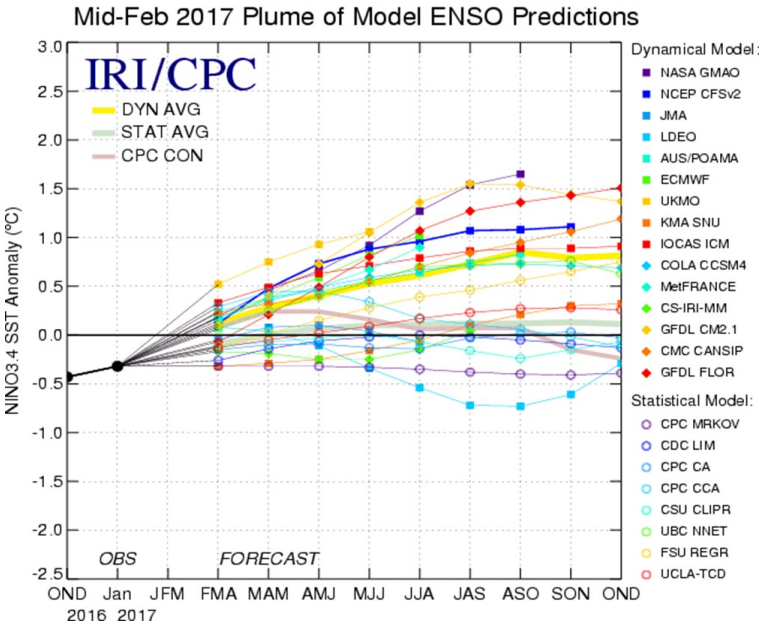
The first two months of 2017 saw a weather pattern dominated by Pacific influences, with storm after storm pounding the West Coast. These storm systems drew a large amount of warm air into the central U.S., which then translated to the eastern U.S. With this pattern in place, there was more opportunity for severe weather and tornadoes, and the result included a significant tornado outbreak on January 21.

Some resemblance of this winter's pattern will likely continue into March, with a series of somewhat-infrequent but very dynamic storm systems digging into the western U.S. before lifting up into the Midwest and northeastern U.S.

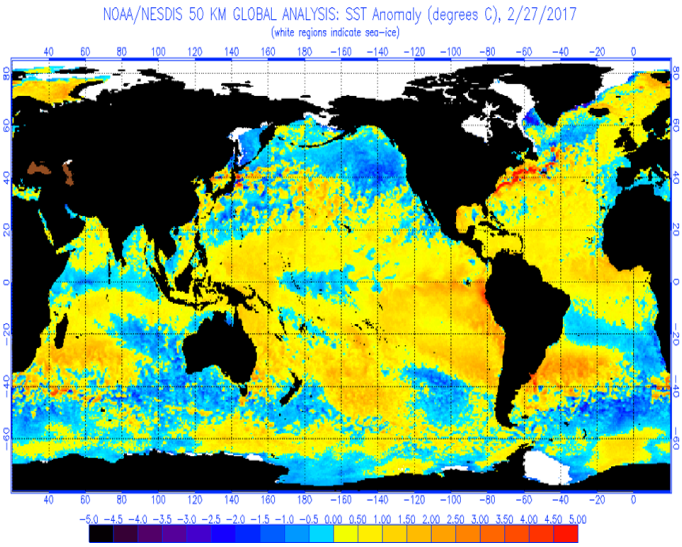
This means that many northern areas not accustomed to early season tornadoes will likely see the biggest uptick in tornado activity in March, whereas parts of the Deep South may be on the lower side of normal when it comes to the tornado count. These storm systems traversing the Northern Tier of the central and eastern U.S. almost seem more indicative of a June weather pattern than a March one.

Overall, I think March will average out to a near normal tornado count to kick off the start of meteorological spring. While we will see continued periods of strong warmth east of the Rockies, somewhat-persistent troughing over the East Coast will try to stifle the transport of rich Gulf of Mexico moisture northward. This will limit the overall atmospheric instability, which is a key ingredient in forming tornadic storms.

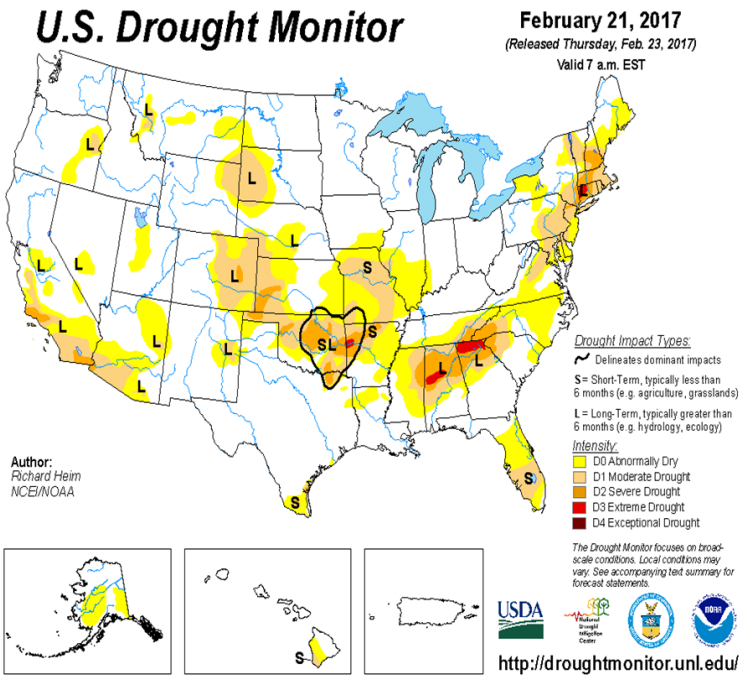
Looking into the long range signals for April and May, I took a look at the El Niño-Southern Oscillation (ENSO), Pacific Decadal Oscillation (PDO), and Atlantic Multidecadal Oscillation (AMO).



Though we are technically coming out of a weak La Niña, the atmosphere behaved differently from a typical weak Niña event this winter. Instead, the weather pattern over the Continental U.S. reflected more of an El Niño pattern, with widespread warmth across much of the country and above normal precipitation across parts of the Southern Tier. Not an unprecedented pattern during weaker Niña winters, and it does help narrow down the analog field in the forecast.

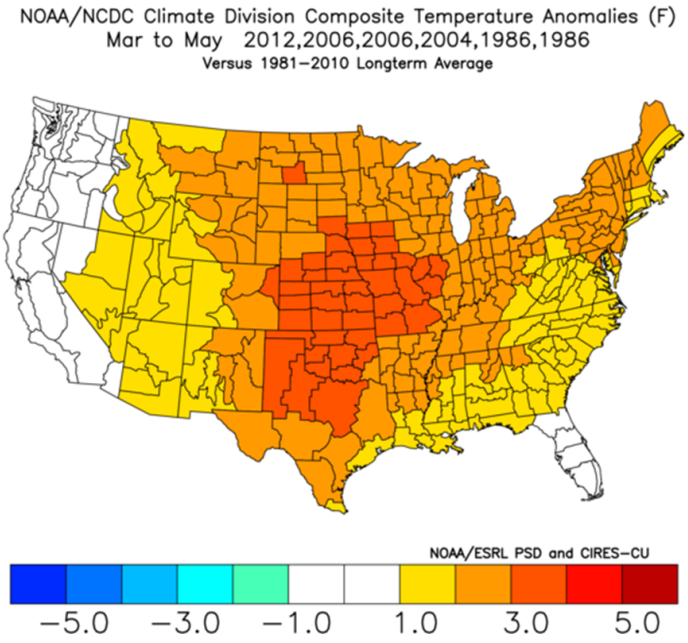


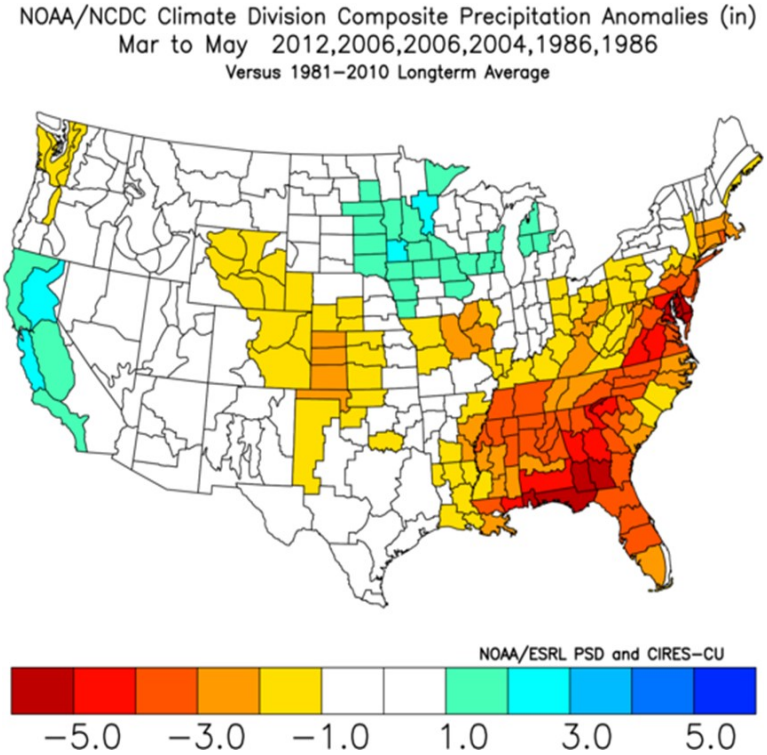
The PDO has been positive, but the weather pattern over the western U.S. has been anything but reflective of a positive PDO pattern. Usually, a positive PDO will lead to warmer and drier conditions in the western U.S., but index values do not always tell the whole story, which is why looking at the sea surface temperature anomalies themselves can be more helpful in knowing where the pattern stands going into the long range.
The warmer than normal Atlantic is keeping the AMO positive, which favors a warmer eastern half of the U.S. and drier than normal conditions across the Deep South.



Monitoring the drought heading into spring can be very beneficial. Large areas of moderate drought or worse can create a positive feedback loop. This means that the dry region will be more susceptible to warm and dry weather compared to areas that are not in drought. This spring is starting with patches of drought scattered throughout the country. In my opinion, there really isn't enough of an area or severity of drought to really indicate long term warm and dry potential, so drought conditions were not weighted.

So weighing in the recent pattern, the shorter-term forecasts, and the main players in the long range, I have come up with four analogs, with different weightings. I like 2006 and 1986 the most, with a lesser weighting on the years of 2012 and 2004.





The overarching theme from these years is a somewhat active storm pattern keeping the western U.S. to near normal temperatures and precipitation, while abundant warmth and somewhat dry conditions take over in the eastern half of the country.

Bottom line…
The actual tornado counts of the analog years were somewhat mixed, but they generally favored a normal to active start of tornado season before dropping to a quieter than normal May. Since not all months are created equal, it's this quiet back part of the season that ends up weighting the spring forecast to learn more toward the below normal side.

Severe Weather Awareness

While it wasn't weighted very highly, my analog year of 2004 did produce the second highest May tornado count on record, so there *could* be some upside potential to the late season. Odds of the tornado count ending up below/near/above the normal off 511 tornadoes (1991-2010 average) for meteorological spring:

Below normal: 40% (less than 460 tornadoes)
Near normal: 45% (between 460 and 550 tornadoes)
Above normal: 15% (above 550 tornadoes)
Long term forecasts, while generally providing added value to climatology, are still very broad-brush outlooks and do not offer a very consistent level of skill. This forecast only hopes to capture some of the most reliable information available to provide a best guess as to what spring may bring.

More Tornadoes and Tornado Deaths in 2017 Than 2016? Probably So

It's been a blessedly quiet year for U.S. tornadoes, climatologically speaking. According to Patrick Marsh (NOAA Storm Prediction Center), the year 2016 delivered a preliminary total of 1060 tornado reports through Dec. 28, with few or none expected through the rest of the year. This may sound like a very high total, but the number of final tornado reports typically drops from the preliminary total by about 15 percent after duplicate reports have been weeded out. The annual number drops even further relative to prior years when it's adjusted for "inflation" against earlier decades, when fewer people were watching and reporting every twister. Using a linear trend adjustment, Marsh estimates that the final, inflation-adjusted tornado total for 2016 will be around 888, which would be the lowest for any year going back to at least 1954 assuming that the database is normalized (inflation-adjusted) through 2015. "Four of the last five years—2016, 2014, 2013 and 2012—have been the quietest years on record when report inflation is accounted for," said Marsh.

This year did produce a few dramatic outbreaks during peak tornado season, but these played out mostly in open country, where few structures were damaged and few people were hurt. The deadliest events of 2016 were "off-season": seven people died in a Southeast and East Coast tornado outbreak on Feb. 23-24--the nation's second-largest February outbreak on record--and five deaths occurred across the South during an overnight outbreak on Nov. 29-30.

All told, tornadoes have killed only 17 people in the U.S. in 2016, well below the average toll of 46 per year over the three prior years. Assuming we make it to Dec. 31 without any additional tornado deaths, which looks almost certain, we'll have been graced with the least-deadly U.S. year for twisters since 1986, when only 15 people were killed. In data going back to 1875 provided by Harold Brooks (National Severe Storms Laboratory), the only other year with fewer than 20 deaths was 1910, with just 12 fatalities

The strong El Niño of 2015-16 likely helped tamp down tornado activity this year, at least in the heart of Tornado Alley. Researchers at IRI/Columbia University have shown that the most active spring seasons for tornado and hail over the central U.S., especially the Southern Plains, are linked to strong La Niña events, while the very quietest seasons are related to strong El Niño events. In January 2015, the researchers, led by John Allen (now at Central Michigan University), called for better-than-even odds (54 percent) of a below-average number of tornadoes this year, as opposed to the 33/33/33 percent split (below, above, and near average) one would otherwise expect.

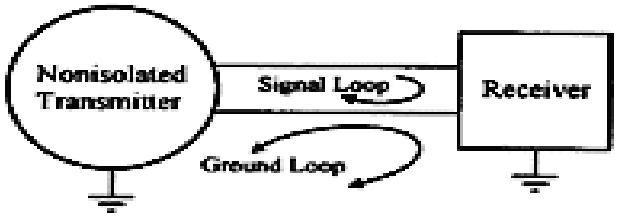
The Experimenters' Bench

Understanding Ground Loops and Proper Shielding of Instrumentation Cables

The Ground Loop is a significant cause of frustration and errors in measuring systems, especially but not limited to low cost systems. The cause of ground loops is pretty straight forward to understand, but difficult to identify and resolve. The simplest solution is to use electrically isolated inputs, but these type of sensors usually cost twice as much as non-isolated measuring devices. Most times the cheaper sensors will be installed, with the hope that the electrician takes all precautions to isolate the sensor wiring from ground loops.

You may find that wireless sensors are taking over a larger portion of the market as security of the signals becomes tighter. They eliminate all chance of ground loops, and continuously perform their own diagnostic of their communications.

What is a Ground Loop?



A ground loop arises in a system when points that we use as a ground reference are both at different potentials, and there is more than one electrical path connecting these ground points. The problem arises when the signal lines are connected in such a way that circulating ground currents are able to flow through one or more signal conductor. This current that ends up flowing in the loop could reach hundreds of amps in the worst case scenario, but most of the time it is in the range of 500 mA and less. As this current flows through the resistance of the signal conductors, a voltage drop occurs. Ground loops can therefore cause problems by adding or subtracting current or voltage from the process loop. Because this current is variable, it cannot be "calibrated out".

This addition or subtraction causes the receiving device to be unable to differentiate between the wanted and unwanted signals, and thus can't accurately reflect the actual process signals.

Why Do We Ground the Instruments, Why Not Leave Them Ungrounded?

> The first reason is safety. If a higher voltage accidentally came into contact with the instrumentation system, the ungrounded system would pose a threat to personnel. If a grounded electrician touched a sensor that was sitting at a higher potential… ciao bella.
>
> Whereas a grounded instrumentation system will cause a fuse to blow, thus rendering the system safe.
>
> The second reason is to ensure that the system is operating within its operating voltage range. If the system isn't grounded, the system could be charged to a high voltage by static electricity or insulation leakage. Also, high voltages will cause the insulation of the cables to breakdown, which will inevitably lead to measurement errors.

The third reason is that the sensor may need to be welded to to the object it is used to monitor. For example, a thermocouple may be welded to ensure the best thermal contact and response time, thereby grounding the thermocouple. Another example is a PH electrode that is in electrical contact with the fluid being measured.

Causes of Ground Potential Differences

Ground returns in electrical power systems

Inductively induced currents

Lightning Strike

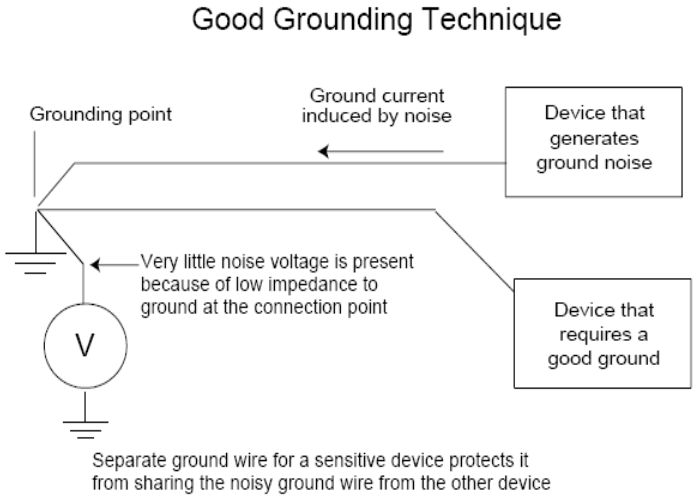
Corrosion of ground connections

Solutions

A Single Ground is a Good Ground.

The simplest and most effective solution is to ensure that your measurement system is connected to a single ground point.

This might not be possible because of grounds needed for electrical safety, communication links with computers that have their own ground, or sensors that are grounded.

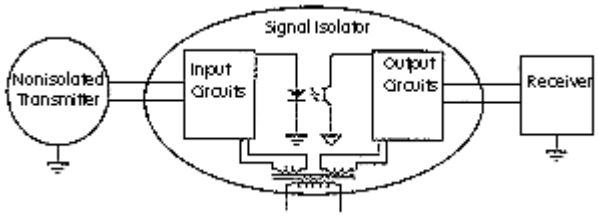


Signal Isolators

When ground loops can't be eliminated completely, the next solution is to use a signal isolator. They break the galvanic path (DC continuity) between all grounds, while allowing the analog signal to continue throughout the loop.

An isolator can also eliminate the electrical noise of AC continuity (what they call common mode voltage)

The best signal isolators use optical isolators for their input, output and power isolation. If you don't have this three-way isolation, you could have a ground loop occur between your isolator's power supply and the process input or output signals.



An Opto-Isolator Integrated Circuit

Opto-Isolator

When an electrical signal is applied to the input of the opto-isolator, its LED lights, its light sensor then activates, and a corresponding electrical signal is generated at the output. Unlike a transformer, the opto-isolator allows for DC coupling and generally provides significant protection from serious overvoltage conditions in one circuit affecting the other.

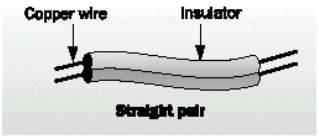
Isolation Transformer

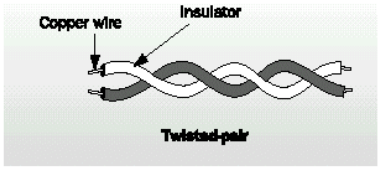
An **isolation transformer** is a transformer, often with symmetrical windings, which is used to decouple two circuits. An isolation transformer allows an AC signal or power to be taken from one device and fed into another without electrically connecting the two circuits. Isolation transformers block transmission of DC signals from one circuit to the other, but allow AC signals to pass. They also block interference caused by ground loops. Isolation transformers with electrostatic shields are used for power supplies for sensitive equipment such as computers or laboratory instruments.

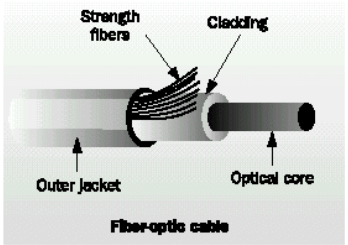
Isolation transformers are commonly designed with careful attention to capacitive coupling between the two windings. This is necessary because excessive capacitance could also couple AC current from the primary to the secondary. A grounded shield is commonly interposed between the primary and the secondary. Any remaining capacitive coupling between the secondary and ground simply causes the secondary to become balanced about the ground potential.

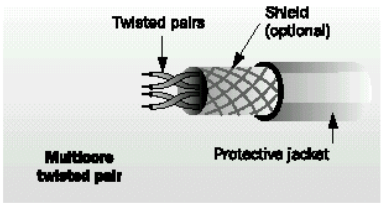
Shield Grounds

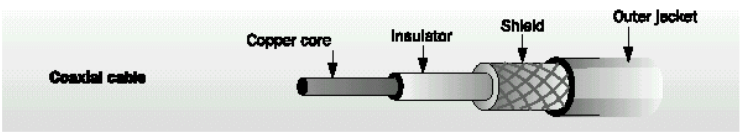
If shielded wire is used, the shielding should be grounded at only one end, preferably the controller end. If you ground both ends, ground current will flow through the shield and inductively induced noise into the signal wires.

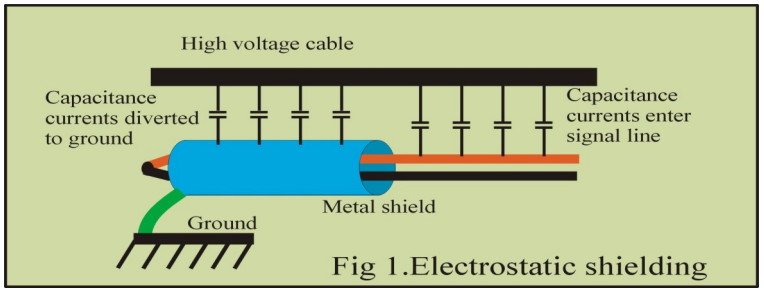












Shielding Solutions

A cable shield is placed between the core or components of a cable and the outer jacket, or over individual components within a cable, to contain the RF signal or keep out unwanted interference. Cable shielding is offered in a wide range of designs and configurations. Each type of shielding has its own distinct advantages and disadvantages that need to be considered when selecting the best and most cost-effective option for a given application. Shields available on the market today include:

Braid Shields. Braid shields provide superior structural integrity while maintaining good flexibility and flex life. These shields are ideal for minimizing low frequency interference and have lower DC resistance than foil. Braid shields are effective at audio, as well as RF ranges. Generally, the higher the percentage of braid coverage, the more effective the shield.

Foil Shields. Foil shields consist of aluminum foil typically laminated to a polyester or polypropylene film. Foil shields provide 100 percent cable or component coverage, improving protection against radiated emission and ingress at audio and radio frequencies. Because of their small size, foil shields are commonly used to shield individual pairs of multi-pair cables to reduce crosstalk. Foil shields may also be bonded to a coaxial cable insulation or cable jacket with a layer of adhesive, allowing for faster, easier and more reliable termination. They have less weight, bulk, and cost less than braid shields and are generally more effective at higher frequencies. Foil shields are more flexible than braid but have a shorter flex life. Drain wires are generally used with foil shields to ease termination and ground electrostatic discharges.

The shorting fold construction technique in foil shield design helps improve high frequency performance by maintaining metal-to-metal contact, thereby increasing the foil shield's range of effectiveness to higher frequencies. This is achieved by folding one edge of the shield tape back upon itself. Thus when the tape is wrapped around the cable, there will be metal-to-metal contact along the seam or edge of the shield tape, better approximating the performance of a seamless tube. Without the shorting fold, a slot is created through which signals can leak and cause interference.

Combination Foil/Braid Shields. Combination shields consist of more than one layer of shielding and provide maximum shield efficiency across the frequency spectrum. The combination foil/braid combines the advantages of 100 percent foil coverage with the strength, flexibility, and low DC resistance of a braid. Typical braid coverages range from 60 to 95 percent. Other combination shields available include various braid/braid, foil/braid/foil, and foil/braid/foil/braid designs.

French Braid Shields. A relatively new development in cable shielding technology, especially suited to audio and RF cable applications, is an ultra-flexible double spiral shield. This design consists of dual spirals of bare or tinned copper conductors, with the two spirals tied together by one weave.

The French braid shield construction provides longer flex life than standard spiral shields, and greater flexibility than conventional braid shields. It produces a much lower level (up to 50 percent less) of micro phonic and triboelectric noise than either spiral or conventional braid shields. In addition, since it is not fully woven, the double spiral shield is easier to terminate than a standard braid. It also provides for lower DC loop resistance than a single spiral, resulting in improved performance.

Early Radio: Military Communications

Communications Operations in Combat

Supporting the Field Forces

The 54th and 53d Signal Battalions, supporting I Field Force at Nha Trang and II Field Force at a base camp called Plantation near Long Binh, were corps signal battalions, modified to operate in Vietnam. The main command posts of both the field forces, unlike those of corps, were semi permanent and did not deploy. There were also other differences between the operations of a field force and a doctrinal corps, and these differences were reflected in the communications that were provided to field force headquarters and corps headquarters in Vietnam.

The principal peculiarity of field force signal communications resulted from the need to supplant traditional wire with mobile multichannel radio relay systems across the miles that separated the base camps of the subordinate units. Multichannel radio systems were extended to lower levels than ever before. In some instances, multichannel service was provided as low as artillery battery level whereas, by accepted doctrine, normal corps systems terminate at artillery group level. Both corps signal battalions were capable of operating approximately eighteen multichannel radio relay links. It was normal to connect all U.S. combat troops and those of Free World Military Assistance Forces within the field forces' tactical areas of responsibility with the field force headquarters. In addition, it was common practice to employ circuits and systems of the 1st Signal Brigade's Corps Area Communications System to provide alternate routing.

Each of the two field forces had a distinct and separate method of employing the resources of the Corps Area Communications System to supplement the organic communications; each had a specific reason. The II Field Force, operating in the relatively flat and populous III Corps Tactical Zone, used the corps area circuitry as alternate routing for its own combat system. In essence, the Corps Area Communications System and the II Field Force's combat communications system were interconnected throughout III Corps Tactical Zone to the extent that each system could potentially provide 100 percent backup for the other.

HON CONG MOUNTAIN SIGNAL SITE, *focal point for integration of 1st Cavalry Division communications and 1st Signal Brigade's Corps Area Communications System.*

On the other hand, I Field Force had the responsibility for II Corps Tactical Zone, which consisted of about one-half the area of the Republic of Vietnam, the largest and most mountainous tactical zone in the republic. Neither the 54th Signal Battalion of I Field Force nor the 1st Signal Brigade's corps area communications resources in II Corps Tactical Zone could alone provide the necessary command and control communications from I Field Force headquarters in Nha Trang to the various U.S. and other Free World Military Forces combat headquarters in the zone. Therefore a concept evolved under which the 54th Signal Battalion would provide the multichannel communications from the forward command post-be it a newly created landing zone for a multibrigade operation or a remote fire support base occupied by an artillery group-to a communication complex of a 1st Signal Brigade unit. From there the communications would traverse the Corps Area Communications System to Nha Trang and into the I Field Force headquarters. The alternate routing or backup capability that prevailed in III Carps Tactical Zone existed only within the Corps Area Communications System in the II Corps Tactical Zone.

Supporting the Divisions

The combat communications systems of each division in Vietnam differed from the standard doctrine in separate ways. These departures from doctrine came about partly as the result of the difference in terrain and operating conditions throughout the country and partly because of the fact that each division was, in essence, "writing its own book" on counterinsurgency warfare. The order during 1966 was "search and destroy" and each combat division had its own way of conducting such operations. As a result, during the Vietnam War the various division signal officers continually tailored their signal battalions and adjusted their methods of operating.

During the period 1969-1970 when I enjoyed the pleasure of hosting a countrywide Signal Officers' Conference, I was constantly amazed and impressed at the divergence of opinion that appeared in any discussion regarding the solution to a common problem. This can be attributed not only to the different circumstances in which each senior communicator found himself, but also to the inventiveness and free thinking that the signalman has always displayed.

For the most part, each division signal battalion in action in Vietnam had the same mission. All these units were responsible for providing the command and control communications to the division's maneuver elements, to the direct support elements, and to the combat elements of the Free World Military Assistance Force operating in the division area. In addition, the signal battalions were required to use division resources to provide communications facilities in the various base camps, complementing those provided by the Corps Area Communications Systems, which handled the bulk of the administrative and logistical traffic.

In the Republic of Vietnam a division usually operated in an area of responsibility covering 3,000 to 5,000 square miles. Such an operating area was enormous as compared to the 200 to 300 square miles in which a U.S. Army division would operate in conventional warfare. In addition, the divisions in Vietnam frequently established battalion-size and occasionally company-size fire support bases, all of which had to be tied together with reliable, responsive communications to ensure quick reaction in an emergency. As often as not, the division had the job of tying in Vietnamese Army elements, Special Forces camps, and U.S. advisers at province and district headquarters, so that mutual support was possible. The need to tie in all of these, while dealing with the factors of varying terrain and weather, made the provision of effective communications a challenge to each division. Brigadier General William M. Van Harlingen, Jr., Assistant Chief of Staff for Communications Electronics at U.S. Army, Vietnam, from July 1967 through January 1969, stated in his debriefing report of January 1969, that the "division signal problems in South Vietnam bear little resemblance to those in a more conventional war."

The mobile multichannel radio relay system was the backbone of division communications. Generally found in a division area were a dozen or two multichannel radio relay links that connected the headquarters with brigade and battalion command posts and fire support bases. As in the field force systems, the sole-user circuit requirement was extensive. On the average, approximately one third of the total available circuits were restricted to sole-users, and the majority of these terminated at the division tactical operation centers. For alternate emergency routing of circuits, the divisions utilized the corps area communications systems wherever and whenever possible. During combat operations, when maneuver elements initiated their action from established base camps, the mobile radio relay links were extended to the area of combat action. Alternate routing and backup links were used extensively, and the field force and the corps area communications systems often provided needed assistance, especially for intelligence, logistic, and administrative communications.

In division signal battalions, personnel and equipment authorizations were modified in order to meet the huge requirements placed on them, but in all cases a great deal of support was necessary from the corps area communicators. The necessity to rely on the Corps Area Communications System for additional support was particularly true of the austere signal battalions of the airmobile divisions, which were streamlined lightweights designed for mobile, nomadic operations, but were caught instead in the semi permanent environment of combat support and fire support bases.

Special Forces Communications in Vietnam

U.S. Army Special Forces were first employed in Vietnam in 1961. In the early stages of U.S. involvement in Vietnam, small detachments were deployed on a six-month temporary duty basis with a larger detachment based in Saigon as the control element. The mission of the U.S. Special Forces was to recruit and train Vietnamese irregular paramilitary forces to defend their own homes and hamlets. In 1964 the 5th Special Forces Group was deployed to Vietnam. This group, headquartered at Nha Trang with the Vietnamese Army Special Forces, had detachments spread throughout the country at the most isolated villages and hamlets, working with and advising the Vietnamese local defense forces. As more and more conventional U.S. troops arrived in Vietnam, the U.S. Army Special Forces effort expanded. By June 1966 the Special Forces had operational control of over 40,000 Civilian Irregular Defense Group troops and advised 35,000 members of the Vietnamese Regional Forces and Popular Forces.

To support the countrywide U.S. Special Forces mission, the signal company of the 5th Special Forces Group established secure radio teletypewriter links from the operational base at Nha Trang to the detachments and teams in each corps tactical zone. This primary system was supplemented by long-distance voice radio nets that virtually blanketed the country. The U.S. Special Forces communications system was not the subject of much fanfare in Vietnam and was overshadowed by the elaborate fixed communications installations that appeared throughout the country. It is significant, however, that the long distance high-frequency voice and teletypewriter radio nets of this system were the only means of contact with the outside world for many small Special Forces detachments. The communications operated and maintained by the signalmen of the 5th Special Forces Group were independent of any other U.S. system in Vietnam.

Communications for the Battle for Dak To

What happened in the battle for Dak To, near the Cambodian border in central Vietnam in November 1967, illustrates not only the responsiveness of the U.S. Combat communicator during a fluid and furious engagement, but also the interconnection and mutual support which the division and field force signal battalions and the 1st Signal Brigade's area battalions continually provided for each other throughout the Vietnam War.

The battle of Dak To was not a separate operation in itself but occurred within the boundaries of the U.S. Army 4th Infantry Division's Operation MACARTHUR. Nevertheless, the size of the two opposing forces, the length and violence of the engagement, and the over-all significance of the battle have made the events that occurred in the vicinity of Dak To from late October until 1 December 1967 among the most significant that occurred in the Central Highlands.
In late October U.S. reconnaissance revealed the presence of the North Vietnamese Army's 1st Division, with its four regiments supported by a rocket artillery regiment, deployed between Dak To and the common border area of Vietnam, Cambodia, and Laos. U.S. intelligence information pointed toward an imminent North Vietnamese Army attack on Dak To. To meet this threat, Major General William R. Peers, Commanding General, 4th Infantry Division, on 1 November sent his 1st Brigade with an attached battalion of the 173d Airborne Brigade to positions just west of Dak To.

When immediate contact was made with the enemy and heavy fighting ensued, the I Field Force commander, Lieutenant General William B. Rosson, provided General Peers with more troops and support. The remainder of the 173d Airborne Brigade arrived in the Dak To area on 5 November. The next day the 4th Infantry Division established a tactical command post at Dak To to control the two subordinate headquarters. The buildup of forces, which included significant numbers of combat support and logistic units, continued until the 18th, when Colonel Donald V. Rattan's 1st Brigade, 1st Cavalry Division, joined the battle, establishing its battlefield command post at Polei Kleng, near Kontum. By then the fighting was spreading to the west as the North Vietnamese forces were destroyed or pushed back into their sanctuaries in Cambodia and Laos. (Map 4)

The furious action around Dak To during the month of November, together with the fact that a force of U.S. Combat and support troops constituting more than a complete U.S. division had been committed, posed some problems to the 4th Infantry Division signalmen. For example, while the 124th Signal Battalion, commanded by Lieutenant Colonel William M. Spitz, was busy establishing a complete division communication system in the Dak To battle area, it also had to maintain its previously established network at Pleiku and take care of the rest of the division area in 11 Corps Tactical Zone. The enemy made sure that his presence would not be forgotten elsewhere by stepping up attacks by fire and ambushes throughout the entire Central Highlands. In a classic example of combat communications support, the 124th Signal Battalion successfully met the challenge by judicious use of its own resources, as well as those provided by I Field Force's 54th Signal Battalion and the 43d Signal Battalion of the 1st Signal Brigade.

FIRE SUPPORT BASE ON A RIDGE NEAR DAK *To. Tall antennas were used to extend range of mobile voice radios.*

The 124th's initial effort in support of the battle of Dak To was the installation of two 12-channel links from the division main command post at Camp Enari near Pleiku to the division's 1st Brigade forward command post at Dak To. Upon arrival of the division tactical command post at Dak To, on 6 November, the battalion was operating a mobile, one-position switchboard for the 1st Brigade of the 4th Division. With the increase in activity it became necessary to install a second switchboard for the division tactical command element. This second switchboard, like the first, was shortly saturated; it became apparent that the 1st Logistical Command's forward support activity, airfield control personnel, and other support units, continually arriving by air and road, all had a need for area communications support. The Division Signal Officer made a request to Headquarters, I Field Force, for area service in order to relieve the increasing pressure on his two small mobile switchboards and the command and control teletype circuits which his signal battalion had activated. As a result, the 1st Signal Brigade's 43d Signal Battalion, under the command of Lieutenant Colonel Edwin B. Gentry,

MAP 4

installed area telephone and message service at Dak To as well as a 12-channel general-user link from Dak To to Pleiku. Thus relieved of area service responsibility, the communications resources of the 124th Signal Battalion could and did remain oriented toward the command and control effort.
As the 173d Airborne Brigade, commanded by Brigadier General Leo H. Schweiter, arrived, it was tied into the system. The 124th installed the necessary links between the division tactical command post and the 173d's battlefield command post at Ben Het, west of Dak To. To provide the circuits from the 173d forward command post back to its aviation support, which remained at Kontum, and its base camp location at An Khe, a mix of 124th, 43d, and I Field Force's 54th Signal Battalion multichannel links was employed. Lieutenant Colonel Robert M. Springer's 54th Signal Battalion provided a multichannel link between Dak To airfield and Kontum. At Kontum this link tied into an established 43d Signal Battalion system to pick up the An Khe circuits. Two other 54th Signal Battalion links already in operation, one from Camp Enari to Pleiku and one from Pleiku to Dak To airfield, were used for additional special purpose circuitry.

Some of the largest demands for circuits over the systems provided by these three battalions were to support U.S. air operations. Not only was there a need for extensive communications at the Army airfields but there was also a requirement for air route traffic control and point-to-point close air support circuits. Finally, significant numbers of channels were needed to control and guide the large bomber effort directed by General Westmoreland. The extensive requirements for communications in support of air operations were not confined to this battle, but were typical of most other operations in Vietnam.

As the battle reached a peak in mid-November, the area system between Dak To and Pleiku proved insufficient. The 1st Signal Brigade thereupon made arrangements to install a 24-channel tropospheric scatter system with mobile equipment between Dragon Mountain, adjacent to Camp Enari, and the U.S. Advisers compound, which stood next to the village of Tan Canh and had been consistently used as a radio relay site into the Dak To airfield. Of these twenty-four channels, the 124th Signal Battalion was to use twelve in direct support of the 4th Infantry Division. In order to extend these circuits to the division tactical command post at the airfield, the 124th's linemen installed a 12-channel landline carrier system using spiral-four cable. This four-mile link was one of the relatively few cable systems installed outside the perimeter of U.S. camps in Vietnam. Usually radio relay would have been used, but in this case the 4th Infantry Division signalmen had simply exhausted the supply of radio equipment.

In all, during the thirty-three days of the battle for Dak To, over fifteen multichannel links were installed and operated in direct support of the operation. The majority of these belonged to the 124th Signal Battalion. Without the help and assistance of the communicators from the I Field Force and the 1st Signal Brigade, however, the support provided the combat and the combat service commanders during this significant battle would have been very lean at best.

Danger of EMP

Geomagnetic storms: The Carrington Event

What it is: Solar weather suddenly produces big charges in the upper atmosphere and renders it highly conductive; immense currents flow through the ionosphere.
Scope: Planet wide or continent wide
Possible Strength: Perhaps 3,000 nT/min, according to an OECD "worst case scenario" study.

Actual observed strength: The Carrington Event has been estimated at 1,760 nT/min. If the July 2012 "near miss" had hit, NASA is guessing around 1,200 nT/min.
In March 1989, a CME about one-third to one-half the size of the Carrington Event triggered a geomagnetic storm over the northern hemisphere with a Dst of around 400-500 nT/min for 92 seconds. Hydro Quebec's high-tension lines were, in places, 1,200-km long, i.e., 1.2 million meters. The long lines acted like one big series circuit, and the result was severe damage to transformers and switching equipment, with protective relays taking down most of the Quebec power grid (and parts of the northeast US with it).

Dangers: Massive voltage surges in long conductors, most especially power and any remaining non-fiber optic, non-coaxial communication cables. Damage to high-voltage transformers might take years to repair and replace.

EMP process: The CME itself is just the trigger for the geomagnetic storm that causes the EMP. In normal conditions, solar electrons and protons constantly enter Earth's magnetic field, which sweeps them toward the north and south magnetic poles. As they enter the Earth's ionosphere, each charged particle rips past millions of atoms, tearing electrons off them and converting them to charged ions. That's how the ionosphere stays ionized even though the charges are constantly finding each other and canceling each other out. When anything drastically increases the charges in the ionosphere -- such as the trillion-fold increase in incoming charged solar particles that is a direct hit from a big CME -- the ordinary diffusion process is overwhelmed. Huge electric currents flow through the ionosphere, creating a rapidly changing magnetic field, which in turn induces currents in conductors on the ground, 30 to 100 miles below.
What are the chances? A few per century.

Protection: Filter your power, and if you hear we're about to take a Carrington-class hit, unplug and power down. The conductors in a typical office or industrial facility are not long enough to build up significant voltages in Carrington conditions, but you don't want to be hooked up to a 1,000-mile long wire that could.

Lightning
What it is: Surely you've seen lightning before.
Scope: Up to a kilometer or more away, if it strikes a conductor that allows it to reach your facility.
Possible and actual observed strength: There's a very large experiential base with lightning. Within a few meters of the strike point, around 10 million nT/min; at a kilometer away, the strength falls off to about 10 thousand nT/min.
Dangers: Fires, secondary explosions, severe electrical damage including various freakish accidents.
EMP process: Lightning is a huge oscillating current through ionized air between big charges on the ground and in the clouds.
What are the chances? Over time, nearly every local high point on Earth is hit many times by lightning.

Danger of EMP

Protection: Lightning rods, insurance, prayer. Most of the precautions against lightning are familiar to people everywhere. If nothing else, it proves we can live with EMP if we just get enough practice.

Local supernova
This is the one that is least likely to matter.
What it is: If one of the exploding stars called supernovae goes off in our neighborhood, within a few dozen light years or so its gigantic X-ray and gamma ray output could cause massive Compton scattering in the ionosphere.
Scope: Planet wide

Possible strength: If ionospheric EMPs are really limited to about 1 million nT/min, then that would be the upper limit.
Actual observed strength: Historical evidence (mostly fossil chemistry and ice samples) argues that these types of EMP have happened, probably at a level comparable to the very largest CMEs.

Dangers: Similar to nuclear ionospheric EMPs with one major exception: The gamma bombardment may continue for many months, and because it will do so, it is quite likely to gradually produce a global brown cloud of nitrous oxide that will eliminate most of our ozone, resulting in the death of the whole food chain (beginning with plants and marine life). So even though you might be a bit perturbed when you find your phone, game console, and tablet are not working, you'll probably be much more bothered a few weeks or months later when the famine sets in.

EMP process: Supernovas radiate unimaginably huge amounts of hard gamma and x-rays, which Compton-scatter in the ionosphere.

What are the chances? Of a nearby one, pretty low. Astronomers have scouted the neighborhood thoroughly, and the nearest real prospect for such a supernova is IK Pegasi, which is 150 light years away -- too far to do much more than give us all some celestial fireworks. A reasonable guess is there's nothing to worry about for the next few million years. Still, it's possible that a close-by supernova or hypernova caused the Ordovician Extinction Event -- and if so, the odds are as bad as once in a billion years.

Protection: The same things you would do for CME and nuclear EMPs will work here. You just won't be around to feel proud of your proactiveness for as long.

Club member Howard Schmidt W7HAS has become an S.K.

Howard A. Schmidt, W7HAS, of Muskego, Wisconsin -- a global leader in cybersecurity and the first person to hold the post of White House Cybersecurity Coordinator -- died on March 2. An ARRL member, he was 67. Schmidt served both Presidents George W. Bush and Barack Obama as their administrations' top cybersecurity advisor. He also held top security posts at Microsoft and eBay. In 2009, after President Obama named him as White House Cybersecurity Coordinator, Schmidt told ARRL that he credited Amateur Radio with getting involved in technology.

"I love technology, and it was Amateur Radio that caused me to build my first computer -- a Sinclair ZX80 -- to use for EME calculations," he said in a 2009 interview. "I studied all about the OSCAR systems and would build equipment to monitor when they would pass within range of Arizona," where he spent his younger years. That, he said, set him on the path to computer crime investigations and computer forensics, which, in turn, led to his career in cybersecurity.

First licensed as WB7NUV in the late 1970s, Schmidt was active on VHF and UHF, including packet, and said TAPR was "a real inspiration."

By the time he joined the Obama administration, which he left in 2012, he had only recently gotten back into Amateur Radio owing to what he called "an administrative error." Due to a clerical mistake, the FCC had erroneously mailed him an Amateur Extra license, prompting him to buy a full complement of gear. By the time the error was resolved, he said, "I was hooked on Amateur Radio all over again."

Schmidt distinguished himself in both the public and private sectors, including more than 26 years of military service with the US Air ForceForce — he served three duty tours in Vietnam — and later as an Army Reserve special agent with the Criminal Investigation Divisions' Computer Crime Unit. In the private sector, Schmidt was president and CEO of the Information Security Forum and an executive director of SAFECode. With former Secretary of Homeland Security Tom Ridge, Schmidt was also a partner in Ridge-Schmidt Cyber, an executive services firm. Along the way, he was a police officer and a member of the FBI's computer exploitation team. As director of the Air Force Office of Special Investigations Computer Forensics Lab and Computer Crime and Information Warfare Division, he established the US government's first dedicated computer forensics lab.

In 2011, at Schmidt's invitation, an **ARRL delegation briefed** several National Security Staff members on the capability of Amateur Radio to assist in emergencies. "The White House is looking for ways that the great work of Amateur Radio operators can continue to support emergencies in the future, with particular attention to increased use and dependency on internet-based technologies," Schmidt told the delegation.
He was the author of *Patrolling Cyberspace: Lessons Learned from a Lifetime in Data Security*, and was a contributor to *The Black Book on Corporate Security*.

ARRL Newsline

The Chicago Chapter of the IEEE-EMC Society will be holding a special program on "Man-Made Noise and the Impact to Radio Communications – The Changing Environment".

The Chicago Chapter of the IEEE EMC Society will hold it's Wednesday-April 19th meeting at Fermilab in Batavia, Illinois. This Meeting is free of charge, and is open to all interested parties, not just IEEE members LOCAL AMATEUR RADIO OPERATORS ARE ENCOURAGED TO ATTEND.

The Meeting Program will feature Mr. Ed Hare (W1RFI) IEEE Vice-President of Standards and American Radio Relay League Laboratory Manager and Dr. Greg Lapin (N9GL) - Co-chair of the Spectrum and Receiver Performance Working Group of the Federal Communications Commission (FCC) Technological Advisory Council.

Detailed information and a map to the meeting location can be found at; http://www.central.arrl.org/ieee/

For Registration;

Contact Kermit Carlson, W9XA, at 630-840-2252 or email Kermit@fnal.gov

Please note that the location at FERMILAB is Building #327, NOT the Wilson Hall High-Rise. Originally there was an offer for a tour of the laboratory, however at this time the tours are full. Seats are still available for the meeting.

ARRL Central Division Director: Kermit A Carlson, W9XA
w9xa@arrl.org

Next Regular Meeting

The next meeting will be on **Thursday, March 30th, 2017,** 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:

April 27th , 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

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.	

VE Testing:

March 25th, 9:30am— 11:30am

No testing: June, August or December

ALL testing takes place at: Ham Radio Outlet 5720 W. Good Hope Rd. Milwaukee, WI 53223

Area Swapfests

April 1st, MRAC/MAARS Swapfest Location: Milwaukee, WI Type: ARRL Hamfest
Sponsor: Milwaukee Radio Amateurs' Club/Milwaukee Area Amateur Radio Society
Website: http://www.w9rh.org/club-events/swapfest/

April 8th, Madison Hamfest Location: Stoughton, WI
Type: ARRL Hamfest
Sponsor: Madison Area Repeater Association
Website: **http://www.qsl.net/mara**

MRAC Working Committees
100th Anniversary:

- Dave—KA9WXN

Net Committee:

- Open

Field Day

Dave—KA9WXN, Al—KC9IJJ

FM Simplex Contest

- Joe – N9UX
- Jeff – K9VS

Raffle

- Tom – N9UFJ

Newsletter Editor

- Michael-KC9CMT
- Pancho– KA9OFA

Webmaster

- Dave, KA9WXN

Refreshments

- Open

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)

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

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

Saturday Night Yaesu Fusion Net 7:00 P.M., W9RH Repeater, C4FM digital mode, using "DN"', digital narrow mode

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.

2 meter 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.

Minnesota/Wisconsin Yaesu System Fusion, Wires-X Technical Net.
Monday Evenings 7:30 P.M. Local Time.

Sponsored By
BARS -Bakken Amateur Radio Society.
Where: On the MRAC repeater,
145.390MHz, Offset -600KHz, PL Tone encode of 127.3.
The Net is carried via a RF Node Link to Wires-X Room (21493) .
The net is held in the Digital Narrow (DN) mode.