
# Lewisville Amateur Radio Association

## "THE ARRAY"

**APRIL 2020**

***From the President's Shack, Ron Ford, KF5OMH:***

**History was made –** With the COVID-19 shelter-in-place order in effect we had to find a different method of having our March Membership meeting. Thanks to Steve, W5JK, for getting us fixed up with a session of GoToMeeting where we were able to conduct a virtual meeting. We were blessed to have Jim's, WB8YWA, family and some longtime friends join us for a special memorial presentation. If you would like to see the presentation it is on the home page of our web site, https://w5lvc.org/.

**This is it** – This is the last column I will write as the President of LARA. The last two years have gone by quickly. They were not without their challenges but all-in-all they were a good two years for the club. Many thanks to the other officers who served with me. It was a great team that worked well together. I ask that all the members give the incoming officers all the support possible and when they ask for help, please step up and volunteer.

**Election of Officers** – As you are reading this issue of the newsletter the annual election of officers is taking place. You should have received a link to your secret ballot from HamClubOnline. Please take a minute and submit your selection for the candidates of your choosing. The election closes on April 17.

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**Web Site: W5LVC.org**

*Check us out*
**facebook.com/w5lvc/**

*Lewisville Amateur Radio Association*
*Is a 501(c)(3) organization*

## LARA Upcoming Events

### Business Meeting

**8:00 AM Saturday**
**February 15, 2020**
**Lewisville Central Fire Station**
**188 North Valley Parkway**
**Lewisville, TX**
**Temporarily Suspended**

### Weekly Nets

**"Information and Help Net"**

**Wednesday, 7:00 PM on 145.170**
**PL 110.9, -.600 repeater**

### Saturday Breakfast

***(except 3rd Saturday)***

**Main Street Cafe**
**208 E. Main Street**
**Lewisville, TX 75057**
**Temporarily Suspended**

### Association Contact Information

**Email: W5LVC.Club@gmail.com**

**Mailing Address:**

**LARA, P.O. Box 292282**
**Lewisville, TX 75029**

### Welcome New Members

Robert Zink

## 2019-2020 Officers

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**"THE ARRAY"**

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Association membership is open to all persons interested in amateur radio. Join at any meeting, by mail or on-line through our web site. Annual dues are $25 individual, $30 family.

***The President's greeting, from page 1***

Thanks to Steve, W5JK, for coordinating both the nomination and election processes.

**Meetings --** Since we are restricted from having face-to-face meetings, we've been doing virtual meetings using a product named GoToMeeting. Some folks have asked why we're using this technology and not doing the meetings over the air using one of the area repeaters. The GoToMeeting platform offers several benefits that just don't work over the air; specifically, the ability to show a presentation and have the presenter in control of his presentation along with being able to see everyone's smiling faces. Watch your email for the link to the meeting the week prior to the event. Again, thanks to Steve, W5JK, for making this facility available to us.

**Summer Field Day** – we're in need of an individual to coordinate our Summer Field Day event. Conner Pavilion at Lake Park has been secured for the occasion but we're in need of an individual or two or three to coordinate the details. This is a great opportunity for someone to get some experience at leading one of our popular events. Don't think you have what it takes? Sure, you do! Several of the officers are more than willing to help you work through it and be successful.

**By-law revision** – the recent by-law change proposal was passed with the majority of the membership voting and the majority of those votes in favor of the change. The by-laws have been revised to incorporate the new wording and have been posted on the web site under the Resources tab.

**Upcoming events –** There are a lot of events scheduled for the next few months that are in jeopardy due to the current gathering restrictions. Keep your eye on the specific event web sites along with our club calendar for late breaking news of postponements and cancellations.

Looking forward to seeing everyone at the meeting on April 18 where Perry, NE5ET, will be presenting our program on VOACAP - Propagation. Join in and invite a guest. There is no doubt in my mind that this will be another virtual meeting.

73, Ron KF5OMH

## Lewisville Amateur Radio Association Information and Help Net

Every Wednesday evening at 1900 (7:00 PM) on the 145.170 repeater (-.600 offset 110.9 PL)

Stop by for friendly discussion on various topics related to our great hobby. Just never know what will come up.

Having an issue with your station? Bring it to the net; there are always folks on board who are willing to help.

Remembering Jim, WB8YWA

*Following is the introduction to the memorial video delivered by Mike, W5EVT, during the membership meeting on March 21, 2020.*

Jim Horton, WB8YWA, became a silent key this past Monday, March 16 at 6:30 PM. Jim would have celebrated his 75th birthday on March 18 and was dearly looking forward to it.

He and his wife, Sherry, moved to Lewisville in 1996. Jim was licensed in 1975 in Michigan. He loved HF and 6 meters. 6 meters was his favorite band.


When the club was founded, Jim joined our club as one of the original members. when we were a group of about 15 and held our meetings at the Fat Cow BBQ on Valley Ridge Blvd.

It didn't take long for him to become active and a back-bone member in our club. Jim was the first elected Technical Director for the club and he held that office to this day. He also started our Wednesday evening Information and Help Net and was the voice of the net as Net Control most Wednesday evenings unless he was traveling. He loved calling the net and was excellent at convincing other less experienced individuals that they could also do it; not that he really wanted to give up the job though.

He also enjoyed working the National Traffic System. He was the Traffic Manager for the state of Michigan for many years. He would check into several nets every day that he was around a radio and assisted in passing and untold amount of traffic. This past Tuesday the 7290 Traffic Net recognized him for his services.
Jim was a Life Member of ARRL. Jim was the first, and only to this point, recipient of a Certificate of Merit from the ARRL North Texas Section Manager, Steve Lott Smith. He was very proud of that honor. The fun part of the presentation was that we were able to keep it quiet until the evening he received the award. It was a total surprise to him.

Our membership roster stands at approximately 50 individuals. Every one of those members has been welcomed by Jim and the majority of us have been the recipient of his vast knowledge of Amateur Radio. If any one of us ever needed help with a problem Jim was right there offering his assistance.

Jim was an early riser. He was up before the chickens every morning six days a week to get on the air with a group of long-time friends around the country; a group of which he was co-founder and known as the "Morning Group". They have a long history of never-ending friendship. He also introduced many of his Lewisville area friends to the group and we are now active participants. A highlight for Jim was face-to-face meetings of the group in February of 2018 and 2019 at the Orlando Hamvention. At these gatherings Ron and I had the honor of spending three days sharing old memories and making new ones.

Thus far it sounds like Jim's life rotated around amateur radio and LARA. That is far from the fact. He enjoyed his family most of all; his love for his wife, Sherry, his kids and grandkids above all were foremost in his life. He was active in his church and had accepted Jesus Christ as his Lord and Savior a long time ago.

He enjoyed afternoon swims with grandkids, hunting and fishing with his kids and grandkids, family meals after he did the BBQing, hooking up the fifth wheel camper and heading off across the country, cruising on the big ships with friends, Cub Scouts with grandson Max and much more.


JIM HORTON, WB8YWA-sk


# *Jim Horton, WB8YWA-sk*

# Treasurer's Report

*Clark Highsmith, K5LGX*

Greetings members and friends of LARA,

March was a challenging one as our nation and the world came under the grip of the real-life drama of the Wuhan Flu. I pray that everyone is healthy both physically and mentally. I pray for those adversely affected economically. I also pray for our leaders and those on the front lines battling this contagion. Let's continue to seek out ways to help and encourage one another during this time.

The month was also challenging for our club as we lost one of our most dedicated members and a Christian brother, Jim Horton (WB8WYA). The month was relatively quiet from a financial standpoint. We had several membership renewals and one new member join. We issued one refund to an individual who registered for our General class that did not take place. We also supported a useful QSL service, EQSL.cc, with payment for one year at their Bronze membership level.

April is my last month serving as club treasurer. You won't get rid of me too easily; I plan to stick around and attend club events and help in other ways. Thank you for allowing me to serve in this capacity.

Clark Highsmith. K5LGX

**LARA Treasurer's Report--March 31, 2020**

| | | | | |
|---|---|---|---|---|
| **Checking** | | | | |
| Beginning | | | | $3,005.63 |
| Income | | | | |
| | Dues | | $75.00 | |
| | Donations | | $0.00 | |
| | ARRL memberships | | $0.00 | |
| | Events | | $0.00 | |
| | T-shirts | | $0.00 | |
| | Miscellaneous | | $0.00 | |
| | Total Income | | $75.00 | |
| Expenses | | | | |
| | Paypal Fees | | $1.03 | |
| | Events | | $0.00 | |
| | Subscriptions (EQSL.cc) | | $12.00 | |
| | Miscellaneous | | $15.00 | |
| | Total Expenses | | $28.03 | |
| Ending | | | | $3,052.60 |
| Petty Cash (Included in | | | | $0.00 |
| **Club Assets** | | | | |
| | For Sale | $0.00 | | |
| | Stock (Not for Sale) | $3,009.34 | | |
| | Loaner Equipment | $375.00 | | |
| | | | $3,384.34 | |
| **LARA NET** | | | | $6,436.94 |

## Support LARA with AmazonSmile

AmazonSmile is a simple and automatic way for you to support your favorite charitable organization every time you shop, at no cost to you. When you shop at smile.amazon.com, you'll find the exact same low prices, vast selection and convenient shopping experience as Amazon.com, with the added bonus that Amazon will donate a portion of the purchase price to LARA. To shop at AmazonSmile simply go to smile.amazon.com from the web browser on your computer or mobile device. You may also want to add a bookmark to smile.amazon.com to make it even easier to return and start your shopping at AmazonSmile. The AmazonSmile Foundation will donate 0.5% o the purchase price from your eligible AmazonSmile purchases. On your first visit to AmazonSmile (smile.amazon.com), you need to select Lewisville Amateur Radio Association as the charitable organization to receive donations from eligible purchases before you begin shopping. AmazonSmile will remember your selection, and then every eligible purchase you make at smile.amazon.com will result in a donation to LARA.

## Kroger Rewards

If you shop at Kroger and are a member of their Rewards Program you can also support LARA by selecting Lewisville Amateur Radio Association as your charitable organization of choice. Simply sign in to your account and select us and Kroger will donate 0.5% of your eligible purchases to LARA.

## Matching Funds

Many employers will match hours that employees spend supporting a non-profit with donations to that non-profit. If your employer has such a program LARA may qualify to receive these types of funds as we are an approved 501 (C)(3) organization. So, you're retired? Some companies even support a program of this nature for their retirees. Check with your current, or former, employer to see if they have a program of this nature. If 501 (C)(3) details are needed contact the club treasurer.

**"Information and Help Net"**

**Wednesday, 7:00 PM on 145.170**
**PL 110.9, -.600 repeater**

**BATTERIES PLUS BULBS**

**1093 W. MAIN ST., SUITE #222**
**LEWISVILLE, TX 75067**

***Your Destination for Batteries, Light Bulbs, Lighting Fixtures & Repairs.***

Here is a Club benefit that very few of us take advantage. We get 10% discount on all purchases at the **Batteries Plus Bulbs** location in Lewisville, right across the street from the fire station.

They have batteries for cars & trucks, cell phones, SLA, motorcycles, boat/ marine, and golf carts. They also have Alkaline batteries and do cell phone repair. As well as key fob replacements, lighting & fixtures and chargers.










# Area Repeaters

| FREQ | SHIFT | PL | CALL | NAME | ALLSTAR |
|---|---|---|---|---|---|
| 144.9100 | none | none | W5NGU-4 | DCARA DIGIPEATER DENTON | |
| 144.9900 | none | none | KC5GOI | DCARA DIGIPEATER ROSSTON | |
| 144.9900 | none | none | KD5EOC-10 | DCARA WL GATEWAY | |
| 145.1700 | -0.600 | 110.9 | W5FKN | DCARA DENTON COUNTY EOC | |
| 145.2100 | -0.600 | 110.9 | N5MJQ | METROCREST ARA CARROLLTON | |
| 145.4000 | -0.600 | 110.9 | NETARC | GRAPEVINE | |
| 145.4900 | -0.600 | 85.4 | WD5U | ROSSTON TOWER | 41089 |
| 146.6200 | 0.600 | 110.9 | N5ERS | GRAPEVINE | |
| 146.7800 | 0.600 | 131.8 | WQ5A | WISE COUNTY SKYWARN | |
| 146.9200 | -0.600 | 110.9 | W5NGU | DCARA DENTON | 41087 |
| 146.9400 | -0.600 | 110.9 | K5FTW | FT. WORTH SKYWARN | |
| 147.3800 | 0.600 | 110.9 | K5LRK | LAARK THE COLONY | 47668 |
| 147.4500 | -1.000 | none | W5NGU-C | DCARA EOC D*STAR "C" | |
| 147.4900 | -1.000 | none | KE5YAP-C | DCARA ROSSTON D*STAR "C" | |
| 147.9700 | none | none | K5YX-10 | WINLINK GATEWAY | |
| 224.0000 | -1.600 | 110.9 | K5LRK | LAARK THE COLONY | |
| 224.2000 | -1.600 | 110.9 | KE5GDB | DCARA DENTON | 43409 |
| 224.9200 | -1.600 | 110.9 | AF5RS | AF5RS | 43784 |
| 440.6625 | 5.000 | none | N5LS | DMR MARC CC1 | |
| 440.6875 | 5.000 | none | W5NGU | ROSSTON DMR MARC CC1 | |
| 440.7125 | 5.000 | none | KE5YAP-B | DCARA ROSSTON D*STAR "B" | |
| 441.3250 | 5.000 | 88.5 | W5NGU | PORTABLE DCARA REPEATER | |
| 442.1750 | 5.000 | 110.9 | NETARC | SOUTHLAKE | |
| 442.6000 | 5.000 | 131.8 | WQ5A | WISE COUNTY SKYWARN | |
| 442.6500 | 5.000 | 110.9 | N5MJQ | METROCREST ARA CARROLLTON | |
| 442.7500 | 5.000 | 110.9 | KA5R | TROPHY CLUB | |
| 442.9250 | 5.000 | none | W5NGU-B | DCARA EOC D*STAR "B" | |
| 443.2250 | 5.000 | 110.9 | N5ERS | DECATUR | |
| 443.3000 | 5.000 | 110.9 | K5LRK | LAARK C4FM ONLY | |
| 443.5250 | 5.000 | 118.8 | WA5LIE | DCARA DENTON | |
| 443.7375 | 5.000 | 141.3 | N6LXX | ROSSTON TOWER | |
| 443.8250 | 5.000 | 103.5 | KC5BY | COPPELL HIGH SCHOOL | 40666, 50187 |
| 443.8750 | 5.000 | 110.9 | NETARC | DFW AIRPORT | |
| 444.0500 | 5.000 | 110.9 | W5NGU | DCARA DENTON COUNTY EOC | |
| 444.2250 | 5.000 | 110.9 | K5CFD | COPPELL | |
| 444.5125 | 5.000 | 123.0 | KE5UT | CELINA | |
| 444.7000 | 5.000 | 110.9 | NETARC | SOUTHLAKE | |
| 444.8500 | 5.000 | 110.9 | N5ERS | GRAPEVINE | |
| 927.0500 | -25.000 | 110.9 | W5FKN | DECATUR | |
| 927.4125 | -25.000 | 432.0 | N5LS | DENTON | |
| 927.6125 | -25.000 | 110.9 | W5NGU | DCARA DENTON COUNTY EOC | |
| 927.6625 | 25.000 | none | N5LS | DMR MARC CC1 | |
| 1253.6000 | none | none | W5NGU-G | DCARA EOC D*STAR "G" | |
| 1259.2000 | none | none | KE5YAP-G | DCARA ROSSTON D*STAR "G" | |
| 1293.2000 | -20.000 | none | KE5YAP-A | DCARA ROSSTON D*STAR "A" | |
| 1293.4000 | -20.000 | none | W5NGU-A | DCARA EOC D*STAR "A" | |

# The Effects of Ground

**ARRL**

The ground around and under an antenna is part of the environment in which any actual antenna must operate. Antenna fundamentals, deal mainly with theoretical antennas in free space, completely removed from the influence of the ground. This article is devoted to exploring the interactions between antennas and the ground.

The interactions can be analyzed depending on where they occur relative to two areas surrounding the antenna: the *reactive near field* and the *radiating far field*. You will recall that the reactive near field only exists very close to the antenna itself. In this region the antenna acts as though it were a large lumped-constant inductor or capacitor, where energy is stored but very little is actually radiated. The interaction with the ground in this area creates mutual impedances between the antenna and its environment and these interactions not only modify the feed-point impedance of an antenna, but also often increase losses.

In the radiating far field, the presence of ground profoundly influences the radiation pattern of a real antenna. The interaction is different, depending on the antenna's polarization with respect to the ground. For horizontally polarized antennas, the *shape* of the radiated pattern in the elevation plane depends primarily on the antenna's height above ground. For vertically polarized antennas, both the *shape* and the *strength* of the radiated pattern in the elevation plane strongly depend on the nature of the ground itself (its dielectric constant and conductivity at the frequency of operation), as well as on the height of the antenna above ground.

## Feed-Point Impedance Versus Height Above Ground

Waves radiated from the antenna directly downward reflect vertically from the ground and, in passing the antenna on their upward journey, induce a voltage in it. The magnitude and phase of the current resulting from this induced voltage depends on the height of the antenna above the reflecting surface.

The total current in the antenna consists of two components. The amplitude of the first is determined by the power supplied by the transmitter and the free-space feed-point resistance of the antenna. The second component is induced in the antenna by the wave reflected from the ground. This second component of current, while considerably smaller than the first at most useful antenna heights, is by no means insignificant. At some heights, the two components will be in phase, so the total current is larger than is indicated by the free-space feed-point resistance. At other heights, the two components are out of phase, and the total current is the difference between the two components.

Changing the height of the antenna above ground will change the amount of current flow, assuming that the power input to the antenna is constant. A higher current at the same power input means that the effective resistance of the antenna is lower, and vice versa. In other words, the feed-point resistance of the antenna is affected by the height of the antenna above ground because of mutual coupling between the antenna and the ground beneath it.The electrical characteristics of the ground affect both the amplitude and the phase of reflected signals. For this reason, the electrical characteristics of the ground under the antenna will have some effect on the impedance of that antenna, the reflected wave having been influenced by the ground. Different impedance values may be encountered when an antenna is erected at identical heights but over different types of earth.

**Fig 1** shows the way in which the radiation resistance of horizontal and vertical half-wave antennas varies with height above ground (in l, wavelengths). The height of the vertical half-wave is the distance from the bottom of the antenna to ground. For horizontally polarized half-wave antennas, the differences between the effects of perfect ground and real earth are negligible if the antenna height is greater than 0.2 l. At lower heights, the feed-point resistance over perfect ground decreases rapidly as the antenna is brought closer to a theoretically perfect ground, but this does not occur so rapidly for actual ground. Over real earth, the resistance actually begins increasing at heights below about 0.08 l. The reason for the increasing resistance at very low heights is that more and more of the reactive (induction) field of the antenna is absorbed by the lossy ground in close proximity. This results in increased loss that is reflected in the increased value of the feed point resistance.

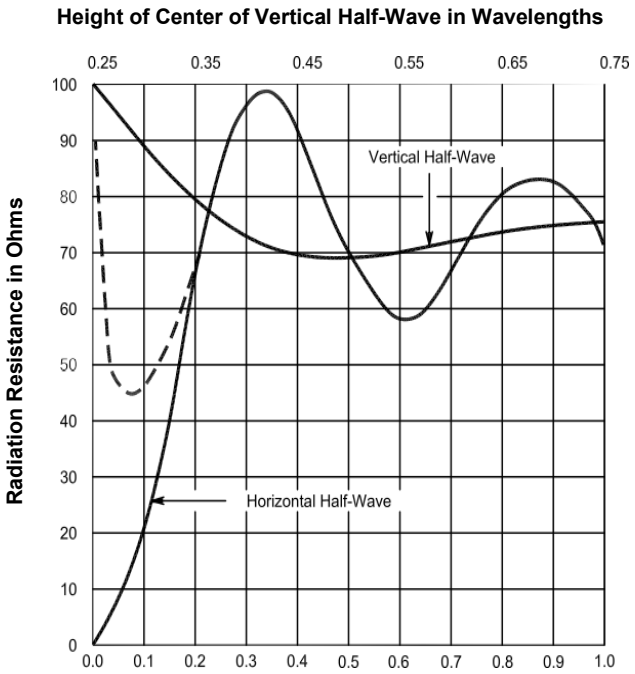


**Fig 1—Variation in radiation resistance of vertical and horizontal half-wave antennas at various heights above flat ground. Solid lines are for perfectly conducting ground; the broken line is the radiation resistance of horizontal half-wave antennas at low height over real ground.**

For a vertically polarized λ/2-long dipole, differences between the effects of perfect ground and real earth on the feed-point impedance is negligible, as seen in **Fig 1**. The theoretical half-wave antennas on which this chart is based are assumed to have infinitely thin conductors.

## Simulating a Perfect Ground in the Reactive Near Field

The effect of a perfectly conducting ground (so far as feed-point resistance and losses are concerned) can be simulated under a real antenna by installing a very large metal screen or mesh, such as poultry netting (chicken wire) or hardware cloth, on or near the surface of the ground. The screen (also called a *counterpoise system*, especially if it is elevated off the ground) should extend at least a half wave - length in every direction from the antenna. The feed-point resistance of a quarter-wave long, thin vertical radiator over such a ground screen will approach the theoretical value of 36.6 ∧. Of course on the lower HF bands such a screen is not practical for most amateurs.

Based on the results of a study published in 1937 by Brown, Lewis and Epstein, a grounding system consisting of 120 wires, each at least l/2 long, extending radially from the base of the antenna and spaced equally around a circle, is also the practical equivalent of perfectly conducting ground for reactive-field currents. The wires can either be laid directly on the surface of the ground or buried a few inches below.

Another approach to simulating a perfect ground system is to utilize the ground-plane antenna, with its four ground-plane radials elevated well above lossy earth. Heights (between the bottom of the ground-plane and the surface of the ground) greater than λ/8 have proven to yield excellent results.

For a vertical antenna, a large ground screen, either made of wire mesh or a multitude of radials, or an elevated system of ground-plane radials will reduce ground losses near the antenna. This is because the screen conductors are solidly bonded to each other and the resistance is much lower than that of the lossy, low-conductivity earth itself. If the ground screen or elevated ground plane were not present, RF currents would be forced to flow through the lossy, low-conductivity earth to return to the base of the radiator. The ground screen or elevated ground plane in effect shield ground-return currents from the lossy earth.

## Less-Than-Ideal Ground Systems

Now, what happens when something less than an ideal ground screen is used as the ground plane for a vertical monopole? Typically this will take the form of an on-ground wire radial system. A great deal of mystery and lack of information seems to surround the vertical antenna ground system. In the case of ground-mounted vertical antennas, many general statements such as “the more radials the better” and “lots of short radials are better than a few long ones” have served as rules of thumb, but many questions as to relative performance differences and optimum number for a given length remain unanswered, as is the justification for the rules of thumb. Most of these questions boil down to one: namely, how many radials, and how long, should be used in a given vertical antenna installation?

A ground system with 120 λ/2 radials is not very practical for many amateur installations, which often must contend with limited space and funding. Unfortunately the ground resistance, Rg, increases rapidly when the number of radials is reduced. To minimize ground loss where a large, optimum ground system is not possible requires that we understand how ground losses occur and how to optimize the design of a ground system that can fit within the space and budget available.

## E and H Fields

E and H fields were introduced to explain some basic concepts concerning antennas. To understand the reasons for ground loss we need to look at the E and H fields in the near field, but we need to have some feeling for what E and H fields are. The following is a brief description of these fields. It is certainly not a rigorous description but should give at least an intuitive feeling for what is happening.

In 1820 Hans Oerstad discovered that a current flowing in a wire would deflect the needle of a nearby compass. We attribute this effect to a *magnetic* or *H-field*, which at any given location is denoted by the bold-faced letter **H**. **H** is a vector, with an amplitude expressed in A/m (Amperes/meter) and a direction. **Fig 2** shows a typical experimental arrangement. The shape of the magnetic field is roughly shown by the distribution of the iron filings. This field distribution is very similar to that for a vertical antenna.

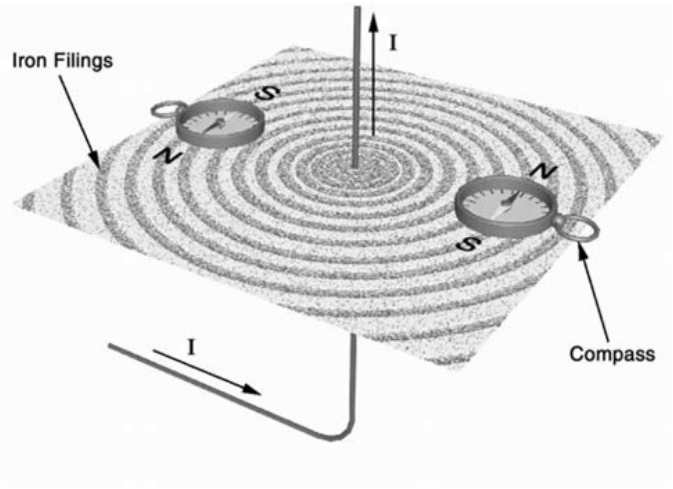


**Fig 2—The magnetic lines of force that surround a conductor with an electric current flowing in it are shown by iron filings and small compass needles. The needles point in the direction of the magnetic or H-field. The filings give a general view of the field distribution in the plane perpendicular to the conductor.**

A compass needle (a small magnet itself) will try to align itself parallel to **H.** As the compass is moved around the conductor, the orientation of the needle changes accordingly. The orientation of the needle gives the direction of **H**. If you attempt to turn the needle away from alignment you will discover a torque trying to restore the needle to its original position. The torque is proportional to the strength of the magnetic field at that point. This is called the *field intensity* or amplitude of **H** at that point. If a larger current flows in the conductor going through the piece of paper holding the iron filings, the amplitude of **H** will be larger. Currents flowing in the conductors of an antenna also generate a magnetic field, one component of the near field.

An antenna will also have an *electric* or *E-field*, which can be visualized using a parallel-plate capacitor, as shown in **Fig.3**. If we connect a battery with a potential Vdc across the capacitor plates there will be an electric field **E** established between the plates, as indicated by the lines and directional arrows between the plates. The magnitude of vector **E** is expressed in V/m (volts per meter), so for a potential of V volts and a spacing of d meters, E = V/d V/m. The amplitude of **E** will increase with greater voltage and/or a smaller distance (d). In an antenna, there will be ac potential differences between different parts of the antenna and from the antenna to ground. These ac potential differences establish the electric field associated with the antenna.

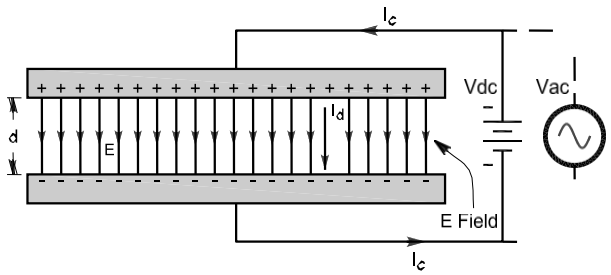


**Fig 3—Example of an electric field, E=$V_{dc}$/d. When the dc source is replaced with an ac source there will be a displacement current ($I_d$) flowing between the capacitor plates.**

## The Effect of Ground in the Far Field

The properties of the ground in the far field of an antenna are very important, especially for a vertically polarized antenna, as discussed above. Even if the ground- radial system for a vertical has been optimized to reduce ground-return losses in the reactive near field to an insig- nificant level, the electrical properties of the ground may still diminish far-field performance to lower levels than "per- fect-ground" analyses might lead you to expect. The key is that *ground reflections* from horizontally and vertically polarized waves behave very differently.

## Reflections in General

First, let us consider the case of flat ground. Over flat ground, either horizontally or vertically polarized downgoing waves launched from an antenna into the far field strike the surface and are reflected by a process very similar to that by which light waves are reflected from a mirror. As is the case with light waves, the angle of reflection is the same as the angle of incidence, so a wave striking the surface at an angle of, say, 15° is reflected upward from the surface at 15°.

The reflected waves combine with direct waves (those radiated at angles above the horizon) in various ways. Some of the factors that influence this combining process are the height of the antenna, its length, the electrical characteristics of the ground, and as mentioned above, the polarization of the wave. At some elevation angles above the horizon the direct and reflected waves are exactly in phase—that is, the maximum field strengths of both waves are reached at the same time at the same point in space, and the directions of the fields are the same. In such a case, the resultant field strength for that angle is simply the sum of the direct and reflected fields. ( This represents a theoretical increase in field strength of 6 dB over the free-space pattern at these angles.)

At other elevation angles the two waves are completely out of phase—that is, the field intensities are equal at the same instant and the directions are opposite. At such angles, the fields cancel each other. At still other angles, the resultant field will have intermediate values. Thus, the effect of the ground is to increase radiation intensity at some elevation angles and to decrease it at others. When you plot the results as an elevation pattern, you will see *lobes* and *nulls*.

The concept of an image antenna is often useful to show the effect of reflection. As **Fig 15** shows, the reflected ray has the same path length (AD equals BD) that it would if it originated at a virtual second antenna with the same characteristics as the real antenna, but situated below the ground just as far as the actual antenna is above it.

Now, if we look at the antenna and its image over perfect ground from a remote point on the surface of the ground, we will see that currents in a horizontally polarized antenna and its image are flowing in opposite directions, or in other words, are 180° out of phase. But the currents in a vertically polarized antenna and its image are flowing in the same direction—they are in phase. This 180° phase difference between the vertically and horizontally polarized reflections off ground is what makes the combinations with direct waves behave so very differently

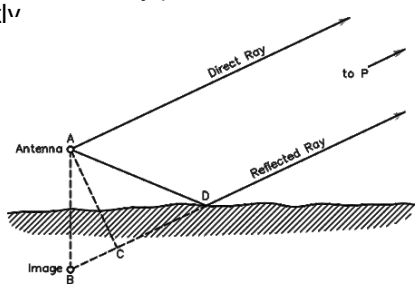


**Fig 15—At any distant point, P, the field strength will be the vector sum of the direct ray and the reflected ray. The reflected ray travels farther than the direct ray by the distance BC, where the reflected ray is considered to originate at the *image* antenna.**

## NETLOGGER TIPS

Netlogger is free software that most local clubs use to log check-ins to their nets. Like any freeware they ask for a $5.00 donation to help support the servers. This document is meant to be a quick guide to aid in the download and setup of the software. The help files in the HELP tab are a very good aid for detailed information.

www.netlogger.org is the home page. From there click on the download icon. In the middle of the page click on the caret under **Select Your Version**. Select the version for your computer. Complete the Name/Call Sign and Email info and click the Download button.

In your Download folder click on the .exe file to install the software. Follow the on-screen instructions.

After the installation is complete Netlogger is ready to use to monitor net check-ins –

- At the top of the page click on the blue button reading SELECT NET
- Click on the line for Information and Help Net. If you don't find it, be patient, the logger just hasn't set the net up yet.
- After selecting the net go to the bottom of the page and click the Monitor Net button. You will now go back to the detail page where you can see the check-ins as the logger enters them.
- You can see a list of folks who are monitoring the net by clicking the blue View Monitors button.
- By clicking on the blue AIM Window. AIM means Almost Instant Messaging. Used to communicate with others logged on to Netlogger. Patience is the key here; it is slow.

If you want to be able to log for a net there are a few more setup steps –

- Click the Setup tab at top of page. Click Accounts and complete the QRZ.com info. This allows Netlogger to pick up detailed information on each check-in. Note that this requires a paid subscription to QRZ.com.
- Click the Setup tab again and click the Auto Carriage return selection. This allows the cursor to move to the next blank line when entering call signs.

Creating a net so you can be the logger –

- Click on the blue Create Net button
- Complete the following information –
  - Net Name: Information and Help Net
  - Server Cluster: NETLOGGER
  - Net Password: KF5OMH
  - Verify Password: KF5OMH
  - Net Control: enter call sign of NCS
  - Frequency: 145.170
  - Mode: FM
  - Band: 2m
- Click OK

You are now ready to log a net. Simply enter the call sign and hit Enter as folks check in. As you hit enter all of the other associated information will populate from QRZ.com.

Once the net is over click on File>Save As and save the file with the default name. Send a copy of the file to Ron, KF5OMH at kf5omh@arrl.net.

Click on the CLOSE NET button. If you don't do that we'll get zinged from the owners with a threat to close our account.

The foregoing information is the very basic to get you set up to monitor and/or log a net. There is a lot of "fancy" stuff that can be done with Netlogger. If you're interested just work your way through the Help files; otherwise, just enjoy the tool at this level.

Questions? Contact Ron, KF5OMH, 972-742-7839 or kf5omh@arrl.net.

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**To All ARRL Members and ARRL VEC Accredited Volunteer Examiners**
04/02/2020

We know many examiners have canceled amateur radio license exam sessions to meet the requirements and recommendations of national and local government and of health officials. *The health and safety of examinees and our Volunteer Examiners (VEs) is first and foremost in any decision-making process.* The ARRL Volunteer Examiner Coordinator (VEC) does not offer video-supervised online amateur radio licensing exams at the present time. We are aware, however, that some VE teams are exploring alternative formats on a local basis. Please use ARRL's **License Exam Search** to find scheduled exam sessions in your area and verify with the local exam team that the session is still being held.

The ARRL VEC is continuing to process license examination materials from VEs who have completed exam sessions, although some delays may occur under the circumstances. The ARRL VEC electronically forwards all required data to the FCC for qualified examinees.

We understand that some examination candidates are continuing their studies toward new amateur radio licenses and license upgrades. We also know some will be frustrated that, at this time, the ARRL VEC does not offer online licensing exams. Amateur radio is not alone in this challenge, though.

While each of us continues to respond to the immediate evolving crisis, we also know that we must keep an eye on the future. Throughout its decades of service, the VEC system has served the FCC as a shining example of the successes of a privatized system. The ARRL VEC and our VEs are recognized throughout the Amateur Radio Service for our integrity and efficiency. Adapting our all-volunteer license examination administration will be a challenge, but it's a challenge we are committed to undertake in order to advance the program and improve service.

While we face unprecedented challenges, opportunities also await. We are grateful to support radio amateurs in our common pursuit of skill, service, and discovery. ARRL and the ARRL VEC remain steadfast in serving the amateur radio community. We will provide updates as they become available