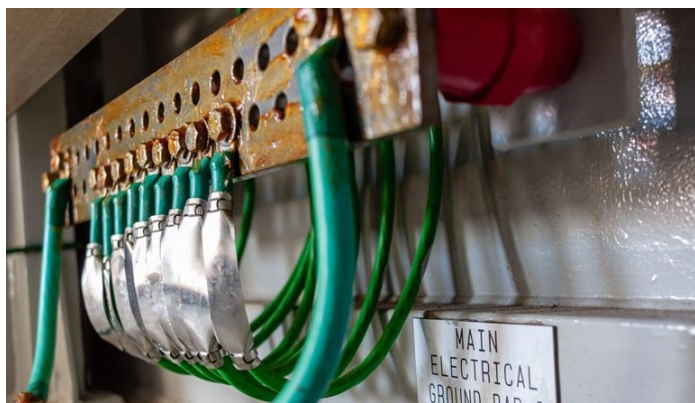


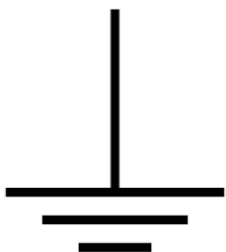
Microvolt

Monthly newsletter of the Utah Amateur Radio Club

February 2025



Let's talk about Grounding



Soon after entering the craft, many amateurs become aware of the need for *grounding* their equipment. Yet, anybody who has seen questions about grounding posted on social media is aware of the many, often conflicting answers that appear from self-proclaimed grounding experts. Exactly what is grounding, why is there so much disagreement over it, and why should we care about it? Let's take a closer look at this important but embattled topic.

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Cover – Grounding

An electrical **ground** is a reference point in an electrical circuit from which voltages are measured, but it can also be a common return path for electrical current, or a direct physical connection to the Earth itself. **Grounding** (*earthing* in the UK), therefore, is the process of providing a conductive pathway between an electrical system and a ground.

Some of the controversy surrounding grounding lies in whether to ground, what to ground, and how to ground it. Disagreements, even among experts, often stem from urban legend (*That's how we've always done it!*) without empirical data. Many claim that they have never grounded their equipment, and have operated for decades without problems due to lack of grounding. Grounding is a little like car insurance, it seems like a waste, until you need it.

In spite of controversy or folklore, we recommend the ARRL book *Grounding and Bonding for the Radio Amateur*, the undisputed final word for most grounding questions.

Should I ground my station?

Whether you should ground something comes down to why it should be grounded at all. The most important reason to ground your station is for **safety**, not performance. Your HT (handheld transceiver) contains a self-contained “ground” made of its chassis, to complete its **ground plane**. But a safety ground is only necessary when you connect your HT to an outdoor antenna or other external conductor, where large amounts of static can collect from wind, dust, and moisture.

Many hams are tempted to ground their transceivers to reduce the noise they hear on HF. In general, grounding will not reduce your received noise. Then again, grounding can help with phase noise and noise generated by common-mode current. Also, although often critical for *vertical antenna* performance, in most cases, grounding will not help with *wire antenna* performance (receive better, transmit better, greater efficiency, etc.) If you do find that grounding your transceiver or wire antenna actually does help with performance, you likely have an antenna problem, not a grounding problem.

Still, you might convince yourself that grounding your rig won't hurt anything, and it can only help. Most modern transceivers are powered by DC (direct



current), and are not subject to the dangerous voltages presented by house current entering the rigs. For this reason, they really don't need their chassis grounded; in fact, doing so can create a ground loop, which can generate unwanted noise.

Bonding

When discussing grounding, one important sub-topic that necessarily arises is **bonding**, which is not the same. Bonding means the combination of two practices: 1) electrically connecting multiple conductors to bring them to the **same electric potential**, and 2) bringing to ground potential a conductor that normally is **not intended to carry electrical current**.

For example, your metal refrigerator door should not normally conduct the 120 VAC that's supplied to the compressor motor or the fan. But if a house current wire inside became frayed or loose by vibration, it can accidentally contact the door from the inside and give the person a wakeup call, should he or she come in contact with the door. In this case, the fridge chassis should be bonded with the outlet ground, provided by the ground (third) pin of the wall outlet to prevent such a shock. If the wire then loosened while the chassis is bonded, the contact should cause the breaker to pop (open) at the panel, preventing an unwanted experience.

An unrelated word of caution: fuses and breakers are installed for a reason. If one repeatedly opens, simply replacing the fuse or resetting the breaker won't solve the problem that caused it to pop in the first place. When the breaker trips, be sure you know why it tripped before blindly resetting it. It might be nothing, or it might be your house circuit telling you that something on it wants to burn your house down.

Microvolt editorial staff

Editorial – Ground types

When discussing grounds and grounding, we often find the need to distinguish between different kinds of grounds, because they are not all the same, or have the same purpose. Still, there is some overlapping usage between them, adding to the confusion. Among those most applicable to amateur radio are signal ground, chassis ground, RF ground, safety ground, earth ground, and lightning ground.

Signal Ground

Each electrical and electronic circuit contains conductive points whose signal levels can be measured in relation to a reference point known as *signal ground*. Furthermore, a circuit can contain multiple local signal ground reference points that are isolated from each other by function or by components, to maintain signal integrity or improve noise immunity, for example.

Chassis ground

Many devices contain circuit boards that are mounted on a metal frame or enclosed in a metal box, often called a *chassis ground*, because it's conductive and typically used for safety, as well as for an electrical reference.



RF ground

We amateurs tend to use two types of *RF ground*, one is a conductive path for completing an RF (radio frequency) signal circuit, and the other is a conductive plane for providing a reflective surface for radio waves. In the first type, one of the two transmission line conductors is thought of as a “return path” for electrical RF energy. The second provides a *ground plane* or *counterpoise* off which radio waves can reflect in place of an earth ground.

Safety ground

Any ground connection that is used to protect humans from harm and sensitive electronics from damage is known as *safety ground*. One type of safety



ground is built into the equipment, such that its chassis, shield, or enclosure is bonded to a common grounding point to either equalize hazardous electrical potential or provide a grounded pathway for such energy. Another is the kind that an operator attaches or implements at the time of use, such as a wrist strap or anti-static mat.

Earth ground

An *earth ground* is any conductor that is directly connected to outdoor earthen soil. For amateur purposes, an earth ground is often achieved by one or more conductive rods driven into the dirt. In the US, they are also bonded with the electric service enclosure, which uses its own earth ground.

Lightning ground

A *lightning ground* is no more than a low-impedance electrical connection to a safety ground or an earth ground, and whose primary function is for safety. The ground connection protects equipment and structures by directing much of the lightning current to Earth.

Finally

A circuit signal ground can be the chassis ground, the safety ground can share conductors with the RF ground, and lightning ground and earth ground can be one and the same. This illustrates how grounds by different names can serve common purposes, but can also contribute to the confusion when attempting to distinguish between them. Hopefully, this discussion can help clarify the meanings when people do not agree on the implementation of a ground.

Anything to add? Email editor@utaharc.org

Letters to the editor

Dear Editor:

I'm new to ham radio, but I've owned a fishing vessel for years, and I've got an Icom IC-M803 marine onboard for distress. Am I allowed to use my ham call sign on the marine radio?

Harley in Hyrum

Dear Harley:

On one hand, you'll need to consult the FCC rules for identification requirements on maritime frequencies. On the other hand, when you're transmitting on amateur frequencies, it would be fun for us to make a contact with somebody who announces a call sign with the /MM suffix, which stands for *maritime mobile*.

Dear Editor:

How necessary is it that I get my dipole up really high? I live at a location where I'm just not able to go higher than about 20 feet. I've read [on a blog](#) that if I lower a 20-meter dipole to 20 feet above ground, I not only lose 2.5 dBi of gain from the ideal, but end up with a classic cloud burner. If that's true, do I need to tell my YL that we have to move?

Jeffrey in Salt Lake City

Dear Jeffrey:

If you want to erect your antenna to work NVIS (near-vertical incidence skywave), then lowering your dipole to 20 feet might be just perfect for that. If you're more interested in working DX (long-distance), then yes, you'll need to raise it higher than 42 feet for maximum benefit. And the claim about losing 2.5 dBi of antenna gain can depend heavily on soil conductivity. As for telling your spouse that you should move, what your better half wants is more important than what your antenna needs.

Dear Editor:

I'm trying to get back into ham radio after being absent for a couple of decades, and I'm a little confused about my Advanced license. Can a person still use an Advanced license today? Can it still be renewed, or will I need to upgrade?

Tom in Salt Lake City



Dear Tom:

A person holding a valid, unexpired Advanced Class license can indeed operate on amateur radio frequencies allocated for the Advanced and lower license classes. Although the Advanced license is no longer issued, a person currently holding an active Advanced license can renew that Advanced license indefinitely. By the way, if you had obtained your Advanced license before 03-21-1987, and your Advanced license has expired, you can obtain a General Class license if you simply show proof of your Advanced license and pass the Technician Class license exam.

Dear Editor:

Sorry if this is a newbie question. The other day I heard a guy on the 146.940 repeater announce that he is "mobile" but was not talking to anybody that I could tell. I thought broadcasting is not permitted on ham radio. Isn't that announcement a one-way broadcast, or did I misunderstand?

Shelby in Herriman

Dear Shelby:

The person you heard announce that he's mobile is perfectly within his license privileges, as long as he also announced his call sign within ten minutes. In the rules (Part 97.111.b.2) a licensed amateur is permitted to make a brief one-way transmission "necessary to establishing two-way communications with other stations" which I believe was the intent of the operator you heard.

Send your thoughts to editor@utaharc.org

Club news

The January 2025 club meeting featured a remote presentation by Willem Schreuder ACØKQ and John Maxwell WØVG regarding the services provided by the RMHAM (Rocky Mountain Ham) club and linked network system via redundant IPv4 and microwave nodes. Their amazingly huge and complex Colorado network is mostly relegated to emergency communication, and requires the dedication of many technically expert volunteers.



Willem Schreuder ACØKQ



John Maxwell WØVG

The club meeting actually started with Marv Match KA7TPH remembering [Morris Farmer AD7SR](#), our immediate past president who recently became silent key. Next, he led us in a vote to add the two club engineers to the Board of Directors, and the motion carried. Marv also reminded us that we had previously voted against raising dues.

You can see the [video presentation here](#). Visit the [club YouTube channel](#) to view past club meeting presentations.

UARC Financial Statement 2024

Income	8,293.03
ARRL Dues.....	30.00
Book Sales.....	978.03
Donations	20.00
Dues.....	5,560.00
Future Dues	1,180.00
Interest Inc.....	0.00
Steak Fry Income	525.00
Expenses	8,677.30
Administrative	613.63
ARRL Membership	105.67
Books	806.23
Capital Equipment	0.00
Field Day	282.57
Insurance	926.20
Meeting Expense	875.40
Microvolt	2,900.00
Postage.....	800.00
Printing.....	2,100.00
Professional licenses.....	325.74
Remote HF	367.85
Repeater	248.60
Sales Tax	81.57
Bank Fees.....	258.19
Steak Fry Expenses	885.65
Net 2024 gain	-384.27

UARC is NOT hosting Winter Field Day for 2025

We tossed around the idea of whether we should join the rest of the nation and put together a Winter Field Day event for the first time in many years. In the end, there was just too much to do in such a short amount of time that we decided to recommend that our membership participate with another club such as [BARC](#) or [DCARC](#) or [UVARC](#), who has already organized a WFD event.

For your information

UARC Spring 2025 Potluck

You and your family are invited to a potluck dinner 6:30 pm Thursday 13 March 2025. at the Salt Lake County Facilities Cafeteria, 2001 S State St, room S1-100. Details are posted [on our website](#). We've [posted a signup sheet here](#).

Winter Field Day 2025

UARC does NOT plan to participate in Winter Field Day this year but encourages you to get involved with another club that's participating. WFD takes place from noon Saturday January 25 through noon Sunday January 26.

Field Day 2025

Saturday noon 28 June through Sunday noon 29 June near [Payson Lakes](#). We plan to start setting up Thursday night about 6:00 pm.

License classes

Salt Lake:

General : Tuesdays 7:00 pm to 9:00 pm
147.160+ MHz (127.3 Hz tone)

Orem:

Technician : 4 Tuesdays, 6:30 to 8:30 pm
Jan 21, Jan 28, Feb 4, Feb 11
Visit psclass.orem.org to register (\$10)
Orem Traffic Training Room, 95 E Center St
HamStudy.org account required
Email nojiratz@hotmail.com for info

Eagle Mountain:

Technician : 5 Thursdays, 7 to 9 pm
Feb 6, Feb 13, Feb 20, Feb 27, Mar 6
Email ki6oss6365@gmail.com to register (free)
Eagle Mountain City Hall, 1650 Stagecoach Run

Exam sessions

Salt Lake County:

- Email Garth Wiscombe W7PS w7ps@arrl.net
Jan 27, Feb 24, Mar 31, Apr 28, May 19, Jun 30, Jul 28, Aug 25, Sep 29, Oct 27, Nov 24
- Email Rick Morrison W7RIK w7rik@arrl.net



Utah County:

- Sat 15 Feb 2:30 pm : **Provo** : [signup](#)
- Wed 19 Feb 7:00 pm : **Provo** : [signup](#)
- Sat 22 Mar 10:00 am : **Eagle Mtn** : [signup](#)

Club repeaters

Farnsworth Peak : 146.620– MHz (no tone)

Scott Hill : 146.620– MHz (no tone)

Lake Mountain : 146.760– MHz (no tone)

SDRs and beacons

Northern Utah WebSDR : [sdrutah.org](https://sdr.utah.org)

KK7AVS SDR : k7xrd.club

N7RIX SDR : <https://sdr.n7rix.com>

K7JL beacon 28.2493 MHz

HF remote and club transceiver stations

If you'd like to learn how to get started using the remote stations, visit the [HF Remotes link](#) on [the club website](#):

<https://user.xmission.com/~uarc/HFRemote.html>

How can I help?

Reach out to the club leadership by sending an email to uarc@xmission.com. Also, add to this page by emailing editor@utaharc.org

Registration: www.utahdcc.com

\$15 Adult - Youth Under 18 Free

Utah DCC

Utah Digital Communications Conference

Bridging the Gap: Effective Communication in Emergencies

SATURDAY
FEBRUARY 22ND, 2025 AT 8 AM

REGISTRATION
UTAHDCC.COM



**Hands-on
Demonstrations**

**Seminars on Amateur
Radio Communications**

**Utah VHF Society
Annual Meeting**

**Fox Hunt & Antenna
Build-It Workshop**

Virtual Attendance Option



Conference Location:
Salt Lake Community College Miller Campus
9750 South 300 West Sandy, UT 84070

utahdcc@gmail.com

www.utahdcc.com

Spotlight – Fui Taotua K7FUI

Hello, my name is Fui Taotua. My family and I have lived in Utah County / Orem for over 20 years now. I don't have a background in radio, but my experience in Information Systems has made me comfortable with technology and picking up new skills. My journey into ham radio started when our Provo Utah Wasatch Tongan Stake began emphasizing emergency preparedness. As part of this effort, we looked into ham radio for emergency communications. My wife got her license, and I followed, earning my license as K7FUI.

When I passed my exam, I received a welcome letter from KNØJI inviting me to join the UVARC club. I attended a meeting and was fortunate to meet Noji, who gave me a quick tutorial on setting up my first radio, a Yaesu FT-60R. He also introduced me to his ham radio guide on his website, which was incredibly helpful as I was getting started. My wife and I each got a Yaesu FT-60R, and like many beginners, I was hesitant to press the PTT button at first.

To ease into it, I brought my radio to my son's football games and started checking in with the New Ham Net, run by Jim W7KLA. Those early experiences were invaluable in building my confidence and skills. I also discovered the J-Pole antennas from WE7OMG, which I've used successfully at ward camps and other activities. Using the radios regularly has really fueled my passion for ham radio. A radio has now become part of my everyday carry (EDC).

I passed my General exam at the end of last year, and while I haven't ventured into HF yet, it's my goal for 2025. I'm considering the Icom IC-7300 or the Yaesu FT-710 for my first HF radio. For now, I'm set up with two Icom IC-2730s - one as a base rig and one in my truck. My base station runs off a Powerwerx SS-30DV 30-amp desktop DC power supply with Anderson Powerpole connectors and connects to a Diamond X510-HDM dual-band antenna. I also have a Diamond X50NA dual-band antenna running side-by-side for versatility.

In addition to those setups, I've accumulated several Baofeng radios (you can never have too many radios, right?) and have recently become a fan of the TidRadio H3 and H8. I mostly check into nets using the TidRadio H3 with NicFirmware software.



This year, my son earned his ham radio license (KO7RAD) before leaving on his mission, officially making us a "HamFam"! During one of his trips in Papua New Guinea, where he was picking up Church leaders from the airport, a security officer handed him a ham radio (a Baofeng UV-5R) as their form of communication from the car. Recognizing it, he said, *Oh, this is a ham radio, and I'm familiar with this.*

I'm also helping our stake (now the Orem Utah 2nd Stake) with communications by sharing what I've learned and supporting other members in earning their licenses. Our stake has been blessed with a slot for a Stake Net on the 146.780 repeater. However, participation has been low so far, with just our family and a few other members regularly joining. One of my goals this year is to increase participation and strengthen our communications network.

Ham radio has not only become a rewarding hobby but also a valuable tool for strengthening community connections and preparedness.

– 73, Fui K7FUI

Tech corner – Your station ground

Many amateurs struggle with questions about grounding, even after we've discussed grounding: what to ground, how to ground, and the reason for grounding. And yet, it occurs to me that one reason questions keep recurring is the lack of a tangible, big-picture grounding demonstration. I've decided to try and fill that void by creating just that, a somewhat complete, portable grounding visual aid, which I'll call my *model* or *demo*.

On your roof

If your rooftop antenna is installed on a mast, like the open-stub J-pole pictured here, your mast will need to be grounded, according to the NEC ([National Electric Code](#)). You can ground your mast by connecting a heavy (6 AWG minimum) ground wire between your mast and your ground rod, using ground-



ing clamps on both. If your mast isn't connected to your antenna base, you should connect the ground wire to both the mast and the antenna base.



The ground below

As directly below your antenna mast as possible, you need to drive an eight-foot ground rod into the dirt, and attach your ground wire to it. You might find that your yard contains more rock than dirt, preventing you from driving your rod all the way in. In that case, you can either drive your rod in at an angle, or simply cut your rod short after you've driven it down as much as you could.

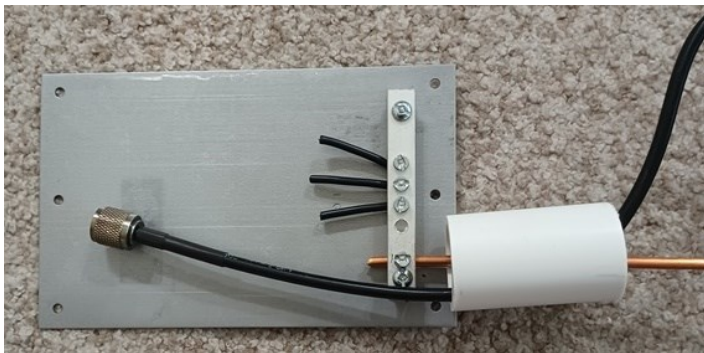
Locate your *electrical service*, or the place where

Tech corner – Your station ground cont'd

your electrical power enters your home. Drive one ground rod for every 16 feet between your antenna ground rod and your electrical service, then **bond** them all to your service by attaching bare grounding wires between all of them and your service. All your ground rods and bare connecting grounding wires should be buried in the dirt.

In your shack

The short piece of PVC on the model represents your house wall, where your coax and ground can enter. You should get hold of a thick sheet of steel or copper and mount it on your shack wall or desk. This is known as your **ground panel** or **ground plate**. Then, install a grounding bus bar to the plate. Attach a thick grounding wire between your ground rod outside and your grounding bus bar.



All your AC-powered shack equipment can be grounded to this single plate, which will provide the safety ground and yet prevent ground loops, caused by daisy-chaining equipment grounds. Each of the little, black wires protruding from the grounding bus bar in the visual aid represents each wire that connects to your power supply, amplifier, and other AC-powered shack equipment.

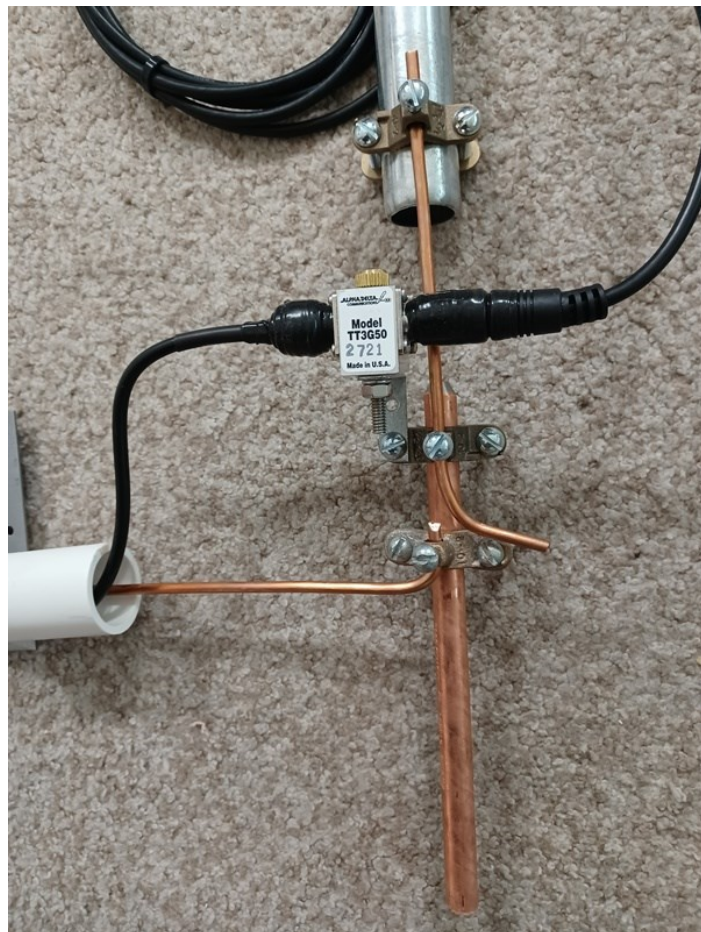
If you live on the second floor, or find it otherwise impossible to connect your outdoor ground wire to your shack ground plate, simply connect the plate to the ground pin of your nearest room outlet instead. On the ground rod nearest your shack, install a **surge suppressor** (or *lightning arrester* or *antenna discharge unit*, depending where you read it) onto your ground rod. On my own house, I use one that has SO-239 connectors for the coax connections and a stud for the ground connection, to allow mounting on a grounded bracket.



Routing of your coax

Once you connect your coax to your antenna, form an **RF choke** by coiling your coax in six turns of six-inches in diameter if your coax is RG-8X. Tie the loops together and to your mast with UV-proof zip ties. Connect the other end to one side of your surge suppressor.

Connect a length of coax from the other side of your suppressor, through your house wall, and into your shack. It doesn't matter that you run your coax alongside your ground wire anywhere along their paths; they'll neither help nor interfere with each



Tech corner – Your station ground cont'd

other.



Although my little model uses RG-8X, I actually recommend [LMR-400](#) if your coax is longer than, say, 50 feet.

Just outside your house entrance, I highly recommend forming a drip loop for your coax, one thing missing from my little contraption. Finally, wrap all exposed coax connectors with silicone tape, such as [Stretch-and-Seal](#), and avoid using electrical tape, except only temporarily. Once applied, silicone tape should keep out moisture, prevent UV (ultraviolet light) damage, and is easy to remove, if needed.

Will it work?

I'm hoping that I can use this little visual aid to show people how their entire grounding solutions should appear on a miniature scale, if they're done properly. Obviously, each grounding configuration will have to be tailored for each individual rooftop application, but I believe this model should answer many questions regarding proper grounding.

My actual shack ground rod, plus surge suppressors for my VHF and HF antennas. Notice the two 4 AWG bare copper wires going into the ground to the antenna and to my service. The braid is my ground connection to my indoor ground plate.

By the way, the short piece of grounding wire in the model tailing off the ground rod, opposite the PVC is merely a suggestion of where your ground wire continues to bond to your next ground rod, and eventually, to your service.

Noji Ratzlaff KNØJI

Silent key– Morris Farmer AD7SR

On Christmas Eve 2024 the amateur radio community lost a long-time friend and mentor in Morris Farmer AD7SR, who became a silent key. He had taught numerous ham radio classes and was the immediate past UARC president, in spite of being wheelchair-bound since 1967 due to Guillain-Barré syndrome.

Morris graduated from the University of Utah with a Bachelor's degree in Math and Physics and a Master's degree in Chemistry. He joined the US Air Force and was stationed in the Philippines during the Vietnam War, when he became paralyzed. During a hospital stay, he met his lifelong love Carol, whom he married. Morris eventually worked at Evans and Sutherland, from where he retired. He joined the US Coast Guard Auxiliary and patrolled several Utah waterways with Carol by his side.

Here are some thoughts from those who have been touched by Morris through the years:

I have such good memories of the kindness and technical focus of Morris! He became UARC president in 2018 and asked me back then to lead the HF Remote setup at Leamington -- It has been a great club project involving many members, thanks everyone and we'll miss Morris a lot! Let's have a good productive 2025 in memory of him.

Gary Crum KK7DV

I'm very much saddened by this news. Morris was one of the cornerstones of UARC and I will miss him. I will also miss his participation on the UARC board. Great man . . . he will be missed.

Marvin Match KA7TPH

Thank you for relaying the sad news...Morris is an important part of UARC and will always remain so. With Sympathy and love to all.

Jeri Brummett WJ3RI

I was saddened to hear about the passing of Morris. Morris has contributed much to amateur radio. He was the one who got the remote station up and running. This helps individuals who can not put up antennas in their homes. This remote station gives them an opportunity to get on the low band rig. Morris we will miss you.

Linda Reeder N7HVF



I was interested in Amateur Radio but never thought I had enough time to study and pass the exam. That all changed shortly after I joined the US Coast Guard Auxiliary and met Morris! I attended the Technician class he was teaching, which started the beginning of September 2013 and ended mid-November. That may seem long for a Technician class, but I was able to pass that and the General exams in one sitting. I then attended his Extra class and passed that exam in June 2014. I will miss Morris; he was not just my mentor but a good friend as well.

Doug Bosen W7GPD



Silent key– Morris Farmer AD7SR cont'd

I went to his home a few times for classes he had in the basement...super smart guy, just wanted to share his talents with others.

Michael Thomas KA7VCA

We were shocked to read of the loss of our courageous friend and neighbor. We shared so many meaningful conversations over the years. We admired Morris greatly.

Wes and Jean Keller

I liked Morris a lot. We worked together at Evans and Sutherland and I always valued his perspective. He was a smart guy...compassionate and very likable.

Ron Walker

Morris has always been a ham's friend, willing to offer kind help and draw from his vast reservoir of technical experience. I will miss hearing him on both the 6-Pack Net and the Utah County 6-meter Net.

Noji Ratzlaff KNØJI

He was a great guy, really enjoyed talking to him and asking his advice. He will be missed.

Chuck Walker KF7PK

His joyful presence in the halls of Evans and Sutherland will long be remembered.

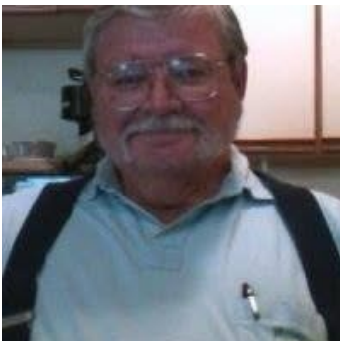
Bob Schumacker

Morris, Carol, and I have been friends for over 35 years. We enjoyed many thoughtful and deep chats at what used to be the Santa Fe up Emigration Canyon. I enjoyed lunch with the Evans and Sutherland guys at work and things we talked about. I'm incredibly grateful for the assignment he and I set for ourselves, getting access to his shack from upstairs using remoteHams. If it weren't for this effort, I'd never have gotten to spend so much time with him and Carol these past few years. I admire him for living life to the fullest as much as his body and pain would allow. Morris has done so much for the hobby and for us amateurs in the valley. He leaves a huge hole in our hearts.

Elisabeth Barry N7MEB

Elisabeth arranged for the [Final 7-3](#) to be performed over the air on two of Morris' nets following his passing, to properly honor him. You can read [his obituary here](#) and [another here](#) and his [Facebook page here](#). A life celebration is planned for Morris later in 2025.

73, Morris.



Strays – Lightning protection

Lightning is a beautiful, alarming, deadly, and widely misunderstood natural phenomenon. In spite of its awesome display of force, are there measures you can take to protect your equipment and yourself against its effects?

What is lightning?

Lightning is a sudden and massive static electrical discharge that results in a super-heated display of energy. Although it's electricity, it's neither AC (alternating current) nor DC (direct current), but a **transient** (surge) transfer of power (voltage and current, or energy per unit time).

It starts as a collection of “free” electrons, the result of ionization in the clouds likely due to the **triboelectric effect** from particle friction. When the electric field strength of the imbalance between the cloud and ground exceeds the **dielectric strength of the air** for the given distance, it triggers a series of events. The air between the cloud and the ground ionizes, forming a stepped electrical path to allow current flow in an attempt to equalize the potential difference. This gives rise to a brilliant **spark** that's accompanied by an acoustic shock wave known as thunder.

Lightning behavior

The seemingly unpredictable behavior of lightning can appear to many that it doesn't follow the rules of nature like we humans might expect. Rest assured that lightning follows the laws of physics like everything else, but because of its high-energy nature, it requires some understanding that often fall outside daily mortal experience.

Because lightning is a transient, its signal (voltage and current) rises and falls quickly. So quickly that it can be characterized by a (Taylor) sum of many high-frequency components. These high-frequency harmonics, in turn, create electrical eddy currents within an electrical conductor for a short period of time, resulting in a greater portion of the signal to flow near the outside of the conductor, a behavior known as **skin effect**.

One side effect of the skin effect is an increase of conductor impedance as a function of frequency, giving most conductors an inductive appearance. When lightning current encounters this high conductor impedance, yet is within reasonable electric field prox-



imity of another conductor exhibiting a greater electric field difference, the current can arc over to the other conductor through the air, a seeming contradiction.

How to minimize the effects of lightning

Lightning is so powerful that it seems like there's little you can do to keep your equipment safe from its harm. Even if you as an amateur take every precaution, your gear can still be subject to that big, bad bolt. Here are a few things you can do toward *your best effort*:

- Drive a ground rod into the dirt below each rooftop antenna, and connect solid bare 4 AWG copper wire between each ground rod and its antenna mast.
- Drive one more ground rod into the dirt just outside your shack (radio room), unless one of the above rods is already there.
- Install a ground panel in your shack.
- Connect all your ground rods, your shack ground panel, and your electrical service panel ground together with solid bare 4 AWG copper wire.
- Install a surge protector (“lightning arrester”) on your ground rod and route your coax from your rooftop antenna through the protector.

Unplug or leave plugged in?

Whenever a lightning storm approaches, do you picture the repeater owner rushing up the mountain to disconnect the coax from the radio gear? Neither do I. But his repeater equipment is ham radio gear like yours, so shouldn't he be worried enough to unplug the coax? The repeater owner might indeed be a little concerned about lightning; I mean, repeater towers **do** get struck.

At the risk of over-simplifying the remedy, here's my

Strays – Lightning protection - cont'd



recommendation: *If you've routed your coax through a surge protector as I've described, then whether or not you unplug won't make much difference. But if your coax isn't routed through a surge protector, then unplugging is more dangerous than leaving it plugged in.*

With your grounding properly installed as outlined, you're as protected against lightning damage as you reasonably can be, whether or not you leave your cable plugged in. If you don't route your coax through a surge protector, do you believe that a few feet of separation is enough to stop lightning after it's already traveled a half mile to your antenna? In fact, the spark gap you provide by unplugging it presents an attractive path for the high-potential electric field to establish a low-impedance streamer between your equipment and the coax, even if you've placed your coax connector in a glass jar.

Popular lightning myths

- **Lightning takes the path of least resistance.**
Lightning, like all electricity, takes all connected paths, inversely proportional to path impedance.
- **Grounding an object will make it more attractive to lightning.**
Grounding will not make one object any more "attractive" to lightning than another.
- **If it's not raining, or you don't see clouds, lightning won't form.**
Clouds are necessary, but its discharge can originate from far away, even out-of-sight.
- **Lightning only strikes the tallest objects.**
Lightning can discharge through any conductive object that possesses lower electric potential compared with that of the source.
- **Lightning victims can become "electrified" and carry a residual charge that can hurt somebody else.**
It's perfectly safe to come in contact with a lightning victim if you both are in a safe place.

Protecting yourself from lightning

- As it says, **When thunder roars, go indoors.**
- Don't stand under or near a tree during a lightning storm; stay away from open water, hilltops, and mountain ridges when lightning is within a few miles.

- Don't seek shelter in open structures, such as baseball dugouts, gazebos, pavilions, carports, or your front porch.
- Don't bathe, shower, or stand near plugged-in electrical appliances during a lightning storm.
- Don't stand outside near utility poles, towers, guy wires, or tall buildings, even though they might seem "professionally" grounded.



- Avoid close proximity to conductive objects, such as barbed wire, chain-linked fences, swing sets, and street signs during a storm.
- Bring your pets indoors when a storm approaches.

You can read a brief but more comprehensive discussion about lightning [on my website](#).

Noji Ratzlaff KNØJI

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We encourage you to submit original pictures (highest resolution), articles, software and hardware descriptions, appropriate humor, and responses to editorials. Email the content, pictures attached, to the editor at editor@utaharc.org by the 24th just prior to the target month.

The **Utah Amateur Radio Club** was organized under its present name in 1927, although its beginnings may date back as early as 1909. In 1928, it became affiliated with the **American Radio Relay League** (club #1602) and is now a 501(c)(3) non-profit organization. It holds a club station license with the call sign W7SP, a memorial to Leonard "Zim" Zimmerman, amateur radio pioneer in the Salt Lake City area.

The club meets each month except July and August. The meetings are usually held on the second Thursday of the month at 7:30 PM in the University of Utah's **Warnock Engineering Building**, room 2230.

Club membership is open to anybody interested in amateur radio; a current license is not required. Dues are \$20 per year. Send dues to club secretary James Bennett, 4960 W 5400 S, Kearns, Utah 84118. Email address changes to kk7avs@gmail.com

Tax-deductible monetary contributions are gladly accepted. Send directly to club treasurer Shawn Evans, 1338 S Foothill Dr, #265, Salt Lake City, Utah 84108-2321. For in-kind contributions, please contact uarc@xmission.com to make arrangements.

UARC maintains the 146.620– and 146.760– repeaters, which are administered by the **UARC Repeater Committee**. Direct comments and questions to any committee member. The 146.760– repeater is on IRLP node 3352.

Call the **UARC Ham Hotline** at 801-583-3002 for amateur radio information, including club, testing, meeting, and membership information. Leave a message, and we'll make an effort to return your call.

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