NCARC Tri-Bander

Volume 7, Number 6 June 2026

From the NCARC President

Joe Hawley KDØTYU
president@ncarc.co

It's been a busy couple of months for the Northern Colorado Amateur Radio Club. One of our biggest accomplishments has been the continued work to complete the Red Feather repeater project. We are now in the final stages, and more information will be available soon about our plans to permanently link the system. This project has involved a tremendous amount of work, and I want to thank everyone who has contributed their time and effort to make it a reality.

We have also been making changes to the way we conduct our Volunteer Examiner (VE) testing sessions. You'll find additional information elsewhere in this newsletter that explains the new process and how these testing opportunities will be offered going forward.

At our June club meeting, we will be presenting the exciting changes planned for Field Day on June 27. During the presentation, we'll discuss our setup plans and demonstrate several of the antennas that will be used during the event. Some of these antenna designs are unique and may be something you've never seen before. If you're interested in HF operating or would like to learn more about portable station setups, this is a meeting you won't want to miss.

Looking ahead to July, we are planning another Rosin Corps workshop. We are exploring a new registration process for the event and are currently evaluating a dual-band antenna project for participants to build. More details are elsewhere in this newsletter.

I want to thank each of you for your continued participation and support of the Northern Colorado Amateur Radio Club. Because of your involvement, our club has grown into one of the largest amateur radio clubs in Colorado. Your enthusiasm, volunteer efforts, and willingness to share your knowledge are what make this organization successful.

As always, if you have ideas for future presentations, technical topics, club activities, or building projects you would like to see, please let us know. We are always looking for ways to make the club more valuable and enjoyable for our members.

Thank you again for your support, and I look forward to seeing you at our upcoming events.

NCARC Club Meeting

June 20, 2026

8:30 am Golden Corral opens- breakfast and socialize, **9:00 am** club meeting

In Person and online

Join Zoom Meeting
https://us06web.zoom.us/j/88127185059?pwd=QYfk8vaWa08xqbNeLauKp6qb2qW1af.1

You choose what you feel comfortable doing: attend in person or online.

Topic:

Field Day Prep

Pete Robbins WØRCR and Randy Barnett KFØRUW

&

What's On Your Bench

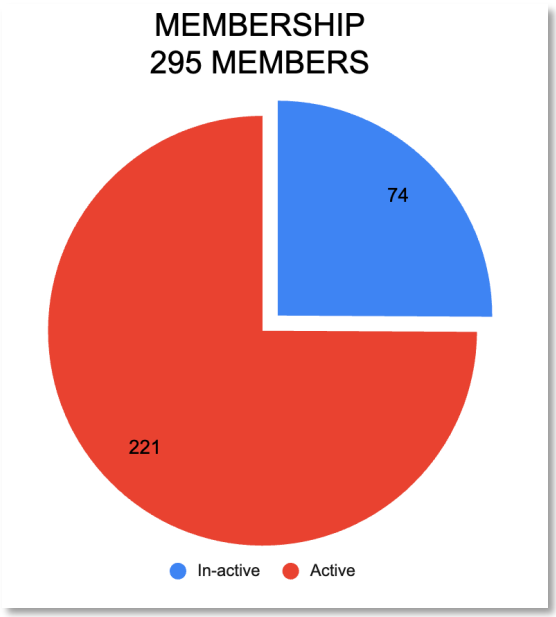
Bring along anything new, interesting or just fun! Ham radio show and tell!

Location:
The Golden Corral
1360 Sculptor Dr, Loveland CO 80537

Treasurer's Report

May was a fantastic month for the club from a financial perspective! Here are some quick highlights:

- **New Members:** We are thrilled to welcome 9 new hams to the club this month.
- **Storage:** We've officially moved into a slightly smaller storage unit. This move is saving us **over $1,500 per year** in ongoing costs.
- **Equipment Sale:** We sold off some of our old, unused gear to help boost our funds.



Finances

Opening Balance	$15,391.63
Incoming	$3,145.76
Outgoing	$1,128.47
Ending Balance	$17,408.92

Income:	**Expenses**
• Membership Dues • Sale of Equipment • Donations	• Parts • Storage • Shipping • Event Venue

Please welcome our newest club members:

KC3HDO	AF4IG
NØIGD	KDØGN
KFØYNK	KFØYQH
KFØYNL	AG6FO
KE5KWQ	

Pete Robbins - WØRCR
treasurer@ncarc.co

Rosin Corps Event

The Northern Colorado Amateur Radio Club will be hosting a hands-on **Flowerpot Antenna Build Project** on **Saturday, July 11, from 10:00 AM to 12:00 PM** at 235 Regina Drive, Fort Collins, CO

The Flowerpot antenna is a popular design that offers a rewarding experience, helping you feel accomplished and eager to try new projects, whether you're new or experienced.

The cost is **$15 per person**, which covers all materials needed to build the antenna.

Since materials and instructor help are provided, space is limited. Interested participants should register as soon as possible using the link below.

To sign up, please click on the following link: FLOWER POT

We look forward to seeing you there and helping you build an antenna you can be proud of and enjoy putting on the air!

Interested in helping with the ARRL Year of the Club events?
Please contact Joe Hawley and volunteer!

Please Renew Your Membership for 2026!

Remember – your dues are due in **January**!
If you haven't paid yet, you are past due.
Renew your NCARC membership now!
It's quick and easy.
Click here!

AMATEUR RADIO FD★26

A NATIONAL RESOURCE

JUNE 27 - 28

Open to the Public

7784 County Rd 72, Windsor CO
Starting 9:00 AM

American Radio Relay League (ARRL) Field Day is the largest annual amateur ("ham") radio operating event in North America. whether just thinking about ham radio or already licensed - Come Get On The Air!






Scheduled Events - Saturday June 27th

Interested in HF? Get hands-on experience at Field Day.
Special sessions are scheduled throughout Saturday

1000 - 1200: Hands-on training with experienced Hams to setup antennas and radios for your HF station. Find out the costs and get ideas of what will work for your ham shack. Below are the antennas and radios planned for setup:

- Wolf River Coil & Yaesu 450D radio
- Octopus & Elecraft K4 radio
- Center Fed Dipole & ICOM 7300
- QRP setup Xiegu G90 with Super Antenna

1300 - 1430 Lunch & Drinks Provided

1200 - 1800: Use the above radios and antennas to work with experienced Hams and Get On The Air! *GOTA!*

- SSB Voice
- CW Morse Code
- Digital FT8

Demonstrations:

- CW Morse Code
- Digital FT8
- Winlink
- APRS
- Fox Hunt

Sign up here: https://ncarc.co/ncarc-field-day-2026/

Field Day *is coming up soon and this year the NCARC is doing something special.*

If you have ever been interested in making contacts around the globe, learning about different types of transceivers and antennas, or making your very first HF contact, this is the event for you!

When: Saturday, June 27, 2026

Where: 7784 County Road 72, Windsor, CO

RSVP: https://forms.gle/8rT37qYcFazkpriY6

For Beginners & Curious Minds

Starting at 10 AM, we are going to set up several ham stations, explain the pros and cons of each rig and antenna, discuss off-grid power, and answer all your questions. If you have ever wanted to know how to get started with your own home station, this is a great hands-on way to learn about some of our hobby's most popular setups:

- Wolf River Coil & Yaesu 450D
- Octopus Antenna & Elecraft K4
- Center-Fed Dipole & ICOM 7300
- QRP Setup: Xiegu G90 & Super Antenna

After the walkthroughs, we want to help you get on the air and start making contacts! From 12:00 pm till sunset, there will be several stations and hams that will help you get on the air. We will have food, drinks, and a lot of fun.

For Experienced Hams

If you are already an experienced ham, this is a fantastic opportunity to test your portable/EmComm equipment outside the comforts of home, mentor new hams, and enjoy the camaraderie.

RSVP

Please sign up online to let us know you're coming. On the form, please indicate:

1. If you need space to set up your own equipment.
2. If you want to operate club equipment.
3. If you will be joining us for the morning learning sessions.

We hope to see you all there! Sign up here: https://forms.gle/8rT37qYcFazkpriY6

Red Feather Crystal Lake Repeater Project Finally Complete

By Joe Hawley, KDØTYU

On May 30th, a group of dedicated Northern Colorado Amateur Radio Club members made the trip to Red Feather Crystal Lakes and officially completed the Crystal Lake repeater project. After nearly eight years of planning, searching, negotiating, engineering, and construction, the system is finally on the air and serving the community.

This project began almost eight years ago as we searched for a suitable location for a new repeater site. During that time, we explored numerous possibilities, including county-owned properties and U.S. Forest Service locations. After many discussions and evaluations, we ultimately found the perfect home on private property in the Red Feather area.

A special thank you goes out to the residents and supporters in Red Feather who stood behind this project and helped make it possible. Their support and cooperation were invaluable throughout the process.

The site now hosts an analog FM repeater on **447.125 MHz** with a **100 Hz tone** and standard negative offset. Initial testing indicates the repeater is performing exceptionally well. Because it is a linked repeater, it can be connected to any of our other club repeaters, and we are currently evaluating which permanent link configuration will best serve our members.

In addition, the site is home to the Northern Colorado Amateur Radio Club's first **DMR repeater**. The DMR machine operates on **145.385 MHz**, uses **Color Code 7**, and is connected to the Rocky Mountain backbone network. **Time Slot 1** is assigned to Rocky Mountain Wide, while **Time Slot 2** is assigned to the North talk group. We greatly appreciate the cooperation and support we have received from the Rocky Mountain Ham Radio community over the past two years as this portion of the project came together.

This accomplishment would not have been possible without the dedication of many volunteers. Special recognition goes to our engineering team: **Chip, Mark Young, Mark Sheets, Bob Nada and James Cizek**, who worked tirelessly on the project while balancing their many other commitments. Their expertise, persistence, and countless hours of work helped turn this vision into reality.

The project required cooperation among club members, local property owners, community leaders in Red Feather, Larimer County representatives, and our partners in the amateur radio community. It truly represents what can be accomplished when people work together toward a common goal.

The entire site is powered by solar energy, and we believe the system is well-positioned to provide reliable service for many years to come.

Looking ahead, we will be working with the Red Feather Crystal Lakes community to help licensed operators develop their skills and to explore the possibility of offering amateur radio licensing classes in the area. Our goal is to continue growing amateur radio participation while providing valuable communications resources to the community.

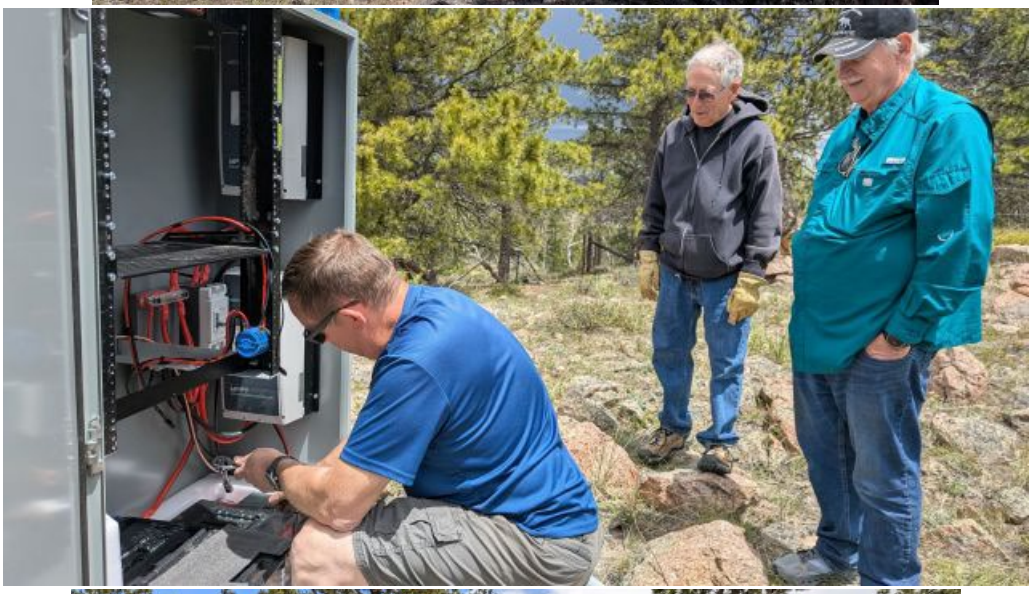
To everyone who contributed time, effort, expertise, equipment, and encouragement throughout this long journey—thank you. This project was truly a labor of love, and its successful completion is a testament to what the Northern Colorado Amateur Radio Club can accomplish together.

Job well done!

Red Feather Crystal Lakes Project Pictures

From David Taylor, KBØOLE











PS: We are considering creating a place for club pictures to be maintained on the web. Dave took many great pictures, too many to include here! More info soon!

Tech Report

James Cizek, KIØKN
techchair@ncarc.co

June 2026

Horsetooth

We lost one of the repeater controller interface boxes due to an unknown catastrophic failure. This controller was attached to the 447.275 repeater. A group of front range clubs have been collaborating for over a year on a redesign of this particular piece of hardware. The new design is *signifiacantly* better than the current one we normally purchase. It's almost ready for prime time and we've been asked to help 'beta' test some of them when ready. As part of this agreement, Colorado Connection gave us a replacement controller interface to fix the 447.275 rapidly. We are very excited about the new hardware that will be coming soon and the new capabilities it will add as well!

The GPS antenna failed at Horsetooth which resulted in loss of signal and that took the 2 voting receivers for Buckhorn offline. I installed a temporary antenna and got that back online. NØEMP also helped replace some power lead crimp lugs that were never done right the first time (we just didn't have the right parts when initially installed) with high current hydraulically crimped-on lugs.

We rebooted the entire rack to give all the hardware (repeaters, computer, APRS digi, network, and Winlink gateway) a fresh start. The site is in great condition now.

We have had GPS problems at many of our sites. I need to rethink that strategy and come up with something a little more resilient. Cellular sites have this figured out so I am sure we can too!

Nunn

We finally have a time scheduled to replace the antenna. It will be done July 9th which should return this site to full capacity!

Buckhorn East (NCARC):

Other than the ongoing GPS challenges there (we are running on temporary GPS there too), everything is running smoothly and normally.

Buckhorn West (RMHAM):

I have moved the primary virtualization server to this location for now. We are in the middle of upgrading it to fast solid state hard drives. It hosts things like "listen live", our camera server, the North Network authentication server, and a small host of other things. Purchasing solid state drives in this time of AI market driven explosion has been a challenge, but I am investigating many options and hope to have this wrapped up soon. We also are hosting the microwave shot to Red Feather here and the dish and cabling were recently installed.

Grover

Now that Red Feather is out of the way on the air, the frequency and repeater change will be made here soon! Watch for more info shortly.

Red Feather

A tremendous effort by all involved! Two (2) repeaters are on the air and working great. With almost 3 kW of solar power and almost 500 Ah of lithium battery, this site is staying VERY healthy on power budget and is operating better than we had hoped. So far, coverage appears to be even better than we had mapped out, and all equipment is operating at normal levels. This site is hosting the 447.125- 100.0 analog repeater and the 145.385- CC7 North and Wide Talkgroups DMR repeater. Both repeaters are set at about 20 watts and each uses a single folded dipole antenna. We are thrilled to have this new coverage for our members and guests in the Red Feather / Crystal Lakes areas.

We will continue refining the analog machine with adjusted buffers, courtesy tones, etc. Also, we will develop a linking strategy that works best for all. Currently, the 447.125 is linked full time to 447.275 at Horsetooth so that RF/Crystal Lakes residents can join the NCARC nets.

Overall

All other sites are operating normally.

Did You Know?

A regular contribution from Bob Schmid, WA9FBO

The Wheatstone Bridge

How do we make a precision resistance measurement? There are several methods, each with different accuracy and limitations. Let's investigate.

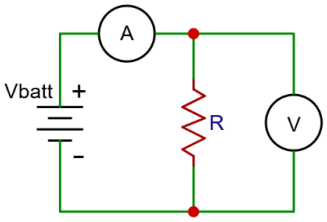


Figure 1 - Voltmeter/ammeter method

The voltmeter/ammeter method

We can place an unknown resistor R across a voltage source and measure the voltage and current (Fig. 1); R = V / I. It works, but it's not very accurate unless you use good equipment. Low-ohm resistors draw lots of current, creating voltage drops. High-ohm resistors draw tiny currents, making accurate ammeter measurements difficult.

The voltage divider method

A better way is to use a voltage divider (Fig. 2). Assume R1 is known and R2 is unknown: R2 = R1 • (V_{R2} / V_{R1}). No current measurement is needed; you only measure voltages, and there are very good voltmeters available. Other advantages include not having to know the exact value of V_{BATT}—only the ratio of the divider voltage matters—and the ability to select R1 so the resulting current falls in a range that measures well.

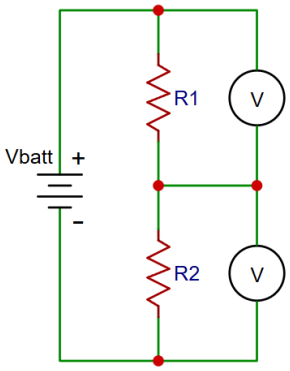


Figure 2 - Voltage divider method

Depending on the method used, there can be errors from V_{BATT} droop, the nonzero resistance of an ammeter, the (very small) current drawn by a voltmeter, and the calibration, temperature drift, and linearity of the meters themselves.

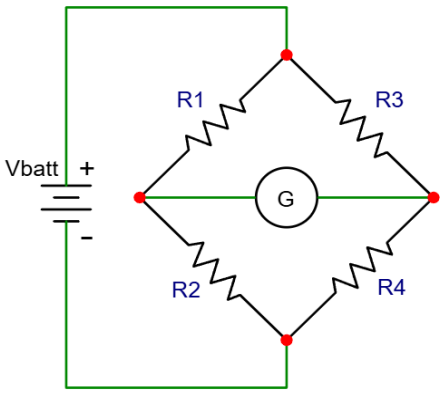


Figure 3 - Bridge method

The bridge method

Enter the Wheatstone Bridge, an improved method traditionally drawn in a diamond shape to emphasize its symmetry (Fig. 3).

How does it work? If we redraw it slightly (Fig. 4) we see that it's actually two voltage dividers, R1-R2 and R3-R4. A sensitive current meter (galvanometer G) *bridges* between the outputs of the two dividers and serves as a null detector. A null detector reads zero current when the bridge is balanced, which happens when the ratios are equal: R1 / R2 = R3 / R4. Let's say R1 and R3 are known, R2 is a calibrated variable resistor, and R4 is the unknown resistance. At balance, R4 = R3 • (R2 / R1), and we can read R4's resistance on R2's calibrated dial. The result is a direct-reading resistance meter. R3 could serve as a range multiplier by making it a rotary switch selecting precision resistors.

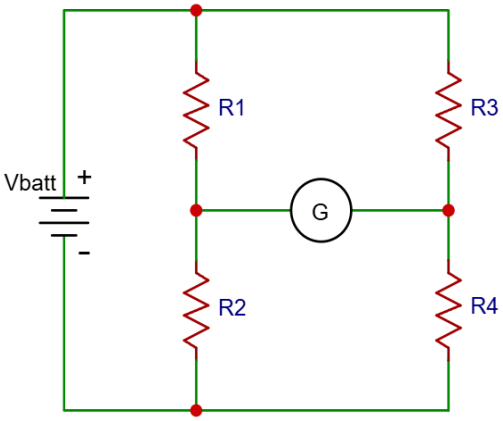


Figure 4 - Redrawn bridge

The Wheatstone Bridge (continued)

What are the advantages of using the bridge?

- We get high-precision resistance measurements using basic parts.
- The accuracy depends on resistors, not meters, and we can get resistors that are matched to very accurate ratios and temperature tracking.
- We balance the ratios of resistances, so variations in the supply voltage don't affect the null point.
- Looking for zero current is often easier and more accurate than making absolute voltage or current measurements. The detector only indicates "zero" or "not zero", and we don't need to know its gain or calibration.
- If we need to detect very small changes (microamperes or less), we can amplify the bridge's output—the voltage at G.
- A bridge can measure extremely small resistance changes, which makes it useful for sensing temperature (RTDs or thermistors), mechanical strain or pressure (strain gauges), light level (photoresistors), and even small variations in wire resistance.
- Reactances can be added to the balancing arms for AC impedance measurements.

What about today?

Why care about a 19th-century curiosity in the age of digital multimeters? Because the SWR bridge, the antenna analyzer, the impedance bridge, and many other modern instruments are direct descendants of it.

For example, an SWR meter doesn't look much like the classic Wheatstone bridge often drawn as four resistors in a diamond, but electrically it works the same way: it compares the balance among four arms.

Looking at Fig. 4, assume R1 and R3 are fixed resistors, which set the reference ratio of the bridge. The transmission line (forward power) and the antenna (reflected power) form the effective resistances of R2 and R4. The operation is like a Wheatstone bridge: the detector compares the voltages at the R1-R2 and R3-R4 junctions. When the antenna impedance matches the transmission line, those voltages are equal and the reflected-power indication goes to zero; when they are not, reflected power indication appears.

As with the original Wheatstone bridge, the instrument is not measuring absolute voltage or power. It's detecting how far the system is from balance—an old idea that remains extremely useful.

Who Was Wheatstone?

Sir Charles Wheatstone (1802–1875) was a pioneer who helped turn electricity from a curiosity into science. A trained musical instrument maker, Wheatstone had a lifelong fascination with how sound and electricity behave. He invented the English concertina, co-developed one of the first practical electric telegraphs, and even built a stereoscopic viewer that gave people their first taste of 3-D images.

The famous Wheatstone bridge that bears his name was actually invented a decade earlier by **Samuel Hunter Christie**. But Wheatstone improved and popularized it in 1843, turning it into a precision tool for measuring resistance long before digital meters existed.

Free Amateur Radio License Testing Available

The Northern Colorado Amateur Radio Club is committed to helping new and existing amateur radio operators earn or upgrade their licenses. That's why we offer free amateur radio testing sessions by appointment.

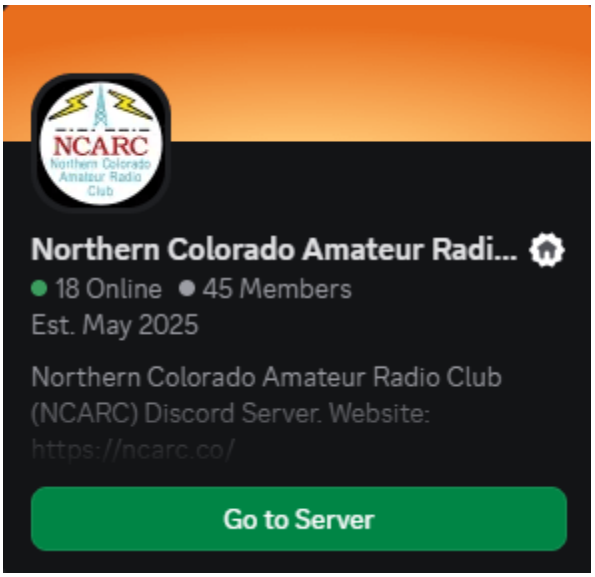
If you are ready to take your Technician, General or Amateur Extra exam, our Volunteer Examiners can often arrange a testing session at a time and location that works for you. We can meet at a local coffee shop, restaurant, community location, or other suitable venue. In some cases, we may even be able to come directly to your home.

We do ask for a few days' notice to coordinate our exam team, but in most cases, we can accommodate testing requests at almost any time.

Whether you're getting your first license or upgrading to the next level, we're here to help make the process as convenient as possible.

For more information or to schedule a test session, please get in touch with the club president Joe Hawley, KDØTYU, at president@ncar.co or 970-689-0828.

Join our NCARC Discord Server!



Out with the Old, In with the New (or How the Club Saved $1,500/Year!)

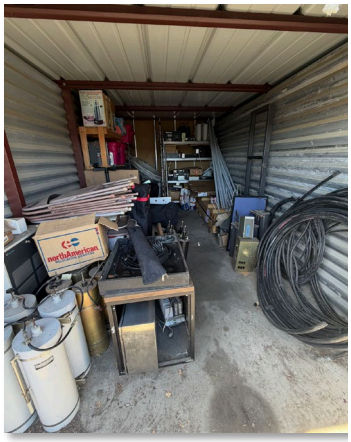
By Pete Robbins, WØRCR

About ten years ago, our club needed a reliable place to store our growing collection of gear, tables, chairs, spare parts, and all the essential equipment used to run our annual Hamfest. Over the decade, we certainly lived up to our amateur radio reputation and accumulated *a lot* of stuff. Unsurprisingly, the cost of that storage unit tripled over the years.

Last month, we decided it was time for a change.

Thanks to an incredible crew of club members who came out on a Thursday afternoon, we tackled a decade's worth of old books, radio gear, and repeater equipment. We sorted the treasures from the trash, tidied everything up, and officially downsized!

Old Storage Unit



New Storage Unit



While we are still at the same storage location in Loveland, we moved into a slightly smaller, much more efficient unit. The best part? **This move is saving the club $1,500 a year!** A huge thank you to everyone who pitched in to heavy-lift, organize, and help optimize our club resources. Your time and hard work made a massive difference for our budget!



Thank you Ted, NØRQV for taking photos!





Want Gear? As part of our cleanup, we set aside some great surplus items for sale. Be sure to check out the items below, as they are available to anyone in need!



Upcoming Ham Radio Events

ARRL Field Day: Jun 26-27, 2026, Windsor, CO. More info here.

Rosin Corps: Jul 11, 2026, Fort Collins. More info here

Courage Classic Bicycle Tour: Jul 18-19, 2026, Copper Mountain, CO. More info here. Contact Christian WØCDN.

Never Summer Race Event: Jul 24-26, 2026, Gould, CO. More info here. Contact Wayne ADØKE

Fall Equinox Marathon: Sep 20, 2026, Poudre Canyon, CO. More info here. Contact Marty KØMLG

Red Feather Trail Jamboree: Sep 25-27, 2026, Red Feather, CO. More info here. Contact Bryan NØBCB

Blue Sky Marathon: Oct 17, 2026, Fort Collins, CO. More info here. Contact Ron KØAZA

Weekly On Air Events

FoCo CW Round Table, Tuesdays, 8:00 pm MT, 7.118 +/- for QRM. More info here.
NCARC Tech Net, Mondays, 6:00 pm MT, 447.275 (100 Hz tone)
NCARC Club Net, Wednesdays, 6:30 pm MT, 447.275 (100 Hz tone)

Biweekly Get Together

Martinez-Clarke Luncheon: every other Wednesday, 11:30 am,
(next one Jun 24, 2026) Perkins Restaurant, 2222 W Eisenhower Blvd, Loveland, CO

From the Editor
Ann Donoghue KØARD

Field Day is going to be really fun this year!
Bring family and friends and get them involved!

Hope your summer is filled with fun ham radio things!
Send me a story and photos!