NCARC Tri-Bander

Volume 7, Number 1 January 2026

From the NCARC President

Joe Hawley KDØTYU
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As we move into the heart of winter, I'd like to take a moment to sincerely thank every one of you for being a member of the Northern Colorado Amateur Radio Club. Your continued support, participation, and enthusiasm are what make this club strong and keep amateur radio thriving in our region.

We are very much looking forward to our upcoming **NCARC Hamfest on January 17th**, which is shaping up to be another great event. Hamfest is always a highlight of the year — a chance to connect with fellow hams, browse gear, share stories, and welcome new people into the hobby.

If you're planning on having a **vendor table**, now is the time to act. We are down to the **last few days for table reservations**, and availability is getting tight. Historically, this is when tables disappear quickly, so don't wait and risk getting shut out.

Thanks again for being part of NCARC. We appreciate all that you do for the club, and we look forward to seeing you at Hamfest on January 17th!

NCARC Club Meeting

January 17, 2026

HAMFEST 2026

Admission: $7

You know you want to go!

Big floor show, lots of vendors with lots of stuff to sell

Great Speakers

RAFFLE!!

Free License Exams

9:30 am

Bring your FRN number
If upgrading, bring your current license

Location:
Thomas McKee 4-H Building
5280 Arena Circle, Loveland CO
40.44286, -104.9863

(Do not park in handicap spaces in front unless you have a sticker/hang tag)

Volunteers Still Needed

The NCARC Winter Hamfest will be held in just a few days on Saturday, January 17, 2026, and will be located at the Larimer County Fairgrounds, in the Thomas M. McKee 4H Building at The Ranch in Loveland, Colorado.

This is our annual fund-raising event and Volunteers from within NCARC are fundamental to making this event a success. We have several positions open in the following areas from 07:00 AM to midday which will allow you plenty of time to visit the vendor tables and save a few $ on admission fee.

If you are planning on going to the Hamfest then do your club a favor and help out as a volunteer. *We need a few additional volunteers to help with General Admission and selling Raffle ticket*s.

Admission Doors – taking admission payments, rechecking admission, and handing out door prize tickets.

Club Table – help with door prizes, membership renewals and applications.

Raffle Tickets – selling raffle tickets

Vendor Check In – Working with vendors, accepting payments and last-minute table sales.

Session Moderators – working with presenters.

HOW TO SIGN UP...

Check out the 2026 Hamfest page and use the form on the volunteer page to sign up and help your club.

NCARC Hamfest https://ncarc.co/hamfest-2026/

NCARC Volunteer https://ncarc.co/hamfest-2026/hamfest-2026-volunteer-page/

Thanks

Pete Borley

KF0BTB (kf0btb@gmail.com) 925 980 8570

NCARC Winter Hamfest Volunteer Coordinator

Hamfest Speakers

Great topics this year with outstanding speakers. You won't want to miss it!

	Estes Park Room (Virtual)	
	Moderator: Joe Forman, KF0TUV	
Time	**Speaker**	**Topic**
9	Callum McCormick M0MCX	Antenna Height, Radiation Angle and Why DX is Hard
10	Bill Salyers AJ8B	DXCC 1 Byte at a Time
11	Joe Eisenberg K0NEB	3D Printing for Radio

	Timnath Room	
	Moderator:	
Time	**Speaker**	**Topic**
9	Ed Mohrman WA7EM	200 DXCC with 100 Watts and a Wire
10	Dave Swartz W0DAS	The Many Ongoing Citizen Science Projects of HamSCI and the NCARC Connection
11	Violetta Latham KN2P	Youth - The Future of Amateur Radio

	LaPorte Room	
	Moderator:	
Time	**Speaker**	**Topic**
9	Open	
10	Chuck Poch K0ITP	Benefits of Amateur Radio Volunteering
11	Open	

Treasurer's Report

Bob Nauta WØBNC
treasurer@ncarc.co

December 2025

Account	Checking	Raffle	Savings	PayPal	Total
Beginning Balance	$226.00	$2,684.00	$5,043.00	$3,654.00	##########
Deposits	$0.00			$0.00	$0.00
Transfers					$0.00
Withdrawals	$233.00			$0.00	$233.00
Ending Balance	($7.00)	$2,684.00	$5,043.00	$3,654.00	##########
Outstanding Items					$0.00
Net Balance	($7.00)	$2,684.00	$5,043.00	$3,654.00	##########
Net Change	($233.00)	$0.00	$0.00	$0.00	($233.00)

Expenses: Storage, Tech class food, Red Feather Tower

Revenue: Memberships

It's Time to Renew for 2026!

Renew your NCARC membership.
It's quick and easy.
Click here!

Did You Know?

A regular contribution from Bob Schmid, WA9FBO

Fast 'n' Hot Chips

Modern data centers housing AI supercomputers draw as much power as small cities—tens or even hundreds of megawatts. With such staggering energy use, you'd think something exotic is happening inside. But the reality comes down to physics: most of that energy goes into charging and discharging tiny capacitors. Let's explore that.

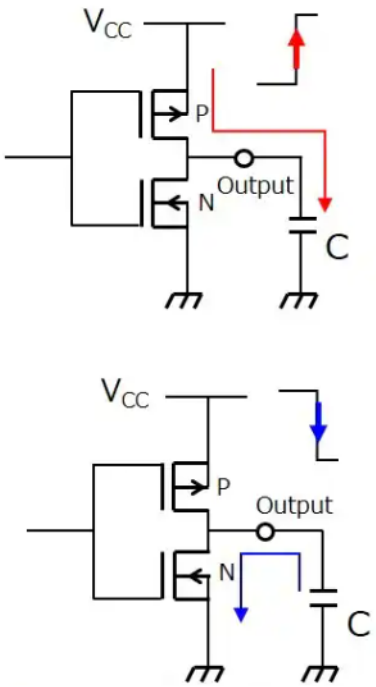


Fig. 1 - Power Dissipation Due to C_{LOAD}

Capacitance

Modern integrated circuits—CPUs, GPUs, and AI accelerators—are based on CMOS (Complementary Metal-Oxide-Semiconductor) technology. And in CMOS, logic gates are built from pairs of N-type and P-type MOSFETs that act as switches (Fig. 1). When idle, these gates consume almost no power. But during switching, current flows to charge and discharge the load capacitance C, made up of the next stage's gate, the routing wires, and stray capacitance from the circuit layout.

Every time a digital logic gate switches from low to high (upper drawing), it charges this capacitance. When it switches back from high to low (lower drawing), that charge has to go somewhere. It flows out of the capacitor and through a transistor to ground

Resistance

But wait. Capacitors store and release energy, not consume it. Why does switching a capacitor require power, and where does it go?

When charge flows through resistance, it produces heat. In CMOS chips, resistance comes from transistors, metal interconnects, and output drivers—not the capacitors themselves. Off-chip, PCB traces add more resistance.

Each time charge moves in or out, resistance in the surrounding circuit turns some of that energy into heat. That's where the power goes, and why switching speed and capacitance matter. (Modern chips also have *static* power loss due to leakage currents, but in high-speed logic, *dynamic* power losses usually dominate.)

AI Is Hungry

The humble CMOS switch is efficient—but at AI's scale and speed, even tiny per-switching losses add up to significant power consumption. With high clock rates, wide data paths, heavy simultaneous switching, massive compute arrays, and workloads that keep them active, it's no wonder today's chips get hot—even though they're "just switching".

The Math

The following equation goes by several names, one being the “dynamic power” formula. It yields the average power handled by a capacitor in a switching environment:

$$P = ½ \bullet C \bullet V^2 \bullet f$$

It states that if capacitor ***C*** (farads) is charged and discharged ***f*** times per second (hertz) with a peak voltage across the capacitor of ***V*** (volts), then an average power of ***P*** (watts) is dissipated somewhere in the circuit.

To reflect the actual workload, the result may get scaled down by an *activity factor*, representing the proportion of transistors switching per cycle. In other words, while modern chips contain billions of transistors, only a fraction are active at a time.

Reducing the Hunger

What can be done to reduce power dissipation? We don’t want to slow things down by lowering ***f*** because frequency is tied to performance. But we can reduce ***C*** by using smaller transistors (smaller gate capacitance), using shorter wires (less parasitic capacitance), having each output drive fewer inputs, and reducing the number of active switching blocks. And it’s especially effective to reduce ***V***, since power rises with voltage squared.

Summary

Capacitors don’t consume energy, but moving charge into and out of them does. In CMOS circuits, that movement happens through resistive paths: wires, transistors, and drivers. The energy isn’t lost in the capacitor itself—it’s dissipated as heat in the surrounding circuitry every time a voltage level changes. At today’s switching speeds and scales, that adds up fast—making dynamic power a major factor in modern chip power budgets.

Tech Report

James Cizek, KIØKN
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January 2026

Nunn

We have finally gotten the repeater problems ironed out, but it appears the antenna has probably failed. The club is in the process of obtaining a replacement and should have that site back on the air properly soon!

Red Feather

The needed equipment enclosure delivery is imminent. All the other needed equipment is here and in the process of being built now. More to come on this soon, but we should have that site on air soon too (weather permitting of course!!).

All Other Sites

We are working on building up a new version of the PC-based repeater controllers. This should help even more with stability and new features (though we are pretty darn stable now!!). This change should be mostly invisible to members, but it will help us maintain security on our network of repeaters and help keep things modernized.

Fun video of NCARC tour of WWV (in 2017)

Courtesy of John KB0NE

https://www.youtube.com/watch?v=2G_AqivVfpM&t=4s

NIST was 5 µs off UTC after the power cut

From Jeff Geerling, Dec 22, 2025, used with permission https://www.jeffgeerling.com/

Were you late?

If you were 5 microseconds late today (*Dec 22, 2025*), blame it on NIST. Their facility in Boulder Colorado had its power cut for multiple days. After a backup generator failed, their main ensemble clock lost track of UTC, or Universal Time Coordinated. However, even if you used the NTP timing servers they run, they were never off by more than 5 microseconds.

5 µs might seem insignificant. But it *is* significant for scientists and universities who rely on NIST's more specialized timing signals. No, you don't need to panic. Yes, they have it under control now. But I thought I'd go over what happened, what it means, and what we can learn from NIST's near-outage.

What happened

The NIST campus, which distributes Internet time on six of the most popular NTP servers, lost power last Wednesday. The power company was forced to cut power because of wind gusts over 100 mph (160 km/h). Power lines were coming down and they didn't want to risk starting a wildfire. The whole campus was locked down for safety, so nobody could enter or exit.

They have backup generators. And those were working... but apparently one of the generators failed after a couple days. Specifically, the generator that powered the main ensemble clock that's used by the NTP servers. Things were dicey last Friday, and they couldn't get any more staff in to fix it.

Jeff Sherman, the Group Leader for NIST's Time Realization and Distribution Group, considered shutting down the backup generator that powered the time servers. That would've prevented them from sending out inaccurate time, which would be worse than no time at all for a lot of applications.

NTP's designed so you have multiple servers and if one fails, it won't cause you to lose time. And luckily for NIST, they have *another* building on their Boulder campus with more clocks, and that building could transfer time back to the one that had the power failure, if they needed to. But yesterday Jeff posted another update: power was restored, and *apparently* there were still some staff on-site who saved the clocks.

They were able to re-route emergency power after the main backup generator went down. Battery backups, I'm assuming some big UPSes, were able to bridge the gap, until they got the *backup* backup power going. When all was said and done, their monitoring showed deviation from UTC was less than 5 µs.

Seeing all that, Jeff and the team at NIST decided to keep their time servers online. But why would they do that, if they were off? Well, time scales are important here. If you're on a Mac like I am, go in the Terminal and run sntp time-a-b.nist.gov. This or a command like ntpdate on Linux gives back an error bound, that shows latency between your computer and the NTP time servers.

```
$ sntp time-a-b.nist.gov
+0.005771 +/- 0.035081 time-a-b.nist.gov 132.163.96.1
```

In my case, it's showing 0.035 seconds. That's 35 *milliseconds*, or 35 *thousand* microseconds. 5 microseconds isn't even a blip there. So instead of taking down the servers, which could cause *more* problems, NIST kept them online. But Jeff said NIST's time is usually about 5,000x more accurate. If you're one of the universities or aerospace companies that relies on NIST for timing, a 5 µs difference probably *does* matter.

So they'll be working with those groups directly. But for most people, they'll never even notice. Jeff finished off the email mentioning the US GPS system failed over successfully to the WWV-Ft. Collins campus. So again, for almost everyone, there was zero issues, and the redundancy designed into the system worked like it's supposed to.



Time is fragile

I was following this closely over the weekend. I have two Raspberry Pi GPS clocks in the studio. One runs my main Stratum 0 NTP server, and the other one I have running as a backup for testing. (Yes I know I should have 4+ going for good quorum.) They both run off my outdoor GPS antenna, which is distributed in my rack room *and* in my studio for time research.

Like my studio, *most* places that need precise time rely on GPS. And that could be a problem! I'm glad redundancies kept GPS from drifting—I don't know what would happen if GPS time went away, but it wouldn't be good! The main takeaway is this: *timing infrastructure is fragile*. CISA identified a lot of risk in the US's over-dependence on GPS.

Because of that, the US announced it's trying to find good alternatives for PNT (Position, Navigation, and Timing). I was at a meeting at the NAB where Jeff Sherman, the scientist who wrote the two NIST updates, was talking about BPS. The Broadcast Positioning System would give us redundancy even if GPS was down. Yet even *with* multiple time sources, some places need more. I have two Rubidium atomic clocks in my studio, including the one inside a fancy GPS Disciplined Oscillator (GPSDO). That's good for *holdover*. Even if someone were jamming my signal, or my GPS antenna broke, I could keep my time accurate to nanoseconds for a while, and milliseconds for months. That'd be good enough for *me*. (If I'm being truthful, it's actually overkill, but I'm in the time-nut rabbit hole now—if you know, you know.)

Some places *do* need nanoseconds, for science experiments, RF, media, or finance. And they might run their own even more precise clocks. But they still trace things back to NIST, at least most do here in the US. So, when NIST's disaster response is tested, everyone's watching. Last week, when we were microseconds from disaster, the team at NIST fixed it so almost nobody noticed.

Upcoming Ham Radio Events

NCARC Hamfest: Jan 17, 2026, Thomas McKee 4-H Building, The Ranch, Loveland, CO

Technician License Class: Feb 28, Mar 7, 2026, Larimer County EOC Facility, Johnstown, CO. More info here.

Quad Rock Race Event: May 9, 2026, Lory State Park, Fort Collins, CO. More info here. Contact Ron KØAZA

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

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 Jan 21, 2026) Perkins Restaurant, 2222 W Eisenhower Blvd, Loveland, CO

From the Editor

Ann Donoghue KØARD

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I hope you have a terrific time at Hamfest!!