

CCARC News

Capital City Amateur Radio Club

March 2024 – Helena, MT

An Update on Solar Considerations

By Tom Mandera KE7VUX

A quick recap from my presentation at the club meeting several years ago.

A TH-D74A handheld draws 48ma, 135ma, or 260m (power saving mode, squelch closed, receiving) or roughly 0.66w, 1.8w, and 3.6w. When transmitting at 5w, that becomes 19.32w.

An FT-8800 mobile draws 6.9w with the squelch closed, and 117.3w when transmitting at 50w.

When we apply a TX vs RX duty factor, I come up with some rough figures of:

HT @5w – 5.3w, Mobile @5w power – 26w, @50w – 48.8w, a [KX3@5w](#) – 6.72, and 100W HF at 75w.

For a lead-acid battery, you should discharge it no more than 50%. That means a 12V 50AH battery (a somewhat typical “RV” battery) has about 500wh we can use.

That’s enough to run the HT for 100 hours (500wh/5.3w), a 50w mobile for 10 hours (500wh/48.8w), the HF station for 6.5 hours, or the KX3 for 75 hours (500wh/6.72w)

If you want Lithium Ion, those can go to 80% depth-of-discharge. I use a Dewalt 20V tool battery at times, and I have a 9ah version. At 80% discharge, I can get roughly 144wh out of the battery (20V * 9AH*0.8%).

Coming Events

March 4, 2024, CCARC monthly meeting 7 pm at the Salvation Army, 1330 Hudson St. or on Google Meet, <https://meet.google.com/zfs-ctwp-bax>

March 16 – CCARC Social 2 pm until ?, at the Brewhouse downstairs. **Bring family!** Buffet provided, drinks and other food extra.

April 1 – 7 pm, National Weather Service “Storm spotter” training! Members and nonmembers welcome. Questions, contact Al WA1TYB.

May 25 – Antenna Day, 11 am – 3 pm, at the Zinn Ranch. Contact Ray K7ZIN.

Trivia Net - every Sunday, 7:30 pm in 147.22.

When I ran the portable repeater during the Elkhorn race in 2023, I had the repeater up for a bit under 12 hours. I also had some other power consumers going – my HF radio, the furnace fan – but overall, I used (and subsequently replenished) about 720wh of power. Since I had other loads, the actual repeater needs over 12 hours are less than 720wh.

To do this on battery alone, I would need a 120AH 12V battery (or two 60AH) or with Lithium Ion I would need a 20V 45AH battery, or maybe with a used electric car battery pack, a 48V pack with 20AH capacity.

But what if we didn’t have to rely on battery power alone?

Montana averages a bit over 4 hours of full sun equivalent every day. More in the summer, less in the winter.

That means it’s easy to assume a 100w solar panel can produce 400wh in a day (A small bit

early in the morning and late in the afternoon, with most coming at mid-morning to mid-afternoon.) If we replenish 400wh, we only need 320wh more to reach 720wh.

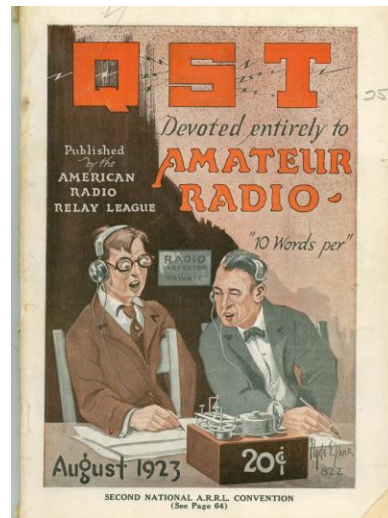
Now we can use a single 53A 12V lead acid battery. Current prices suggest a 75AH battery is \$130, while the 105AH battery we need without solar is \$180.

A 100w panel should be well under \$100 these days, and you can often find it bundled with an inexpensive PWM charge controller.

Instead of buying a massive battery (or two), you might get away with less battery and add in some solar. The solar will help keep your battery above 12V to keep the electronics happy, and the smaller battery will weigh less – and cost less to replace when it eventually wears out. You're also not paying \$.15/kwh to recharge the battery when you get home (not a big factor since we're talking about less than 1kw)

A note about charge controllers.

Pulse Width Modulation (PWM) chargers are the cheapest. You can get a 30A unit for charging 12 or 24V for \$15. You must use a panel that is slightly higher in voltage than the battery, but not significantly. Consider a 24V battery bank if you do have a 30V or so panel – you can always step down from 24V to 12V or 13.8V as needed later, but you get double the wattage by doubling the voltage since the controller is rated in Amps, not volts ([30A@12V](#) is 360w, while [30A@24V](#) is 720w) Because of the switching nature of the controller, you may get some undesired RFI. (Cont'd on page 8)



My One-Hundred Year Ham Heritage

By DeLona Zinn KI7YMZ

In about the year 1923 when the radio came to be of great interest, my grandfather, Oscar Nielson, managed to secure a simple receiver that used a 01-A vacuum tube in a regenerative circuit. It was powered by an "A" battery consisting of a six volt "hot shot" of the type used to power the Model T Ford ignition for starting; two 76-1/2 volt "B" batteries, and 4 1/2 volt "C" battery. The grid voltage for the tube was from the "C" battery, fed through a grid leak resistor, which was formed by drawing a pencil line between two terminals. Whenever the tube quit oscillating, my grandfather would erase the pencil line and draw another one until it resumed operation. The set provided audio power enough for one headset. He later had it modified, adding another tube for audio amplification, so they could use two headsets.

My father remembers that he, his dad, and mother took turns listening to programs from some of the early radio broadcast stations such as KDDA Pittsburg, WLW Cincinnati, one in Des Moines, Iowa, also several others. They listened to some of the early programming from KQW San Jose, California, which later became KCBS. Another one was KNX Hollywood.

To provide an optimum antenna, my grandfather went to the mountains and cut a couple of tall lodge pole pine trees and set one in the ground by their house and the other by the barn. A cross arm was fastened at the top of each pole with two parallel wires suspended between. At the house end, the wires were tied together to one feed line to a window on the south side of the kitchen. It was fed through a lightning arrestor to the antenna connection on the radio. A good earth ground was provided by attaching the ground wire to an old brass auto radiator buried several feet in the ground just outside the window. With no power lines or electrical appliances to generate interference, reception was limited only by propagation and atmospheric noises.

Thunderstorms occurred quite frequently throughout the year during the warmer, humid days. One day, during a particularly severe storm, static charges built up on the radio antenna and were arcing across the lightning arrestor. My grandmother thought that this would be a good time to disconnect the lead in from the radio. She pulled the wire loose from the terminal on the set. Just then, lightning struck close by creating a higher charge on the antenna creating a loud ZAP and arc from the end of the wire to the window screen. This startled her so much that she could not speak for a while.



My father, Ivan Nielson, K6RQG, loved ham radio. I believe he got his ham license sometime in the late 40s or early 50s. He was proficient in CW and

could copy and transmit more than twenty words per minute. He was MARS coordinator for the Bay Area since 1955. As I remember, he coordinated an emergency radio during a major flood. He had this tiny ham shack in a small guest bedroom, which contained several large radios given to him by MARS stacked upon his desk. He had a long wire antenna strung from a twenty foot galvanized TV pole in the courtyard of his home. The end of the antenna was connected to a very tall tree in the yard. As I recall, his radio was crystal controlled and he had a drawer full of crystals that he would swap out, depending upon the frequency he was using. Ray K7ZIN was fascinated by my father's hobby and would often join him in some QSOs. Ray remembers talking with stations in Europe and Asia. He had a wall full of QSL cards from all over the world with a world map hanging on his wall.



Join the SOTA Movement!

Enhance Your Ham Radio Skills

By Al Le Vie KH7AL

Greetings Fellow Hams,

This year, I've set a personal goal to share with others the joy and challenge that is Summits on The Air (SOTA) within our vibrant ham community. Part of this effort will be conveyed through my podcast called, "Diet SOTA" — a playful nod to keeping SOTA an active part of our 'ham radio diet' and exploring the lighter, human

side of our hobby. For my first installment, I was greatly humbled to have the opportunity to interview our friend Rob Kingery, AE7AP, about his ham journey and SOTA experience. If you have not checked it out yet, please do through this link: https://youtu.be/OQ0L4jZsiSs?si=K2w_80VLrs8Dhee2

I'm reaching out to you here to encourage each of you to embark on your own SOTA adventures. SOTA isn't just another activity; it's a gateway to refining your operating skills across CW, contesting, portable operating, and DX chasing, all while enjoying the great outdoors, or from the comfort of your home. Whether you're maneuvering through a pile-up to make that crisp, clear contact from a summit, or you're on the other end, chasing those activations from your shack, each interaction is a step towards mastering your radio skills.

Why SOTA?

- **Skill Development:** SOTA activations and chases are prime opportunities to sharpen your operating techniques in real-world conditions. From dealing with varying propagation to managing interference, the experience is invaluable.
- **Physical and Mental Benefits:** Combining ham radio with hiking and nature, SOTA is the perfect hobby for those looking to add a bit of physical activity to their routine, offering both mental and physical benefits.
- **Community and Friendship:** The SOTA community is welcoming and supportive, offering a sense of camaraderie that's hard to beat. Sharing experiences, tips, and encouragement. It's a fantastic way to make lasting friendships.
- **Adventure and Exploration:** Every activation is a new adventure, a chance to explore parts of the country—or even the world—you might never have considered visiting.

Whether you're a seasoned ham or new to the hobby, there's a place for you in the SOTA community. I encourage you to give it a try, be it through activating a local summit or chasing from your home station. Let's make this year one filled with adventure, skill enhancement, and community growth.

Keep SOTA in your diet, and let's discover the lighter, human aspect of why so many of us thoroughly enjoy this part of ham radio. You can follow my Diet SOTA content via links to Spotify, YouTube, and SoundCloud on my website here: <https://sites.google.com/view/kh7al/home> or by scanning this QR code below.



The Yaesu 891 Go Box Build

By Stacy Webb KK7CJV



Eric KE7NLU built the Ultimate Go Box with a computer and Yaesu FT-991A radio that can do all things radio but is a lunker at 38lbs. I wanted a Go Box that could fit into my Northface Backpack, so I could easily carry the radio gear up a mountain for more SOTA activations. My Radio Go Box needed to be light enough for a short hike,

fit in the backpack, and accommodate 100 watts. Most of my research found QRP to be a very popular set-up for SOTA activations. But I was determined to find a solution to have the capability of a full 100 watts on an activation. Santa knew exactly what I was looking for! The Yaesu FT-891 is a HF/50Mhz All Mode Transceiver. The compact design weighs 4.1 lbs. and has 100 watts of high-power output. A bonus to the Yaesu FT-891 is that the face plate/control head of the radio is removable, opening the mind to new Radio Go Box designs. Now to find a case that will fit into the backpack and fit the radio, LDG-Z100 plus tuner. We chose the Apache 2800 case from Harbor Freight (\$29.99). Eric made the aluminum brackets to hold the radio and tuner in place. He machined vents, button, display, and mounting holes before powder coating the exposed aluminum face plates that hold the radio control head, display, power button, mic and radio control head storage. We purchased a 10AH Lithium Iron Phosphate battery from Ebay for \$35. He 3D printed the storage box that holds the mic and where the radio control head situates when closed. The 3D box is built to contour the case on the front side so it will sit flush on the face plate. The case plate is mounted on the lip of the case and screws are screwed into the meat of the case. The lid of the case comes with 4 predrilled holes where a powder coated aluminum plate is mounted with 4 sheet metal screws. The Lid plate holds the radio control head and touch screen. The case plate provides venting for the main body of the radio and tuner, has the main power button, and has a mic and radio control head storage. We have drilled some side vents in the case for added ventilation to protect the radio from overheating. On the rear exterior of the case are ribs which we found to be very convenient to place the antenna connector and charging port in between the ribs for added protection. The charging port can be charged via solar, battery charger, or power supply set to a low 10-amp charge. The radio go box final weight is 17lbs.

Now that we had got everything to fit into the case it was time to do some Research & Development, so out to our local park for a POTA activation. We found some bugs. We found during the activation that the main power button was easily bumped which shut the whole production down-several times. We also found RF noise interference on numerous bands which signaled a noise problem within the box. We found that the display serial communication was causing noise within the radio. An RC Filter was added to the RX and TX serial lines, and this solved the issue. During a CCARC coffee meet-n-greet AL-WA1TYB suggested putting Eric's other product, GPS Time Sync Dongle, into the radio Go Box build. We were used to operating the Yaesu FT991 in the Ultimate Go Box which has a UTC time clock on the face of the radio so during our activation/R&D we fully understood Al's suggestion. Once the discovery was made there was no clock to write down the time of our QSOs. Eric redesigned the board, squeezed more wire into the space-deficient case and installed a GPS dongle by the main power switch. The GPS dongle now provides protection to the main power button, solving the touchy main power button getting bumped. He redesigned the display with a GPS page that provides UTC Time with battery backed real-time clock if GPS is unavailable, grid square, latitude & longitude, altitude, and speed. (Cont'd on page 6)



Fun Contacts and Bands

Eric Webb KE7NLU - I participated in the CQ 160-Meter Contest on SSB and learned that this band behaves about the same as 40M and 80M in that it opens up short and then progresses long. My first contacts were in Colorado and Arizona, then later Virginia and Florida.

Ray Zinn K7ZIN – Tanzania on 20 m., VE6XP Canada on 17 m., Los Angeles on 30 m.

Off-Roading

By Zhaun Paddock

I was pleased to have my cousin reach out to me in December asking about ham radio and licensing. He studied hard and in January passed all 3 tests to become a brand new extra. He lives in Billings so I am hoping to guide him. Hopefully a local ham there will also help with some local knowledge. Listen for his call AI7VU. We want to get him on HF soon.

The past couple of weekends have yielded some opportunities for off-roading, and as always ham radio as well as LMRS radios are used on these adventures. My son Mathew with his learner's permit, with his mother Jennifer riding shotgun has attended these adventures in his 1995 Isuzu Rodeo. He is really doing great and having fun as well.

Matthew, supervised by Jennifer, and Tanner with me supervising took John AJ7MT on his first off-road adventure in deep snow. John and I used ham bands to communicate. However, since Matthew has not yet tested, he used the LMRS frequency, leaving me to juggle microphones and yes, occasionally mixing them up. We had a blast as we traveled to Park Lake and beyond. Tanner drilled a hole in the 2 plus feet of ice to see if he could catch a fish.

I enjoy mixing ham radio into my other adventures. - *Zhaun AI7BM*



FCC News

Submitted by Ray Torella
KF6OJE, Spokane Valley, WA

On the ARRL Newsline broadcast they announced the FCC has proposed that HOAs cannot prohibit licensed hams from attaching external antennas for ham operator use. The FCC proposed that hams can operate during emergencies, and especially during disasters and outages. If passed by Congress, it will be Federal law which all HOAs must comply with.

Stacy's Go Box (Cont'd from previous page)

Throughout our activations I have had hunters asking our altitude or grid square. Now I will have it right in front of me at my fingertips.

With revisions to the radio go box complete, we decided to play hooky on a beautiful Friday to do more R&D. February 23 was a clear blue-sky day with a confirmed 46 degrees. Eric has been working towards his next POTA award of a Kilo (1000 QSOs from a particular park) on K-4572 Lewis & Clark NHT and only needed 59 more contacts to attain his new award. I had wanted to activate the trail at York's Islands Fishing Access Site just outside of Townsend. This is the only place along all the many miles of the expedition that has been named after York, Clark's personal

slave. After reading the many log entries of the expedition, I recognized the incredible contributions York made to the journey and wanted to activate this particular site. Eric's 1000th QSO just happened to be a Canadian station from Ontario running just 6 watts and a 58/59 signal reports. We also happened to get a QSO from a direct descendent of William Clark while activating the Lewis & Clark NHT!

Our battery was waning, and our R&D had proved successful, when an unfamiliar vehicle pulled up. Our location was well out of the way. We told our hunters we had a visitor and were going QRT. Larry KG7MKC, a local ham from Townsend arrived. He heard our activation on 20 meters via ground wave and even tried calling us, but the other stations were just stronger. When another hunter had asked where we were located along the trail, Larry knew where to find us. The three of us enjoyed a very pleasant 2.5 hour in-person chat about all things radio: CCARC, Trivia, and the Belmont Repeater. Meeting a new-to-us ham, making our activation goals, and successfully testing the radio go-box left us full of happy memories.

CCARC Jackets

John Monson AJ7MT reminds you club jackets are still available. The price of a BASIC jacket with the logo and your callsign is still \$65. Long cut jackets and other options are available but do cost a little more. When we all wear the same jacket, people can easily spot us as hams with communication abilities. However, if red is not your color, then the club logo, your name and call sign, and other items can be put on a garment of your choosing. Contact me for pricing and details. Also, since I am employed by the company doing embroidery, I cannot discuss jacket ordering over the radio. Text or call me at 406-459-4040. Thanks, John AJ7MT



Image from Barnstable ARC

From the Foxes' Den

By Bob Gomes W7AFM

All the foxes are ready to go! Some have been laughing about something they are planning. Brian and I are just waiting for the weather to make up its mind up whether we are going to have snow or warmer weather.

The foxes all are getting very vocal. They want to get a fox hunt going! They don't think they can be found that easily. Well, hopefully we'll find out soon as the weather gets better. That's all for now. All you fox hunters keep your gear ready and clean. It could be any time!

Solar Considerations

(Cont'd from page 1)

Maximum Power Point Tracking (MPPT) controllers are much more expensive, but they've come down in price. They're usually extolled for their higher efficiency, but I'm more interested in the ability to mix-match voltages. That is, with MPPT you can use a 40V panel to charge 12V batteries. The same rule as above, that going to a 24V system is a smart move still applies as well. For a 15A MPPT, you'll pay \$50. It'll let you use panels up to 75V.

One very interesting aspect of this is that you can also undersize the controller or oversize the array, and the cost is wasted power.

The 75V/15A controller will only charge your 12V battery at up to 15A, but you can supply it with 400W (which would be 33A at 12V) and the excess power is just wasted.

Use this to your advantage – you can add an extra panel or two to account for low light, or shading, or poor orientation so that you produce more power at the margins (and likely more at peak/ideal conditions) without feeling the need to upgrade to a \$500 MPPT controller to handle the extra power.

A 200w panel is a good pairing with a 75V/15A controller. Around the noon hour, the battery will see a 15A charge rate. The rest of the day, it'll see less.

Pair a 400w panel(s) with that same controller, and it still only sees 15A at noon, but it might also see 15A at 11am/1pm, and even 10am/2pm. The power curve has a flat spot at the top, but the area under the curve is growing wider.

Doubling your panels will double your output in the morning and evening. This will also mean your battery will reach full charge earlier in the day, making your electronics happier.

A 100V/30A MPPT controller will set you back \$112, compared to the 75V/15A at \$50. Not a huge difference, but it gets more significant as you add more amperage – and so does the gauge of wire from your MPPT controller to your battery.

A note on the seasonal differences. I said Montana averages a bit over 4 hours of sun a day (4.25). I can confirm from my own experience that in December, my solar array produces 20% of what it produces in June. Snow, overcast skies, and the low sun angle all contribute to the drop. I could make a little more power if I adjusted the angle of the panels to account for the sun angle, but I'd make less in the summer.

I've upgraded my camper's solar system a few times over the years – starting with a 60W 4-panel

kick-stand kit from Costco (\$300), upgrading to the 3-panel 55w unit a few years later (\$240), then I moved to a 100w roof mounted panel (\$100+\$30 PWM) with plastic stand-offs glued to the fiberglass roof. I would still put the 55w kickstand out in the sun, but realistically the 100w roof panel did all I needed most of the time and was zero maintenance.



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