

The HAM-ER

(amateur radio emergency response)

www.hendricksares.org



July-September 2019

Inside This Issue

- 1 MESSAGE FROM THE E.C.
- 2 TAILGATE-FEST 2019
- 3 BATTERIES OR US
- 6 HEAT ILLNESS
- 7 RADIO SPEAK
- 9 PACKET RADIO PT.2
- 10 CONTACT US
- 11 UPCOMING EVENTS /
TRAINING UPDATES

Front Page News :

AE9R PACKET STATION



FOR MORE INFORMATION SEE PAGE- 7

Message from the Emergency Coordinator Field Day.

Boy, what a time to practice one of my favorite hobbies.... Emergency Radio Communications.

FIELD DAY.... Good times, good fellowship, good band conditions, great food.

Look for us at the H.C. Fairgrounds; 11a-6p Sat. 22

Don't forget about the Tailgate-Fest coming up soon !

73

Ron Burke KB9DJA



Chief editor/publisher of The
HAM-ER: Ron Burke

Tailgate-Fest is a great way for you to buy, sell, or swap amateur radio equipment



The C.T.S. and H.E.R.O. groups will sponsor a Tailgate-Hamfest on Saturday, July 27th.

- *** Food and drinks will be available. Tickets: \$5 at the gate. No set-up fee. Free parking.**
- *** Children under 16, and youth that are FCC licensed under 18 have free admission.**
- *** Hours will be 8am to 12pm, DOOR PRIZES WILL BE GIVEN AWAY DURING THE EVENT.**
- *** Location of this event is: The Aviation Institute of Maintenance,
7251 West McCarty St. Indpls. IN. 46241**



Batteries or Us

How Much Battery Do You Really Need?

It's always some variation of "How big of a battery do I need to run my (fill in the blank) radio?" It comes up a lot, not just in my email but also on the various forums and blogs I visit. The question is too open ended and comes with too many variables to give a definitive answer, but there are some basic battery concepts that will help you sort through this confusing topic.

Before asking the question, provide some answers.

It certainly does not help that many of the answers floating around the internet are based on guessing, hypothetical conditions, and overly generous manufacturer data. Before you can know how much battery you "need", first find out how much power all your stuff consumes and what you plan on doing with it in the real world. *Off Grid Ham* reader James (whose question was the inspiration for this article) asked about going off grid with his Yaesu FT-450 radio. The official Yaesu specifications state that this radio consumes maximum 22 amps/304 watts on transmit, and 0.55-1.5 amps/8-21 watts on receive depending on the audio level (these numbers are rounded).

Discharge reality.

James wants to run his radio with a 35 amp hour AGM battery and charge it with a 2 amp plug in charger. He plans on adding a solar panel at a later time. So what can he realistically expect from this setup?

A 35 amp hour battery can provide 35 amps for one hour. This is known as the *C-rate* or 1C-rate. The 2C-rate would be 17.5 amps for two hours, the 3C is 11.66 amps for three hours, and so on. Following the math, the 35 amp-hour battery should push James' 22 amp transmitter for a little over ninety minutes. In the receive only mode, assuming an average of 1 amp, the battery will go for 35 hours.

But let's deconstruct this. Under most conditions an amateur will be transmitting only part of the time, and even then, the radio will not continuously pull maximum amperage. A modulated signal will cause the current to swing up and down, hitting the peaks only momentarily. In fact, the radio will draw continuous peak power only when transmitting in the AM mode, which is seldom used anyway.

Duty cycle is expressed as a percentage and is the term used to describe the ratio of transmit to receive. If your duty cycle is 50%, that means you split your radio time equally between talking and listening. Keeping your duty cycle low (*ie*, don't run your mouth on the air too much) will stretch battery life.

Battery performance varies greatly depending on the temperature, age of the battery, and internal characteristics. Even identical batteries can yield different results due to small inconsistencies in the manufacturing process. There is also the rule of diminishing returns: From the moment a battery is placed into service, its abilities begin to degrade. Whatever performance you get on Day One, it will only go down from there.

I mentioned earlier that manufacturer claims are overly generous. I'll bet a gold microphone that the average 35 amp hour battery, even a brand new one, will not produce 35 amps for an hour. It might not hit 35 amps at all. Do not ever expect a battery to perform to its published specifications. The development of lithium batteries has brought actual results closer to marketing hustle, but lithium batteries are still too costly for the average amateur.

One way to get more runtime from a battery is to turn down the transmit power. I heavily promote QRP operating here on *Off Grid Ham* not only because I personally like it, but because it has real, practical value in that it conserves a lot of energy for only a modest sacrifice in signal effectiveness.

Getting back to the question...how much can James get from a 35 amp hour battery when hooked up to his FT-450? We've gone over the math: Depending on his duty cycle, he'll have at most a few hours of operating time if he's running full power. **Continue on next page**

Continue from page 3

AGM BATTERY STATE OF CHARGE	
Level	Voltage
100%	13.00V
90%	12.75V
80%	12.50V
70%	12.30V
60%	12.15V
50%	12.05V
40%	11.95V
30%	11.81V
20%	11.66V
10%	11.51V
0%	10.50V



GRAPHIC COURTESY OF AUSSIESOLAR.COM

The 22 amps/304 watts specified for the FT-450 is predicated on a 13.80 volt power supply. An AGM battery will likely not even take a charge to 13.80 volts, and if it does, it won't stay there once the battery is placed on a load. As the voltage drops, the radio will continue to work but will not put out full rated power. Ultimately, the radio may operate erratically or shut down completely. Some radios, such as the FT-817, easily tolerate voltage swings and will work between 8.00 up to about 16.00 volts. Do some research on your particular model and find out how low the supply voltage can go before you have problems. You could end up in a situation where you have an otherwise good battery that isn't useable because the radio is too picky. Or, the radio works on receive but shuts down when you try to transmit because the voltage drops too low.

Going in reverse: Charging the battery.

What should James expect when he's ready to charge his 35 amp hour battery back up? A commonly accepted formula for calculating charge time is:

$$\text{amp-hours} \div \text{charge current} = \text{charge time.}$$

James said he was using a 2 amp charger. So the calculation would look like this: 35 amp-hours ÷ 2 amp charge = 17.50 hours. This general purpose formula is not 100% accurate for all battery types, but it is a good basic rule that will get you close enough.

Seventeen-plus hours for a fill-up makes for a very long wait! Once again, let's bring it into the real world. That charge time assumes a fully dead 0% charge. And of course, no one lets that happen! Suppose the battery is 50% full when placed on the 2 amp charger. Then we're looking at about half of that 17.50 hours, or 8.75 hours. That's still a long time. What advice would you give James? If you suggested bumping up the charge current, congratulations...you've been paying attention.

The main concern when increasing charge current is that if it's pushed too high, it will cook the battery. The sweet spot would be the maximum charge current that can be applied without stressing the battery. For AGM batteries, the magic number is 20% of the amp hour rating.

Continue on next page

Continue from page 4

Walking and chewing gum at the same time.

It's not enough to have sufficient current to charge your battery in a reasonable amount of time. In an ideal off grid setup, you'll also want power to run your equipment simultaneously. This is a careful balancing act that requires filling the battery faster than you drain it while still having extra juice to run your gear. On top of that, you must contend with the fact that whatever you are using as a fuel source (solar, wind, etc.) is not consistently available.

For this illustration, we'll use solar panels as a main power source. Because we took the time to do some research (and didn't just wing it) we confirmed that we'll need about 1.00 amp or so just to operate the FT-450 in an idle receive mode, plus (ideally) a 7.00 amp charge current. That's a baseline of eight amps before we've even started transmitting. A 130 watt solar panel will produce a little over 7.00 amps, but that's at full sunlight. You're not going to have full sunlight all the time.

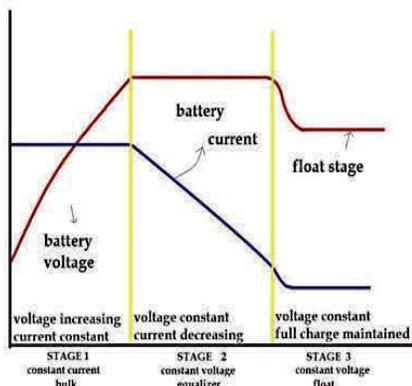
At this point there is a choice to be made: 1) Go with the 130 watt panel knowing it is just barely enough. When the sun isn't strong, the battery will fill in the hole. The solar extends battery time up to a point, but you're probably discharging the battery faster than you can fill it and eventually the tank will run dry. If the sun is strong, the solar will do most of the work but you'll still have to mind your duty cycle to avoid getting ahead of your available power. 2) Add more solar capacity to give yourself some "headroom" when the sun is weak. If you do it right, you can operate all day and still have a 100% charged battery at sundown.

In either case, we've already determined that the 35 amp hour battery alone will not push the FT-450 on full power transmit for very long, and a 2 amp charger will technically work but will have an unacceptably long charge time. When it gets dark and you lose your solar, you'll either need to go off the air, reduce transmit wattage, switch to another electric source such as a gas generator, or have enough additional batteries (with corresponding solar capacity for charging) to pull you through the night.

What we learned today.

- Before doing anything, know how much power you will really need. Do not guess. Use real numbers.
- *C-rate* is how much current a battery can provide for one hour. It is synonymous with amp-hours.
- *Duty cycle* is the ratio of transmitting to receiving, expressed as a percentage. Duty cycle is a huge factor in how long your battery will last.
- Manufacturer battery specifications cannot be completely trusted and are usually overly generous.
- $\text{Amp-hours} \div \text{charge current} = \text{charge time}$.
- For AGM batteries, the maximum safe charging current is 20% of the amp-hour rate.
- An effective off grid operation will be able to charge a battery faster than it is drained.
- Determining how much battery you "need" depends on your operating goals and power demands of your equipment.

THREE STAGE CHARGING CURVE



GRAPHIC COURTESY OF COASTAL CLIMATE CONTROL

Twenty percent of 35 is 7. At seven amps of current, how long will it take to get James' battery charged up?

$35 \text{ amp-hours} \div 7 \text{ amp charge} = 5 \text{ hours}$.

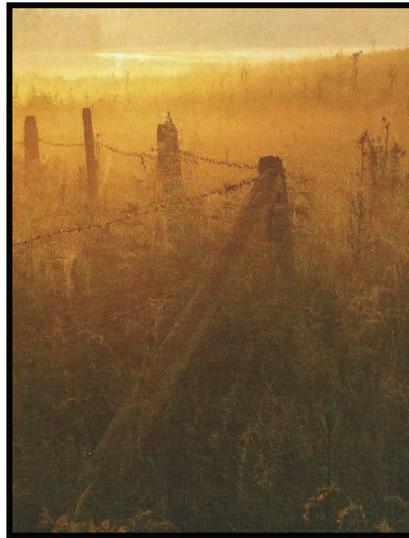
Don't forget that five hours is for a 0% charged, totally dead battery. If we start with a more realistic 50% charge, then our recovery time drops to 2.50 hours. That's not bad at all.



EXTREME HEAT & HEAT ILLNESSES

Heat waves kill more people than all other natural disasters combined.

More than 400 Americans die each year from the Summer heat.



The human body has a built in air conditioner by producing perspiration or sweat. When this evaporates from the skin it has a cooling effect. Extremely **hot** weather can put a strain on this system. High humidity makes the problem worse by making it harder for sweat to evaporate.

HEAT CRAMPS: are muscle spasms, usually in the leg and abdomen, that result from dehydration. This can be the first sign that an individual is getting dangerously hot. The person should drink plenty of water and stretch or massage the areas as this may help to relieve the spasms.

HEAT EXHAUSTION: is more serious than cramps. The victim may be weak and sweating heavily. The skin may be cold and clammy. Have the person lie down in a cool place and loosen or remove necessary clothing. Apply cool wet cloths or sponging. Have them drink water in sips.– a half glass every 15 minutes.

HEAT STROKE: is a life threatening condition. The victim's skin may be hot and dry and their pulse rapid but weak. The person's temperature may be very high. In addition to taking steps to cool them off call 911 or take them to an emergency room **IMMEDIATELY.**

PRECAUTIONS AGAINST EXTREME HEAT

When the weather is very hot, limit your outdoor activities. Eat light, well balanced meals and drink lots of water. Get plenty of rest. Limit alcohol consumption, which can dehydrate you. Wear loose-fitting, light-weight, light colored clothing and wear sun-block.

Outdoor window coverings such as awnings or louvers that block the sun can dramatically reduce the heat inside a home. Cardboard covered with aluminum foil can be placed between the windows and drapes to reflect heat.

If your home has no air conditioning, consider spending the hottest times of the day inside somewhere cooler, such as a public library or community center. During a heat wave, keep up with the news reports to learn of shelters open to the public. Be sure to check on family and friends, especially check on the elderly and those who live alone.

DO NOT LEAVE children or pets unattended, anytime in a car during the day. Even on mild days sunlight can make a car's interior **deadly hot !**



Bill Pfaffenberger
AE9R

My Experience With Packet -- So Far

I have been interested in digital communications for the past 20 years. In the early 2000's I was making a lot of PSK31 contacts. In May, I got interested in FT-8 and quickly worked all the states and by early February had confirmed 100 countries on QRZ.com. However, I started hearing about packet at the monthly HCARS and HCARES meetings and it piqued my interest.

At the January HCARS meeting Wayne Michael and Bruce Jones each showed their TNC (terminal node controllers) for Raspberry Pi they had built from a kit. Since I had already been looking at doing something like that I took the plunge and ordered the kit from Coastal Chip Works. If I could get this board to work with the Raspberry Pi I already had and my old Yaesu FT-530, I could get on packet very inexpensively.

The kit arrived in a few days and it took me a morning to solder all the components on the board. I quickly learned that without the help of my big magnifying glass and my "head-light" I couldn't read the value of the components. The next day I built the interface for my FT-530.

Like any computer controlled device, you can't tell how well you did on the TNC until you get the computer set up to drive it. Coastal Chip Works documentation is okay for a very basic setup through the Raspberry Pi's terminal mode. And I was able to tell that the board was receiving okay. Further research on the web led me to an article by Richard Osgood that got me further along to where I had a basic node, still operating in the terminal mode. Of course I spent several days troubleshooting my software setup before I felt it was working properly.

During this time Bruce Jones emailed me some information on BPQ32. The first thing that caught my eye is BPQ32 is GUI (graphical user interface) and not 100% run in the terminal mode. It only took me a short time to decide to give BPQ32 a try. The good news is that BPQ32 is a suite of apps that work together to create a complete packet station. The bad news is that there is no cookbook out there for setting it up.

So you get this nice looking screen that is doing nothing until you set it up. The developer, John Wiseman, G8BPQ, probably has posted everything anyone has ever needed to set up the software. BUT unless you are a Linux programmer and very familiar with all the acronyms (Linux & Packet) it is very difficult to follow. The information on BPQ32 seems to be disjointed and difficult to find. Like anything else in a web search, you need to pose your search in just the right way to land in the right place.

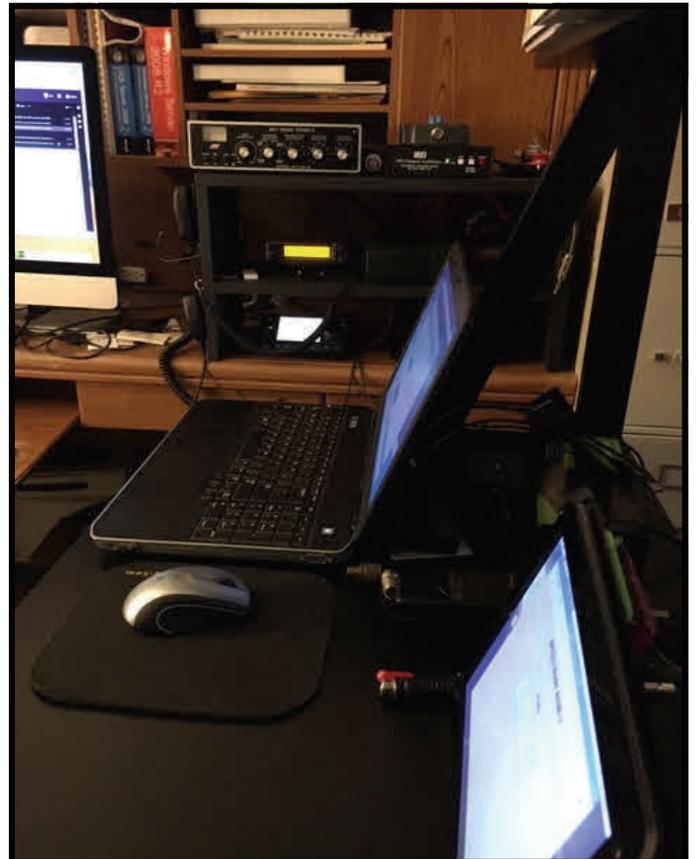
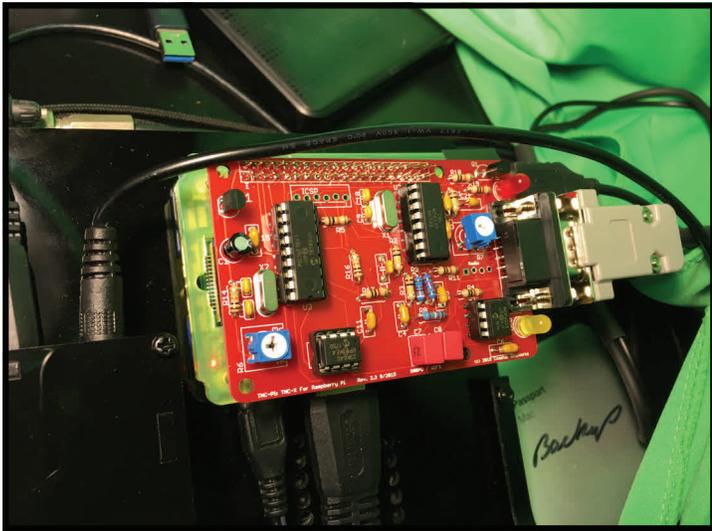
So after many frustrating hours I have a packet node with a BBS and that is about it. I've still got more development to do to get my setup complete. I'm still very much a rookie in this mode and am on the steep slope of the learning curve. Therefore, I have to lean on others who have already mastered this software to help me finish setting up my packet station. I very much appreciate the help of Bruce Jones, Wayne Michael and Bob Burns.

CONTINUED ON NEXT PAGE

CONTINUED FROM PAGE 7

In the pictures you see my formerly surplus Raspberry Pi mounted on a 10" LED monitor. The red board is the TNC I built from a kit and is mounted right on the Raspberry Pi with the Pi's header pins. I ordered a 15 volt wall wart power supply for the FT-530. I gutted an old battery pack and stuck it on the FT-530 to protect the bottom power terminals on the radio (note the Scotch Tape job). Currently, I have a mag-mount 1/4 wave antenna on a file cabinet for my antenna.

73, Bill.



PHOTOS COURTESY OF BILL AE9R

Taking Another Look at Packet Radio

In the late 1980's through the mid 1990's packet radio was all the rage. Amateur radio operators could send email to other hams across the state, across the country or even to other countries. Instead of texting with your phone, you did keyboard to keyboard text on the ham bands. You could browse bulletin boards, send and receive files and even pictures.

All this was done over radio without the benefit of the Internet or cell towers. In fact you didn't even need to be anywhere near a cell tower and even need commercial power. You could run your entire packet radio station on 12 volts. You didn't need a sophisticated computer; in fact you didn't even need a PC!

But what about today? Don't we have much faster means to communicate? Yes we do, we have HSMM-Broadband, ARDEN networks and PACTOR III which all can communicate much faster than packet. So why bother at all? After all, isn't packet 'old school' and no one even makes packet modems today.

Not true, in fact packet modems or Terminal Node Controllers (TNC's) are still being sold in 2017. There are several manufacturers that still produce them including Timewave, Coastal Works/MFJ and Kantronics. The TNC that is the "Gold standard" today seems to be the Kantronics KPC-3 Plus which sells for around \$200.

All the online vendors sell new packet TNC's. -- If you don't wish to be concerned with configuring the TNC. You can buy HT's with built in packet modems. The Kenwood TH-D7/ag (built in the 1990's) can often be found for less than \$150 used on eBay. The Kenwood TH-D72 and the newer TH-D74 both have built in packet modems. Several of Kenwood's mobile radios have built in TNCs.

So why bother with a TNC when you could use a sound card? There are advantages using a TNC instead of a sound card. If you have a TNC with a mailbox, you can set it up so it will receive mail to your TNC inbox without even requiring that you leave your computer on.

You can setup your packet station in the corner of your shack and leave it unattended and free up your computer for more important tasks. If your TNC is fairly sophisticated like the "Kantronics KPC-3 Plus", you can set up your TNC to be an unattended and you can log in without a computer! There are videos that explain exactly how to do this.

So what about KISS modems like the Coastal works/MFJ 1270-X? The problem with KISS modems is that you have to use a program like AGWPE to access the KISS modem. Some find AGWPE a bit difficult to use. Other solutions are to use some other software based program with the KISS modem. But you can't use simple terminal programs like Hyper-Terminal or PuTTY with a KISS modem. You have to use some kind of software.

Sure, Packet Radio is slow, so why use it when there are faster much means to communicate. Well the problem is cost; new Pactor modems cost \$1500. Even used Pactor modems can cost more than the price of new basic HF rig!

While Packet modems aren't expensive (under \$200) they are restricted to line of sight. Unless one has a mountain or a tower at their disposal, you might be lucky to get 10 miles coverage. On the other hand, HF packet radio travels hundreds or thousands of miles depending on frequency.

Packet radio's biggest appeal is it's cost. It may cost you nothing to start your own packet radio station especially if you been a ham for some years. Chances are you may have everything at your disposal to put your own packet radio station on the air tonight. All you need is a computer (that old XP computer sitting in your basement will do fine, even that old Windows 98 computer sitting in the garage will do. Yes, even that ancient 35-year-old VIC-20 can do as well!).

You'll need a 2-meter radio, that old Icom IC-2A sitting in your drawer or that HTX - 202 sitting in the closet will do just fine. You'll need an antenna. You'll also need a TNC, you can find perfectly functional used ones on eBay for \$35 or less shipped! You'll need a terminal program (FREE!). In Windows XP and going back to Windows 98, there is the free "Hyper-Terminal" utility. (PuTTY.)

Check out our link: http://hendricksares.org/docs/misc/packet_handbook.pdf





West Hospital

Every **THIRD Saturday of each month**, we have a monthly radio test of the Amateur Radio Stations located at each hospital.

These tests are at **10:30am**. The purposes for these tests are to check the radio's output and audio signal from the radio at each hospital and get a signal check from anyone located outside of the hospital.

The radio operators from the hospitals change monthly and are practicing their skills on how to handle net protocols and message handling. Operating frequency of **147.570**. Please show your support by checking in and give them a signal check.



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Hendricks County
Amateur Radio Emergency Service

** FOR A COPY OF OUR E-PLAN AND OTHER INFORMATION **

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Hendricks County ARES WEEKLY NET
ON EVERY TUESDAY NIGHT
7:30pm on 147.015



July 2019

Sun	Mon	Tue	Wed	Thu	Fri	Sat
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

August 2019

Sun	Mon	Tue	Wed	Thu	Fri	Sat
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

September 2019

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

Upcoming Events: Summer/Fall 2019

***** Indianapolis Hamfest... July 12 & 13**
2p-7p Friday 12, 6a-2p Saturday 13.
At the Marion County Fairgrounds,
7300 E. Troy Ave.
Indpls. IN.
Tickets: \$8 at the gate.

***** Hoosier Hills/Bedford Hamfest...**
October 5.
Hours : 8a-3p.
Lawrence Co. 4H Fairgrounds, 11265
Hwy 50 West, Mitchell, IN. 47446
Tickets: \$5.

***** Ft. Wayne Hamfest November 16 & 17.**
Hours: 9a-4p 16th, 9a-2p 17th.
Allen County War Coliseum & Expo
Center, 4000 Parnell Ave.Ft Wayne, IN.
Tickets: \$ for both days, \$ for Sun-
day only.
NOTE: \$6 Parking fee.