The Trailing Edge

February 2025

Battery? What Battery? My Indoctrination as an Experimental Avionics Hardware Technician

One of the best known issues in homebuilt aviation is that technology, especially in avionics, continues to advance as time marches on. Just like cell phones, an extant device will become more and more obsolete until at some point the manufacturer either no longer exists or no longer considers the device worth supporting anymore. This is made worse because the process of building an airplane takes a long time, especially when it is scratch built like my Bearhawk. At some point you have to drive a stake in the sand and buy your avionics, freezing their development in time. Do this too early and you have a new airplane with obsolescent avionics that may not be supportable. Wait too long and the building process comes to a halt, because eventually there will be building decisions that depend on what avionics you are installing.

Back in 2000, the new hotness was the Garmin GNS 430, and to avoid a flareup of *Gadgetosis Nervosa*, Gary Aldrich had a new GNS 430 installed in the *Fightin' Skywagon*. Combining GPS, VHF COMM, and VOR/ILS all in one box with a cool moving map (we called it the "Color TV"), it seemed like an answer to prayer for integrated avionics. I had to study how to operate the box before we left for AirVenture that year.

Not to be outdone, competing rival United Parcel Service Avionics Technology (UPSAT) released their Apollo CNX-80 unit, which also combined GPS, VHF COMM, and VOR/ILS. It had a slightly bigger screen than the GNS 430, and was intended to be used with a multi-function display (MFD), the Apollo MX-20, though the MFD was not required.

Just like cell phones kept getting larger, Garmin released the GNS 530, which was just a GNS 430 with a larger screen.

For some reason that I don't remember, Garmin decided to purchase UPSAT and all of its product line. One suspected reason was that UPSAT had figured out how to integrate Wide Area Augmentation System (WAAS) into their GPS receiver, and Garmin was struggling unsuccessfully to do the same. Garmin's solution was to buy UPSAT and thus gain access to their WAAS technology. After the purchase, Garmin decided to continue selling the UPSAT line, but changed the designations to something that sounded more Garmin. Hence, the CNX-80 became the GNS 480.

Thus, in 2006, when I decided it was time to drive the stake in the ground and buy the Bearhawk avionics, the choice for the hub of the system was a Garmin, either a GNS 430, GNS 480, or a GNS 530. By this point, Gary had a new avionics install, this time centered around the GNS 530. The Bearhawk panel is fairly small vertically, and I had already raised the boot cowl about an inch to have more room for the radio stack. Even with this enlargement, the GNS 530 was still too big to fit well. The GNS 480 had a bigger screen than the GNS 430, and it seemed to have a better interface for entering flight plans. It even allowed entering an entire Victor Airway in a single step, while the GNS 430 required entering each waypoint individually. This capability pushed me to buy the GNS 480, which I find funny, since in 17 years I've never actually used that functionality.

Obsolescence Arrives

In the halcyon days of new avionics, if there was a problem with a unit, I just pulled it out and sent it to my avionics guy, who sent it to Garmin. Garmin charged a flat fee for fixing the problem, which was usually done by pulling the circuit board out of the box, slapping a new circuit board in, and testing it to make sure it worked.

As time went by, all of the electronics in my panel became unavailable for purchase. Years later, the manufacturers ceased supporting these boxes as it became unprofitable and the hardware was no longer available. I was thinking about this as I was flying my Bearhawk to AirVenture 2023, and came to the realization that my entire panel, purchased around 2006, was now obsolete. Anything that stopped working could not be repaired, at least not by the manufacturer. At AirVenture 2023, as I always do, I stopped by to see my avionics guy, Tim Hass. I bought my panel from him in 2006, and the fact that he is still in business 17 years later is a great testament to just how good he is. I mentioned to him that I had this epiphany that my entire panel was obsolete. He didn't say anything, but just nodded his head with an expression that exuded "I didn't want to be the one to tell you, but you are correct." Well, better to know that now that to figure it out when something breaks.

As it turns out, Garmin had discontinued support for the GNS 480 on 30 June 2019, which was more than five years before I would need it.

What Battery?

Several years ago, my friend and AirVenture 2009 copilot Stormy Weathers bought a Mooney M20K. In its panel is not just one but two (2) GNS 480s. A few months ago, he told me that the internal battery in one of the 480s was indicating low voltage and had to be replaced. My response was along the lines of "What battery?". There is no mention in any of the pilot-facing materials that there is a battery inside the box, and certainly there was no information on how to replace it.

Some more research determined that the battery is expected to last for 10 years, so perhaps Garmin assumed I would have replaced my GNS 480 with one of their newer, fancier boxes before the battery ran out. Somewhere I read (Ref 1) that the purpose of the battery is to retain the last GPS position so that the box can "find itself" faster upon startup. I would determine that the battery has nothing to do with retaining flight plans, user waypoints, frequencies, or other user entered data, as all of that would still be present after replacing the battery.

Stormy told me of his fix to the low battery voltage as such:

> Yes, both of my 480s have expressed distress over a low internal battery. The solution is simple and elegant. I used my allen wrench to remove the box and take it to the avionics guy on the field at KDTO. He replaced the battery. I recall he told me there are two types of batteries in those boxes. If your unit requires the peculiar one, they have to include an adapter that makes it fit in the same hole. I recall the out the door cost was about $200. That included the guy coming to the hangar to reinstall it and ops check it. We PPL holders are legally allowed to remove such items but not to reinstall them.
>
> When the avionics guy replaced the battery in mine, he came to the hangar to reinstall the box. Of course, it's not an experimental, so he has to do that, right? <FORESHADOWING>I was a little surprised when he said he wanted to pull the aircraft out of the hangar and into the sunshine to ops check the function of the box.</FORESHADOWING> I guess there might have been more to the "ops check" than he was letting on.

My Turn in the Barrel

On 19 January 2026, the mission was to fly "SHACK" Cookson and his two boys to the Patton Museum at Chiriaco Summit (L77). SHACK and I had tried this before, and the ceiling got lower and lower as we approached the destination, so we decided to abort the flight and try it again at a later date. That was on 21 Dec 2016. It only took over nine years to make good on that promise.

On startup on Saturday, 19 January 2026, the GNS 480 started up with the dreaded message.

This looks like the message that Stormy was talking about. Apparently, there is a battery in this box, and it is no longer happy. I guess I shouldn't be too upset—the last record I have of this box being touched by Garmin, possibly to install the WAAS upgrade, was in 2010. That means the battery lasted for about 15 years compared to the projected 10 years, so I guess I got my money's worth.

Rather than send the GNS 480 all of the way back to Tim Hass in Minnesota, I figured I would check with my local avioniker, Jeff Landon, who does my transponder checks and has always provided excellent service. When Monday rolled around, I called Jeff and told him that my GNS 480 was showing a message saying a battery had low voltage and needed serviced. This didn't surprise him at all, and he responded something like this:

> That unit has one of two battery types in it, and you don't know which you have until you open it up and look. Garmin has discontinued service on the 480, but it can be serviced locally. We would have to open it up and see what battery it uses. We don't keep those in stock, and would have to order one from one of the Internet battery supply houses, and that would take at least a week. What I suggest you do is to search YouTube for a video on how to replace the battery and decide if you feel up to the task. If not, then we can do it for you.

I was a little surprised that Jeff was turning down business for himself and suggesting that I do it myself. Then again, his avionics business has a backlog of customers, so he has plenty of business to keep his people fully employed. He also knows that I built a whole airplane, so I could probably handle this.

Extracting the GNS 480

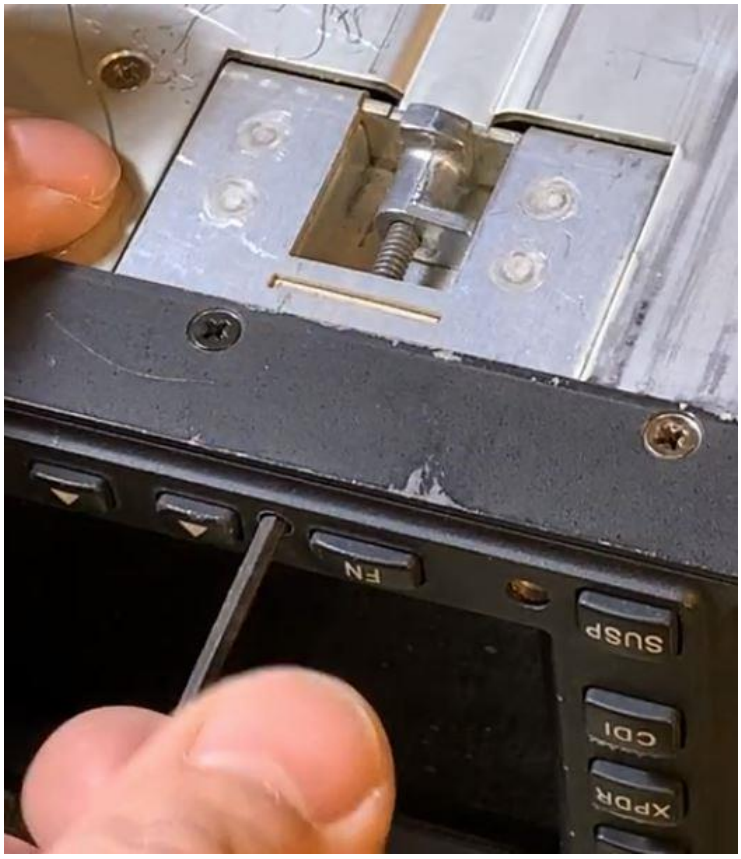
Following Jeff's recommendation, I searched YouTube for something like "Garmin GNS 480 battery replacement" and a couple of videos popped up. Interestingly, one video showed one possible battery, and the other showed the other battery. The first video (Ref 2) ended up showing the same battery that I would find in my unit. Many of the pictures in this article are screen captures from that video, as I wasn't expecting to learn enough from this exercise to write an article as I was doing the repair.

The first step was to remove the GNS 480 from the airplane. Most modern avionics are mounted in a matching tray, which allows easy removal of the box. Generally, the first step is to insert a hex wrench into a small hole in the front of the box and turn it counterclockwise.

Continue to turn the wrench as the box slowly moves toward you out of the tray about 3/8 inch, when the wrench will stop turning. At this point, the box is released. Grab the sides of the box and pull it out of the tray toward you.

The hex wrench turns a screw that moves a dog against the tray, extracting the box.

To seat the box upon reinsertion, turning the screw clockwise rotates the dog 90 degrees, engaging a different slot on the tray. Continuing to turn the screw pushes the box back into the tray. A very slick system.

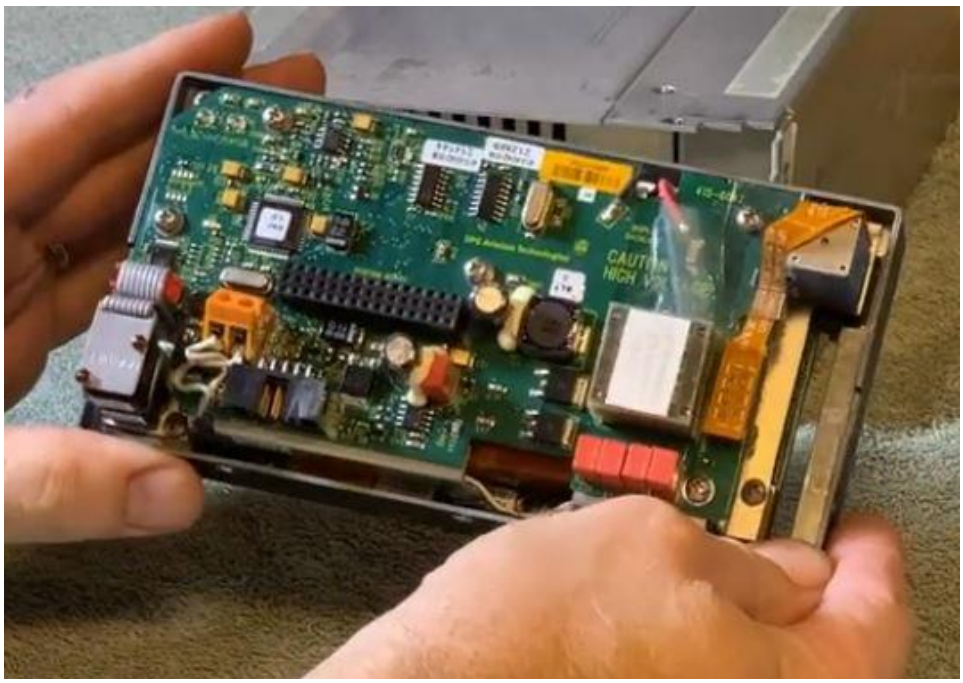


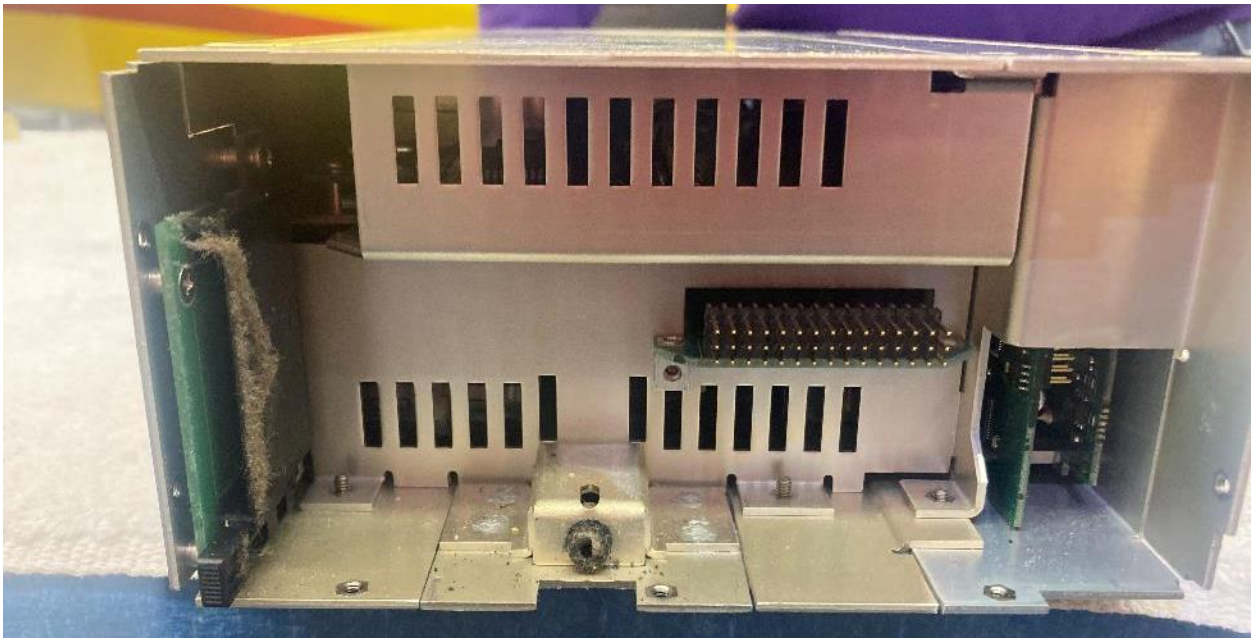
The connectors between the box and the tray are all on the backplane of the box. Pushing the box into the tray pushes the connectors into the corresponding connectors on the tray.

Opening the GNS 480

To open the GNS 480, first remove the screws around the faceplate. The faceplate pulls straight off the front of the box.

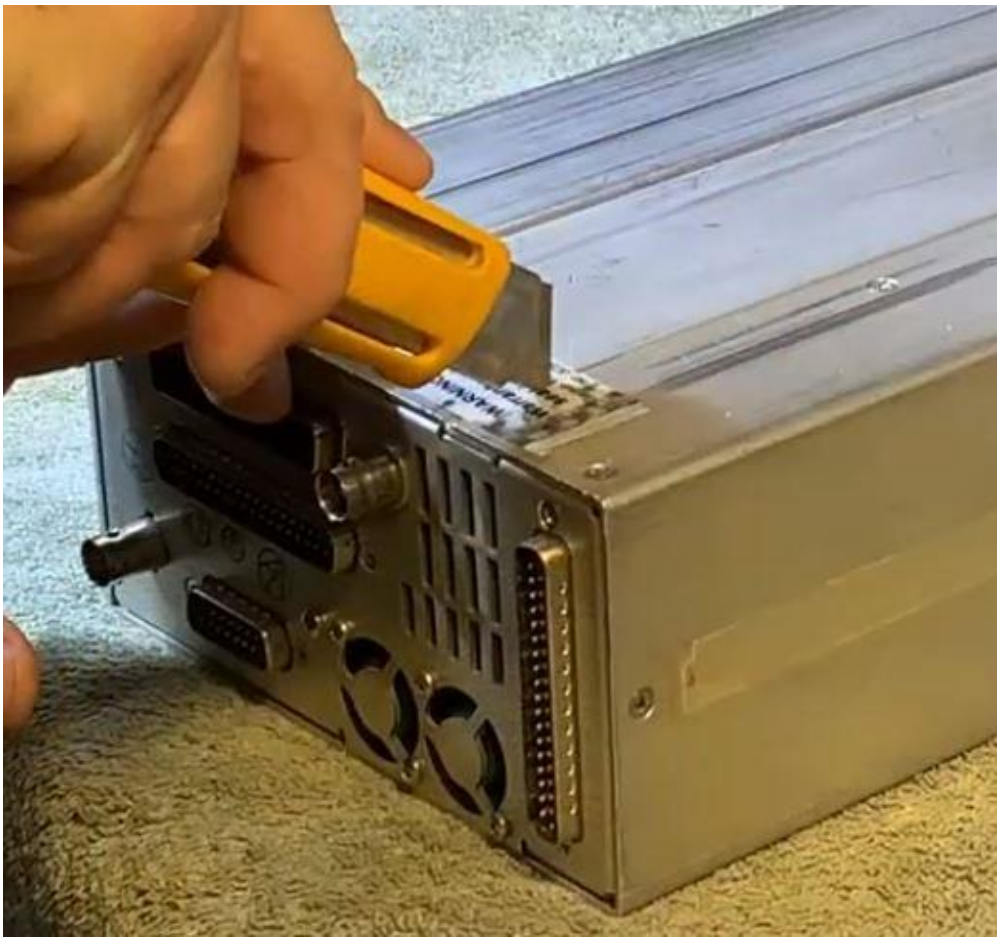
The faceplate is connected to the rest of the unit through one large, multi-pin connector as shown here on the back of the faceplate.





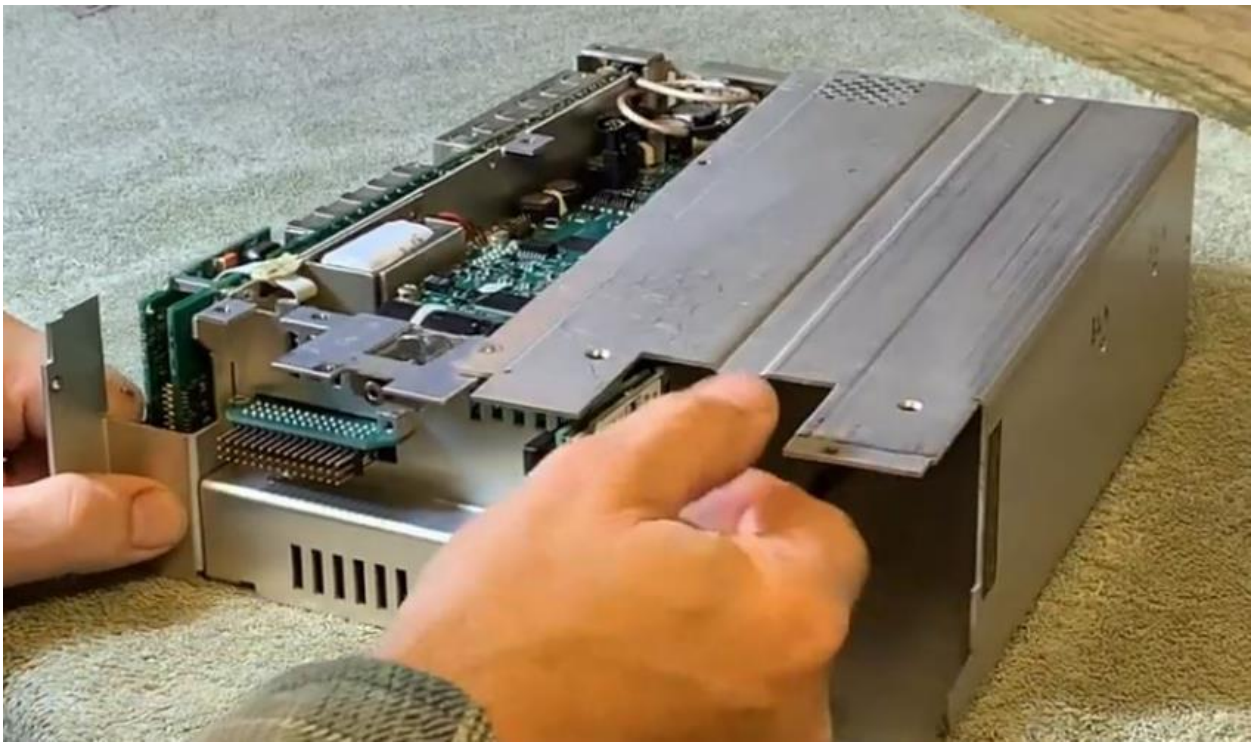
(nice dust on the Compact Flash data card holder)

On the box is a label with the ominous warning that if this seal is broken your warranty will be invalidated. Since Garmin stopped maintenance support on this unit over 6.5 years ago, it really doesn't matter anymore if the seal is broken. Cut with a knife to separate the two box covers.



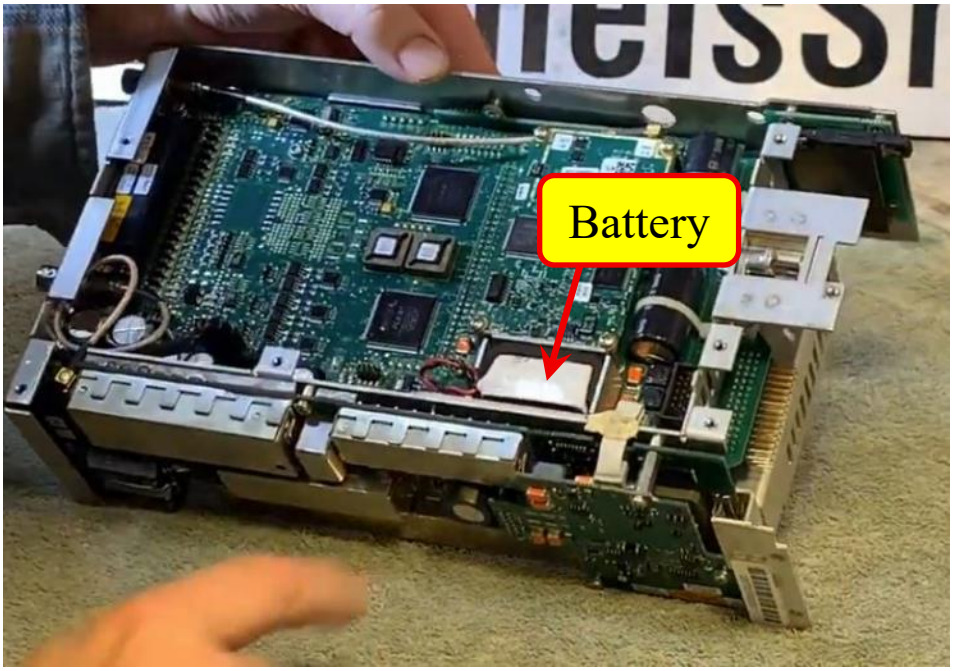
Remove the screws from the smaller box cover and remove the cover. This one has to come off first to let you take off the cover that is covering what you need to get to.

Remove the screws in the larger box cover and remove it. Note the two black screws and where they go. The black screws are shorter than all of the other screws.

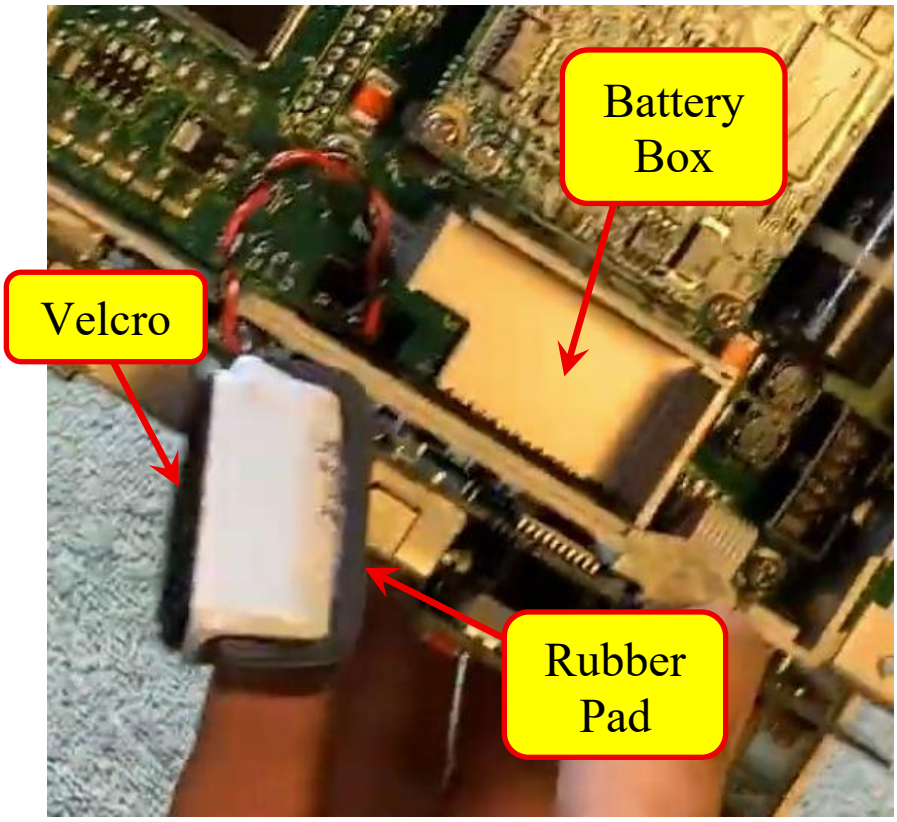


Liberating the Battery

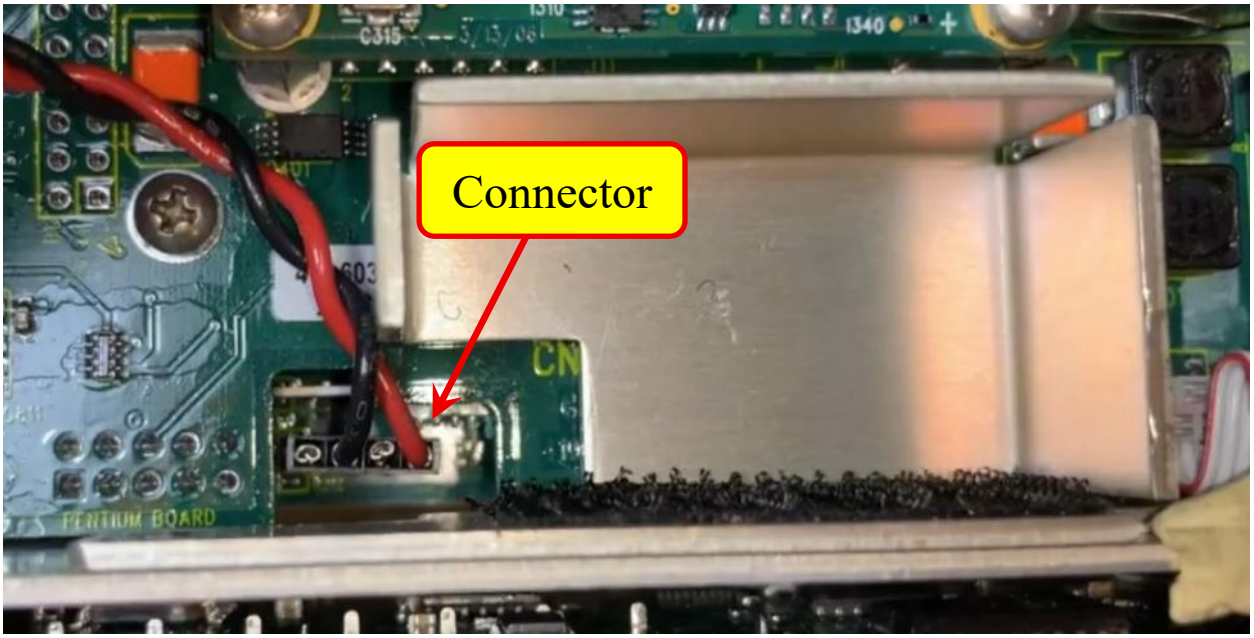
Now we can see the subject battery jammed into its cozy little battery box. The battery is attached by Velcro on the side nearest to you with thick rubber foam jammed in around the other three sides. I pried the battery out by sticking a small screwdriver between the rubber foam and the battery box on the side opposite the Velcro. This rotated the battery up and peeled the Velcro apart.



Here you can see the battery out of the battery box.



The battery is connected with two lead wires to a connector that slides over pins on the circuit board. This connector is not keyed, such that it can be rotated 180 degrees and still fit over the pins. Of course, it won't work as designed in that position. <FORESHADOWING>Thus, it is important to make a note of which orientation is correct before pulling the connector out with needle nose pliers. Unfortunately, I failed to do that! I thought I was saved because the guy in the video didn't make that mistake and stated that the red wire was toward the battery box. Since I ended up with the same battery as shown in the video, I initially figured that this orientation would apply to me. </FORESHADOWING>



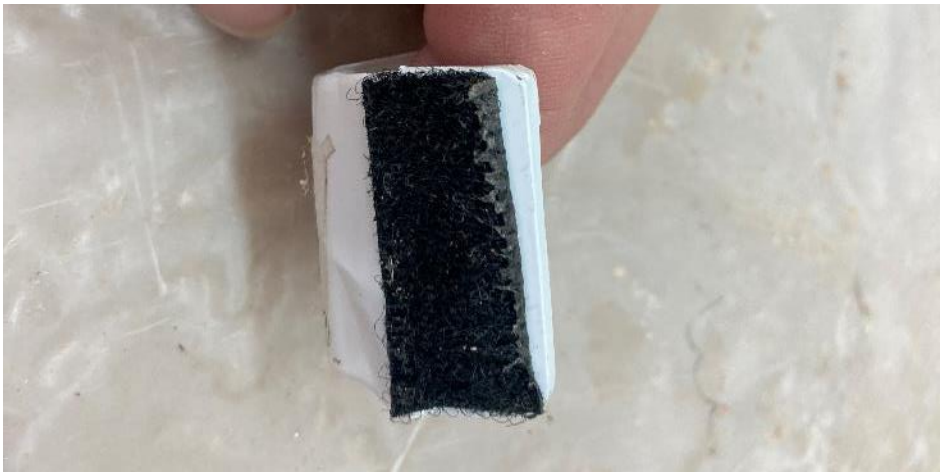
Fabricating the Replacement Battery Package

The battery as installed is wrapped in what appears to be some sort of heat shrink plastic. After cutting the plastic off, we see that the battery is a 3.6 volt lithium battery of the type 17330. This battery was labeled LST 17330, but the replacements I found on Amazon were listed as LS 17330. I can't confirm it, but the "T" may refer to this battery having tabs welded to the terminals for easy wire connections.

As we see here, the battery as installed by Garmin has wires soldered to tabs welded to the battery terminals.

Cutting off the plastic encapsulating the battery shows a flat piece of plastic that creates a flat surface to attach the Velcro to.

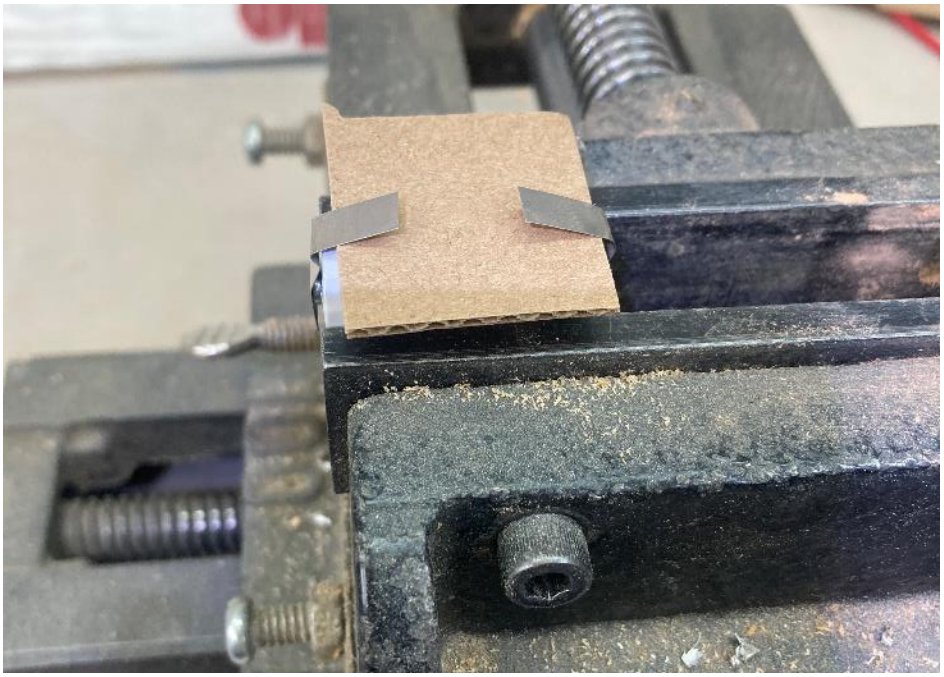
This is the Velcro attached to the outside of the heat shrink plastic opposite the flat plastic piece.



The replacement 17330 batteries are listed for multiple applications, including “Smart Munitions, Unattended Sensors, RFID Tracking, Intrusion Sensors, Asset Tracking, Theft Prevention”. Most options were just the battery with no tabs. I was ready to purchase some tabs and a tab welding tool (recharged from a USB-C charger…of course) when I stumbled across one vendor that sold the battery with the tabs already welded on. The replacement battery cost $25. It took over a week to arrive because it was shipped by USPS and had to travel by truck because lithium batteries are considered HAZMAT.

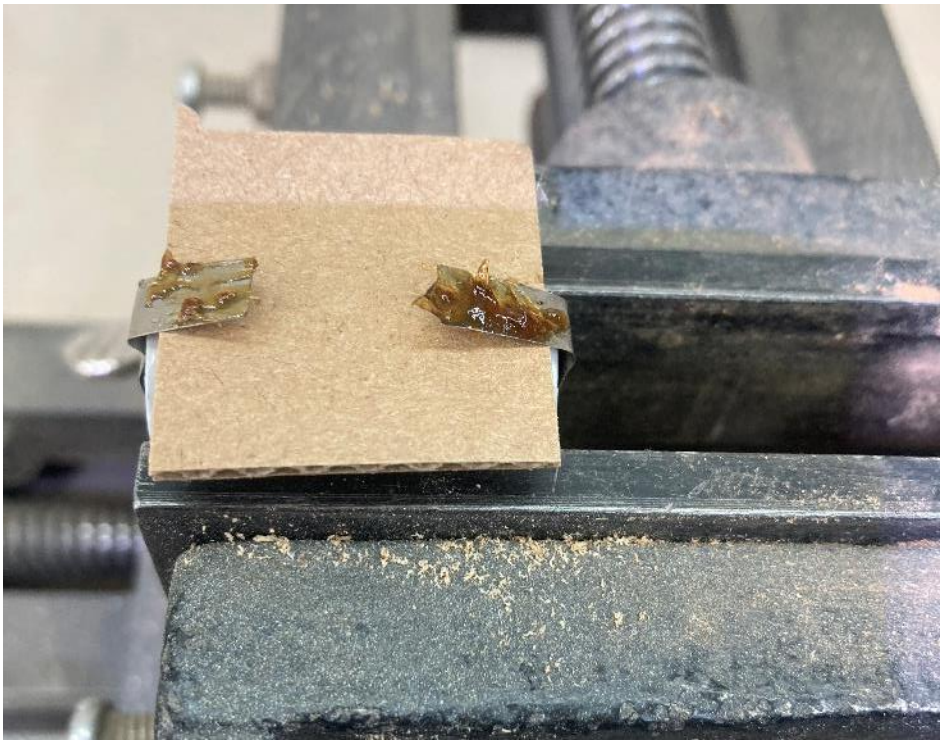
Here the battery is lightly clamped in my drill press cross vise to hold it in place while working on it.

I placed a piece of cardboard under the tabs to protect the battery from the heat of the soldering gun.

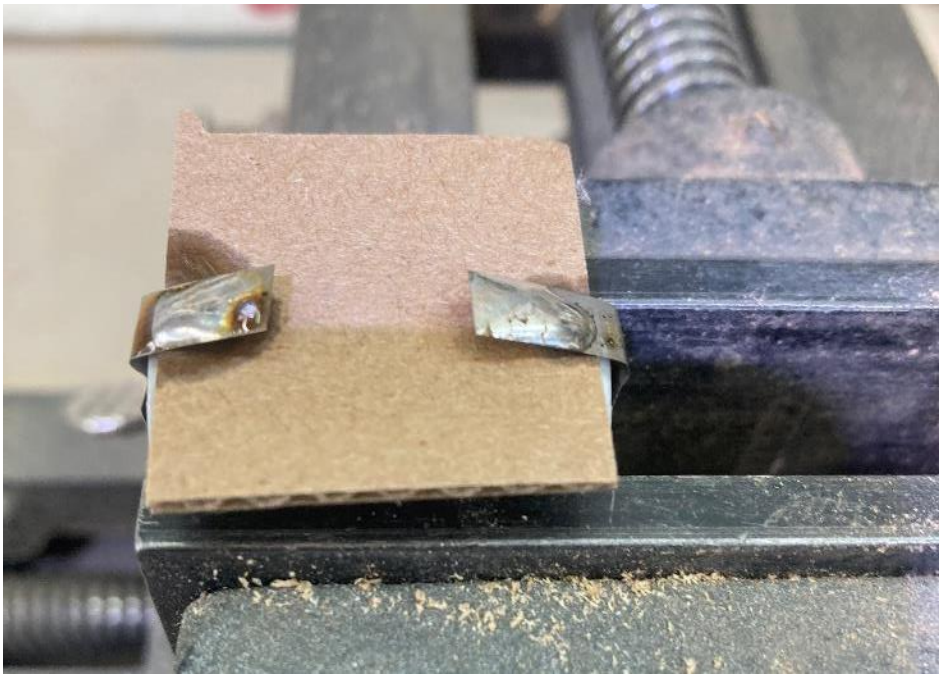


I wondered if I needed to do anything different to solder to nickel tabs from what I did on copper. I found a helpful web page that I did not note the URL (Ref 3) which stated that nickel could be tricky to solder too. It recommended tinning the nickel tab with solder before trying to solder on the wire. It recommended using an acid flux on the nickel, but noted that it would attack the copper tip of the soldering gun, so the flux would need to be cleaned off immediately. However, it also mentioned a possible substitute of "Nokorode" flux. I just happened to have a tin of Nokorode flux which I probably bought back in the early '80s and is still half full.

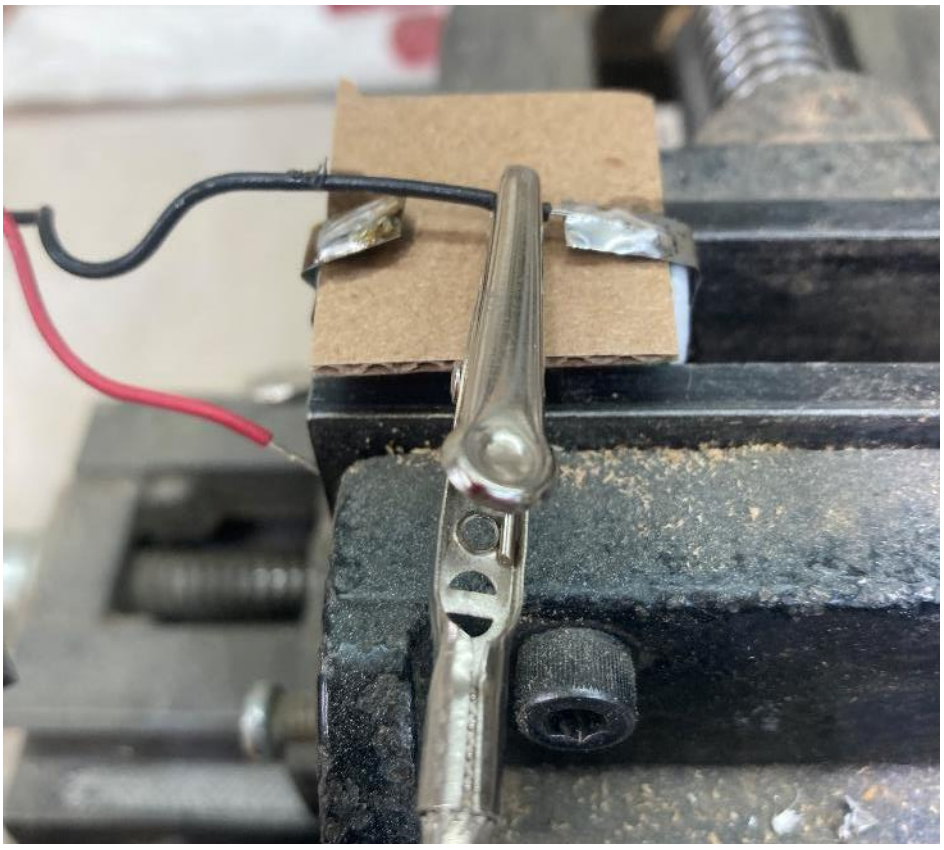
I smeared a healthy amount of the flux on the battery tabs.



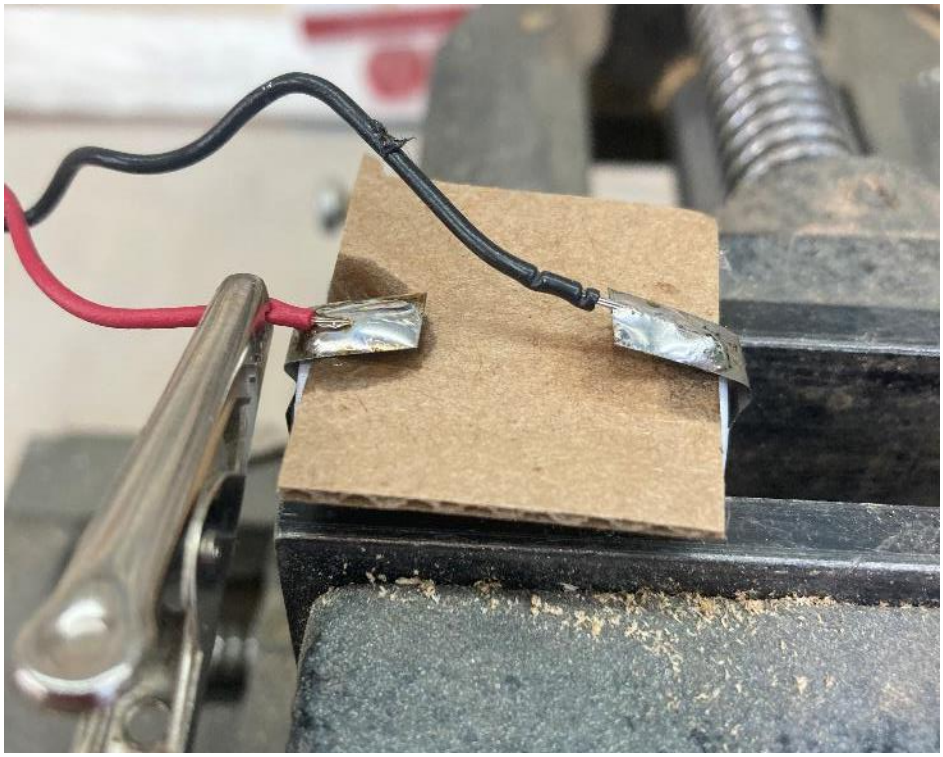
I heated the flux with the soldering gun and applied the 60/40 rosin core solder. The solder flowed and bonded to the tabs with no problem.



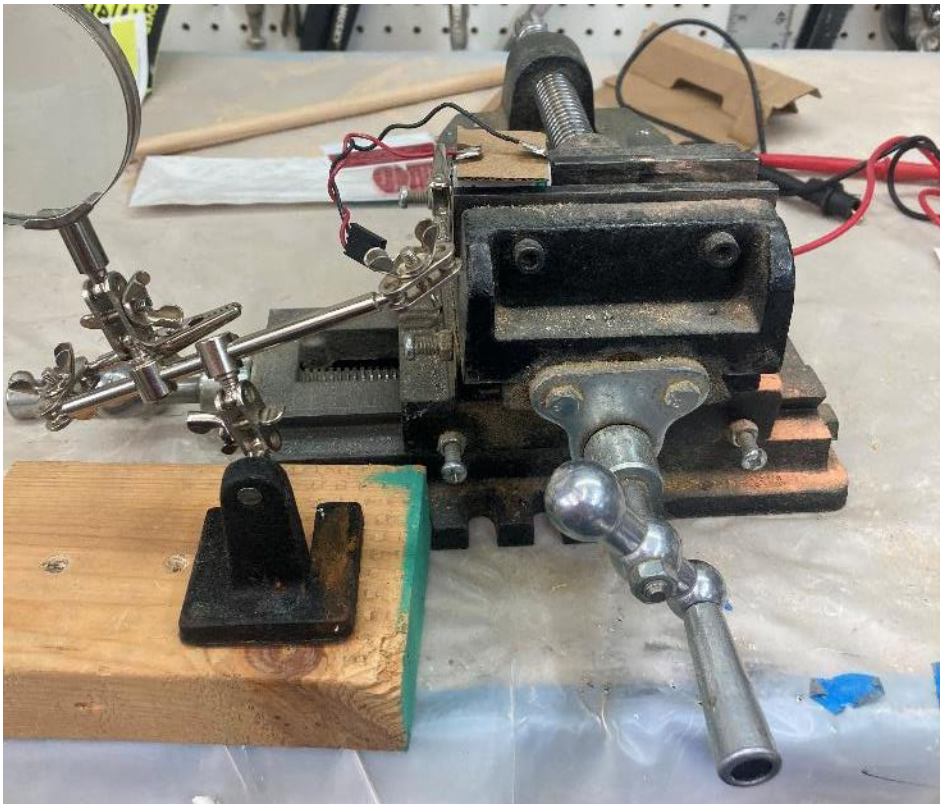
Using a helping hand alligator clip, I held the black wire over the negative terminal. I used the soldering gun to push the wire onto the tab. The solder melted and bonded the wire to the tab.



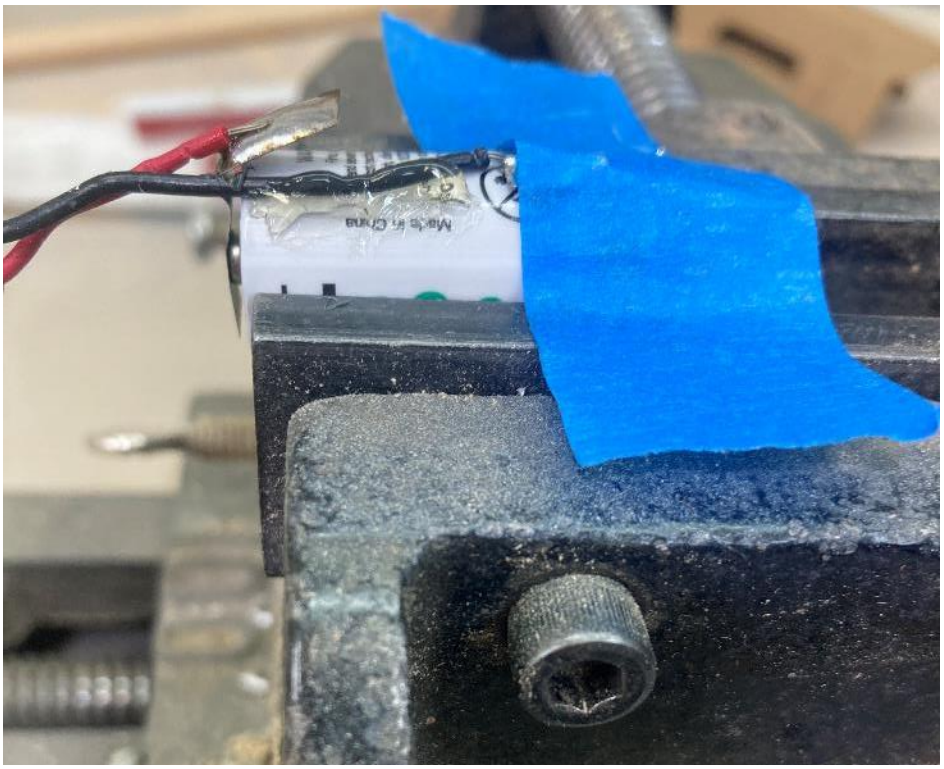
I repeated the same technique with the red wire and the positive tab.



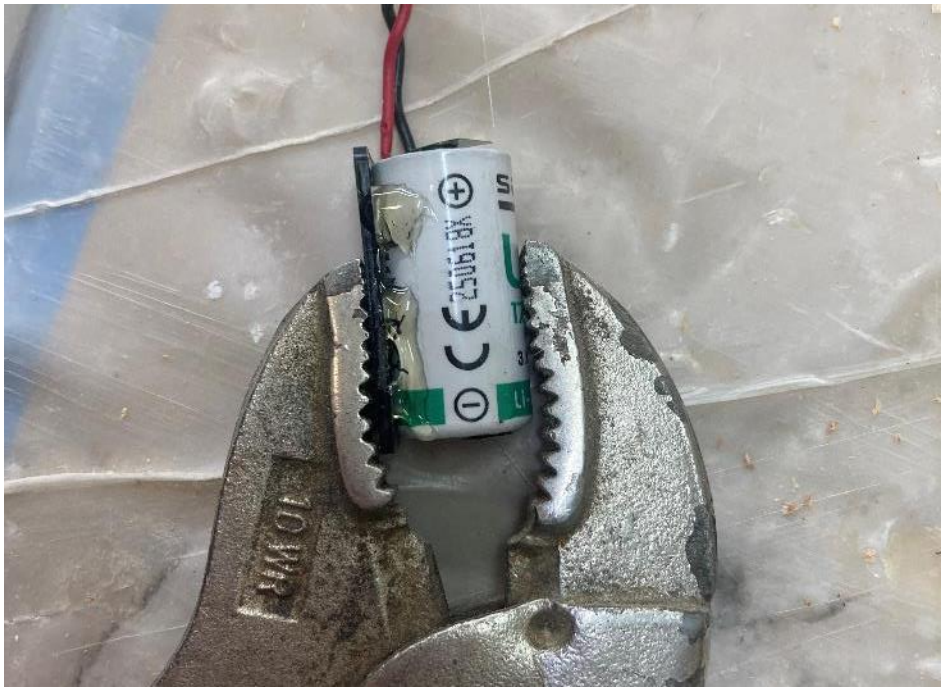
This is a better view of how the wire was held in place.



The negative tab was pressed down onto the battery case with a piece of painter's masking tape, and the black wire was held in place using a hot glue gun. Yes, even "craft supplies" from the aviation aisle at Michael's can be useful on aircraft.



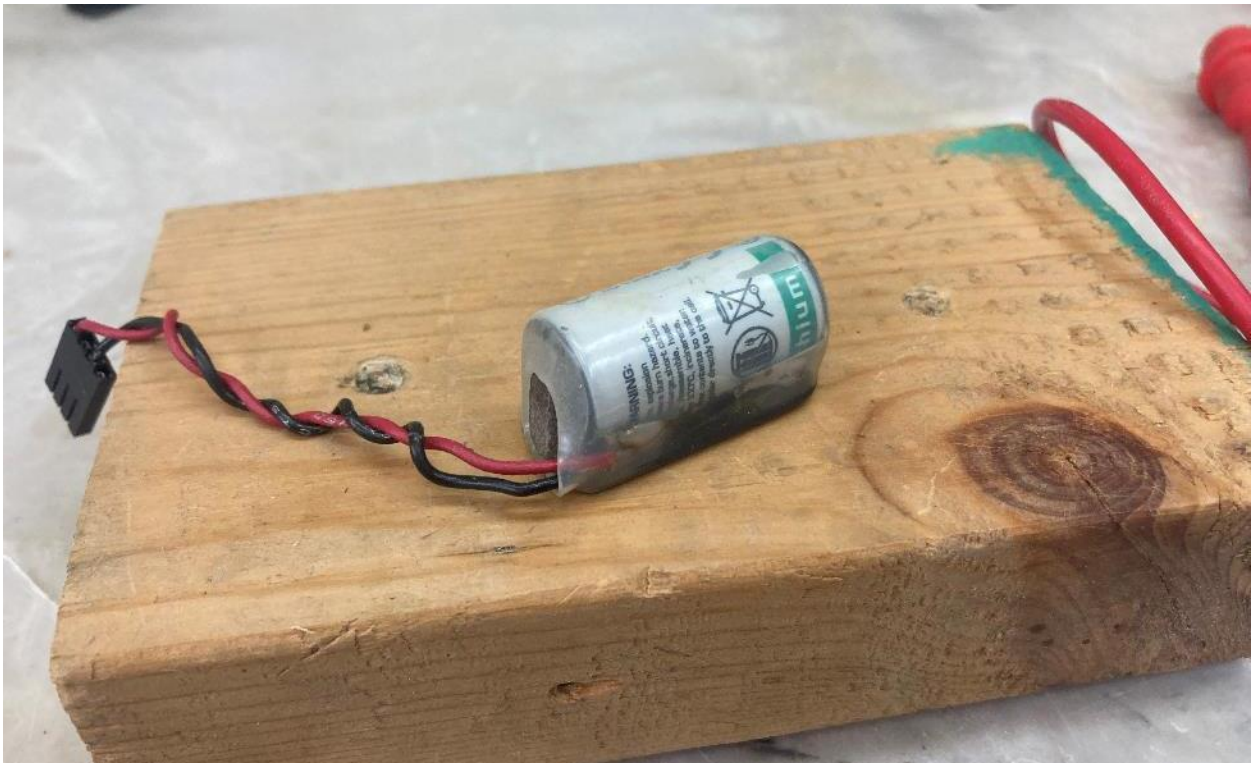
The flat plastic piece was held to the battery with lightly adjusted locking pliers and hot glued in place on both sides. It is important to get the flat plastic piece in the right position relative to the wires so that the wires come out without interfering with the battery box. I got it right the second time.



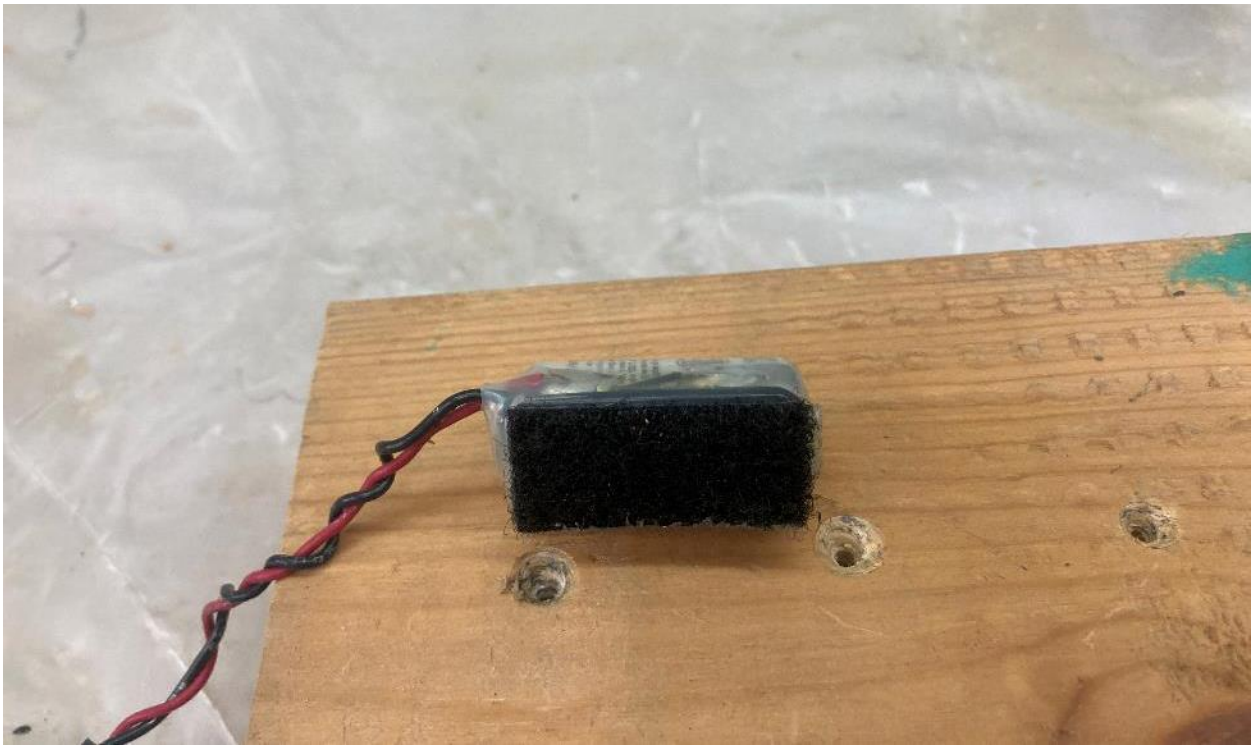
The battery removed from the GNS 480 was packaged with a piece of thin cardboard over each end of the battery to protect the terminals from short circuit. The cardboard pieces removed from the dead battery were tacked in place on the new battery with a drop of hot glue.

To finish the encapsulation, a piece of 3/4 inch heat shrink tubing (left over from making starting battery cables) was slipped over the battery assembly. It just barely fit.

The heat shrink tubing was then shrunk using a heat gun.



The final step was to attach the Velcro piece. My Velcro piece still had sufficient stickum (adhesive) on it after removing from the old installation that I was able to just stick it on the new assembly.



Reinstallation and Testing

The battery assembly was now ready for installation. After dinner, I went to the hangar and installed the battery. I attached the connector in the orientation called out in the video. After pressing the battery assembly into its cute little battery box, I screwed the covers back on the box in the opposite order that they were removed and reinstalled the faceplate. I slid the box back in the tray and made sure it was properly seated. I turned it on and let it boot up. After booting up, there message indicator was flashing. I brought up the message and it still showed "Low Battery Voltage". KRAP! I thought that maybe this was just a message left over from before, so I cleared it and turned off the unit. After turning it back on and letting it boot up, the same message appeared again. KRAP!

I did notice that the battery apparently has nothing to do with retaining the flight plans and frequencies and other user input data, because those were all still there.

Trying to figure out what I could have done wrong, I started thinking that maybe I attached the battery connector to the circuit board backwards. Maybe mine wasn't the same as the video.

I pulled the box out and took out all of the screws to open it up again the second time. I pulled the battery out, pulled out the connector and reinstalled it the other way.

I reassembled the unit and reinstalled it. After turning it on and letting it boot up, it still gave the message of "Low Battery Voltage". KRAP again!

Apparently, that wasn't the answer, so I pulled the box out again and took out all of the screws to open it up again the third time. I pulled the battery out, pulled out the connector and inspected it closely. I found the arrow that points to pin 1, and I saw pin 1 labeled on the circuit board. I had it right the first time, so I installed the connector the first way again.

I reassembled the unit again. As I was reinstalling it...again...I thought that I had heard somewhere that the purpose of the battery was to retain the last GPS position to let the GPS "find itself" faster on startup. Perhaps the software was not measuring the battery voltage, but looking to see if a previous GPS position was present. I opened up the hangar door to let in all of the friendly little GPS signals, fired up the GNS 480 and waited for it to find a good position. After it had a good position, I let it sit for a few minutes, then turned it off.

When I turned it back on and let it boot up, NO "LOW VOLTAGE" MESSAGE WAS PRESENT. In pure reaction, I yelled "YES!" so loud that it could probably be heard at the other end of the airport.

The following Saturday I took the Bearhawk out flying. The GNS 480 worked normally with no "Low Voltage" messages.

Would I have done this to an expensive avionics box that was still under warranty or at least still had factory support? No. However, this box no longer had factory support or warranty, and I had the backup plan that my local avionics shop said they could fix it. Thus, trying this repair was low risk, and, other than time spent, cost me less than $30. In aviation, that's practically free!

- Russ Erb

References

1. Unknown.

2. How to Replace the Internal Battery on a Garmin GNS480, https://youtu.be/Lw0DPGLHFys?si=kLrPJCbnB8MBE1XY , Dec 2024.

3. Unknown