

A few years ago when I was first learning to paraglide I found radio communication to be an inconvenient and distracting part of flying. I was continually trying to figure out the ideal location to stash the radio where I could hear what was being broadcast and easily respond without taking my hands off of the controls or contorting my head to one side or the other in an effort to get my face close to the radio.

I knew that having a speaker, microphone and push-to-talk (PTT) mounted in my helmet and a coiled cable running to my radio would make the most sense. I didn't like the idea of messing with a wire down my arm for a finger operated PTT. With all the components and wiring in one place I would be able to hear a broadcast without the radio turned up so loud it annoyed everyone in the sky and I would be able to respond in a normal tone with push of an accessible PTT switch. However, I just couldn't bring myself to pay the high prices for the professional pre-built systems I was finding on the internet; the choices seemed sparse anyway and building my own was fun.

Scouring the internet I found a 2004 news letter from the *Capital Hill Hang Gliding & Paragliding Club* in Maryland. Ralph Sickinger penned the article and though it applied to a hang glider, it featured a custom made head set for my radio, a *Yaesu/Vertex VX150* and gave me an excellent starting point. The VX150 is relatively compact hand held with the right set of features and a good reputation for durability. *Though only 3 conductors are used for this project, it should be noted that the Yaesu radios use a unique 3.5mm, 4-conductor plug/jack. If you don't use a Yaesu brand jack for the radio side of the cable connection, you may have problems.*

The following set of images, drawings and accompanying text outline the project. Anyone with a steady hand for soldering and some patience can follow this outline or with a little research, modify it for their particular brand of radio.

I was not able to get all parts from one source; you may have to do additional research if your radio is not a Yaesu using the 3.5mm, 4 conductor jack.

Parts list:

- ? Condenser microphone—Radio Shack - 2700101
- ? PTT Switch—Radio Shack—2750646
- ? Resistor (2.2K Ohm)—Radio Shack—2711121
- ? Speaker—www.mouser.com—AS905008-33 or, rob one from a cheap set of compact head phones.
- ? Helmet Plug—www.mouser.com—161-6435-EX
- ? Helmet Jack and Cable—3.5 mm 4-conductor, 20 inch long coiled cable, right angle jack—www.pl-259.com—No part number, call or email
- ? Radio Jack—www.universal-radio.com—Yaesu CT-27A Radio Cloning Cable (*this is the only way I could purchase a 3.5mm, 4 conductor jack that would definitely work on the radio side of the cable*).
- ? Wire—Common 4 strand telephone wire.
- ? Heat shrink tubing (1/16' and 3/16")—Radio Shack - 2781610
- ? Wire ties—Local hardware store
- ? Closed cell foam—Your local kayak shop
- ? Acoustic foam (replacement foam ear pads)—Radio Shack—33376
- ?

Image 1 shows the basic components—resistor and wiring not shown.

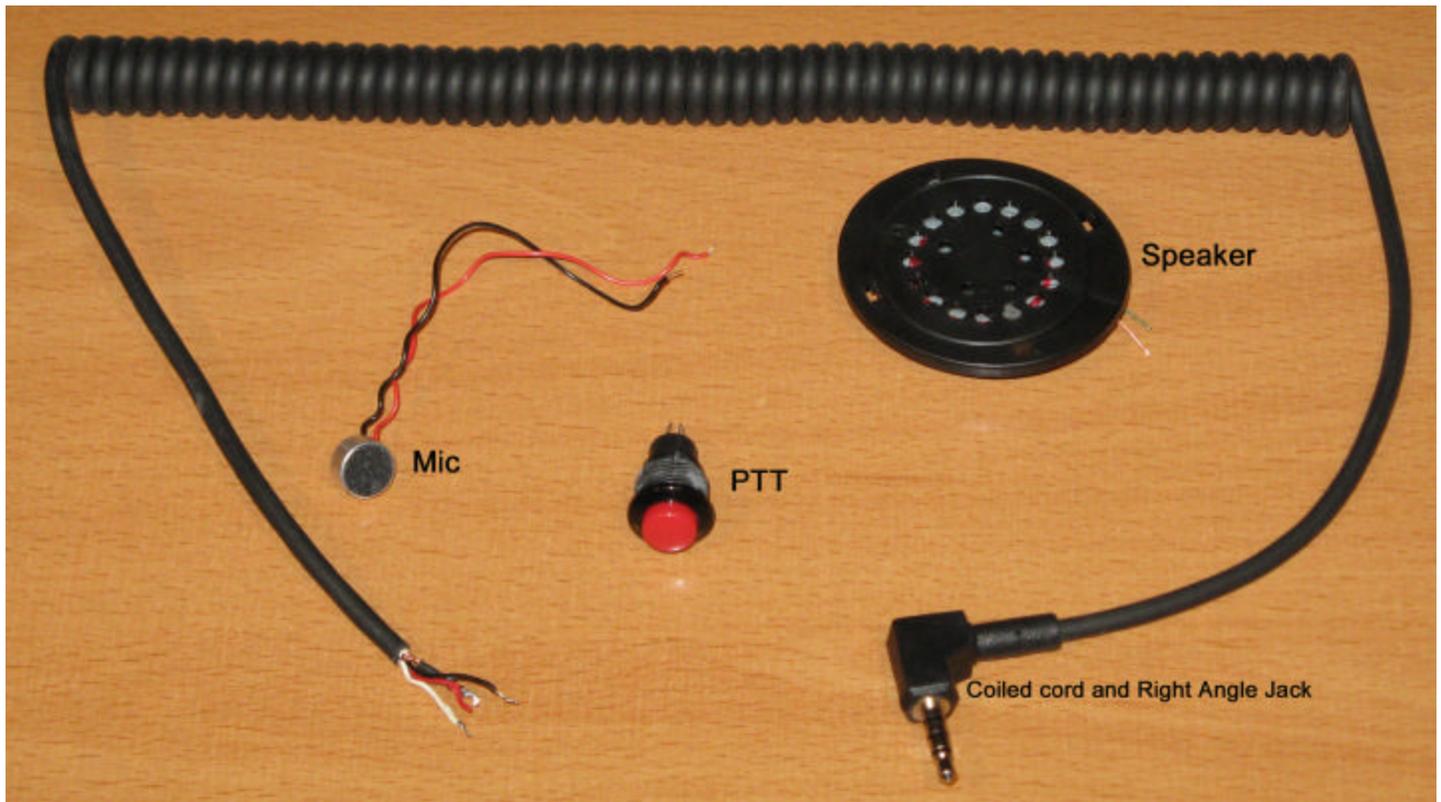


Image 1

Tools and extras:

- ? Multi-meter
- ? Soldering iron, solder and flux
- ? Hot glue gun & hot glue
- ? Drill motor and drill bits

The following, Figure 1, is a schematic of the system.

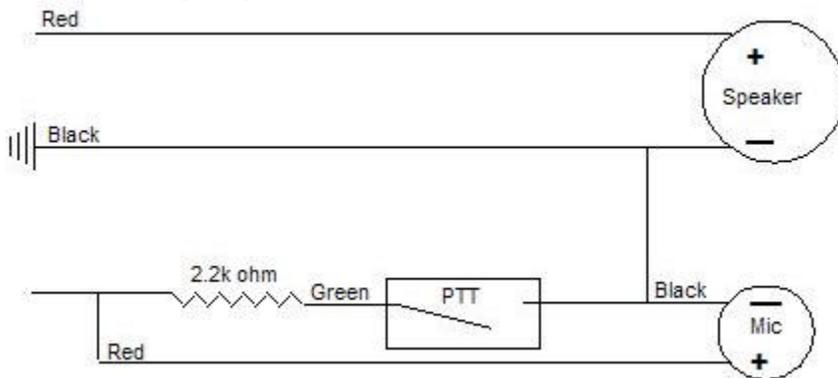


Figure 1

The first step after acquiring all of the parts and pieces is to determine where the components will be located. They can be placed anywhere in the helmet, but keep in mind that the further apart the components are from each other the more fiddling and routing of the wire that is necessary. Figure 2 should help you visualize how the components and wiring can be physically located in the helmet; I located everything on the right side.

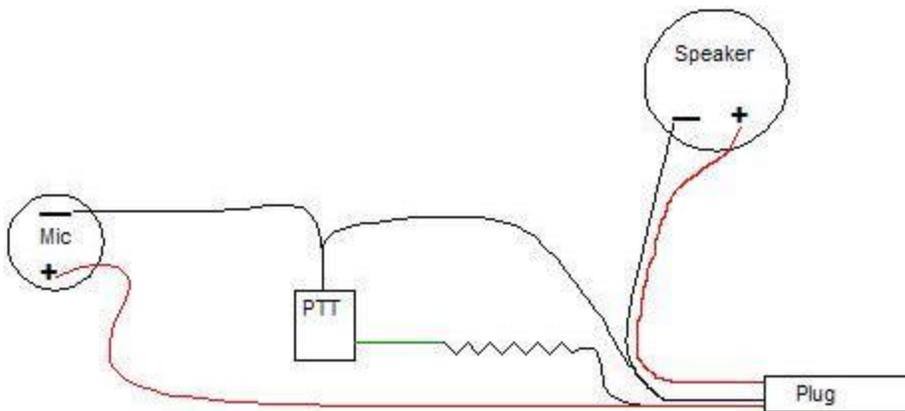


Figure 2

If the inside padding on the helmet is held in place with snaps it will greatly ease the installation of the earpiece, microphone and wiring. Otherwise, you may need to carefully remove parts of the padding and glue them back in place after the system is wired and tested.

Starting with the PTT, I found that the right side of the jaw piece on my full face helmet was a good location. I can easily press it with my thumb while flying with a wrap. I have seen others located on the top of the helmet, but that seemed more susceptible bumps or bangs and it could be argued that drilling a hole in the top of a helmet may be more detrimental to its ability to protect your head than a hole in the side of the jaw piece. Where ever you located it, make sure it won't get caught on your lines or otherwise interfere with flying. The above listed PTT switch requires a 1/2" hole. When drilling the hole for the PTT, start with a small drill bit and progressively work up to the 1/2". Also, as unlikely as it sounds, dull drill bits are less likely to aggressively bite into the composite materials and crack the nice finish on your helmet!

A nut on the backside of the PTT secures it in the hole you have drilled. I chose to pre-assemble and solder everything except the PTT. I then installed the system and easily soldered the last two connections to the PTT. Keep in mind that, unlike the rest of the components, the PTT passes through the body of the helmet; solder it to the system before you install it (the PTT) and you may be looking for creative ways to get the entire headset through the 1/2" hole!



Image 2

The speaker is the largest piece of the system and figuring out how to locate it may take some time. Most helmets have a void or opening in the padding in the general area of your ear. Keep in mind that the speaker does not need to be precisely against your ear; it will be audible if located slightly ahead or behind your ear. Later, after soldering is complete, you can protect the solder joints with a bead of hot glue to adhere the wires to the speaker housing as shown in image 2.

The microphone is probably the most delicate part of the system. It needs to be located inside the face guard, but does not necessarily need to be at the very front; somewhere near your mouth will be sufficient. As with the speaker, I used a drop of hot glue to stabilize the leads; the leads are rather delicate and you run the risk of breaking them off while working on the rest of the project. Microphones can sometimes pick up wind noise, so I encased the mic and the first inch of its wiring in closed cell foam (also call mini-cell) and topped it with a small bit of black acoustic foam cut from an old set of compact headphones. The mini-cell foam can be

easily cut and shaped with a sharp knife (hobby knife) and coarse sandpaper to blend it into the inside of your helmet. Glue the mini-cell to the inside of the face guard. The acoustic foam cuts down the extraneous noise when you transmit and the closed cell foam protects it and the wiring when you mindlessly cram you gloves, radio and who knows what else into your helmet. See images 3 and 4.



Image 3

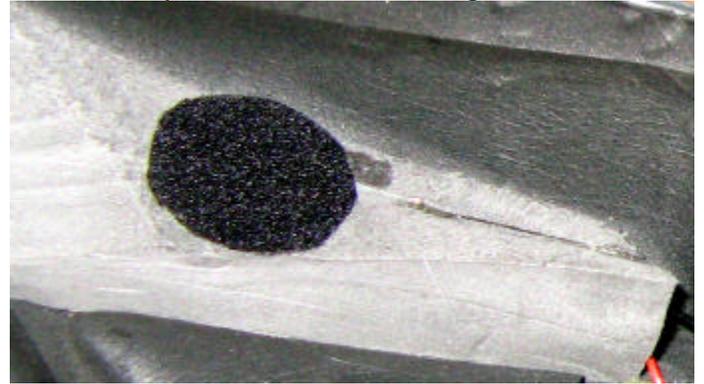


Image 4

As mentioned above, it is easier to solder on a work bench and then install the system in the helmet. Use 1/16" shrink tubing where you will have exposed solder joints. Referring to Figure 2 you can see that a number of the wires share a common contact point. For those joints, solder one wire to another, leaving a single wire for the final connection as shown in Image 5.



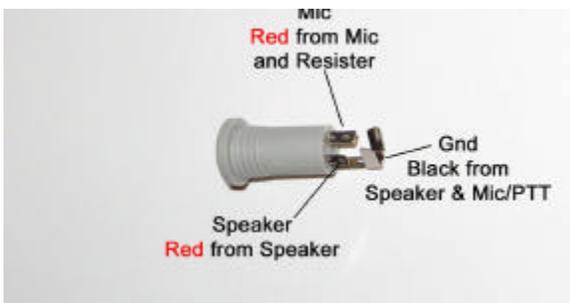
Image 5

Use the following solder schedule as a guide:

- ? Solder a black (-) and a red (+) lead to the speaker. Leave plenty of length on the leads; you can cut them to the appropriate length later.
- ? Solder the black (-) lead from the mic to the wire that will connect the PTT to the plug. *This combined lead will be one of the final connections to the PTT.*
- ? Solder the black (-) lead from the speaker to the opposite end of the previous wire.
- ? Solder one end of the resistor to a red lead such that you will have a short lead that will be soldered to the plug and the opposite, longer, end to the mic.
- ? Solder an additional lead (I used green) onto the resistor. *This will be one of the final connections to the PTT.*
- ? Solder the long end of the above red wire to the red lead on the mic. *Don't forget the shrink tubing.*

You should now test fit your components and figure out where you want to mount the plug. I mounted it at the side of the helmet. If you have a radio pocket in the back of your harness, you may want to consider mounting the plug at the back of your helmet. Keep in mind that the back of your helmet may rub on your harness when you kite or are looking up at that whack you just took!

Make sure the leads can be routed correctly inside the helmet and that they are the right length to be soldered to the plug.



Solder the leads to the plug as indicated in Image 6. Before soldering the plug, you will want to slide some 3/16" heat shrink tubing over the wire bundle. Don't forget the cover/strain relief.

The next step is to build the cable. Using the jack from the CT-27A cable will ensure the completed cable will make proper connection when plugged into your radio. Cut the

Image 6

CT-27A in half (you can use the second half for your buddies helmet; they will be jealous when they see yours). Before soldering, use your multi-meter to ensure the wires match correctly (the color coding may not be the same) and solder this cable to the coiled cable with the right angle jack. Use 1/16" heat shrink tubing to cover bare solder joints and 3/16" to reinforce the completed splice. Double check your work using a multi-meter.

You are probably anxious to get the system in the helmet, but it would be best to test it first. Without installing the mic, speaker and plug in the helmet, temporarily solder the last two leads to the PTT. Using the cable you built above, connect the radio. If you don't have a second radio readily available, you can turn the squelch down and hear if the speaker is working. The VX150 has a red light that lights up when you transmit. Press the PTT on the helmet and the light should come on. If you have a second radio, you can perform a more complete test. Image 7 shows the components soldered up and ready for installation.

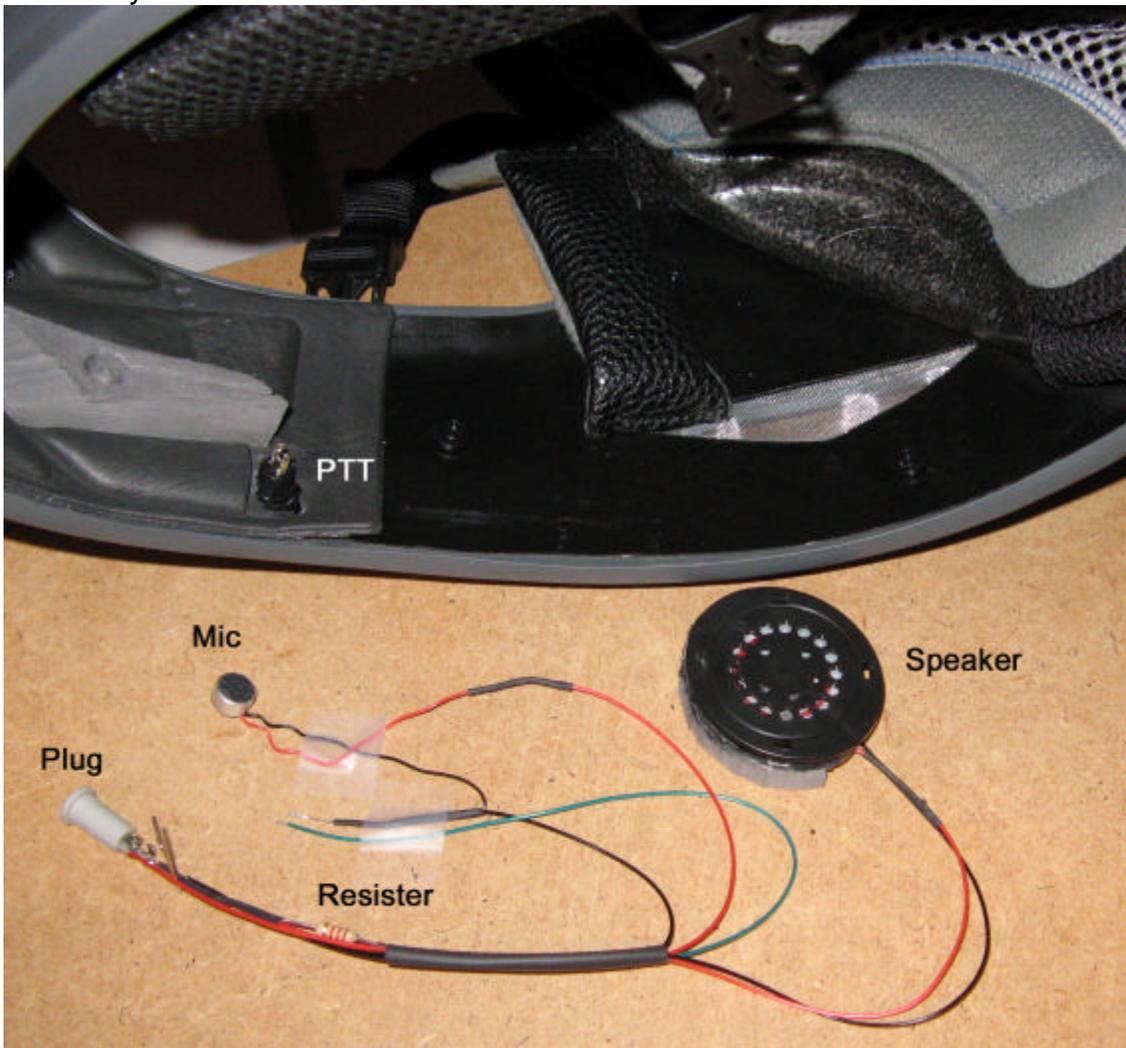


Image 7

Once you are confident of your work, you can de-solder the PTT and install the system. I used hot glue to secure everything except the PTT and the plug. Hot glue worked well to secure the excess wiring inside the helmet. Once everything is glued in place, re-solder the last two leads to the PTT. As with the speaker and mic, for additional protection of the solder joints, I added hot glue around the base of the PTT at the leads. Adding some closed cell foam around the PTT will give it an additional layer of protection; you don't want to have repairs if they can be avoided.

How you mount the plug will depend on where you decided it should be located. I drilled 1/8" holes along the base of the helmet and used three small wire ties to secure the plug and last inch of wiring. The completed installation is shown in Images 8 and 9



Image 8



Image 9

As a final step, you can add some acoustic foam to the speaker to dress it up and make the job look professional. Reinstall any interior foam and trim and you're ready to go fly!