Ham Tips

from KH6CQ

Number 26

Rebuilding a Barker & Williamson BWD-90 Folded Dipole HF Antenna

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The Barker & Williamson BWD-90 is a broadband folded dipole HF antenna which covers 1.8 to 30 MHz with an SWR of less than 2:1. It was installed on the roof of a local hospital in the early 2000's and performed well until 2019. The antenna was lowered for inspection which revealed the copper coated steel radiating wires were severely oxidized and two connections were broken, one at the balancing network and the other one at the balun.

Replacing this antenna with an identical one was out of the question because B&W now only sells them to the military and the cost of a new one was more than four times the original purchase price. Since the key components of the antenna, i.e., the balancing network, balun, and spreaders were not damaged, the decision was made to rebuild it.

Concept

The newest B&W folded dipole antenna offerings no longer use copper coated steel wire. Instead, they use either stainless steel wire or polyvinyl chloride insulated copper wire. Rather than simply rebuilding this antenna to factory specifications, I decided to make a few improvements.

I opted to use polyethylene insulated copper wire because it had better conductivity and would be easier to solder to the terminals on the balancing network and balun than copper coated steel. In addition, the PE sheath not only offered protection from ultraviolet radiation but it was water resistant as well and would be significantly easier to manipulate compared to either the PVC or stainless steel.

One complication of using insulated wire is that it could not be secured to the spreaders by using simple tie wires as in the original design because they would pierce the insulation. I chose to address this issue by using 1/8-inch aluminum ferrules and number 6 stainless steel washers.

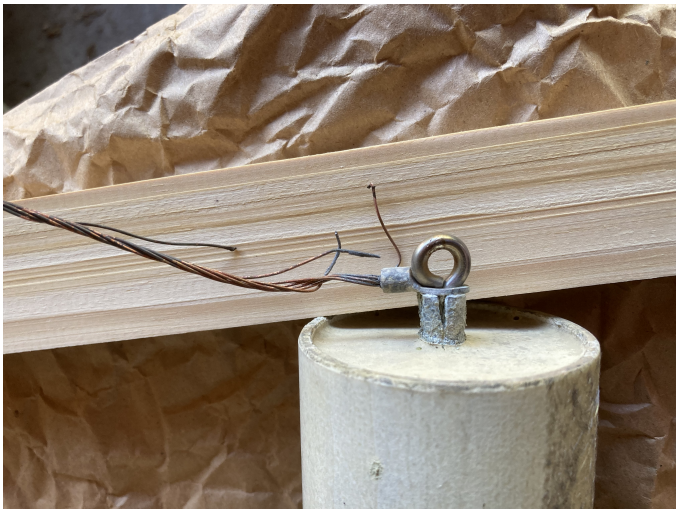

Figure 1 — Failure points were where the copper coated steel wires were secured to the eye bolts on the balancing network and the balun. As the antenna swayed in the wind, abrasion between the wires and the eye bolts caused the strands to weaken and eventually break.

Preparation

Before starting the restoration, I removed all the oxidized copper coated steel wire, mold from the balancing network and balun, cleaned the insect nests out of the spreaders, measured the resistance of the balancing network to confirm it was still very close to 600 ohms, and, with a 620 ohm quarter watt resistor temporarily connected across the balun terminals, checked the performance from 1.8 to 30 MHz with an antenna analyzer.

Rebuild

I used two 100-foot lengths of UV resistant 14 AWG stranded copper antenna wire with PE insulation (Davis RF FW14P), one for each side of the dipole.

I started by securing the antenna wire to one of the end spreaders as shown in Figure 2. Using a black Sharpie® I marked the center of the spreader and using a silver Sharpie® I marked the center of the antenna wire. Then I temporarily attached them together with masking tape while I applied electrical tape and UV resistant Ty-Rap® cable ties. It's important to get the alignment correct; otherwise, the top and bottom wires will not end up being the same length.

Next I slid a ferrule and a washer onto the antenna wire, pushed the wire through the hole in the spreader, and crimped the ferrule. Then I slid another washer and ferrule onto the antenna wire, pushed it against the other side of the spreader, and crimped it. When finished, I repeated this procedure for the lower antenna wire.

The procedure for the other spreaders is similar. The middle spreader was 22.5 feet away from the end spreader, and the spreader closest to the center of the antenna was 21.25 feet away from the middle one. Mark the location on the wire using the silver Sharpie, slide a ferule and washer down the wire, slide the spreader down the wire into position, and crimp the ferrule. Then slide another washer and ferrule down the wire to the spreader and crimp it on the other side of the spreader.

The next step was to secure the antenna wires to the balancing network and the balun. To mitigate abrasion at the eye bolts, the wires were attached using 1/8-inch stainless steel thimbles (found at a local fishing supply store) secured with three ferrules leaving a 9-inch pigtail for the termination loops. See Figures 3 and 4.

Finally 3/8-inch of insulation was removed from the end of each pigtail and tinned. Soldering these into the existing ring terminals on the balancing network and balun was the most difficult part of this project. Even though I used a 200-Watt soldering gun, it took longer than expected to heat the terminals sufficiently so they could be filled with solder and the pigtails inserted.

Comments

I didn't have enough room to support the entire antenna in a horizontal position while working on it so I did it in sections. I supported about half of each side of the antenna on top of boards placed on top of ladders placed on top of saw horses. Although not ideal, this worked well.

The most critical part of this rebuild was making sure both sides of the antenna remained the same length; otherwise, the electrical balance would be thrown off. That was the primary reason for buying precut lengths of antenna wire.

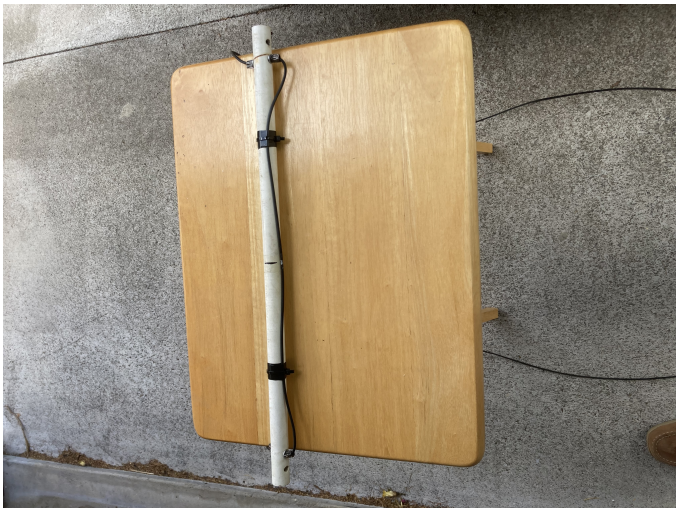

Figure 2 — It is important to align the center of the wire with the center of the end spreader before securing it with electrical tape, washers, and ferrules.

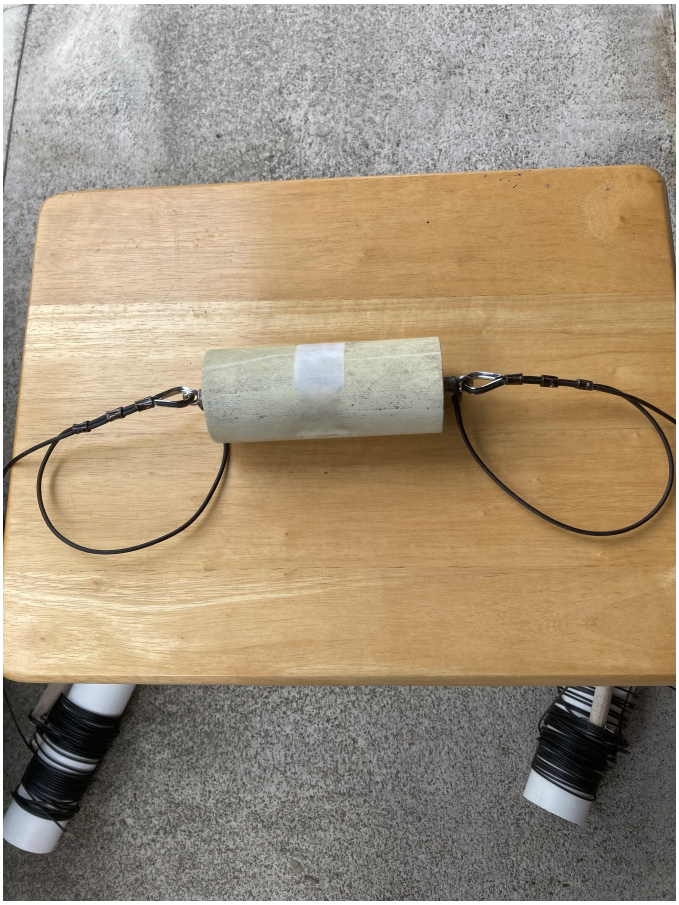

Figure 3 — Top wire attached to the balancing network with thimbles and ferrules. Each side of the antenna is rolled up onto 3-inch diameter plastic pipes for transport to the site.

Although the overall physical length of the antenna is almost identical to the original, the electrical length is somewhat longer. The reason for this is that the insulation changes the velocity factory of the wire making it appear about 5% longer than non-insulated wire. This is not an issue here because it simply lowers the antenna's self resonant frequency which results in a lower SWR at the lower end of the antenna's range.

The 1/8-inch aluminum ferrules were a tad to tight to slide over the antenna wire without scratching it so they were opened up a small amount by hammering a nail of slightly larger diameter through them.

Since there is no strain on the wire where it passes through the two middle spreaders, one split sinker could have been crimped on each side of the spreaders instead of ferrules, however, since none were available, ferrules were used.

The most convenient way to transport this antenna to its final destination, was to roll each side onto a length of plastic water pipe 3-inches in diameter about two feet long and then secure them with bungee cords as shown in Figure 3.

Summary

This Ham Tip described a way to refurbish a Barker & Williamson BWD-90 HF antenna using UV resistant PE insulated wire for less than $80.

Thanks go to the following members of the North Hawaii Community Hospital Amateur Radio Club for their assistance with this project: WH6EHJ, KH7TT, WH7TW, and NH7UA.

You can find more information on the BWD-90 broadband folded dipole antenna and the wire I used to rebuild it at:

https://www.bwantennas.com/bwds.html

https://www.davisrf.com/antenna-wire/flexweave.php

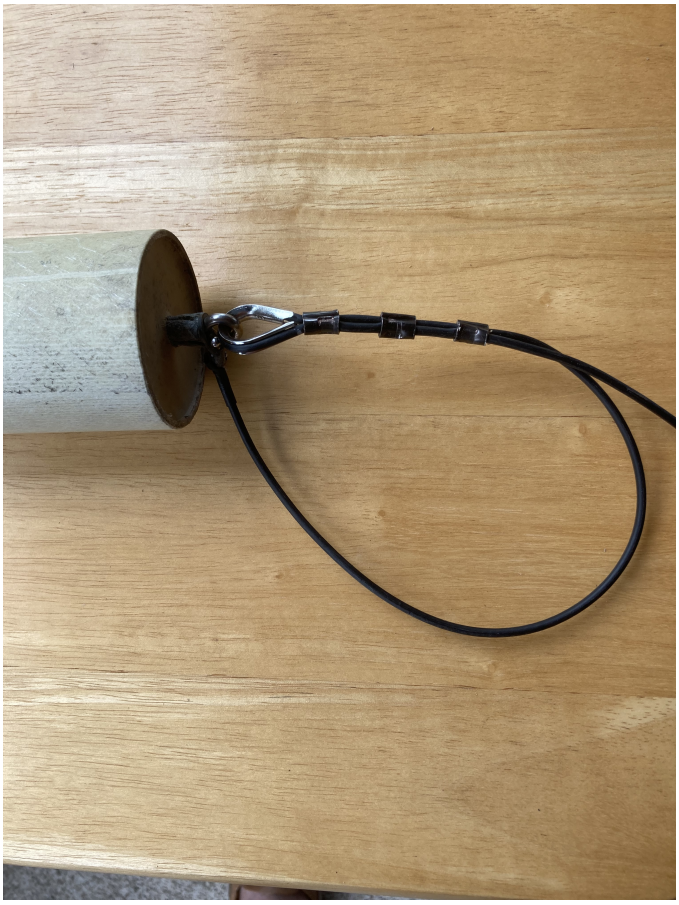

Figure 4 — Closeup of how the wire is connected to the balancing network. The balun was connected in the same way.

73 from KH6CQ

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