DIY

Worthwhile projects you can build on your own

Dual-band satellite Yagi antenna

Many hams get into the hobby of amateur radio, and discover that some satellites have amateur radio repeaters on them, and that a person with even a Technician license can communicate with them. Using an HT (handheld transceiver). But, they eventually discover that making that attempt with a whip, or even worse, a stock, antenna, might allow you to hear the satellite's signal, but might not allow your signal to reach the satellite.

It turns out that, for very little cost, you can make an antenna that can help you effectively use a satellite to communicate with another ham on a different part of the planet. But there's a catch. Satellites contain essentially *cross-band repeaters*, because the hardware to support a same-band repeater is way too heavy. And cross-banding means you need to transmit on one frequency band and receive on another. In this case, the two bands (V/U mode) are 2 meters (145.850 MHz to the SO-50 satellite) and 70 cm (436.795 MHz from the same satellite).

You'll likely enjoy this antenna (patterned after one by KGØZZ), because it's a great directional performer. Let's go ahead and build the antenna, then explain how to use it another day.

Parts list

BNC male connector

One 1¼″ x 60 ″ fiberboard prefinished moulding
Eleven regular heavy (2.4 mm or 10 AWG) steel coat hangers
Two #6-32 x 1″ zinc round head machine screws
Two #6-32 zinc nuts
Eleven #6 zinc flat washers
Eleven #6 zinc lock washers
Nine #6-32 x ¾″ zinc round head machine screws
Nine #6-32 x ¼″ tee nuts
Eleven feet RG-8X coaxial cable
Two 18 AWG ring terminals for #6 stud
One BNC male for RG-8X crimp connector
Four 1″ pieces of ¼″ heat shrink tubing
22 3/32″ silicone end caps

Cut the antenna elements

Straighten and cut four coat hangers to the following lengths:

41″ 19″ 19″ 36 5/8″ 36 ½″

Cut the bottoms off seven more coat hangers to the following lengths:

14 ¾″ 7 ½″ 7 ½″ 12 5/8″ 12 ½″ 12 3/8″ 12 ¼″ 12 1/8″

The two 19″ and two 7 ½″ rods will be the driven elements. Sand the enamel off ¾″ each of them, then curl (with a pair of needle nose) the sanded ends into hooks that fit around a #6 screw, such that their lengths end up as the following:

18 5/8″ 18 5/8″ 7 1/8″ 7 1/8″

Then, set these rods aside.

DIY, continued

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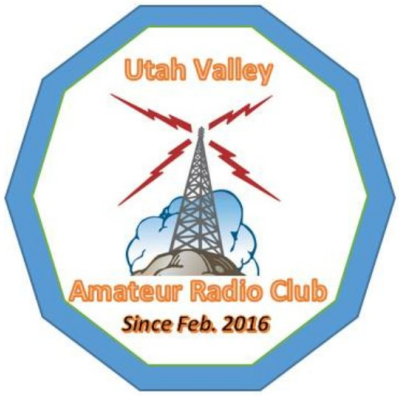


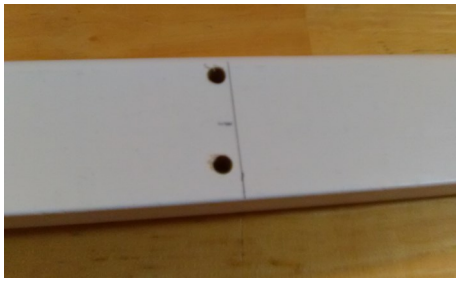
Drill out the boom

Identify one end of the fiberboard as the ***front end***, which will point toward the satellite, and the other end the ***handle end***. (You can use a furring strip instead of fiberboard, but I like fiber because of its resistance to splitting and splintering, and how nicely it cuts.) From the front end, measure and drill ¼″ holes along the center of the boom at the following distances from the front end, to insert the tee nuts:

1 7/8″, 2 ½″, 7 1/8″, 12 ¼″, 14 7/8″, 17 1/8″, 22 1/8″, 32 1/8″, 39 ½″

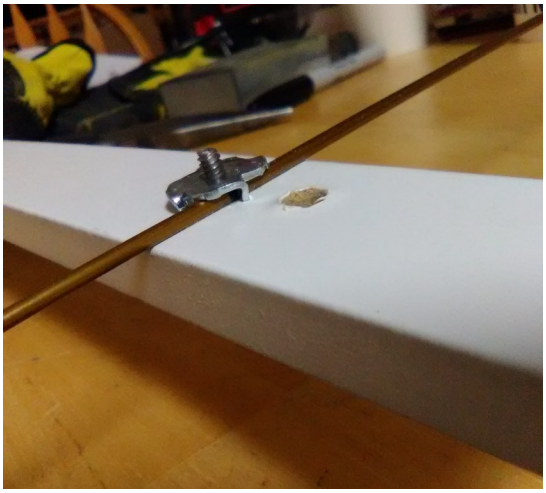
Also, drill two more 1/8″ holes ¾″ apart at 27 1/8″ from the front end.

Attach the elements

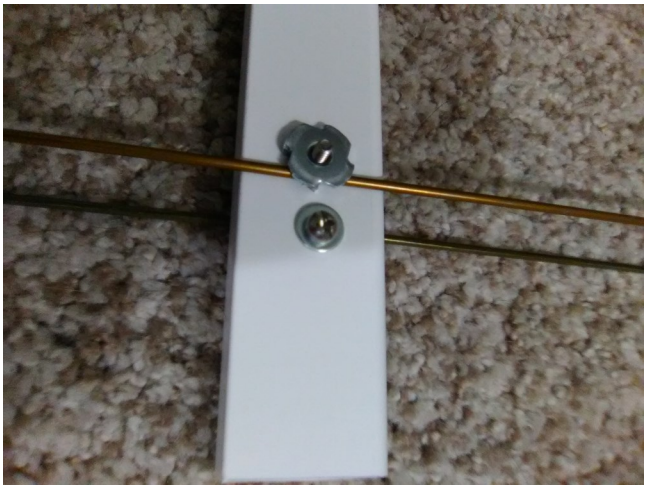


1/8″ holes ¾″ apart

Mark the center of the 36 ½″ element, and attach it to one side of the fiberboard through the 2 ½″ hole by a #6-32 x ¾″ round head machine screw through a lock washer and flat washer on one side, and tee nut over the rod on the other, with the rod through the tee nut closer to the front end. Mark the center of the 12 1/8″ element, and attach it to the other side of the fiberboard through the 1 7/8″ hole by another machine screw and tee nut set, but with the rod through the tee nut closer to the handle end of the tee nut. This is the only element whose rod goes through the handle end of the tee nut; the remaining rods go through the front ends of their tee nuts.



tee nut and rod initial assembly



front end final assembly

Attach the 12 ¼″, 12 3/8″, 12 ½″, 12 5/8″, 14¾″ elements to the 7 1/8″, 12 ¼″, 17 1/8″, 22 1/8″, and 32 1/8″ holes, respectively, with the rods inserted into the front ends of the tee nuts, on the 70-cm side of the boom. Attach the 36 5/8″ and 41″ elements to the 14 7/8″and 39 ½″ holes, respectively, on the 2-meter side of the boom.

DIY, continued

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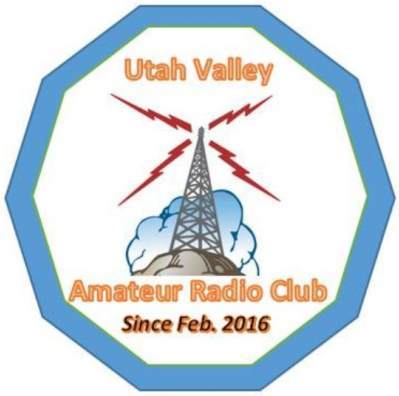
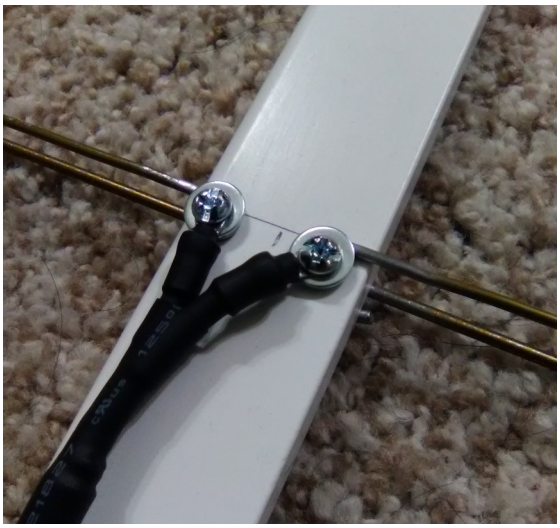


Assemble the coaxial cable and the driven elements

Attach a BNC male connector to one end of the RG-8X coaxial cable, then strip and terminate the other end in #6 ring terminals. Assemble each driven element side by slipping a #6-32 x 1″ machine screw through one of the ring terminals, through a flat washer, through one of the 18 5/8″ elements, through the boom on the 2-meter side, through one of the 7 1/8″ elements on the 70-cm side, through another flat washer, through a lock washer, and through a #6-32 nut.

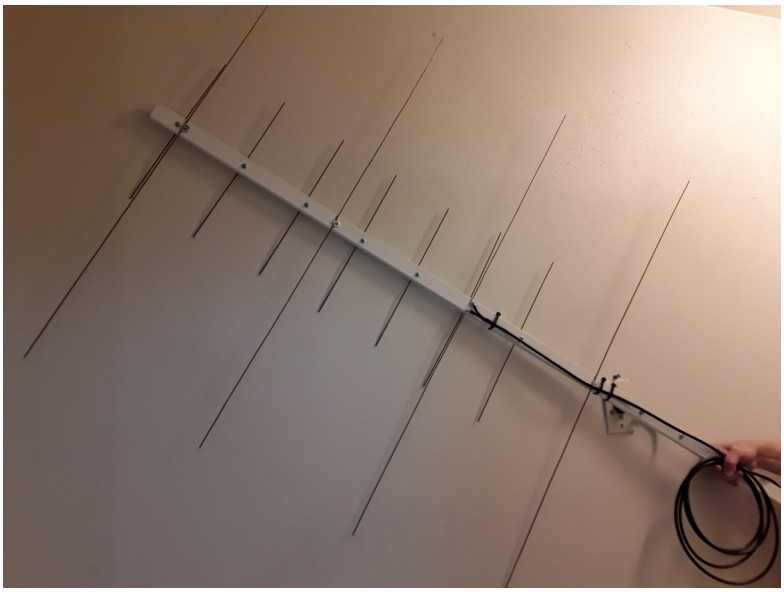


Finally, place three zip ties around the coax and boom, to keep the coax from wandering near the elements. If you want, you can do what I did, and install a small handle, to slip my hand into while I'm holding the antenna in one hand.

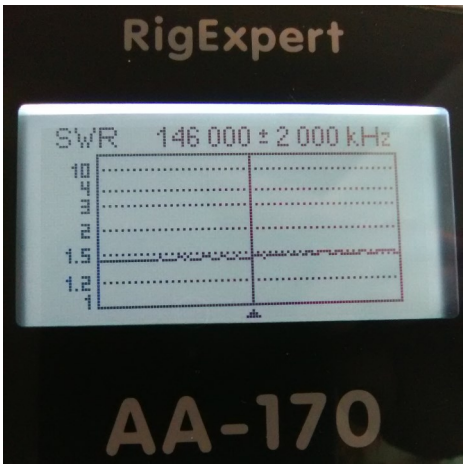
Testing it

It's a little difficult to demonstrate in this newsletter how the satellite contacts sounded like, so I'll just show you my analyzer reading instead. Since I'm transmitting on the 2-meter band, this seems to be the important band to display. As you can see, the SWR is around 1.5:1 across the band. Not bad for homebrew and no matching.

Noji Ratzlaff, KNØJI (kn0ji@arrl.net)



The finished product



1.5:1 SWR across the band