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Ultralight SOTA

Tuesday, May 24th, 2011

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Goal: To construct a lightweight ham radio antenna for Summits On The Air (SOTA) that deploys easily and is highly compact. Through trial and error, we have constructed several variations of SOTA antennas from multi-banded di-pole to bi-directional dual-banders. Each generation of antenna was tested in the field on various SOTA expeditions. Through this experimentation we have settled on a simple 20 meter inverted-v dipole wire antenna as the most effective, lightest weight, and easiest to deploy. In this write-up we will describe in detail the parts and components used to build this antenna, and a step-by-step how-to guide for building your own.

Designed by N1OB and W0LFI. If you have any questions shoot an email to jason@seeksolitude.com

The guide will be broken down in to four sections:

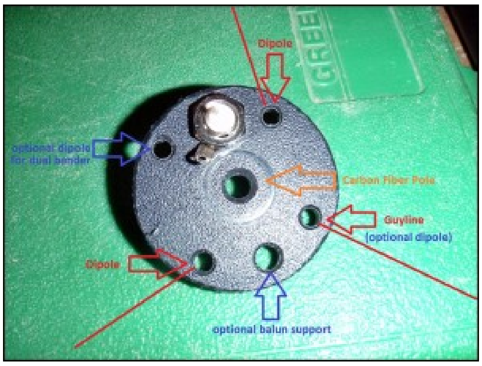
1. The Antenna
2. The Coax
3. The Pole
4. Final Thoughts

Component list:

Quant.	Units	Part Description	Cost ea.	Total	Link
1	ea.	2.1″ Disk Cut from 1/8″ thick plastic with a 2 1/4″ hole saw	$0.10	$0.10	http://tinyurl.com/3s2ury
1	ea.	50 Ohm BNC Bulkhead Jack	$2.95	$2.95	http://tinyurl.com/3dcqsgk/
33	ft.	Toughcoat 'Silky' 26 AWG, antenna wire	$0.20	$6.60	http://tinyurl.com/4xh6um7
115	ft.	PowerPro 80lb Spectra Fishing Line	$0.04	$4.60	http://tinyurl.com/43p7gq5/
1	ea.	LaserPro Stunt Kite Line Winder	$6.00	$6.00	http://tinyurl.com/3lffdro/
N/A	ea.	Heat Shrink Tubing (small)	$0.20	$0.20	http://www.buyheatshrink.com/
2	in.	Brass Tube Stock 5/32 (roughly 2″ total)	$1.16	$2.20	http://tinyurl.com/3fvlwwg

This list is very general. It is intended as a guide to get the components you need to build this or similar antenna designs. The prices are also not 100% accurate as only small quantities of brass and heat shrink are used.

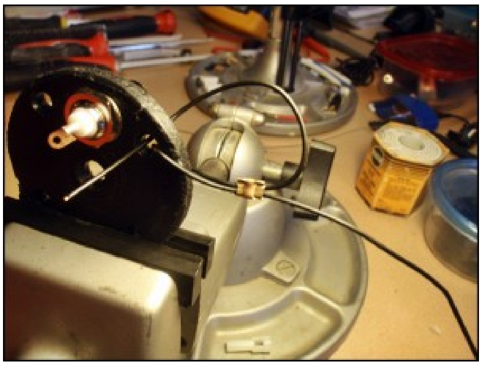
1. **The Antenna:**



The heart of this SOTA Antenna design is the center insulator. It is a 2.1″ diameter circular piece of plastic, cut from a sheet with a 2 1/4″ hole saw. The hole saw cut leaves the 1/4″ center hole, the edges are cleaned up and the pattern of holes shown are drilled. The center insulator shown was cut from a 0.2″ thick sheet of black UHMW which may be hard to find. You could use 1/8″ thick acetal, UHMW or even HDPE sheet readily available online. Commonly available thicknesses of these plastics are 1/8″ and 1/4″ but the 1/4″ will exceed the maximum thread depth of even the bulkhead BNC connectors with the deepest threads so use 1/8″ unless you can find something around 0.2″ The hole pattern is a design that allows for many different types of antenna to be constructed using the same insulator. You will notice that not all of the holes are used in this antenna design because it only requires the two wires and a guyline. Some of the other designs have four wires (the 20/40 dual bander). The diagram above should illustrate which holes are needed for this design. The center hole is required to slip over the top of the carbon fiber pole-fishing-pole. A hole needs to be drilled for the bulkhead BNC connector, two holes for the wires, and one for the guyline.

You will need two lengths of antenna wire. You can use the calculator found here: http://www.angelfire.com/mb/amandx/dipole.html . Cut the wire long, and test the resonant frequency in the field with an antenna analyzer. Sneak up on your optimal frequency a little bit at a time. We chose the QRP calling frequency on 20 meters as the target frequency. Using the standard dipole formula 234 /14.285 less 4% for the inverted V = 15.8 feet for each side. Ours ended up 1:1 at 16.3 feet per side. This may vary depending on components so again; cut it long and sneak up on it.

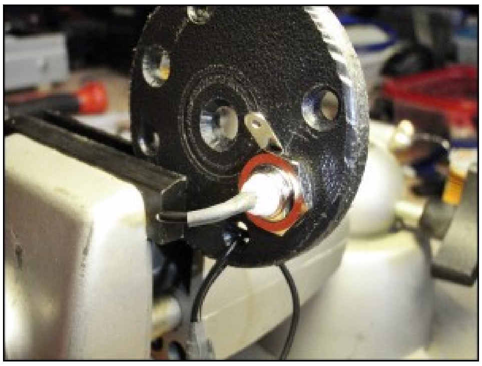
Feed the silky 24 AWG antenna wire through the insulator to form a loop. Slide a small piece of heat shrink followed by a small piece of brass tube stock over the antenna wire. Leave a loop large enough for the wire to move around when deploying the antenna. Also be sure to leave enough slack to loop the wire back through the insulator a second time and solder to the BNC.

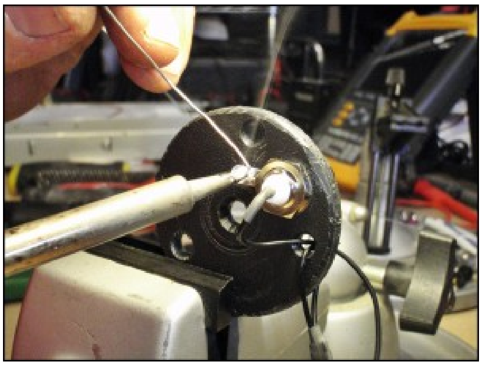
Once you crimp the brass over the wire, slide the heat shrink tubing over top of the brass. This will cover any sharp edges remaining after crimping the brass.

Route the wire through the bottom of the insulator (the side where the coax connects), and solder to the center conductor of the bulkhead BNC.

Remember to slide a piece of heat shrink over the wire before soldering. Slide the heat shrink over the center conductor.

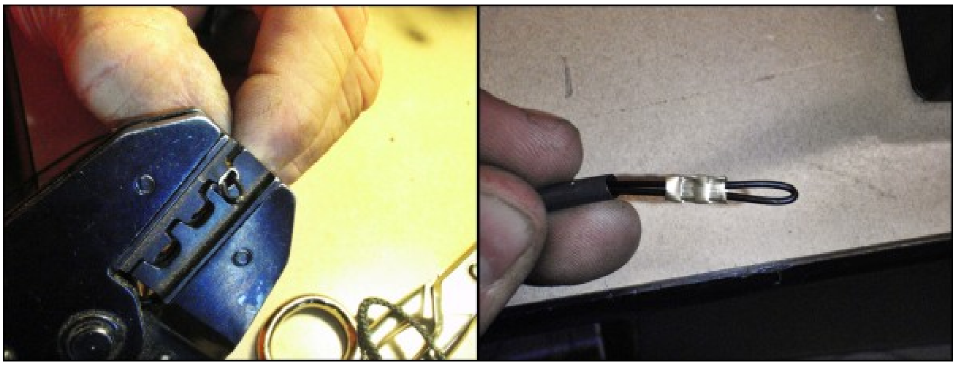


Run the second leg of the dipole in the same manner, creating a loop crimping, and leaving enough slack to solder to the shielding tab.



Solder to the tab and cover with heat shrink. You should be left with something like this:

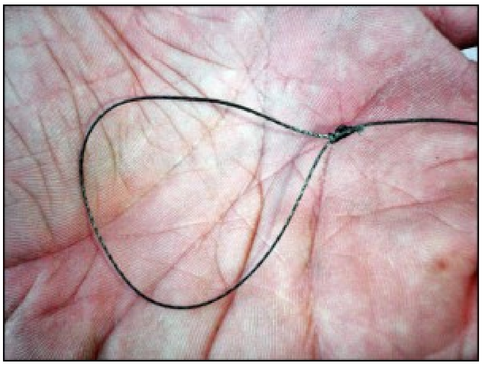
For the ends of the antenna wires, you will want to crimp a small loop for attaching the guylines to get the wire up off the ground.



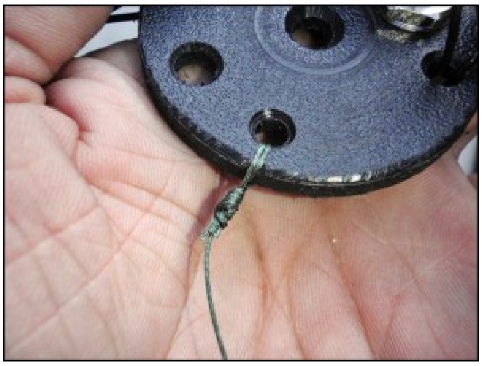
Be sure to slip some heat shrink on the wire first, slide it over the crimped brass and shrink to eliminate any sharp edges.

Next you will want to tie on some Spectra fishing line. We chose to add 30 feet to each wire in case we deploy the antenna on uneven terrain. 30 ft. seems to get the antenna off of the ground with slack to spare in case of damage or other issues. Once you have the loop in the end of the antenna wire, simply tie on the Spectra line using a Uni knot or similar method (http://www.netknots.com/html/uni_knot.html).

At the end of the Spectra line we have found it convenient to tie a loop. This makes it easy to loop the Spectra around a rock, or stakes if that if what you are using. You can use a surgeons end loop for this, or any method you prefer (http://www.netknots.com/html/surgeons_end_loop.html)



Finally you need your third leg. Tie a length of spectra to the hole in the insulator using the same Uni knot. Spool out about 55 feet of line and tie another end loop.



That is it! You now have a 20 meter antenna that weighs next to nothing. Wind up the entire rig on a LaserPro Kit winder, and throw it in your backpack.

2. **<u>The Coax</u>:**

For coax we used RG-174 (it's light, flexible and cheap). We wrap the coax around a toroidal ferrite core to reduce unwanted RF radiating from the shield. (http://www.palomar-engineers.com/). You can make the coax any length, but 35 to 50 feet seems to be enough for most situations.

3. **<u>The Pole</u>:**

There are a couple of different options when it comes to choosing the pole to use in the field. Sticking with the Ultralight theme of this design we decided to go with a carbon fiber pole-fishing-pole. Within this category of poles there are a few options as well. In the pictures here you will see the ProForce 1100, which is a 36.7ft 11m "extra hard" telescoping pole. A list of various poles can be found here: http://www.allfishingbuy.com/Fishing-Pole-10-11.htm We have had great luck with the 10616 pole (also found on that page). It collapses a bit smaller, and is easier to fit in a backpack. **IMPORTANT:** Be sure to remove the last section (the tip) of any pole you purchase. It is fragile and will not be used for the SOTA center insulator. You can always replace it if you feel like heading out to catch some fish with your antenna pole!

Of course with anything carbon fiber it is going to be expensive. The other option is to go with a fiberglass pole. It will be larger, more difficult to carry, and heavier but much cheaper. One example is here: http://www.jackite.com/product_info.php?products_id=132 there are several varieties out there, just search for "fiberglass kite flying pole".

4. Final Thoughts

As with all of our designs, this is a work in progress. We hope this might have helped anyone searching around for antenna how-to's as we did when we first got in to SOTA.

The entire rig (pole, antenna, coax) weighs in at a hair over 2lbs on the scale. You could shave off quite a bit of that by using a shorter coax cable (35ft or so). It was weighed with a 50ft coax.

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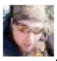
1.  *jason* says:
   [May 24, 2011 at 9:20 pm]()

   If anyone has any questions they can leave a comment here or contact: jason@seeksolitude.com

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2. [*SOTA W6/CT-002 | Seek Solitude Blog*]() says:
   [June 27, 2011 at 2:09 am]()

   [...] off on top of Mt. San Jacinto. This was a great test for our 20 meter ultralight SOTA design (how-to here). After some minor disagreements with the local vegitation, we were able to get the antenna in [...]

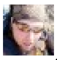
   [Reply]()
3.  *Danny Judd* says:
   [January 28, 2012 at 3:33 pm]()

Nice job on the antenna article. Thanks for sharing. As an x-military photographer and retiree from skilled trades I can appreciate the effort you expended to make this project easy to understand, clearly illustrated and with nothing expected in return.

Again nice presentation!!!!

73,
Danny K4DOJ

Reply

-  *jason* says:
  January 31, 2012 at 11:47 pm

  Thank you for the kind words. I hope this write-up helps some folks out.

  Reply

4. *JohnnyB* says:
   March 6, 2013 at 2:46 pm

   Thank you for this excellent article.

   Reply

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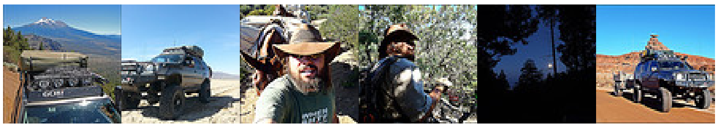

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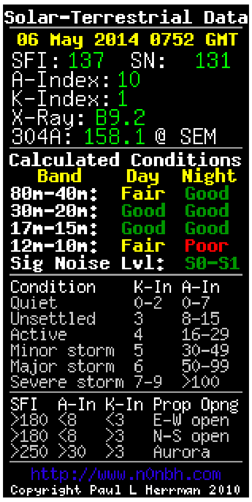

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