EMERGENCY MEASURES RADIO GROUP	**EMERGENCY MEASURES RADIO GROUP**
AMATEUR RADIO RAC EMERGENCY SERVICE	**OTTAWA ARES**

Two Names - One Group - One Purpose

TAPE MEASURE DISCONE – EMRG-602

Version: 1.1

EMRG PUBLIC

This document is classified as PUBLIC, meaning the document can be copied and shared by the documents recipient. Public documents do not contain any personal information or other information such as site details that should not be circulated outside of EMRG or its partners.

Public Documents will be posted on the EMRG WEB site without modification.

Written by: Peter Gamble for the EMRG Management Team

TABLE OF CONTENTS

1.0REVISION SUMMARY

2.0PURPOSE OF THIS DOCUMENT

3.0BUILDING THE ANTENNA

- **3.1THE ANTENNA**
- **3.2MATERIALS LIST**
- **3.3TOOLS REQUIRED**
- **3.4NOTES**
- **3.5PREPARATION**
- **3.6ASSEMBLY**
- **3.7PICTURES**
- **3.8STORAGE & DEPLOYMENT**

1.0 REVISION SUMMARY

Date of Change	Revision Number	Summary of Changes (Section #, type of change)
2004-05-09	1.0	Initial document for the Antenna Building Party 2004-05
2004-05-14	1.1	modified to include last minute changes and improvements uncovered at Building Party

2.0 PURPOSE OF THIS DOCUMENT

This document contains the detailed information how to build a multi band discone antenna, using metal tape measures.

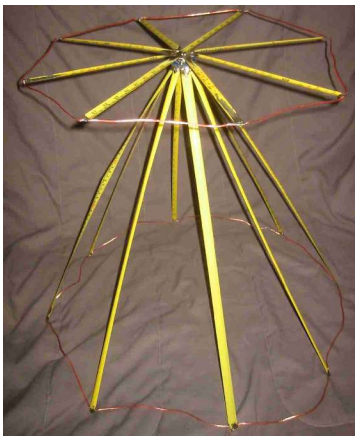
3.0 BUILDING THE ANTENNA

3.1 THE ANTENNA

The objective was to design an antenna that would work well on both 2m and 70cm while being easy to store and carry in a pack. Dual band J poles and ground plane antennas didn't seem to be working, apparently because the 70cm signal wanted to take off at high angles from the 2m portions of the antenna. The 220 MHz coverage of the discone was initially just a bonus.

This antenna was designed by Mike Kelly (VE3FFK)

Antenna Full View >



3.2 MATERIALS LIST

1. 3 ten foot (3metre) metal tape measures (The cheaper the better, see note below)
2. 4 bolts 3/8x 4-40 pan head & nuts(washers & lockwashers nice, but optional)
3. 2x4 inches single sided PC Board (approx)
4. 14 ft stranded wire # 16 or larger (I used 7 ft of speaker wire for this)
5. 6 inches solid wire #14 or larger (a scrap of NMD house wire works here)
6. 1 connector UHF 5 hole with a dielectric that isn't thermoplastic
7. Cardboard or other material to form a jig (see below)
8. Masking tape, maybe some elastics, and a couple of plastic soft drink bottles

- For this antenna session (2004-05), items 2, 3, 4, 5 & 6 will be provided for you.

3.3 TOOLS REQUIRED

- Glasses or goggles
- Aviation snips
- Drill
- Soldering iron and solder, low wattage iron is OK.
- Acid flux paste
- Tape measure (not one of the ones going into the antenna)
- Screwdriver/pliers for nuts and bolts above
- Sandpaper, coarse or medium
- Small hole punch, Dremel tool ,wire brush accessory for drill optional

3.4 NOTES

You will be dealing with sharp bits of measuring tape that will want to wave around in your face. WEAR AT LEAST GLASSES, IF NOT GOGGLES WHEN WORKING ON THIS PROJECT. Even a light scrape with the cut corner of a measuring tape could get nasty. The hazards of soldering and use of acid flux, while serious enough to get publishers' lawyers a few lines in most magazines, are incidental in comparison. It isn't worth taking chances. 'Nuff said.

It may be possible to make this antenna with a BNC connector rather than a UHF one, by making a single hole in the middle of the cone board and soldering the connector to it. The problem would be to find a good way to support the disk. I haven't tried it (yet).

The measuring tapes used in this antenna should be as cheap as possible. The material in more expensive tapes is more brittle, harder to cut, and coated with plastic and paint that is harder to remove. For once, cheap is good.

When measuring tape lengths with another tape measure, be VERY sure you are marking or cutting the CORRECT tape.

Printed/Unprinted: Printed means the inside of the shallow "U" formed by the measuring tape, usually printed with the distance markings. Unprinted is the "outside" of the "U", usually painted a uniform colour.

Lightly Flux: Use a disposable stick, etc to spread a light coating of flux paste to the desired area of the steel. More is NOT better.

Paint stripping: A careful reading of this procedure will reveal that it is not strictly necessary to remove the coating from both sides of both ends of each section. It is easier to do so than to figure out at each step which side (painted or unpainted) needs to be stripped. The mesuring tapes encountered so far have a plastic coating, yellow paint and metal blueing over the steel. The best way found so far to remove these layers is to remove the outer layers with a wire brush chucked in an electric drill, followed by emery cloth or sand paper to remove the deepest layer.

Dimensions are not very critical, use a ruler, not a micrometer.

3.5 PREPARATION

Cone Tapes: Measure and mark 8 two-foot sections of measuring tape (do not cut yet). Sand or Dremel away the paint and any other coatings on both sides at both ends of the marked sections. Similarly, remove the coating from the marked side at 4 and 8 inches from one end. This will remove the distance markings, so you will have to re measure before cutting, but it is easier to remove the coating at the middle of a section of tape than at an end. Re-measure and cut the 8 strips, making sure the cuts are nearly perpendicular to the strips. Some have found it easier to mark the sections by making a slight cut at the intervals, then remove all the coatings. Others have cut the sections before removing the paint. Round the tips of the cone strips.

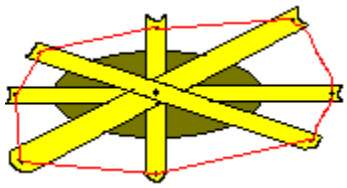
Disk Tapes: As above, measure and cut 4 strips of 21 inches. Punch the centres of each strip with a hole just large enough to pass the centre pin of the connector. Round the tips of the disk strips. Punch a small hole near each of the edges, but not so near as to cause the tape to crack. Practice on a piece of scrap.

Disk Board: Cut a disk 1-5/16 inches in diameter with a hole in it just large enough to pass the centre pin of the back of the UHF connector. The diameter of the disk board is not critical.

Cone Board: Mark a disk 1-9/16 inches in diameter. This diameter is a maximum value. Enlarging the diameter of this part could degrade the UHF performance of the finished antenna. Drill centre hole large enough to allow disk to fit over BACK of UHF connector. Drill 4 bolt holes to allow UHF connector to be bolted to disk. This is best done by marking and drilling one, bolting the pieces together and using the connector to guide the drill for the next three bolt holes. Cut out the disk from the board. Form solid wire into a circle to fit on copper at the perimeter of the disk and solder it there.

Spacer: Make two spacer pieces out of scrap board. Diameter should be at least large enough to cover the back of the connector. Make a hole in the middle of each to accommodate the centre pin of the connector.

3.6 ASSEMBLY



Disk Assembly: Lightly flux both sides of the centre of each disk strip. Build a stack of strips over the disk, with the open side of the U facing away from the disk. Use a drill bit, dowel or pencil to fill the centre hole to keep the solder out. Push down on the centre with a hex nut or similar item and flatten the tapes in the vicinity of the centre. Solder the unprinted side of the strips to the disk. Ensure that they have resumed their U shape well inside the edge of the disk board. Also ensure that the centre hole remains clear.

Disk Perimeter Wire: Add a perimeter wire to the top (printed) side of the disk. This can be done with by stripping the ends of short sections of insulated wire and placing the ends in the perimeter holes. Solder the wires into the holes. Try to make the wires straight from one strip to the next, forming an octagon around the edges of the disk. At the same time, avoid pulling any of the strips together with the wire. The idea is to have no tension or slack in the system when finished.

Cone Angle Jig: A jig must be devised to hold the tape measure strips used for the cone at approximately 60 degrees to the work bench, in order to allow them to be soldered to the cone board. This can be as simple as a board clamped in a vice or a cardboard triangle taped to the bench top. Use what you have.

When set up you should be able to do the following:

- Place the cone board, copper side up, on a horizontal surface.
- Place the end of a strip onto the board, leaning at an angle against the solid copper wire ring.
- It should be 30 degrees outward from vertical, or 60 degrees up from horizontal (same thing).
- You will need to get at both sides of the tape to be able to solder it to the board and the wire.

Cone Assembly: Lightly flux both sides of one end of the first cone strip and place it, painted side facing toward the centre of the disk, as noted in the jig assembly instructions. Solder it in place, but avoid getting solder in the vicinity of the bolt holes on the board. Keep in mind that you want to avoid heating the whole assembly so much that the copper ring comes off the board while installing the strips. Rotate the board 90 degrees and solder in a second strip. Solder in a strip at 45 degrees between the first two.

If your measuring tape strips are too wide to fit in this manner, some overlap is allowed, or you can cut the end of the strips down in a slight taper. If you must do this, try to solder the tapers together side by side, since the tapering cuts make the tapes susceptible to cracking in this area.

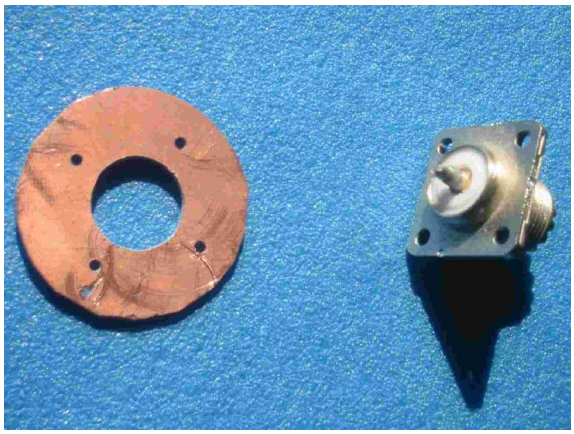
Continue around the board until all 8 strips are soldered in place. As the assembly proceeds and the previously soldered strips begin to get in the way, they can be controlled by folding them in half or rolling them up and taping them in this position with a bit of masking tape. This also makes it easier to get the soldering iron in position for those last "inside" solder joints.

Cone Perimeter Wire: Stand the cone up. Use masking tape to hold down the free ends at the base of the cone. At this point you should have a truncated cone about 25 inches in diameter at its base, with the ends of eight pieces of measuring tape evenly spaced around the perimeter. If you have, you are a better antenna builder than I am. Congratulations. If on the other hand, your cone looks like mine did, try to figure out which strips are skewed the worst and re-solder them so they aren't too far off their intended angle. When you are finished, the strips should have no twist in them and the spacing between the tips shouldn't be different by more than about 2 inches (Remember: the dimensions aren't too critical).

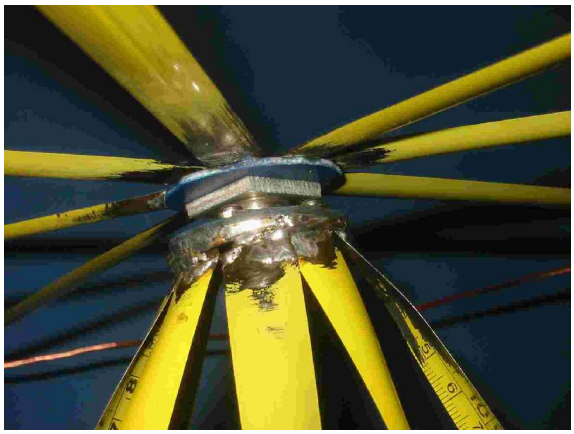
Now solder a perimeter wire around the inside (painted side) of base of the cone. As with the disk, avoid pulling the strips to one side or the other when soldering the wire. There should be no twists in the strips, and not much slack in the wire segments when you are done. The best way I found to do this was to mark a spot on the wire, fold the strip, solder the wire, and then unfold the strip. I'm pretty sure someone else can find a better way to do this part.

Final Assembly: At last.. Bolt the connector through the cone from the inside, with the tip sticking up and the connector part down. Place the spacer pieces over the centre pin of the connector with the copper sides of the spaces facing each other. Solder the disk to the centre pin of the connector, copper side up, with the arms of the disk over the arms of the cone. (It doesn't matter much, and the disk may be free to rotate anyway, depending on the design of your UHF connector.) The non copper clad side of the board should rest evenly on the shoulder of the connector.

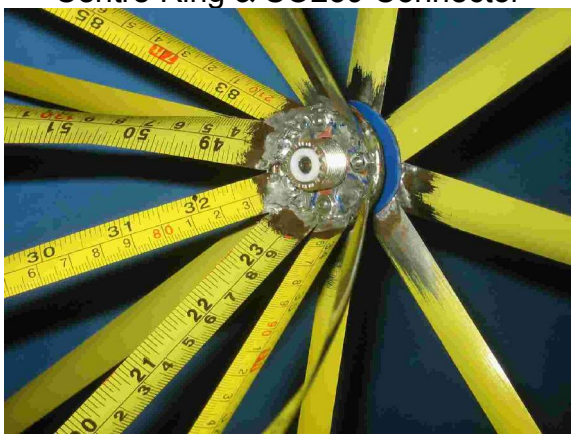
3.7 PICTURES



Centre Ring & SO239 Connector



Centre Hub



Inside View

Storage

3.8 STORAGE & DEPLOYMENT

Folding, Storage and Deployment: The easiest way to fold this antenna is to take four adjacent cone strips in each hand and bend them against your body so they form first two "L's" then two deep "U's". They can be secured with an elastic band. The disk can then be folded down against the sides of the cone pieces.

I currently store my discones in a pair of cut off plastic soft drink containers. The best way to unfold the antenna is to release the disk (pointed away from you), then turn the antenna around so the disk is near you, and release it. Typically the perimeter wires will get a little tangled, so it doesn't snap into shape all at once.

The antenna will work sitting on a flat surface, conductive or not. Although it will hold the weight of enough coax to reach from the connector to the perimeter of the cone, if it is deployed this way, the coax should be weighted or taped down so the antenna isn't dragged around. The antenna is really meant to be suspended from above by a cord. When deployed this way, the cone will become a bit taller as the elements droop, but this isn't a problem.