The Big Kahuna

A 15' high, 160 meter Distributed Capacity Twisted Loop Antenna.

by Jim McLelland WA6QBU

If you're like most hams, you don't come close to having enough room for an antenna for our lowest band, 160 meters. Not being much different, I not only lack sufficient space for a low-band antenna but, like most cliff dwellers before me, I can't even put up an outside clothesline. So, I developed the Distributed Capacity Twisted Loop (DCTL) prototype on 40 meters (see *73*, September 1993, page 26) and then applied what I learned to a 160 meter version.

The result is a 15-foot-high equilateral triangle that you can hang on the side of your house or, like I do, from the balcony when the XYL isn't looking. It can be built in a couple of hours, doesn't cost much and, as the title (Big Kahuna) suggests, packs a real punch. If you've got room for a 10 meter dipole you've got room for this, so quit stalling, get out your soldering iron and go for it.

Description

The DCTL is a loop made from 300 ohm twinlead, but with a twist. To understand the "twist," look carefully at Figure 1. You'll notice that opposite ends of the loop do not connect to each other. This is a critical point in getting the loop to resonate. These open, opposite ends connect to a capacitive stub that does the fine tuning, but most of the tuning capacitance is distributed along the whole length of the loop. It is this capacitance that lowers the frequency of the wire loop so that about 1/8 wave will resonate instead of the usual 1/2 wavelength. In short, a loop about 50 feet long (15 feet across) has replaced a 246-foot-long dipole. The impedance drops drastically and must be raised back to 300 ohms. This is accomplished with a shorted "hairpin" stub impedance matching device across the feedline. The net result is a loop antenna resonated between 1.8—2.0 MHz with a 300 ohm impedance and a "Q" of 100. This produces a very narrow bandwidth of about 20 kHz. However, you can easily adjust the SWR to 1:1 over the entire 200 kHz, 160 meter band with a balun and tuner.

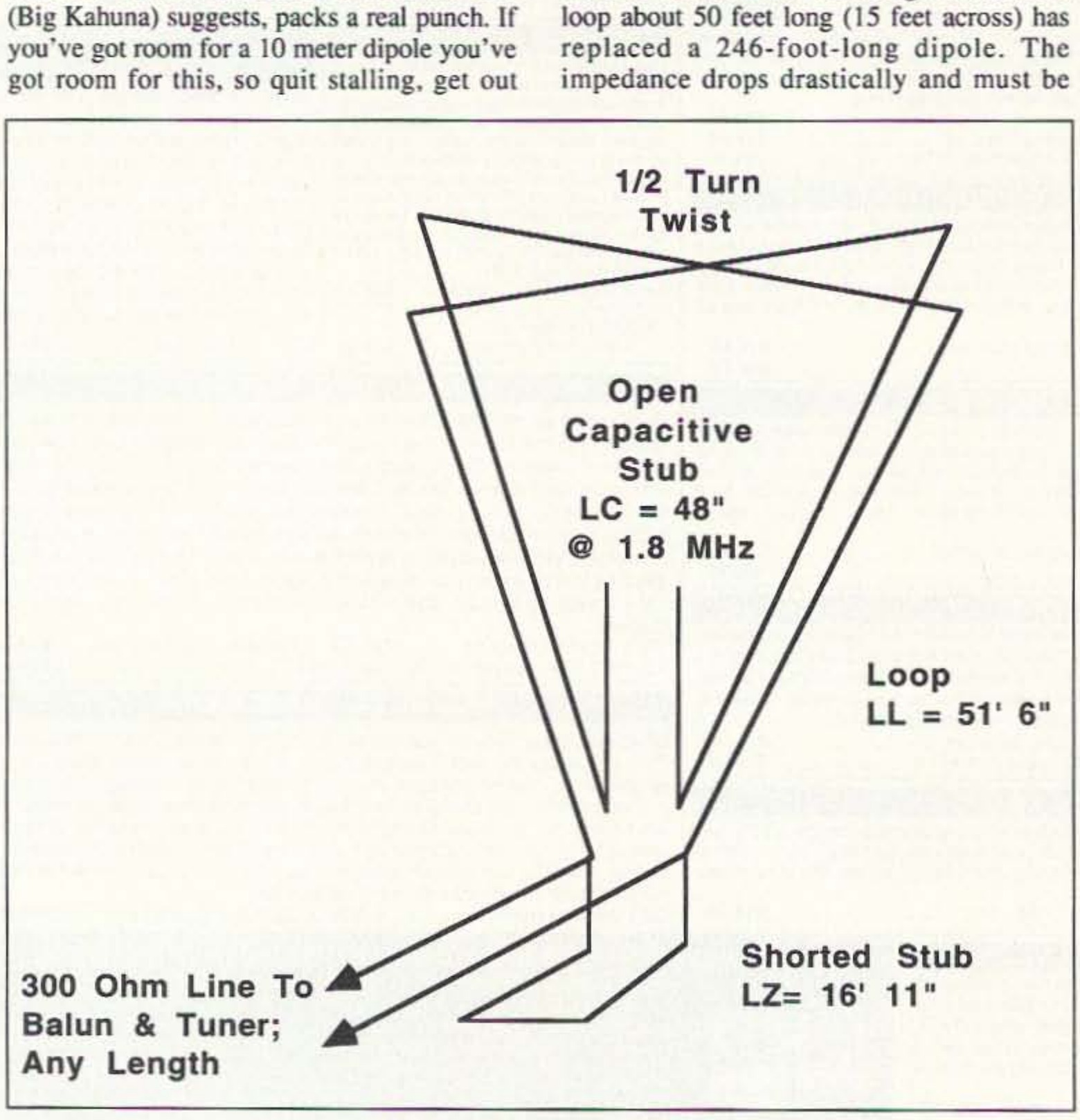

Figure 1. The Big Kahuna 160 meter DCTL dimensions.

Construction

The loop is cut for 2.0 MHz and the capacitive stub is made long enough to pull the resonant frequency down to 1.8 MHz. Then it is easy to trim the stub to anywhere in the band. All DCTL parts are made from 3/16" twinlead, available from Radio Shack (15-1153), or you can order a complete kit from Antennas West (see the Parts List). Either way, you'll have enough wire left over for some lead-in to the balun/tuner.

Figure 1 shows the lengths required. Remember, they are critical, so *measure carefully*. Twist together and solder all connections. Don't forget to put pieces of shrink tubing on all the leads *before* you solder anything! After soldering and insulating, the shorted "hairpin" stub (16'11") can be attached directly to the lead-in with shrink sleeving, or it can be rolled up into a 12"-diameter loose coil, or it can even be left to hang free. The antenna characteristics change a little from one method to the other, but they all work fine.

The open stub is quite frequency-sensitive. Keep it away from other antenna components and metal in general. If it can't hang freely, attach it to an insulator, such as a twinlead standoff.

The 48" length lowers the loop resonant frequency 200 kHz and its effect seems to be fairly linear. Before you do any trimming, however, complete the construction and install the antenna. You should do it this way because the shape also affects the frequency somewhat, with the resonant frequency going up as the feed point angle gets larger. The loop itself (51.5') *must* be connected so that there is *no continuity* (infinite resistance) between the terminals that connect to the feedline. Check and connect these leads before the shorted "hairpin" stub is attached.

Installation

If your operating location permits, mount the DCTL as an equilateral triangle or diamond, with the feed point down. If not, then go for the most area inside the loop that you can, given your situation. The DCTL will also work as a wide-spaced two-turn loop, but it's down about one "S" unit in comparison. You'll need to retune somewhat, but that's not difficult.

Be sure to use insulating material to support the loop. Nonconducting clothesline works well if beauty isn't important (I keep my odd-shaped creation in the attic). Those of you concerned with aesthetics can get by on an outside wall by following trim boards, using traditional standoffs, and painting your loop the same color as the house. Don't forget, though, that you must stay away from metal objects such as flashing, vents, and downspouts. This includes the lead-in itself. Also, if you have the choice, put the plane of the loop in your favorite directions as it definitely has deep broadside null points.

Tuning

The minimum equipment necessary to get this system working is an SWR bridge, a balun, and a tuner. Without the tuner, your bandwidth is only abut 20 kHz, but with it, you can QSY the whole band with no trouble. There are several "no tuner" options to QSY but they all require changing the effective length of the capacitive stub. You could make several stubs for different frequencies and attach them with banana plugs, or use a rotary switch, or even rig up a remote relay system. I've tried all of these and finally decided that while it was fun to experiment, the tuner worked just as well.

To resonate the loop, trim short pieces off of the capacitive stub until the SWR is where you want it. Remember that shortening the stub 24" moves resonance up about 100 kHz. The best way to check this all out is to use an antenna bridge. Then you can find the starting point and trim until you're in the middle of the band, or where you prefer to be. You may be somewhat below the band edge if your feed point angle is less than 60 degrees (equilateral triangle); with only an SWR bridge, it may be difficult to find the proper stub length. Trimming 3" at a time and checking for an SWR dip is the best procedure, remembering that each change will move the antenna up about 10 kHz. If you don't feel like doing this, cut the stub to 24", resonating the antenna somewhere in the band (hopefully the middle), and use your balun/tuner for the rest. I later discovered that the tuner would resonate the loop on every band down to 10 meters and my antenna bridge showed sharp resonant points on 7, 14, 21, and 28 MHz as well as on the design band.

Testing

Believe me when I say this thing works! I contacted stations out to about 700 miles with S9 signals both ways and my noise level was always below S3. Band conditions were bad and I could still hear northern stations over 1,000 miles away. I didn't try to work them as they were all in round tables and I hated to break-in since I couldn't hear everyone. I later figured out that they were broadside to the loop and in the general area of the null. A 90 degree turn made the north-south stations much stronger.

By the way, the locals tell me that there's even DX late at night! I can't wait.

Another thing to remember, and one reason why I developed this antenna, is that the sunspot cycle is still on the wane. There may be nights when 160 is the only band left working. I'll be ready! Will you? 73

Parts List

All parts needed to build this (160 meter) antenna, or the 40 meter model described in the September 1993 issue of *73*, are available in the "Compact Loop Experimenter's Kit." The parts are:

Twinlead - 5/16"	100'
Shrink tubing - 3/8"	1'
Shrink tubing - 3/16"	1'
Banana plugs	2
Dacron line	50'
Double split twinlead	
Insulators w/hardware	4

Introductory price w/shipping (40% discount for *73* readers): $24

Available from:

Antennas West
1500 N 150 W
Provo UT 84604
Tel. (801) 373-8425