By Rick Rogers, KI8GX

A "One-Masted Sloop" for 40, 20, 15 and 10 Meters

What started off as a compromise replacement for a "monster loop" turned out much better than expected. This antenna may prove to be an exception to the rule that "you get what you pay for."

Over 33 years of hamming, one of my favorite activities is building and testing antennas. Of all the types of antennas tried, I get the best bang for the buck from simple, horizontal loops.

Designing the Loop

An interesting property of loop antennas is that they are harmonically resonant. As shown by Doug DeMaw, W1FB, a loop designed for 7.1 MHz will also resonate at 14.2 MHz, 21.3 MHz, 28.4 MHz, etc.[1] See Figure 1. The ability to operate on multiple bands without retuning and the multidirectional nature of their radiation patterns make horizontal loops especially useful for DX, contest, and net control applications where having to wait to rotate a beam can be a disadvantage. Another advantage of the loop antenna is that it tends to be quieter on receive than some other designs, such as Yagis or verticals.[2]

The best antenna I ever built was a 160-meter full-wave horizontal loop. Even though the antenna was only up about 35 feet, it did a pretty good job on 160, is spite of radiating most of its energy skyward. Where this antenna was really effective, though, was on its harmonics. An *EZNEC*[3] model of this antenna shows, for example, that at 10 meters, it radiates multiple low-angle lobes, some with gain figures of more than 13 dBi.

Of course, a monster like this had (note past tense!) its problems. It required 4 masts, 540 feet of wire and a big chunk of land. As the reader might guess, antennas that big suffer a lot from the wind, even if made out of relatively strong wire. Mine was made of 17 gauge aluminum fence wire but it seemed like I was always repairing damaged masts and broken wires. [Solid wire is more likely than stranded wire to break as a result of repeated flexing.—Ed.] After about six months of constant struggle against the elements, the antenna and three of its four supports succumbed to wind-driven hail.

After the storm, and several unsatisfying weeks trying to get by with a homebrew vertical, I thought to try something a little less ambitious. What I had in mind was a loop that would use only the single remaining support. A quick session with *EZNEC* showed that a sloping loop, 140 feet in circumference (a full wavelength on 40 meters), with the feed point elevated on a single 30-foot support should resonate on 40, 20, 15 and 10 meters. The antenna should also produce reasonable gain in multiple directions, especially at the shorter wavelengths (see Figure 2). This "one-masted sloop," a *sloping loop* supported and fed at the top corner, turns out to be a good performer and costs almost nothing.

Building the Loop

Construction couldn't be easier. First, buy or build a dipole center insulator with coaxial connector as described in *The ARRL Handbook for Radio Amateurs* (see

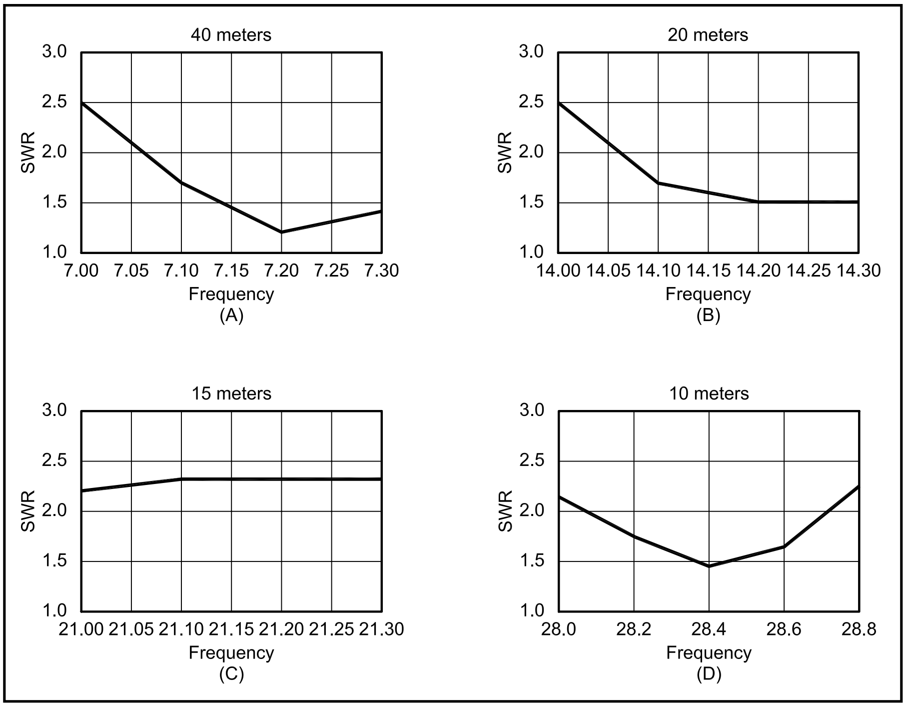

Figure 1—SWR vs. frequency plots for the 136-foot, 40 through 10-meter sloop. The SWR minimum for the four bands is easily adjusted by adding or deleting small lengths of wire from the loop.

[1]Notes appear on page 46.

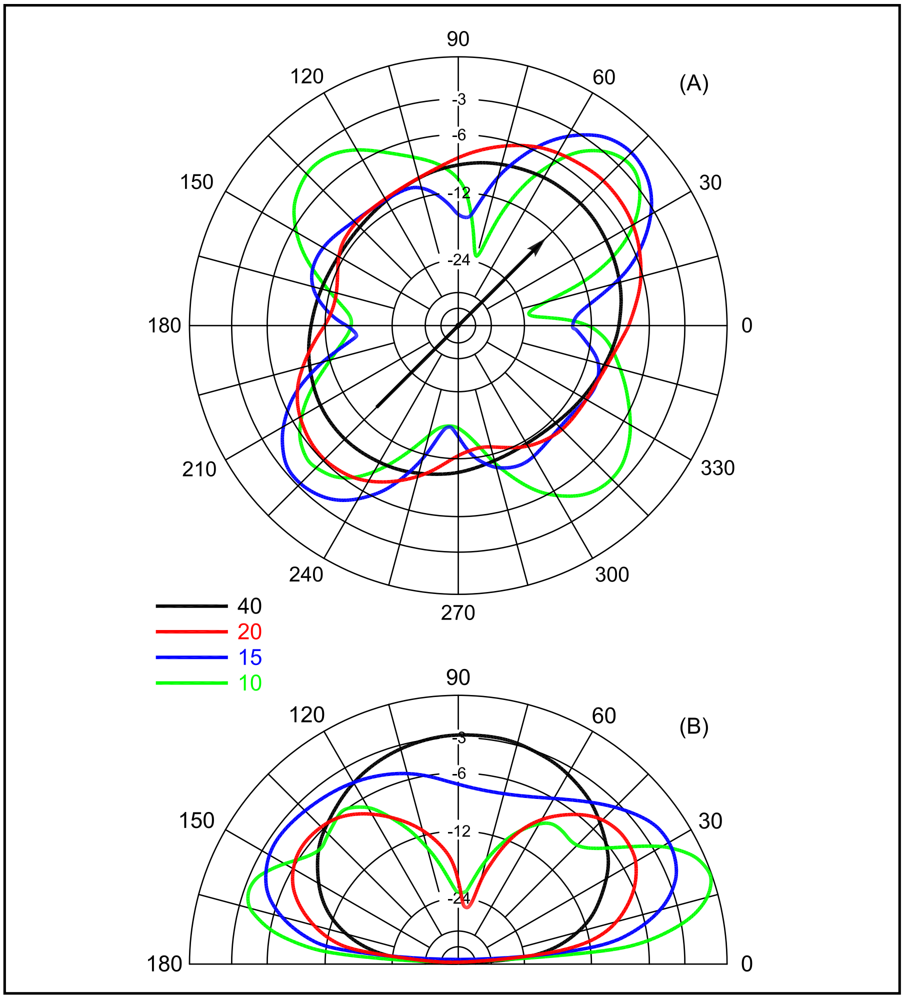

Figure 2—*EZNEC* study of the far field radiation patterns of the 40 through 10-meter "Sloop." The arrow indicates the direction of the slope. A is the azimuth plot at 30 degrees elevation. B shows the elevation plot along the axis of maximum gain, 45-225 degrees.

Figure 3).[4] Connect the opposite ends of the 140-foot wire to the center insulator. I prefer 14 gauge stranded and insulated wire because it is easy to work with. Tie 50-foot lengths of 3/16-inch rope to the antenna at points 35 feet away from the center connector on each side. [You may wish to use a ceramic insulator at the side and bottom tie-line attachment points, particularly if high power will be used; see Figure 4.—Ed.] Connect 50-Ω coaxial cable such as RG-8 or RG-58 to the connector and raise the feed point to a height of 30 to 40 feet. Pull the side tie lines sideways and down until the upper half of the antenna forms a taut 90-degree angle and slopes at 30 to 45 degrees with respect to the ground (see Figure 3). Tie off these lines. Attach a short (2-3 foot) length of line to the bottom point of the loop and tie off the bottom of the loop to a stake or a fence post.

The loop will need to be pruned for the antenna to resonate at the desired frequencies. To do this without raising and lowering the antenna for each adjustment, remove lengths of wire at the bottom of the loop and then solder the ends back together. Shorten the loop a few inches at a time until the SWR approaches 1:1 at the desired 40-meter frequency. Adding wire will lower the resonant frequency on all bands.

In my case, a final length of 136 feet yielded SWR values lower than 3:1 over the entire 40, 20 and 15-meter bands. The loop also produced a 2:1 SWR over almost 1 MHz of the 10 meter band (see

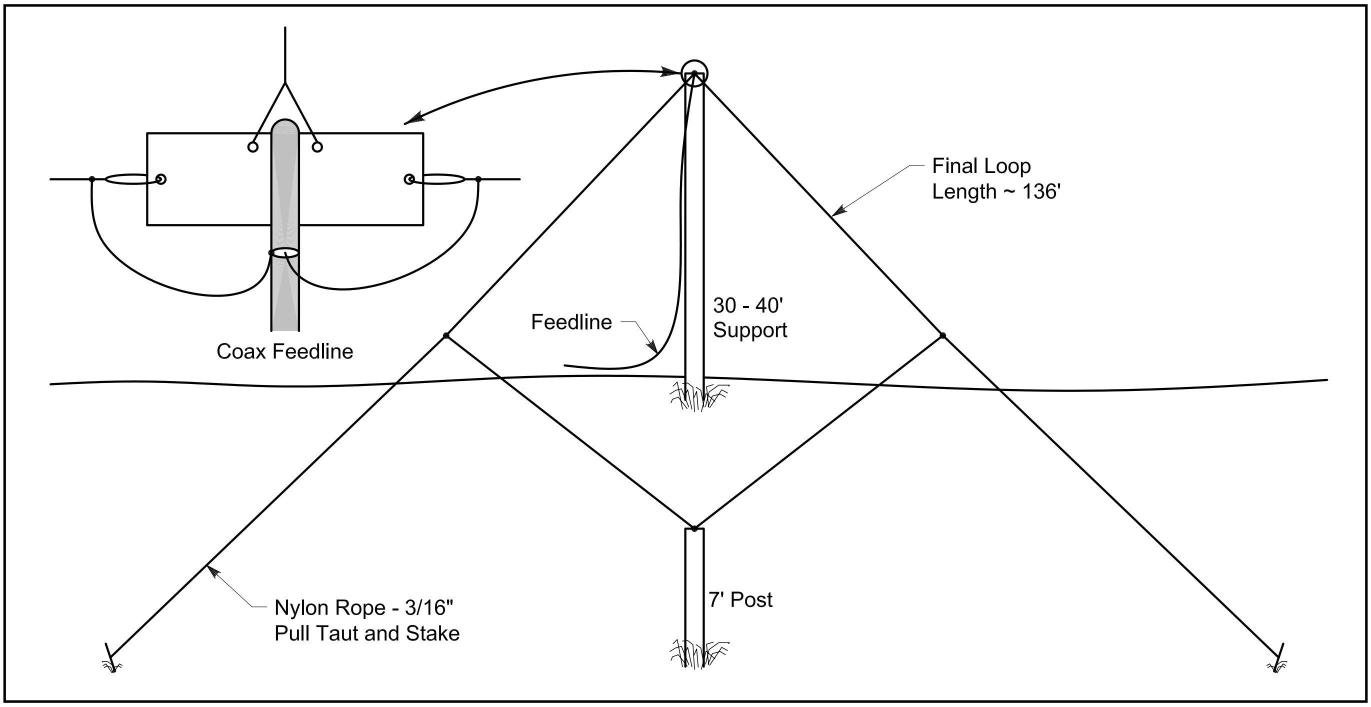

Figure 3—The vertical support of the Single-Masted Sloop can be a mast, tree, building, flagpole, and so on. The simplicity of the design and the multidirectional gain delivered at the harmonics make this antenna a good candidate for Field Day.

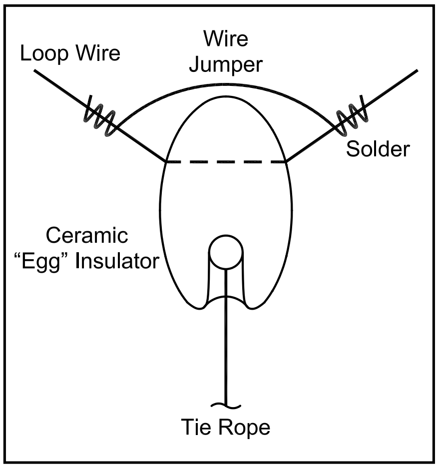

Figure 4—One simple method of attaching tie ropes to wire antennas.

Figure 1). Since I typically hang out in the phone sections of these bands, my antenna was tuned for the best match there. My old Kenwood TS-830 and ancient Hallicrafters HT-41 kilowatt amplifier—both with adjustable pi matching output networks—easily tune to this antenna at any frequency on all four bands. Most recently manufactured rigs can handle the 2 or 3:1 SWR at the band edges. [To lessen the SWR, particularly at higher frequencies, the loop can also be fed with open-wire line.—Ed.]

Results

The results with this antenna are gratifying, especially given that it can be built in a couple of hours from scrap wire and hardware, tunes easily, doesn't need to be elevated to great height and occupies a reasonable "footprint." Stations in Europe, Japan, South America and the Azores were worked with 100 W on 20, 15 and 10 meters within an hour or so of completion and with good signal reports. I tried the antenna on 40 meters during the November 2001 Sweepstakes to get some idea of its performance on that band. I was pleased to find that contacts could be made with the antenna on both coasts from central Ohio at midday in spite of *EZNEC* showing much of the energy on 40 meters radiates straight up (see Figure 2). The performance, simplicity and cost of this antenna suggest to me that this would be the antenna I would roll up and take along on that low-budget DXpedition to the Caribbean.

Notes

[1]Doug DeMaw, W1FB, "A Closer Look at Horizontal Loop Antennas," *QST*, May 1990, p 28.

[2]See Note 1.

[3]*EZNEC* 3.0 Antenna Design Software by Roy Lewallen, W7EL (**www.eznec.com/**; **w7el@eznec.com**).

[4]Chapter 20 ("Antennas and Projects") of any recent *ARRL Handbook* contains drawings that illustrate ways of attaching a center connector.

Rick Rogers, KI8GX, was first licensed as WN6HGY in 1968, followed by WA6EZT, N9COO and N7GEF. He is a professor of Neuroscience at Louisiana State University where he does research on, and teaches, neurophysiology and physiological instrumentation. A chance encounter with a neighborhood ham cleaning out his garage (SamWestfall, K6PHH) in 1967 started Rick, then 13 years old, on his career in ham radio and science. Ham radio provided an ideal entry point into neurophysiology since the principal elements of the nervous system neurons "talk" to each other using frequency modulated electrical pulses. The ARRL Handbook for Radio Amateurs *can be found on the bookshelves of quite a few neuroscientists, whether they are hams or not. You can reach the author at 9831 Bank St, Clinton, LA 70722;* **rogersrc@pbrc.edu**.

VHF/UHF CENTURY CLUB AWARDS

Compiled by Eileen Sapko Awards Manager

The ARRL VUCC numbered certificate is awarded to amateurs who submit written confirmation for contacts with the minimum number of Maidenhead grid locators (indicated in italics) for each band listing. The numbers preceeding call signs indicate total grid locators claimed. The numbers following the call signs indicate claimed endorsement levels. The totals shown are for credits given from December 8, 2001 to February 11, 2002.

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50 MHz
100

1185	W9CSY
1186	Void
1187	K6YK
1188	KØDLW
1189	PY5IP
1190	VE2VLJ
1191	K1NU
1192	KJ6CA
1193	KB8GC
1194	K6CF
1195	N8YV
1196	KD5GJR
1197	KE6TVM
1198	SM3GBA
1199	KC8KSK
1200	WB6YIY
1201	WM3O
1202	W4KVS
1203	W4PRZ
G8BQX	500
OK1MP	350
VE6NTT	300
VE7VDX	200
KØCS	450
KØDI	150
NEØP	225
WAØFQK	175
KAØJGH	600
K1BD	125
K1SIX	850
WB1FLD	250
NJ2F	400
W2BZY	525
KB2TGU	350
N3RN	200
W3HHN	375
W4GLV	400
KE4HOA	200
N4MM	750
W4UDH	675
KE5K	200
W5OZI	900
AA5XE	600
WD5K	900
K5TN	500
N6JV	425
KC6ZWT	125
W6OMF	275
WX7M	375
WO9S	225

144 MHz
100

597	NL7CO
W6OMF	125

432 MHz
50

G4RGK	190

902 MHz
25

32	N2BJ

2.3 GHz
10

66	N2BJ

10 GHz
5

117	NØUGY
118	KH6/WAØQII
AA5C	35

24 GHz
5

13	NØUGY

Satellite
100

113	KB9RCA
KK5DO	650
W5ADC	250
K5OE	625
N5AFV	325
K9HF	300

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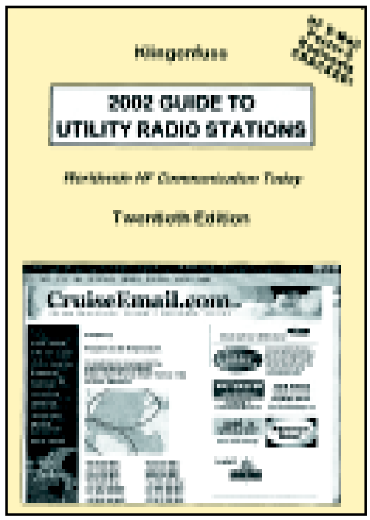

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