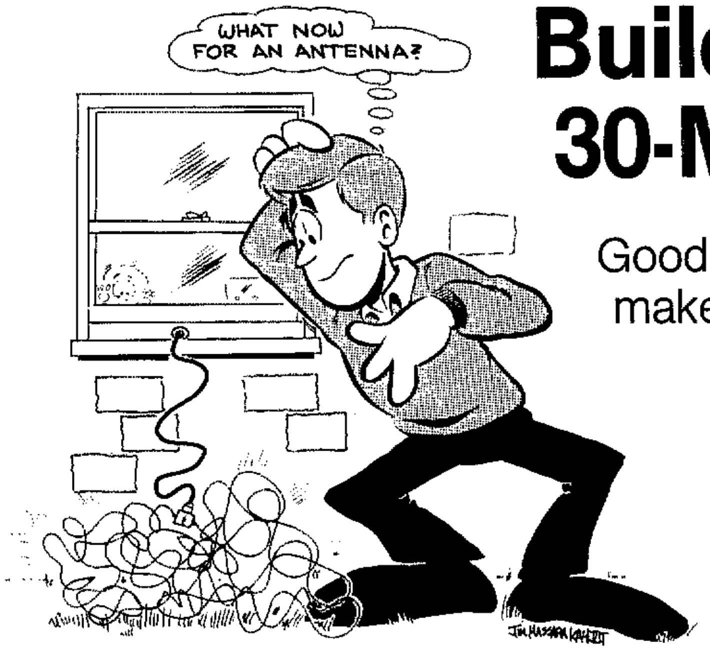

Building and Using 30-Meter Antennas

Good propagation and minimum QRM make 30 meters a great band for the DX hunter and ragchewer. Good results are possible without elaborate antennas. Let's review some simple ones and scale them to the new WARC band.

By Doug DeMaw,* W1FB

What makes 30 meters so interesting and unique? Perhaps the most outstanding virtue of 10.1 MHz is the propagation characteristic found there. In a nutshell, it is a pleasant combination of the good features we've learned to enjoy on 40 and 20 meters. For the most part, 30 meters is open to some part of the USA or world most of the time. The skip is generally longer than it is on 40 meters, and when 20 is dead, 30 is often open. I'll always recall how amazed I was during my first weeks on the new band, when in Connecticut I was able to hear JAs, ZLs, Europeans and U.S. stations at the same time! I don't remember having that happen on the other hf bands.

Another nice aspect of 10.1 MHz is the present lack of recognition for states or countries worked. At this time, there are no WAS or DXCC awards being issued for 30 meters, and there are no contests being staged. That, plus the 250-W input power limit, cw and RTTY only, make the band a delight to work if you enjoy chewing the rag or operating QRP. The band is not infested with operators who seek to pile up high contest scores or garner new states and countries for the purpose of acquiring an award. The 10.1-MHz band has proven ideal for many of us who have regular schedules with friends.

The U.S. frequency allocation is 10.100 to 10.109 MHz. A second segment exists from 10.115 to 10.150 MHz. *Beware: 10.109 to 10.115 MHz is a "no-man's land" for U.S. operators!* It is illegal for us to operate in that portion of the band. Don't be misled by VE signals in that part of the band: Canadians are allowed to use 10.109 to 10.115 MHz.

The Fine Art of Antenna Selection

I have observed some interesting practices, respective to antenna use, since becoming active on 30 meters. Many amateurs who are trying the band for the first time are using antennas that are cut for other bands — at least until they decide if they wish to stay active on 10.1 MHz. I went through a similar exercise during my first month on the band. I was surprised to find that any hf band antenna would bring reasonable results if the SWR was disguised by means of a Transmatch. Of course, the feed-line losses varied with the antenna being used, since different lengths and types were involved. For example, I had good luck with a 40-meter 5/8-λ sloping vertical, even though I was brute-forcing rf energy through a tapped-coil matching network at the base of the antenna. I was pleased to learn that my Cushcraft A4 triband Yagi would radiate well when using a Transmatch at the transmitter end of the feeder. I had reasonable success when feeding my shunt-fed 50-ft tower, which was resonant at 80 meters.[1] Each antenna enabled me to work DX and local (USA) stations, but the tribander for some reason had the advantage of reduced QSB. I hasten to state that there appeared to be no directional characteristics when using the A4.

If you have a center- or end-fed Zepp antenna, or a dipole with tuned feeders, chances are that you will find that antenna to be ideal on 30 meters. Many stations I have worked displayed strong signals when using that style of antenna. I had no antennas with tuned feeders, so I finally erected a sloping dipole with 50-ohm coaxial feed line, and it worked very nicely for all-round QSOing. But, let's consider some antennas that are designed for 30-meter dedicated use.

Effective Wire Antennas

I find it surprising that a number of amateurs have written to me and asked, "What shall I put up for 30 meters? Can you give me a set of dimensions?" Cutting an antenna to the proper length is perhaps the easiest task we hams must face. Yet, there are many who lack the confidence or knowledge to tackle that simple job. *The ARRL Antenna Book* should become a standard reference for those amateurs.[2]

Fig. 1 shows some basic wire types of antennas that should yield good results on 30 meters. The antenna at A is the popular, easy-to-erect drooping doublet, drooping dipole or inverted-V. This antenna and the others we will consider in this article can each be supported by a single mast or tower. That simplifies the installation. The inverted-V exhibits an omnidirectional radiation pattern. The enclosed angle should be about 90 degrees, but angles up to 120 degrees provide good results.

The length of the inverted-V legs do not become the exact length obtained from the ft = 468/f(MHz) formula. Cut them a trifle long to permit trimming the length for an SWR of 1:1. The final length will depend on the proximity of the wires to nearby conducting objects. The height of the lower ends above ground will also affect

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[1]Notes appear on page 29.

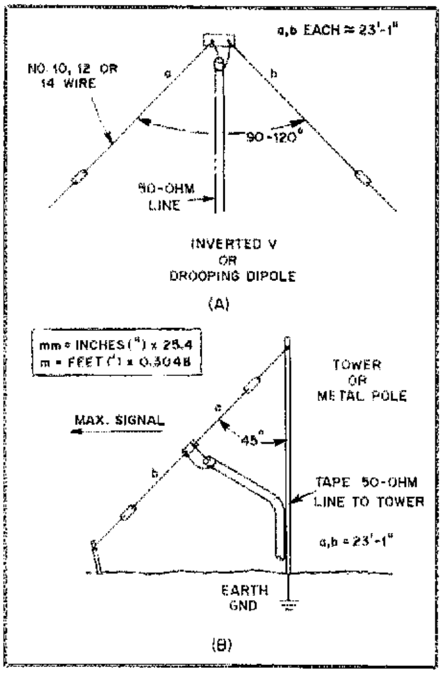

Fig. 1 — Good all-round results can be expected when using the inverted-V antenna shown at A. For successful DX work, the center of the dipole should be at least 0.5 wavelength above ground. The sloper seen at B will serve nicely for local and DX work on 30 meters. The arrow indicates directivity off the slope of the antenna when the supporting structure is metal.

the final length. Trim equal amounts of wire (1/2 inch at a time) from the ends of the dipole until the SWR will decrease no further. Although the SWR may not drop to as low as 1:1, it should be close to that ratio when using 50-ohm feed line. The height above ground for the center of the antenna should be as high as practical. Ideally, the feed point would be a half wavelength (48 feet) above ground, or greater. But, lower heights will permit good operation, too. The higher the antenna, the better the low-angle radiation and, of course, the better the DX results. This rule applies to operation on any hf band.

The antenna seen at B of Fig. 1 is excellent for DX and local use. By "local," we may consider a distance of a few miles out to a couple of thousand miles or more. This sloping half-wave dipole is commonly referred to as a "sloper" or "full sloper." If the antenna is supported from a grounded metal structure as shown, there will be directivity (not gain) in the slope of the dipole, as we have indicated by the arrow in Fig. 1B. A slope angle of 45 degrees is generally used for this radiator, but larger angles can be employed without significant change in performance. Any convenient size of wire can be used for the legs, a and b, provided the wire is strong enough to support the overall dipole. If you have a short mast, causing the lower end of antenna-leg b to be near the ground, some trimming of the antenna length may be required in order to reduce the SWR to near 1:1. Best results will be had if the lower end of the dipole is at least 6 feet above ground. If a tall wooden support is used for the antenna, you may want to erect the radiator as a vertical dipole (perpendicular to the ground). This will yield a good low-angle radiation lobe, which will be ideal for DX work. The pattern will then be omnidirectional. As many as four slopers are used by some amateurs (spaced at 90-degree intervals around the tower). The feed lines are switched by remote means to provide directivity in four directions.

Effective Wire Loop Antennas

Some advantages are possible if we configure our 30-meter wire antenna as a closed loop. If a full-wave loop is erected (Fig. 2A), we will realize increased aperture (called *capture area* by some hams), and there can be a marked reduction in local man-made noise during receive. A full-wave loop is seen as a triangle in Fig. 2A. Again, a single support is specified. The triangle has sides of equal length, although some disparity in the equality will not spoil the antenna performance. As shown, the loop is equal to the driven element of a Delta Loop beam, but with the feed point inverted.

Although top feed is shown in Fig. 2A, the antenna could be fed at the center of one of the sides or at one of the lower corners. You may wish to experiment with the feed point to learn which one provides the best results for your type of operation. Shifting the feed point will change the polarization of the signal and will also have some effect on the radiation angle. I prefer top feed, but have also fed this type of antenna at the center of the bottom leg.

Tuned feeders (open-wire line or 300-ohm TV ribbon) are specified in the interest of reducing feed-line losses (especially if a long run of coaxial cable would be required). The tuned transmission line will permit this loop to do a good job on 10 meters, too. Although it is not exactly related in terms of the third harmonic, it will radiate well on 28 MHz. It also should work well on 20 and 15 meters.

Coaxial cable can be used to feed the loop in Fig. 2A, but a quarter-wave matching transformer will be needed in order to obtain a low SWR. The feed impedance of the full-wave loop is approximately 115 ohms. A section of 72-ohm coaxial cable, 16 feet 1/2 inch long, can be inserted between the loop feed point and the 50-ohm line to the shack when coaxial-cable feed is desired. The piece of RG-59/U or RG-11/U cable will then serve as a matching transformer to convert the feed impedance to that of the 50-ohm line. A low SWR should result. The size specified for the 72-ohm section is a quarter wavelength for 10.125 MHz, and the 0.66 velocity factor of the cable has been included in the dimension. The exact length will depend on the type of 72-ohm line you use; the velocity factors differ slightly with respect to the insulation used. The ARRL's *Handbook* and *Antenna Book* list the velocity factors for the various popular coaxial cables. The formula is 246/f(MHz) × 0.66 when using solid polyethylene insulation.

Height factor h of Fig. 2A is of importance if we are to have good DX results with the loop. Ideally, dimension h would be 35 feet or greater to ensure a low angle of radiation. But, good results can be had with much lower antenna height. I enjoyed very good DX results with a 40-meter version of this antenna, even though the lower leg was just 4 feet above ground. I was able to work 22 countries with a 2-W QRP cw

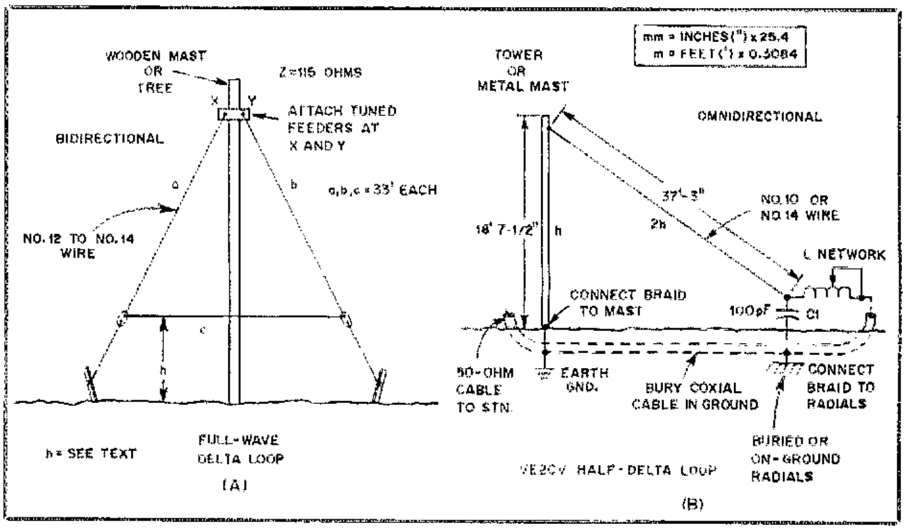

Fig. 2 — The full-wave loop at A can be thought of as the driven element of a Delta Loop beam antenna. It is capable of yielding excellent results on 30 meters, but maximum directivity is at right angles to the plane of the loop, making it a bidirectional radiator. A 30-meter version of the VE2CV Half-Delta Loop is shown at B. This is a highly effective DX antenna, but is practical also for "local" communications. Ground radials are needed with this antenna.

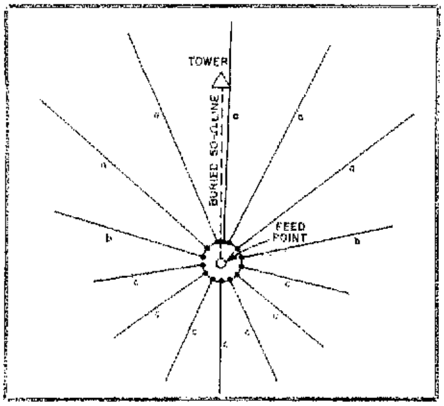

Fig. 3 — Looking down on the Half-Delta Loop, we envision the layout for a suitable radial system. The greater the number of radials, the better the effective ground under the antenna. Radials "a" should extend slightly beyond the vertical element of the loop, as shown. Depending on the ground conductivity in a given region, fewer radials than those shown may be ample. Good results have been reported by some amateurs who used only ground rods at each end of the loop.

rig during a three-month period when I lived in Connecticut. The loop was broadside east and west.

There is no reason why the loop of Fig. 2A could not be erected in a square, or even a slightly rectangular format if your property requires it. Irrespective of the antenna shape, the radiator will be a full-wave loop if the overall length is taken from 1005/f(MHz), which provides the answer in feet. The sides of the loop should not be too close together (long, narrow rectangle), lest performance be impaired. Such a format would approach that of a folded dipole. The radiation from the loop will be bidirectional off the broad side of the antenna.

The Half-Delta Loop for 30 Meters

The complete story about the Half-Delta Loop was carried in *QST* and other literature.[3] Therefore, we won't delve too deeply into the theory of operation. In effect, our loop conductor (tower and slant wire) is 0.5 wavelength long, plus a k factor of 1.15. Again, a single support structure is needed (h of Fig. 2B), and that section of the system must be conductive, since it is an electrical part of the loop. There should be *nothing* atop the mast or tower, because any additional conductors will seriously affect the antenna resonance and performance. This means that a tower with guy wires or additional antennas can't be used for the Half-Delta Loop. A tree or wooden mast can be used, however, provided a vertical wire (h) is added to take the place of the missing tower or metal mast. So, you need not have a tower to use this excellent antenna.

Electrically, the antenna of Fig. 2B functions as a full-wave loop by virtue of the missing half of the loop appearing in the ground as an image. The polarization is vertical, and the radiation pattern is principally omnidirectional. The angle of radiation is very low, which makes the loop excellent for ground-wave communication and DX.

A feed impedance of approximately 100 ohms will result if the dimensions are correct and when a reasonable ground system is used with the loop (radials). A matching transformer made from 72-ohm coaxial cable (described for the antenna of Fig. 2A) could be used if the L network of Fig. 2B was not desired. A low SWR would result. The simple L network will, however, permit precise matching to 50- or 72-ohm line.

The feed line is buried a few inches in the ground to keep it from being a physical hazard to people. The performance will be just as good if the feed line is simply laid on the ground. In either event, the shield braid of the feeder should be connected to the radial wires at one end of the loop and to the base of the tower at the remaining end.

Good results can be obtained with a few in-ground or on-ground radial wires. A suggested minimum number is illustrated in Fig. 3. A ground rod, or a group of rods tied together electrically and spaced 3 feet apart, should be located at the feed point and at the base of the tower or mast.

The L network of Fig. 2B may contain a coil that can be tapped during the SWR adjustment. For 30 meters, I use a hand-wound inductor that has 20 turns of no. 14 copper wire. The coil diameter is 1-1/2 inches, and the length is 6 inches. C1 should have 1/8-inch plate spacing for power levels up to 250 W — the maximum dc-power input allowed in the USA for 30 meters. C1 and L1 are varied until the SWR is 1:1. The bandwidth of the L network will be great enough for coverage of the entire 30-meter band when the SWR is adjusted at 10.125 MHz.

Vertical Antennas

A ground-plane vertical will generally give better performance results when it is used in preference to a ground-mounted vertical at 30 meters. As we approach the upper end of the hf spectrum, the signal is affected more and more by nearby conductive objects (power lines, downspouts, plumbing, fences and even large, dense trees with foliage). Absorption and pattern distortion can result when the antenna is obstructed by such things. Better performance will result if the vertical is elevated above the nearby clutter. Another advantage to the above-ground installation is the reduced number of radial wires required. A system of four "floating" radials will permit the system to do a good job for DX work.

A simple ground-plane vertical is shown in Fig. 4. The vertical portion consists of aluminum tubing. To ensure ample rigidity and longevity, I use telescoping sections of tubing (3), starting with a 1-1/2 inch diameter piece at the bottom. The sections slide into one another for a length of 12 inches. Four slots are sawed in the outer tubing at each joint to permit a good bond between the sections when using a stainless-steel hose clamp. A short piece of dowel rod inside the inner tubing at each joint will permit the clamps to be drawn up tight without distorting the tubing.

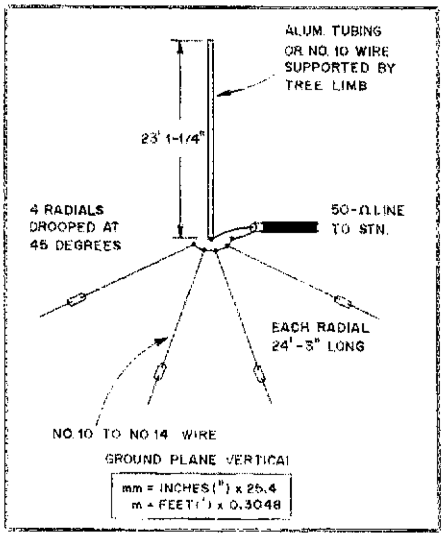

Fig. 4 — Details of a ground-plane vertical antenna for 30 meters. This omnidirectional, low-angle radiator will do a fine job for DX and local operations. See the text for information on construction methods.

The radials can serve as guy wires for the support mast. If they are drooped as shown in Fig. 4, the feed impedance will closely approach 50 ohms. If they are at right angles to the vertical element, the impedance will be on the order of 30 ohms, thereby requiring a matching section.

An antenna of this type can be made entirely from wire if you have a tall tree from which to hang it. The vertical element would then be made of wire and would require an insulator at the top end. Irrespective of the construction method used, this style of antenna provides low-angle radiation and has an omnidirectional pattern.

Tag Ends

We did not get into a treatment of gain types of directional antennas in this article. Certainly, Yagis, quads, ZL Specials and other types of antennas are worth considering if you want a single-band beam antenna. The intent here was to describe some simple, inexpensive wire antennas that are capable of delivering good performance at 30 meters. Needless to say, these antennas can be scaled to other bands of operation, and should provide equally good results. Good luck and happy DXing!

Notes

[1]m = ft × 0.3048; mm = in. × 25.4.
[2]The greatly revised 14th edition is now available from ARRL.
[3]J. Belrose, "The Half-Delta Loop: A Grounded, Vertically Polarized Antenna," *Ham Radio*, May 1982. Also, J. Belrose and D. DeMaw, "The Half-Delta Loop: A Critical Analysis and Practical Deployment," *QST*, Sept. 1982.