Take one modified helical CB whip, add even a low-power transceiver, and mix well while driving (safely, of course), and you've got the world at your fingertips. What's a "helical CB whip"? Read on...

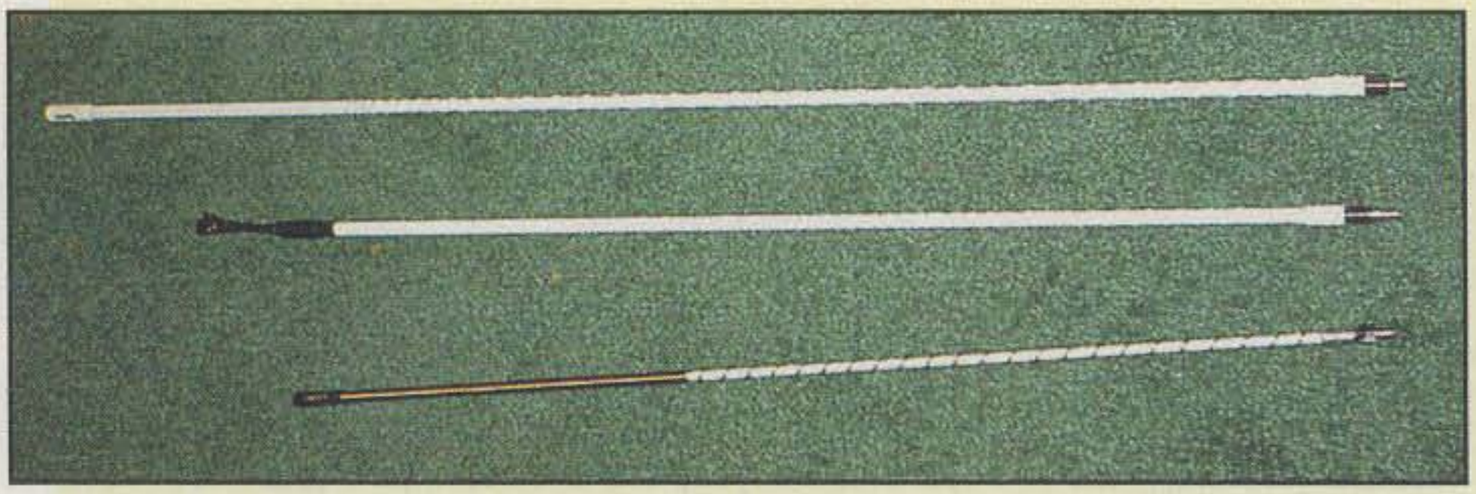
Easy Mobile Antennas for 10 & 15 Meters

BY KARL SCHULTE,* WA2KBZ

"ZL2 xx this is WA2KBZ/Ø, QRP mobile in Missouri, over." I waited anxiously to see if my flea-power 5 watt rig and minimal antenna would get through the pile-up. Back he came (Okay, it was after my fourth try) with "Go ahead the QRP mobile station, you are 57 in New Zealand, over." I did it! I had wondered if using my FT-817 and a tiny 3 foot modified CB whip would get me to the other side of the world, and the 10 meter QSO was now in the logbook. I was later to make numerous contacts around the U.S., to Europe, South America, and "Down Under" with that combination and a similar 4 foot version on 10 and 15 meters.

The efficiency of these short, modified CB helical whips is so high that I am on my way to DXCC mobile using them and a QRP rig. While I do have several full-size mobile antennas from Mark Products (makers of the Heliwhip© and its variations, as well as private-label CB whips for the trucker field—more on this below), Hustler, and so on, which are all fine products, I often find them too large. When flying or using rental cars, or when the XYL objects ("it looks silly up there!"), a shorter antenna is called for. The Outbacker is available in several models that would have fit the bill, but I like to play with antennas and wanted something much cheaper (in case airline security was to take it away).

In my Motorola career, I was the "Chief HF Consultant" for a number of years, designing HF systems worldwide and working with various antenna companies to find the elusive solution to a small, but efficient HF mobile antenna. One of those companies was Mark Products (see box for contact information). The firm's antenna family uses a fiberglass core and winds a top-loaded, roughly helical coil of enameled wire on it, most of the turns being on top.



Three of the whips described, both 3 and 4 foot models.

In testing various versions of these antennas, they were found to be far more efficient than an 8 foot whip with a base tuner, except above 25 MHz, where the 8 foot whip was nearly resonant. In the middle HF frequencies from 10 to 18 MHz, they were only a few dB below a full 1/4-wave whip at their resonant point. Bandwidth was poor on 80 and fair on 40 (pick your favorite frequency and stay near it), but excellent (nearly the entire phone band) on 20. There are other companies now making copies, but I will refer to the originals in this article, as that is what I used as the basis of the antennas described. With small variations, the same general procedure should work with the other similar products.

Top-Loaded Antennas

First, why use top-loaded antennas? In a simple way, a vertical whip can be considered as half of a vertical dipole, with the car body (or earth) taking the place of the other half. The maximum current of a dipole antenna is in the middle portion, so the maximum current (and radiation) of the vertical whip is at the bottom half. Base loading puts the high-current section into a very poorly radiating coil (or tuner). Top loading is the most efficient for a given length, as the high-current portion of the antenna is able to radiate. I won't go into the full explanation here, as this is mostly a construction article. The center-loaded whip (also seen at large truck stops) is midway between the other two types and can be modified as well, but at greater cost.

Visit a RadioShack store, a large truck stop along the highway, and other distributors, and you will find a wall full of CB accessories (many of use to hams, by the way). You should see a variety of plastic-covered whips with spiral wire turns showing through the plastic, some thin and some a bit thicker. The useful ones for this project are the 4 foot and 6 foot models. Try for a fatter glass core and the white or red covers (easier to label as to its modified frequency).

Prices vary, but $8 to $14 is typical. The 6 foot version is more efficient by a few dB, but the 4 foot model is easier to pack. The 3 foot model is okay, with reduced performance on 10, but only if you have a 100 watt rig, not QRP. I will

*3515 Schott Rd., Jefferson City, MO 65101
e-mail: <wa2kbz@aol.com>

address the 4 footer, but the technique is applicable to all of the above.

As purchased, the whip is tuned to about 27 MHz and is meant to screw into a standard-thread CB mobile mount, a number of which will be hanging right next to the antennas. For portable, no-holes operation (assuming you don't have a tractor trailer truck), the magnet mount is best. This will work for smaller ham whips as well, by the way. The antenna should be used in the mount you tune it up with, as there will be variations among mirror, trunk-lip, and magnet mounts, as well as general location of mounting (roof or trunk). A heavy-duty, plastic-covered white whip with a red cap is likely to be a Mark Products "private label" antenna. Whichever choice you make, you must be able to see the wire spiral beneath a soft plastic cover.

Retuning Tools

You will need to have/buy/borrow a wattmeter or SWR meter and a short coax jumper (every ham should have one of these anyway). With the SWR bridge between the radio and antenna in its mount, tune to the bottom edge of 10 meters, set it for low-power CW or FM out, and check SWR. Record it (it will be very high). Begin the frequency change to 10 meters by sliding off the cap (toothpicks carefully slid under the cap to break vacuum may help). Using needle-nose pliers or tweezers (your wife will have these), pull up the end of the wire and remove about three turns.

On Your Mark...

If you try to find Mark Products on the internet today, you'll succeed, but you won't find any HF antennas. When I worked at Motorola, Mark Products had already merged to become Anixter-Mark; later it split off, again becoming just plain Mark, then Mobile Mark. Finally, the company sold off its low-frequency antenna line to Solarcon, in Holland, Ohio. It appears that Solarcon sells only to dealers, not directly to consumers. Information is available on the web at <http://www.solarcon.com> or by phone at 800-445-3991. Two other manufacturers of helical-whip CB antennas are Aerpro International in Australia (<http://www.aerpro. com>) and Wilson Antennas in Rock Island, Illinois (<www.wilsonantenna.com>).

Using a flat-blade screwdriver, push the cut end of the antenna wire back down inside the plastic cover. It must lie flat against the other turns to avoid corona.

Put the plastic cap back on, return the antenna to its rooftop place, close the car door (after you get back in!), and recheck SWR. It should be lower. If you have an MFJ HF or HF/VHF Analyzer, you can go below the 10 meter band and find its resonant point and follow it up into the 28.4 MHz target point for SSB. You may not use your ham radio, as it would be illegal to transmit, even with a 1 watt signal, outside of the band. Go up to about 28.1 and recheck; it should be worse. This step ensures that you did not take off too much and go past the lower edge of 10. Take off another turn and repeat the above. Proceed slowly and carefully.

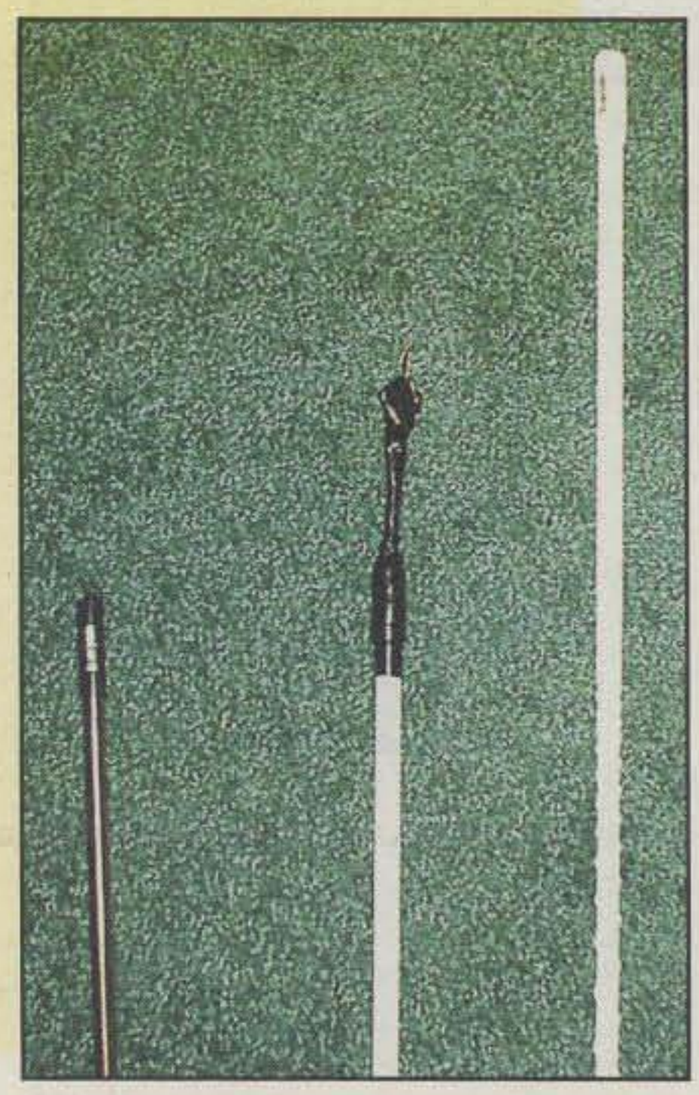
When you are very close, a turn or two too much will jump you up into the FM portion of 10 meters instead of the SSB sub-band. You may have to cut away some of the outer wrap, but always leave at least 1/4 inch above the last turn. I have done this on six antennas, and it takes about 15 minutes to do it right. Lose patience and you could keep going up to 6 meters as a consolation prize!

By the way, this 11–10 meter version can work on 6 meters as well; just be careful and go slowly. A calibrated SWR antenna tool such as the MFJ Analyzer or equivalent is recommended. This will allow 6 meter FM (vertical polarization) with a 3 foot antenna and very good efficiency.

On-the-Air Check

Being sure that you have the last/top turn pushed down flush and the cap back on, you are now ready to use it. As an added advantage, the plastic antistatic weatherproof cover reduces rain static as you drive (and helps you find the car in the parking lot).

First check the bandwidth; a 4 foot whip centered on 28.4 MHz should work from 28 to 28.9 with good to very good SWR. It will be no more than one-half to one S-unit below a full-size whip, and—if it is placed on the roof—equal to an 8 foot whip mounted on the bumper. You will be able to get into parking garages and gas stations without breaking glass and scraping up the antenna on the roof. The 3 and 4 foot



Close-up of the top sections and the gradually increasing pitch of the helical windings. The 15 meter antenna has a "top hat" covered with tape and and a few turns of wire capacitively coupled outside of the tape to fine tune it.

versions are easily packed in a two-suiter (but keep the magnet away from video and audio tapes!). The 6 foot version on the roof will be superior to a full-size whip on the bumper by several dB, but doesn't travel as well. All of them also reduce intermod from out-of-band signals, acting like a pre-selector. Ten meters is still hot, so come join the fun!

15 Meter Version

The first half of this article discussed how to make a quick modification to a helically wound CB whip to get on 10 meter mobile quickly and cheaply. The same antennas can be made to work on 15 meters and are also effective (I just worked six states on the east and west coasts, South America, and some Europeans with a 4 foot version using my 5 watt FT-817; one QSO was even made with 2 watts). Reports varied from 53 to 59, depending on band conditions. I used a 3 footer in Turkey with the same rig last year and made several QSOs around Europe until I got my long wire up.

To operate on 15 with one of these whips, which again are found at RadioShack and most large truck stops, there are two ways to go: cheap and harder but neater, or cheap and easy but a bit unprofessional. I'll describe both. As before, you will need a calibrated signal source (MFJ Analyzer or ham rig) and an SWR bridge, but also some heat-shrink tubing (large hardware store, RadioShack, etc.), some large tinned lugs for # 8 wire, tools, and perhaps copper-coated welding rod or hobby-store brass wire.

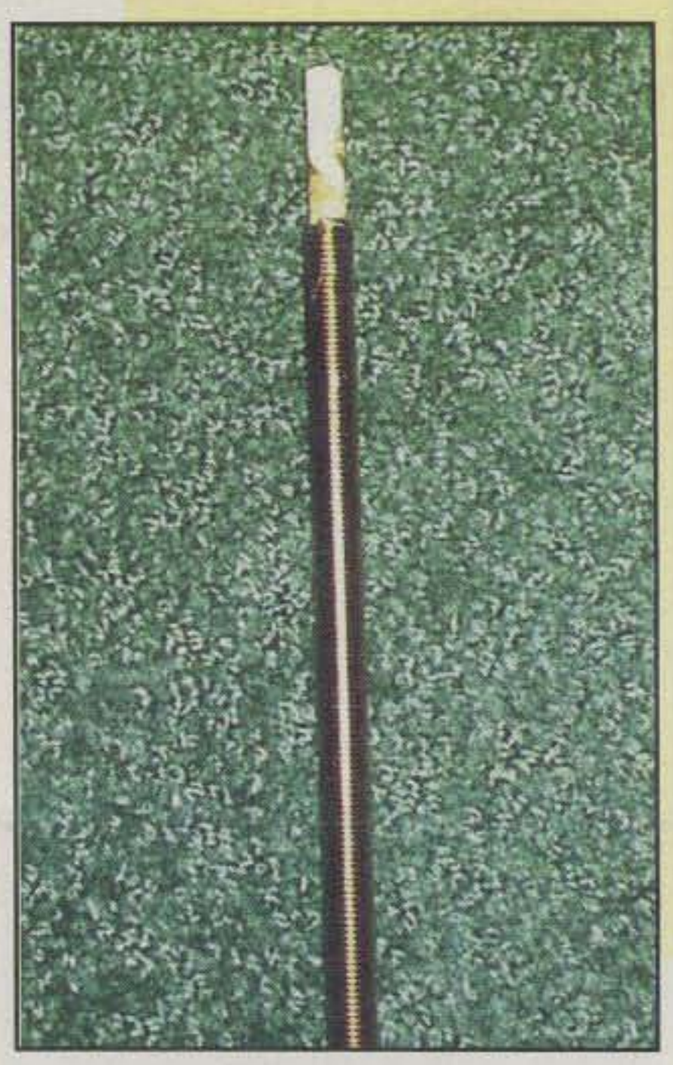
In either case, remove the top cap, drill a small (about 1/16 inch) hole in the top, and set it aside. With needle-nose pliers, pull up the end of the antenna wire approximately 8 inches. *Do not cut it yet!* Thread the wire into the cap hole and replace the cap where it was. With a knife, scrape off the enamel at the top of the wire, place a lug there, and *gently* squeeze it with the pliers to make contact. It should not slide, but be able to be "unsqwuozed" to loosen it. With the antenna in its mount/location, check SWR at 21 MHz. Using an MFJ Analyzer is definitely easier, as you can find its real resonance and better judge how much to adjust. As the added capacity of the top wire has greater effect on the frequency than the few turns removed, the frequency will be much lower than 11 meters, probably around 19 MHz (as it was for me). By clipping off *small* (1/4 inch) pieces of wire and replacing the end lug (you'll need several), you will walk the antenna up to the *bottom* edge of 15 meters. Be patient! The goal is almost reached.

Now put two pieces of heat shrink over the wire (lug off), shrinking each in turn. Drop a bit of Q-dope (dissolved Lucite) or clear fingernail polish at the base of the wire where it enters the outer wrap to lock it place. *When it dries,* replace the end cap, with wire (now covered by two layers of shrunk shrink) sticking up through it. Replace the end lug (trim enough wrap to bare/clean off the wire at the tip). Check SWR; it will have changed. If it moved down, clip off a little bit of wire, replace the lug, and recheck. A small change in the top section will make a big change in frequency. If you go too far, say up to 21.5, use the next-size lug. As long as you end up with your resonant/minimum SWR point anywhere between 21.2 and 21.4, it will make a fine 15 meter mobile antenna.

The last step is to final-crimp and solder the lug to the wire, coat the joint and lug with Krylon spray or clear polish, and recheck SWR. Even extra solder can change it a few kHz. A tiny bit clipped off the end of the lug (do not leave any sharp points) or a few turns of black tape at the base of the end cap will affect frequency; you can use this to fine tune. Mine was at 1.2:1 on 21.35 less than an hour after I started the project.

Now what about the brass wire? For those who feel that a good signal is not enough, but also want good looks (the first version will look odd, especially to XYLs), the wire or brass rod can be used for the end of the antenna. It must be thick enough to stay vertical in wind (70 mph) but flexible so it will bend if it hits something. You must drill a small hole in the top of the fiberglass rod, close to dead center, about 1/2 inch deep. It should be just a hair larger than the wire used so that glue or epoxy (a thin coat on the end of the wire/rod) will fill the gap. Mount the brass hobby rod or copper-coated welding wire in the hole. Remove approximately 6 inches of wire coils and cut off the wire, but leave enough to wrap around the brass wire where it enters the fiberglass (after thoroughly cleaning off enamel and epoxy). Solder the antenna wire end to the brass wire/rod. After it cools, coat with nail polish and slip one just-big-enough heat-shrink tube over the brass and shrink it. Using a heat gun or soldering iron held close (rather than a match) is best, as the nail polish may ignite with a flame and leave a carbon film. Put the cap on over the wire, clean off the wire end, gently put on the lug, and proceed as above to move resonance into 15 meter SSB.

The lug on the end acts as a loading capacitor (like a tiny top hat) and makes the antenna safer to eyeballs. Now you can still work mobile DX when the sunspots fade and kill 10 meters! ■



*Close-up of the top of the helical winding. The last turn **must** be pressed flush against the turns below it to avoid corona effects from its sharp end.*