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Author: Steve Cerwin, WA5FRF

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Bicycle-Mobile Antennas

NEW HAM COMPANION

By Steve Cerwin, WA5FRF and Eric Juhre, KØKJ/5

10227 Mt Crosby Dr
San Antonio, TX 78251

7874 Hawk Trail
San Antonio, TX 78250

Take your FM hand-held on the road!

If you're a ham *and* a bicycling nut, you know that there are many good reasons for going mobile on your two-wheeler—with safety topping the list. Whether you ride alone or with a group, the unexpected can always happen. Reliable amateur communications can be a valuable asset in an emergency—maybe even a life-saver. Take, for example, the 1992 "Hotter'n Hell Hundred"—a grueling 100-mile bike tour/race held in hot, dusty Wichita Falls, Texas, in August. During the event WA5FRF used his bicycle mobile station to summon emergency help for a rider who had collapsed from heat exhaustion and dehydration. Chalk up another "save" for ham radio!

When riding for pleasure and exercise, having ham radio along makes the miles go by quicker. But the path to an efficient bicycle mobile installation is not straightforward. Several years and *many* miles were spent testing different antenna configurations.

Development and Testing

The rig most bike-mobileers use on the road is a 2-meter FM hand-held, with perhaps a lapel speaker/mike or a boom-mike and headset. Unfortunately, most use the standard rubber duck antenna with the radio held against the body in a waist mount. This invariably results in poor performance and short range. As is the case with your home station, the *antenna* is the key to successful operating. Vast improvements can be achieved by separating the antenna from the rider and using full-size, high performance antennas.

A pannier bag mount (luggage rack) over the rear wheel is a good location for an antenna because it provides about as much distance between the rider and the antenna as possible. The first experiments with bicycle-mobile antennas were done with a simple quarter-wave whip mounted at the rear of such a rack. It was hoped the antenna would see the bike frame as ground and work against it. No such luck. The bike frame was actually a very poor ground reference because the whip could not be adjusted to any length that would provide an acceptable SWR. Performance was dismal, to say the least!

Next, a J-pole and a vertical half-wave fed with a gamma match were tried. These antennas worked well and could be tuned to an SWR of less than 1.5 to 1. With each of these antennas, direct contacts to base stations 20 miles away became routine. Local repeater operation was solid as well. Both antennas, however, proved to be mechanical nightmares. The J-pole, at an overall length of 57 inches, was huge and top-heavy, swaying wildly with hard pedaling or hard braking. (Thank goodness we always wear helmets!) Even worse, this wobbling motion caused rapid wear on components in the lower matching section of the antenna. The vertical half-wave was just as bad, if not worse. The gamma matching section made it even more top-heavy than the J-pole.

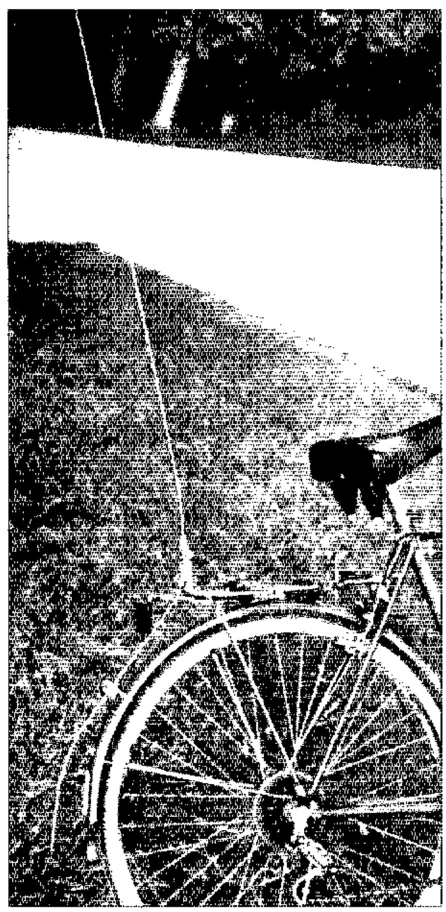

Fig 1—A ⅝-wave antenna and counterpoise mounted on the back of a bicycle luggage rack. *(photos by Steve Cerwin, WA5FRF)*

Still seeking a simple antenna, attention was turned to the venerable ⅝-wave whip. Of course, that meant that if the antenna was to load, the grounding problem mentioned earlier would have to be solved. This turned out to be easier than expected. Simply mounting a quarter-wave counterpoise extending directly below and away from the antenna did the trick (see Fig 1).

The antenna was home brewed with parts from an old CB whip, but commercial antennas work equally well. The 19-inch counterpoise was made from stiff wire and connected directly to the antenna's base mounting plate. The counterpoise was held away from the bicycle fender by a plastic spacer secured with a plastic tie-wrap.

This antenna is a real barn-burner—outstanding in all categories! The SWR is better than 1.5:1 and on-air performance is excellent. We made numerous roadside comparisons between the ⅝-wave and the rubber duck. Without exception, the full-size bike-mounted antenna proved to be the consistent winner. Mechanically, the ⅝-wave is more stable and very well behaved. QSOs with base stations, through repeaters, and with other mobiles were enjoyed using this setup.

A Resonant Antenna Mount

WA5FRF logged over 3000 miles and the antenna installations served him well. In time, he acquired a new bicycle—a hybrid, which had neither fenders nor a luggage rack. He wanted a special mount which would support the antenna at a reasonable standoff distance and provide a resonant counterpoise. The results of this development are shown in Figs 2 and 3. The mount is made from ⅜-inch aluminum rod stock used for the vertical and lateral supports. A piece of aluminum U-channel serves as the actual antenna mount. The supports attach to existing threaded holes on the frame and the whole assembly is painted to match the bike's color scheme.

The vertical supports are ¼-wavelength long (19 inches) and insulated from the frame by short sections of Fiberglas tubing (½-inch OD × ⅜-inch ID). These vertical supports also act as the resonant counterpoise. Short pieces of aluminum rod are inserted into the bottom of the Fiberglas tubes to provide crush strength at the attachment point to the frame. The Fiberglas tubes are attached to the vertical supports and bottom inserts with small screws. The bottom ½-inch of each support is shaped into a **D** cross section by making axial and radial cuts with a hacksaw through the Fiberglas tubes and aluminum inserts. This provides a flat surface for mounting against the frame. Approximately 1 inch of open tubing exists between the inserts and the bottom ends of the vertical supports to form the insulating section.

The lateral supports attach directly to the bike frame immediately behind the seat post (no insulators). The threaded attachment holes were originally used to hold the rear reflector. The reflector is moved to the back of the antenna mount and secured in place with an angle bracket. The lateral supports are also 19 inches long (a quarter wavelength) and are bent to fit the frame and provide clearance for the bike bag behind the seat. The length of these elements is probably not critical, but a quarter wavelength tends to isolate the antenna base from the bike frame and positions the antenna at a workable distance behind the rider. The coaxial cable from the threaded antenna mount is secured to one of the lateral supports with tie-wraps.

The antenna itself is a commercial ⅝-wave. A standard threaded mount allows for quick and easy removal of the antenna for bike storage, transport or service. The antenna is pruned to resonance (1.3:1 SWR) using the manufacturer's instructions and an SWR bridge. Since the SWR changes slightly with the position of the rider, the final adjustments are made with the rider on the bike in a normal riding posture.

As with the previous ⅝-wave design, performance of the installation is outstanding. Being a true glutton for punishment, WA5FRF participated in the "MS150 Bike to the Beach," a two-day, 150-mile ride from San Antonio to Corpus Christi, Texas. Using this antenna system with a 4-watt hand-held, he enjoyed continuous communications over the entire course.

Hints and Kinks for Bicycle Mobiling

If you plan on going bicycle mobile, here are a few tips for the road:

❑ Most bicycling accidents involve head injuries, so *always* wear a helmet. Special bicycle helmets are available. They're lightweight, ventilated and provide good protection. Padded riding gloves are worthwhile, too. They give your hands more endurance and protect them in the event of a fall.

❑ Never obstruct your hearing by covering both ears with headphones. Your sense of hearing is crucial when riding in traffic. A lapel speaker/mike is safest, followed by the type of headset which loosely covers only *one* ear. Keep in mind that wearing headphones while cycling is illegal in many localities. Besides, covering even one ear may interfere with your ability to determine the direction that big gravel truck is coming from!

❑ *Learn and follow* the rules of the road. Bicycles are vehicles and are accorded the same rights (and responsibilities) as automobiles.

❑ Set up your bicycle mobile installation so you can always ride with both hands on the handlebars. Some boom-mike/headsets have inline push-to-talk (PTT) switches which can be held and operated in one hand while both hands remain on the handlebars. A handlebar-mounted PTT switch is another attractive alternative. Keep wires and cables away from pedals, chains, etc. Make sure they don't restrict the free side-to-side movement of your handlebars.

❑ Don't mount your transceiver directly on the bike frame. Bikes have no shock absorbing ability and normal road vibration can break parts in the radio. We know this from bitter experience! Steve, WA5FRF, carries his radio clipped to his waist. This allows his body to act as a shock absorber. He also has the HT secured at the end of a neck strap to keep it from falling. The BNC connector on the antenna cable is only pushed onto the HT antenna connector (not twisted and locked) so that the cable will pull free in the event of a fall. Eric, KØKJ/5, clips his HT to his bike bag behind his bike seat. This seems to provide adequate shock isolation and keeps him from being tangled in the antenna cable when getting on and off his bicycle. He uses a lapel speaker/mike which plugs into the radio and is clipped to his shirt collar while riding.

Conclusion

Bicycle mobile operation can be a lot of fun and it significantly enhances the safety of cycling. The ability to access an autopatch in the event of an emergency or mechanical breakdown is well worth the effort required to install your radio! With the right antenna, you'll enjoy surprisingly good coverage.

See you—or even better—talk to you on the road!

Steve Cerwin, WA5FRF, holds an Extra Class amateur license and has been a ham for over 30 years. He is a Staff Scientist for Southwest Research Institute where he designs custom electronic instruments and systems. Steve graduated with a BS degree in physics from Saint Mary's University in 1971 and now teaches an evening course there in Electrical Engineering. Other interests include radio-controlled model aircraft, photography, hunting, fishing, boating and, of course, bicycling.

Eric Juhre, KØKJ/5, is a retired Air Force Major, currently freelancing in technical writing, small computer maintenance and software design. He spent 15 years as an Instructor Pilot and flight examiner on Strategic Air Command Electronic Communications, Airborne Command Post and Reconnaissance aircraft. Eric graduated from the University of Missouri in 1972 with a Bachelor's Degree in Journalism. He has been a ham for over 30 years.

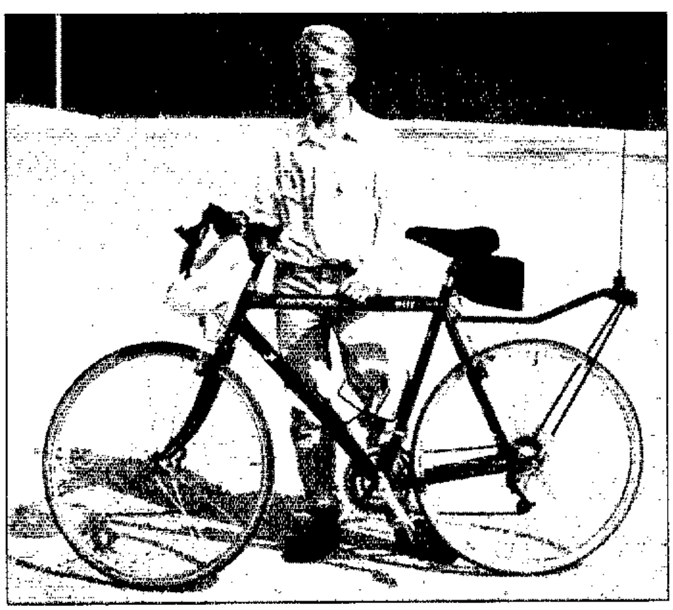

Fig 2—Andy Cerwin with his father's hybrid bicycle. The bicycle is equipped with a resonant antenna mount and ⅝-wave antenna.

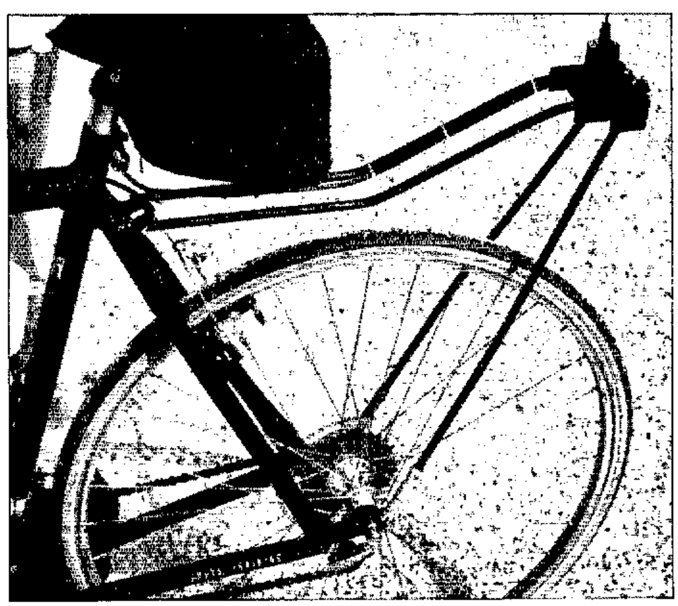

Fig 3—The vertical supports of the antenna mount serve as the resonant counterpoise.