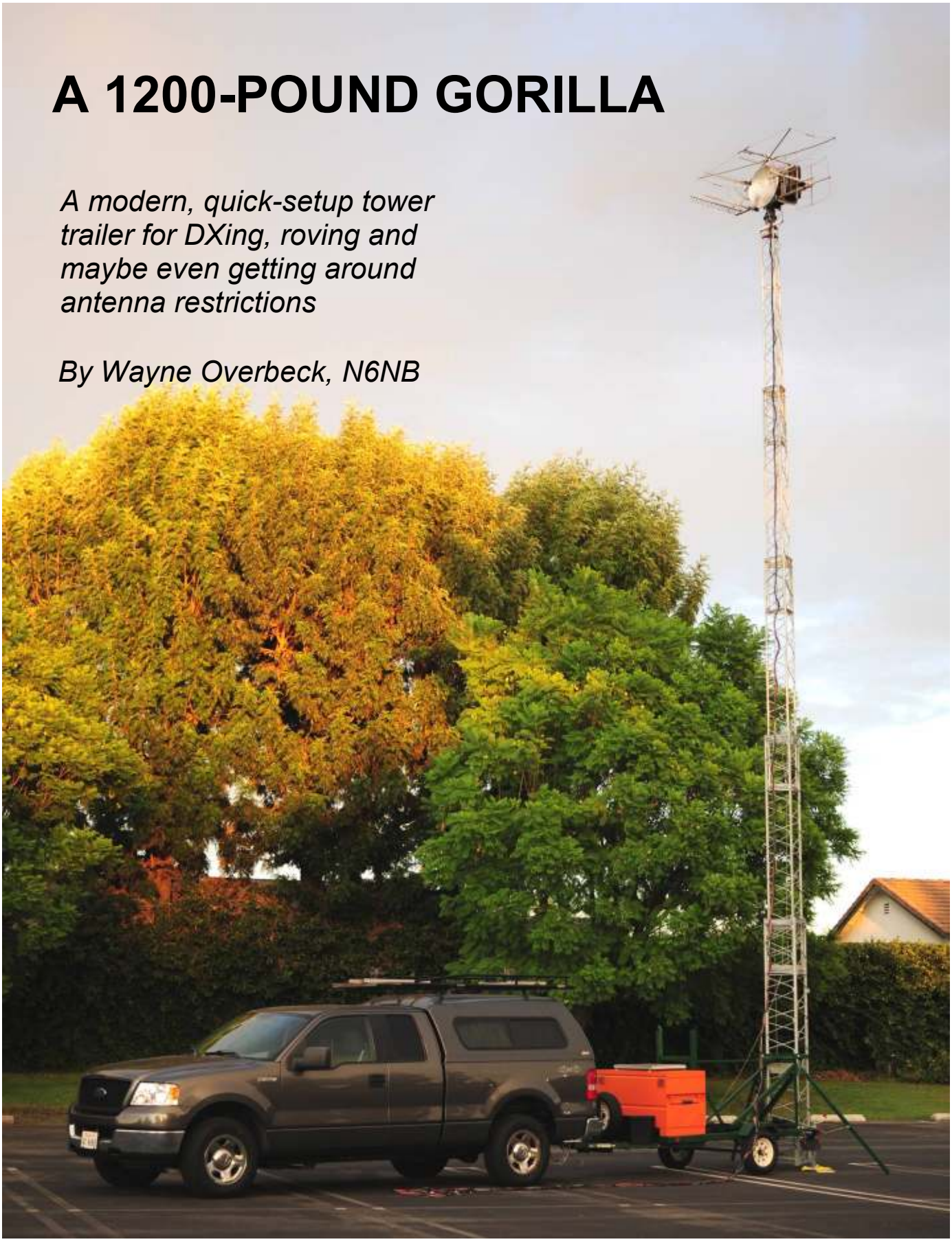
A 1200-POUND GORILLA

A modern, quick-setup tower trailer for DXing, roving and maybe even getting around antenna restrictions

By Wayne Overbeck, N6NB



One of the biggest challenges of portable operating or roving is finding a way to get antennas high enough to clear obstacles in the near field. Now thousands of radio amateurs face the same challenge at home--in the form of antenna restrictions. According to recent filings with the Federal Communications Commission, about 62 million Americans live in deed-restricted communities. In many of them outdoor antennas are banned or heavily regulated.[1]

A few hams have a solution: a tower trailer. As a *licensed vehicle*, a trailer is not subject to many land-use restrictions that would apply to a *structure*. Radio amateurs have been known to park a tower trailer on a driveway or behind a gate and put up an antenna high enough to clear the surrounding buildings and trees in a community where a fixed antenna would not be allowed. When that happens, the city or association board has to grapple with a dilemma: allow a ham to have an antenna on a trailer or find a way to outlaw trailers.

Hams have been building tower trailers and rebuilding surplus ones for years. At least two articles about building tower trailers appeared in ham radio magazines more than 30 years ago.[2,3] But tower trailers have always been expensive to buy and a lot of trouble to build. That has now changed with the advent of low-cost imported utility trailer kits (yes, *kits*). Major home improvement chains and tool importers offer them with payload ratings of nearly a ton at prices under $400.

This article is about turning a utility trailer kit into a modern tower trailer with electric winches to control all tower movements. The winches are powered by a "gel" cell battery that is recharged by a solar panel mounted on a large storage box. The tower has an extended height of 41 feet plus the height of a rotor and mast. It can easily support an HF Yagi or a stack of VHF+ antennas. In the photos here, the tower trailer is configured for VHF contests, with a stack of antennas covering all 10 bands between 50 MHz and 10 GHz. The setup time from arrival at a site to getting on the air is only a few minutes.

BUILDING THE TRAILER

The starting point in building this trailer was to purchase a 4'x8' utility trailer kit at Harbor Freight (item #94564). The complete kit weighs about 200 pounds and can be built in a weekend. This model has the highest payload rating of any trailer listed on Harbor Freight's website. The finished trailer has a gross vehicle weight rating of 1980 pounds and a rated

payload of 1720 pounds. The trailer kit comes complete with lighting and a manufacturer's certificate of origin.

Once this utility trailer was built, getting it registered and licensed was easy in my case. The California Department of Motor Vehicles did a perfunctory inspection and promptly issued a license plate. Then the real work began: turning a utility trailer into a tower trailer. When it was finished, the entire package weighed in at 1200 pounds, including the original trailer, the tower and the superstructure to support it, a large orange job site box from Home Depot, antennas, a rotator, three electric winches and a 75 ampere hour gel cell battery to power them, a solar panel and various accessories.

The design was dictated by the tower that I had on hand, a U.S. Towers model TMM-541SS. It has a retracted height of 12'6" (slightly more than indicated in the manufacturer's specifications) and an extended height of 41'. The stated weight of the tower is 430 pounds, but that includes the weight of the concrete tower base, not used on a tower trailer. The tower itself weighs just under 400 pounds. A small rotator such as a Yaesu G800 will fit inside the top section, but only with the top section extended part way. I mounted a G2800 rotator on top of the tower, using the pre-drilled holes and adding almost a foot more to the retracted length of the tower. I wanted to be able to travel with a stack of VHF+ antennas in place to make the setup at each site go faster, so I allowed additional room over the tongue for the antenna stack. As shown in the photos, the tower overhangs the rear by 49" to allow it to be tilted to an upright position by winches on the trailer. Appropriate lighting marks the tower overhang.

To strengthen the trailer frame and provide a way to mount the tower support structure, I added three pieces of steel running the full length of the trailer bed (8'). These three (two lengths of 2" angle stock and one 2" channel) are secured to the original frame with hardened 3/8" bolts. The superstructure, shown in the photo at left, is attached to these added steel pieces. The structure holds the tower in place 35" above the trailer frame. The tower rests in a cradle at the front and on a pair of heavy duty hinges at the rear. These hinges are secured with hardened 1/2" bolts to a large bracket that supports the weight of the tower and provides stability when the

tower is upright. A lower bracket is bolted to the trailer frame to secure the base of the tower in place before it is elevated to its operating height.

The rear of the trailer frame has two trailer jacks that fold down to allow the frame to hold the weight of the tower when it is upright without placing an additional load on the hitch, trailer tires and suspension system. With a front tongue jack in place, the tower can be raised and lowered even if no vehicle is hitched to the trailer as long as the wheels are blocked. If a vehicle is hitched to the trailer, the receiver hitch may need a drop or a rise of 1-2" to keep the trailer level and the tower vertical when upright. That depends on the hitch height of the towing vehicle. It wasn't needed on my Ford F150 but was needed on two other towing vehicles that have been used.

Two outriggers were added to the trailer frame to provide lateral stability when the tower is raised to its full height. As shown in the photographs, they travel on the trailer and swing outward on their hinges for use. Cables and turnbuckles secure the outriggers to the trailer.

The trailer has two storage boxes that are necessary not only for storage but as a counterweight to the tower. Without them, the tower trailer would be dangerously rear-heavy. The large orange storage box weights 150 pounds empty. The smaller additional tongue box provides a place to store tools that might be needed when the tower is horizontal for travel. The orange box cannot be opened fully except when the tower is upright. With the boxes plus the antenna rotator, antennas, gel cell battery, solar panel, and other equipment mounted forward of the axle, the tongue weight is about 100 pounds.

A spare tire is also mounted on the tongue of the trailer, attached to angle stock that I added to reinforce the tongue.

One of the more interesting aspects of this tower trailer project was hoisting the tower onto the trailer. Despite the dire warnings about overhead use that always accompany hand winches, guy cables and pulleys, a hoist was fashioned from 2x4s, steel channel stock and a heavy 8' ladder to lift the tower. Making sure no one was underneath the

tower or the hoist, I used a hand winch to lift the tower high enough to roll the trailer under it. Then I lowered the tower into its final position.

Perhaps it's worth noting that I did essentially the same thing to install an LM-470, a 70' tower that weighs over 1,000 pounds, on a homemade tower trailer in 1978--and lived to write about it[4] That tower is shown halfway raised in the 1978 photo at left. It is still in place on its trailer nearly 35 years later, but it isn't likely to move ever again. It was towed to a mountaintop in the Tehachapi area in 1995 after I built a cabin on an 8-acre parcel there. Someone promptly jacked up the trailer--which weighed well over 2,000 pounds with its tandem axles and four wheels--and stole not only the tires but also one of the axles and the springs. The tower trailer stayed there, jacked up on blocks, with the LM-470 upright for use on the mountain. Years later, a forest fire roared across the mountain, destroying over 100 buildings and almost everything in a 14,000-acre area--but leaving the tower trailer and LM-470 largely intact, upright but with no axles or wheels.

In this new tower trailer project, some things have been improved. In place of a hand winch, two electric winches are used to tilt the tower upright. The main winch pulls the tower up to a point just short of vertical. At that point, a second winch is used to restrain the tower so it doesn't crash into the supporting frame when its center of gravity shifts. The two winches work together to gently guide the tower to its upright position. Once the tower is upright, a third electric winch raises the tower to its full height. These three winches are rated at 2,000 pounds each. Using them makes the tower erection process go very quickly. The only obvious disadvantage is that they are much noisier than a hand-cranked winch. Raising and lowering the tower late at night in a residential neighborhood is not recommended! This tower trailer might survive in a deed-restricted community because it is a licensed vehicle instead of a structure--but not because it would go unnoticed or unheard.

One major change in the trailer itself was required before it was roadworthy. Two of the trailer lights that came with the kit only worked intermittently. I replaced them with a set of aftermarket LED trailer lights that work reliably and make the trailer hard to miss on the road at night. In addition, three LED clearance lights mounted inside the bottom of the tower make its full length obvious.

SETTING UP AND USING THE TOWER TRAILER

Once the tower trailer was built and tested, a stack of VHF+ antennas was mounted on an aluminum frame attached to the G2800 rotator. A large black outdoor case atop the tower houses transverters and in some cases amplifiers to deliver 10 watts output on 902, 1296, 2304, 3456, 5760 and 10368 MHz. That power level was chosen so the unit would qualify for the QRP portable category in ARRL VHF contests. The box was mounted on top to minimize feedline losses. The stack also includes a cubical quad for 144, 222 and 432 MHz and a Moxon for 50 MHz, with feedlines going down the tower to the operating position. The cable harness also includes a 144 MHz i.f. cable, a cable to carry the 10 MHz Rubidium reference signal up to the transverters, a heavy 12-volt power cable, a rotator cable and a control line to select the desired band in the tower-top box.

The typical setup involves just a few steps. First, you park in a level place and set the brake. Then you go to work on the trailer, lowering the two rear jacks and positioning the two outriggers. Next, the tower is raised to its upright position (as shown at left in a photo reminiscent of the 1978 photo on the previous page) and the lower rear bracket is secured around the tower with two 1/2" bolts. Finally, the tower is elevated to its full height and the cable harness is routed neatly out of harm's way. This can all be done quickly enough that it's feasible to get on the air in several different places on a given day.

How well does this system work? In the places where rovers often operate, the results with a tower trailer can be spectacular. With buildings and foliage in the near field, normal vehicle-mounted rover antennas have their limitations. Only if it's possible to get into the clear on a foliage-free hilltop does a typical rover setup perform very well on long paths. But with a tower trailer, it's an entirely different game. When the tower is raised from its nested height to its full height, signals often increase by four S-units or more. Many locations that would otherwise be useless suddenly become outstanding when you can raise your antennas above trees and

buildings. Even in an open field, raising your antennas from a height of 10' or 12' up to 45' can make an amazing difference.

A tower or tower trailer is useful even on famous mountaintops like Mt. Greylock, MA, or Mt. Equinox, VT. Those places have enough foliage that a tower can make the difference between a so-so signal and a truly big signal. The proof of that is W2SZ, the perennial top scorer in VHF contests for more than 30 years. Twice a year the Mt. Greylock Expeditionary Force hauls several towers up the mountain and installs them just for a contest, only to dismantle them after each contest is over. The extra height is needed to clear obstructions even on Mt. Greylock.

Having a tower trailer available turns a lot of ordinary places into truly great VHF locations, including many wooded hilltops and even seaside sites where it's impossible to get clear of buildings without elevating your antennas 30 or 40 feet above ground level. But once you can do that, a whole world if DX awaits.

I would like to thank Carrie Tai, W6TAI, for her help in building this tower trailer. She did all of the painting, among other things. In fact, it was her idea to paint a red utility trailer and the unpainted steel superstructure the green color shown in the full-color version of this paper. Only she could envision that a green trailer with a silver tower and a bright orange storage box would look okay.

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[1] See Comments of Community Associations Institute in GN Docket No. 12-91, May 17, 2012.
[2] Overbeck, Wayne, "Godzilla on Wheels," in *CQ*, August, 1980.
[3] Overbeck, Wayne, "You CAN Take it With You," in *Ham Radio Horizons*, January, 1979
[4] Overbeck, "Godzilla on Wheels," *CQ*, August, 1980.

About the author: First licensed in 1957, Wayne Overbeck has been interested in portable VHF+ operating for more than 50 years. He won the Radio Amateur of the Year Award at the Dayton Hamvention in 1980 as well as the ARRL Technical Excellence Award and the John Chambers Memorial Award of the Central States VHF Society in 1978, largely for his VHF expeditions and his work on the original "VHF Quagi" antenna. As a contester, he had the highest single operator scores in 10 VHF/UHF contests while operating in California in the 1970s. Then he towed a tower trailer east and won two contests on Mt. Equinox, VT, setting a September VHF scoring record that was never broken while ARRL sections were being used as multipliers. More recently, he had record scores as a rover in all three major VHF contests and also set new records in all three as a single operator in the QRP portable category. He is a retired attorney and Professor of Communications at California State University, Fullerton who holds Ph.D. and J.D. degrees.