

Electronic wizard Ken Meyer

a handy man to have around

By KETA STEEBBS

Attention, all you good people out there in Scannerland.

Did you know there's a law against repeating what you hear?

That's right, anyone can listen in on a scanner but once you tell a single soul, including your spouse, what you've heard, you've violated a federal law.

This informative little tidbit (which places both my best friend and editor in the outlaw class) was one of many hitherto unknown subjects I learned from a young man, who, despite his lack of formal education, could double as a walking encyclopedia.

His name is Ken Meyer; he's 35 years old; his title is "communications security deputy" and for the past four years he's worked in the secured section of the safety building.

Unlike the "day men" who are familiar to the average visitor, Ken is virtually unknown. Working as he does the 3 to 11 p.m. or even more hectic graveyard shift, Ken goes on duty after "office hours." That's why the only citizens who really get to know him aren't overjoyed. They're usually there unwillingly.

Despite certain obvious drawbacks, such as understaffing, poor layout and numerous other faults pointed out in a recent study, the jail isn't too bad a place to work. At least Meyer enjoys his job and has

no qualms about saying so.

An engaging, articulate man with a lifelong interest in radio, Meyer's forte is being kept busy, especially when it comes to improving the safety building's communication system. Although his prescribed duties alone fill a two page (single spaced) job description form, Ken still finds time to put his electronic wizardry to work.

Officially, a communication-security deputy is charged with the responsibility of "performing a wide variety of duties connected with the radio center and other related work as required." This sounds simple enough but doing the "related work" sometimes gets hectic, especially for a one man operation.

Ken, an efficiency expert who functions best with little sleep, has simplified surveillance of the cell area by installing a closed circuit television set (picked up at a swap fest) which enables him to monitor the back hallway without leaving the radio room.

Radio men have traditionally served as jailers and, as such, are responsible for the security and welfare of prisoners. The officer on duty is required to make periodic checks on the building (inside and out), operate the breathalyzer when necessary, lock prisoners in their individual cells, dispense medication, make bedding arrangements, serve meals, release and lock-up Huber prisoners and keep all jail and traffic records up to date.

During slow periods, they are expected to serve civil and criminal papers.

"The busier I am, the better I like it," Ken grins. "That's why I enjoy working nights when most of the action takes place."

One night, he admits, he could have done with a little less excitement. This was when an upset looking individual toting a shotgun tried to enter the locked building. When Meyer refused to trigger the lock, the gentlemen walked off, only to return a short time later and stand outside the undraped window, gun in plain view, peering in the radio room.

"I felt like a sitting duck," Meyer confesses. "All I could do was radio

the nearest patrol car and ask for help. It turned out the man was emotionally disturbed and just wanted to leave his gun with me before he hurt somebody but how was I to know that?"

Long an advocate and prime mover in the 911 emergency number system, Ken says that even now persons calling one of the two safety building number, benefit from almost the same service. Radio operators answer all incoming calls for both the police and sheriff's departments and dispatch assistance wherever needed.

These two numbers also serve as a clearing house for the Door county ambulance service, the highway department and local constables. An offense that takes place in Sister Bay, for example, is reported to the safety building and relayed to the nearest patrol car or village constable.

"Stress that," he urges. "Most people don't realize that all calls, no matter what their nature, go to the sheriff's office. No one in the city police department has that responsibility."

Many calls are routine, others are literally a matter of life or death. Whenever the phone rings, Ken says grimly, the operator has to be prepared for the worst. Routine calls, he adds, could be anything from a complaint about a barking dog to a request for highway conditions.

Road reports, he notes, proved so time consuming they're no longer given locally. Callers are now referred to a toll free phone number which Ken would like to see published and kept for reference. It's 1-800-363-300.

Meyers would also like to pass on a tip, hard as it may be to follow, to persons calling for an ambulance. Admitting these are stress situations, at best, Ken says it's impossible to dispatch paramedics when he doesn't know the address.

"It's difficult getting details when people are distraught but if they'd only remember to tell us where they live and calm down long enough to

Electronic wizard

answer a few questions, help would arrive sooner."

Ken says if communications were his only responsibility, life would be just great but jail duties sometimes create problems—especially on busy nights. Claiming the radio room is only up to proper manpower 17 per cent of the time, Ken can sympathize with persons who complain about "nobody being on duty."

"There's nothing more frustrating that getting a busy signal or, what's even worse, no answer at all when you're calling an emergency number," he agrees.

Ken says that because fire calls are the only calls of an emergency nature not dispatched from the safety building, a 911 system would be a decided improvement.

"It would make a big difference throughout the entire county," he explains. "The sheriff's department would still be the answering point but we'd be able to call the Sturgeon Bay fire department on a call transfer system using dedicated telephone lines. All other fire departments would be dispatched by call relay."

Ken says these "dedicated lines" are, as their name implies, used for emergency purposes only. The cost of this system would be borne by the Sturgeon Bay fire department while the call transfer system would be paid for by other county municipalities.

The only exception, Meyer adds, is Washington Island which, because it has its own police, fire and rescue services, would be better served by a separate 911 system.

Acknowledging that implementation of the proposed 911 system is at least a year away, Ken switches to the present. He says he's now working with the newly formed Southern Door fire department to install a direct dispatch system and both Egg Harbor and Baileys Harbor are showing interest in having the same type of service.

Updating the safety building's radio console is another project occupying Meyer's spare time. This console, the mainstay of the county's entire communication network, should be replaced, according to Ken, by a more sophisticated model.

"It should be equipped with a remote receiver installation and designed to be operated by two men during the busy season. This type of console is also essential for the 911 system."

Comparing his job to that of an air traffic controller, Ken says there's

one major difference. Traffic controllers rarely have a dull moment.

"In this job it can be dullsville one minute and sheer panic the next. When you see every light on the board begin glowing, hear a prisoner screaming in the cellblock and see someone pounding on the door hollering to get in, you know you're not going to need No-Doze to keep awake."

Not that Ken needs much sleep. Friends, who frequently compare him to Thomas Alva Edison, say that like the Wizard of Melrose Park, this local communication expert functions well on a few hours rest. One visit to the Meyer home explains why.

Closed circuit television monitors the visitor on the way in, during a family-room chat, and, presumably, zeroes in on the rear of the car on the way out. Not only that but all outside noises, no matter what their source, are picked up by a particularly acute sound system.

Expected visitors, of course, do not set off a blood curdling burglar system but heaven help the nosy-rosy who attempts to enter without due notice. Even Bonnie Meyer, Ken's understanding wife, can't explain her husband's phobia for all things electronic.

For example, the Meyer's 12x17-ft. entryway is devoted almost exclusively to an impressive array of objects defined as follows: (1) a homemade teletype terminal and teletype machine, both in excellent working condition; (2) a band communication receiver capable of picking up world wide broadcasts (including commercial stations); (3) a two-meter VHF radio which allows Ken to talk through other repeaters as far away as Milwaukee; (4) a stereo system which pipes music into every room in the house and garden; (5) a Sony tape recorder, good for any number of uses, and a host of other gadgets only their owner could explain.

Ken also has a telephone built into his hand-held portable radio and, with the aid of repeaters, can cover "an unbelievably long range."

The sheriff's department, he says, only has four portable radios in use. Because these mobile units could provide excellent communication in the event of a disaster, Ken would like to see more purchased.

Most of his own equipment comes from the before mentioned swap fests (either purchased or bartered) and, after being lovingly renovated,



Looking more like a modern newspaper office than a standard radio room, this secured part of the safety buildings is where Communication Security Deputy Ken Meyer takes and receives messages.

performs like new.

No story on Ken Meyer would be complete without mentioning his membership in the Sturgeon Bay Radio Club with some 25 active members. Each of these, he notes, has some sort of mobile unit and each is well versed in emergency communication training.

Because of his vast expertise, Ken has recently been named County Warning Officer and, as such, works closely with the Emergency Government coordinator. This appointment, while appreciated, is one he'd like to change.

"I'd like to see the duty officer

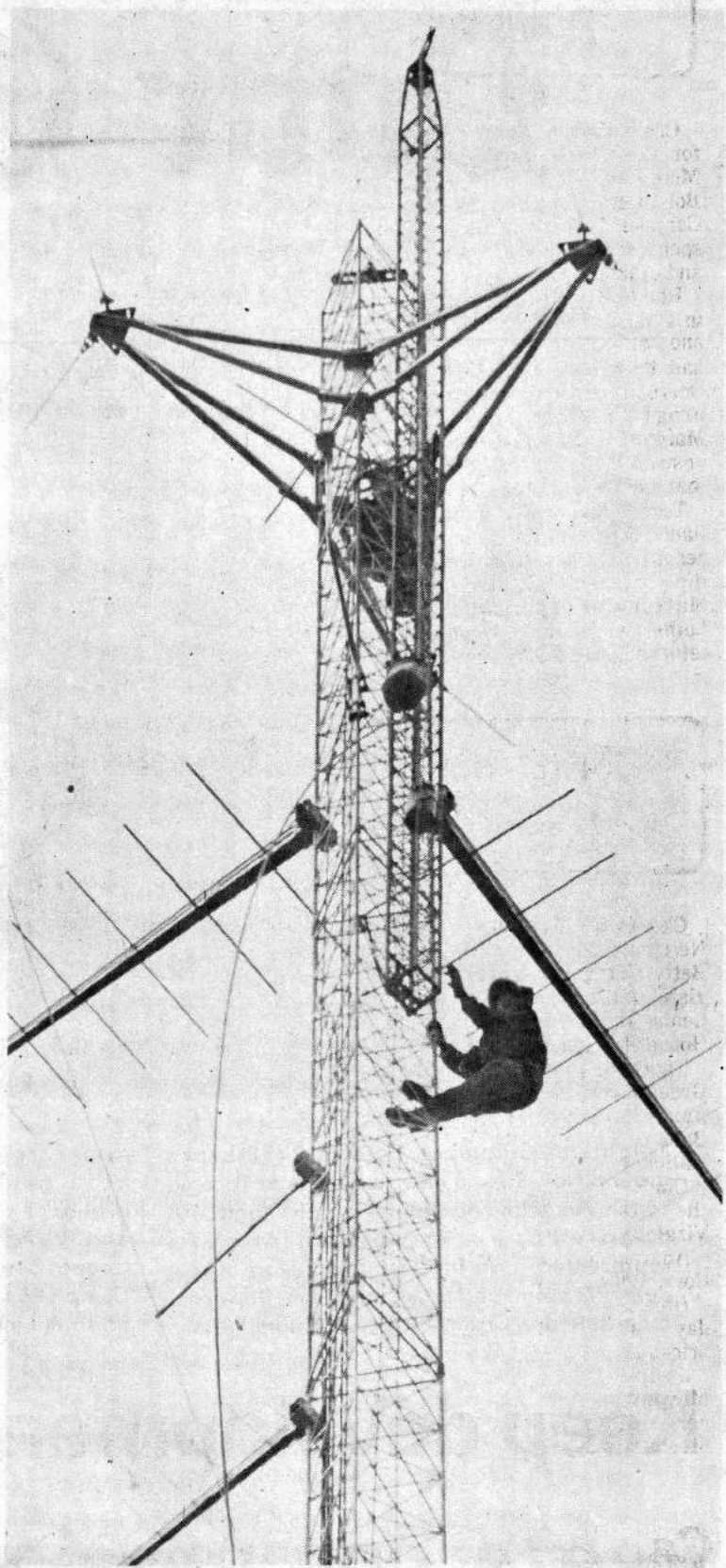
made warning officer simply because speed is essential in an emergency. That way there'd be five of us sharing the responsibility.

The four other radio operators, Cliff Schroeder, Richard "Biz" Virlee, Ed Hunsader and Al Birnschein, are all experienced deputies whose stories will be told at a later date.

Meyer, meanwhile, keeps protesting his inventive mind by no means qualifies him as an electronic genius.

"All I have," he smiles, "is a knack for using and improving other systems."

Thursday, November 11, 1982



A workman checks out the 200-foot cable television tower erected in Ken Meyer's backyard this past week. Satellite receivers will be installed shortly and service is expected to begin in January.

—Ken Meyer



A satellite antenna for cable television was recently installed by Total TV at the residence of Ken Meyer on County Trunk TT in the town of Sturgeon Bay. The antenna is aimed at SATCOM F-3 which is in geosynchronous orbit around the earth, 22,300 miles above the equator.

Antenna installed

Cable TV is coming closer.

A small satellite antenna was on the Ken Meyer property on Michigan street by Total TV of Green Bay on Dec. 8.

For those familiar with the logistics involved in such an operation, the antenna is aimed at SATCOM F-3 RCA III-R. It operates in geosynchronous orbit around the earth (22,300 miles above the equator) making one orbit every 24 hours.

The satellite is a repeater or relay station in the air that re-transmits signals from remotely located stations on the earth.

SATCOM F-3 has 24 channels and

is presently sending HBQ, the Movie Channel, CNN News, ESPN Sports, Superstation, WTBS, and the Nickelodeon among others.

The larger 4.6 meter antenna dishes are expected to arrive later this week and will be installed on the concrete pads recently poured by Russ Cihlar Masonry.



Ken Meyer presents a different idea, a 1943 army half-track, for competition among almost 200 vehicles in the Kiwanis-Old Bolts car show at Door County Fair Park.

—Advocate photo by Joe Knaapen

RESCUE FROM THE WOODS

By
Ken Meyer
Sturgeon Bay, Wisconsin

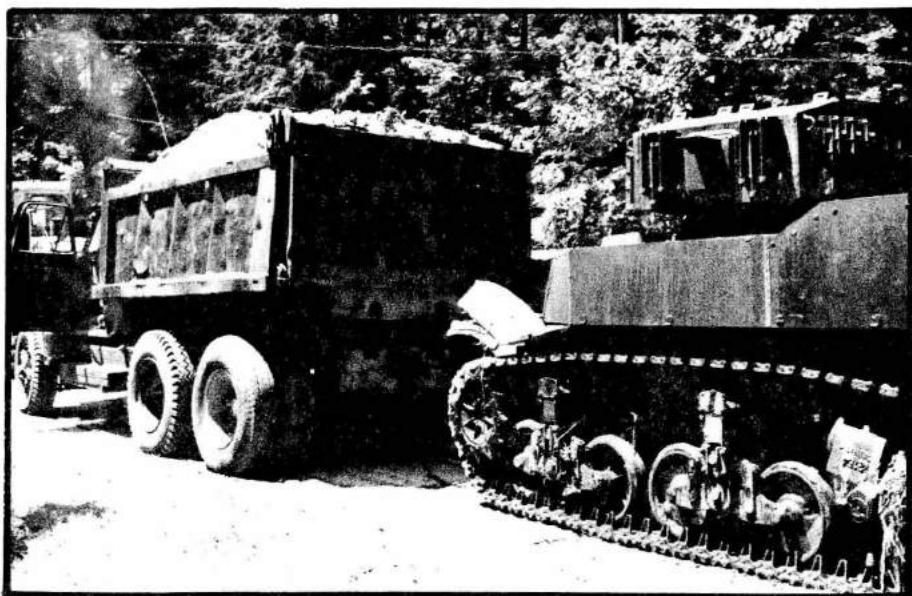
I had been looking for a WW II vintage tank for several years, so was used to the "Your're looking for WHAT???" questions whenever I asked "Don't happen to know where there's an old tank, do you?" However, in January, 1985, a friend said, "sure, I used to drive past one all the time, it's parked in front of a junk yard in lower Michigan." By this time, I was used to following leads that ended up nowhere, but every time I heard of what sounded like a good "tip" on where I might get a real tank for a reasonable price, I got right on it and tracked it down as quickly as possible. I soon got the junk yards phone number and called it's owner. "Not only do I have a tank, I've got two of them, and one runs real good" was his reply, (excitement) "but, I won't sell either one of them." (dejection). I asked if it would be all right to at least look at them, and maybe take pictures, to which the owner seemed very agreeable. You can guess where the family vacation went that summer, A July ferry boat ride across the lake to Michigan from Wisconsin. The first one we looked at was stored inside his barn, behind old cars, fire trucks, and literally thousands of old, collectable "goodies". This tank turned out to be a motor gun carriage, sporting twin 40mm guns. It looked to be in pretty good shape from what i could tell, but was not really what I was looking for. (This one was big, and had no closed turret, only the open gun turret). We then went outside to look at his other one, which was almost completely covered with weeds, trees, and was in fact a M5A1, just what I wanted!!!! The owner repeated several times, take all the pictures & climb over em all you want, but they are not for sale. By this time my mind was already trying to put together a deal to get him to want to sell "This old rusty one".

I started out by sending him lists of old "collectable" things that I had, or could get that I thought he might be interested in.

After many phone calls, letters, more phone calls, we finally made a deal, I would swap my old Lionel train set (That I had since I was young), an old WW I rifle, a 1930's "Wincharger" generator, a telescope, a M-1 carbine, and cash. Excitement! A deal has been made, June 16th, 1986 is set for the "pick up" date. (Almost a full year since I had gone over to look at it).



M5A1 in the Michigan "Jungle" - July 1985.



After successful pull "Free" - June 16, 1986.

We rented a large semi-tractor with a flat-bed trailer from a local farm implement dealer, complete with driver, for the pick up.

I decided to take the ferry boat across the lake instead of driving around, so we could sleep on the way. (This might have been a good idea, but how much sleep can you get when you're on your way to

pick up a tank?) The trip across the lake was in fog so thick it seemed like we would run way behind schedule to drive the 70 miles from the ferry boat dock to the junk yard, but after a quick breakfast in a local restaurant, the fog lifted. (Fate is with us, so far at least). After arriving at the junkyard and quickly looking over the owners other "collectables", we back the semi into position, and try to pull the

ARMY MOTORS

M5A1 out with the yard owners large front-end loader. No go. The tank doesn't even wiggle. Dig sand away from the tank with the front end loader, and with hand shovels. Try again. The tank has been here since the early 1950's, and isn't about to move now. My semi driver says "Well, looks like we're not going to get this loaded today" My reply is "We are staying here until the tank is on your truck", at which time my driver starts digging sand away from the tank also. But it doesn't look good, it appears that the tracks are frozen solid. We pour old automatic transmission fluid all over the track pins, and the yard owner decides to try his large dump truck. We connect the dump truck to the tank, and hook the front end loader to the front of the dump truck. In a mighty roar of engines, the tank comes out of its "home" in the woods. (Relief) after towing it for hundred feet or so, both tracks start turning freely, and we load it up on the semi with no problems. On the way back to the boat, we get stares, and all kinds of funny looks from people. When we load it onto the boat, the captain himself comes down and asks the usual question "what are you going to do with that"?

Once in my driveway, the tank rolls off the truck almost by itself, once we unchain it. (Must like it's new home) my 13 year old boy thinks its really neat, but I can't say the rest of the family shares our feelings. The first thing I have to do is to get the outside of it looking better, It's sitting right in front of the house. We remove the front fenders and attempt to straighten them with a sledge hammer. Wrong tool. The fenders won't give up to such a feeble attempt. Put one in my 20 ton press, with hardwood planks for backing, and the fenders come back into shape. Wire brush off loose rust, grind away weld from around where the hatches were at one time welded shut. Wire brush more, grind, sand, take pictures of the original unit markings on the front lower belly pan, and the plates under the engine compartment doors. (If anyone can help identify this tank from any of these markings, please let me know).

The cannon barrel had been cut off, so we construct a "new" one out of thick wall pipe, and turn down the outside in a lathe to resemble a cannon barrel, and construct the inside of it to the same general shape as an orchard "Bird Scare" cannon that fires propane gas. Spray on several coats of OD paint, and apply the white lettering and stars, and it starts looking like a real tank. By now even the wife and rest of the family are at least not giving us dirty looks anymore, and they start to enjoy this project also. I weld a one inch thick steel plate that has

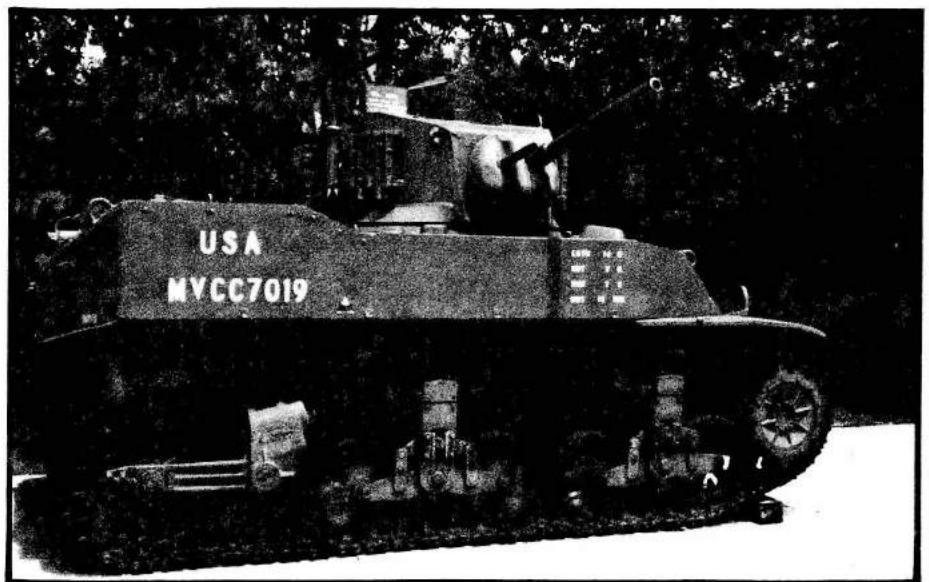
been threaded for a spark plug, and pipe fitting to the inside of the cannon barrel. Rig up a spark coil to the spark plug, and turn oxygen and acetylene from a cutting torch into the cannon, close the valve and "fire" the spark plug. Bang the results awe everyone, including me. It sounds like a real cannon. It looks like a real cannon going off. We add a replica .30 machine gun to the turret mount, and I drill lots of holes in some pipe and stick it in the other machine gun mounts. Now it looks great from the outside, unfortunately the inside work has been going slower. It had 40 years of dirt, old toy guns, sticks, stones, marbles, even some old empty machine gun brass near the bottom of this mess. (It's harder working inside than I thought, most clean-up work in here is done by my son, Matt). I

venture inside to spray all bolts & nuts with oil, and start getting things free again. In going through my collection of old radios, I find that I have the correct radios for this tank. Now even the inside is starting to look better. Winter is coming, and there is no way we can beat the race before the first snow to get it running, so we hire a small bulldozer to tow it into the barn for winter. (We're going to remove both engines and have them overhauled, they are too far "gone" to even attempt running as they are).

The plan is to install on Oldsmobile 455 V-8 temporarily, to use the tank in parades & such, until the original engine is fixed up. We have the Olds engine & hydramatic transmission ready to go in, and are now in the process of



Rear view.



After two months work.

switching engines. Just in removing the "hood" from a tank is a chore, we used chain jacks from the beams in the barn roof, and slid it off the back of the tank. While working on the tank, a friend who stopped by to look at it said "If you're interested in such things, after a 1/4 mile walk through the woods, an old Willys Jeep with small trees growing through it, standing on property adjacent to mine. I never noticed it before. After a short "Haggle over price" I was towing a new toy home for \$50.00. After cleaning out all kinds of junk and garbage from it, I discovered it was in much better shape than I had thought. Very little rust, and almost every thing was there, except the engine, which I knew was bad. Then the search started for a Willys Jeep motor. We found one in a farmers sprayer, which we bought for \$10.00, and removing the pump for the farmer. He said that the engine ran good, last time he ran it, 10 years ago or so.... The engine was now "tight" and after taking it all apart, we found "One big blob of rust" So much for having a \$60.00 Jeep. Another friend who stopped by to see the "strange" things I was collecting, just happened to have a set of .030" oversize, brand new Willy's pistons, from a job he did many years ago. Hmmm, might still have a running jeep for a reasonable price.... We're in the process of trying to put it all together now. Now when "They" ask "What next?" I simply say "Maybe a nice Huey..."



"M5A1 Night Fire".



ARMY MOTORS

AMOS

By
Jim Graham
Racine, Wisconsin

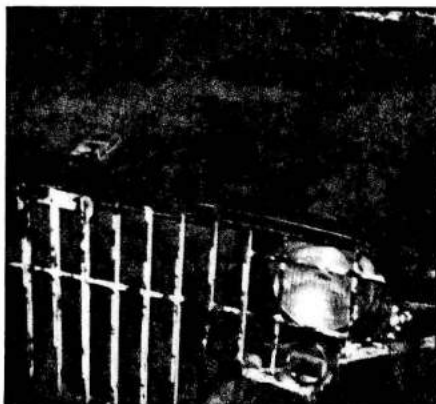
Amos is a first series GP I recently acquired. While removing paint on the rear panels the name Amos appeared in yellow lettering. No big deal, but I recalled seeing a photo of a disabled GPW on page thirty of the spring issue of Army Motors. This GPW also bore the name Amos on its rear panels. Either the driver of that GPW also liked the name or, I would like to think, a career army non-com had been assigned the GP stateside and later in the ETO also named a GPW assigned to him Amos.

Whenever another GP is rescued from the boondocks something controversial in regards to restoration is concerned. In this instance it is the rear bracket mounted reflectors. Amos sported two King Bee No. 295 type reflectors. These almost certainly were factory mounted and what I would use upon restoration. They are badly deteriorated and required extensive restoration. Ford's motto of having better ideas, took a nosedive regarding the mounting of these reflectors. They appear to have been mounted as an afterthought, in a very vulnerable area, especially on an MV. The design flaw is the somewhat flimsy bracket. The logical answer lies in the Army's stringent weight requirements for the prototype jeeps. To backtrack to the reflectors, King Bee was a supplier for Ford and the first GP's. Due to the 'hurry up process' for the Jeep I am assuming there were minor variations in suppliers parts.

Amos has the single center hood mount pad which identifies it as a first series, GP; That is, if someone didn't change the hood, which is possible, but not probable. The vital identifying ID plate is missing from the dash, although the other two remain. How frustrating, that this small thin brass plate, the key to the origin and date of manufacture, should be missing. The front part of the frame is badly rusted and pitted and, of this writing, I have had no success in uncovering stars or numbers.

I then tried to uncover numbers on the sides of the hood. On the one side this was attempted, the numbering had been removed by an abrasive method. Possibly the first civilian owner did not want army ID numbers on it. So, it was back to the drawing board, which in this case is the frame. This process will have to take place as time permits. Alas poor Amos, where from art thou?

When I acquired Amos from a farmer, the power plant was a 1949 Mercury engine. He insisted that Ford made jeeps that way and also mentioned it would go like hell; that is, when it was running years before. I went along with his reasoning, as to him this was just another old jeep, and I felt it safer not to pursue Amos' true identity as the price could rise! To my regret I did not take any photos before altering the GP back to its original configuration. Someone had meticulously altered the hood, firewall and cowl sections. Even the sought after 16 inch wheel had been cut and rewelded to 15 inch. The 15 inch wheels in that bolt pattern were not readily available then, for a four wheel drive vehicle. All in all a very professional job had been done on Amos, not the usual amateur cutting and welding. Factory formed four-inch wide sheet metal pieces had been spot welded to the hood side bottoms, and the firewall and cowl professionally finished. The body in general is rough, although the dash has only one added hole. As to the rest, the Ford script rear piece is intact, which is unusual, and the hood does not have the usual hole cut for a J.C. Whitney air cleaner. The windshield assembly is quite intact, apart from two large cracks in the glass. Only time and money will decide the fate of Amos. Were I not a prototype jeep nut, it would probably be part of our local landfill site.



Our '62 409

by Ken and Bonnie Meyer
#12114 Sturgeon Bay, WI

In 1963, we bought a '61 Impala 2 door hardtop, black with red interior, 348, 3x2 carbs, 4 speed transmission. After putting over 140,000 miles on this car over the next 12 years, we finally sold it to move on to a newer car.

I had always liked the roofline of the '61, but preferred the lower body style of the '62, so I had been "on the lookout" for a '62 Bel-Air coupe ever since I first saw one.

I got real serious about finding one in 1984. I finally found what I was looking for in 1986. This Corona Cream Bel-Air had 35,700 original miles on it. It had a nice straight body with no accident damage, but suffered from typical Wisconsin lower body rust.

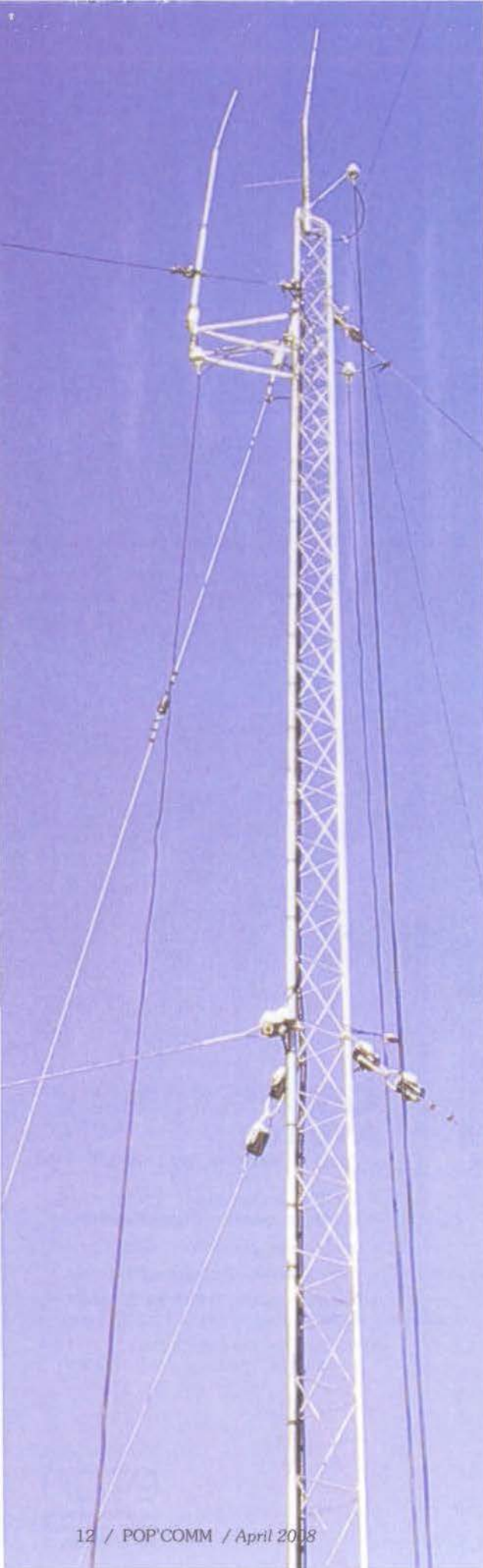


We got the car home April 20th, 1987, and spent the next month gathering small parts needed for the restoration. Work was started in June. We were on a "crash" schedule to get the car ready for the local car show at the end of August. The car was sprayed the original color with lacquer. The engine was disassembled, checked and put back together, and everything was installed in the car. We also installed original '62 interior panels, original carpet, etc. This car came with a push-button AM radio, which we replaced with a radio "delete" panel in keeping with the "drag racer" theme of the car. We are still looking for a heater delete panel to complete this theme, and some "mint" condition emblems to replace weathered ones.

In 1965, I built a B/Altered drag car using a '62 409 HP engine. As I cut out the bottom of the original dual quad air cleaner to mount an air scoop, I remarked to a friend "20 years from now I'll regret cutting this up." Sure enough, I did, I was only off by two years in that prophecy.

We completed this phase of the restoration in time to bring it to the car show. Special thanks to my wife Bonnie, and friends for help with, (and putting up with) this restoration project.





Antenna Support Structures For The Common Man—How To Build A Tower With Only \$500

Proven Tips For Putting Steel In The Sky Without Spending A Small Fortune

by Ken J. Meyer, K9KJM

Almost everyone who's been in the radio business or hobby for any length of time knows that a radio station is only as good as its antenna system. And for that system to be much good, the antennas usually need to be mounted high above the surrounding area. That eventually leads radio communication enthusiasts to say to themselves "I sure wish I had that in my backyard" whenever they pass some tall commercial-type radio tower.

As much as we'd like to have a big tower in our backyards (or even a tripod and mast on the roof), there are a number of potential roadblocks that must be overcome to get the tallest and best antenna support structure, or "tower," possible. Lack of funds can definitely be a big roadblock. But it doesn't have to be that way; you just need to make the most of something called a "Resource Triangle."

Geometry Is Your Friend

Years ago I heard how any project can be accomplished with the right combination of elements—to your Resource Triangle, that is, with the three points being TIME, MONEY, and SKILL. That triangle can be adjusted any which way. If you have lots of time and skill, you can succeed at most any project with very little money. Or, if you have lots of time, but very little skill and money, the project still can be accomplished; it will just take much longer. You get the idea. The exception of course is money. If you have boatloads of money, you can get by without a lot of either skill or time; you can just hire it all out!

Think small...An example of an old TV tower recycled to a 50-foot Rohn 25 tower holding up 11-meter CB antennas.

Kenneth J. Meyer, K9KJM, has been a life-long communications enthusiast. In addition to his Extra class ham license, Ken also has an FCC GMRS license, operates an FCC licensed VHF commercial radio system, and provides technical support to various radio communications systems. He currently has seven towers in his backyard.

As mentioned, the expense connected with a tower is an obstacle for many; it certainly has been for me! So over the years I found many ways to use time and skill to accomplish a goal like getting a decent tower without breaking the bank.

If You Can Build A Backyard Swing Set, You Can Probably Do This, Too

To build your own tower, you must first determine if the law is on your side. There are a few key questions to ask yourself: Do you own the property in question, or rent? If a renter, you need to check with

the landlord. If you're a homeowner, is there a (dreaded!) homeowner association private agreement with restrictions on your property? Then there's the FAA. Are you near an airport or under a flight path?

You also need to check with the local zoning or planning department. Most rural areas have almost no regulations for non-commercial towers, but some cities and villages do have restrictive ordinances that need to be addressed. Note that even if there *is* some type of local ordinance restricting your plans, if you're a ham you have PRB-1 (a federal law you can read more about at [http://wireless.fcc.gov/services/index.htm?job=prb-](http://wireless.fcc.gov/services/index.htm?job=prb-1&id=amateur&page=1)

[1&id=amateur&page=1](http://wireless.fcc.gov/services/index.htm?job=prb-1&id=amateur&page=1)) working in your favor. The threat of a federal lawsuit usually will work magic in getting the local zoning board to see things your way, or at least in being willing to compromise on the height of the tower allowed.

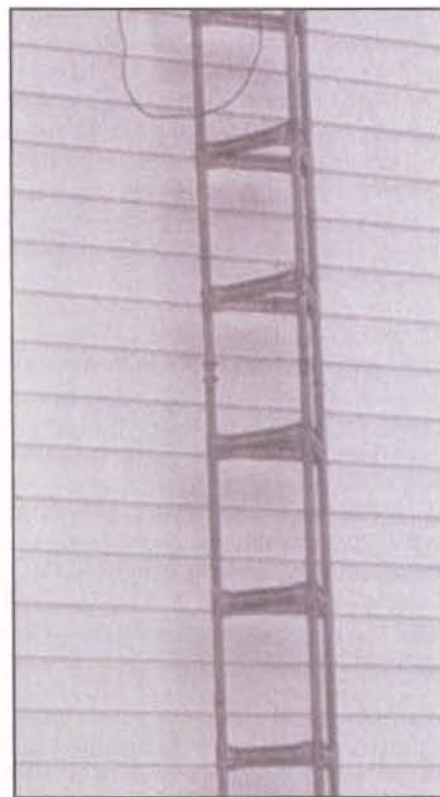
All these rules and regulations may have some people saying, "The heck with it, I don't need a tower that bad," or you may be tempted to think, "My little 30-foot mast will go unnoticed." To the first I say it's much easier than you may think; to the second I say: builder beware. You don't want to go through all the trouble and even moderate expense of building a nice antenna support only to have someone show up with a legal order to make you take it down!

Now The Fun Stuff

After you've determined that you can indeed legally put some steel in the sky, it's time to do the really fun part: planning just what you can do on your specific property. If you own or rent a small city lot, a 200-foot tower may be a little far fetched. If your lot is only 100 feet wide, maybe a 50-foot tower would be more appropriate. Regulations will affect



Or think tall...A PiRod 200-foot commercial tower recycled to ham radio use when the cable company went to fiber optics. This photo also shows some satellite dish antennas.



A Rohn 6 type tower—and the only one tower pictured that's not on the author's property! This kind of tower is suitable for light-duty use only.

this decision, too, since many rules state that the “fall zone” of any tower lie within your own property lines.

Your homework also included researching various types of towers, manufacturers, and materials, and learning about antenna support structures in general. Fortunately, research doesn't cost anything, and—especially if you have access to the Internet—is fun and easy.

A Few Words On Towers In General

Here's a little tower history to give you a foundation (pun intended!):

Only about 30 or so years ago, television reception was a real challenge in broadcast fringe areas, which prompted the purchase and installation of “TV towers” for better TV viewing—and to get those “blacked out” football games. Now that cable TV and direct-to-home satellite dish antennas have become the norm, many of those old TV towers are going unused. The good news is that they're a perfect source for very low-cost antenna support structures for radio enthusiasts! All you have to do is to go door-to-door asking the owner if he or she would like to get rid of that old TV tower. In many cases, the answer is YES! And the price is usually right: either free or close to it. A small

“Wanted” ad in a local newspaper may also bring in many leads, especially if you can indicate that the old tower would be used for REACT, ARES, or other public service-type operation.

But before you go knocking on doors, you need to know what you're looking for. Most of the early TV towers were what I call a “Rohn 6-type.” This refers to a tower with fairly small-diameter tube legs (only about 3/4 inch), horizontal braces between the legs, and no diagonal braces at all. There were a number of companies making them, and several different versions, that were popular in the 1950s. Unless there are some special circumstances, I would *avoid* this type of tower.

Instead seek out something with a somewhat larger diameter leg (about 1-1/4 inches outside diameter) and that has diagonal solid steel braces making a “Z” pattern up the tower. I refer to this design as “Rohn 25G-type,” though other manufacturers made similar models. A Rohn 25G tower will free-stand to a height of 50 feet with a reasonable wind load of antennas, and it can be installed with guy wires (at 80-percent of the tower height for maximum strength) to a height of over 150 feet. Yes, you would need to collect a number of TV size towers to come up with a really tall tower like that, but it can be done!

Be aware that Rohn also made a model very similar to the 25G, known as the “20.” The Rohn 20 can also be a useful tower,

Tools Of The Tower Trade, And How To Use Them

You've gotten a good overview of the steps involved, now here's what you need to help you take them:

Bolt Action

As you're disassembling your discovery, the easiest way to remove the tower leg bolts is with a plain carpenter's claw hammer. Remove the nuts with wrenches, use the hammer to tap the bolt as far as it will go, then use the claw part of the hammer to just pull the bolt out like an old nail.

A word about the bolts: Rohn 25 bolts are galvanized grade 5 fine thread 5/16 and 1/4 inch. If you can save any of them, good, but you'll still have to buy some new ones, so **ONLY** use grade 5 steel bolts! Do **NOT** use stainless, or grade 8. Stay with what the factory used!

Clean Up Your Act

Use a wire brush to get any loose scale or rust off the tower sections. In most cases they will need a little touch up. The product to use is “Instant Cold Galvanize” in either spray (much easier) or brush-on form. This is sold in many hardware, auto, and home supply stores.

To make your “new” tower really look new, a very light coating of bright aluminum spray paint (I just use 99-cent-a-can type) will really make it look nice. Or, if you want more of a “stealth” installation, just leave the Cold Galvanize alone. It dries to a nice dull grey that will blend in with the sky and really needs no topcoat.

Guy Wire Guide

If you decided to put up a guyed tower, the correct guy wire to use would be either 3/16 or 1/4-inch EHS (Extra High Strength) galvanized steel type. A low-cost source of 1/4-inch can be your friendly local cable TV construction crew. Most cable companies use 1/4-inch EHS. (Power and telephone companies use 3/8-inch and larger, which is pretty heavy for a small

tower.) If you're lucky enough to find any cable TV overhead construction work in your area, your odds of getting some of that cable (and the “pre-forms” or “grips” for each end) are pretty good!

You'll need some way to put proper tension on the guy wires. For those really short of money, some of the two- or three-bolt cable clamps used by the cable company as anchor rods could be pressed into service, along with some extra cable clamps for extra security. The best way is to install turnbuckles at each anchor rod. The minimum size would be 3/8-inch high-quality galvanized steel type; 1/2- or 5/8-inch would be better.

There are various types of tension gauges available, but on a small tower the “feel” of the guy wire by an experienced person works about as well as anything. If you're doing your first tower, it's a good idea to hire a tower professional to stop by after your job is done to inspect the whole thing, and have him or her pay special attention to guy wire tension. Most tower specifications call for the tension to be 10 percent of the cable strength, so a 6000-pound cable should be tensioned to 600 pounds. I usually tension smaller towers on the light side to keep down-pressure to a minimum.

If you're unable to obtain guy wire supplies from the local cable company line crew, Texas Towers (<http://texastowers.com/online.htm>) has almost everything you could want for a tower installation, including “Phillystran,” a non-conducting, very high-strength material that can be used for guy wires. While Phillystran is fairly expensive, it's *the* way to eliminate the steel guy wires up near the top of the tower if you want to side-mount lots of antennas, or if you want to use the tower itself as an HF antenna.

By the time you calculate all the insulators, pre-forms or cable clamps, and extra labor to install insulators the old-fashioned way, Phillystran turns out to be a pretty good deal. It's also an option that can be easily utilized at a later date if needed.



A Word of Caution: Pictured here is a Rohn 25G tower, about 12 inches wide. Should you be able to find a similar, or even larger, tower you are very lucky indeed! Rohn also made a slightly larger model, the 35G (also called a Motorola contract tower), which is very rare, as well as a model 45G, a heavy-duty tower. But be careful: Rohn also made a lighter-duty model, the "20." The 20 and 25G can be distinguished because the 20 has about 18.5 inches between horizontal "steps" and only seven horizontal bars; the model 25G has eight horizontal braces, and about 15.5 inches between braces. The 25G is rated to a height of about 150 feet when properly guyed; the 20 is only good for very small antennas and a height of about 40 feet! Don't confuse the models!

but is not nearly as strong as the 25G. See the boxed photo and caption of the Rohn 25G tower for details on how to tell them apart.

Prior Planning Prevents...

Make sure you've carefully planned out just how you'll be getting that old tower *safely* down and *safely* home. If you have no problem with heights, you might be able to do it yourself (with a helper and a good-quality safety belt!), but if you have no experience climbing you'll definitely need someone who can help you take the tower down.

Hopefully, you've already joined up with people with similar interests from your area, but if not, this is a great time to do so. Join a ham radio club or the local REACT team. Find a friendly tower worker, utility lineman, steel worker, or someone else you could team up with. Be open to looking and asking, and sooner or later it will all come together.

Whatever you do, don't rush it or take any needless chances doing work you're not comfortable with. Tower work can be dangerous! NEVER work on a tower without proper safety equipment, including safety belt or harness, hard hats, and so on.

Step By Step

So now you've found your tower, maybe a typical 25-year-old Rohn 25G, freestanding model, complete with a rotor at the top and an old television antenna dangling in the wind. Most of these smaller towers have not had proper maintenance, so the leg bolts, especially those near ground level, will be worn, leaving the tower somewhat wobbly. But that's why you got it for free, or close to it!

The way to make those old "loose" joint towers safe is to borrow (or buy) some cable "come alongs" to jack each tower leg tight together again, especially that first, lowest tower leg joint, which is normally the loosest. Once you have done that, you (or your qualified helper) should be able to climb up. If the tower really seems loose, attach some type of temporary guy ropes to help steady it. It's then a simple matter to take the old antenna and mast down and to unbolt the upper tower section.

Borrow or build an erection fixture, or gin pole (a simple piece of pipe with a rope pulley at the top), so the weight of the tower section can be mostly handled by the helper on the ground; experienced tower workers are able to "manhandle" Rohn 25 sections without a gin pole. Factory-made gin poles have fancy clamps to easily attach to the tower legs, but you can use other types of attachments, as long they're sturdy and can handle the weight. Again, don't take any chances with this stuff. Hint: I did it myself years ago—NOT a good idea!

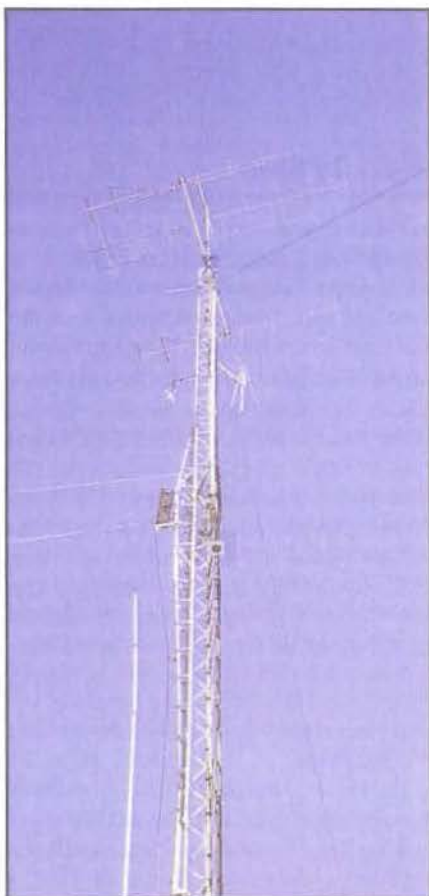
Take it from me, if you're uncomfortable with any of it, don't do it. You might have to dig out a little more money to hire a friendly cable TV guy to stop by with his bucket truck to take the sections down, but it's worth it in the end.

Once all the tower sections are on the ground, you'll have the base left sticking out of the ground in most cases; the installers usually just dug a one-cubic foot hole and filled it with concrete around the first tower section. Just take a hacksaw and cut the legs off as close to the ground as possible. Now you can transport your goodies home. Many of these towers will easily fit in the back of a small pickup truck, but you may need to make more than one trip.

With everything now home, it's helpful to use a pair of saw horses to get the tower sections up at a suitable working height. Sight down each section to make sure it's nice and straight. Look over the bolt holes to see if any are elongated from too-loose bolts. If some holes are badly elongated, I'd recommend using those for a guyed tower only, although some people have drilled out the holes to the next larger size (3/8 and 5/16 inch) with success. If the bolts have "crushed" the legs somewhat where they bolt together, you can take a short section of pipe that just slides inside the leg and "tap" around with a hammer to get them round again.

Location, Location, Location; Foundation, Foundation, Foundation

The location of a tower in relation to your "radio room" is always a compromise. For VHF and UHF it's nice to keep it as close as possible to reduce coax feedline loss. Then again, for



Here's a 65-foot recycled Rohn 25G tower supporting VHF and UHF ham antennas.



An old farm water pump windmill tower recycled into holding up the ends of ham wire antennas.

HF use, and for lightning protection, it's good to have it a reasonable distance from your radio equipment. When you lay out where your tower will go, keep in mind that someday you just might want to make it even higher. Plan ahead for possible guy wire anchor points so you'll have that option in the future, even if right now you're not going to be using guy wires. And don't forget that fall zone, either.

When you're sure where you want the tower, start digging. Rohn specifies a concrete base measuring 4 feet by 4 feet and 4 feet deep. Hand digging is the best way to get it done. If you don't want to, or can't, dig it you then hire some local teenagers. Just remember that the neater the hole, the better. The concrete you'll be putting into the hole needs to be poured against UNDISTURBED soil only! NO below-grade forms! If you want the concrete to show above grade, you can use a 2X4 form to make the top few inches look neat.

Next, put some gravel in the hole where the tower legs will go, then wrap some tape around the bolt holes of the tower section you'll be putting in the hole, or use the section you hack-sawed off that

has no bolt holes. Put some gravel around the tower legs in the hole to provide drainage so any moisture in the tower legs has a place to escape and won't build up.

If you're going to start out with a guyed tower, also dig the anchor holes at this time, at a distance 80-percent of tower height out from the base for maximum strength. For example, a 100-foot-tall tower should have the anchors 80 feet away from the base of the tower. Actual distance is measured to where the guy anchor rod enters the ground, so the hole and concrete will be a few feet further away from the tower. If you know anyone who works for the local power, phone, or cable companies, galvanized steel anchor rods can usually be recycled from them.

A typical anchor hole for a 100-foot tower would be 3 feet by 3 feet, with 1.5 feet of concrete, buried 4 feet down. Actual dimensions will depend on what your local soils are like. Follow the specs written by Rohn; you can find them at www.radiancorp.com/ROHNET/rohnet2004/html2004/index.html. You'll need a full cubic yard (at least) of concrete for your tower base, and about another yard for your

anchor holes if you'll be guying this tower. The ONLY way to get the concrete is to have the big truck come over! Do NOT consider the little sacks of premixed cement and gravel for your tower! Years ago you could save a few bucks by buying the cement, sand, and gravel to mix your own concrete. Those days are long gone. Now the easy, simple, cheap way is to just be ready when the truck comes to pour.

Contact the local Redi-mix concrete people and tell them what you're doing; many concrete jobs have those big trucks heading back to the plant with several yards of concrete left over from some other job. That's the concrete to get! Tell the dispatcher what hours of the day and days of the week you can be available to pour. If you have to order your own, you might be hit with a "small load" extra charge. Try to avoid that! Some areas also have rental places where you rent a small mixer full of concrete—that's another "TO AVOID." You need over one cubic yard of solid concrete that will be *strong*. Don't take any chances with the concrete! You want a good strong mixture, with 4000PSI the ideal, but get at least a 3000PSI mix.

Make sure you have some fairly sturdy temporary guy wires or ropes holding the lower two sections of the tower plumb, and check to make sure it stays that way as the concrete is pouring. Then sit back and wait—at least two weeks—before starting to assemble the tower. Concrete reaches well over 80 percent of its ultimate strength in 28 days.

To assemble, just reverse the procedure you used with the gin pole in taking the tower down. With at least two people, it will go fast, and in an hour or two it will be up and finished! Don't forget to take a few pictures as it goes up!

The Best Part...

If you really scrounge and get many of the supplies as described in this article, you may be able to build that 50- to 100-foot tall tower for \$500 dollars or less! And the same principles apply if you're going for a simple pipe mast or a tripod on your roof. Search around for an old TV antenna setup and "recycle" it before shelling out the big dollars for a brand new installation.

Yes, it can be done—I've done it myself many times and so have others! But even if you can't do it for that low of a price-tag, by following some of these ideas you should be able to build a good tower/antenna support for much less than full retail. The sky's in reach! ■

Lightning Protection: Taming Thor's Thunder— On A Budget

*Learn How To Affordably Safeguard Your Valuable Radio
Equipment—And Maybe Something Far More Precious*

by Kenneth J. Meyer, K9KJM, K9KJM@ARRL.net



If you're a radio hobbyist, your radio equipment is extremely valuable to you. It's an investment, and like all investments it needs protection. One way to protect that investment is by making sure that you have adequate lightning protection in place. There are plenty of sources explaining how to protect your radio shack from lightning damage, but few people implement the proper protection because of the perceived high cost of (copper) supplies. While this article certainly isn't the "last word" on the subject, it will show you that you don't have to take an expensive approach and provide you with tips on how to properly protect your station—without breaking the bank.

First, let's dispel some old wives' tales regarding lightning. For starters, it is possible to take a direct lightning strike to your antenna mast, tower, or other support without your equipment suffering damage. Commercial, police, fire, and ambulance systems, cell phone towers, broadcast stations, etc. take direct lightning strikes during most large lightning storms, and when they're properly protected they don't suffer any damage. True, that equipment does have extensive ground systems and shiny copper straps that cost a lot of money to have installed, but it's possible to add protection on a budget. Don't listen to those misinformed folks who say "Nothing can protect from a direct lightning strike." Radio equipment survives lightning strikes all the time.

But wait, you say, doesn't a typical lightning bolt have millions of volts and many thousands of amps of power? Well, yes, they can. But lightning bolts, like lots of other things, come in all different sizes. While a large, powerful lightning strike of several "strokes" of longer than normal duration can have lots of power, even the largest strikes can be handled with large low-inductance conductors because of the very short duration of even the longest and largest strikes.

Indeed, part of the confusion over the years about lightning stems from the fact that lightning strikes can be large or small. So when someone tells you that his sta-

Kenneth J. Meyer, K9KJM, is an extra class amateur radio operator who has actually used all of the cost-saving ideas in this article to install lightning protection systems on a low budget. He has supervised many commercial tower installations.



A worker "Cadwelding" (see text) #2 solid copper wire with 4-inch-wide flat copper strap. The dark material around the copper strap is Harger "ground enhancement."

tion was hit with a direct lightning strike and suffered no damage, despite having only minimal grounding with small-size conductors, that may be true—but he may have been extraordinarily lucky and taken only a minor hit.

In these tough economic times, why take chances with your valuable equipment, especially when it can be safeguarded inexpensively?

Proven Approaches For The Frugal Hobbyist

The first order of business for properly protecting a station—or home for that matter—is to make sure you bond (that is, electrically connect) all ground points together with a low-inductance conductor, such as a flat copper strap or a heavy gauge wire. This means that your electric power entrance ground, cable TV entrance, telephone landline entrance, hamshack ground, mast or tower ground, etc. all need to be bonded together.

Think of your equipment like a boat on a rough sea: When a large wave—a lightning strike, in our case—causes everything to move up and down together, the equipment is safe. Damage happens when there is a potential difference between ground paths; bonding eliminates that difference. Bonding is of extreme importance and we'll get back to it shortly.

The actual device used (lightning arrester, grounding coax switch, etc.) is much less important than the proper bonding and grounding of coax shields before they enter the building. It's also important to understand that damage from lightning to most home stations comes in via surges to the electric AC power system, and not from direct antenna strikes, except in rare cases.

A VERY important step in protection is to install a "whole-house"-type of surge suppressor at your electrical power entrance panel. Such protectors are available from most electric shops, home supply stores, or companies specializing in these devices. A suitable device should cost between \$50 and \$100 or so retail, although I've found whole-house protectors (Delta LA 302-R) on eBay for only \$35. Such protectors must be installed in the main breaker panel. If you are not comfortable working in this way, hire a professional electrician to install it.

When lightning strikes the power line in your neighborhood, the power company arrester on the pole (or underground pedestal) will divert much of the surge to ground, but there will still be a very large spike of energy entering your home. It's the job of this whole-house protector to dump much of that to ground right at the entrance panel. Then the familiar surge suppressor outlet-type

strips have a much better chance of getting the surge down to a level that won't damage your devices.

The Ties That Bond

Now let's get back to bonding your grounds together. Just hooking a light-gauge wire between the grounds is not enough. You need a low-resistance, low-inductance conductor (in this case, low inductance means having lots of surface area; see <http://members.cox.net/pc-usa/station/inductance.htm> for more). This is where many hobbyists throw up their hands in despair as they check out the prices of #2 stranded copper wire, or similar. Copper prices recently surpassed \$4/pound, making it beyond the means of many of us. While prices have come down since, retail copper products remain fairly expensive, but a little legwork (or phone work) can pay off in a big way here.

A flat copper strap of between 2 to 6 inches wide by about .025 inch thick is the material of choice, but it can be quite steep if bought from a lightning protection company at full retail. In most cases, you can go right to your local home supply store and buy (or order) copper roof flashing for much less. An even better low-cost source could be an upscale roofer or roofing company that installs copper flashing. All will have "scraps" that can be purchased for just above scrap prices. The seamless roof gutter installation companies are another good source. They mostly use aluminum, but usually have copper available. (Note: Do make sure you watch out for the really paper-thin copper,

which is nothing more than decorative. It looks and feels like copper "tin foil," and that material is much too thin for grounding. You want copper that is about .020 inch or so thick, or about the thickness of both sides of a paper matchbook cover).

Speaking of aluminum, it's usually not a good idea to use aluminum as a bonding conductor—at least outdoors and certainly not underground. Although aluminum is a great electrical conductor, there are serious corrosion problems associated with transitioning between copper and aluminum, and aluminum turns to a white powder in many soil types. Spend the extra effort to find copper.

If you have to run wire instead of flat copper strap because you were unable to obtain enough of a good wide strap, use the largest size wire you can get. Here again, old, used copper wire will work every bit as well as shiny new stuff, and outdoors or underground no one will know the difference! Check with local scrap yards for some nice heavy copper wire. Other sources include construction or wrecking companies that tear down buildings. Offer to pay more than they could get at the scrap yard for some of the heavy copper wire.

Even plain household copper wire can be used with a little planning. Common #12 or #14 gauge plastic insulated home wire can be stripped of its insulation easily with a knife. It's then an easy matter to attach a number of strands of that wire to an electric drill motor on one end and to a vise on the other and twist them into a larger size wire. Another possible low-cost conductor is flexible (soft) copper tube. A good size is 3/8 inch, and even new on sale this costs less than a dollar a foot. As an electrical conductor, tubing is almost as good as solid #2 copper wire.

It is important to keep a fairly large radius on all bends in the wire or strap (no sharp bends!). And try to keep your conductors always pointing downward—don't have them point down and then back up, then back down, etc.

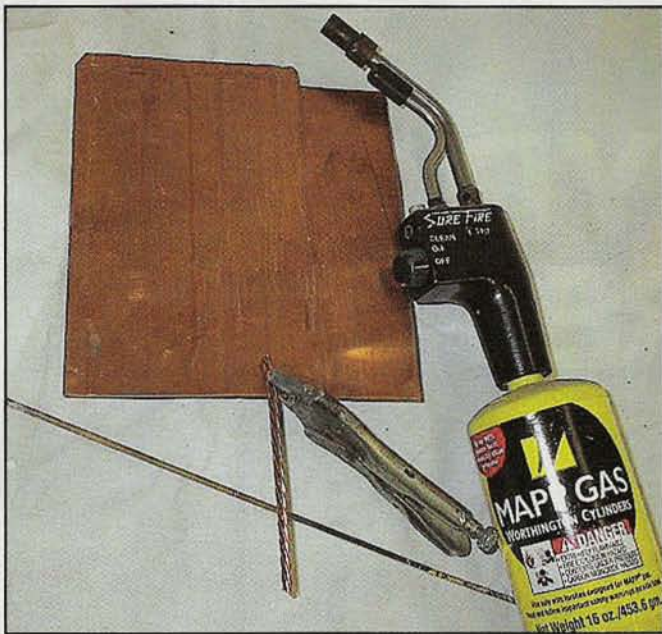
Grounding Rods

Most hobbyists know that ground rods need to be driven for an effective ground system, but many don't know that those rods should be spaced about twice as far apart as their depth. For instance, you should space rods that are eight feet deep about 16 feet apart; if you space them closer, they lose effectiveness. Again, bond the rods together with copper wire or strap. Power company research has shown that #6 copper wire can handle approximately 96 percent of all direct lightning strikes without fusing open. (Research also found that it was much more economical for the power companies to just replace material damaged by those very rare "huge" lightning bolts that overwhelmed #6 wire rather than use heavier gauge wire at each power pole. Typically, only critical locations that simply cannot be allowed to fail, like tall tower sites or electric power substations, will use much larger diameter wire.) Nice, shiny new 5/8-inch heavy copper-clad steel rods sell for about \$10 each in home supply stores.

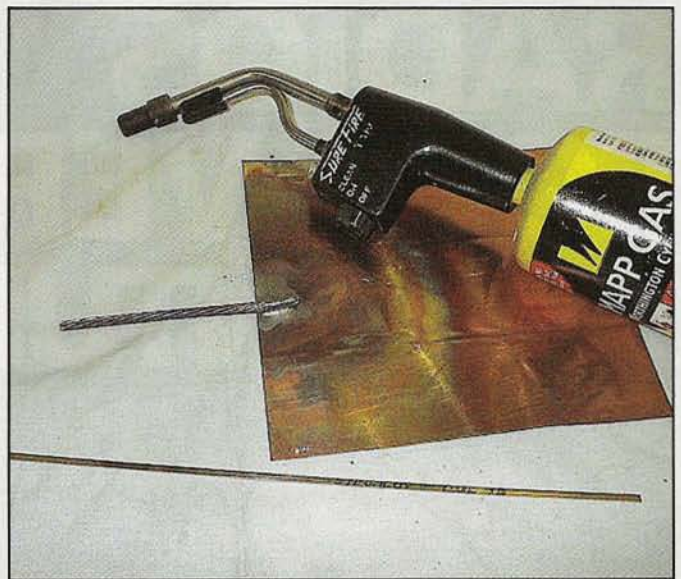
Most installations should have at least six driven rods, depending on surrounding soil type. For instance, if you have wet, swampy soil you may get by with fewer ground rods than if you're on top of a sandy, dry soil hill. If deep rods can't be sunk, additional shorter rods, or a large radial wire system will work to provide a good ground. In extreme cases, where it's hard to drive in rods of any depth, a homebrewed ground enhanced rod can be made up of a section of used copper pipe that's drilled full of holes and filled with rock salt. Bury it as deep as you can, placed vertically, horizontally, or whatever.



A spectacular shower of sparks as the Cadweld exothermic material burns, producing the weld between a #2 copper wire and a 5/8-inch copper-clad ground rod. The black color graphite mold containing the molten weld metal is clearly seen.



Ready to weld. A flat copper strap (scrap from a copper roof gutter installation that the author straightened out) with a stranded #6 copper ground wire. Locking-type pliers holding the wire in place, Silvaloy Excel 15 rod, and small handheld torch using MAPP gas are also shown.



Completed weld. It took only a few drops of the welding rod to make a very secure weld. Note the change in color of the copper. To make the rod flow, the copper needs to be brought up to an almost red color.

A very low-cost source of high-quality ground rods can be as close as your local utility. Check with the power company or telco parts manager for used "pull out" ground rods. As these rods are just copper-clad steel, there's practically no scrap value to them. Often such old rods will be given to you, especially if you mention that you're a ham radio operator, member of ARES, REACT, or associated with any other type of emergency communications service. Yes, the rods will be bent up beyond recognition, but can be straightened between two trees. Or if they're bent too badly, cut them in half to make two good four-foot-deep rods. A bonus to using these old rods is that most of them will come complete with a commercial-quality wire clamp still attached to them, and hours soaking in some penetrating oil should make those old clamps function as good as new (and those clamps are expensive brand new!).

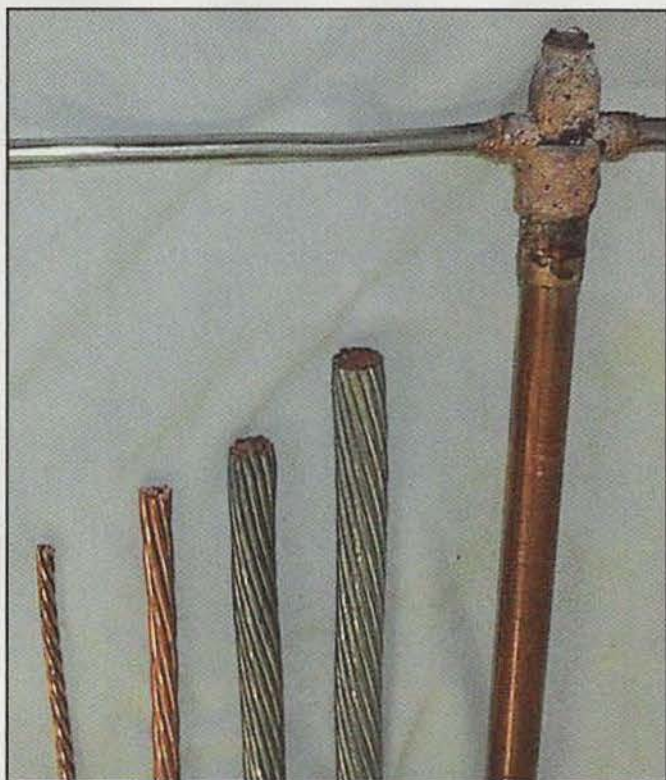
While you're talking to the person in charge of disposing of those old rods, it doesn't hurt to also ask if he can sell any used copper wire that would be suitable for grounding. Avoid the small 4 feet deep by 3/8 inch diameter "ground rods" sold in discount stores. This is not so much because of their size but because they're normally just copper plated, not heavily copper clad, and will turn to rust in a very short time.

Putting It All Together

Now, how do you join all these parts together, or more properly, how do you actually join the copper strap and wire to the rods? Nowadays the "pros" mostly use exothermic welding, like Cadweld, to do the job. (Exothermic welding uses several chemicals that burn at a very high temperature to "weld" metals together.) While that type of bonding is very good, it's far from low cost. You either have to buy or have access to many molds of the various types, or buy the "one shot" weld kits, and both approaches are fairly costly. Good-quality mechanical clamps are also pretty expensive.



This photo, taken in the author's ham shack, shows a "single point ground" panel with various coax switches that put unused antennas to ground, along with several brands of lightning arrestors. The copper sheet is "bonded" with the outdoor ground system with a 6 inch wide copper strap. The sheet is .022 inch thick copper screwed to a 3/4 inch thick plywood panel.



Close up of a completed "Cadweld" exothermic weld of a #2 solid copper wire to the top of a 5/8-inch-thick ground rod and examples of ground wire relative sizes. From left, #6 stranded copper ground wire, #2 copper wire, #2/0 wire, #1/0 wire, Cadwelded 5/8-inch ground rod.

underground in most soils and will blow apart if subjected to a direct lightning strike of any large magnitude.

Single Point Grounding

One of the most important concepts to remember is to have what is known as the "single point" ground, usually close to where all I/O (Input/Output) lines like coax, rotor wires, etc. enter the building. Commercial towers with a large bankroll to spend on lightning protection use a heavy copper plate, usually about 1/4 inch thick by 4 inches tall by 24 inches wide, to bolt all the lightning arrestors to. You can save lots of money and have just as effective a system by simply using some .025-inch-thick copper sheet, screwed to a piece of 3/4-inch-thick plywood.

Make this plate whatever size it takes to fit all of your coax switches (the ones that connect all unused antennas to your ground system) and attach whatever lightning arrestors you plan to use. Bond that panel to your outdoor ground system with as wide a copper strap as you can manage to get through your wall or window, and keep that interconnecting strap as short and as free from bends as possible.

Lastly, install the actual lightning arrestors themselves. Industrial Communications Engineers (I.C.E.) makes a good-quality one. Polyphaser also makes good arrestors, which are usually used at the public safety and commercial communication tower sites. I also like Alpha-Delta and similar constructed "strip line" grounding coax switches for VHF and UHF, and I use older ceramic rotary coax switches that ground unused ports for HF.

I personally run antennas that I have *no* intention of operating from during a thunderstorm to the grounding coax switch, and I run antennas that I *do* plan to use while a storm is raging overhead through a quality arrestor.

Now, Do Your Research

In well over 30 years of operation with my personal systems and also in overseeing commercial repeater tower sites with antennas at the very top of tall towers, I have NEVER had damage to radio equipment—and these antennas and towers *were* hit by direct lightning strikes numerous times, as measured by Polyphaser LSC-12 Strike counters.

While nothing in life is 100 percent certain, following the correct bonding and grounding procedures will go a long way toward protecting your station. Even if you can't follow through with all the recommendations, taking some of the steps along the proper path will reduce damage—and, more importantly, the odds of personal injury—over having nothing in place at all.

There is no cookie cutter formula for effective lightning protection. Each site and installation has enough variables to make it unique. Soil conditions, equipment layout, and other parameters combine to make all situations different. You need to do plenty of research (see some suggested resources below) before you can decide what's the best way to protect your station.

Again, this article was not intended as a definitive source on how to install an effective system, but to provide you with a good starting point on how to do a proper job on a low budget.

For additional information, I suggest visiting the following sites for starters:

ARRL: www.arrl.org/tis/info/pdf/0208053.pdf

Polyphaser: www.comm-omni.com/polyweb/appendixA1.htm

I.C.E.: www.iceradioproducts.com/

A good resource can also be found at

<http://members.cox.net/pc-usa/station/ground0.htm>. ■

A good low-cost approach to connecting all the elements is to obtain some of the welding "brazing" rod used in the air conditioning trade, which goes by the name of Silfoss, Silvaloy, among others. These are "hard" braze rods with a silver/copper/nickel content. A small handheld propane torch will flow and weld them together under most conditions with light or fairly heavy gauge wire (the actual brazing process is very similar to plain old soft soldering; it just requires more heat to "flow" or melt the rod).

To do a good job in the real world with heavier gauge wires, you can use MAPP gas. This comes in a small container, just like propane, for a handheld torch but burns at a much higher temperature than propane and will work in flowing the weld in most cases. If you don't already own a small propane/MAPP gas handheld torch assembly, one can be purchased at a reasonable price from most home supply or hardware stores. They have many uses besides welding a ground system and would be a good investment. Or borrow one from a friend if your budget's really tight.

The hard silver solder sticks, or brazing rods, cost around \$2 each, and one stick can make lots of connections. They can be purchased at most larger welding supply stores, and you can also check with your local air conditioner/refrigeration repairman. If some of your copper is really old and oxidized, a light sanding to clean it up will help the rod flow more easily. I use a small vise-grip-type pliers to hold conductors close while welding. DO NOT use any type of soft solder for these connections! This includes all types of lead/tin and the newer so-called plumbing "silver solder," which is still a very low temperature solder. Such solders will turn to a white powder