the Bobtail curtain and inverted ground plane part one

History and useful information by the originator of this popular DX antenna

Woody Smith, W6BCX, the originator of the Bobtail Curtain, provides humorous and informative anecdotes on this popular DX antenna, using a Q & A format. Some of our older readers will recognize him as the previous editor of *Radio* (predecessor to *CQ* magazine). This article is well worth reading carefully. **Editor.**

I was flagged down recently at the monthly TRW (Los Angeles) Swap Meet by an old timer I hadn't seen for twenty-five or thirty years.

"Hey, Woody, I'm sure glad you are wearing jumbo call letters. As I recall you used to be pretty sharp on antennas. The wife and I just retired to a place in the country with enough room for me to put up some decent antennas for a change, and I sure need some help.

"Over the last several years I've been reading lots of good things about a 40 and 75 or 80-meter array called the Bobtail Curtain that's supposed to do a real job on DX, and I'm thinking of putting one up for 75 meters. Do you know enough about the Bobtail to answer a couple of questions I haven't found answers to?"

"Well," I replied as I looked away and scraped a circle with my big toe in a futile attempt to feign modesty, "if I can't answer them authoritatively I deserve to be embarrassed. I wrote the original article on the Bobtail, back in 1948."

"Nineteen hundred *what* did you say?"

"It appeared in the April, 1948 issue of *CQ* under my name, with the title 'Bet My Money on a Bobtail Beam,'" I added. Then, seeing as how he was duly impressed with my credentials, I proceeded to answer his questions, all of which I had been asked before at one time or other.

Because certain questions have kept recurring over the years, a recap of those particular questions along with brief answers would seem to be in order. Also included are historical data on the evolution of the Bobtail from the inverted ground plane (IGP). The IGP has not received the recognition and popularity it deserves as a highly effective 40 and 75-meter omnidirectional antenna for long-haul DX. Then, for the benefit of those who always like to know all about the why, some additional details and information will appear in Part II of this article.

basic Bobtail Q & A

Q. My 40-meter Bobtail does an amazing job on DX compared to my old antenna, but I don't have room for a 75-meter Bobtail. What if I put up only half a Bobtail on 75, with two tails instead of three? How should I feed it?

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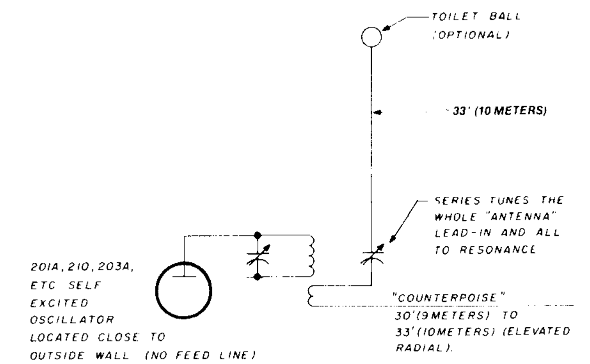

fig. 1. This simple 30 up and 30 out was responsible for lots of real DX on 40 back in the good old days. The copper toilet ball often was employed by the superstitious as a DX talisman (and by the author just for insurance). In 1928 the single-wing radial, then called a counterpoise, frequently was engineered to be about clothesline high (no driers in those days).

A. The three-element version is the elegant version, with better suppression of end-fire high-angle lobes from the horizontal section as compared to a two-element version without end radials. If end radials (extending out beyond the vertical elements) were employed on a two tailer, the horizontal space taken up would be the same as for the standard three-element Bobtail. A two-tailed version, by the way, actually is two-thirds of a three element, not half.

For gain, the two-tailed version without end radials (nowadays sometimes referred to as the half square, per K3BC) is nearly as good as the three tailer if properly fed. I'm partial to feeding the bottom of either leg via a resonant tank. Refer to the answer to the third question regarding coax feed.

Q. I'm going to have trouble getting poles up high enough on 75 meters. Can I cut off 15 or 20 feet from the tails of a 75-meter Bobtail by inserting loading coils in each tail near the bottom? If so, how far up should they be placed?

A. Yes, go ahead. On 75 I would place the coils up about 5 or 6 feet from the bottom. Don't shorten the poles and the tails any more than you have to, or the business part (top) of the vertical radiators won't be able to "see out" as well. Construction of suitable loading coils will resemble good quality trap coils. Any loss in performance other than a slight reduction in bandwidth will be a result of the lower antenna height. There will be very little loss in gain when using coils if the Q is reasonably good.

On 40 meters I see no excuse for loading coils. I would use poles at least 40 feet high so the current loops are well up off the ground, With poles this high on 40, no loading coils are required. If nearby buildings are more than one story, still higher is better yet. Keep in mind that the tops of the vertical elements always like it better when they can see out.

Q. Why can't I just feed one of the current loops of a two-tail Bobtail with coax? How well will it match 50 ohms?

A. You can feed it that way, and it will work, and the VSWR will be tolerable. The coax should be brought down at a 45-degree angle *toward the center*, not to the side or outside, until at ground level. Then take it where you want. There is no way to dress the coax that will avoid completely all undesirable coupling to the far side of the antenna, and this will result in some antenna effect on the coax. Fortunately, it will not be bad enough to cause serious problems. Unfortunately, coax will not work satisfactorily at half or twice frequency.

Q. When three vertical elements are used with bottom feed of the center element, how does the current compare in the three elements? Is it the same in all three, or twice as high in the center element? Or something in-between? I've heard arguments about this.

A. Intuitively one might conclude that the current distribution is 1-2-1 (binomial). But I learned long ago to be wary of deductions that are immediately obvious. What if the complex mutual impedances existing between the various elements should produce a significant effect upon the current distribution? These impedances and the net effect are quite difficult to calculate. The original article stated simply that the current is considerably greater in the center element. Measurements taken subsequently with the aid of a spotting scope confirmed that the distribution in a typical installation *approaches* 1-2-1.

Q. In your *CQ* article and in the description of the Bobtail in your book *The Antenna Manual* you show inductive (link) coupling between the feedline and the parallel resonant matching tank that voltage feeds the driven element. Can't I just use a variable tap instead, or maybe a tapped L-network? It would be easier to adjust than a link.

A. Inductive coupling was chosen primarily to cut down on possible receiver front-end overload and cross modulation. A 40-meter three-element Bobtail looks like a big omniverous Marconi to 160-meter and broadcast-band signals. If you don't have any 160-meter friends nearby or any high power a-m broadcast stations within a few miles, you should have no trouble using a tank or L-network with a variable tap on the coil (in lieu of the inductive link). You can always add a 50-ohm highpass filter designed for about

2500 kHz cutoff if you do happen to come up with a cross-modulation problem.

Q. In your description of the Bobtail Beam in the *Antenna Manual*, but not in your *CQ* article, you mention the use of a small ground screen under the bottom end of the driven element. How important is this? What are the benefits?

A. Such a screen makes a highly effective rf ground, much better than something buried in or driven into the soil, for a ground-independent antenna (meaning one which has little current flowing to ground or ground substitute at the feedpoint). The Bobtail falls in this category. Resonant radials above ground get in the way, are not required for efficient operation of a Bobtail, and may actually upset the pattern under some conditions.

An earth ground is useful primarily for lightning protection, and even if one is employed near the feedpoint for this purpose, a small ground screen in addition is recommended. Grounding considerations are covered in more detail in connection with further discussion of feed methods.

evolution of the Bobtail

The Bobtail may be considered as a broadside array of co-phased quarter-wave radiating elements configured as inverted ground planes. Let's start this Bobtail discussion with a review of the inverted ground plane before progressing to an array using them.

If you have trouble accepting a ground plane with only one radial, don't. Maybe the definition of ground plane has to be stretched a bit, but in the late 1920s (with some still in use in the early 1930s) there was a widely used 40-meter DX antenna often referred to as the 30-30 (**fig. 1**) which could be considered a ground plane flying on just one wing. It used a vertical quarter-wave radiator in conjunction with a neck-high quarter wave horizontal counterpoise which was nothing more than a single above-ground radial.

When the hams moved from 160 meters to 80 and then to 40, the easiest thing to get going in a hurry was a scaled-down antenna-counterpoise arrangement used on the lower bands. Usually the 30-foot radiator and the 30-foot counterpoise were brought in directly to the rig, placed by a window to keep the inside leads short. Feedline? Who needs a feedline? The overall length, with a sum total of about 60 feet outside, was just about right for series tuning to resonance by means of a variable capacitor, more often known in those days as a variable condenser.

Sometimes a copper toilet ball was placed atop the vertical radiator as a combination DX good luck charm and top-loading capacitance that substituted for the multi-wire flat top on a 160-meter Marconi. One big gun DXer claimed it put some kind of DX English on the radiated wave, while the small-caliber crowd always looked to see if he had tongue in cheek. Yes, I used a copper toilet ball. Just in case. No use taking any chances. Besides, nobody had proved yet that the ball did not do any good.

Don't ever pooh-pooh this venerable antenna, because its record of DX worked on 40 speaks for itself. Back in the late '20s a local ham friend worked (QSL confirmed) what was then Madagascar, now Malagasy Republic, on 40-meter CW a half hour before local sunset, running about 50-watts input. Yes, he did it with his trusty 30-30, complete with toilet ball. The rig used a 210 7-1/2 watt triode in a self-excited oscillator, and except for tube type, was typical of perhaps half the CW rigs on the air. Not too shabby from California, even if conditions did happen to be especially good at the moment. From a decent location and with good conditions such results then were commonplace enough with a 30-30 to be considered only slightly amazing.

Actually, the old 30-30 corresponds to a modern trap vertical that uses about 30 feet of effective vertical radiator on 40 meters working against an above-ground resonant radial. The toilet ball, when used, did add to the effective height, but without a loading coil probably not very much.

the center-tapped Windom

While the 30 up and 30 out was popular as a simple yet effective 40-meter DX antenna, the traffic and rag-chewing crowd on 40 had their very own favorite for short- and medium-haul work. This was the single-wire-fed Hertz, oriented horizontally at 30 to 40 feet. Its performance out to several hundred miles was such that its popularity and reputation were well deserved. And it was the ultimate in simplicity.

The antenna first got media attention in an article by Williams, 9BXQ (no W prefix back then), appearing in the July, 1925, issue of *QST*. This was followed by several others over the next few years.

As the name implies, this dipole antenna was fed by a single wire attached to a super-magic point on the dipole between 1/7 and 1/6 of the antenna length from the center. The exact point for minimum VSWR varied with feeder and antenna wire sizes and with surrounding objects, particularly ground.

This does minimize standing waves on the feeder, often bringing the VSWR very close to 1.0 if the dipole length also is correct. But contrary to a misconception widely held at the time (and still somewhat prevalent), unity VSWR does not eliminate radiation from (and pick-up by) the single-wire feeder.

Reduce radiation and pick up? Yes, some. Eliminate it? No. We have simply converted the line to a

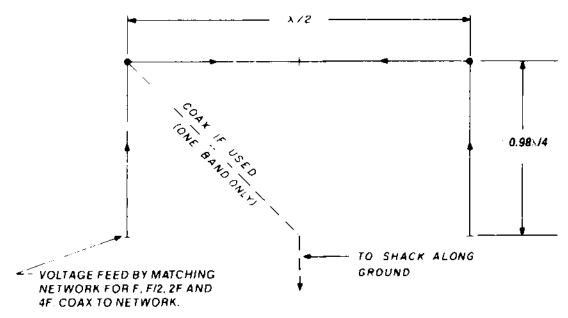

fig. 2. The old 30-30 works even better upside down. When inverted, two can be tied together as shown and voltage fed at one end to make an effective broadside curtain for DX. This elementary Bobtail, or half square did not stir up much interest back in 1948 because it looked too simple, but lately has received a lot of favorable attention.

traveling wave radiator (antenna). Minimizing the VSWR alters the pattern of radiation from the feedline somewhat, and reduces but by no means eliminates the net feedline radiation and pickup.

By 1929, enough conflicting information was floating around on the proper method of arriving at the magic tapping point for the feeder that Loren Windom, W8GZ, was prompted to write what has become a classic article on the subject. The article appeared in the September, 1929, issue of *QST*, and made it unnecessary to fret or argue over the subject any further.

Remember the Yagi-Uda situation, where the English-speaking Mr. Yagi (later Dr. Yagi) made it very clear in his classic 1928 IRE Proceedings paper that he was merely reporting on the work of Professor Uda, who had developed a clever new parasitic array a couple of years before? Well, the same thing happened with the single-wire-fed Hertz. Much of the early work was done at Ohio State University, and W8GZ gave them full credit. W8GZ made it very clear that he was acting solely as a reporter and was claiming no credit for collaborating on the actual development.

Nevertheless, over the years the single-wire-fed Hertz became better known as the Windom. In fact, in Great Britain it was generally referred to as the Windom almost from the day the article by W8GZ first appeared. Dr. Hideji Yagi, meet our Mr. Loren Windom, another reporter on antenna developments. He, too, unwillingly became world famous for an antenna he did not develop or invent.

Back when horizontal Windoms were common, an acquaintance of mine with one at 40 feet kept insisting that he could raise DX easier if he changed the match by sliding the tap a bit toward the center. He wondered if there were some easy way to figure out where the optimum DX tap should be attached without moving it a few inches at a time and comparing results (not too practical).

At first he thought I was kidding when, after getting suspicious as to what actually was going on, I suggested he move the tap to the exact center and see what happened. How about dropping the feeder straight down for about 33 feet, then cut it there and voltage-feed the bottom end with the Zepp feeders he had saved when he converted his Zepp to the Windom?

About a week later he called me breathlessly to announce that the new antenna was working so well that over the weekend he worked some new countries. He would have phoned me sooner except that he was too busy working DX, he explained.

upside down is better

On-the-air tests showed that this inverted configuration of what today would qualify as a two-radial ground plane consistently outperformed typical 30-30 installations on long-haul DX. Subjectively the improvement appeared to be at least a full S unit (then called an R unit).

Tests run more recently confirm that there is only one way to get a regular ground plane to perform as well as an inverted one. That is to get the whole ground plane up in the air where it is well removed from ground and pretty much in the clear. But on 40 and particularly on 75/80 meters this seldom is feasible.

Pat Hawker, G3VA, editor of the RSGB (Great Britain) book *Amateur Radio Techniques*, long ago recognized the advantages of turning a ground plane upside down at high frequency. For years Pat has been hawking (excuse me, *extolling*) the merits of the inverted ground plane for DX in his book.

the Bobtail takes shape

When it came time for me to get something back on the air after WW2, I recalled the results obtained from an inverted ground plane on 40-meter DX, and got to wondering: Is there something I could squeeze on my lot that would do a better job on 40-meter DX than an inverted ground plane? How about two of them in phase (**fig. 2**), oriented so the bidirectional pattern would cover the most important geography? How about using only one radial for each vertical element and bringing the radial ends together so that only two poles would be required? The half-wave spacing would be just right for broadside (in phase) operation of the vertical elements. And the voltage and phase at the tips of the two upstairs radials would be the same and therefore could be joined.

The antenna now would resemble nothing more than a bent fullwave antenna; so it should be possible to get away with feeding only one end (either end). The radiation from the two halves of the horizontal section should cancel well enough that the spurious end-fire lobes from the horizontal section don't represent much wasted power. Receiving, these minor lobes are going to pick up off-axis QRM, but it shouldn't be too high a price to pay for such simplicity.

With the project barely past the bill of materials stage, came an unsurmountable obstacle: I would be moving. There was nothing to do but abandon the project. The trouble was that having gotten all steamed up about the new brainchild, I just couldn't stand not having somebody, *anybody*, put one up to confirm my expectations. So I approached some of the local DX, golf, fishing, and self-styled world-class antenna experts and tried to interest at least one of them in putting up a 40-meter job.

Sad to relate, the very simplicity of the antenna turned out to be my undoing. No takers, even when I offered to help put one up. Their reaction was unanimous. They patiently pointed out to me that, as any fool could plainly see, no antenna that simple could possibly be much good, especially when it is upside down with the counterpoise on top. Obviously, if anything as simple as a bent piece of wire could be all that wonderful on DX, everybody would be using one.

How about enticing them with a more elegant version I had been thinking about. It would perform only slightly better and would require 50 percent more room, but would appear to be more sophisticated, more complicated, and more elegant looking. It definitely would not look like a bent piece of wire. How about adding a vertical element and feeding the bottom of the center one? It would produce only slightly more gain, but a cleaner pattern. More important at the moment, it would certainly be more impressive-looking when sketched.

Fortunately it did turn out to be easier to sell. I quickly got a willing customer who had room for a three-element 40-meter job. Thus, the Bobtail was born (see **fig. 3**).

When he reported back to me on its DX performance, he kept using the words phenomenal, fantastic, etc., ". . . especially beyond 2500 miles when compared to my old antenna."

As a result of his plugging it over the air, I started receiving requests for information. To cut down on this I decided to write an article describing the antenna. When I contacted the editor of *CQ* about a Bobtail article, I recounted my lack of success in stirring up interest in a simple, two-element version. We decided not to include the two-tailer, but possibly make it the subject of a follow-up article.

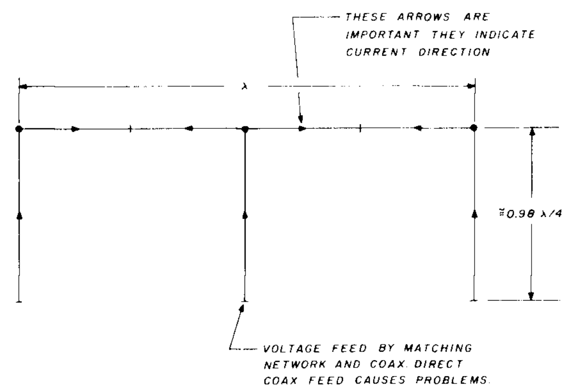

fig. 3. The classic three-element or elegant Bobtail provides better cancellation in the horizontal portion, resulting in less short-haul QRM when trying to receive weak DX. But it takes up more room (usually too much for 75 and 80 meters).

The Bobtail with its three elements looked intriguing enough in the published article to inspire some readers with room to put one up to action. Then among some fan mail and requests for more information appeared a couple of surprises. Two correspondents advised me independently a few days apart that to get a Bobtail to fit their lots they had gone ahead on their own and made it more compact. Both did it by using two instead of three elements, and feeding one end of what was left. Both correspondents were quick to add that their simplified versions worked just great, gave fantastic results, etc., etc. "Just thought you might like to know."

I wrote them indicating I was glad to hear that their chopped Bobtails were doing such a good job, and congratulated them on their ingenuity. Somehow I felt it would appear pretentious of me to write an article on my truncated Bobtail, so never did.

Thanks to Ben Vester, K3BC, for seeing that it finally got some favorable publicity ("The Half-Square Antenna," *QST*, March, 1974). And speaking of the Half Square, Ben's designation certainly is tidier and more descriptive than something like Two-Element Chopped Bobtail Curtain.

Part II will include, among other things, quantitative information on the gain of the Bobtail and Half Square (both free-space theoretical and real world practical DX-signal gain), multi-band operation and performance, more information on feed methods, construction considerations, and some dimensions for 10-MHz Bobtails.

ham radio

Bobtail curtain follow-up: practical DX signal gain

The second part of a two-part series on this remarkable antenna

The actual DX signal gain of any one type of antenna over another, at distances beyond about 2500 miles, does not always correlate well with the theoretical "free space gain over isotropic." After all, antennas do not operate in free space. Surrounding objects, especially ground, are a part of the antenna system.

For distances beyond 2500 miles, angles of signal departure below about 15 degrees are almost always the most effective. This is true regardless of propagation path, whether it's one acute geometric bend near midpoint or a chordal or ducting mode. And it's true regardless of ionospheric tilt. Although it's most noticeable on 10 and 15 meters, it still applies to long-haul 40- and 75/80-meter propagation.

To get the angle of radiation down while still keeping the antenna height acceptable on 40 and 75/80 meters, vertical antennas have long been used. Some verticals do a good job. A few, such as a full-size half-wave vertical, can do an excellent job in all directions. Others seem to radiate "equally poorly in all directions." I'll not take time to go into all the reasons why short vertical radiators that are current fed near ground level are often ineffective.

As noted in Part I of this article, simply turning the antenna upside-down greatly reduces the ground loss problems. For one thing, it minimizes the conduction current flowing to ground at the feed point when the antenna is ground mounted. It also minimizes the losses caused by displacement currents in the near field fighting their way through lossy dirt trying to find a "mirror image" that, in this case, is more theoretical than real. In addition, getting the high-current portion up in the air allows the antenna to radiate somewhat more effectively, and it lowers the angle of radiation slightly.

Users of the Bobtail antenna often report gain improvements on long-haul DX of from 10 to 20 dB over their previous antenna. But only a little of that improvement results from the azimuthal directivity. The sometimes startling effectiveness of the Bobtail for 40- and 75/80-meter DX is the result of its inverted configuration. This is ordinarily more noticeable in a built-up, residential area than in an open field.

The gain attributable to the horizontal directivity of a two-element Bobtail, or half square, is about 4 dB over that of an inverted groundplane using two resonant radials. The half-power beamwidth of each lobe of the bi-directional figure-8 pattern is about 60 de-

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grees — wide enough to cover some worthwhile geography while still providing useful gain.

The full-size Bobtail (for those that have the room) has a directivity gain of slightly over 5 dB (compared with the same reference). The half-power beamwidth is about 50 degrees. Four or five dB doesn't sound like much, but if your signal is marginal it can make the difference between copy and no copy. On receive, the discrimination you get from the azimuthal directivity can be worth more than the 4 or 5 dB when it comes to what you can copy through noise and QRM.

The slight extra gain of the full-size Bobtail over the two-element should be considered a bonus. The main advantage of the full-size version is that spurious lobes are reduced in amplitude, and therefore end-fire, high-angle pickup on receive is reduced. There is no point in being able to deliver a readable signal 6000 miles away on 40 if you can't hear the other station because of bad off-axis QRM from a station 600 miles away.

direct coax feed versus voltage feed

As noted in Part I, if certain precautions are taken, direct coax feed can be used with a half-square version of the Bobtail. The disadvantage of doing so is that it limits the antenna to one band. Voltage feeding one end of a half square permits use on half frequency, as sort of a drooping, half-wave dipole. At twice the frequency it functions as a combination of two co-phased vertical dipoles a wavelength apart, with the resultant cloverleaf end-fire and broadside pattern having its nulls filled in fairly well by the pattern produced by the horizontal full-wave portion. Voltage feeding the half square at three times frequency produces an interesting multiple lobe pattern that results in unpredictable results. Voltage feeding one end of a half square cut for 40 meters will thus provide a low-angle, "far DX" figure-8 pattern on 40 while also doing a good general-coverage short- and medium-haul job on 80.

On 20 meters the composite pattern obtained results in a good, general-coverage "long" DX antenna that in addition is effective in the 750- to 1500-mile range. Voltage feeding it on 15 meters produces an interesting multiple lobe pattern that will sometimes, as noted above, produce results that often are surprising — and occasionally amazing.

On 10 meters it should be considered simply a random long wire that is capable of providing lots of good clean fun when the band is hot.

Unfortunately there is no really good way to feed a three-element Bobtail directly with coax, even for one-band operation. No matter how the coax is brought down from the center element there is going to be objectionable unbalanced coupling to the coax from radiating portions of the antenna. Using a balun does not cure the problem.

Connecting the coax to an end radiator junction as described for the half square does reduce the unbalanced coupling, but the current distribution in the three elements no longer is symmetrical. Current will be greatest in the fed element, thereby skewing the pattern and reducing the gain.

> *"Here's the best place to feed a Bobtail curtain . . ."*

The only really good way to feed a three tailer is to voltage feed the bottom of the center element. This permits multi-band operation in pretty much the same fashion as with the half square, though the lobe pattern on bands other than the fundamental will be slightly different. The main difference is that on half frequency the three-tail version makes a much better end-fire "medium DX" antenna than a half square. However, this is at the expense of high angle (short haul) effectiveness, particularly broadside.

"Zepp" voltage feed

Way back in the 1930s, PA0ZN came up with an antenna resembling a two-tail Bobtail (or half square) in appearance except for feed method. It was fed at the center of the horizontal section (a high impedance point) via Zepp feeders. The antenna obviously belongs to the "inverted ground plane" family, with the attendant advantages over a right-side-up arrangement.

However, the mutual impedance between the Zepp feed line and the rest of the antenna is such that strong in-phase currents are induced in the line, thus producing considerable "antenna effect" on the feed line. This is strong enough to produce sufficient distortion of the pattern to "dirty up the nulls" a bit without providing a significant increase in gain. The pattern is cleaner when the Zepp feed line is attached to one end of the radiator. While both radiator and feed line are unbalanced slightly with such an asymmetrical arrangement, the resulting imbalance is not enough to cause serious mischief.

If you want a dual band (say, 40 and 20 meters) omnidirectional DX antenna and would like to use Zepp feeders all the way to the shack, I would suggest an inverted ground plane with two radials, with the vertical element of the I.G.P. fed at the bottom with one side of the open wire line.

If you would like to Zepp feed a three-element Bobtail, be sure to feed the center element. But remember that the main reason for using a three-element Bobtail instead of a half square is the cleaner pattern, and while Zepp feeding the center element will not unbalance the antenna itself, the inherent unbalance in the Zepp feed line will cause some pick-up by the line when receiving, even if the open line is brought off at right angles out of the near field.

Considerable voltage will be built up across an open feed line at the high impedance points when the line is used as a Zepp feed line on transmit, so be sure to use sufficient spacing if you are running power.

ground screens and grounding

No antenna that is fed via an unsymmetrical feed system can be 100 percent ground-independent. However, if the impedance between antenna feed point and ground is over about 1000 ohms there will be very little current flowing to ground. In this case not much of an earth ground will be needed at that point for the antenna. A small ground screen, laid on the ground or a flat roof, or suspended or supported near the network matching 50-ohm coaxial line to the high impedance Bobtail antenna feed point, makes an effective rf ground. Such a screen will make a better rf ground than a lightning stake, or stakes driven in the soil. If one of the latter, properly installed, is advisable for lightning protection in your area, it still is a good idea to use a small ground screen as an rf ground.

One ready-made ground screen widely available is a 3 × 5 foot (0.9 × 1.5 m) piece of galvanized hardware cloth, packaged by Sears under the catalog number 44531 and available off-the-shelf at some Sears retail stores. Current catalog price is about $7.00 a roll.

To see if the ground screen is doing its job, simply touch the "rf ground" while running low power to see if the VSWR or field strength changes significantly. If it does, either shorten the connecting wire between screen and matching network or series resonate the wire with a mica capacitor. The value will not be especially critical. Possibly on 75/80 more screen will be required. Ordinarily if the antenna dimensions are near optimum, not much screen will be required in order to do the job properly.

10-MHz Bobtail dimensions

Because adding 10 MHz to a typical tribander is not the easiest thing in the world to accomplish, there is bound to be interest in 10-MHz Bobtails and half squares. Dimensions are not extremely critical. Except for direct coax feed of a half square, slight deviations from optimum can be compensated for in the tuner or matcher at the antenna end of the coax line.

Assuming No. 12 or 14 wire (M2.1 or 1.6) and typical insulators, the following dimensions will be found satisfactory for 10.1 to 10.15 MHz:

spacing of vertical elements:	48 feet 9 inches (14.86 m)
length of vertical elements:	23 feet 7 inches (7.19 m)

For the sake of convenience the voltage fed element can be made up to 5 percent shorter or 8 percent longer if fed by a resonant tank or L network. For Zepp feed, the fed element should be cut to the exact length shown.

guys and metal masts

When using wooden masts to support a Bobtail the usual precautions apply to breaking up adjacent guy wires to avoid resonance. There is nothing wrong with using metal masts of EMT or aluminum tubing as the outside vertical elements to save lot space. This requires a strong base insulator of low loss material, preferably having low shunt capacity. Nonmetallic guys do a better job electrically than guy wires, even if the latter are well broken up. The tubing should be of no greater diameter than what is required for adequate mechanical strength. A tubing element will be slightly shorter physically than a wire element for the same electrical length. Also, the shunt capacity of the base insulator will require shortening the element a bit more. However, if you merely make them 3 percent shorter than a wire element of optimum electrical length, and try to keep the base shunt capacity low, it should be close enough. Tubing joints should make good electrical contact or be jumpered.

Unless a piece of thick-walled fiberglass tubing or the like is used as the base insulator, it should be used only to support the weight of the mast, and not to hold the bottom rigidly vertical. This probably means an extra set of guys.

Keep in mind when planning your installation that the bottoms of the tails are quite hot with rf and can cause a bad burn if you are running much power. One way to avoid this is to slip some small-diameter clear plastic (such as fuel line) tubing over the ends of wire tails closer than 7 feet (2.5 m) from ground. If you decide to use metal tubing for the end elements, slit or saw lengthwise a few feet of PVC plastic pipe and tape it over the bottom of each mast.

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