Counterpoise?
On the Use and Abuse of a Word

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The term *counterpoise* has a long history in antenna engineering and amateur practice. Today, it may be among the most misused terms in amateur circles. Indeed, if we examine both the history of the term, its meaning, and its misuses, we might reach an interesting conclusion: there is no such thing as a counterpoise in antenna analysis, even though the term has a long and somewhat respectable use in antenna engineering.

Although my bookshelf has many gaps and covers antenna history in fits and spurts, we can detect some trends in the use of the terms, along with the seeds of misuse. Therefore, let's begin with a small informal history of the term counterpoise.

The Rise and Fall of the Counterpoise

I have several texts and popular books on radio and on antennas dating to the 1920s. In none of them do I find the term counterpoise. However, I do find references to a venerable antenna type that shall prove significant in these notes: the inverted-L. Fed at its base and strung between the equipment building and a far-end support, the antenna was once the most popular home antenna for those experimenting with radio receivers in the early 1920s. In Chapter 3 of *Practical Radio* by Henry Smith Williams (1922), we find the antenna name along with diagrams and instructions on how to arrange it. Part of the discussion involves grounding. However, the concern is for lightning protection to meet the requirements of the Board of Fire Underwriters. Hence, we meet such new ideas as the lightning arrestor (a gap mechanism) and old ideas such as the knife switch to short the antenna terminals to a ground connected either (ideally) to a ground rod or (practically) to a water piper. (My local cable system still--for convenience--uses a water-pipe ground connection out of doors.)

My earliest ARRL book is *The Radio Amateur's Handbook* for 1930. Chapter 11 covers antennas. This chapter makes no reference to a counterpoise. However, it does divide antennas into two categories. "Those in which the ground is an essential part are known as Marconi antennas." "The second type of antenna is the Hertz antenna, in the operation of which the ground does not play an essential part." (Page 159) Although few people still refer to a Hertz antenna in general categorical ways, the term "Marconi antenna" still makes its appearance, some times referring generically to a vertical monopole system (with or without a top hat structure) and sometimes referring to a specific design. The referent to the term requires a scorecard.

The idea of a counterpoise worked its way into amateur radio literature largely from AM broadcast practice, although references to the counterpoise rarely reveal the term's source. Instead, we have to follow indirect clues. For example, many references to the term appear in descriptions of antennas for 160 meters. Indeed, many earlier (pre-1960) uses of the term do not include references to 80- and 40-meter antennas, strongly suggesting that early writers took the 1.8- to 2-MHz band to be an extension of the AM broadcast band. However, not all references are quite so specific.

In the *Frank C. Jones Radio Handbook* for 1937 (p. 39), we find the critical distinction derived from AM broadcast practice.

A counterpoise which consists of one or more wires in a network insulated from the ground wil often reduce loss resistances which might occur when the quarter wave antenna is connected to poorly conducting earth. The counterpoise in the case of a network of several wires acts as a condenser plate with high capacity to earth, with the result of lower loss in the antenna system; for this reason the counterpoise should be fairly close to the ground. [See **Fig. 1.]**

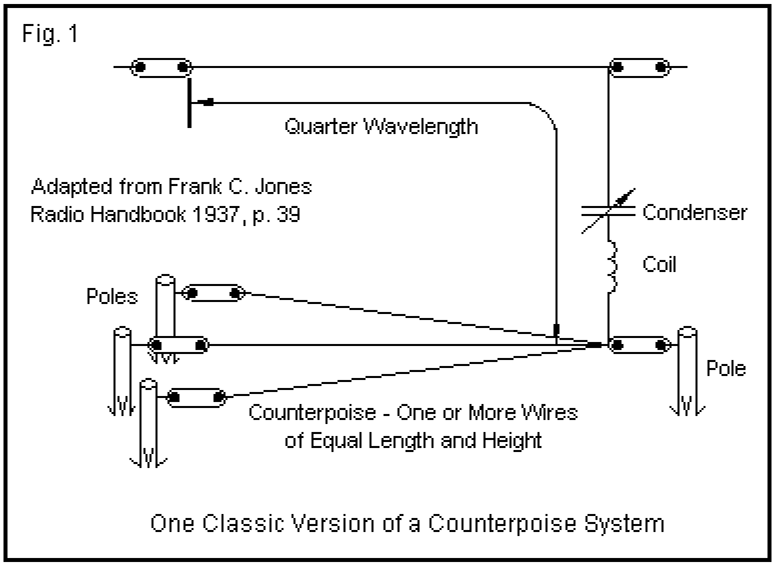
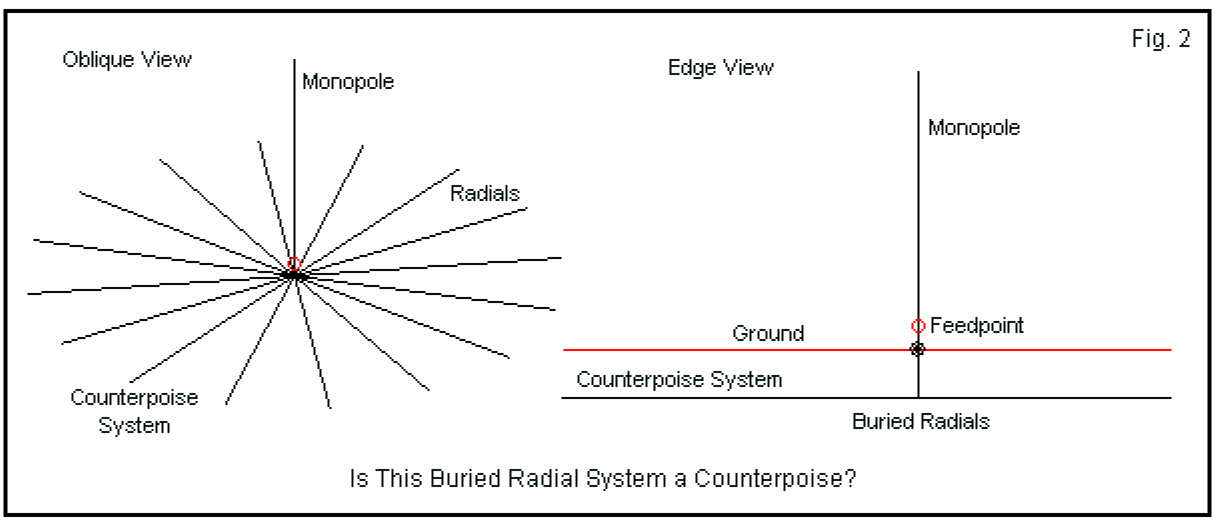


Fig. 2 shows a vertical antenna with an elaborate ground wire system buried under the surface of the earth for the purpose of obtaining low loss resistance connection to the ground. This system is more generally used than the counterpoise.



The Jones handbook of course eventually became the famous Editors and Engineers *Radio Handbook* so ably edited for decades by Bill Orr, W6SAI. However, the last edition (the 23rd) contains no mention of the counterpoise. Nevertheless, Jones captures the critical distinction that gave the term counterpoise its good sense. It distinguished the buried radial system from a system of radials very slightly elevated from the ground. The entire radial system is insulated from the ground so that the only electrical connection occurs by virtue of the capacitance between the radials and the earth.

The sketch of the counterpoise system in **Fig. 1**, which is adapted from figure 6 in Jones' handbook and contains the essential features, also contains the seeds of some later misuses of the term. The antenna is the inverted-L, a necessity for most amateurs with limited yard space. More relevant is the drawing of the counterpoise wires. We find a few wires that do not form a full radial structure, and they all go in the direction of the horizontal portion on the inverted-L. An uncritical reader might well get some odd ideas. For example, perhaps we do not need a full set of radials in a counterpoise. In addition, perhaps it is important that the wires appear beneath the horizontal leg of the inverted-L. Finally, perhaps a counterpoise wire or set of wires is important to horizontal antennas. Following Windom's 1929 *QST* article, we might treat the vertical portion of the inverted-L as simply a one-wire feedline to the true element, the horizontal portion of the antenna.

Following the end of World War II, the amateur market once more received a spate of books on all facets of radio practice including antennas. *Antenna Manual* by Woodrow Smith, appeared in 1948. Unfortunately, it did not result in the periodic updates that marked the other Editors and Engineers offering by Orr. However, it remains a classic in amateur literature. On p. 154, Smith repeats the Jones statement about the counterpoise, in contrast to the buried radials ground system.

> In the case of very rocky or poorly conducting soil a *counterpoise* often is substituted for a buried network of wires. A counterpoise is a network of wires place *above* the earth a slight distance and insulated from it, so arranged to produce a very high capacity to the earth.

In the same post-war era, ARRL developed a continuing series that has become as well-known as its Handbook. The earliest *The ARRL Antenna Book* on my shelf is the 5th edition from 1949. On page 62 we find a discussion of elevated vertical monopole radials, followed by this statement:

> The lengths of wires and the configuration used are not especially critical. . ., particularly when the ground plane is close (in terms of wavelengths) to the actual ground. The ground plane is usually called a **counterpoise** when so used.

The first and seemingly casual statement about counterpoises actually marks the beginning (or close to it) of another misuse of the term as it folds together all forms of elevated radial systems. As we shall see, there may be good reason to separate the elevated radials from a counterpoise system as understood by AM broadcast engineers of the period.

On pages 220 and 221 of the same volume, in a discussion of antennas for 160 meters (Chapter 10), we find a more extended discussion of "The Counterpoise."

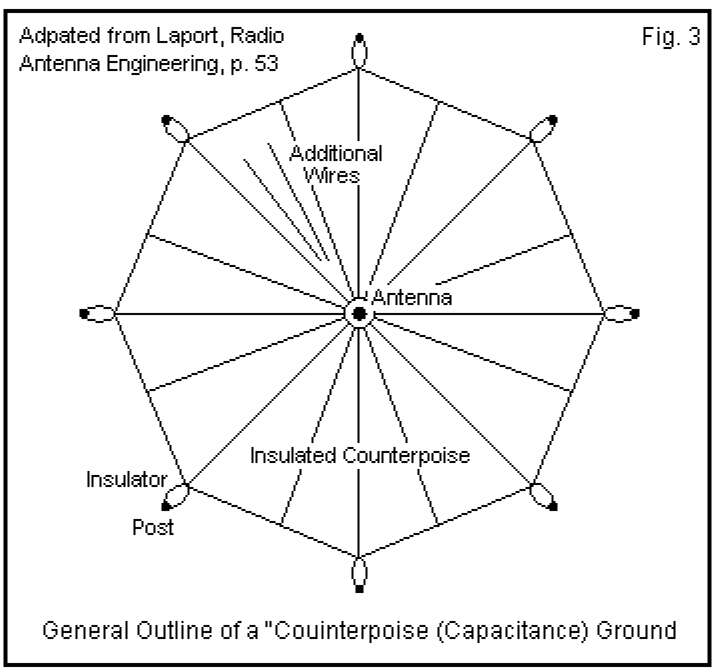
> The counterpoise is a form of capacity ground which is often quite effective. Its use is particularly beneficial when a extensive buried system is not practicable, or when an ordinary pipe ground cannot be made to have sufficiently low resistance, as in rocky or sandy soils.
>
> The shape of the counterpoise may be made anything convenient; square or oblong arrangements are usually easy to construct and will work satisfactorily.
>
> To work properly, a counterpoise must be large enough to have considerable capacity to ground, which means that it should cover as much ground area as the location will permit. . . .The capacity of the counterpoise will be approximately equal to that of a condenser consisting of two plates, each of the same area as that of the counterpoise, with spacing equal to the height of the counterpoise above ground.
>
> The height of the counterpoise is not particularly critical. . .from 6 to 10 feet [0.01 wavelength to 0.02 wavelength] above ground.
>
> [T]he best performance will be secured as a general rule, when the counterpoise is insulated from ground.

The discussion contains further details on the construction of a 160-meter counterpoise system. Indeed, it is one of the most extensive discussions in amateur radio literature. Interestingly, *The Radio Amateur's Handbook* for 1952, especially in connection with 160-meter antennas, in Chapter 14, on p. 342, under the heading of 160-meter monopoles that are usually inverted-Ls, repeats the kernel of the *Antenna Book* account.

> The use of a counterpoise is recommended where a buried system is not practicable or where a pipe ground cannot be made to have low resistance because of poor soil conditions. A counterpoise consists of a number of wires supported from 6 to 10 feet above the surface of the ground. Generally, the wires are spaced 10 to 15 feet apart and located to form a square or polygonal configuration under the vertical portion of the antenna.

The 1952 *Handbook* reason for using a counterpoise does not jibe completely with engineering practice in the same year. In fact, we may turn to an engineering classic, *Radio Antenna Engineering* by Edmund A. Laport, which appeared in 1952. The full discussion of radial system alternatives is too long to quote extensively, but Laport describes the basic idea succinctly on p. 52.

> The counterpoise is an insulated net of radial wires assembled above the ground to form a large capacitance with the ground. From the earliest days of radio, the merits of the counterpoise as a low-loss ground system have been recognized because of the way in which the current densities in the ground are more or less uniformly distributed over the area of the counterpoise. Any tendency toward nonuniformity of current distribution in the ground will increase the portion of the ground current toward the edge of the counterpoise. It is inconvenient structurally to use very extensive counterpoise systems, and this is the principle reason that has limited their application. The size of the counterpoise depends upon the frequency. It should have sufficient capacitance to have a relatively low reactance at the working frequency so as to minimize counterpoise potentials with respect to ground.
>
> There should not be any connection to actual ground in the antenna circuit when a counterpoise is used.



See **Fig. 3** for a sketch adapted from Laport's volume. My version is simplified in omitting the antenna control box ("tuning house" below the wires) and, more significantly, in only showing a few of the wires that make up the counterpoise system. As Laport notes, the counterpoise system is preferable to a buried radial system in terms of loss reduction in the AM broadcast band. However, for ground-mounted installations, it is usually impractical. Hence buried wires in AM broadcast antenna systems are more common. However, the counterpoise system remains necessary in urban situations, when such antenna must be mounted atop buildings with somewhat dubious conductive structures below the ground-plane system.

However, the extensive references to the details of a counterpoise system begin to dwindle after Laport's work. (In many ways, Laport's volume is a compendium of engineering practices in antennas for the 2 decades prior to the release of his text in the early 1950s.) For example, in *Wave Propagation and Antennas* by George B. Welch, 1958, we find on p. 183 only a small reference to the counterpoise in connection with increasing the efficiency of short vertical monopoles.

> A ground system mounted in insulated supports a short distance above the earth is called a *counterpoise*.

By 1974 and the 13th edition of *The ARRL Antenna Book*, the extended account of the counterpoise system has disappeared from the discussion of 160-meter antennas. Instead, we have a somewhat vague mention of raising the antenna and radials off the ground, although some reference to the capacitances involved still occur.

> Such a system is sometimes called a counterpoise.

The absence of detail on the counterpoise, as understood in the 1949 to 1952 period, was bound to result in some potential confusions. Just when they begin is dim, but by 1991 and the 16th edition of *The ARRL Antenna Book*, they are in relatively full force. On pages 2-36 to 2-37, we find a detailed account of the work of Doty, Frey, and Mills, who used a 64-radial system 5' above ground at 27-30 MHz to test the effectiveness of a vertical monopole. Despite that fact that the large radial system is 0.12 to 0.15 wavelength above ground, a relatively great height for such systems, the text still calls the assembly a counterpoise system. In addition, on page 3-11, we find an additional statement.

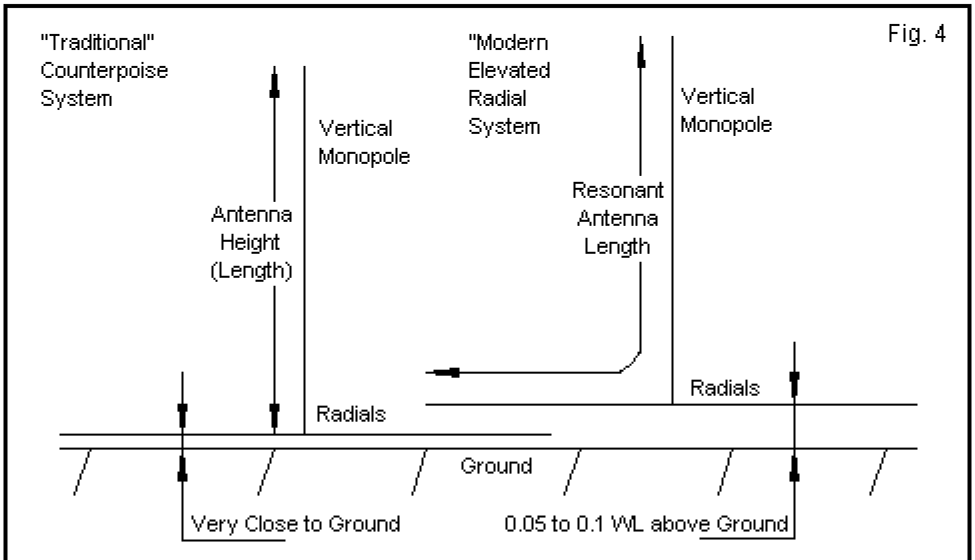
> The effect of a perfectly conducting ground (for radiation resistance purposes) can be simulated under an antenna by installing a metal screen or mesh such as poultry netting (chicken wire) or hardware cloth on or near the surface of the ground. The screen or counterpoise system should extend at least a half wavelength in every direction from the antenna.

The use of a densely packed ground screen has been common practice in AM broadcast work for many decades, although it often shows up in the form of short radials placed between the longer radials on the standard 120-radial broadcast buried ground plane. However, texts like Laport's do not call this a counterpoise. It lacks the required elevation above the ground.

By the appearance of the 20th edition of *The ARRL Antenna Book* in 2003, the departure from engineering practice in the use of the term counterpoise is relatively complete. For example, on page 2-16, we find the following statement.

> The term *ground plane*is also used to describe a vertical antenna employing a 1/4 wavelength vertical radiator working against a *counterpoise* system, another name for the ground plane that supplies the missing half of the antenna. The counterpoise for a ground-plane antenna usually consists of four 1/4 wavelength radials elevated well above the earth.

Of course, this use of the term flies in the face of the history of the term to refer to radial systems that are close enough to the ground to exhibit a relatively high capacitance between the radials and the ground. As well such systems would contain many radials or other wires to simulate to the degree possible a solid plate for maximum capacitance. To further the confusion on the use of the term counterpoise, we find on page 3-2 a repetition of the statement quoted from page 3-11 of the 16th edition, referring to the ground screen on or in the ground at the antenna base. Finally, on pages 6-8 to 6-9, we find reference to the work of Al Christman, KB8I (now K3LC), who has perhaps done the most research with monopoles using elevated radial systems. Christman is clear in noting that the height of the radials that allows the use of only a few radials (compared to the large radial systems needed in buried systems) introduces a change in the way in which we view the radials. Whereas the counterpoises of Laport and others contained many wires of somewhat indefinite length (up to perhaps 1/2 wavelength), the elevated radials in his study required attention to the combined lengths of the radials and the vertical section to obtain resonance. **Fig. 4** outlines the differences.



Distinguishing a Counterpoise from an Elevated Radial System

Nevertheless, on page 6-8, we find the following statement.

> A counterpoise is most commonly a system of elevated radials, where the radial wires are interconnected with jumpers. . ..

With respect to systems using vertical monopoles, the confusion or conflation is now complete. At one time, the notion of a counterpoise distinguished a certain kind of ground system from the typical system of buried radials. The counterpoise consisted of radials (ideally) or other shapes (practically in restricted spaces) insulated from the ground and placed relatively close to ground as measured in terms of wavelengths. The theory of the counterpoise involved creating sufficient capacity between the ground radial system and the ground itself to increase the efficiency of the monopole system, and as reported by Laport and others, it yielded higher efficiencies in some cases than buried radials.

One consequence of the engineering use of the term counterpoise was a 3-part distinction. Below the ground, we have *buried radial systems* with the wire in direct (or nearly direct, if the wires are insulated) contact with the ground. Next, we have *the counterpoise* alternative to buried radials. The counterpoise size and wire density equaled that of the buried radial system for maximum efficiency. Third, we have *elevated radials*, where the capacitance between the radials and the ground is too small to be effective in the determination of antenna efficiency. Rather, the radials become part of the antenna structure sufficiently independent of the ground that antenna resonance is a function of the overall antenna size at the operating frequency. Under these conditions, of course, the required element and radial lengths will change according not only to antenna height, but as well with the number of radials used and whether we leave the tips open like spokes or connect them together with a perimeter wire. The general properties of elevated radials apply regardless of the height of the antenna above ground once we pass through the frontier between the counterpoise and genuinely elevated radials.

Unfortunately, current literature available to radio amateurs blurs the distinction among these three relatively distinct cases, only one of which corresponded to the traditional engineering use of the term. If the term now covers every type of antenna with radials, then we may completely drop the term and simply say that an antenna needs radials to work. Or we might even resurrect the term "Marconi" antenna, although that option might itself create more confusions than it resolves.

Practical Consequences and Recent Aberrations

As "they" say in television advertisements, "But wait. There's more."

The conflation of the traditional engineering use of the term counterpoise with monopole radial systems in general leaves the would-be antenna builder with massive decisions and no way to answer them. The counterpoise itself, as described in the literature, requires complete insulation from the ground. A buried radial system is already in direct contact with the ground. An elevated radial system may use without harm a single safety lead connected to the hub of the radials and a ground rod. For static discharge and lightning safety, the counterpoise requires different safety switching and discharge methods relative to the other systems.

More intriguing is the question of at what height to place, respectively, the counterpoise and the elevated radials. For convenience and safety of individuals using the ground-plane space, most literature recommends a height of 6 to 10 feet for a 160-meter counterpoise. However, that height may in fact be greater than optimal for maximum capacitance between the counterpoise and the ground. Heights closer to perhaps 1 to 1.5 meters (3.3 to 4.9 feet) may be more satisfactory, with proportional reductions when using a counterpoise on either 80 or 40 meters.

In contrast, the minimum height at which elevated radials become very effective is between 2 and 3 meters (6.5 and 9.8 feet), almost regardless of which band one uses in the lower HF spectrum. In this region, 6 to 8 radials generally suffice for an elevated system, but the length of the radials requires adjustment in concert with the length of the vertical section to obtain resonance and a stable feedpoint reactance over small changes in system height above ground. The physical distances represent heights that average about 0.15 wavelength at 160 meters, 0.3 wavelength on 80, and 0.6 wavelength on 40 meters. As well, these are only heights where the performance and the feedpoint impedance stabilize. Some additional height is possible before the far-field radiation pattern begins to show signs of deterioration. For further information on lower-HF elevated radial systems, see any of Al Christman's articles or see Chapter 6 of *Ground Plane Notes*, available from *antenneX*.

In its engineering form, the counterpoise emerged as an alternative to buried radials systems for AM broadcast use. We may model both systems using equivalent monopoles and radials systems. Let's use a test frequency of 1 MHz, in the middle of the AM broadcast band. For a buried radials system, let's lay down 128 radials, each 0.003-m in diameter (about the same diameter as AWG #10 wire). The radials will be 1/2 wavelength long, since that is one of the recommended values for a counterpoise system, and buried radials are not extremely sensitive to length. The radials will be 0.1-m (about 4") below the surface of average ground (conductivity 0.005 S/m, relative permittivity 13).

We may use the same set of radials for a counterpoise by raising them to a height of 2-m (6.56' or 0.0067 wavelength) above the same ground, with no connection between the radials and ground. Otherwise, the radials are identical to the buried set. Let us assume for at least a moment that 128 radials composed of wires with the specified diameter form a very reasonable approximation of a solid surface. We may calculate a capacitance value for the virtual capacitor of which the counterpoise is one plate. The calculated capacitance is about 3.5e-7 Farads, which yields a capacitive reactance at the design frequency of about -j4.5e-1 Ohms. The reactance is under 1/2 Ohm, although the initial assumption may be shaky. The actual reactance is likely some higher figure due to the open-end structure of the modeled counterpoise radial system. Nevertheless, the calculation shows the general range of values toward which counterpoise designers aimed.

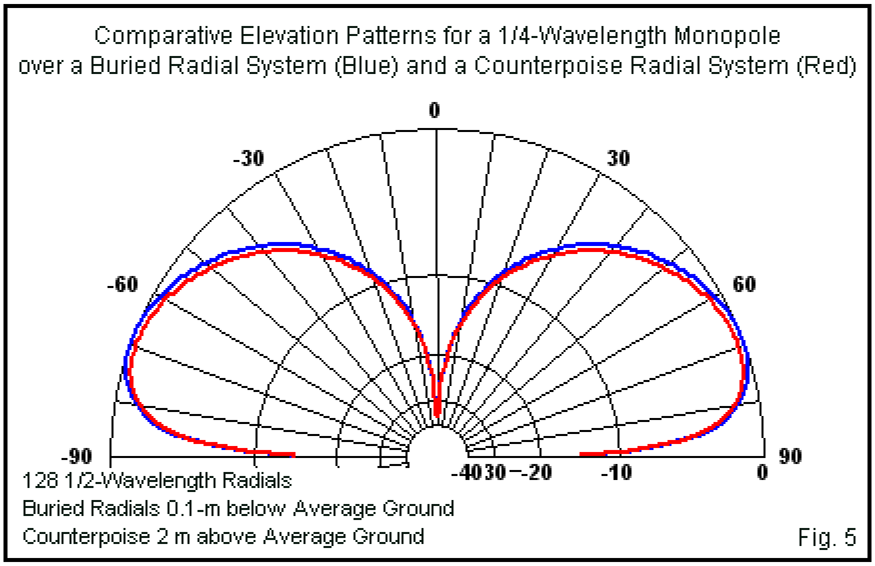


Fig. 5

Fig. 5 overlays elevation patterns for the two monopole installations. Both patterns have a TO elevation angle of 21 degrees. The buried-radial system yields a maximum gai of 2.24 dBi, while the counterpoise system shows a maximum gain of 1.93 dBi, about a 0.3-dB difference. One might change the counterpoise system gain by solidifying the radial structure, perhaps with cross wires linking the radials, especially in the outer regions in which the radials show maximum separation.

Despite the similarity of antenna performance, the current distribution along buried radials is not the same as along the slightly elevated counterpoise wires. **Fig. 6** shows graphs of the current magnitude along the radial wires. Both parts of the figure use the same maximum current value (red) in order show the variations. The monopole current will appear wholly red, since the currents in the individual radials begin in the feedpoint segments at 1/128 the source current.

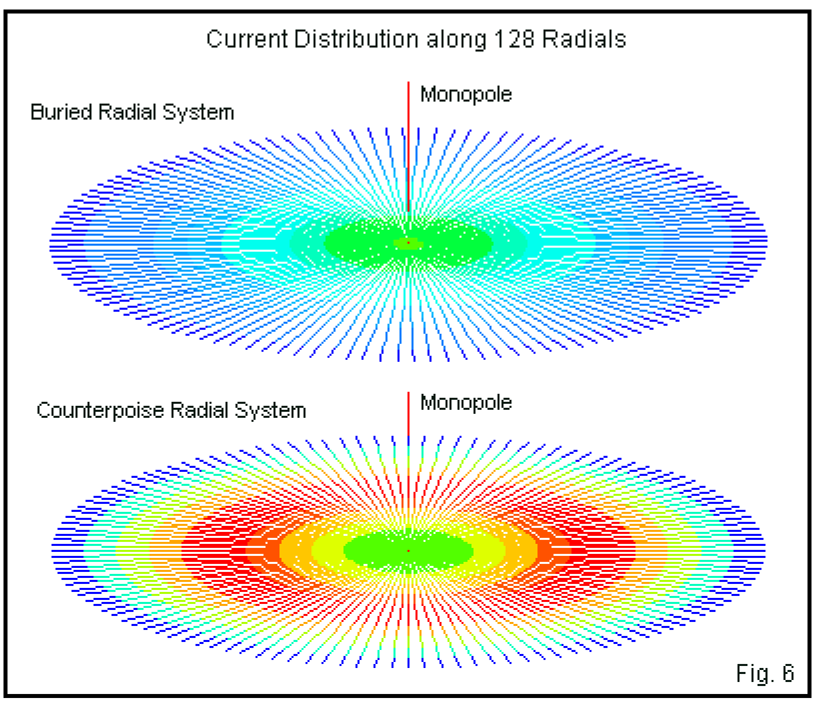


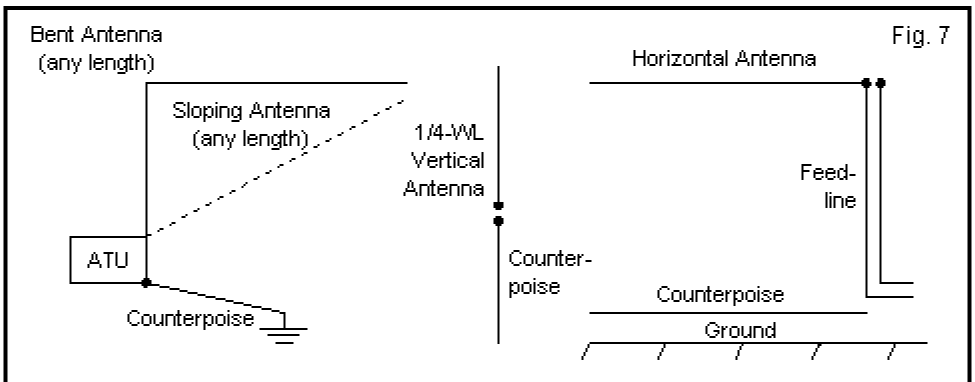
Fig. 6

The currents in the buried radials begin at a relatively low level and continually decrease along the length of the radials. Because buried radials are in a medium of limited conductivity and significant relative permittivity, the current distribution is not the same as in wires in air. The level of segmentation in the model does not permit us to view small fluctuations in the radial currents, but the overall progression is typical of radials systems of all sizes.

In contrast, the counterpoise radials show an interesting pattern with a current peak roughly 1/4 wavelength from the monopole and then a relatively smooth current magnitude decrease toward the radial ends. Although the current progression is smooth along the radial wires of the counterpoise system, it is not symmetrical on each side of the peak (red) values. An adequately sized counterpoise system is one in which the radials or other structures are large enough to allow the current distribution its full progression. Nevertheless, the monopole alone plays the dominant role in setting system resonance, just as it does with a buried radial system.

Counterpoises, as understood in mid-20th century engineering literature and some amateur literature of the same period, then, are far different electronic devices than true elevated radials that are part of the antenna's resonant length. Elevated radials, ranging from Christman's research subjects to VHF ground-plane radials, are intrinsically more similar to each other than elevated lower-HF radials are to counterpoises.

Unfortunately, radio amateurs, even those who write about their successful antennas, are subject to impressions and truncated sound bites. Let's combine elements of less adequate treatments of the counterpoise that have occurred in the last quarter of the 20th century. We may begin with one enduring picture, sketched in **Fig. 1**. The antenna shown is an inverted-L, with a truncated 3-wire counterpoise extending under the horizontal portion of the antenna wire. Let's add the sound bite that virtually any wire extending from the base of a monopole is a so-called counterpoise wire. In this combination we have the makings of some serious misuses of the idea of a counterpoise.



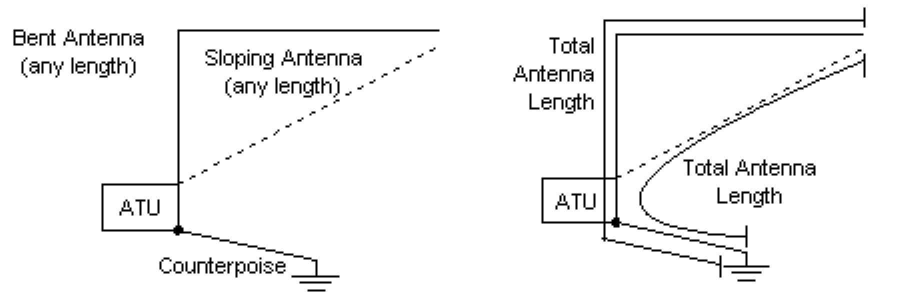
What the Counterpoise Has Become in Some Amateur Radio Literature

Fig. 7 outlines 3 antennas that I have encountered in amateur radio magazines over the lest decade or so. I am purposely omitting the identities of the antenna builders. What the antennas share is a common claim that at least one wire in the system is a counterpoise. The first case involves a field antenna, either in the form of an inverted-L or in the form of a sloping wire. Since the antenna is end fed, we normally require an antenna tuner to match the impedance at the wire's end to the transceiver in use. Normal practice would show as direct a connection between the tuner's ground terminal and the earth. What the innovator adds is a somewhat long wire that he terms a counterpoise, and this wire leads to the earth connection.

The second antenna comes from a number of sources. In one article, the innovator creates a monopole and then uses a so-called counterpoise wires to dangle off the edge of his apartment balcony or deck. Having heard that the counterpoise wire length is not critical, he cuts it casually. The third case involves a horizontal wire antenna end fed with parallel transmission line. Adhering to the apparent picture in **Fig. 1**, he adds a wire underneath the horizontal aerial wire and claims that this counterpoise improves performance.

All three claimed antenna parts called counterpoises emerge from the murkiness that has come to surround the term. The term "counterpoise" comes from mechanical systems contexts. It means a counter-balancing force, ordinarily a weight on the other side of a fulcrum. This name, as it has been conflated in amateur literature to suggest anything with radials, has acquired the additional meaning of an antenna part that does not itself radiate but permits the radiating parts to radiate better than they would without it. There is nothing in the world of antennas that corresponds to the dead weight facet of this misshapen version of the concept of a counterpoise. Every part of an antenna contributes to the antenna far-field pattern (except those parts that we specifically design to have self-canceling radiation). Hence, there is no such thing as a mere counterpoise.

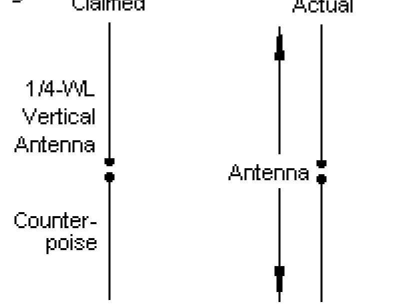
Fig. 8



Actual Antenna Includes the So-Called Counterpoise Wire

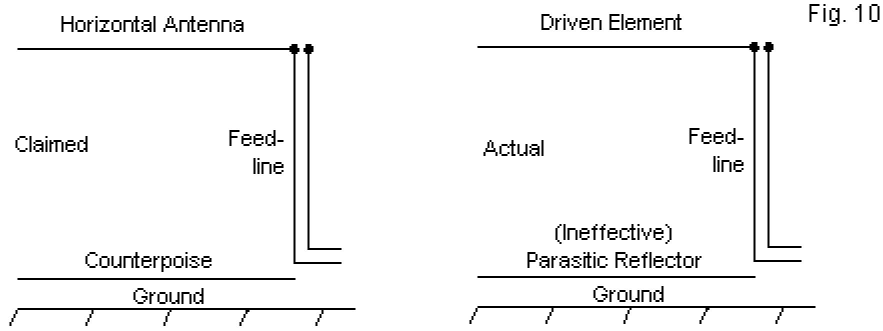
Fig. 8 shows both the claimed and the actual antenna on the left in **Fig. 5**. The actual antenna runs from the earth connection through the tuner to the far end of the wire, whether it is sloping or bent. Since the tuner is effectively in series with the wire, it forms an off-center feedpoint for the antenna. Of course, the current in the wire running close to or one the ground contributes little if anything to the antenna's far-field pattern. At most, it may present the terminals of the ATU with an impedance that more easily fits within the tuning range of the components.

Fig. 9



Actual Antenna Includes the So-Called Counterpoise Wire

The claimed version of the antenna in **Fig. 9** is among the most insidious because of the market for commercially made mini-monopoles. One such antenna comes with a bale of wire that the user is supposed to unroll. He then tunes his antenna and kicks around the wire bale until he achieves a satisfactory match. What the user does not realize (since he has already purchased the antenna) is that most of his antenna is lying at his feet. In the less problematical version shown in the figure, the entire antenna constitutes a vertical dipole. The length of the upper and lower ends together contribute to the overall resonant length, and the lower portion of the antenna--if we mount it from an elevated support--does as much of the radiating as the upper portion. In most circumstances, it will not matter whether the actual feedpoint position is slightly off-center with respect to the peak current position on the overall antenna. Since the current level changes very slowly in the vicinity of its peak value on a dipole element, the feedpoint impedance will also change very slowly.



The Actual Function of a Horizontal Antenna's So-Called Counterpoise Wire

The third case (C) is a modern adaptation of a very old scheme of running a second wire at or near the ground under a horizontal wire, ostensibly to improve some mysterious relationship between the upper wire and the earth. Actually, the horizontal antenna performance remains unchanged, and the wire becomes a trip for anyone careless enough to walk through it. At best, it serves as a parasitic reflector, possibly converting a general-purpose antenna into an NVIS (Near Vertical Incidence Skywave) special, as suggested by **Fig. 10**. However, single wires close to the ground do virtually nothing to improve even the performance of NVIS antennas. A ground screen that exceeds the elevated antenna's dimension by about a half wavelength in every direction is necessary to create an effective planar reflector.

In every case, the so-called counterpoise can be analyzed (and modeled) as a part of the antenna.

Where Does All of the Discussion Leave Us?

On the one hand, we have the information left to us by the history of radio antennas before the concept of a counterpoise lost its meaning. On the other hand, we have the collection of misunderstandings (a collection larger than the samples shown here) that have resulted from the conversion of the term counterpoise into a general-purpose word having little import. The fuzzy, blurry current use has been the source of many an egregious error by casual writers about antennas that they have built. Indeed, the present use is only a malevolent ghost of the original.

One major option is to restore the term to its traditional meaning alone to indicate a large radial or screen insulated from the ground but close to it to serve as a capacitively coupled ground for monopoles. That option would force upon writers of articles and handbooks several responsibilities.

1. The treatment of the counterpoise would need restoration to the length at least of the version found in the 1949 edition of *The ARRL Antenna Book* or in sources like Laport's *Radio Antenna Engineering* in order to give the term clear sense.

2. Such writers would also have to clearly distinguish between a true counterpoise and monopole radials elevated far enough off the ground to lose enough of their capacitive coupling to ground to act as the simple completion of a dipole, with one end composed of a symmetrical set of elements whose radiation is largely self-canceling.

3. The same writers would have to overcome the temptation to refer to any set of monopole radials as a counterpoise. Indeed, they would have to overcome the temptation to call anything other than the traditional counterpoise by that name.

Now let us suppose that we find fault in either the correctness of the theory that underlay the traditional antenna engineering concept of a counterpoise or that we determine it no longer has relevance in that meaning to current antenna practice. Because confused and conflated alternative meanings for the terms tend to create greater misunderstandings than they resolve, this option leads to only one action: that we drop the term altogether from the antenna lexicon.

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