Once more into the fray! W1ICP enters the antenna arena in this two-part series on comparing quads and Yagis.

One More Time Yagis Versus Quads, Log Periodics, And Others–Part I

BY LEW McCOY*, W1ICP

Since the advent of computer programs for configuring antenna patterns and gain, the discussion of what is the theoretically best rotary directional antenna has resurfaced. Recently I reviewed a five-band quad ("The Lightning Bolt Quad," *CQ*, April 1993), which got me thinking about the interesting comparison of quads versus Yagis.

I have lectured on the subject more times than I can remember. As far as I know, I have read and studied all the articles on quads and Yagis that I have come across. I know Bill Orr's *Cubical Quad* book by heart and have used it to build several quads. In addition, I have designed many quads and delta loops (as well as Yagis and trap beam antennas). I have had and used many Yagis and many quads, so I guess I can write about them with some authority. And before I forget, *CQ* has just published a very complete book on quads, *The Quad Antenna*, by Bob Haviland, W4MB, an amateur who knows the subject extremely well. Every quad man or anyone interested in putting up a quad should read it. (It is available from *CQ* for $15.95 plus $2.50 shipping and handling.)

Let's first discuss a little history, as I always feel our readers are interested in background material. Basically, the idea of a directional beam antenna using parasitically excited elements was first discussed by Yagi and Uda, two Japanese scientists. (There were directional multi-element beams before this time, but it was customary for all elements to be "driven" or directly connected from the generator or transmitter.)

Yagi and Uda set down the concept of using more than one half-wavelength antenna element to obtain directional patterns. One antenna element was "driven" in that the feed line was attached to it from the transmitter. By spacing another dipole a certain distance behind the driven element, this second element was excited by the field from the driven element (see fig. 1). Power was fed with a direct connection to what we now define as the "driven" element. It was found that by using two elements, one driven and the other parasitically excited, a four to five decibel gain could be achieved in the desired direction as compared to a single dipole. In addition, signals coming from several directions could be attenuated, giving us what we call "front-to-back and front-to-side" signal attenuation.

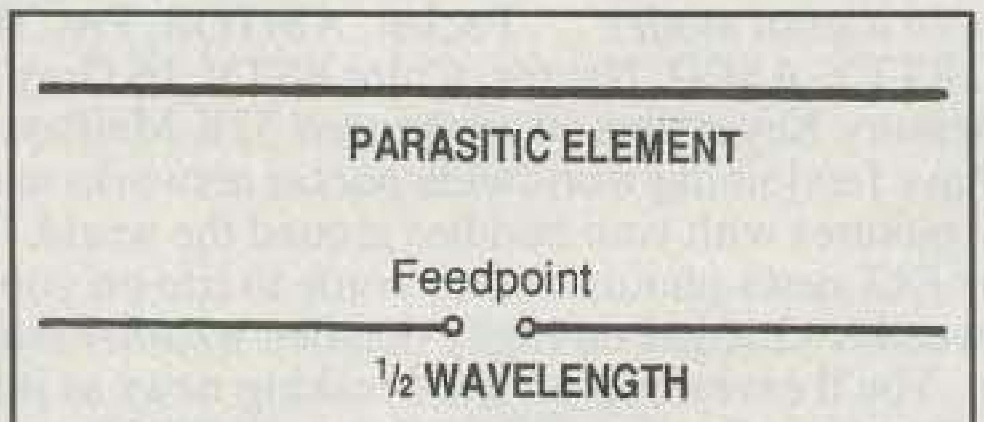

Fig. 1– The original design of the Yagi consisted of a dipole driven element, with a parasitically excited dipole to the rear.

Let's stop here and define the type of gain discussed in this article. One hears of many types of gain figures when antennas are discussed. However, there are really only two basic methods of expressing gain in antennas. In engineering, an isotropic radiator is used as a basis of antenna gain comparisons, and the gain is expressed in dB (decibels).

Unfortunately, an isotropic radiator is not a real antenna, but a theoretical one. An isotropic antenna is calculated to radiate energy equally well in all directions. The sun would be a reasonable example or analogy, but even the sun doesn't radiate equally in all directions It is, however, a close approximation to an isotropic antenna.

A half-wavelength dipole at resonance has a figure-eight pattern of radiation, with two major lobes on each side (broadside) to the dipole. The gain in these lobes is on the order of 2.14 dB as compared to an isotropic antenna. In other words, our isotropic antenna is theoretical unity, and we go up (or down!) from there.

The amateur must realize, however, that in comparing gains, comparisons of a real antenna to an isotropic antenna provides bigger numbers. A three-element monoband Yagi would have on the order of 7 dB gain as compared to a dipole 7 dBd (note that last "d" in dBd; it means dipole). If we compare the Yagi to the isotropic we would add 2.14 dB and come up with 9.14 dBi, the "i" meaning isotropic. Amateurs like to get the most gain for their money, so it is wise to know what is being compared to what. In this article, all the gain figures mentioned are in dBd—dipole comparisons.

Getting back to our discussion of beams, as more parasitic elements were gradually added to the Yagi concept, the gain of the beam increased. Usually, there was one slightly longer element used (a reflector), and slightly shorter elements (directors) were also used. Again, these added elements are all what is known as "parasitically excited." It was found that a driven element used with a reflector and director would shape the signal into a directional pattern that had approximately 7 dB of gain compared to a single driven element or single resonant dipole. The driven, reflector, and director elements were all on the order of one-halfwave long in overall length, the reflector being slightly longer and the director slightly shorter.

One other important point for newcom-

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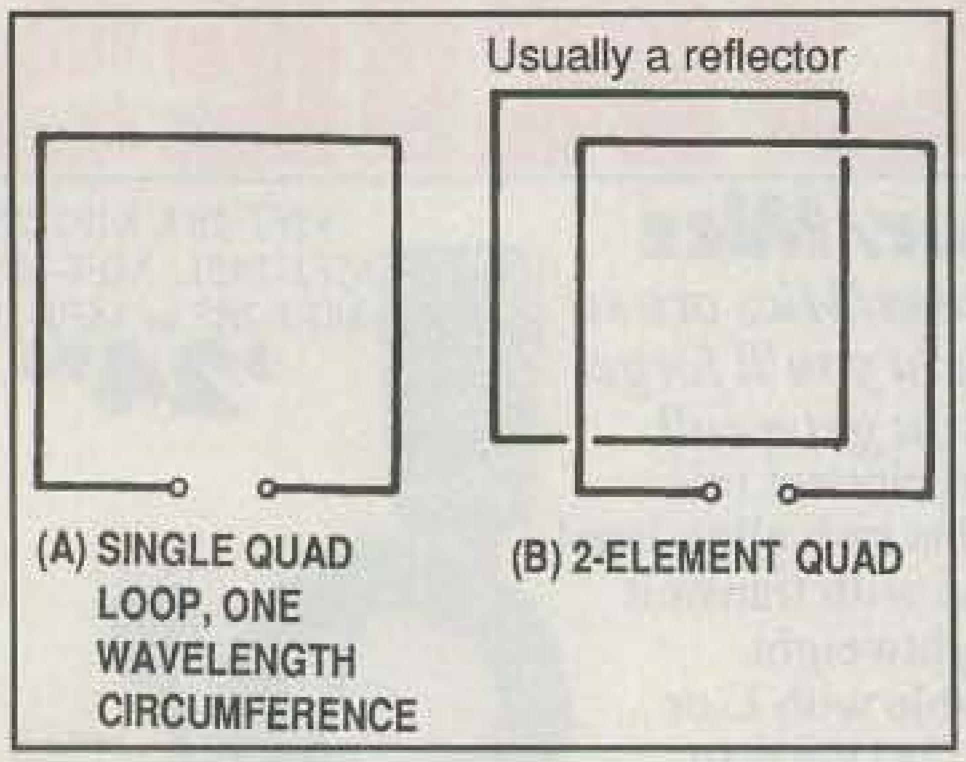


Fig. 2– The quad loop can be used in a square configuration or as a diamond. The single loop has a feed impedance of approximately 100 ohms. This antenna has a measured gain of 1.8 dB as compared to a dipole, or almost 4 dB as compared to an isotropic radiator.

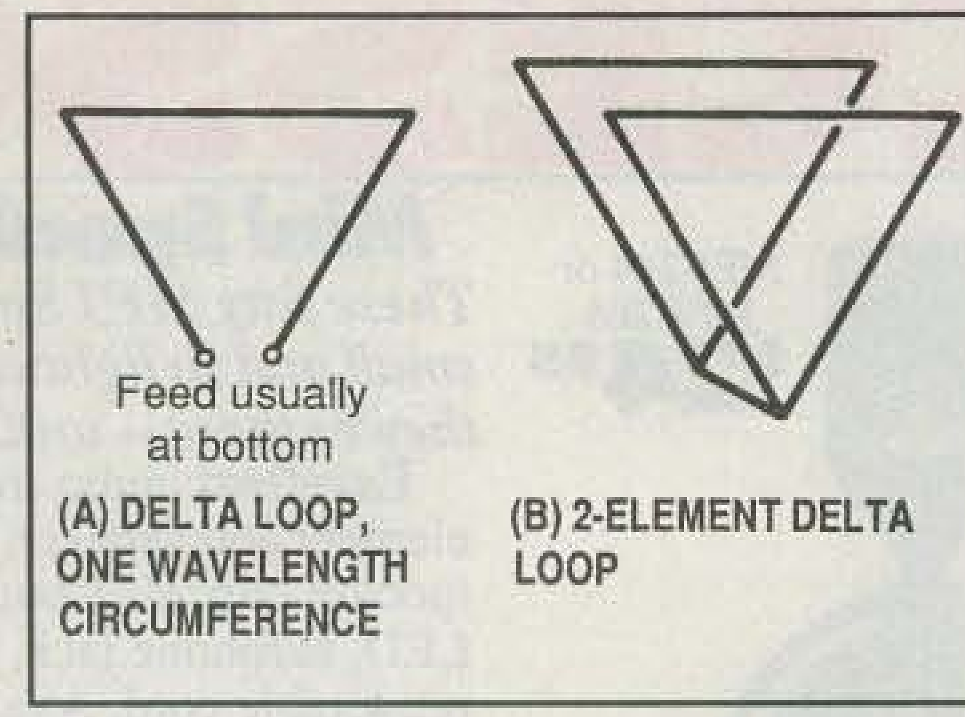


Fig. 3– At (A) is the basic Delta loop, normally fed at the bottom and used with a gamma match. The impedance without matching is slightly more than 100 ohms. At (B) is a beam configuration. Actual construction details can be found in the ARRL Antenna Handbook.

ers to consider when discussing beams. A three-element monoband beam will produce about 7 dB. Many amateurs believe that they can obtain much higher gain simply by doubling the size of the beam. In other words, if a three-element beam provides 7 dB gain, then a six-element beam will provide 14 dB gain. I hear this on the air and my hair starts to stand on end! There is a rule, and while not completely exact, it is certainly good enough to be depended on. If you double the number of elements *and the length of the array*, you can usually expect to get a 3 dB increase in overall gain—in other words, about 10 dB gain as compared to a half-wavelength dipole. Three dB is not insignificant, because that really means doubling the effective power in the best direction. Keep this rule in mind, though: To go from 10 dB to 13 dB, you must again double the size of the array, either with a very long array or stacked beams.

To repeat, from this original design we come up with the Yagi-type beam, which usually consists of three elements that have a gain on the order of slightly more than 7 dB compared to a dipole. This is for a single band beam, not the popular multiple-band trap beam. I'll attempt to discuss multiband beams, traps, etc., in a moment, but for now let's think single bands.

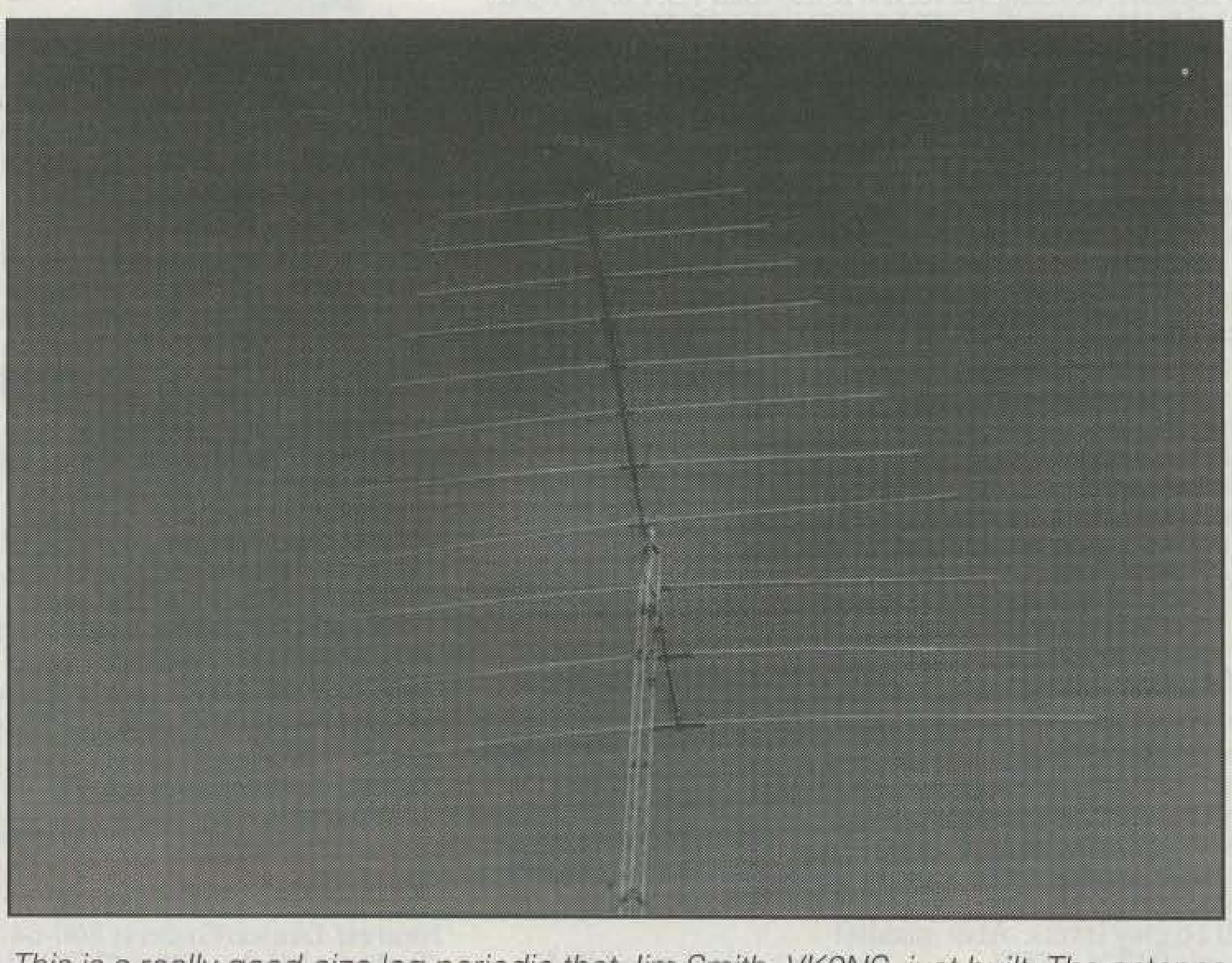
Just after WW II, an amateur named Clarence Moore, W9CLF, designed a different "Yagi" type beam, which at the time was really a new concept in rotational directional beams. What Clarence designed was what we now know as the "quad." The basic quad consisted of a square-shaped driven element one wavelength in size (the normal Yagi uses one-half wavelength elements) with a parasitically excited one-wavelength reflector element added—in other words, a two-element beam (see fig. 2[A] and [B]).

The Yagi-Uda type beam described above consisted of what some of us refer to as "High Q" elements, and the RF voltages at the ends of the elements could be (and are) very high. Shortly after WW II Clarence Moore was working at a station in Quito, Ecuador, which is at a very high altitude—somewhat over 10,000 feet. The Yagi-Uda design, because of these high voltages, had a bad habit of developing corona discharge from the element ends. These corona arcs caused the antenna to burn up and destroy itself. Moore tried several methods to reduce the voltage coupling from the element ends. He even tried using copper toilet flush bowl floats on the elements. However, nothing worked. The antennas still burned up.

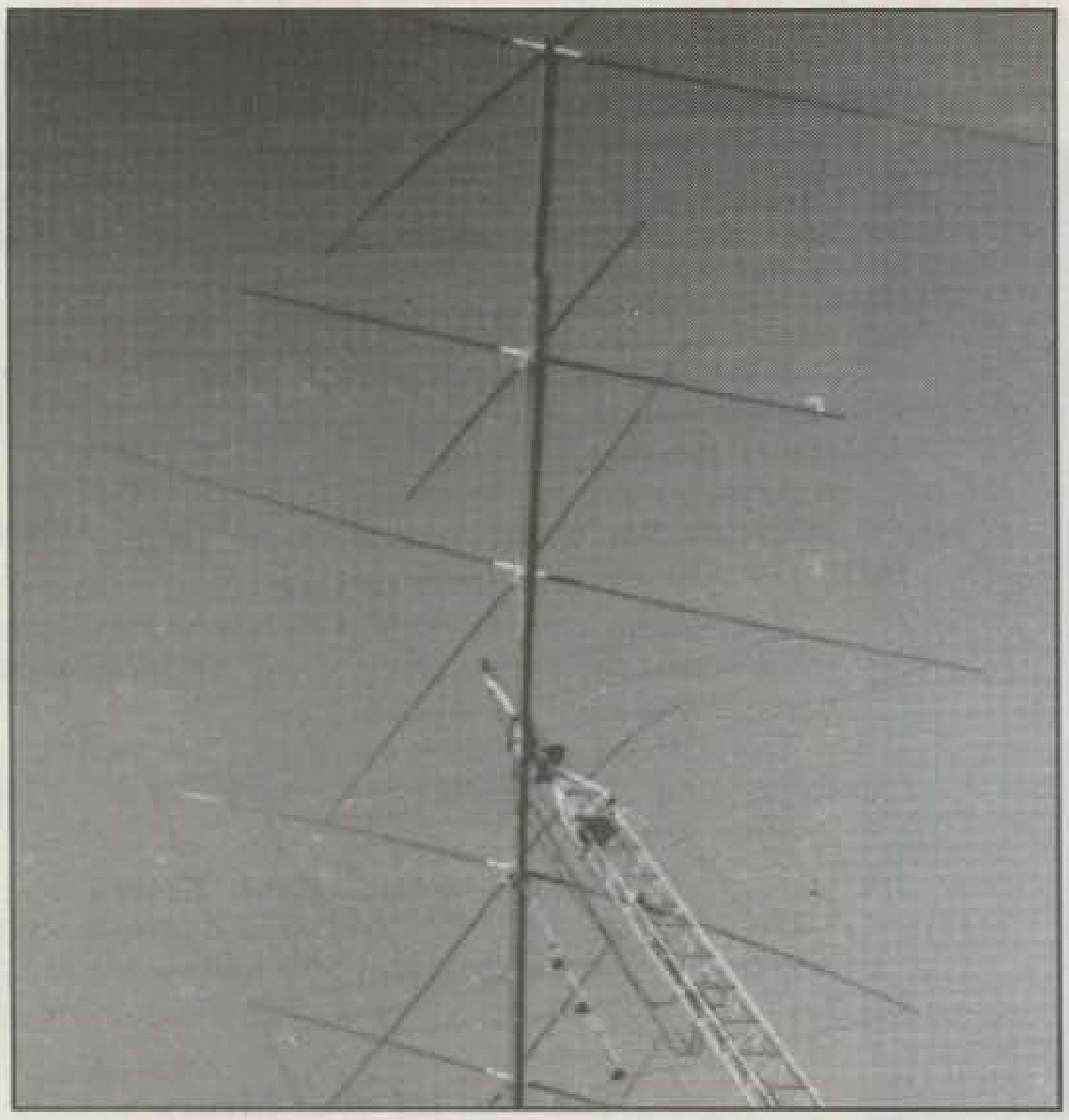
Moore rationalized, and very correctly I might add, that an antenna with "Low Q" elements wouldn't have this problem. He therefore constructed a Yagi beam using full wavelength elements consisting of closed full-wave loops. Moore immediately solved the corona problem using a single loop. He then considered adding elements for a more directional antenna, which he did. He found that in his measurements, by simply using a driven element (full wave in size) and a single reflector (full wave), he could very closely approach the 7 dB gain of the three-element, half-wave element length Yagi.

Moore found several features in this new antenna which made it a worthy competitor of a Yagi. At that altitude rain and snow striking a Yagi in many instances created very heavy static simply because of the electrical charge in snow or rain. It is worth mentioning here that there were several quads used by the military in the recent Desert Storm operation. Sand storms, with their charged sand particles, made the use of Yagis practically impossible, while with the quads the noise was not present. In addition, the basic two-element quad is usually much lighter in weight to rotate.

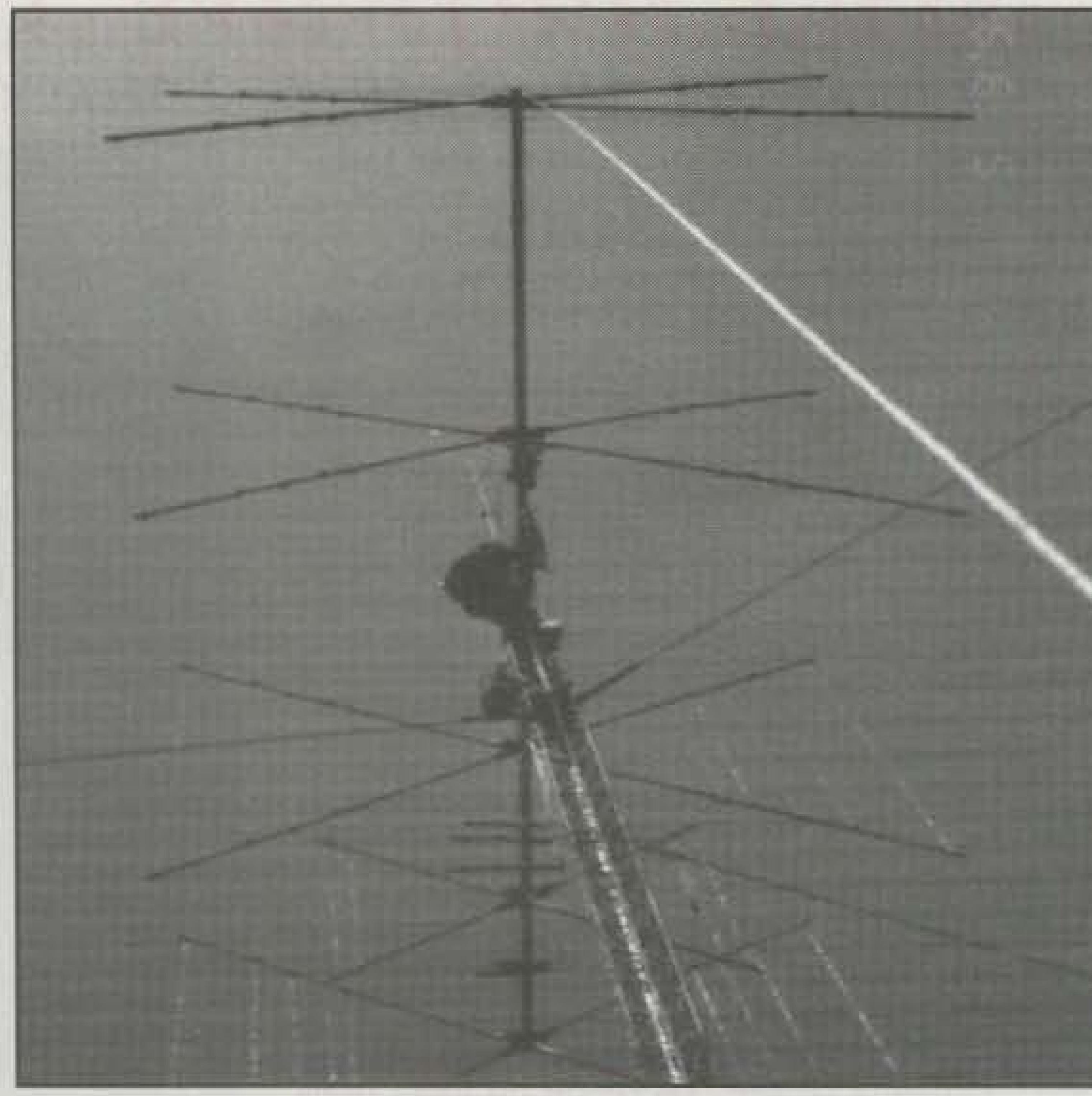
Moore, however, had a very difficult time convincing the antenna engineering society that he had made a worthwhile



This is a really good-size log periodic that Jim Smith, VK9NS, just built. The antenna is designed to cover 20 through 10 meters. The shortest element is 13.5 feet, while the longest is 30+ feet. This antenna ranges in gain from 5 through 8 dBd.



This is a very large multiband quad that Arch Doty had up some years ago. He said it was a world beater, but he could not find a rotator that would stay together. Too much wind-loading.



This is a commmercial multiband, multi-element quad made by Antenna Mart. CQ has never reviewed one of these antennas. I've seen it at Dayton and other conventions, and it looks like a real performer.

contribution to the art. I have always felt sorry that Moore never really received the recognition he so richly deserved. But the quad did become very popular with foreign stations, simply because the construction materials were easy to obtain, and the antenna was cheap to make.

As an aside, I knew Moore personally. While we were not exactly next-door neighbors, he only lived about 100 miles from me when I was W9FHZ living in Illinois and he was living in Indiana, back in 1947. At that time a large group of DXers hung out at 28.500 MHz on 10 meters chasing DX, and Moore, when he was home from Ecuador, was one of them. Obviously, there was a lot of competition and serious discussion of quads versus Yagis long before the quad really became popular. Also, to be honest, I was of the "wide-spaced" Yagi school because several of us had discovered that wide-spaced element Yagis performed better than close-spaced jobs. I will also admit that many of us did not know a lot about antennas then. This was really the beginning of the directional beam era. However, in all honesty, Clarence Moore with his two-element quad could take DX away from many of us at times when we were using four-element beams. I also might add for those who question, we were all running the legal limit, which was one kilowatt input to the final amplifier in those days.

It was only a few years later that I went to work for the ARRL in the Technical Department. I found that although the department had checked out a single quad loop and found that the loop had nearly double the decibel gain of a dipole, there was no enthusiasm for a quad.

As to actual gain, a single full-wave loop showed 1.8 dB gain over the half-wave dipole. I will admit it was a cumbersome antenna to build, and in those days it was not really strong structurally.

While this has nothing to do with a technical article on quads and Yagis, I cannot help but mention it. When I moved to Connecticut and went to work at the ARRL, the salary was nothing to brag about. I was married with two daughters, and so like many, I didn't have much money for towers, antennas, and so on. At that time I discovered that Persian rugs were shipped from the Middle East wrapped around long bamboo canes. It so happened that there was a rug store just across from ARRL headquarters. I made friends with the store owners and soon had a supply of canes, which made excellent supports for the wires of quads. And believe me, I made quads! (Plus scores of other weird antennas!) I honestly believe that at the time I probably garnered more experience with quads than most amateurs. However, while all this is related, I am getting away from the real aspects of this article.

I have long argued that for a given boom height a quad has a "slightly" lower angle of radiation than a Yagi. There is a current stacking effect in a quad element so that you really have two halfwave elements with the current points at the bottom and top. Such stacking, while not great, does produce more power at a slightly lower angle. I know there have been tests made (over short periods) that argue I am mistaken. However, knowledgeable DXers and most old timers will tell you that because of a slightly lower angle of radiation, the quad will "open" a band to DX earlier and keep the band open slightly longer than a Yagi at the same boom height. I agree with these people, and I have a very good reason for doing so.

For a number of years, while employed at the ARRL I was also engaged in a "monitoring" program of several foreign broadcast stations. I was using a two-element quad at a boom height of 50 feet. At the same time, another amateur who also worked at the ARRL was engaged in the same program, monitoring the same stations, and he was using a Yagi at exactly the same boom height—50 feet. Without exception, I could hear the stations earlier and later than the other amateur could. This was not a test that was conducted over a week or over a month, but over a two-year period consisting of well over several thousand stations being monitored! I'll be the first to admit that this was empirical testing, but it sure was one very long and conclusive empirical test.

I therefore stick by my guns on point one: For the same boom height, the quad does have a lower angle of radiation than a Yagi. In my mind, this is a point in favor of the quad. However, I must be very honest here and state that as to actual gain, there wasn't that much difference in received signal strengths between my quad (multiband) and the three-element Yagi. However, note that I said my quad was a three-bander—20, 15, and 10.

Again, I want to be fair and not leave the wrong impression. Those quads with bamboo spreaders really did not care for Connecticut ice storms. Not that the Yagis particularly liked ice either, but they did stand up better to the weather. Because of this early quads got a bad reputation. Keep in mind, however, that this was over 40 years ago, and construction techniques have vastly improved since then. I can see no real difference in structural strength between quads and Yagis using modern materials. So if I have to judge Yagis versus quads from a structural standpoint, I think the time has come to forget about the old bamboo quad days. The modern spiral-wrap plexiglass support rods certainly equate to aluminum tubing in strength. On that basis, then, let's call them even. In fact, I know of several quads that weathered the 1992 hurricanes while Yagis did not.

I haven't yet touched on Delta Loop beams, which consist of full-wavelength elements, the same as a quad. This antenna was designed by Harry Habig, K8ANV. In the beam configuration the triangle (see fig. 3) is fed at the bottom. There are two main radiation points—the bottom where the antenna is fed, and at the center of the top of the triangle. The two sides of the triangle are customarily mounted on the boom with a wire connecting the top. One of the advantages of this method is that for a given boom height, additonal height is also achieved while providing a lower radiation angle. One of the disadvantages of the Delta Loop is that when multibanding, completely seperated antennas are required, making a physically "tough" job of boom mounting. Gains of a two-element quad are very similar to those of a two-element Delta.

I hope I have whetted your appetites up to this point. In Part II, I will try to get into the real meat of the subject of comparisons. We will discuss multibanding and what the best all-around multiband antenna is (in my opinion!). Also, I will covert log periodics and the Sommer-type beam.

(To Be Continued)

This month W1ICP wraps up his discussion of antenna comparisons and leaves us, as usual, better informed.

One More Time
Yagis Versus Quads, Log Periodics, and Others—Part II

BY LEW McCOY*, W1ICP

In Part I we went over some basic information in our antenna comparisons. What do we look at next in our comparison of antenna types? We are forced to examine multibanding and performance.

Back in 1953 Buchanan, W3DZZ, described a multiband Yagi in *QST* which was really a single antenna with a single feed line. It started a revolution in Yagi design that has continued to today.

Buchanan calculated that he could take a three-element beam, insert very reactive traps in each of the three elements (driven element, director, and reflector), and make each set of three elements resonant on 20, 15, or 10 meters. This he did, and it was a very practical antenna. However, traps do contribute losses, and it was and is difficult to come up with element spacing that is optimum for each band.

One point I may have glossed over earlier is that of element spacing. In order to obtain the optimum gain and bandwidth with, say, a three-element beam, there are certain element spacings that work best. When we go multibanding, we introduce a real problem in trying to get the best gain, bandwidth, and match without introducing losses. To compensate, manufacturers have added extra elements to attempt to solve these problems. What we end up with, and no one argues this point, is a compromise antenna. We sacrifice gain and signal pattern to obtain a multiband, single-feed antenna. Even worse, we sacrifice some performance in order to obtain a 50 ohm match. For newcomers, one of the main considerations for the impedance of a Yagi (or any beam) is element spacing. One can obtain gain, but end up with undesirable matching situations. This gain can be lost due to actual ohmic resistive trap losses (and sacrifices in

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I couldn't resist showing this photo. Jim Smith, VK9NS, of Norfolk Island really knows how to put up a log periodic.

VK9NS ready to connect the big log periodic to the rotor mast. I assume that he is using a very husky rotor, because the wind loading would be, and is, high for this type of antenna.

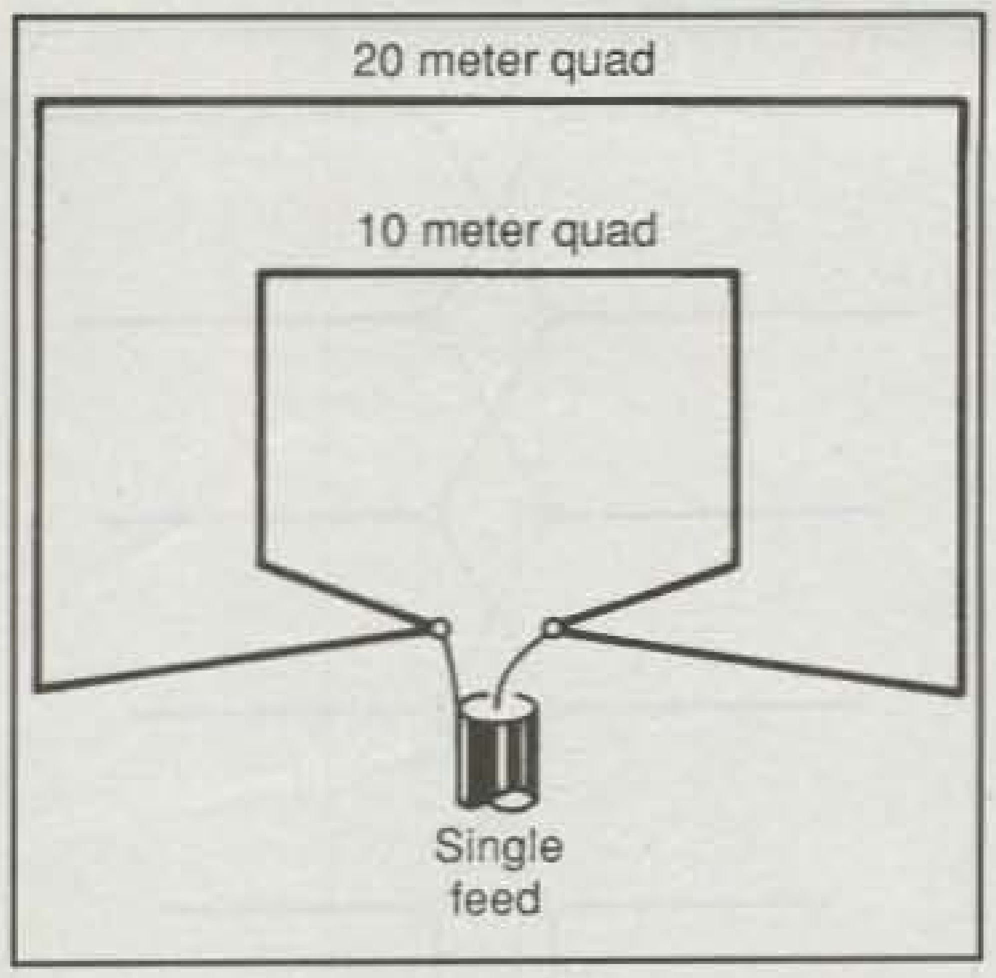

Fig. 4– Two quads elements, 20 and 10 meters, fed together may or may not cause a change in actual radiation patterns because of power division in the loops. When on 20 meters, the 10 meter loop presents a "reasonable" reactance. This tends to divorce the 10 meter loop from the 20 meter loop. On 10 meters the 20 meter loop has an impedance that is higher in value, but the 20 meter loop will still radiate 10 meter energy. And a two-wavelength loop has a pattern different from that of a single wavelength loop. There is certain to be some interaction. As pointed out in the text, however, whether this is bad or good is at present anyone's guess. The simple answer may be feed-line switching.

element spacing). Pattern loss (front to back and front to side) also comes about because of element spacing.

To be fair, I must emphasize here that the gain difference between a monoband three-element beam and a trap beam may only vary about one to two decibels, and that isn't much when considered as a fraction of an S-unit. What about multi-banding a quad? Do we have the same compromise losses? If so, how much?

In this case you can find yourself in some very strange waters indeed. First we need to specify whether or not we are using a single feed line to joined quad elements (see fig. 4). There is an important point in discussing quad feed lines that should be addressed. If we feed two different antennas with a common feed line and both antennas have similar impedances, the power will divide and feed both antennas. When we do this with *directional* antennas, we will have problems with our signal being radiated in undesired directions. In other words, we are going to get pattern changes.

I think other writers have avoided talking about this when discussing quads. For example, take the case of a 10 meter quad and a 20 meter quad fed together with a single feed line. First we must keep in mind that a quad driven element is a full-wave loop with an impedance of about 100 ohms or so. Our 10 meter quad loop (100 ohms impedance) is a more or less resonant antenna fed with 50 ohm coax. When we mount a 20 meter full-wave quad loop around the 10 meter loop, we have now added a two-wave-length loop (our 20 meter loop will have an impedance of about 250 ohms when fed with 10 meter energy) to the 10 meter loop. Assume we go on 10 meters. Is our 20 meter loop going to accept power also? Simple Ohm's law tells us while 10 meters is the lower value, 100 ohms, we still will be putting power into the 250 ohm 20 meter impedance. We have two more or less resonant antennas tied to the same feed line, so there is no doubt that our 10 meter power is going to go to both loops. How much power and how much the pattern is changed is a very good question. Frankly, I don't have the answer, and I don't think anyone does. It would take some fancy computer modeling. And, we haven't even started talking about adding a reflector or director to this quad.

Let's jump to a quad I recently reviewed in *CQ* ("*CQ* Reviews: The Lightning Bolt Quad," April 1993). This is a five-band job, driven elements and reflectors. It uses proportional spacing to obtain the best gain per band. However, five driven elements are connected to a common feed point. I am guessing here, but I assume that the total impedance of the array comes out to 20 to 25 ohms. (And for the benefit of any antenna engineers reading this, I am not really overlooking the various reactances that are all lumped together here.) After all, we are connecting several 100 ohm (five) impedances in parallel and Ohm's law applies.

The beam in question uses a Jerry Sevick 2:1 type transformer that works almost perfectly, so we get from 25 to 50 ohms with no problem. I very carefully checked this beam for impedance matching on all five bands, and the very worst case was only slightly more than 1.5 to 1 SWR! I would still prefer to switch the feed line for each band to provide some isolation. I would then be sure that the loops are not interacting.

But all of this still does not answer the question of patterns. What I can say from tests on this antenna and many, many other multiband quads using single feed lines is that there does not appear to be too many or too serious pattern foul-ups. From the computer programs using simply the 20/10 combination there appears to be a slight clover-leaf pattern on 10 meters. But in actual practice, it doesn't show up, at least not to a point where it can be checked on either ground wave or DX. Which means, I guess, I should not trust the MININEC computer program, or to be even more honest, maybe I'm not inputting the correct information.

There should be an aside here. More and more amateurs are depending on computer-derived information for antenna construction. Early on I wasn't happy with what I was seeing from some of these computer programs as far as quads were concerned. I now see that others agree with me. One of the finest antenna programs is ELNEC, which was done by Lewellyn (the computer program is advertised in *CQ*). I would like to quote from Roy's documentation in his program.

"Experiments indicate that quads require a large number of segments (perhaps 12 or more per loop side) to give a reasonable representation of front-to-back ratio. When dealing with wires connected at an angle, MININEC (and also ELNEC) "cuts the corner" by half a segment length. This doesn't cause much error with single loops, but apparently causes enough change in the relative currents in multiple loops to quite noticeably affect indicated front-to-back ratio. The forward pattern and gain are *fairly* accurate *[editor's note: italics are mine]* with 6 segments/side or so. The segment-tapering method is an effective but rather tedious way of improving the accuracy of front-to-back indications. I am investigating methods to improve quad modeling but I haven't made any breakthroughs yet."

I'm sure if anyone can make "breakthroughs" it will be Lewellyn. The business of quad modeling—and statements you hear from amateurs who "computer model" quads—should, in my opinion, be viewed with care.

Let's get back to single feed line, multiple quad elements. Bottom line: It has to be that some power is being radiated by *both* antennas at the same time. I could easily pose some "cute" guesses here, and I wouldn't mind hearing from quad people as to what their "guesses" would be. For example, let's assume a single feed line to a 20/10 quad is being used on 10 meters. Would the gain be more or less than that of a 10 meter quad by itself? Keep in mind that the 20 meter part of the antenna is actually a larger antenna for 10, with a more effective aperture. I could go on, but I would prefer readers open their minds and be inquiring. Of course, one answer here is to use a single feed line and then use one of the antenna feedline switches such as Ameritron makes. This would put the direct feed on only the desired antenna.

When discussing common feed lines, what about losses in relation to the quads that are not in play? There are bound to be some ohmic losses, but by the same token, because the loops are made from good low-loss wire, the losses cannot be great. In fact, they are almost not worth mentioning. So on the basis of losses, when comparing a multiband trap Yagi to a quad, apparently the quad will come out the winner.

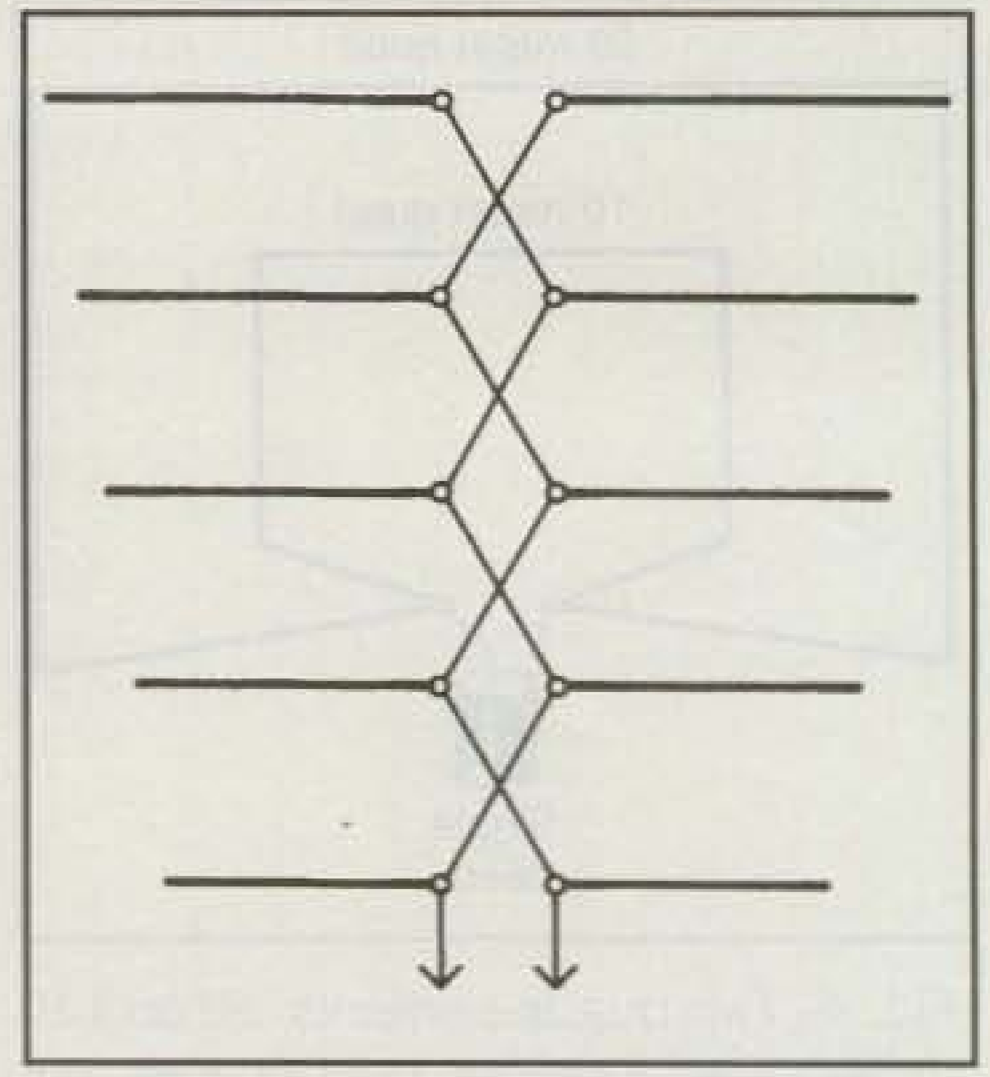

Fig. 5– The log-periodic configuration. Simply, the shortest element (front of beam) is resonant (approximately) on the highest frequency. The longest element (rear) is roughly a half-wavelength at the lowest frequency. For example, a 20 through 10 meter (2:1 range) log periodic would have the shortest element at about 16 feet (half-wave on 10). The longest element would be on the order of 33 feet. This is only one type of log periodic; there are many variations.

Where does this leave us overall in quads versus Yagis? From this writer's viewpoint, the quad appears to have a bit more going for it. Bear in mind that I've never mentioned price, and I probably should. Quads are usually much cheaper to build, as aluminum can be very expensive. So it leaves us with appearance.

This may sound like an attempt at humor, but unfortunately—or fortunately—it is a fact of amateur life (I've been married for 55 years!). Convincing your non-amateur wife that you should have a tower and beam can be a difficult if not impossible task. You can use the old ploy, which I did, that a radio antenna provides a zone of protection from lightning. (All wives are afraid of lightning, but then again so am I.) Frankly, I think your best approach, or at least one I would recommend, is to take your wife out to a nice dinner, and possibly really splurge and get her a nice dinner ring. Then when you are sure she is in the right mood, spring the antenna on her. But don't forget to lead off with that lightning bit, as it really works.

Once you have convinced your wife, then your next decision is more important. Does a quad look better than a Yagi? Remember that beauty is in the eye of the beholder, but neighbors make really terrible beholders!

I can say without fear of contradiction

that quads always bring more comments from other amateurs—no doubt about that. They tend to set one apart.

Some Last Items

It is said, and often proven, that a quad is a low-noise antenna, such as for snow or rain static, when compared with a Yagi. This is absolutely true. As I mentioned earlier, at one point in my career I had both a 20 meter Yagi and a 20 meter quad. Switching between the two during a snow storm left no doubt in my mind that the quad was quieter. However, again this is a minor point unless the storm occurs during a DX contest, when it quickly becomes a major point!

Still another item that must be considered when deciding on a quad versus a Yagi is the type of person you happen to be. Are you an introvert or extrovert? This is really important simply because by definition an introvert prefers to be left alone and not be bothered by people. How does this relate to quads versus Yagis? Very simple. Neighbors have been known to ignore a Yagi simply because it looks like a large TV antenna. In fact, you sometimes can get away with convincing a neighbor that the Yagi is used for TV! On the other hand, amateurs are accustomed to seeing Yagis, so they probably won't question you too much.

Ahhh, but a quad! Your neighbors are bound to bother and pester you about that "strange" antenna. And certainly, other amateurs will constantly be getting on your frequency to "test" your signal against theirs. It's really not deliberate QRM, but more likely could be called a search for knowledge(?). I don't endorse such action, but amateurs do like to prove they have a better—or the best—signal. So if you are an introvert, I wouldn't recommend the quad to you unless you live on a mountaintop away from people, as I do. (However, by the furthest stretch of the imagination I am not an introvert.)

Before closing, I should add a word or two about log periodic antennas. These are very good multiband antennas (see fig. 5). The ones which amateurs consider for HF usually have a 2:1 frequency range—say, from 20 meters through 10. The word "through" must be considered because actually you are really paying for something you are not going to use. Keep in mind that the antenna covers "all" the frequencies from 20 through 10. This is why the military loves them. That is really not as bad as it sounds, because in order to work the five bands—20, 15, and 10 plus the two WARC bands—the cost becomes part of the package.

The gain of a log periodic for such coverage is usually on the order of about 5 to as much as 8 dB compared to a dipole. In simpler language, the gain will depend on the design, and there are many design factors which control log periodics. The impedance of such an antenna is on the order of 50 ohms over its frequency range, providing an SWR of less than 1.3 to 1 over the antenna's range. I have taken this information from a very excellent research paper entitled "Log Periodic Antenna Techniques" by L. G. Bullock, C. T. Elfving, and S. K. Miller (Technical Report ECOM-01829-M1016, Apr. 1967). It is not a Yagi type nor parasitic type array. In a log periodic all elements are driven. Log periodic antennas that cover 20 through 10 meters are relatively expensive compared to a quad, and maybe not as much so compared to a trap Yagi. In my humble opinion I would rate the log periodic very high as a multiband beam. My experience with the antenna is not from owning one, but rather from using one in military and other government uses, so I can't claim any "expertise." I do know they have a very good front-to-back and front-to-side performance.

Some last comparisons in rating the three types of antennas are their weight, wind load, and turning radius. The lightest in weight is the multiband quad; at least the five-band quad I mentioned earlier came in at about 30 pounds. This was a two-element reflector and driven-element type. More elements means more weight. Some of the larger trap band beams weigh in at the 75 to 100 pound range, and the log periodic for the same coverage probably weighs in at slightly over 100 pounds. The quad has the smallest turning radius because it is in a square configuration. The log periodic has the largest radius simply because of boom and longest element length.

As to wind loads, if you are interested in this type of information, I suggest writing to manufacturers. They all advertise in *CQ*, and they will be happy to give you the information. I would like to take this opportunity to thank my fellow QCWA director and a real good antenna man Arch Doty, K8CFU. Arch supplied me with the research paper on log periodics mentioned earlier and a photo of one of his big quads.

This article is meant to provide some of the many newcomers to the hobby with some "thinking" material. It may give the reader a clearer picture of how a multiband beam antenna performs. But remember what I said: Educate your wife or parents and emphasize lightning protection. I have been in amateur radio for 50 years, and knock on wood, I've never had a direct hit! ■