MORE HAM BANDS — LET'S QSY TO 30 METERS

By Gilbert C. Ford,* W7OXD

We amateurs have generally tended to look at amateur radio's future in pessimistic terms — shrinking frequency allocations, decreasing ham population, etc., etc. Personally, I think some of the best days for ham radio lie just ahead in the next two decades. One facet of this bright future as I see it is the distinct possibility of additional new ham bands and the expansion of present ones, particularly in the h.f. portion of the spectrum. Your first reaction may be that this view is wildly optimistic, but remember there once was a day when amateurs did not have the present 15 meter band. Even such conservative voices as *QST's* editor and FCC's new chief of the Amateur and Citizens Radio Division have recently suggested that new h.f. amateur bands are a distinct possibility for the future. See the November, 1971 *QST* editorial and Prose Walker's remarks as reported in the March, 1972 *QST*.

With the ever-growing use of microwaves, satellites, and cable for commercial, government and military communications, the pressure on the high frequency part of the radio spectrum (3 to 30 mHz) will grow less and less. Sooner than we may expect, the opportunity for expansion of amateur frequency allocations may be at hand.

Imagine that the year is 1980, and that a new international radio conference is being held in Geneva. The move to the more reliable satellite, microwave, and cable communication links has relieved the demands on the 3 to 30 mHz region so markedly that amateurs feel that the time is propitious for requesting additional frequencies. When this time comes, as it surely will, we must not just think of a few minor expansions of present bands, but we ought to request several entirely new amateur bands in the h.f. region.

We should begin working now towards a 1980 amateur frequency allocation such as listed in Table I. The particular set of frequencies here suggested represent slightly less than a doubling of the presently assigned frequencies in the h.f. region. Amateurs now have 12.2% of the spectrum space between 3 and 30 mHz. The proposed list would give us 22.3% of the total.

But the availability of 4 new bands would enhance the amateur's ability to communicate much more than is indicated by the approximate doubling of spectrum space. Having 500 kHz at 15 meters and 500 kHz at 17 meters is worth more than 1000 kHz at either wavelength because of the additional versatility and variety of propagation characteristics made available. When 15 meters does not open over a certain path, one might well shift to 17 meters and find the path open. Faced with the widely varying propagation characteristics of the ionosphere as produced by day to night, season to season, and sunspot cycle changes, the availability of 9 amateur bands in the h.f. region would give the amateur greatly increased communications flexibility and reliability.

The proposed new bands bear a harmonic

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80 meters	3.5-4.0 mHz
55 meters	5.25-5.75 mHz
40 meters	7.0-7.5 mHz
30 meters	10.5-11.0 mHz
20 meters	14.0-14.5 mHz
17 meters	17.5-18.0 mHz
15 meters	21.0-21.5 mHz
12 meters	24.5-25.0 mHz
10 meters	28.0-30.0 mHz

Table I — Proposed 1980 amateur h.f. frequency allocations.

Band		Dipole Length (Feet)	Quad Length of one side	
			Driven Element (Feet)	Reflector (Feet)
80 meters	3.5 mHz	134.0	70.4	72.8
55 meters	5.25 mHz	89.0	47.0	48.5
40 meters	7.0 mHz	67.0	35.2	36.4
30 meters	10.5 mHz	44.6	23.5	24.3
20 meters	14.0 mHz	33.5	17.6	18.2
17 meters	17.5 mHz	26.8	14.1	14.6
15 meters	21.0 mHz	22.3	11.7	12.2
12 meters	24.5 mHz	19.1	10.1	10.4
10 meters	28.0 mHz	16.7	8.6	9.1

Table II — Basic antenna dimensions for the proposed amateur h.f. spectrum.

Band		Length of one leg (Wavelengths)	Gain (db)
80 meters	3.5 mHz	0.75	
55 meters	5.25 mHz	1.13	5
40 meters	7.0 mHz	1.50	· 7
30 meters	10.5 mHz	2.25	8.5
20 meters	14.0 mHz	3.00	10
17 meters	17.5 mHz	3.75	11
15 meters	21.0 mHz	4.5	11.5
12 meters	24.5 mHz	5.25	12
10 meters	28.0 mHz	6.0	13

Table III — Gain data for rhombic antenna with leg length of 210 feet.

relationship to the old bands and to each other. This harmonic relationship is not so important from the viewpoint of transmitter design nowadays with band shifting done almost entirely by mixing instead of the former doubling or tripling, but having amateur bands harmonically related does tend to keep some excessive second and third harmonic radiation within our own bands instead of elsewhere. This advantage fails, however, at the high frequency end of each band, and completely over all of some of the bands suggested. Except for the proposed 17 meter band, the new frequencies proposed in Table I steer clear of the normal presently assigned short wave broadcast bands. This particular band request could easily be shifted to 17.0-175 mHz with practically no disadvantage to amateurs.

Equipment Requirements

If these new ham bands became available without much previous notice, the initial surge of band users will no doubt get there via converters or new crystals and coil changes in present gear, but the ham gear manufacturers would soon have a new generation of transceivers with additional positions on the band selector switch. The ham mags would be filled with conversion articles describing how to add the new bands to every conceivable type of previously existing equipment. Before long the

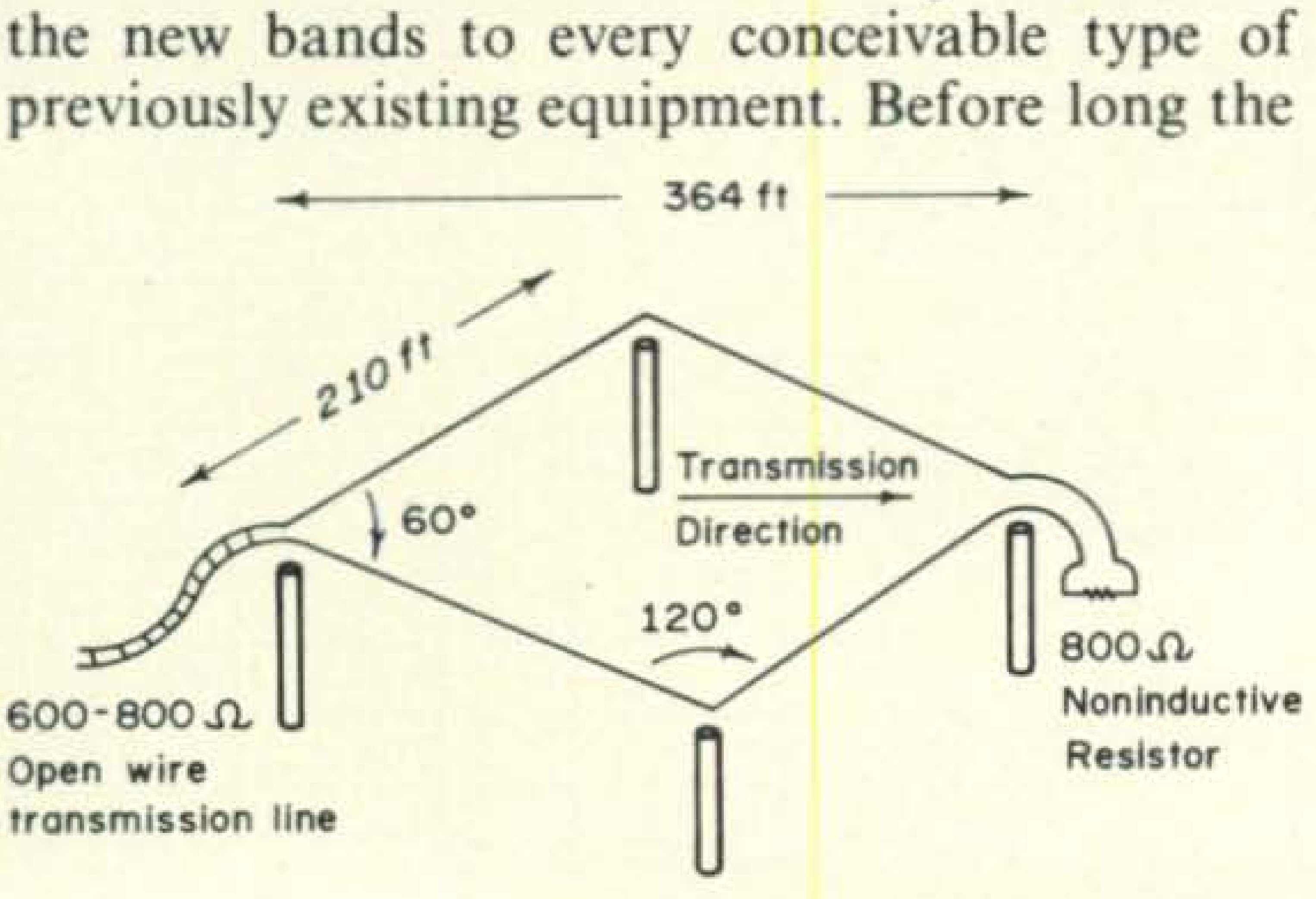

Fig. 1 — A rhombic antenna suitable for 55, 40, 30, 20, 17, 15, 12 and 10 meters.

pictures of the first 9 Band WAS winners would appear. From then on it would begin to seem as if hams had always had 9 h.f. bands.

Antennas

Although I don't recommend that you start just yet to put up antennas for the new bands, it is a fun topic to think about. Table II gives dipole and quad dimensions for both the old and new bands. A look at the numbers in Table II shows that we can expect to see a fair number of 30 meter quads. And a few hardy pioneer types will attempt to erect 6 band quads to cover 30, 20, 17, 15, 12, and 10 meters. My suspicion is that they will be at least initially markedly disappointed in the performance of such monsters. With the bands so closely spaced interactions between the elements will probably be quite pronounced. For example, a 10 meter reflector may know no better than to act like a 12 meter director.

No doubt ham ingenuity will eventually find techniques for making such a 12 or 18 element behemoth work the way a beam ought to work. The broad band frequency characteristics of the rhombic and log periodic antenna will find increasing favor with those hams having sufficient space to erect these big ones.

A nonresonant rhombic with legs of six wavelengths on 10 meters exhibits a gain of 13 db on 10 meters and 8 db on 30 meters. The gain of such an antenna on the other bands is shown in Table III.

In practice the gains given in Table III cannot be obtained from one antenna structure, since the angles shown in fig 1 would have to be varied somewhat from band to band to achieve the maximum possible gain, but a rhombic giving a gain of 7 to 10 db on all seven bands from 40 to 10 meters is quite feasible. Such an antenna is shown in fig. I.

A log periodic or transposed log periodic dipole array antenna can be built to cover the entire 10 to 30 mHz range with behavior nearly independent of frequency. Gain would typically be in the 5 to 8 db range, and the s.w.r. would not exceed 2.5 anywhere in the 10 to 30 mHz region. Such an antenna would be large, but not unmanageably so. For best performance a boom at least 45 feet long would carry some 16 or 18 elements ranging in length from 44 feet down to about 13 feet, with the element lengths and spacings varying in a logarithmic manner. Detailed theory and design information can be found in the articles listed in the bibliography at the end of this article.

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More Ham Bands *[from page 26]*

Propagation Characteristics

What will the new bands be like? If you have ever done any general shortwave listening, you already have a fair idea of what to expect. You might dust off that general coverage receiver, and explore those frequencies that may be yours someday. Keep in mind, however, as you listen, that commercial stations, especially short wave broadcasters, characteristically run very high power and have deluxe antenna installations when judged by amateur standards. Another way of anticipating what the new bands will be like is to note that they are located halfway between our present frequency assignments. As a consequence, the proposed 30 meter band will exhibit propagation characteristics intermediate between those we presently experience on 20 and 40 meters. The 12 meter band will be a hot daytime DX band during the maximum sunspot activity portion of the solar cycle. The 17 meter band will be an excellent DX band rivaling 15 and 20 meters. It will tend to be open for DX a little more often than 15 and somewhat less frequently than 20 meters over the sunspot cycle.

A perusal of the typical circuit analysis curves shown in figs. 2 and 3 shows the usefulness of the proposed bands at different times of day for both low and high sunspot activity. Through a good share of the sunspot cycle the 30 meter band will be an outstanding DX performer, especially during evening, night, and early morning hours local time. The convenience of these hours for operating will probably make it one of the most heavily used bands. As sunspot activity approaches a minimum during any solar cycle, the 5.25 mHz band will no doubt out-perform both the 3.5 and 7.0 mHz bands, and will exhibit particularly good performance during the popular early evening hours.

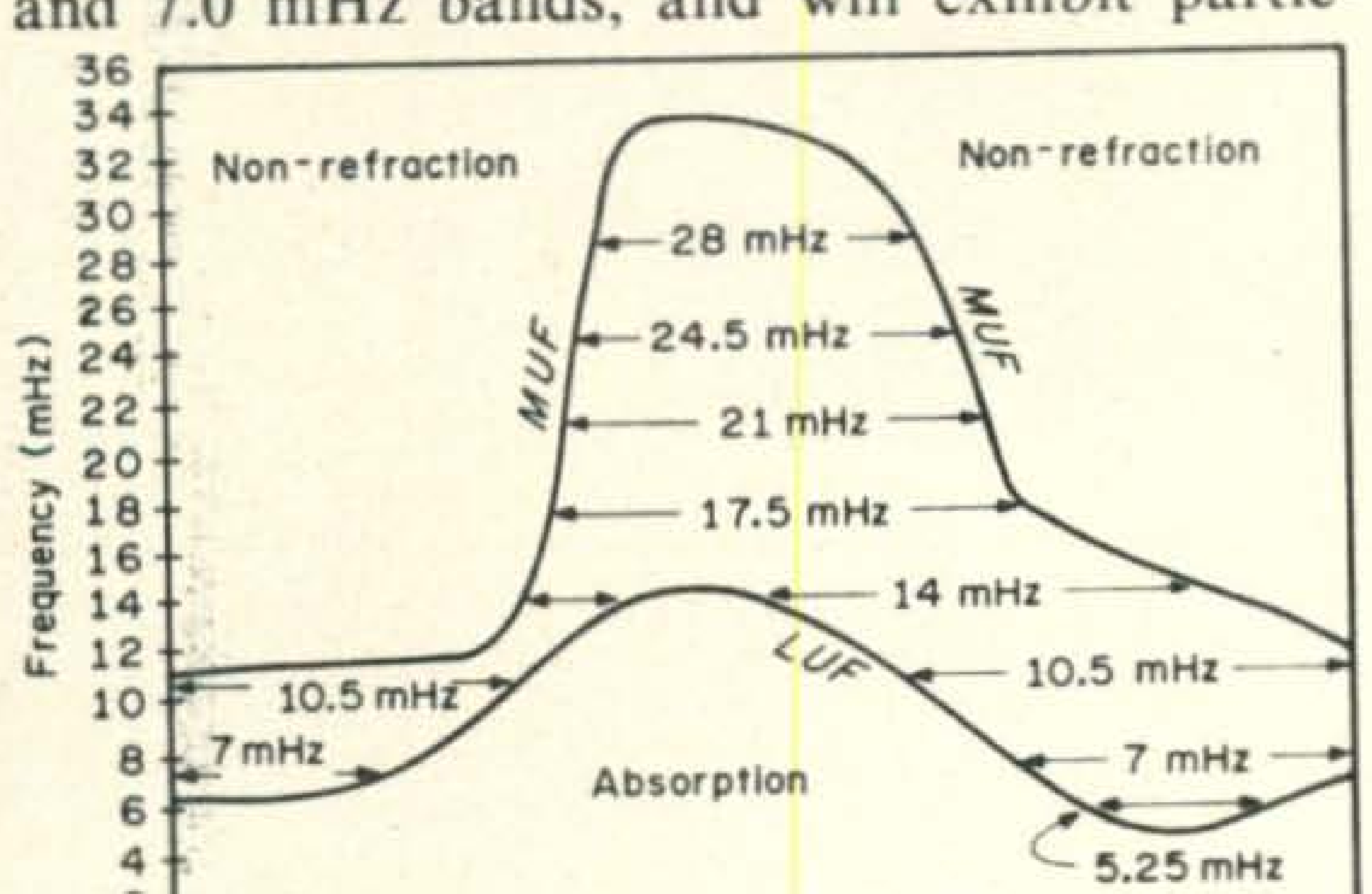

Fig. 2 — Characteristic m.u.f. and l.u.f. curves for a 3000-4000 mile path towards the east during a period of high sunspot activity — winter season.

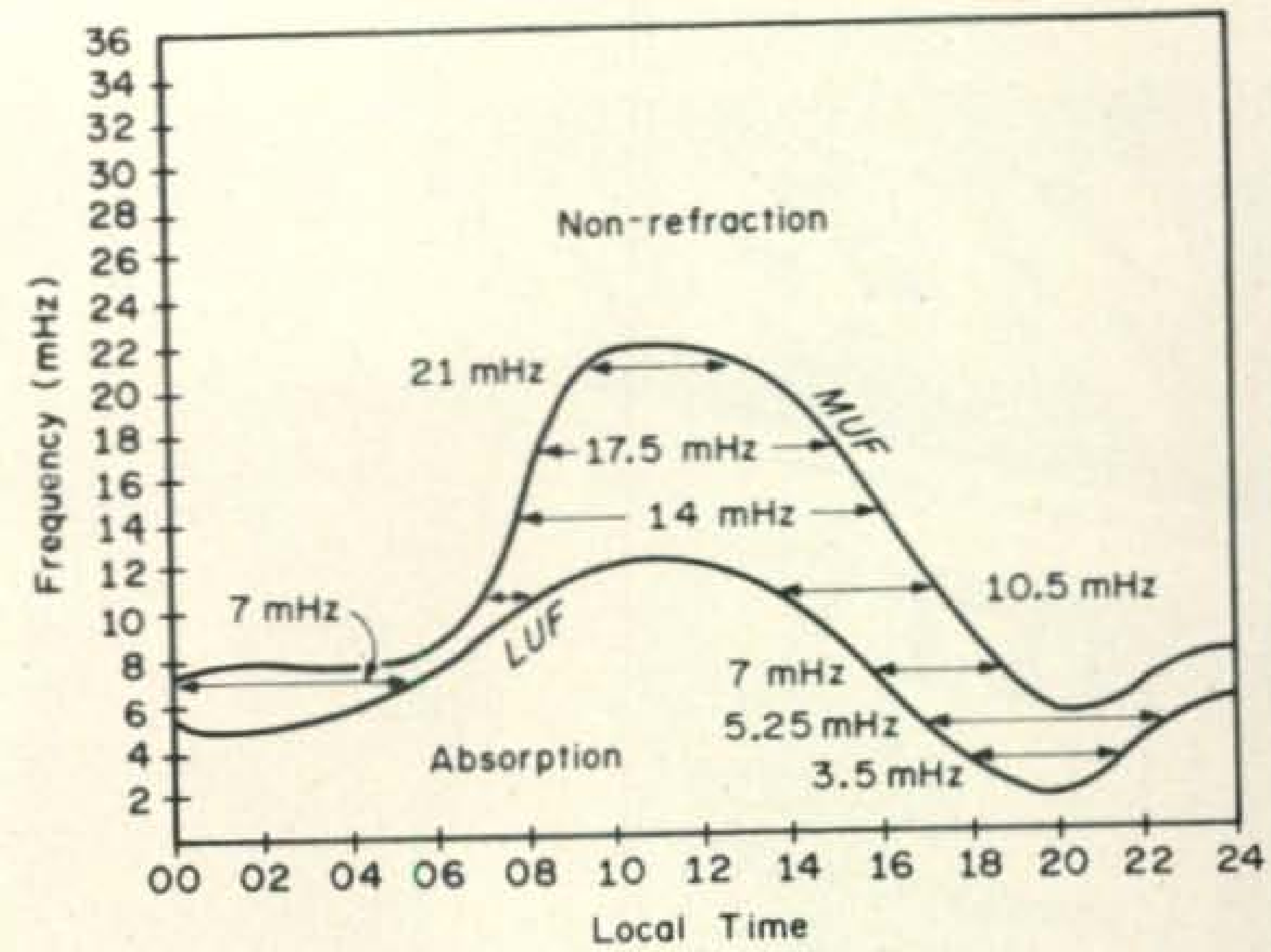

Fig. 3 — Characteristic m.u.f. and l.u.f. curves for a 3000-4000 mile path towards the east during a period of low sunspot activity — winter season.

Strategy

Now that I have whetted your appetite for more and bigger ham bands, we ought to discuss ways and means of getting them. What should our strategy be? International frequency allocations are never determined by the general public. Plebiscites and referendums just aren't used in determining international frequency allocation tables. This statement should not be interpreted to mean that we should in any way neglect the public service aspects of amateur radio, but the cold facts are that the key people who originate position papers and vote at the international radio conferences are most frequently administrator types, usually with technical backgrounds in communications. The highest level government people generally do not have much direct interest in such mundane matters as how the h.f. radio spectrum is carved up unless pressure groups have gotten to them, but if they do choose to become involved, they can be powerful friends or foes of amateur radio.

How can we make friends, patrons, and benefactors of persons in key positions? First, our best friends will be people who are active hams themselves. Furthermore, we need friends not only in the governments of the United States, Canada, and Western Europe, but around the world. The day is long past when North Americans and Western Europeans could dominate international radio conferences. Amateur radio needs friends in all countries. We probably can't do much more to create a positive attitude towards ham radio in eastern Europe and parts of Asia, but we could be doing much more in most regions of the world. If half of the effort we expend launching and participating in DX expeditions could be re-directed into establishing centers in schools and clubs in developing countries for the training of new hams, we would not only shortly have a lot more authentic DX stations on the air, but we would be developing the support for ham radio frequency allocations that we may sorely need in future years. The 15-year-old boy in Africa that we help today by providing him with the opportunity to learn electronics and to acquire some ham gear may well be the frequency allocations engineer representing Nigeria in the 1990 Geneva international radio conference.

Amateur radio can have a bright expanding future if we as amateurs will make the right decisions and take steps necessary to implement them in the next few crucial years.

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Getting The Edge [*from page 40*]

ing examination. You will be handed a card to send from, at approximately 20 w.p.m. Don't worry about hitting 20 exactly; strive for well-spaced, properly sent characters. Accuracy here is important, not QRQ. If you make a mistake, then send the mistake symbol, and continue sending. Take your time; relax.

As you can see, getting that little edge requires hardly more than the application of a generous amount of common sense, and you know you have that. So, relax. That Amateur Extra code exam is a cinch. ■

Vertical vs Horizontal [*from page 31*]

made noise. The principal sources of noise then are internal receiver noise and galactic noise picked up by the antenna. Both of these noise sources are independent of antenna polarization. The result is a situation where the noise is independent of polarization but, as we said above, vertical polarization gives a slight advantage for the signal. Vertical polarization, therefore, should hold a slight advantage for the repeater uplink.

For the mobile-to-mobile operation both antennas are low and close to manmade noise. Under these assumptions vertical polarization will give a slight advantage, according to Dr. Brown. If the situation is such that external noise is very low — such as a mobile parked in an open field, where receiving noise is the limiting factor, vertical polarization will give a considerable advantage, however.

We can summarize the preceding material by saying that when the transmitting antenna is high, and the receiving antenna is low and in a noisy environment, such as v.h.f. broadcasting or a repeater downlink, horizontal polarization will give a better signal-to-noise ratio at the receiver. For mobile-to-mobile operation or a repeater uplink with the repeater receiver in a quiet location, vertical polarization will give the best signal-to-noise ratio.

Summarizing, we have shown that the optimum system configuration for repeater operation from a propagation point of view would be to use horizontal polarization for the downlink and vertical polarization for the uplink. However, in any repeater system there are many factors to weigh besides propagation simple as possible even to the extent of complicating the repeater hardware. Since vertical polarization is preferable for the repeater uplink as well as mobile-to-mobile, it appears that the mobile should be vertical; also it is hard to beat a vertical whip for economy and esthetics. Any loss this causes in the repeater downlink can easily be compensated by increasing the repeater power slightly. We have also shown why horizontal polarization is used by v.h.f. broadcasting.

And so, good reader, if you have come this far, you deserve a beer — drink heartily! ■

Letters [*from page 7*]

the east coast first? You can work that anytime." "Why do I have to wait so long to work this station?" or "Why are you working the west coast first?" and a long list of other gripes.

Of course you hear the same poor operating when the DX station is working someone. Another station calls on top of him and keeps calling. If the DX is asking for the first district, someone on the west coast will call anyway because he doesn't want to wait, or because he thinks he's special.

No one waits anymore for "73 and QRZ" from the DX station; instead they just start calling after the stateside station has said "thanks and back to you for a final." It's one big mess after another and I really don't blame anyone for not taking expeditions, or for not working W/K's.

My praises instead go to organized nets such as the YL system and the African net, where a net control takes command and offbeat ethics are not condoned. I like to DX, and maybe I don't have 300 plus (only 205 as of this date) but because I don't have 300-plus, I don't feel that the world will end.

I think if more people read the excellent article a few issues back ["Tips On Working DX," *CQ*, June '72, p. 24] it would certainly enlighten a few individuals about how to operate.

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