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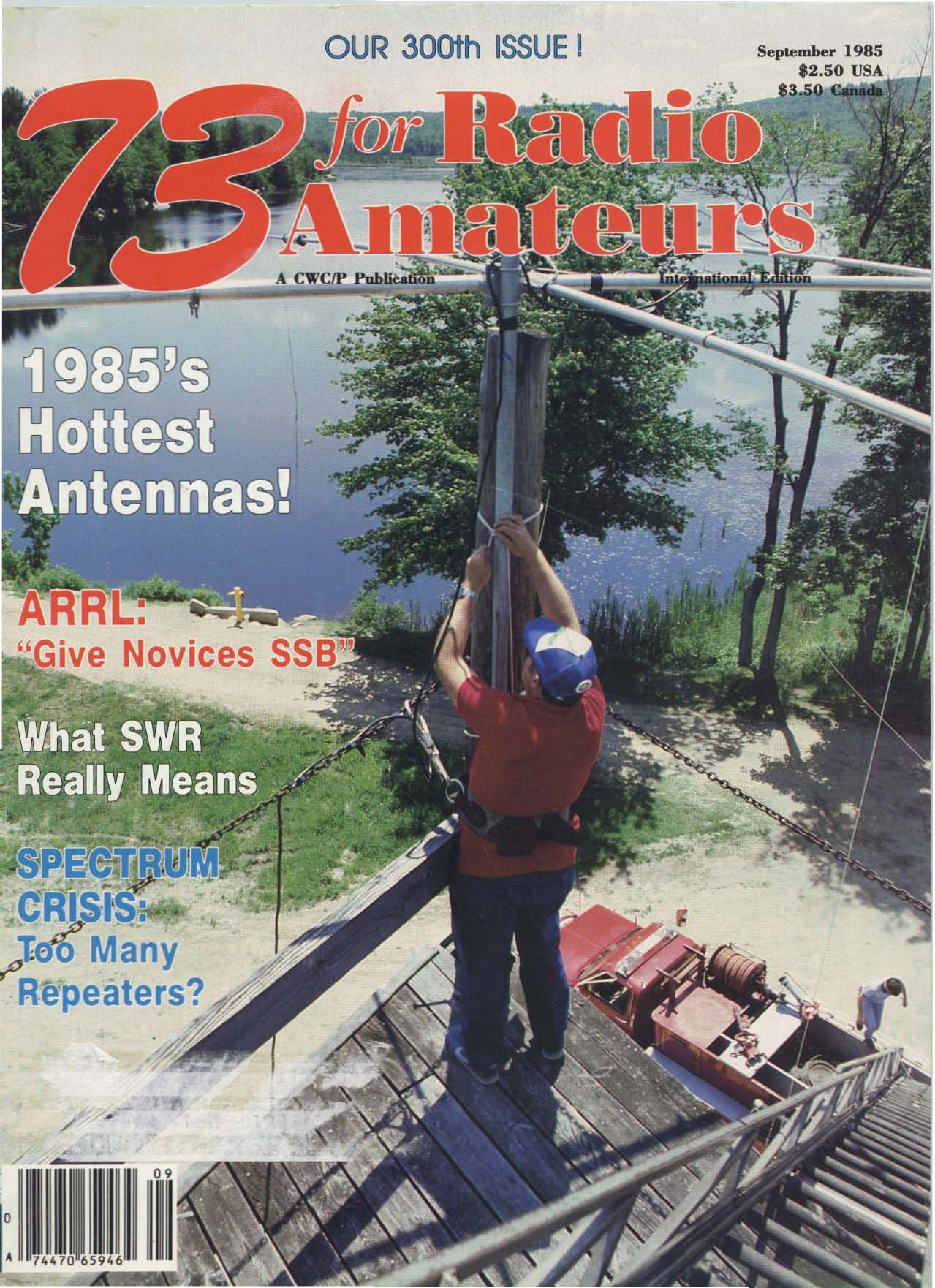

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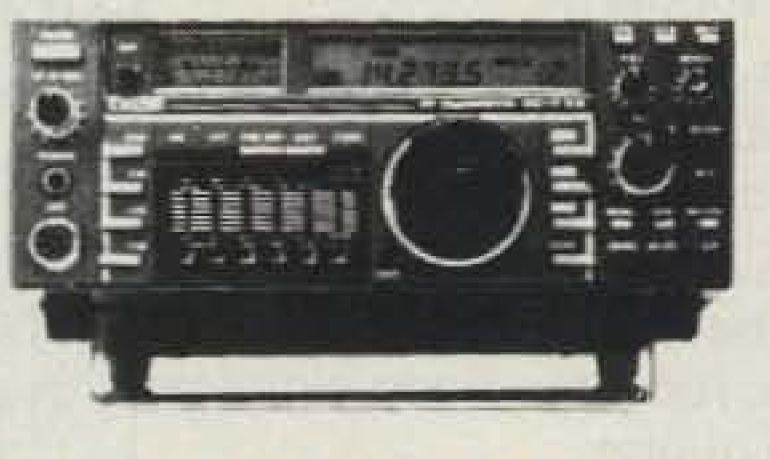

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- There should not be any sampling noises to distract you and rob important syllables. The best phone patches do not use the cheap sampling method. (Did you know that the competition uses VOX rather than sampling in their $1000 commercial model?)
- A patch should disconnect automatically if the number dialed is busy.
- A patch should be flexible. You should be able to use it simplex, repeater aided simplex, or semi-duplex.
- A patch should allow you to manually connect any mobile or HT on your local repeater to the phone system for a fully automatic conversation. Someone may need to report an emergency!
- A patch should not become erratic when the mobile is noisy.
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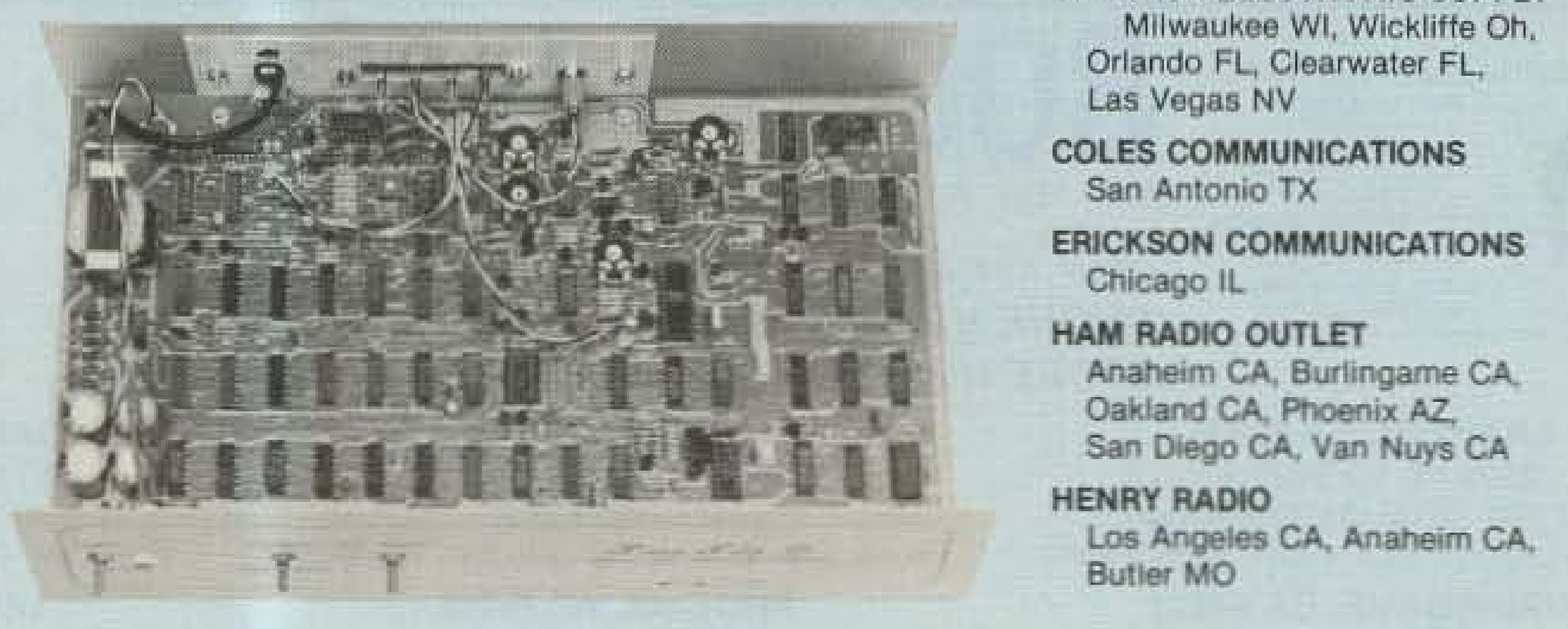

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73 for Radio Amateurs®

ISSUE #300

SEPTEMBER 1985

On the Cover:
David Smith N1BBD secures a 20m beam during the K1XR 1985 Field Day effort. Photo by Frank Cordelle, Bennington, New Hampshire. Above (l to r): Craig Clark N1ACH, Lenny Goodnow WA1UNN, and David Smith N1BBD.

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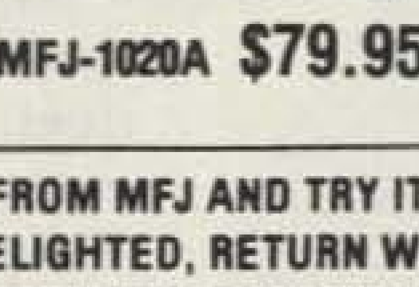

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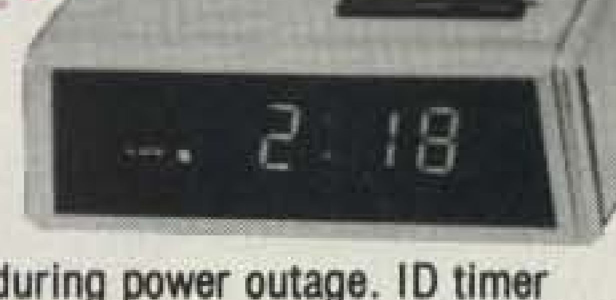

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and it is quiet on receive compared to a regular half-wave inverted vee at the same altitude.

I have no way to determine the radiation angles other than to accept what W4FD and W4ATE wrote in their articles. The darn thing works! The CCD compares equally with my home-brew half-wave dipoles on received signal strength but is superior when receiving weak signals and signals with QSB. I am amazed, in that I must be radiating a mix of both high- and low-angle signals.

My construction was quite simple. I used about 423 feet of #14 insulated house-wire stock for the wire sections. I fed it in the center and constructed the center insulator out of a junk 3/8″-thick hunk of schedule-40 PVC plumbing clamp. One could use probably any strong plastic just so it can support the weight and the pull of the elements and the feedline. The feedline was 70 feet of the best 300-Ohm TV twinlead Radio Shack has (with the foam dielectric). Not having an amplifier, this would work fine and is easier to mount than open-wire line. The TV twinlead with 100 Watts out can handle any mismatches with use of an antenna tuner and be reasonable in terms of losses.

The insulators for the capacitor/resistor networks were 1-1/2″-long sections of 3/4″-diameter PVC pipe (see Fig. 1). After construction, these insulators were filled with clear GE silicone caulk to encapsulate the components for weather protection. Locating the silver-mica caps was the longest project. I found prices as high as $1.25 each to 12¢ each. It pays to shop! The voltage ratings of my caps

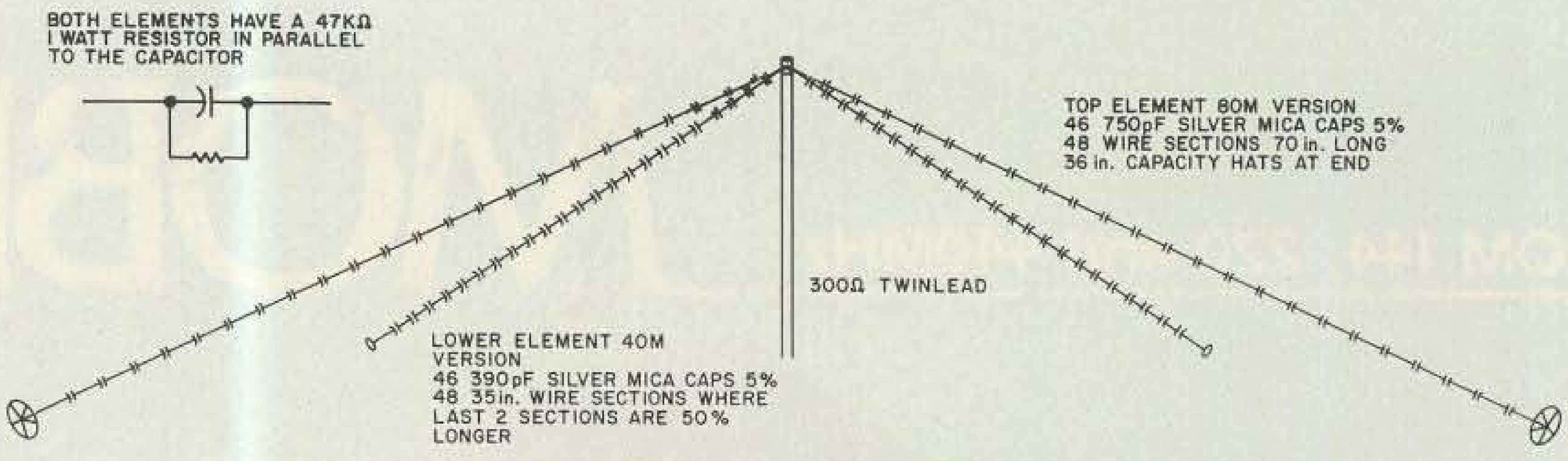


Fig. 2. The 80/40 CCD schematic.

So again (see Fig. 2), the 80-meter element has 46 750-pF caps, 46 47k-Ohm, 1-Watt resistors, and 48 wire sections each 70 inches long. The 40-meter element has 46 390-pF caps, 46 47k-Ohm, 1-Watt resistors, and 48 wire sections each 35 inches long. Actually, the last wire sections of the 40-meter element are 50% longer to help with the current flow out to the tip. The 80-meter element I constructed has 36″-diameter hats for the ends to serve the same purpose. The hats and/or the extended last sections are not really needed for operation, but the authors of the articles do say they will improve the performance of the CCD antenna.

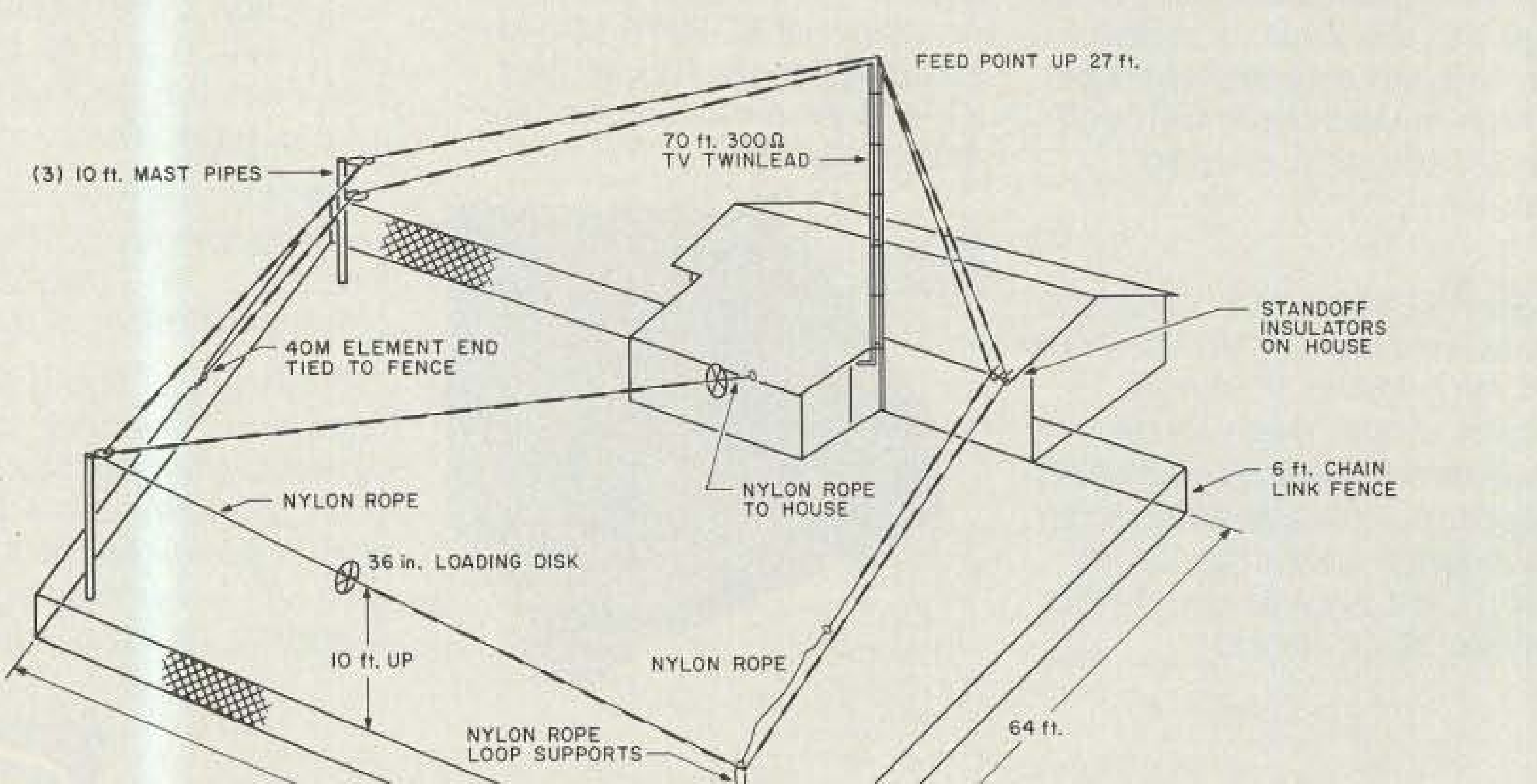
The installation was the fun part (see Fig. 3). I have a 27-foot push-up mast mounted on my house. My backyard has a 6-foot chain-link fence around it, so I clamped the three 10-foot mast pipes to it. With the total mounting area being about 80′ × 64′, I had to be creative!

It ended up like the drawing. Two thirds of the full-wave 80-meter CCD is 10 feet off the ground and only 3 to 4 feet from the metal fence! Yet I worked VKs and ZLs on 80 (with the band open)! The 40-meter element just inches under the 80-meter element was luckier. I'd say about 60% of it is up between 10 and 27 feet (somewhat like a conventional inverted vee).

Most people I contact who are interested in the CCD antenna say they do not have the room. Phooey! I would say my city-size lot is average for urban dwellers, and the neat thing about the CCD antenna is that it is unbelievably tolerant of your creativity! (Now to get the neighbors and XYL tolerant—HI, HI!)

An added plus with the general-coverage feature of my TS-430S, like many of the newer rigs, the CCD setup I use works excellently on those other bands for receive. Remember we have here a very broad high-pass filter of an antenna, with extended aperture.

To build a CCD takes some soldering time, accurate measurement, and thought about designing insulators and mounting. Do not be afraid even to wrap the thing around your house, like going under a roof overhang, if you are in a "no antennas" area. The thing will work! It just totally reverses what we learned about the half-wave dipole. No high supports? Again give the CCD a try and you'll be amazed and on the air. You may end up like me and find it everywhere! ■



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140 Joynton Avenue
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The Downunda Project: Part II

How to assemble and align the DSE 2m transceiver described last month.

Editor's note: Part I of this article appeared in the August, 1985, issue of *73*. Reprinted with permission from *Electronics Australia*.

While the circuit of the new VHF transceiver is relatively complex, its construction is reasonably simple and does not require any special assembly techniques. A soldering iron and a screwdriver are virtually all you need. Make sure the iron has a small chisel-shaped bit for quick and effective soldering.

Most of the circuit components, with the exception of front-panel and rear-panel hardware, are accommodated on a single-sided printed circuit board (PCB) measuring 162 × 199 mm and coded with the Dick Smith Electronics type number ZA1687. The front and rear panels are also made from PCB copper laminate and are soldered at right angles to the main PCB.

The whole PCB assembly fits (and that is the operative word) into a specially designed ABS case which has two interlocking halves secured by four screws. It is a neat and effective assembly.

As can be seen from the photo, the front panel has white silk-screened labeling on a black background. This is combined with an attractive set of knobs and other hardware plus a backlit signal/power meter to produce a professional-looking transceiver.

Construction Aids

All purchasers of this transceiver kit will receive a detailed assembly manual which describes construction on a step-by-step basis. The parts layout diagram comes complete with a grid pattern and you simply insert each part in turn at the grid location and cross it off the parts list.

In addition, the main PCB will be supplied with a screen-printed overlay as seen in Fig. 2. The copper side of the board also has a solder mask to reduce the possibility of solder bridges.

Board Preparation

Before actually mounting any of the components, a certain amount of work on the PCB is necessary. The first job is to remove a 3-mm strip of solder mask from the ground pattern at either end of the PCB. This is best done by masking off each 3-mm strip with masking tape and then removing the solder mask using a cotton ball dipped in nail polish remover.

Alternatively, the solder mask can be scraped off using a sharp utility knife.

Constructors should also inspect the board very closely to see if the solder mask has encroached onto any of the mounting holes of the components. Check also that all component holes have in fact been drilled and that there is no evidence of bridging in the copper pattern. None of these faults may in fact be present, but it is better to spot them now rather than try to find them when most of the soldering is complete.

It may also be necessary to slightly enlarge the mounting hole for power transistor Q22. This transistor is mounted and soldered on the underside of the PCB and secured by a stud which passes through the board.

Q22 requires a clearance hole of 10 mm so that its seating plane can pass right through the PCB and butt up to the aluminum heat sink. More on that later.

PCB Assembly

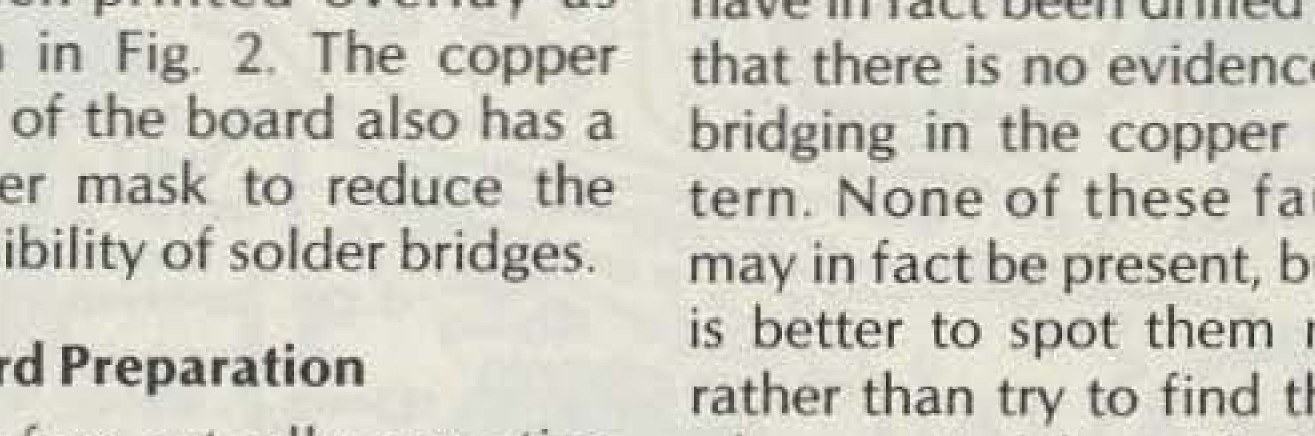
We are now ready to commence assembly of the PCB. Begin by installing the PC stakes and wire links. The wiring diagram (Fig. 3) indicates where most are required. Additionally, four PC pins are required as a foundation for the oscillator enclosure and as locating points for the front and rear panels.

The four PC pins for the oscillator enclosure and ground pin for Q21 should be fitted from the copper side of the PCB so that the longest end is through the PCB.

The use of PC pins for the external wiring is optional but we recommend it. PC stakes make it so much easier to disconnect and reconnect wires if that becomes necessary.

There are 13 wire links on the PCB and all except one of these are labeled "LK" on the overlay diagram. The exception is near C158. This one is shown but not labeled on the diagram. In addition, note that one of the links should be insulated (near D33).

With the job of installing the PC stakes and wire links



The DSE Commander two-meter transceiver kit.

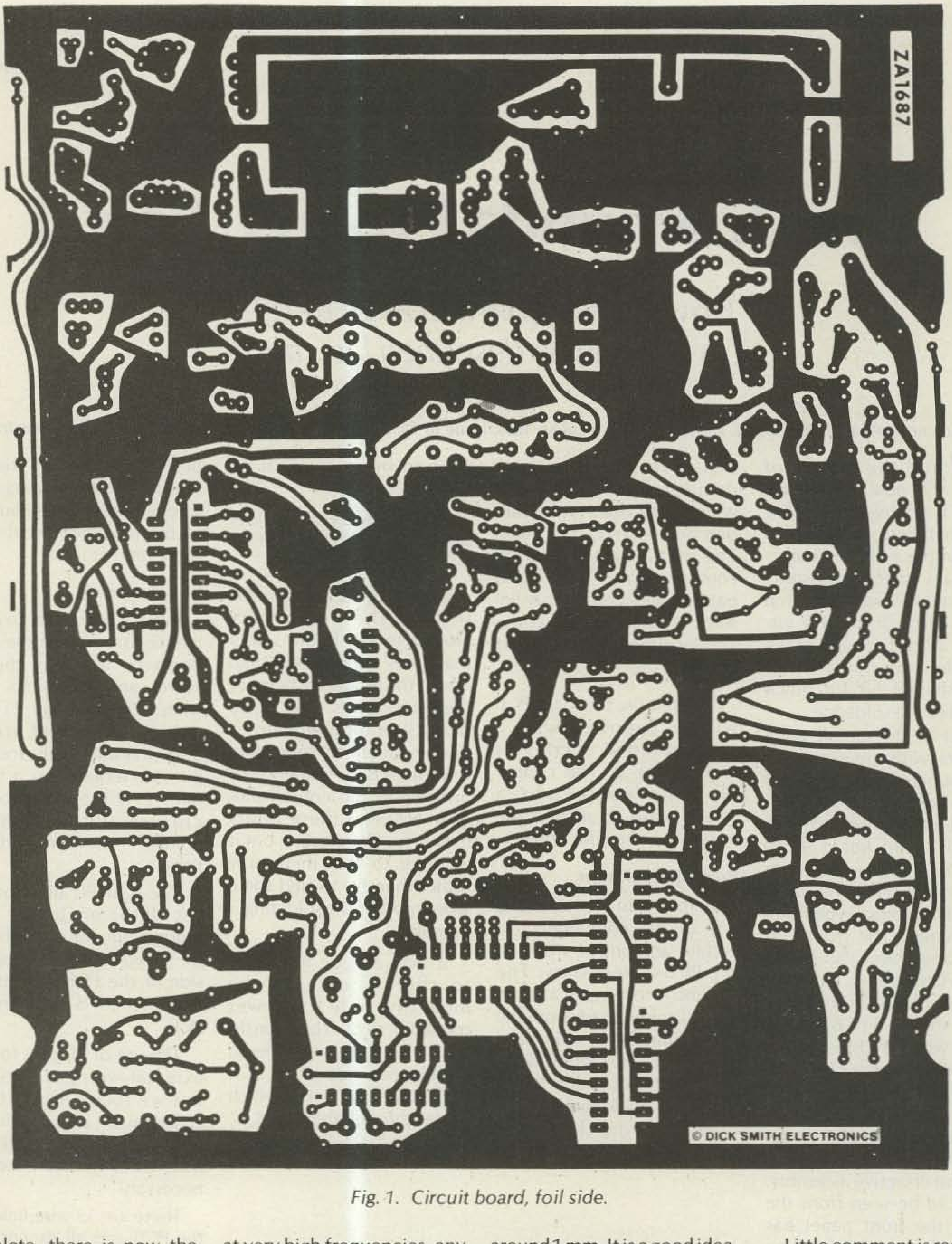


Fig. 1. Circuit board, foil side.

complete, there is now the longer task of installing all the resistors and capacitors.

Keep Those Leads Short

The most important point to remember when installing all these small components is that the pigtails should be kept as small as possible. Because the circuit is working at very high frequencies, any long component pigtails will act as unwanted inductors and play havoc with the performance.

Quite a few of the resistors have to be stood "on end" to fit them in. When this is done the clearance between the end of the resistor body and the PCB should be around 1 mm. It is a good idea to install these vertical resistors with the color code running down the body. It is easier to check the resistor values in this way.

R111 (100k Ω) should not be installed before FL3 and Q8 are inserted and soldered. It loops over these two components.

Little comment is required with regard to mounting the capacitors except that you must use the capacitor type specified. There are no ifs or buts here. Do not interchange green caps (i.e., metallized polyester) for ceramics or tantalums for normal electrolytics (or vice versa).

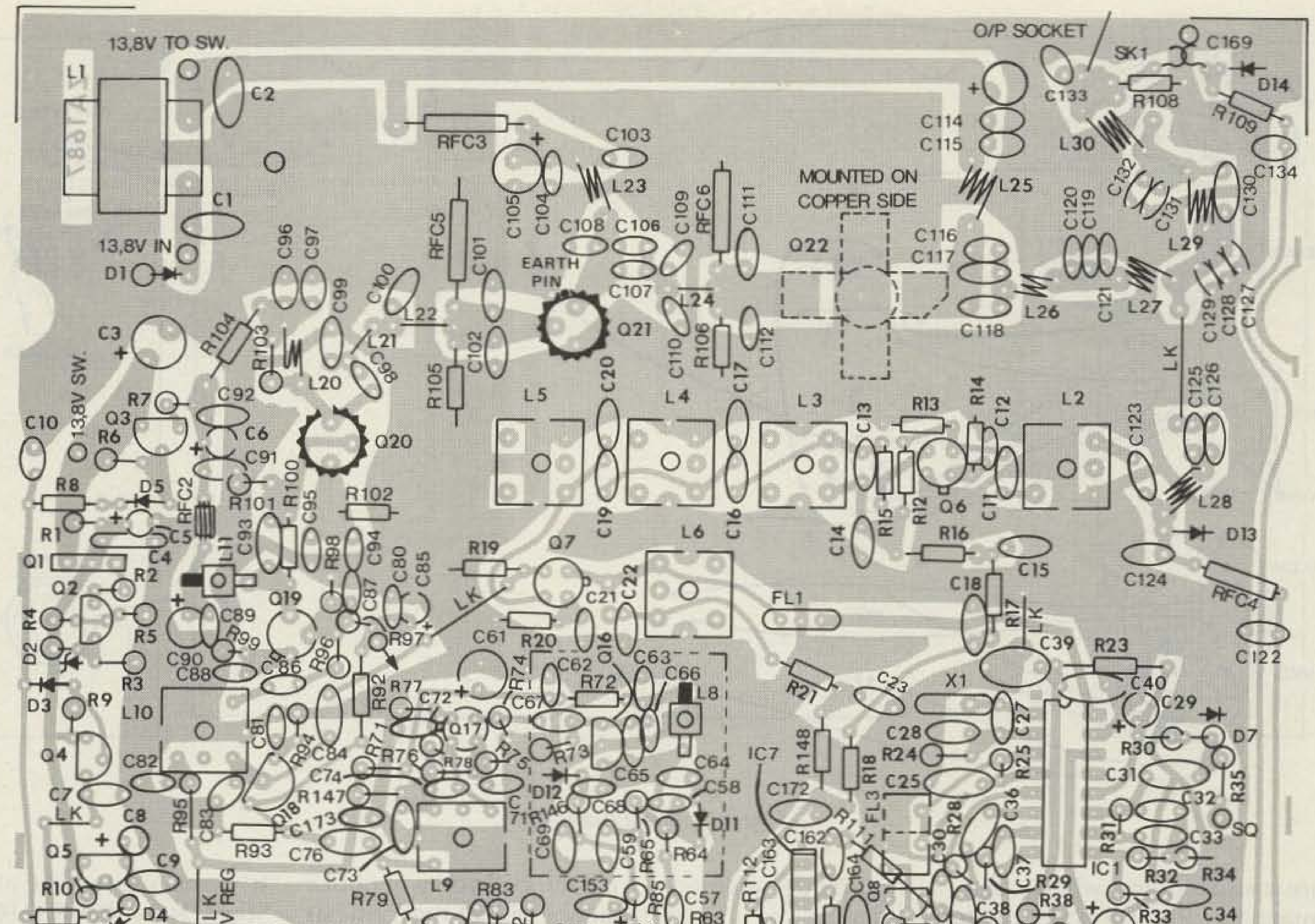


Fig. 2. Parts placement guide.

C169 is a couple of light-duty insulated wires twisted together. The amount of twist is adjusted (sounds very precise, doesn't it?) during the calibration procedure.

Semiconductors

The semiconductor complement is 33 diodes, 30 transistors, and seven integrated circuits. With the total of 70, it might seem a lot, but don't hurry the task to get through it quickly.

Mount the diodes first and again the pigtails should be kept as short as possible. Take particular care with the diodes that are mounted "on end." Make sure that the polarity is correct. Remember that once you have soldered and clipped the leads you will not be able to reuse the diode if you find it has been installed the wrong way around.

Pay particular attention when installing diodes D22, D23, D24, and D25. The cathode end of these diodes is indicated by the red band. The yellow and orange bands make up the code which indicates the diodes' type number.

D14 is installed with cathode end up and anode to PCB ground. It is part of the pickup (including "gimmick" capacitor C169) for the meter circuit.

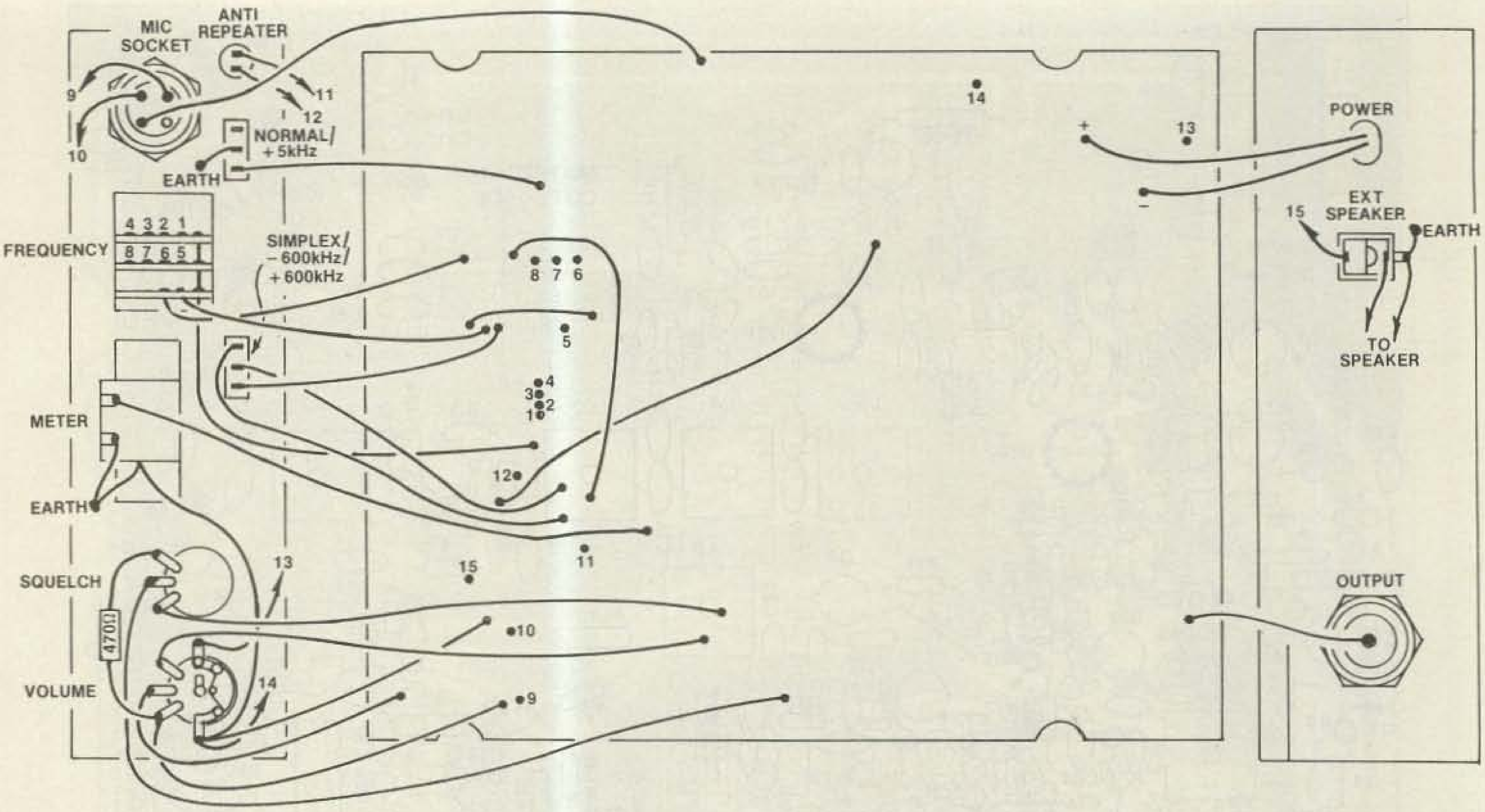


Fig. 3. Wiring diagram.

Care is also required when mounting the transistors to ensure correct lead orientation. Double-check each transistor against the circuit diagram before soldering it into the circuit. All the small-signal plastic-pack transistors plus the metal-encapsulated TO-18 types (Q6, Q7, Q17, Q25) should be mounted so that the transistor bodies are about 3 mm above the surface of the PCB.

In practice, this simply involves pushing the transistors down onto the board as far as they will go without placing undue strain on the leads (and on your fingertips).

The TO-39 metal-package transistors, Q20 and Q21, are mounted flat against the PCB. The metal case of Q21 must also be grounded by soldering it to a PC pin which should already have been installed. Clip-on heat sinks are also fitted to Q20 and Q21.

As already mentioned at the start, Q22 is mounted on the copper side of the PCB. It has four brass tabs which are soldered directly to the PCB copper pattern. Make sure it is correctly oriented before soldering.

The integrated circuits require little comment apart from the two that are CMOS. These are IC2 and IC3, the 4560 decimal address. These should be soldered while the iron has its barrel connected to the PCB ground pattern via a jumper lead. Solder pins 16 and 8 of IC2 and IC3 first, and then the remaining pins.

Inductors

By now you are ready to begin installing the various rf transformers and coils. Ten of these have to be wound by you, the constructor. The necessary details of these are shown in Table 1. The main points to watch here are that you must use the correct gauge of wire for each coil and that the coils are wound exactly to specification.

Note that the hairpin coils, L21 and L24, must be dimensioned exactly as called for in the table.

Coils L8 and L11 are supplied already wound and must be installed the right way around. If you closely examine the red plastic form for each coil you will notice that one side of the form has a long vertical rib while the other has a short vertical rib. In the case of L8, the long rib should be adjacent to L6. In the case of L11, the long rib should be closest to Q1, the BD140.

Assembly of the main PCB can now be completed by installing the filters, the four crystals, and the preset pots.

Finally, it is necessary to shield the vco to prevent spurious radiation into adjacent circuitry. Supplied with each kit is a strip of double-sided PCB laminate which should be cut into four 28-mm lengths. The four strips are then soldered to the PC pins at the corners of the vco circuit.

Final Assembly

Attention can now be turned to the front and rear panels. These are supplied with the necessary cutouts for all the hardware, and assembly is really very straightforward. For example, the frequency-selector switch just clicks into place and has its own built-in retaining system.

Leave the heat-sink assembly and meter off at this stage. Note that R37 (470 Ω) is strung between the outside lugs of the volume and squelch pots, as depicted in the wiring diagram.

With the hardware fitted, slip the front and rear panels into their respective mounting slots in the case and mount the main PCB using the four self-tapping screws provided. The PC pins at the front and rear of the main PCB are now soldered to the end panels and the case fully assembled to make sure that everything fits.

Adjust the PCB assembly as necessary, then remove it from the case and run a series of solder fillets between the ground pattern of the main PCB and the end panels. This provides strength and rigidity.

With this done, the rest of the assembly can be completed. Install the heat-sink assembly for Q22, which is composed of a short channel extrusion and a single-sided heat sink for the rear panel. These are secured using screws and nuts supplied with the kit. Finally, complete the wiring according to Fig. 3.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Alignment

This is quite a straightforward process, although you do need access to some test equipment: (1) a digital multimeter, (2) a dummy load, e.g., DSE cat. D-7027, (3) a 5-MHz (or better) oscilloscope, and (4) a digital frequency meter.

Initial Settings

1. Set the core of L18 flush with the top of the can.
2. Set the core of L9 two turns down from the top of the can.
3. Set the core of L10 one turn down from the top of the can.
4. Set the slugs of coils L8 and L11 one turn down from the top of the form.
5. Set VR68 to ¼ clockwise rotation.

Voltage Checks

Connect the transceiver to a 13.8-V-dc power supply and make the following voltage checks:

1. Without switching on the unit, check that the input voltage is 13.8 V dc. This voltage can easily be measured between the switch contact on the volume control and ground.
2. Switch on (without microphone connected) and check for +10 V dc at the collector of Q1 (allowable tolerance 0.5 V).
3. Check for +10 V dc at the emitter of Q4 (allowable tolerance 0.5 V).

Synthesizer Alignment

1. Check TP1 (Test Point 1) for 10-kHz clock frequency at 6 V p-p (approx.). Measurement for TP1 can be easily taken from under the PCB at pin 7 of IC6.
2. Check TP2 (output from L18 offset oscillator) for rf output. Use a sensitive rf probe or test probe as depicted in the inset in Table 1.
3. With oscilloscope on TP4 (mix-down frequency), located at IC16, and the dc meter with the positive probe to TP3, adjust L8 (vco coil) for 2.5–2.7 V at 144 MHz.

L13	25 B&S En/Cu 1/8 in. (3.2 mm) DIA. CLOSE WOUND	4T	
L20 L30	18 B&S En/Cu 3/16 in. (4.7 mm) DIA. CLOSE WOUND	2 1/2T	
L23 L25	18 B&S En/Cu 17/64 in. (6.7 mm) DIA. CLOSE WOUND	1 1/2T	
L27 L28 L29	18 B&S En/Cu 17/64 in. (6.7 mm) DIA. CLOSE WOUND	2 1/2T	
L22	18 B&S En/Cu 17/64 in. (6.7 mm) DIA.	1T	
L24	18 B&S En/Cu 1/4 in. (6.4 mm) DIA.	HAIRPIN	
L26	18 B&S En/Cu 3/8 in. (9.5 mm) DIA.	1T	
L21	25 B&S TIN/Cu 1/8 in. (3.2 mm) DIA.	HAIRPIN	
RFC2	FERRITE BEAD 25 B&S En/Cu	2T	
RFC3	6-HOLE FERRITE CHOKE 25 B&S TIN/Cu		

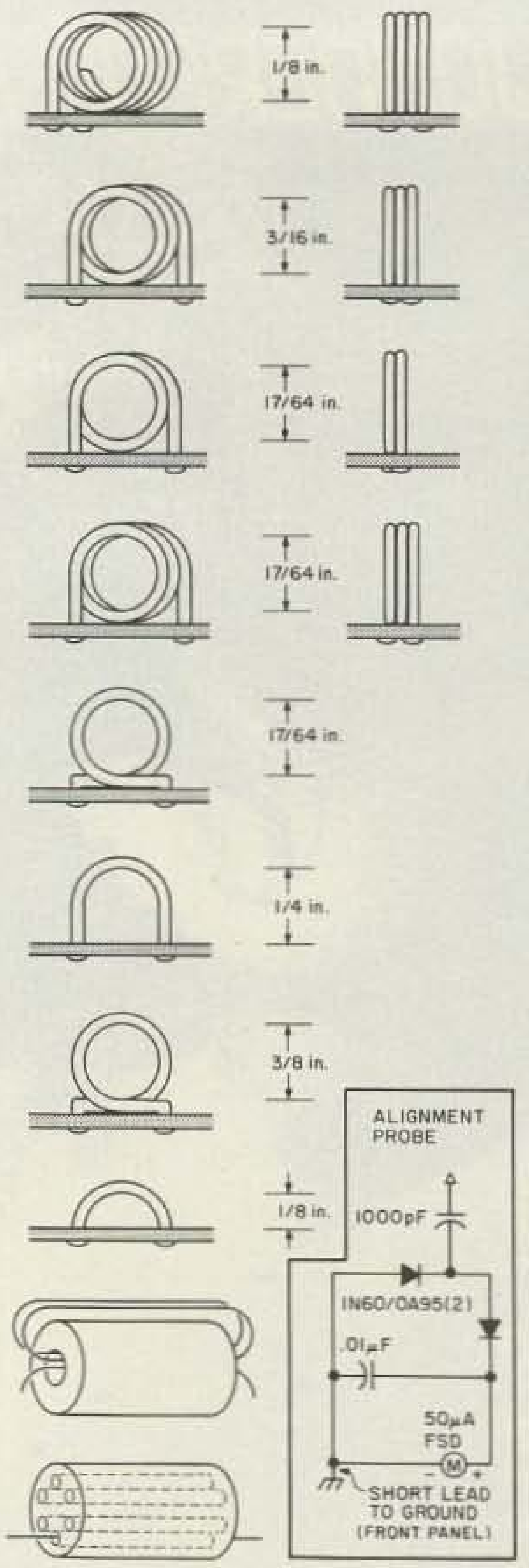

Table 1. Coil construction details.

4. TP4 should show a signal of 600 kHz at approximately 2 V p-p (simplex—144 MHz). (Minimum level of 1 V p-p and maximum level of 2 V p-p nominal.)

5. Adjust L18 (offset oscillator) for maximum amplitude at TP4.

6. Select 147 MHz. The dc volts at TP3 should increase to approximately 5 to 6 volts. The oscilloscope on TP4 will show a level greater than 1 V p-p at 3.6 MHz.

7. Select 146 MHz (simplex). Connect a dummy load to the output. The dc volts at TP3 should be 4–4.5 volts. Now press the PTT button for a short period and adjust VR68 for 4–4.5 volts as measured above.

Receiver Alignment

1. With no signal input, adjust L7 for maximum noise in speaker.

2. With suitable signal source (i.e., signal generator or a hand-held transceiver held near a radio, etc.), adjust L2, L3, L4, L5, and L6 for maximum reading on the signal meter, reducing input as required to obtain half-scale reading. This should be performed at 146 MHz (center band). Your local repeater, slow Morse beacon, or propagation beacon can be used.

3. With a known input frequency, adjust L6 and L7 for best sound (best audio quality).

4. With an accurate input frequency of 146.005 MHz and the +5-kHz switch on, adjust L14 for best audio quality. (A separate 2-meter transceiver using a dummy load and in close proximity can be used.)

5. With an accurate input frequency of 146.000 MHz, change the switch from +5 kHz to normal and adjust L15 (receiver frequency adjustment) for best audio quality. Please note that the +5 kHz must be adjusted first, and then the normal frequency, as these adjustments will interact.

6. At this point, with a calibrated signal, the sensitivity of the receiver should be better than 0.5 μV for 12 dB Sinad.

If minor receiver instability is experienced, change R12 from 10k Ω to 12k Ω. This is due to the variation in gain of the rf amplifier, Q6.

Transmitter Alignment

1. Align at 144 MHz simplex.
2. With a suitable load and frequency counter connected to the output socket, press the PTT button and monitor the input current. Rf output should be available.
3. At 144 MHz simplex, adjust L9 for maximum rf output. Note that this is a critical adjustment; once adjusted, do not alter it.
4. Then adjust L10 and L11 for maximum rf output (still at 144 MHz simplex).
5. At this point, the rf output should exceed 10 Watts.

Approximate current drain is 1.9 A at 10 W and 2.2 A at 15 W.

6. Now select 147 MHz and press PTT. Rf output should be the same as that in step 5, and no adjustment is required. (No tuning is required due to the broadband power amplifier.)

Transmitter Frequency

1. Set normal/+5-kHz switch to the +5-kHz position. Set frequency to 146 MHz, then press PTT, making certain that both frequency counter and dummy load are connected to the output. Then adjust L16 for 146.005 MHz.
2. Switch the normal/+5-kHz switch to the normal position and adjust for correct

frequency (i.e., 146.000 MHz).

Transceiver Modulation

1. With a suitable modulation meter or monitor receiver, adjust VR61 for 5-kHz peak deviation. The setting for 5-kHz peak deviation should be approximately ½ rotation of VR61.

This should be adjusted at 146 MHz simplex (center of band range).

2. Adjustment of twist capacitor C169: With dummy load connected to output, press PTT and adjust C169 by tightening or loosening turns to achieve 90% FSD on the signal/power meter in the transceiver.

Waxing the Vco

Once the alignment has been completed, the vco enclosure can be filled with wax to ensure mechanical stability and prevent microphonics. The procedure is as follows:

1. With 144 MHz selected, check voltage at TP3. Note this reading.

2. Using your soldering iron, melt a liberal coating of transformer wax (supplied) onto the various components in the vco but do not cover coil L8 at this stage.

3. When cool, readjust L8 for the voltage reading previously noted, then use the transformer wax to seal L8.

In some cases, where high ambient noise forces the use of high volume from the internal speaker, microphonics may still occur despite the shield and the wax. If this occurs, the best way around the problem is to use an external speaker.

Construction of the VHF transceiver is now completed. ■

A complete kit is available for $149 plus postage and handling from Dick Smith Electronics, PO Box 2249, Redwood City CA 94063.

Harry D. Hooton W6TYH
1420 Shamrock Lane
Lincoln CA 95648

Fighting Fire With Wire

If 15m is hot and your antenna's not, try the V-bomb array.

Today, the propagation on the high-frequency amateur bands—particularly the 15-meter band—is wild, to say the least. Excluding the WWII years, I have been on the air continuously for over 56 years and have never experienced such erratic and unpredictable propagation conditions as those occurring at this time. Nevertheless, the contacts, brief as most of them are, can be very interesting and exciting. This article is addressed especially to those hams who have joined the ranks over the past few years and may not be very familiar with the vagaries of HF-band radio propagation as we pass through the periodic sunspot minimum.

The newer ham should make himself familiar with the normal action of the various ionospheric layers involved in sky-wave propagation of radio shortwaves. The wild propagation prevalent on the 15-meter band at this time is probably due to sporadic-E refraction. In case you are not familiar with this term, it refers to patches of relatively intense ionization—ionized "clouds" of varying intensity and size, moving, appearing, and disappearing at random.

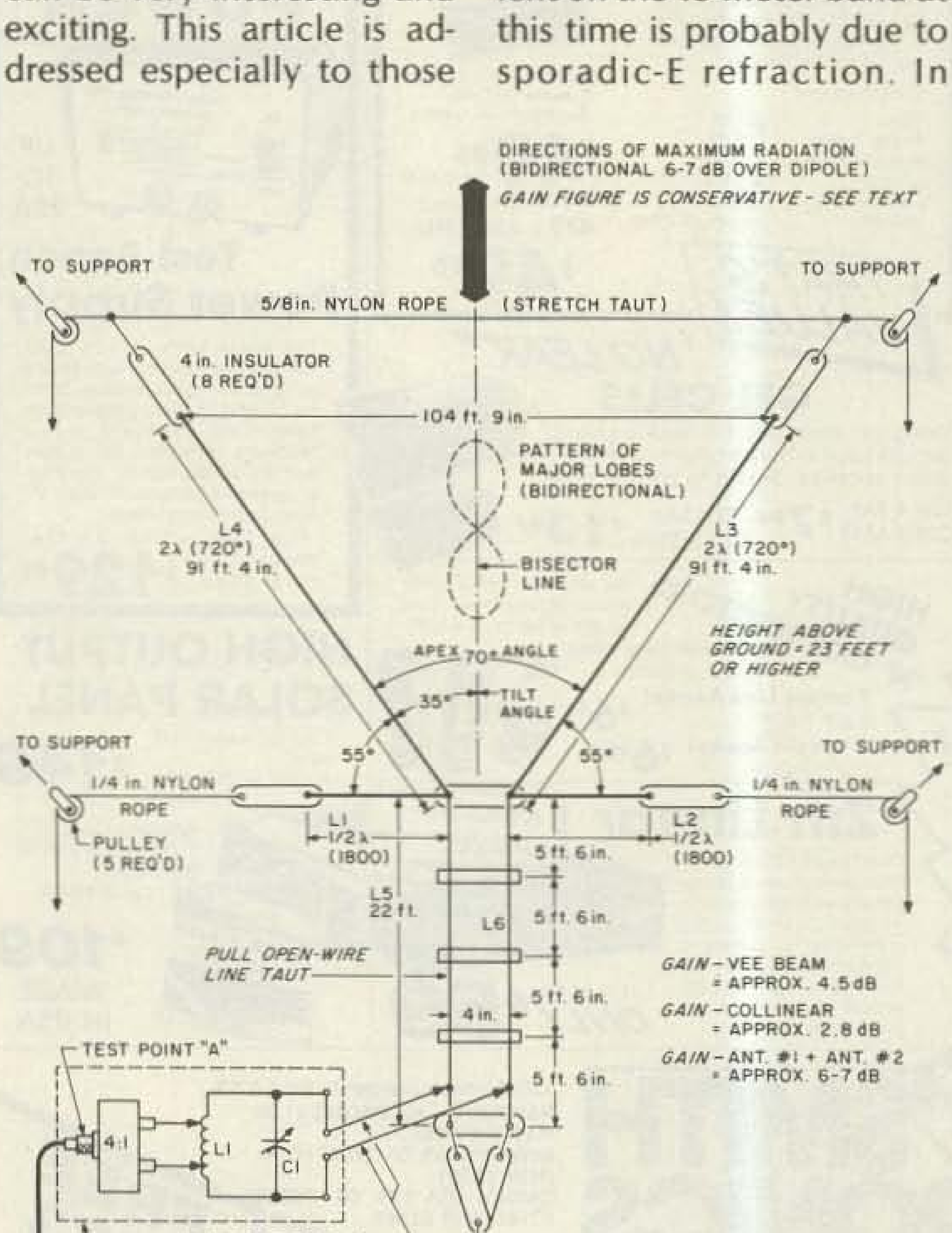

Fig. 1. W6TYH combination array for 15 meters.

At times, the intensity of ionization in a sporadic-E patch is much higher than that of the normal E layer. When this happens, the radio wave is refracted from the electrical cloud and the signals, usually at a distance of 1200 to 1500 miles, are for a short time in the "dB over nine" category. Because the cloud is moving, often rapidly, the exceptionally strong signal can in a matter of minutes (or seconds) drop to a very low value or completely disappear. When the station that you are working suddenly goes out like a light, the chances are that the propagation is due to sporadic-E conditions.

To be most effective for long-distance (DX) communication during periods of sunspot minimum, the angle at which the incident radio wave approaches the ionosphere must be low. When the angle of the incident wave is lowered to approximately horizon-range conditions, the critical frequency is about twice that obtained at 90 degrees.

The critical frequency varies with the ionization density of the ionospheric layers. At this time, most of the DX contacts will be made by amateurs who not only have selected the proper antenna, but also, through their knowledge of propagation characteristics, will be able to take advantage of favorable conditions as they occur. How can we lower the angle of the incident wave? How can we increase the effective DX gain of the popular simple arrays?

High-Gain Design

Most radio amateurs today use factory-built multiband rotary beam antennas placed on the top of high towers, often at great heights. After 56 years of ham radio, I am often amused at the shock expressed by the ham at the other end of the circuit when he is informed that the antenna at W6TYH is a wire beam fed with an open-wire transmission line. In the minds of most modern hams, wire antennas went out with Marconi.

There is also a widespread belief that to construct a high-gain wire array one needs a space as large as the Sahara Desert. A short V beam (two wavelengths or so on a leg) will be effective for most DX work on 15 meters, but it is greatly improved by adding a pair of half-wave wings as shown in Fig. 1.

I am afflicted with a terminal illness—a pulmonary condition that does not permit much physical activity. While in the hospital, I passed the time toying with the idea of installing a V-beam array stretched between three large oak trees surrounding my ranch house. As soon as I was physically able, with the aid of a couple of teenagers, pulleys and ropes were installed in the trees at about the 40-foot level. Then the V beam was installed and performed very well in the two directions along the bisector line. However, it was desired to increase the gain of the array and to lower the radiated vertical angle of the bi-directional pattern. Obviously, another V section placed under the first one, spaced from 3/8 to 1/2 wavelength (free space) would increase the gain by 3 dB, but what about the vertical angle?

At this time we got the idea of adding a broadside curtain and driving the two systems in phase. The first idea was to hang the curtain section on the nylon rope across the open end of the V. However, this would require a very long feedline to the curtain and possibly a great deal of experimental work to make sure that the two systems were actually operating in phase. Finally, we realized that if the feedpoint of the broadside section was connected in parallel with the feedpoint of the V array, the two sections, V and broadside, would be driven perfectly in phase (0° phase difference) and no tricky phasing lines or adjustments would be necessary.

After a great deal of discussion with other hams, it was decided to add the two half-wave sections to the single V section and try it out on the air. The standard of comparison was the two-element yagi array described several times in *73* (see the May, 1980, issue). The yagi has a forward gain of about 5 dB and usually had a slight edge over the original V beam when working VKs and ZLs.

After adding the two half-wave sections, the signal from the V with the added pair of half-wave radiators was S8 while that from the yagi was S6. Subsequent tests with VK stations confirmed that the new array was indeed producing a signal in the South Pacific two S points stronger than that from the yagi.

It will be easier for the reader to follow if we describe the characteristics of each section of the ultimate array as we go. The V beam with which we started has two legs, each 91 feet, 4 inches long, as shown in Fig. 1. The correct apex angle for a V with two-wavelength legs is approximately 70°. The distance across the open end of the V is 104 feet, 9 inches. If we bisect the V as indicated by the dashed line in Fig. 1, we divide the triangle (V) into two parts.

The angle between this bisector line and one leg equals one half of the apex angle or 35°. The 35° angle is called the tilt angle and is important in the design of V, rhombic, and similar arrays. According to standard published data, a V beam with two wavelengths on each leg will have a bi-directional gain of about 4.5 dB over a dipole operating under the same conditions of height and power input.

The feedpoint at the apex of the V is high impedance and is normally fed with a quarter-wave "universal" stub or a tuned open-wire line. The tuned open-wire line used to feed the W6TYH V is a half wavelength (22 feet) long at 21.3 MHz. From the tuned coupler circuit, a 4:1 toroidal balun matches the 52-Ohm (RG-213/U) coaxial line to the transmitter. At the transmitter, a coaxial relay is used to permit instantaneous switching of either the comparison yagi or the V-curtain array to the transmitter and receiver.

The two in-phase, half-wave sections are stretched in a straight line, as shown in Fig. 1, and connected to the V apex feedpoint. These two

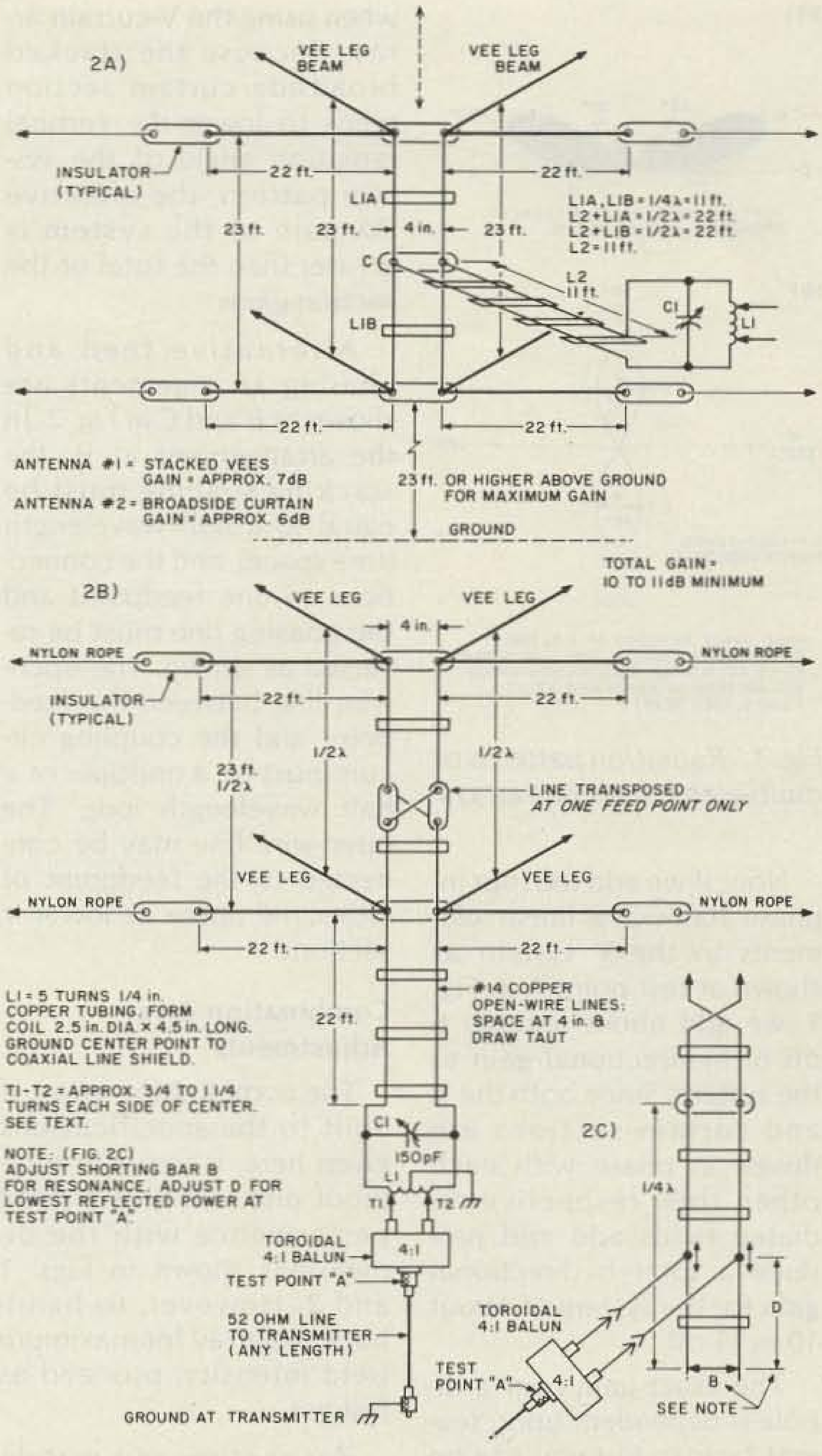

Fig. 2. Details of the stacked V beam with broadside curtain (lazy H). Both arrays operate in phase.

wing sections are each at an angle of 55° with respect to their adjacent legs and at 90° with respect to the V bisector line. Since two half-wave (180°) linear radiators operated in phase have a gain of about 2.8 dB over that of a dipole, we may add this gain to that of the V beam. Thus, the 4.5-dB gain of the V plus the 2.8 dB of the pair of half-wave radiators equals 7.3 dB. Just to be on the safe side, let's call it 6 dB. The effective DX gain will be greater than the calculated figures when additional sections are added to the V and the linear radiators.

When two V sections are stacked, without the broadside elements the bi-directional gain will be increased to about 7 dB in each direction along the bisector. The array normally is fed at test point A, as shown in Fig. 1. If one half of the phasing line (connected between the two apex feedpoints) plus the open-wire feedline are equal to one-half wavelength, as shown, a high impedance will appear at the end of the open-wire line. The parallel-resonant coupling circuit and the toroidal balun complete the transmission-line system between the array and the transmitter.

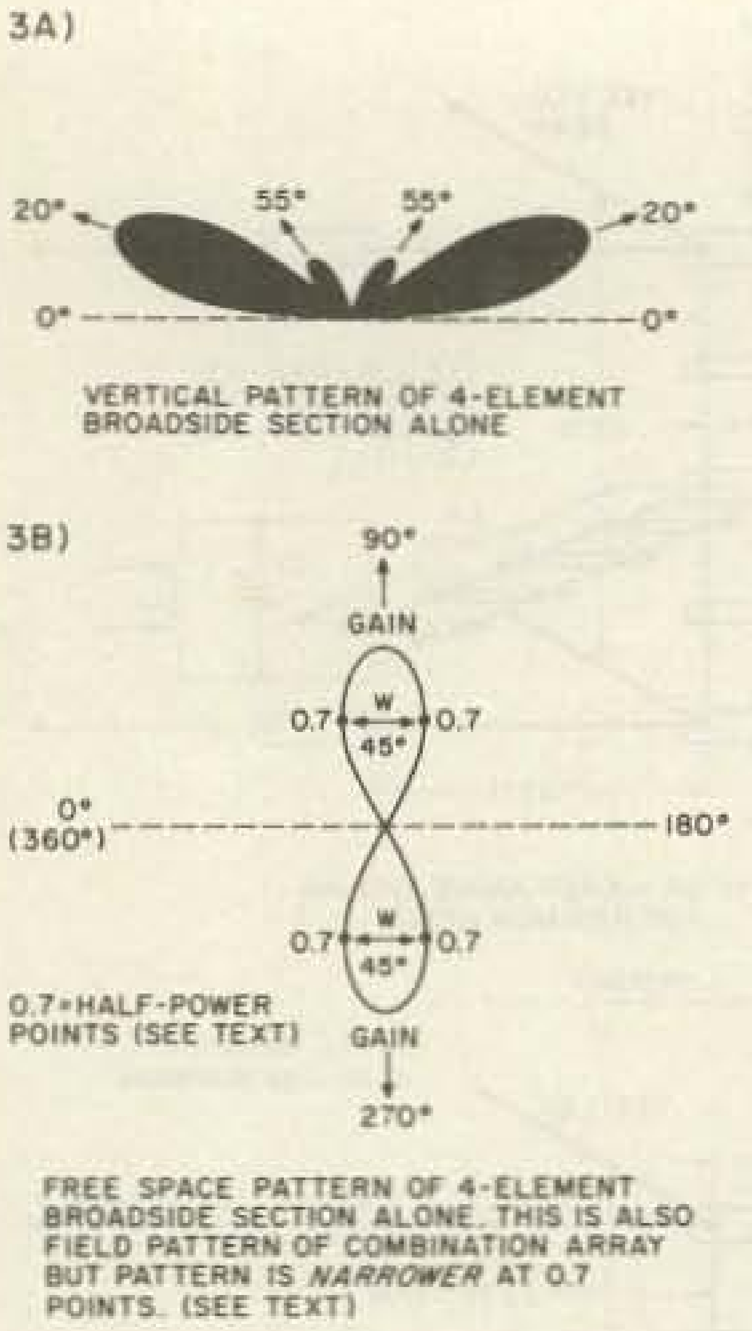

Fig. 3. Radiation patterns of multi-element phased arrays.

Now, if we add the four in-phase half-wave linear elements to the V system as shown at test point A in Fig. 1, we add about another 6 dB of bi-directional gain to the system. Since both the V and curtain sections are driven in phase with each other, their respective radiated fields add and produce a total bi-directional gain for the system of about 10 to 11 dB.

The exact gain over a dipole is dependent upon several factors, but you can be assured that this is a hot antenna system, both transmitting and receiving. Signals from the South Pacific that produce an S-meter reading of 3 or 4 with the yagi usually are past the S9 point when using the V-curtain array. Because the stacked broadside curtain section tends to lower the vertical radiation angle of the system pattern, the effective DX gain of the system is greater than the total of the section gains.

Alternative feed and phasing arrangements are shown at B and C in Fig. 2. In the arrangement at B, the stacking spacing must be equal to a half wavelength (free space), and the connections to one feedpoint and the phasing line must be reversed as shown. The open-wire line between the feedpoint and the coupling circuit must be a multiple of a half wavelength long. The open-wire line may be connected to the feedpoint of either the upper or lower V sections.

Combination Array Adjustments

The combination array, if built to the specifications given here, is virtually foolproof and will give a good performance with the dimensions shown in Figs. 1 and 2. However, to handhone the array for maximum field intensity, proceed as follows.

Resonating and matching: The feedpoints of the array proper and at the coupler end of the open-wire line are points of high impedance (rf voltage). The coupler consists of a 150-pF variable capacitor connected across a copper-tubing coil. The coil consists of 5 turns of 1/4-inch copper tubing wound 2-1/2 inches in diameter and spaced to an overall length of about 4-1/2 inches. The center point of the coil is grounded to the metal case of the toroidal balun and the coaxial-line outer conductor (shield). The balun output terminals are tapped about 1 to 1-1/4 turns each side of the coil center tap. The balun taps are moved closer to or away from the coil center as required during the adjustments.

With the balun connected to the coil, set C1 at about half maximum capacitance. Connect an swr or reflected-power meter in series with the balun input terminal, place the selector switch on forward (F) and turn the instrument sensitivity control completely off.

At the transmitter end of the 52-Ohm (RG-213/U or RG-8/U) coaxial line, apply about 5 Watts of rf power of the correct frequency. For 15 meters, the array normally will be adjusted for 21.3 MHz. Turn up the swr-meter sensitivity control until the indicator reads exactly full scale.

Now, throw the swr-meter selector switch to reflected (R) and quickly rotate C1 for the "dip" or lowest indicator reading. If the indicator does not go all the way down to zero, move the balun output connections further away from or closer to the coil center point and readjust C1.

When properly adjusted, the rf power may be increased to full operating value (say 100 Watts) and the indicator will remain on zero. If the indicator rises as the power is increased, try trimming an inch or so at a time from the open-wire-line conductor length and readjust as above.

Another good test is to check the loading at the transmitter. When the coupler is properly adjusted and the 52-Ohm line matched through the balun to the tuned circuit, the transmitter should load to the proper dc milliamperes without the use of antenna tuners and similar devices. If the transmitter output-stage dc-current value is too low, try moving the balun output terminal connections further away from the center of the coil.

The placement of these tap connections is critical. Move each tap connection about 1/8 turn, retune C1 for zero reflected power, and check the transmitter output circuit dc-current value. With the copper-tubing coil as specified, C1 will be at about half maximum capacitance (about 75 pF).

If the coil spacing is increased, the Q of the tuned circuit will increase and the loading characteristics at the transmitter are generally improved. However, when the antenna coupler circuit is high Q, the bandwidth will be reduced slightly. At W6TYH, the matching and loading adjustments are such that the array may be operated about 100 kHz each side of 21.3 MHz before any noticeable rise in the swr value occurs.

The coupler circuit, as described above, operated perfectly with the V array alone and with the one pair of half-wave linear radiators connected. With this arrangement, the open-wire transmission line was a half

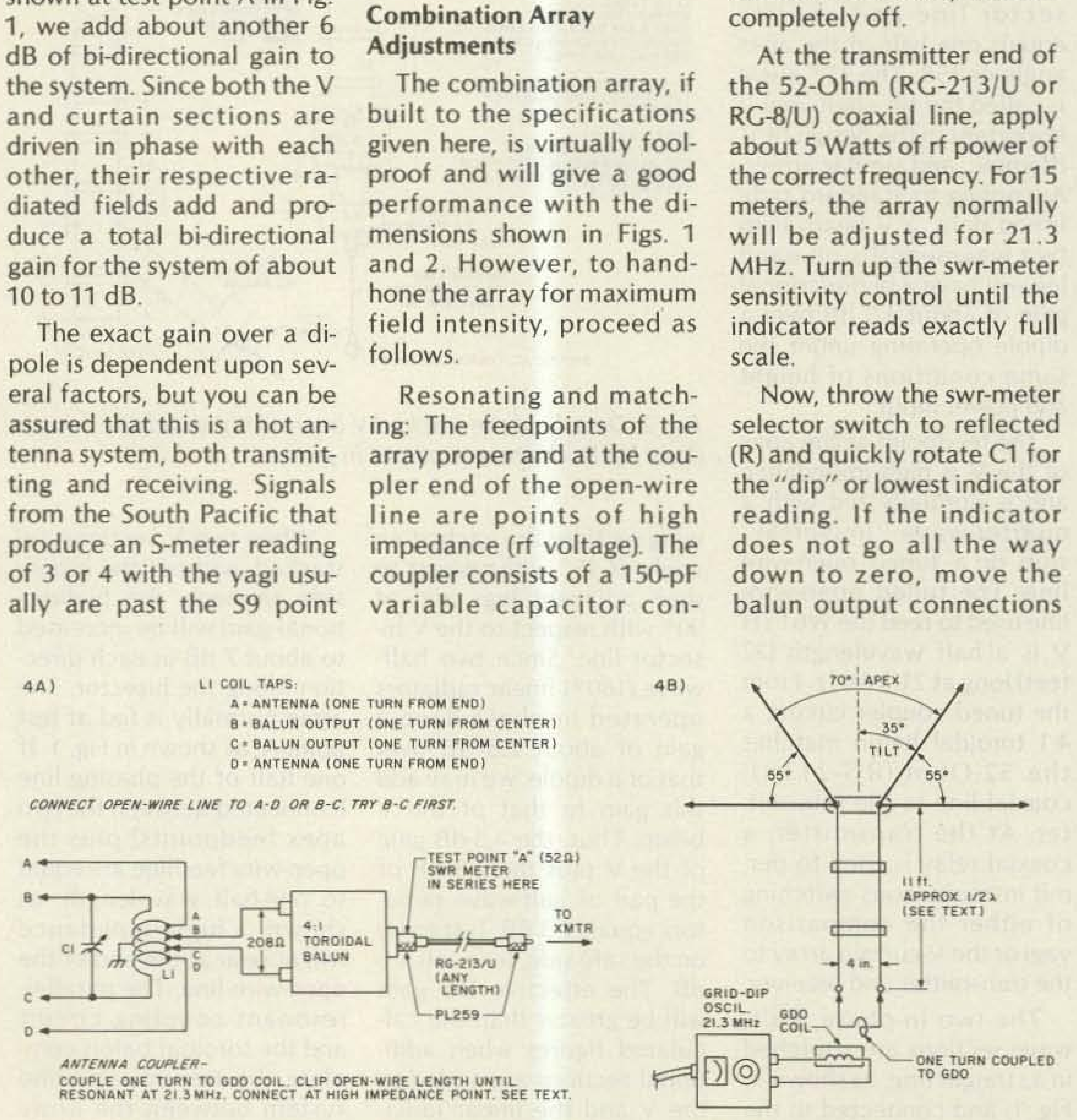

Fig. 4. Antenna coupler details. V-bomb antenna system.

wavelength (22 feet) long. However, when the stacked arrangement was completed, it was found that capacitor C1 would tune to a shallow dip on the reflected-power-meter indicator but a complete (0) null could not be obtained. The coupler circuit was then changed as shown at A in Fig. 4.

Coil L1, in this case, consists of 6 turns of No. 12 Teflon™-covered copper wire wound on a Bakelite™ coil form 2 inches in diameter and 3 inches long. The turns are evenly spaced over the length of the form. The balun output terminal connections are soldered to the copper conductor exactly 1 turn each side of the coil center point.

Tuning capacitor C1 is connected across the entire coil winding, as shown. The open-wire transmission line in our case is connected to taps A and D. The A and D taps are made exactly 1 turn from the ends of the coil. See Fig. 4 at A. The open-wire-line taps are correct for a balanced line of approximately 500 to 600 Ohms.

If you want to be "scientific" and hand-hone the array to resonance, connect a 1-turn coil across the open-wire line, as shown at B in Fig. 4, about 11 feet, 4 inches down the line from the point where the line is connected to the V apex feedpoint. Cut both wires of the line, leaving the line one-quarter wavelength from the apex feedpoint to the 1-turn coil.

Lightly couple the 1-turn "link" coil to the coil of a grid-dip oscillator. Set the grid-dip oscillator on 21.3 MHz and monitor the gdo frequency with a calibrated receiver. The 1-turn coil should be connected to the open-wire line with a pair of copper alligator clips so that it may be slid up or down the line.

As you slide the link coil clips up and down the line, you should find a point where a sharp dip occurs on the gdo indicator. This is the point at which the antenna system is resonant. Always check the gdo frequency with the calibrated receiver when resonance is indicated because the adjustments tend to pull the oscillator off its own calibrated frequency indication.

Next, cut off the unused ends of the quarter-wave line section. Now take the quarter-wave line section that was removed and cut its length to exactly the same as that of the pruned quarter-wave section still attached to the array. The two line sections are now soldered together to form a half-wave line. Attach the coupler circuit and adjust for zero reflected power at test point A, as before. I have found this method to be very accurate in adjusting open-wire lines to exactly one-quarter or one-half electrical wavelength.

On-the-Air Tests

You must remember that the spread of the bi-directional pattern from this array is much narrower than that of a conventional 3- or 4-element rotary beam. This array is most useful for working into a specific area such as Europe or the South Pacific. At W6TYH, we are interested in keeping in touch with friends in Tasmania and New Zealand. The stacked combination V and broadside arrays illuminate all of Australia and New Zealand.

With this orientation, it lays down terrific signal levels across the Great Lakes region of the USA and southeastern Canada. However, because of unstable propagation conditions, only a few European stations have been worked. Once, when working a station in Cleveland, Ohio, the initial contact was made with the 2-element yagi. The signal report was Q5 S6 using the yagi. Then the V-bomb array was switched to the transmitter with the same dc input power. The signal report was S9 + 20 dB.

Using the Super Antenna

Most hams dream of having an antenna with a gain of 10 to 11 dB. A rotary beam (yagi) antenna with gains in this order for the HF bands would be a very expensive device. It is possible to build very high gain fixed-wire antennas for a fraction of the cost of a multi-element rotary beam and the necessary supporting tower.

An antenna system with extremely high gain always has a very narrow, highly concentrated field pattern. In general, antennas with more than 10 dB gain, particularly those of the rhombic type, can cause problems because of the small illumination area both in the ionosphere and at the receiving location. It is common practice in commercial point-to-point communication to build up antenna gain only to a specified level and then "fill in" with high power.

Watch the signal-level meter on a sensitive shortwave receiver tuned to a high-power shortwave broadcast station such as Radio Moscow, BBC, Radio Australia, or the VOA. Note that the signal, as evidenced by the indicator pointer swing, is constantly fading up and down, but the audio level remains fairly constant. These stations are designed with a compromise between high erp and power input to the final stages of the transmitter.

If you live near a VOA station, pay it a visit. These stations are open to public visitation during business hours. However, you should call the station manager and arrange for an appointment. Usually, if a group of three or four hams visits a VOA station, they will arrange a guided tour of the facilities conducted by one of the engineers. ■

Brew a Coffee Ground Plane

No cream, no sugar—just a 440 antenna that really percolates.

Hank Goldman WA2OVC
2530 Independence Avenue
Riverdale NY 10463

This project was awarded third prize in 73's Home-Brew III Contest.

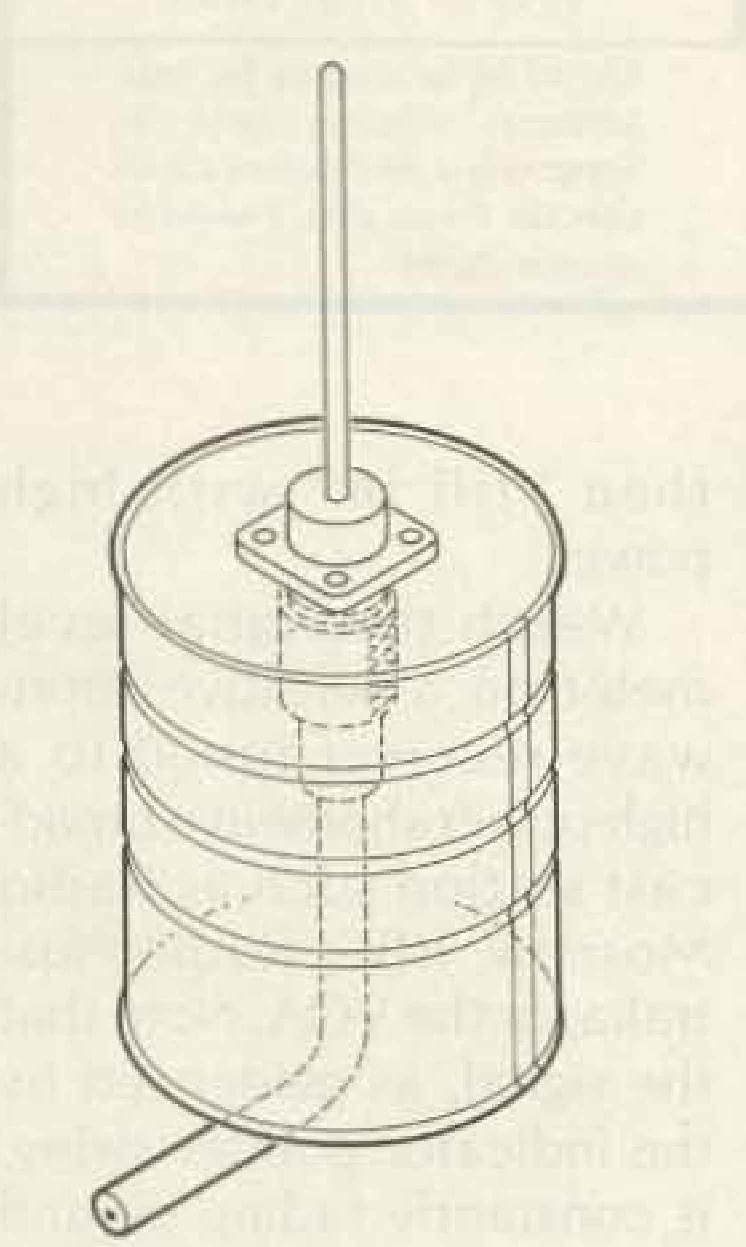

Fig. 1. The coffee ground-plane antenna.

Here is a great UHF antenna project for the readers of *73* that costs much less than the $73 Home-Brew III limit. In fact, if you pay more than $0.73 for the parts, you haven't been to a good ham flea market lately!

This isn't a "toy" project either, because as luck would have it, certain household items resonate on the ham-band frequencies. Specifically, a 1-lb. metal coffee can is a perfect ground sleeve for the base of a "non-gain" very omnidirectional 440-MHz antenna.

The can will be a "freebie" from your kitchen and all you need to buy new (if you don't already have one in the junk box) is a coaxial chassis female connector.

Step 1: Drill a hole in the bottom of the can to mount the connector, which is installed with the threaded part *inside* the can.

Step 2: Cut a 9″ piece of stiff wire or rod and solder it vertically into the connector on *top* of the can.

Step 3: Attach your RG-8 from the radio to the connector *inside* the can. With low power at first, key the rig and measure swr or maximum power out while you trim 1/8″ sections off the rod till the antenna resonates in your favorite part of the band.

Step 4: Once it's resonated, spray everything with silicone and lash it to a mast, or high on your tower.

Step 5: Start having fun. ■


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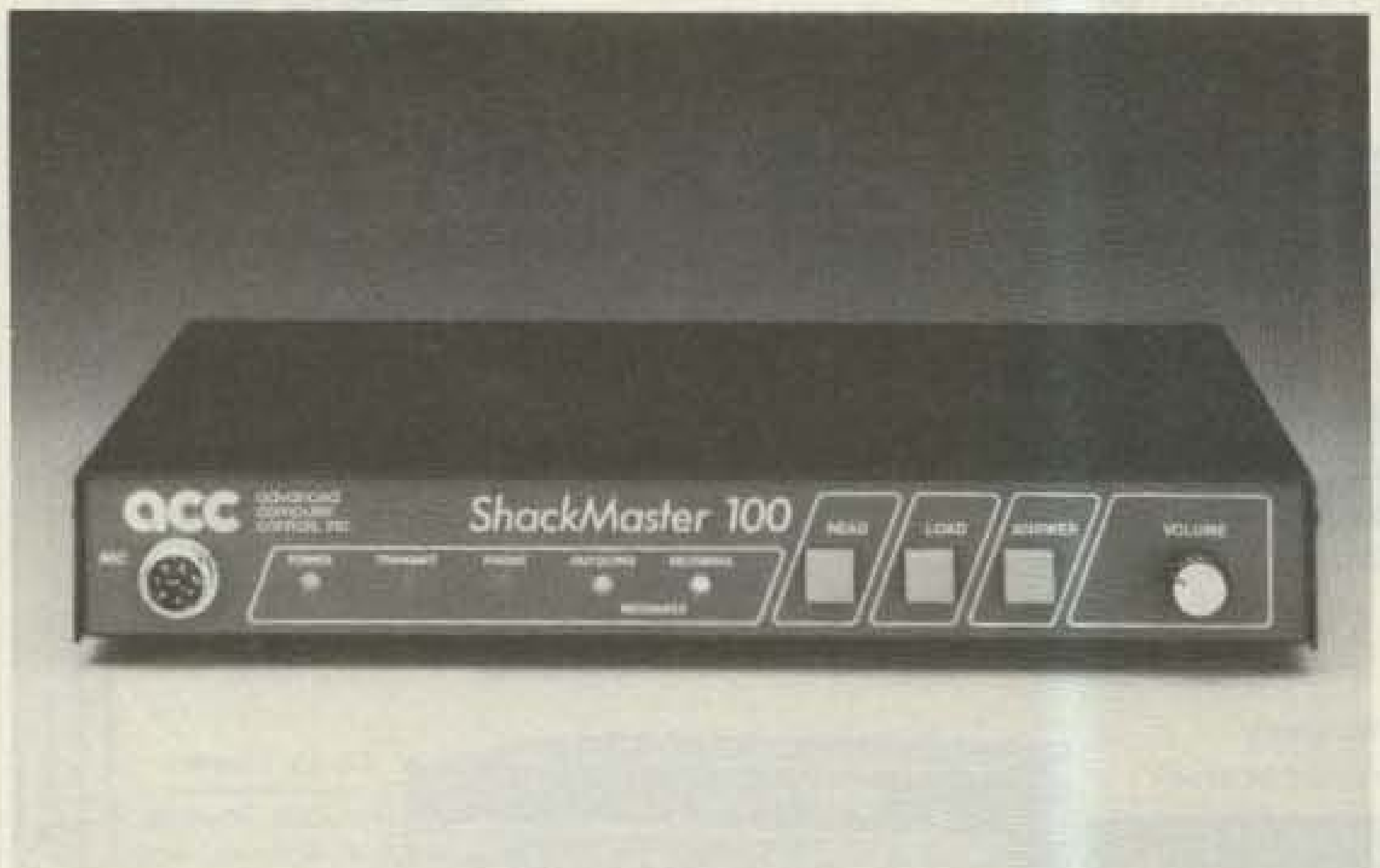
Takin' It to the Streets—Part I

Work the world from your HT! Crossbanding expert WA6AXX explores the how-to of remote and auxiliary operation.

Ed Ingber WA6AXX
Advanced Computer Controls, Inc.
10816 Northridge Square
Cupertino CA 95014



The ShackMaster 100.

Grabbing the Control Window

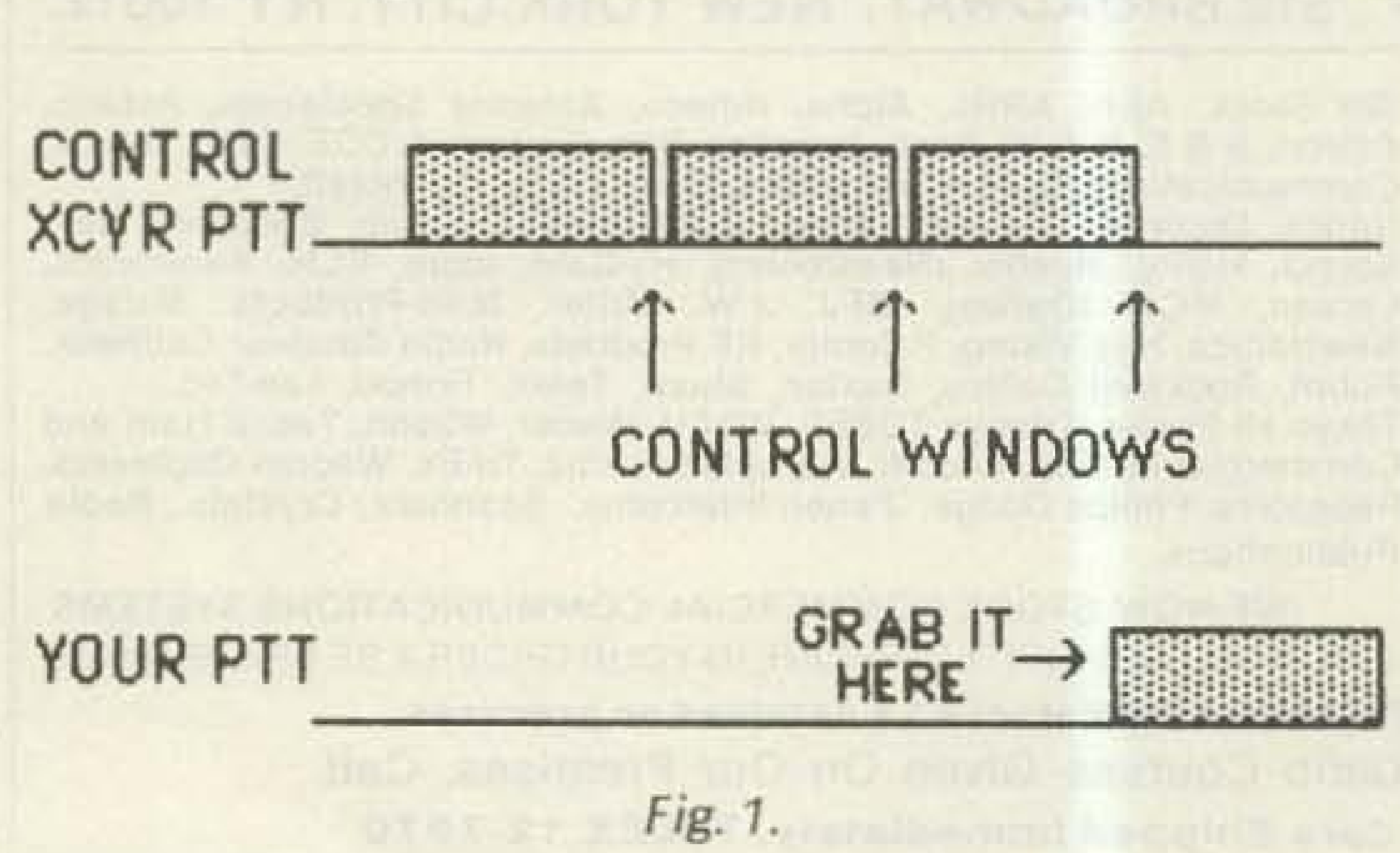


Fig. 1.

Hi, Frank. Look at what I just got.

Hi, Tom. Looks like one of those tiny new hand-helds.

Right. But it's really my new HF rig.

A hand-held HF rig? That means you can carry it around?

You bet. It's an allband SSB rig that puts out a hundred Watts.

A tiny hand-held HF rig putting out that kind of power? Come on, now! I'll bet the batteries last only a few seconds!

No, I get about eight or ten hours of operation from 'em. And see the rubber ducky antenna?

Yea . . .

It does as well as my four-element tribander on my sixty-foot tower at home.

A conversation from the year 2000? Not at all—Tom's ordinary UHF hand-held is linked to his home HF station, which lets him operate his high-frequency equipment from anywhere.

A New Way of Life

Operating today's HF equipment is very similar to the old days of VHF. Without hand-helds or repeaters, getting on two meters meant that you needed a base transceiver with a good outside antenna or a high-power mobile rig. Then, in time, hams discovered that repeaters could retransmit signals to extend their range. Newer technology made hand-helds possible, and when combined with repeaters, hams could carry their "2-meter shack" in their hand. Amateur radio became more fun and the ham's way of life changed!

Not much has changed about operating HF, however. Today's transceivers are certainly easier and much more fun to use than those of the old days, but you still need to be at home in the shack, sitting in front of the rig, in order to operate. The only alternative is a second rig installed in the car, with funny-looking antennas and compromised performance. Even then, the mobile rig is available only when you're in the car. Considering the investment in a modern HF station (rig, linear, tower, antennas, rotor, coax, etc.), and considering that the station is available only a small percentage of the time, there must be a better way—and there is!

That better way involves having your hand-held (or mobile) VHF or UHF transceiver crossband linked to your HF station. As with a repeater, your VHF transmissions are retransmitted by your HF station, and HF signals received at home are retransmitted on VHF back to you.

Did I hear you say that repeaters aren't legal on HF? Right, but this isn't repeater operation—it's remote control of another amateur station (your home station from your hand-held) and is called auxiliary operation.

Crossbanding

What do you need to operate crossband? At home, you need your HF transceiver, of course, plus a VHF or UHF control transceiver to allow you to communicate with your home station. Then you carry around another VHF or UHF transceiver with you, such as a hand-held.

Your hand-held and the control transceiver at home form the control link, which is the key to remotely controlling an amateur station. (The station also can be remotely controlled by wire line, as we'll see later.)

The Station Controller

If another ham were at home to push the buttons and turn the knobs, it would be easy. Just wire speaker audio to the mike and you'd be done. But truly practical crossband operation should let you completely control your home station directly from your remote control point. We need something to act as a station controller, something to tie the equipment together and to let you remotely control it.

Thanks to the evolution of control-system technology developed for modern amateur repeaters and to a new generation of externally-controllable broadband HF transceivers, such a station controller is now available—it is the ShackMaster™ 100 by Advanced Computer Controls.

Since your hand-held is already capable of encoding touchtones™, we'll use touchtone signaling as an easy way to command your home station. The controller needs to listen to the control transceiver and decode and interpret your touchtone commands. The commands that you enter are similar to the keyboard sequences that let you load frequency memories into your HT and let you make it scan. The difference is that you transmit the sequences as touchtones; it is similar to activating a repeater autopatch.

Communication between the operator and the station controller needs to be two-way, however. What frequency are you currently on? Did you enter the command you thought you did? Where is the antenna pointed? Since you don't have a TV camera at your station which would let you look around at how everything is set, you can use the electronic speech synthesizer in ShackMaster to acknowledge and respond to your commands.

The controller must also handle all the audio switching and mixing, control the transmitter push-to-talks, provide VOX detection, allow for convenient local use of the equipment, and display the status of the system.

Operating Simplex

A problem becomes obvious very quickly. With one VHF transceiver, you can't listen and transmit at the same time. Your single control transceiver at home can't, either. When the control transceiver is retransmitting HF activity, it needs to check periodically to see if you want to enter a command or to make a transmission through the HF rig. It does this through a "control window"—a brief interruption in the transmission from the control transceiver which allows the ShackMaster controller to listen for you to break in. (See Fig. 1.)

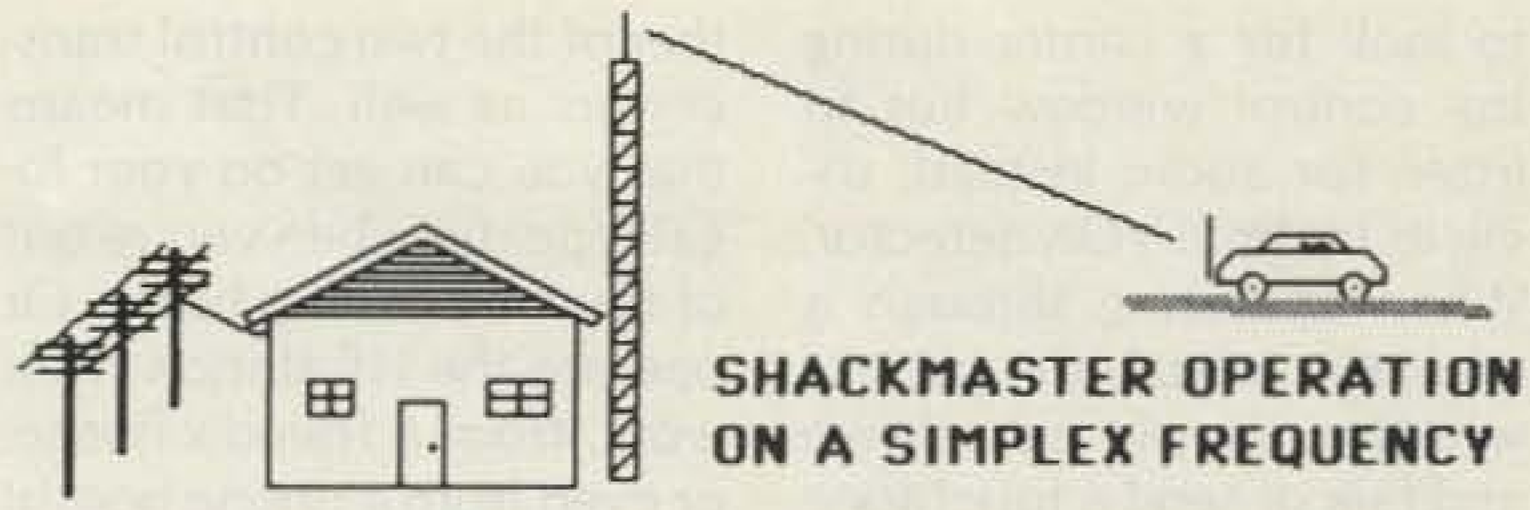


Fig. 2.

If you do break in and grab the window, you keep it and can then change frequency or enter other commands, retransmit yourself through the HF rig, etc. If you don't grab the control window, there's simply a brief "hole" in the transmission from your home station. A short beep just before the window lets you know exactly when to key down to grab it. When you want to grab the window, just wait for the beep and then key down.

The duration of the control window should be as short as possible to minimize lost information, and may be limited only by the switching time of the control transceiver (time to go from transmit to receive and detect a signal at the receiver). Practical window durations range from around 10 ms to 300 ms, depending on the rig. The frequency of the control window is a matter of personal preference, but a window every three or four seconds is about right to ensure positive control of your home station.

Window timing is fully programmable and can be changed while you're operating. For normal operation, you might want the window every few seconds, but for casual listening to a net you can extend the window to occur every ten or twenty seconds or so.

Operating Full Duplex

Simplex operation is great for casual work since you need to carry around only one rig. For higher performance operation, such as chasing DX, two control transceivers (preferably on different bands!) let you transmit commands to your home station while continuously listening. This is full duplex operation. The control window is eliminated and you can tune around and rotate the beam faster, without the need to synchronize to the control window. Full duplex operation is one step closer to actually being in the shack.

Operating Through a Repeater

A good VHF "control" base station can have a range of many miles, obviously depending on local topography, antenna height, and power levels. Range can be optimized to a particular area—for example, along your commute path to work—with a VHF beam. Inevitably, however, you'll want to access your home station when you're out of direct range. Enter the repeater.

Operation through a repeater is similar to operating simplex. Both your hand-held and your control transceiver at home are tuned to the same repeater. The only trick is that the repeater probably has a hang time; the repeater transmitter stays on for a period of time after the input signal goes away. When the station controller interrupts its transmission (the control window) to listen for you, it sees the repeater carrier still present. This would fool the controller into thinking that you've grabbed the window.

The solution is to indicate to the controller that you're activating functions through a repeater. Then it knows not to look for a carrier during the control window but to listen for audio instead, using its internal VOX detector. When operating through a repeater, to grab the control window simply key down and talk or send a touchtone command. The controller's VOX detector senses your presence and lets you keep the window.

Some diplomacy should be used when operating crossband through a repeater, of course. Get the permission of the repeater owner first, and be sure that your command codes won't accidentally activate control functions of the repeater itself. It's also good to be sure that other users of the repeater don't object to the sounds of HF operation on the machine. In many areas, there are lots of fine, open 220- and 440-MHz repeaters which are begging for users. Occasional crossband activity through these repeaters is an excellent use of the resources available.

Accessing the Home Station by Telephone

There may be times when you're even out of repeater range of your home station or when you simply would like the privacy of remotely operating your home equipment from the phone. ShackMaster connects to your home phone line and lets you call home to perform all the functions by phone that you can command over the air. Again, touchtone commands via phone control the HF transceiver and rotor, but also allow you to access either of the two control transceivers as well. That means that you can get on your local repeater when you're out of town by calling home. Or operate the HF station from work, from a friend's house, or even from a phone booth!

Controlling the HF Rig

You want your "pocket HF station" to duplicate as closely as possible actually sitting in front of the rig. To do this, you need the ability to control HF frequency and mode. You also would like to be able to scan, recall the rig's memories, and so on. These functions are all activated with simple touchtone sequences. Commands are provided for direct frequency entry, scanning up or down at three rates, bumping frequency up or down in 20-, 100-, or 500-Hz increments, selecting mode, and recalling transceiver memories. Commands are generally acknowledged with synthesized speech responses.

Rotating the Beam

A simple dipole antenna works great on 40 and 80, but for the higher frequency bands, the chances are that you've got a beam. While you could operate from your remote control point with the beam stuck in one direction, since you want your pocket station to be just like sitting in the shack, the ability to rotate the beam is important.

A rotor-control board is designed to mount inside the Hy-Gain/Telex rotor control box (for the CD-45-II, Ham IV, etc.). The board provides an interface from ShackMaster to the control box, allowing you to remotely rotate clockwise or counterclockwise, specify a direction, or read back the current direction in synthesized speech with simple touchtone commands.

Turning the Station On and Off

Naturally, you want to be able to turn your equipment on when you're using it and back off when you're done. (The control transceiver should stay on all the time, though, so it can hear your commands.) Several forms of general-purpose remote controls are useful. Touchtone-commandable logic outputs can switch relays, turn things on and off, etc. For control of ac-line-operated equipment, an interface to the BSR home-control system provides a simple, clean, safe capability to turn station equipment on and off. Even 115-volt coaxial relays can be controlled for antenna switching.

Controlling the Control Transceiver

We saw earlier that your home station can be accessed on a simplex frequency, on a pair of frequencies for full duplex operation, or through a repeater. But what if you're operating on a simplex frequency and you're driving out of direct range? Or if someone else needs to use the repeater you're working through? You can command your control transceiver, your link from home, to QSY! Two frequency memories inside ShackMaster make it easy to QSY between two favorite frequencies, or any frequency may be entered directly with touchtone commands. If you make a mistake or the new frequency is busy and ShackMaster doesn't hear from you after you tell it to QSY, it'll come back to where you were originally!

Housekeeping

The control transceivers must be IDed periodically, and this function is performed in synthesized speech by ShackMaster. A variety of "control operator"-level touchtone commands allow enabling and disabling various functions remotely. Timers protect against "failure of the control link," such as from driving out of range.

What Rigs to Use?

If you're willing to leave the HF rig on a single frequency, virtually any HF transceiver can be used, but clearly the fun is in the ability to tune around and change modes. That means that the rig must have provisions for external control. The ideal ham transceiver would have a serial computer port on the back which would allow all of its front-panel functions to be activated from the port. While this ideal rig doesn't yet exist, the trend is in the right direction and several available HF rigs have computer ports. They include the ICOM IC-751, Yaesu FT-757GX, Yaesu FT-980, and others. Several older ICOM rigs include limited provisions for external computer control as well.

These modern rigs are solid state and broadbanded and require no tune-up, unlike those of the old days when it was necessary to "dip the finals." Some equipment, such as ICOM's transceiver, linear, and antenna tuner automatically work together without the

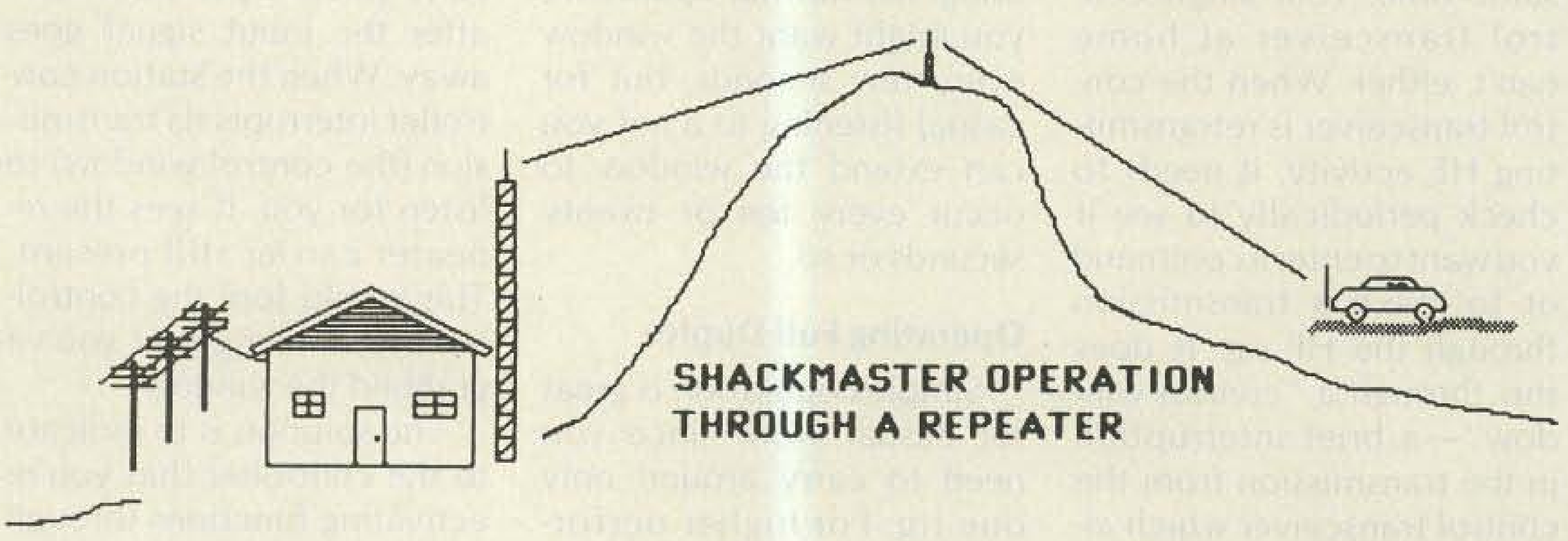


Fig. 3.

need for controlling them separately. With today's equipment, an unattended HF station is as practical as unattended repeaters.

Frequency control of the VHF/UHF control transceivers is less important but can also be useful, particularly for telephone access and for the ability to QSY. Any synthesized, BCD-controlled rig such as one which uses thumbwheel switches is easy to control by electrically simulating the thumbwheels externally. These rigs include many older ones that may right now be sitting on your shelf—the ICOM IC-22U, IC-2/3/4A, Kenwood TR-7400, Azden PCS-3000, etc. ShackMaster's frequency-control-board option can wire directly to many of these rigs. Newer rigs such as the ICOM IC-271 and IC-471 have computer ports for external control.

The Rules

The rules allow an amateur-radio station to be operated by remote control. Transmissions for controlling and intercommunicating with the station are considered manual, locally-controlled, auxiliary operation, and are currently limited to frequencies above 220.5 MHz. (The QCWA has filed a Petition for Rulemaking with the FCC proposing elimination of this restriction on auxiliary operation.) This means that the control transceiver should operate on 220, 440, or 1200 MHz.

Your home HF station is operated under manual remote control, and there are no restrictions on its frequency of operation. Telephone access to your home station is considered wireline remote control.

Operation of your home station by remote control requires some simple procedures, outlined in §97.88, such as posting a photocopy of the station license, a list of control operators, etc. A functional block diagram of the control link and a system-network diagram should be included as part of the station log. Relevant sections of Part 97 rules include §97.3, §97.61(d), §97.88, §97.90, and §97.126.

A New Way Is Here

The ability to carry your HF station with you anywhere changes the character of HF operation. Your expensive home station is available to you 99% of the time instead of only 1% of the time. Even around the house you don't have to be cubbyholed in the shack; you can be with the family or working in the garage or the yard. Meet your skeds, check into nets, and generally rag-chew and work DX from anywhere.

Crossband operation eliminates the need for a second HF rig for mobile operation and thus its expense and vulnerability to theft. And by crossbanding you can take your HF station with you when you leave the car! Of course, you can still put your base rig in the car when you go on long trips.

Apartment and condo dwellers can install an HF station at another location and then use it from home. Radio clubs can get the most out of their club station by allowing members to operate it from their homes. Emergency service groups can have hand-held access to HF to supplement their VHF communications during emergencies.

And most of all, operating an HF station which fits in your hand and clips onto your belt is FUN!

In part two of this article, I'll discuss other useful capabilities of the ShackMaster. ■

Ed Ingber WA6AXX is the President of Advanced Computer Controls, Inc., of Cupertino, California.

Mike Tarnowski WD9ELG
2927 A East Bottsford Avenue
Saint Francis WI 53207

Build the Broadband Bow Tie

It's every ham's dream: An 80m antenna with a flat swr of 1.5:1 from 3.5 to 4.0 MHz. And it couldn't be simpler.

Are you content with being stuck in one narrow segment of the 80-meter band? Do you enjoy tuning your transmatch so your solid-state rig will function properly? If you answered no to either of these questions, you may be interested in this antenna. It works well across the entire band. The swr is better than 1.5:1 from 3.5 to 4 MHz.

The Broadband Bow Tie was built as a Field-Day antenna for Ham Radio Explorer Post 373 (see Fig. 1). In the past we've tried normal dipoles, verticals, and even a double extended zepp. None of these were reliable or broad enough; we decided to try something new. It had to be reliable. It had to be simple to erect and dismantle. It had to be cheap. And most important, it had to cover the entire band without the help of a transmatch.

Library books and old magazines produced two interesting antennas. One was a fan dipole. The other one was called a 10-meter Wonder Bar (Figs. 2 and 3). Both looked good, but neither was quite what I wanted. So I combined the best features of each, and the result is the 80-meter Broadband Bow Tie.

Begin building by finding the parts (see Parts List). Other than the toroid core, all parts can be found at either Radio Shack or your local hardware store.

You will need to start with the two sections of ¾" thinwall conduit. Flatten each end of the conduit for 2 inches or so and drill a ⅜" hole 1 inch from each end. Make a loop in one end of each wire and solder it securely. Put a 5/16" screw through the hole in the conduit, slide on the wire, put on the other hardware, and tighten (see Fig. 4). For permanent installations, each connection should be taped.

Connect the wires to the center insulator as shown in Fig. 5. Each wire is 62' 4" long from the end of the conduit to the center insulator. Temporarily solder a SO-239 connector to the antenna and hook up some 50-Ohm coax. You're ready to set it up and do some preliminary testing.

Set up the Bow Tie at the location you plan to use it. Hook up your transmitter and swr bridge. On-the-air testing should be done in the morning or afternoon to avoid QRM.

Keeping keydown time to

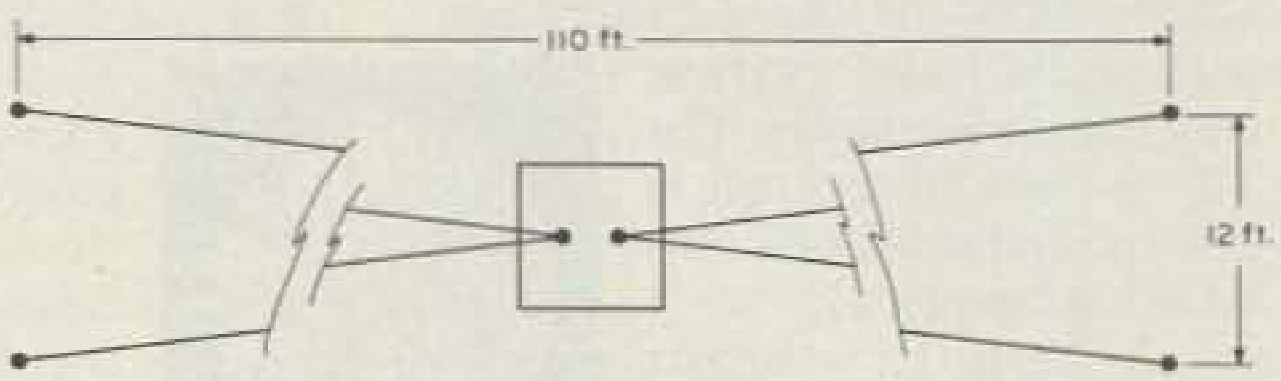


Fig. 2. 80-meter fan dipole.

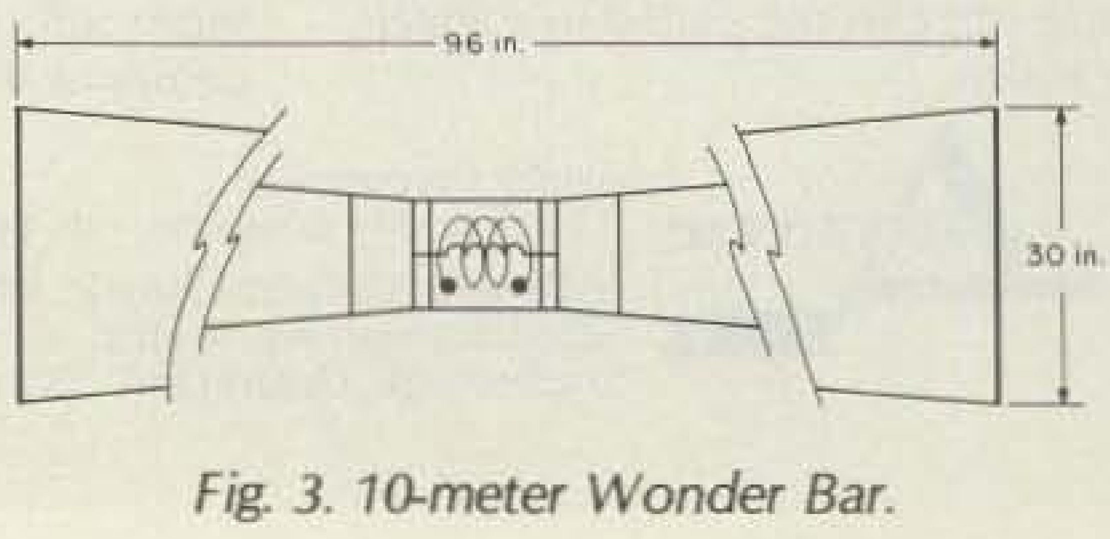


Fig. 3. 10-meter Wonder Bar.

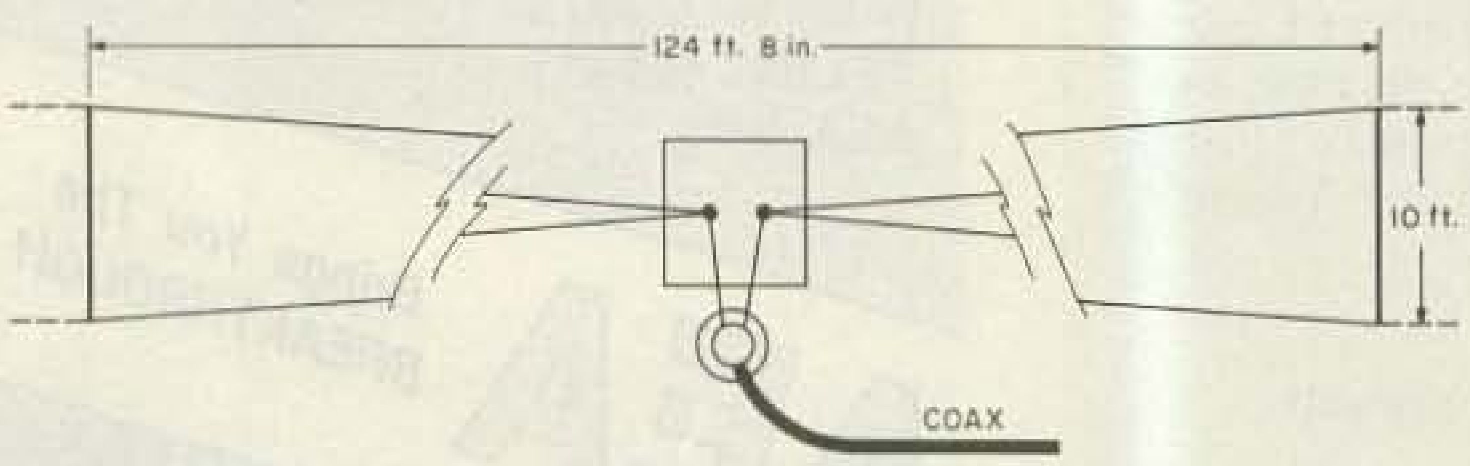


Fig. 1. 80-meter Bow Tie antenna. The 10-foot conduit spreaders can be mounted either vertically (as shown) or horizontally.

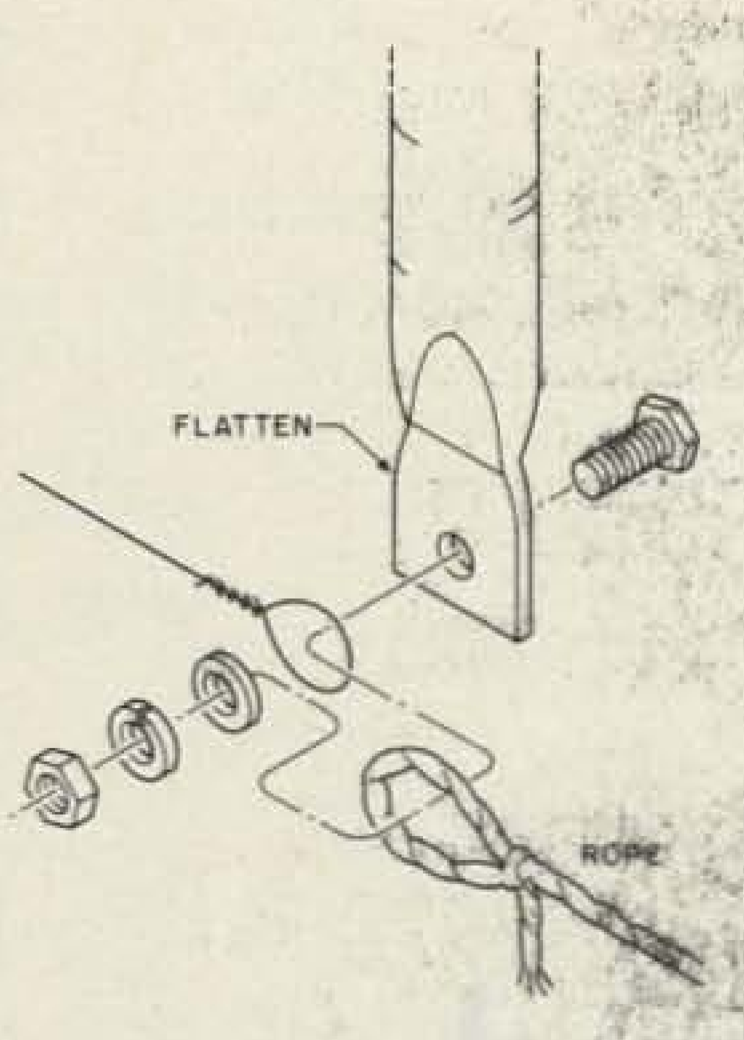


Fig. 4. Detail sketch of spreader, wire, hardware, and rope.

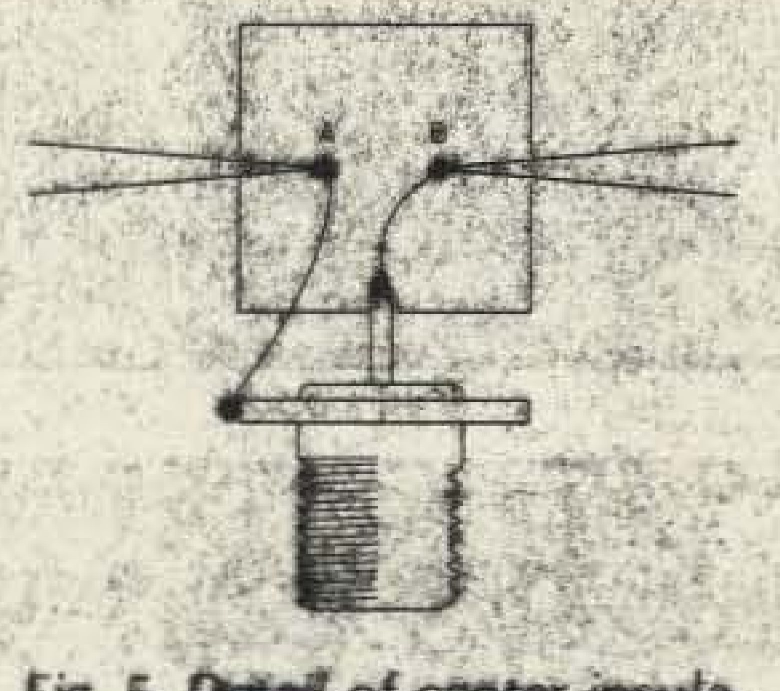


Fig. 5. Detail of center insulator before un-un is attached. SO-239 is removed and put on un-un.

a minimum, check the swr across the band. I checked it every 50 kHz and graphed the results (see Fig. 6). I found that it was flat at 3:1 from 3.5–4 MHz. This could be due to its low height (20' at one end and 6' at the other). It could be that it was too long or it could be simply a characteristic of a large-diameter dipole. The important thing is that it does not change appreciably across the band.

The next step is to wind a transformer to match the 17 Ohms of my antenna to the standard 50-Ohm coax.

My transformer was wound on a junk-box toroid of unknown origin (Fig. 7). Any toroid core that can handle a kW at 80 meters should work. There are 12 turns of #14 enamel wire on the feedline side. There are also 12 turns on the antenna winding, but with a tap at each turn. The correct turns ratio is equal to the square root of the swr, so in my case $\sqrt{3}$ = 1.73:1 or 7 turns on the antenna side. A tapped secondary is used because height above ground may greatly affect the impedance.

Once the un-un (unbalanced-to-unbalanced transformer) is wound, take down the antenna and remove the SO-239. Solder in the un-un

and raise the antenna. You should be ready to operate on 80 and 75 meters.

This antenna was built and erected temporarily in the early afternoon. There was not a lot of activity on 80 or 75 meters at the time. We were able to work any station that we could hear with a barefoot TS-520S. Signal reports varied from S7 to 10 over S9 both ways. Performance seems to be about the same as you get from a dipole. The difference is in the bandwidth. I have never seen a dipole that can cover the entire band the way the Broadband Bow Tie can. I'm pleased with this antenna, and if you try it I think you will be too.

I would like to thank KA9DHM, KC9ON, KA9MBR, and the others in Explorer Post 373 for their help and encouragement.

Afterword

This antenna was taken to Field Day. It was used on CW and SSB. Stations were worked from coast to coast. It was set up 20 feet high between two trees. The swr was even better than Fig. 6 curve B. I sincerely believe that it was worth the effort. ■

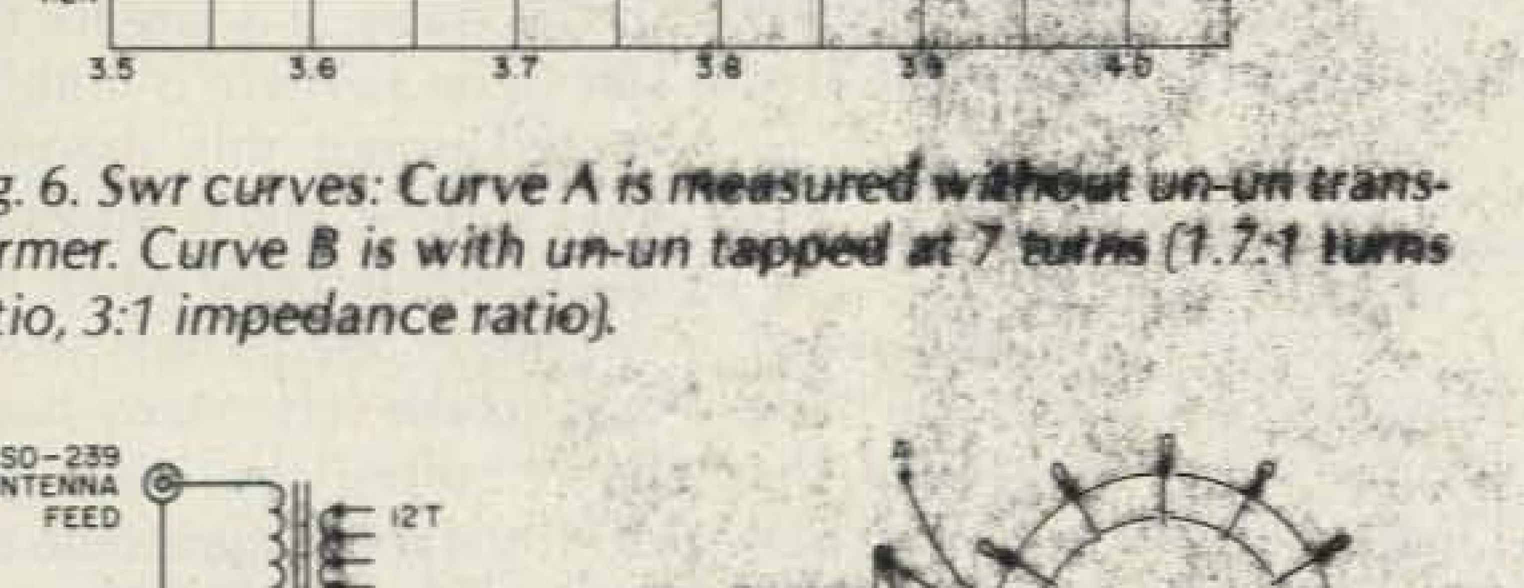


Fig. 6. Swr curves: Curve A is measured without un-un transformer. Curve B is with un-un tapped at 7 turns (1.7:1 turns ratio, 3:1 impedance ratio).

Parts List

4	rolls antenna wire, 65 ft. each, Radio Shack #278-1329
1	center insulator, Radio Shack #270-1518
2	pcs. ¾" thinwall conduit, (EMT), 10 ft. each
4	screws $\frac{5}{16}$-18 x 1.5 inches long
4	$\frac{5}{16}$" flat washers
4	$\frac{5}{16}$" lock washers
4	$\frac{5}{16}$-18 hex nuts
1	SO-239 coax connector
1	toroid core, 2-inch or larger

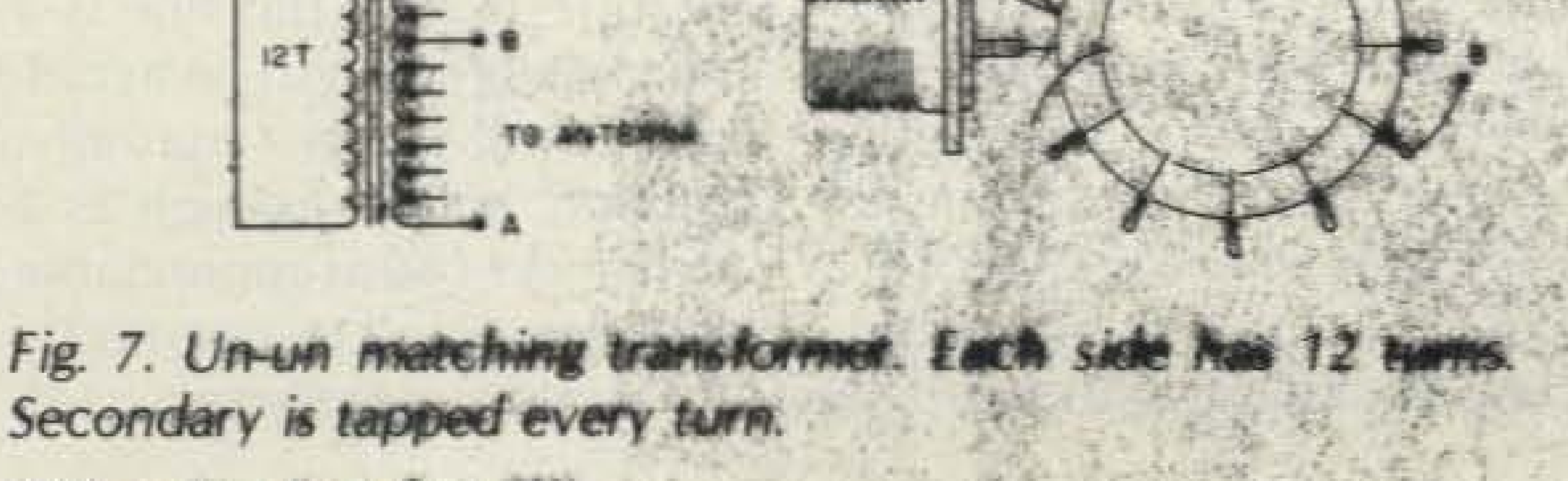


Fig. 7. Un-un matching transformer. Each side has 12 turns. Secondary is tapped every turn.

References

1. Stu Leland W1JEC, "The Old Timers' Notebook: Remember the Wonder Bar Antenna—A 10-Meter Bow Tie?" *QST*, April, 1980, pp. 59–60.

2. William I. Orr W6SAI, "A Broadband Dipole System," *Radio Handbook*, 19th Edition, 1972, pp. 25.9, 25.10, 25.11.

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Coral Gables FL 33114

Don't Fall for Swr Fraud

Your feedline may be swindling you. Find out how much power you are losing and how to stop it.

Most every ham owns an swr meter. This instrument is indispensable for determining antenna resonances and impedance matches. But swr meters indicate the antenna-feedpoint swr only when they are connected at the antenna end of a transmission line. If it is important for you to know the actual degree of mismatch between your antenna and feedline, you must either connect the meter at the antenna feedpoint or incorporate a correction factor into the measurement. It's not very convenient to read a meter while suspended in midair or hanging atop a tower while a brick sits nonchalantly on the key of your 50% duty-cycle transmitter! But fortunately, such contortions are not necessary. There is an easier way to accurately determine the feedpoint swr.

What Is Swr?

There are several ways to define standing-wave ratio (swr), and the definition we choose actually affects the value. The way we generally see swr defined is something like this: If the antenna impedance is a pure resistance (R) and the characteristic impedance of the feedline is Z_0, then the swr is either R/Z_0 or Z_0/R, whichever is greater than or equal to 1. That's very nice, but rarely is the impedance of a real-life antenna a pure resistance. There almost always is some reactance present as well, and this completely ruins the above definition. The constraints are hardly ever met.

Another popular definition of swr is the following: The voltage along a transmission line occurs in "loops" (maxima) and "nodes" (minima). The voltage standing-wave ratio (vswr) is simply the ratio of the voltage at a loop to the voltage at a node: E_{max}/E_{min}. Sounds good! But what if the feedline is very short? Loops and nodes occur at intervals of ¼ wavelength along a transmission line. If the line is shorter than ¼ wavelength, then there is no swr according to this definition. If the line is long, there will be numerous voltage loops and nodes along its length, but because of line loss, no two maxima or minima will be the same. How then can we determine swr?

A third method of defining swr is whatever an swr meter indicates. This definition is quite convenient and makes precise determination possible (assuming the instrument is correctly calibrated and is not affected by external factors). So why not make it easy on ourselves? In real life, how else are we going to determine the swr, anyway?

Effect of Line Loss

Regardless of the kind of feedline you use, it will have some signal loss. Even the largest hardline is not perfect. The loss in any transmission line increases with the operating frequency. Fig. 1 shows the loss in dB per foot as a function of frequency for the most common coaxial lines used by amateurs. The values in Fig. 1 are based on the assumption that the feedline has not become damaged or contaminated (some of the outer jacket eventually gets into the dielectric material of certain cables). These loss figures also are accurate only if the swr is 1—that is, if the line is perfectly terminated. However, this information will help you to discover your feedpoint swr rather easily. To find the matched-line loss for your system, simply multiply the value from Fig. 1 by the length of your line in feet.

Of course, it is rare for the swr to be 1. There is nothing sacred about this theoretical ideal. No electromagnetic angels descend when the swr meter needle dips all the way to the left. Many hams have gotten the idea that even the most miniscule departure from a flat line is a horrible gremlin to be avoided at all costs. Actually, though, an swr as high as 2 will never cause appreciable loss compared to a perfectly matched system; even a value of 3 or 4 is often tolerable. In the old days of radio (and sometimes even today), open-wire feedlines were operated with standing-wave ratios in excess of 10 without detrimental effects. Still, it is a good thing to keep track of your swr since it may indicate aging of your feedline or other changes in the antenna system.

Suppose you measure your swr at the antenna feedpoint and find that it is 3. Now imagine that someone invents a sliding swr meter that can easily be moved along coaxial cable. As you move the meter away from the antenna and closer to your rig, you will observe a gradual, continuous decrease in the swr. Depending on the amount of matched-line loss, the meter may read anything between 1 and 3 by the time it reaches the station end of the cable.

The reason for this is simple: As the signal (electromagnetic field) travels down the line toward the antenna, the field intensity decreases because of losses in the line. Hence the "forward" reading of an swr meter is greater near the transmitter than at points far away along the line. If the antenna is not perfectly matched to the line, some of the field gets reflected at the feedpoint and starts back toward the station. This field, too, is affected by line loss, so the "reverse" indication on your swr meter gets smaller nearer the rig. More "forward" and less "reverse" signal near the transmitter: That's a lower swr.

Fig. 2 illustrates how the line loss under perfectly matched conditions (as determined from Fig. 1) affects the swr difference between the station and antenna ends of the feedline. The difference may be large. Your transmitter sees a certain swr at its end of the line and behaves accordingly; as such, you may have an swr greater than the transmitter can tolerate at the antenna feedpoint but still get away with it because line loss reduces the swr at the station to an acceptable value for the transmitter output circuits.

This difference between feedpoint and station swr may come to you as an unwelcome surprise: Your swr may be much higher than you thought! Perhaps you were laboring under the illusion that it was 1.7 all this time, and now you find out that it's really 4, and perhaps even higher (if your coaxial cable is very old). The good news is that the loss caused by swr is nowhere near as great as most people think. But certainly something is out of adjustment if you have an swr of 4 with a beam or quad.

A severe mismatch with a parasitic array could mean that you are not getting the forward gain or front-to-back ratio that you deserve. Perhaps there is corrosion at the feedpoint and line losses have been hiding this fact from you. A large change in swr at the feedpoint may cause a much smaller change in the swr at the transmitter.

Now, Really . . .

The actual swr on your feedline—the antenna feedpoint swr—depends only on the characteristics of the antenna and feedline as long as we employ the definition of swr based on empirical observation. Otherwise, swr is just about meaningless. The only practical way to measure it on a coaxial line is by using an swr indicator or impedance bridge. And it changes depending upon the location of the instrument on the line.

We need to be concerned only with the swr at the station and the swr at the antenna feedpoint. When putting up an antenna, it is a good idea to make swr graphs of both values for future reference. You don't have to climb to the antenna feedpoint to get the reading there; just use Figs. 1 and 2. Later, if the swr at the transmitter changes, you can use these graphs again to find out how much the swr at the feedpoint has changed.

The first two definitions of swr that were mentioned and then thrown out are useful for one purpose, at least, and are therefore worth remembering. There is a good chance you will be asked about them on your General, Advanced, or Extra class license test! ■

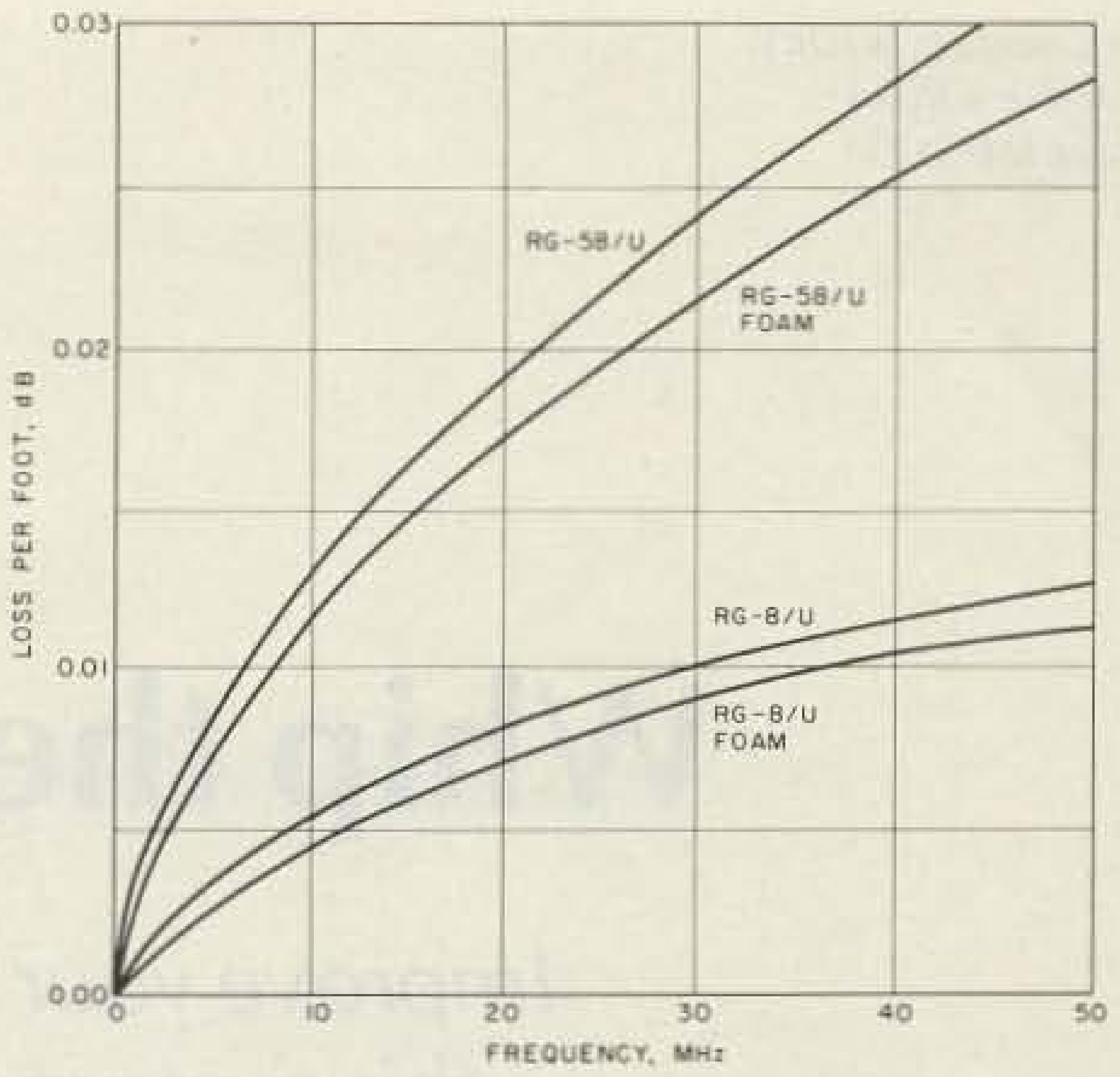

Fig. 1. Loss as a function of frequency for common 50-Ohm coaxial cables. Foam-dielectric cables have lower loss but may age more rapidly. These figures are in dB per foot; to find the overall line loss, multiply by the line length in feet. The result is the loss in your transmission line, assuming a perfect match.

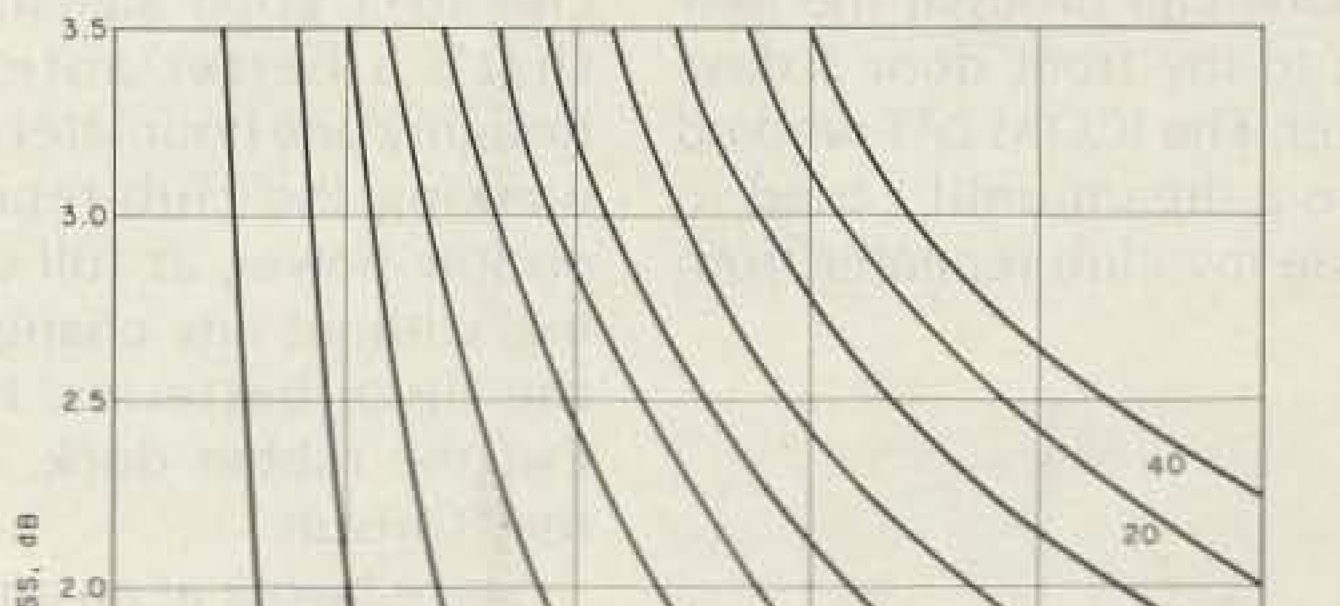

Fig. 2. Difference between station swr and feedpoint swr. Find the station swr on the horizontal scale and the perfectly-matched line loss in dB on the vertical scale. The antenna feedpoint swr may then be interpolated from the curves. In the example shown, the station swr is 2, the line loss under perfectly-matched conditions is 1 dB, and the antenna feedpoint swr is 2.5.

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Whip the Competition

Improve your 2m HT's "mileage" with this custom antenna from Datsun!

After the smoke had cleared from my workbench, I realized that my secondhand HW-202 could not tolerate any more repairs. After many years of service, the old Heath was ready for retirement. Then came the task of searching through stacks of ham magazines to locate a 2-meter rig which suited my budget.

I decided on an HT for practical reasons. One phone call brought the new rig to my front door 3 days later. The ICOM 2AT worked like a dream until I tried to raise my club repeater from my work QTH—the distance was too great to even trip the COR. I then took a serious look at the 30-day return policy. But instead, 3 days later I was the proud owner of a larger battery pack and higher expectations. Even with that, the return policy still looked appealing.

Giving my "toy" one last chance, I took a long look at the rubber duck. Now face it, every ham knows the secret to a good signal, and that's a better antenna! Roughly one hour later I was working the club repeater on low power, at full quieting, without any changes to the rig or batteries. How? Exit the rubber duck, enter the "Datsun."

Since I work at an auto radio shop, finding the right antenna posed no problem. I decided on a custom antenna for a Datsun Stanza (part #FMF-75D by Harada Industries of America, Inc.). This fender antenna is all fiberglass with a stranded copper-wire center conductor. A clean cut at 19 inches from the top ball was the quarter wave I needed. (I would highly suggest using a grinding wheel if possible, as the 'glass will splinter easily if cut with a saw or snips.)

I used a BNC connector for the 2AT, but with some ingenuity, other connectors can probably be used. The BNC is an Amphenol type, #31-4700, for RG-58/U. At the cut end of the whip, scrape 6 mm of 'glass away from the conductor, being *very* careful not to cut the copper wire inside. Next, trim down the circumference of the rod 14 mm past the 6-mm mark, so when the rod is pushed into the BNC sleeve it fits snugly up to the end of the 14-mm mark.

Tin and trim the center wire at 4 mm. Place the BNC center pin on and solder it in place. Don't use too much solder. Next, carefully push the assembled antenna into the connector until the pin is flush with the white insulator at the base of the plug. The 'glass whip should now be snug in the sleeve. All that's needed now (and highly recommended) is 2 or 3 layers of increasingly longer shrink tubing for support about 3 inches up the shaft from the BNC.

Although I have not used any complex antenna formulas in this design, it's still a quarter-wave antenna, and the body of the HT makes up the ground plane. I have used this new antenna for quite some time now and am amazed at the range I can get out of my rig.

I am willing to offer a kit version of this antenna if there is sufficient interest. Send an SASE to the address at the beginning of the article if you might be interested. ■

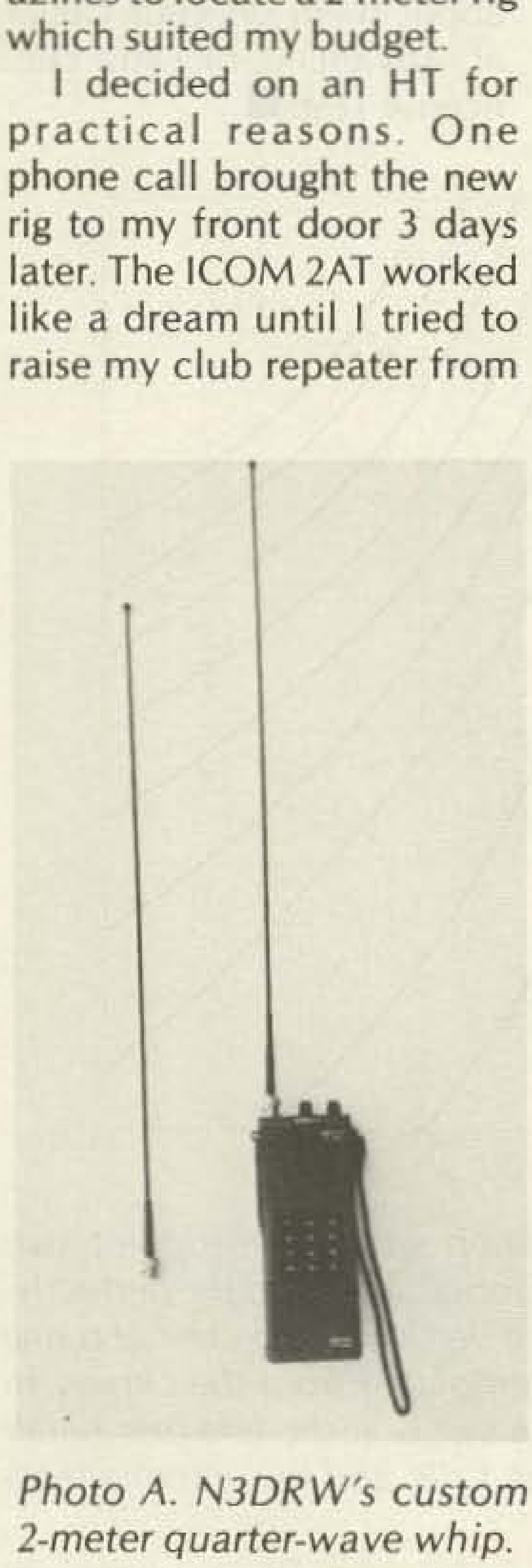

Photo A. N3DRW's custom 2-meter quarter-wave whip.

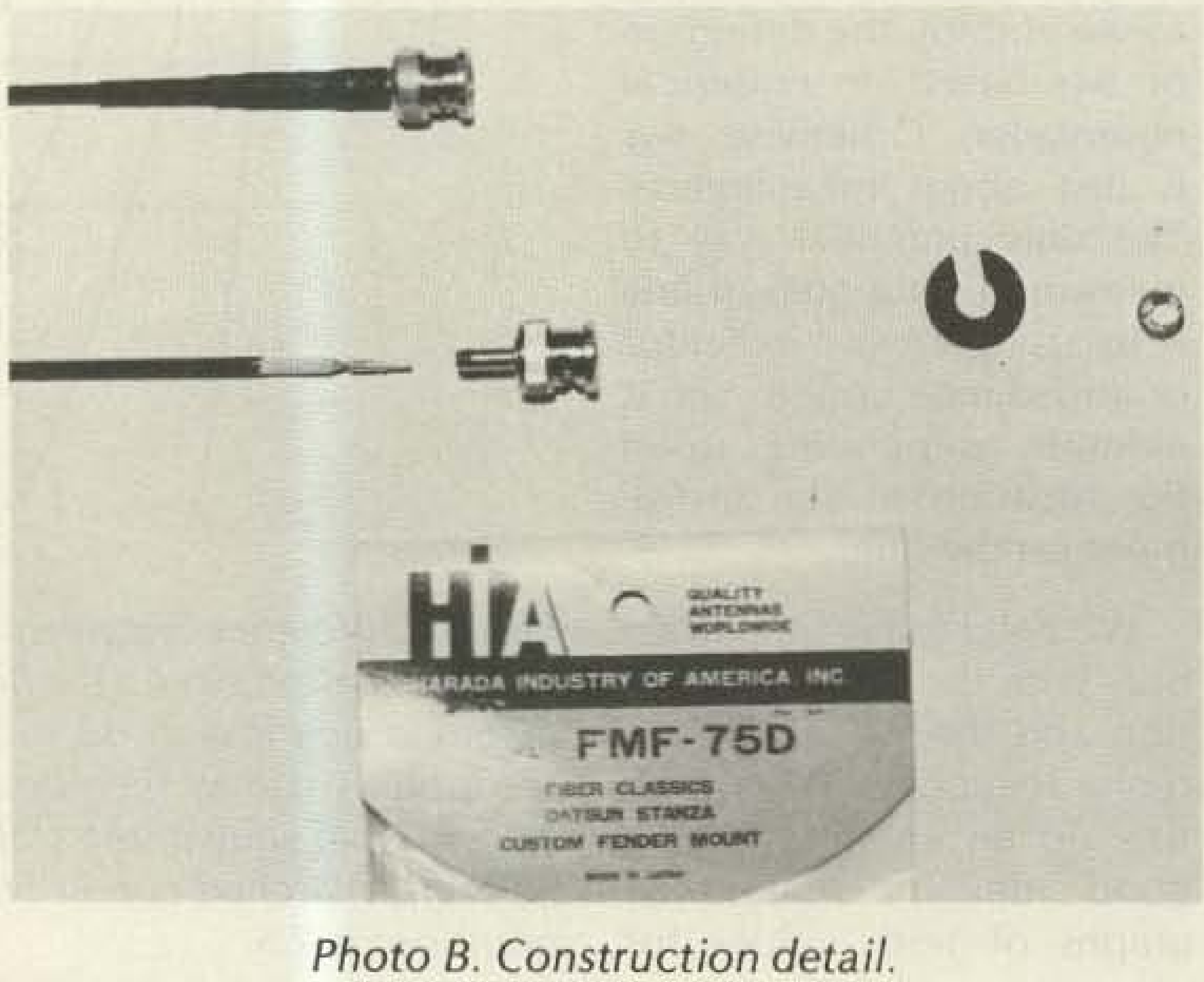

Photo B. Construction detail.

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Exponential Potential

The problem: A broadband antenna fed with coax exhibits narrowband response. The solution: Use this exponential-line matching system.

In high-power shortwave broadcast stations such as the VOA and others, the tapered or *exponential* line is generally used to match the high feedpoint impedance of a single-wire rhombic antenna to a lower-impedance main transmission line or transmitter rf output terminal. As an example, the feedpoint impedance of a rhombic designed for operation at *any* frequency between 4 and 21 MHz might have an input impedance of about 850 Ohms at 4 MHz, 700 Ohms at 14 MHz, and 625 Ohms at 21 MHz.

When the exponential two-wire line is used in conjunction with a lower-impedance main transmission line, the characteristics of the wide-frequency-band antenna are not restricted by transmission-line limitations. Although few hams are likely to realize the dream of owning the ultimate in directional arrays, the exponential line matching section does have other interesting applications, es-

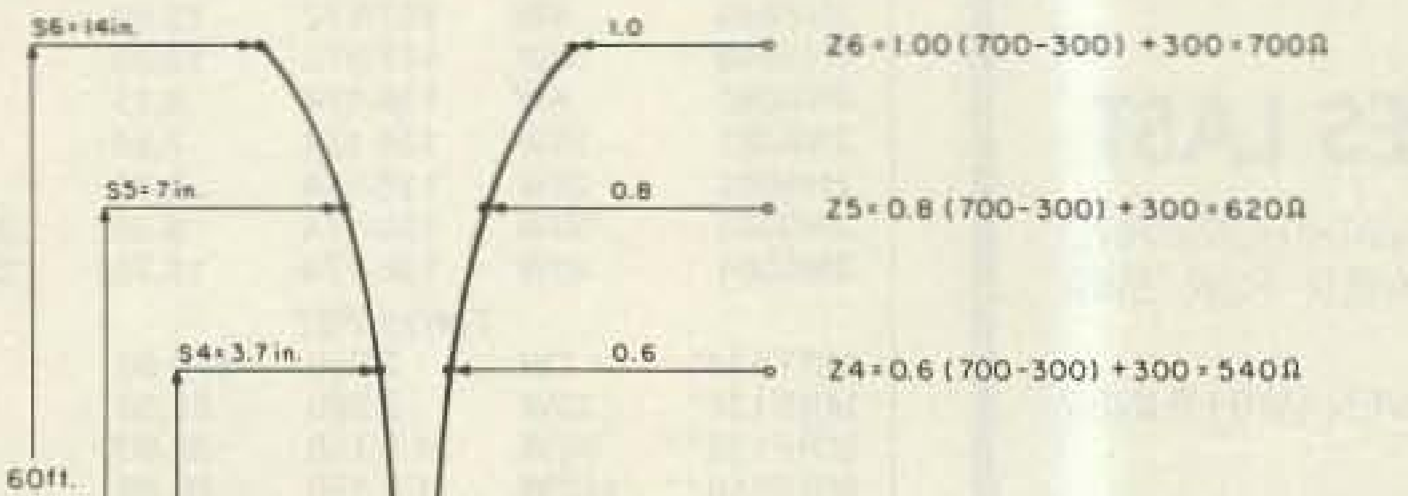

Fig. 1. Exponential line matching system for W6TYH's wideband 75-meter antenna system, using #12 copper-wire conductor (diameter = 0.08081"). S = conductor spacing in inches, center to center.

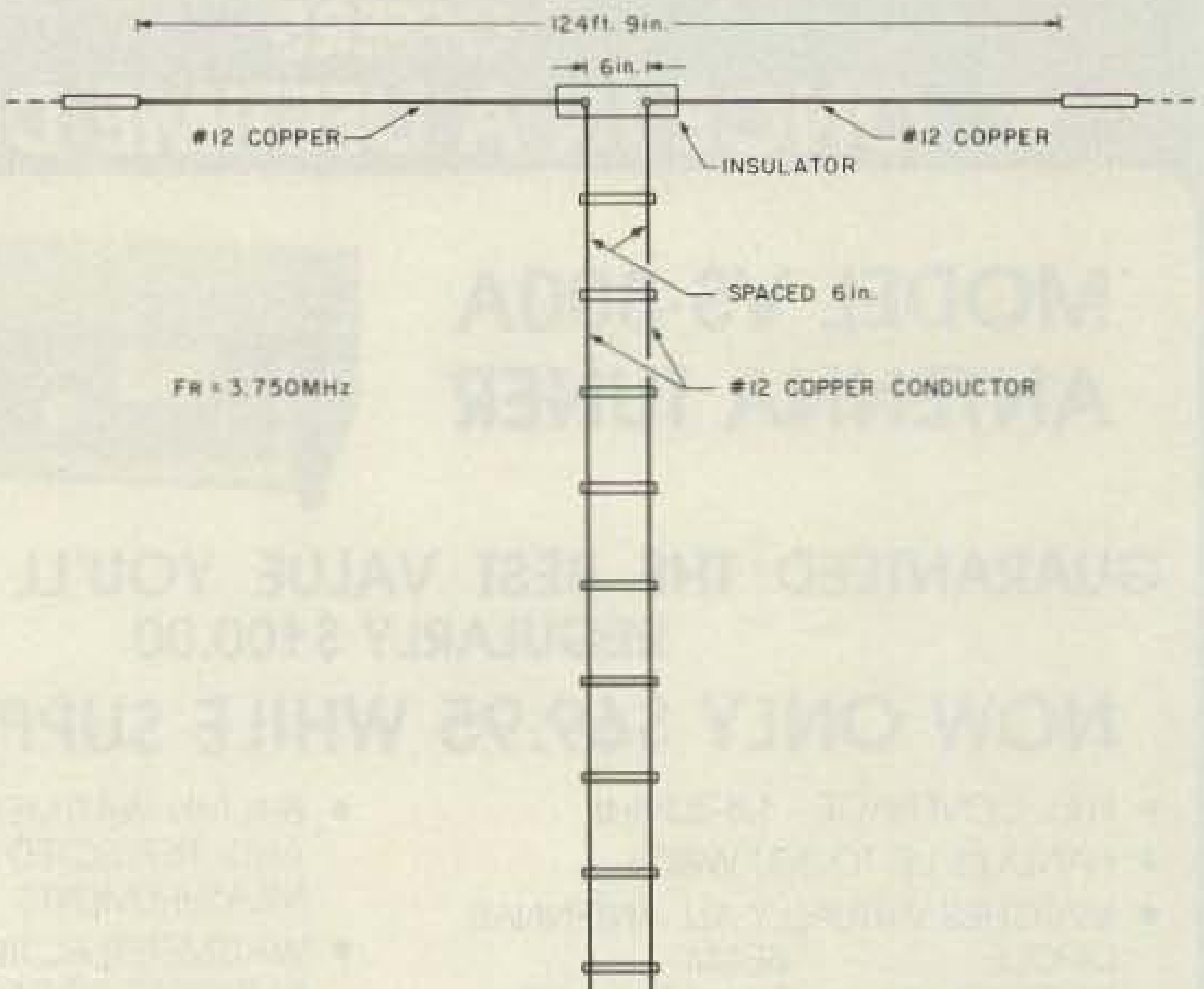

Fig. 2. The original 75-meter dipole at W6TYH (see text).

pecially for shortwave receiving antennas and for VHF and UHF arrays.

As shown in Fig. 1, the spacing between the two line conductors is greatest at the end of the section connected to the antenna. At this point, the impedance of the line is high enough to closely match the impedance of the antenna feedpoint for maximum transfer of rf energy. The other end of the line, in the direction of the transmitter, has very close spacing between the two conductors. If the line is properly designed and constructed, the low-impedance end of the tapered line may be easily matched, for ham purposes, to a standard 300-Ohm TV "ribbon" line or to a 75-Ohm coaxial line through a 4:1 ratio toroidal impedance transformer, as shown.

To design and construct an exponential line matching section, proceed as follows:

1) The length of the line should be approximately a quarter wavelength long at the lowest frequency at which the array will be operated. For an amateur-radio antenna system designed for the lowest operating frequency of 4 MHz (75 meters), the length will be 60 feet. In the following discussion, we will assume a line 60 feet long to be constructed from #12 copper wire (diameter 0.08081").

2) Divide the 60-foot length into five smaller distances of twelve feet each. Since the impedance of the line varies linearly, the impedance at each 12-foot point can be determined with a reasonable degree of accuracy. Assume that the highest impedance point (the antenna end of the line) is to be 700 Ohms and the lowest impedance point (the transmitter end of the line) is to be 300 Ohms. The line is to be exponentially "tapered" between the spacings required for the two impedance values.

3) Now, determine the impedance value at the 12-, 24-, 36-, 48-, and 60-foot points up the line. At 12 feet, the impedance is 12/60 or 0.2 of the difference between the two end impedances *plus the impedance at the low-impedance end of the line.* Thus, at 12 feet, for example, $Z_2 = 0.2(700 - 300) + 300 = 380$ Ohms. Likewise, at 24 feet the impedance is 24/60 or 0.4 of the difference between the two end impedances plus the impedance at the low-impedance end of the line. Numerically, $Z_3 = 0.4(700 - 300) + 300 = 460$ Ohms. At 36 feet, $Z_4 = 0.6(700 - 300) + 300 = 540$ Ohms. At 48 feet, $Z_5 = 0.8(700 - 300) + 300 = 620$ Ohms. At the top end, $Z_6 = 1.0(700 - 300) + 300 = 700$ Ohms. Z_1, at the bottom end, equals $276 \log_{10} 2S/d$, where S is the center-to-center spacing between the two conductors and d is the diameter of one conductor. Both S and d must be expressed in the same basic units.

4) To determine the center-to-center spacing, S, between the two conductors at the various points along the line, use the following formula: $S = (d \times \text{antilog}_{10} (Z_O/276))/2$, where Z_O is the impedance at the point on the line (above), d is the diameter of one conductor, and S is the center-to-center spacing between the two conductors expressed in the same basic units as d.

As an example, for the 700-Ohm impedance point (top), using #12 copper wire with a diameter of 0.08081 inches, $S = (0.08081 \times \text{antilog}_{10} (700/276))/2 = 13.9 = 14$ inches.

Wideband 75-Meter Antenna System

At W6TYH, we used a half-wave, centerfed dipole, cut to 3.75 MHz for many years. This single-wire

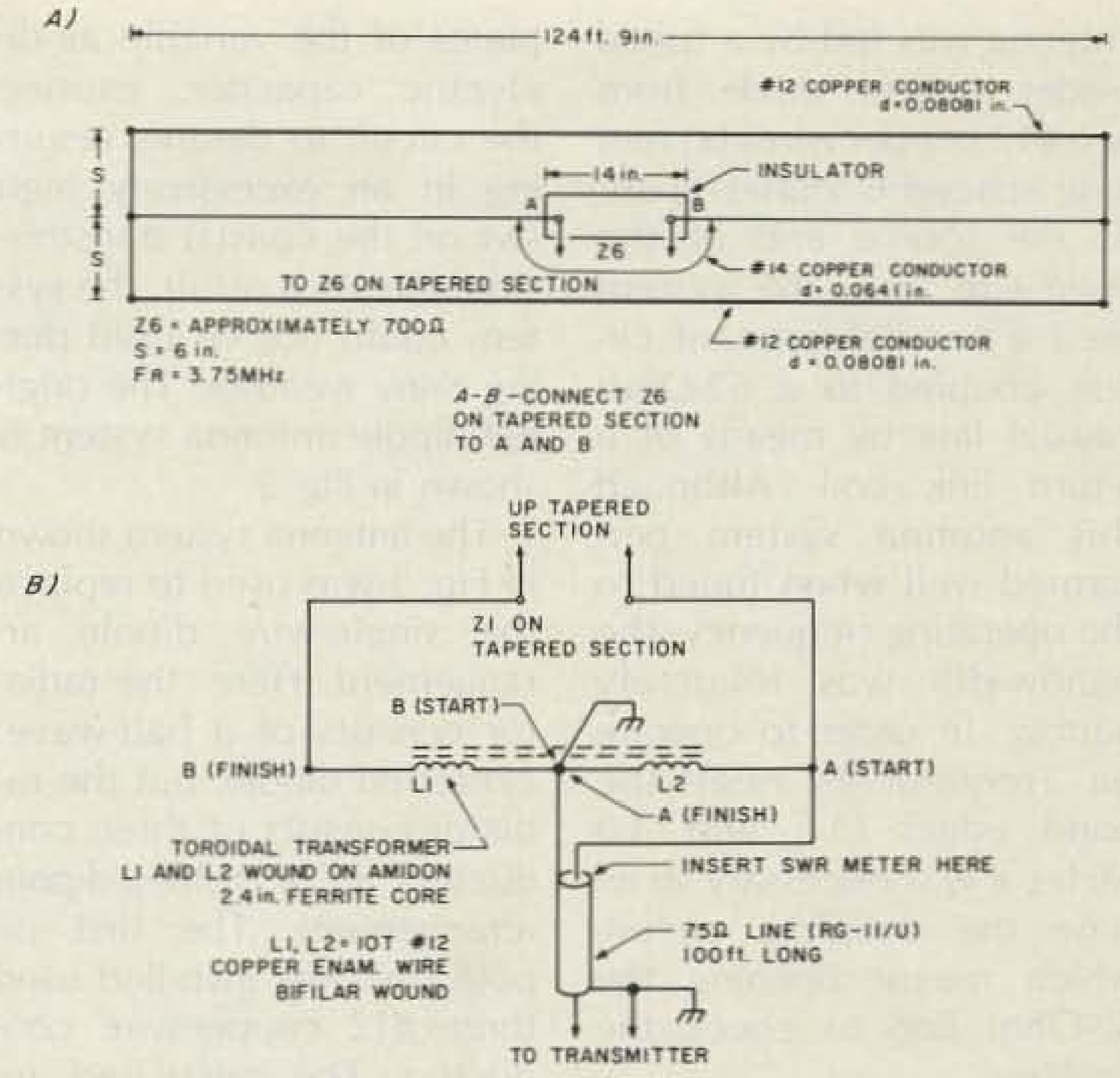

Fig. 3. (a) A triple-conductor system for 75 meters. (b) Method of coupling exponential line to a transmitter.

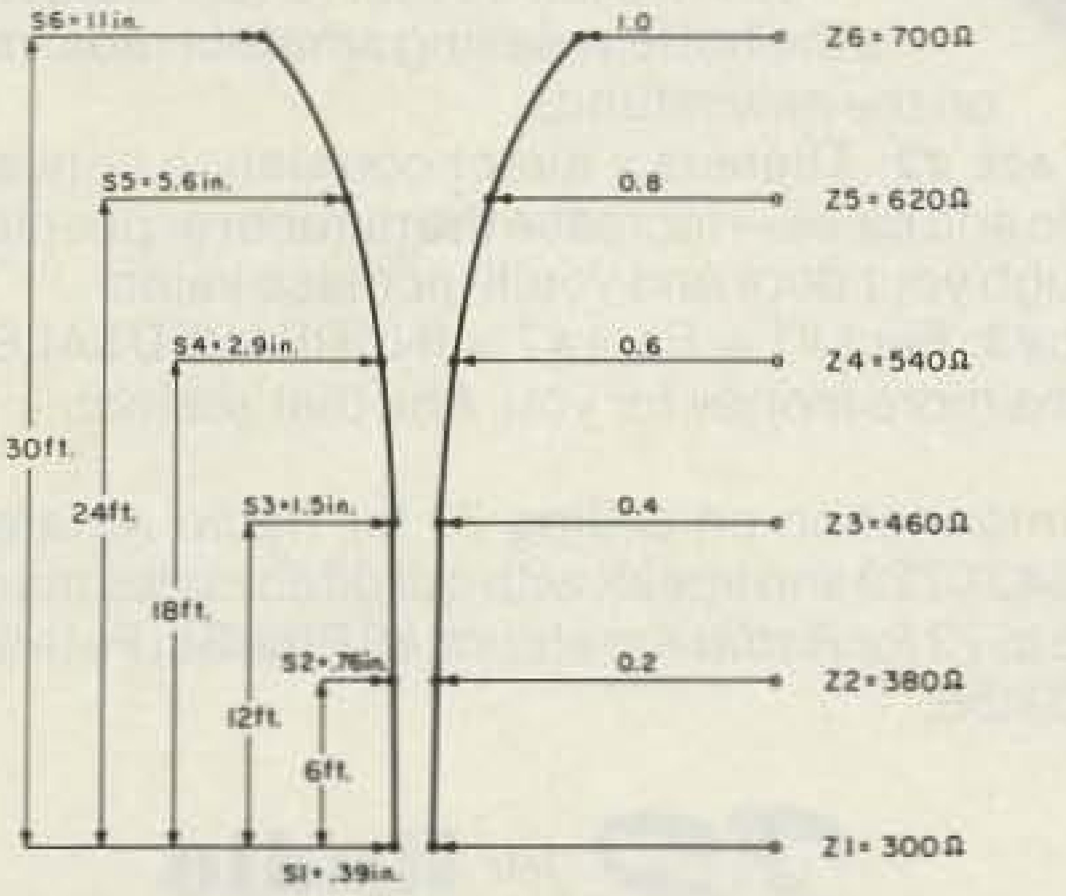

Fig. 4. Exponential line matching system for a wideband 40-meter antenna system, using #14 copper-wire conductor (diameter = 0.064"). S = conductor spacing in inches, center to center.

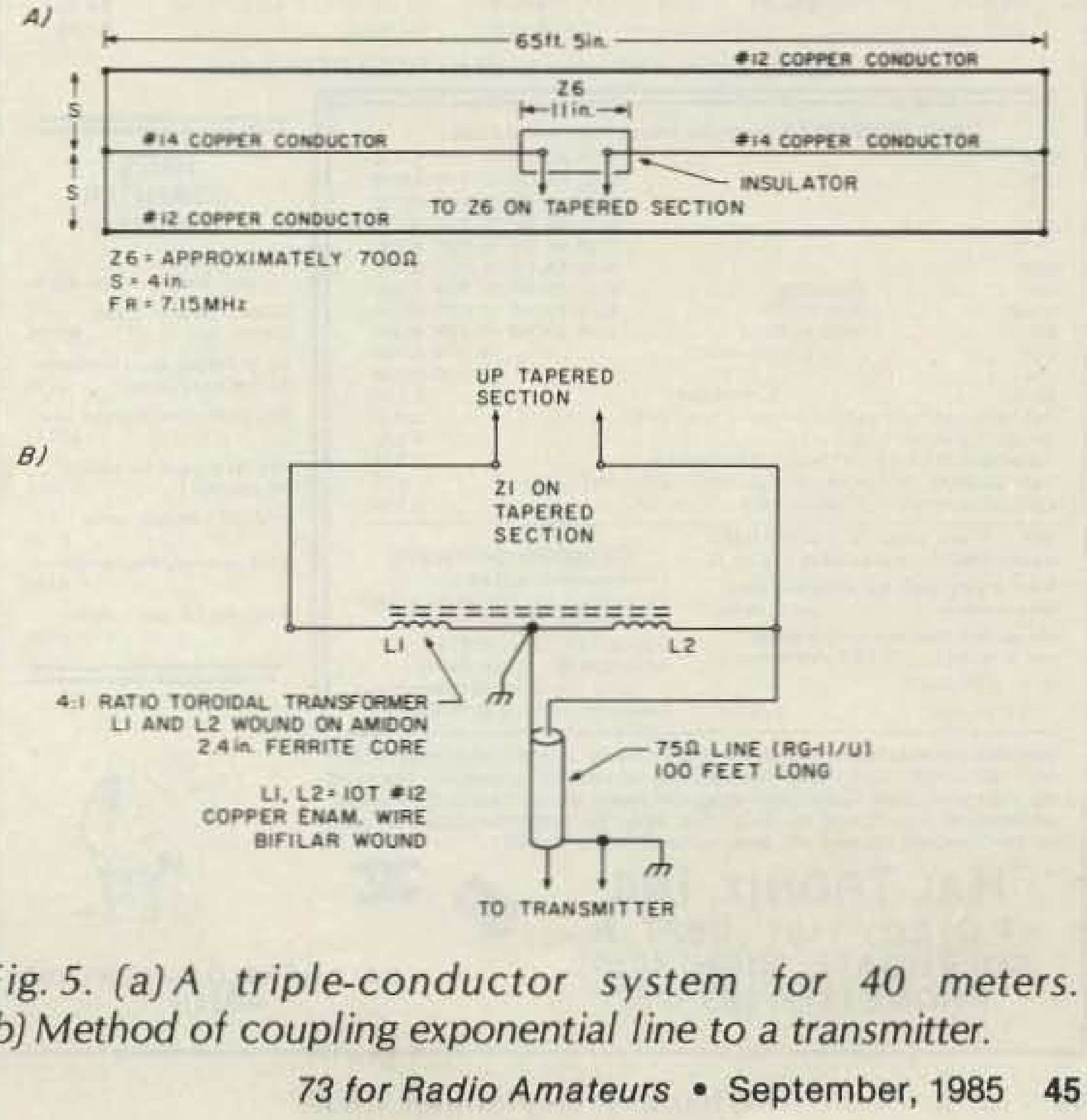

Fig. 5. (a) A triple-conductor system for 40 meters. (b) Method of coupling exponential line to a transmitter.

antenna was fed by a tuned feeder system made from two #12 copper wires 60 feet long spaced 6 inches apart. At the source end of the open-wire line, the system used a parallel-resonant circuit coupled to a 52-Ohm coaxial line by means of a 5-turn link coil. Although this antenna system performed well when tuned to the operating frequency, the bandwidth was relatively narrow. In order to operate on frequencies near the band edges (3.5 and 4.0 MHz), it was necessary to retune the coupling circuit, which meant opening the 52-Ohm line to check the line swr.

Since the tuning circuit was located some distance from the ham shack, this necessary adjustment was a great inconvenience to say the least. Also, in spite of the fact that the tuning unit was placed in a "waterproof" enclosure, during wet weather moisture collected on the plates of the variable air-dielectric capacitor, causing the circuit to detune, resulting in an excessively high swr on the coaxial transmission line. As a result, the system could not be used during rainy weather. The original dipole antenna system is shown in Fig. 2.

The antenna system shown in Fig. 3 was used to replace the single-wire dipole arrangement. Here, the radiator consists of a half-wave, centerfed dipole, but the radiator consists of three conductors in a folded-dipole arrangement. The first dipole that was installed used three #12 copper-wire conductors. The calculated impedance at the center of the middle wire was 675 Ohms, which is a close match to the 700 Ohms at the upper end of the exponential line section. With this arrangement, the swr on the 75-Ohm coaxial-cable line measured about 1.75:1. The center conductor was replaced with #14 copper wire and the coaxial-line swr was reduced to about 1.2:1 and remained close to this value at all frequencies between 3.5 and 4.0 MHz. The system is not affected by wet weather and the coaxial-line swr is the same no matter what the weather, wet or dry.

For 40 meters and the other bands, the tapered matching section is designed in the same manner as previously described. For 40 meters, the length of the tapered section should be about 30 feet. For 20 meters, the length will be about 15 feet. The three-wire dipole should be cut for the band center frequency using the formula 468/f, where f is the frequency in MHz.■

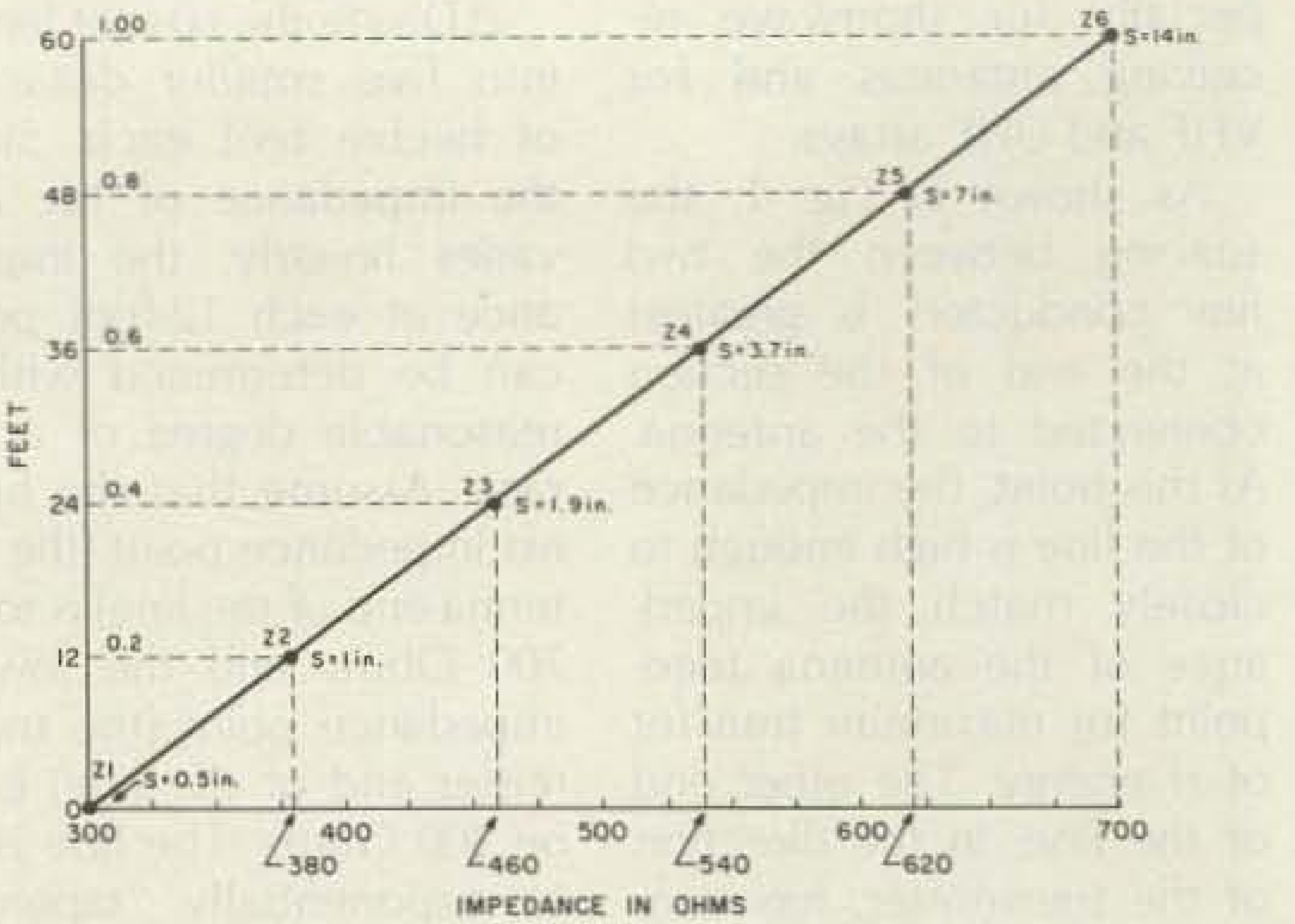

Fig. 6. Graph of impedance versus length for the 75-meter exponential section. Note that the curve is linear.

HF Equipment

HF Equipment	Regular	SALE
IC-735 Xcvr/SW rcvr/mic	849.00	749.95
PS-55 Power supply	160.00	144.95
AT-120 Automatic antenna tuner	TBA	
FL-32 500 Hz CW filter	59.50	
EX-243 Electronic keyer unit	50.00	
IC-730 8-band 200w PEP xcvr w/mic	829.00	569.95
FL-30 SSB filter (passband tuning)	59.50	
FL-44A SSB filter (2nd IF)	159.00	144.95
FL-45 500 Hz CW filter	59.50	
EX-195 Marker unit	39.00	
EX-202 LDA interface; 730/2KL/AH-1	27.50	
EX-203 150 Hz CW audio filter	39.00	
EX-205 Transverter switching unit	29.00	
SM-5 8-pin electret desk microphone	39.00	
HM-10 Scanning mobile microphone	39.50	
MB-5 Mobile mount	19.50	
IC-720A 9-band xcvr/.1-30 MHz rcvr	1349.00	799.95
FL-32 500 Hz CW filter	59.50	
FL-34 5.2 kHz AM filter	49.50	
SM-5 8-pin electret desk microphone	39.00	
MB-5 Mobile mount	19.50	
IC-745 9-band xcvr w/.1-30 Mhz rcvr	999.00	779.95
PS-35 Internal power supply	160.00	144.95
EX-241 Marker unit	20.00	
EX-242 FM unit	39.00	
EX-243 Electronic keyer unit	50.00	
FL-45 500 Hz CW filter (1st IF)	59.50	
FL-54 270 Hz CW filfer (1st IF)	47.50	
FL-52A 500 Hz CW filter (2nd IF)	96.50	89.95
FL-53A 250 Hz CW filter (2nd IF)	96.50	89.95
FL-44A SSB filter (2nd IF)	159.00	144.95
HM-10 Scanning mobile microphone	39.50	
SM-6 Desk microphone	39.00	
HM-12 Extra hand microphone	39.50	
MB-12 Mobile mount	19.50	

	Regular	SALE
IC-751 9-band xcvr/.1-30 MHz rcvr	1399.00	1199
PS-35 Internal power supply	160.00	144.95
FL-32 500 Hz CW filter (1st IF)	59.50	
FL-63 250 Hz CW filter (1st IF)	48.50	
FL-52A 500 Hz CW filter (2nd IF)	96.50	89.95
FL-53A 250 Hz CW filter (2nd IF)	96.50	89.95
FL-33 AM filter	31.50	
FL-70 2.8 Khz wide SSB filter	46.50	
HM-12 Extra hand microphone	39.50	
SM-6 Desk microphone	39.00	
CR-64 High stability reference xtal	56.00	
RC-10 External frequency controller	35.00	
MB-18 Mobile mount	19.50	

Options: 720/730/745/751	Regular	SALE
PS-15 20A external power supply	149.00	134.95
EX-144 Adaptor for CF-1/PS-15	6.50	

ICOM

Options - continued	Regular	SALE
CF-1 Cooling fan for PS-15	45.00	
EX-310 Voice synth for 751, R-71A	39.95	
SP-3 External base station speaker	49.50	
Speaker/Phone patch - specify radio	139.00	129.95
BC-10A Memory back-up	8.50	
EX-2 Relay box with marker	34.00	
AT-100 100w 8-band automatic ant tuner	349.00	314.95
AT-500 500w 9-band automatic ant tuner	449.00	399.95
AH-1 5-band mobile antenna w/tuner	289.00	259.95
PS-30 Systems p/s w/cord, 6-pin plug	259.95	234.95
OPC Optional cord, specify 2 or 4-pin	5.50	
GC-4 World clock .... **(Closeout!)**	99.95	79.95

HF linear amplifier	Regular	SALE
IC-2KL w/ps 160-15m solid state amp	1795.00	1299

VHF/UHF base multi-modes	Regular	SALE
IC-551D 80 Watt 6m transceiver	699.00	599.95
EX-106 FM option	125.00	112.95
BC-10A Memory back-up	8.50	
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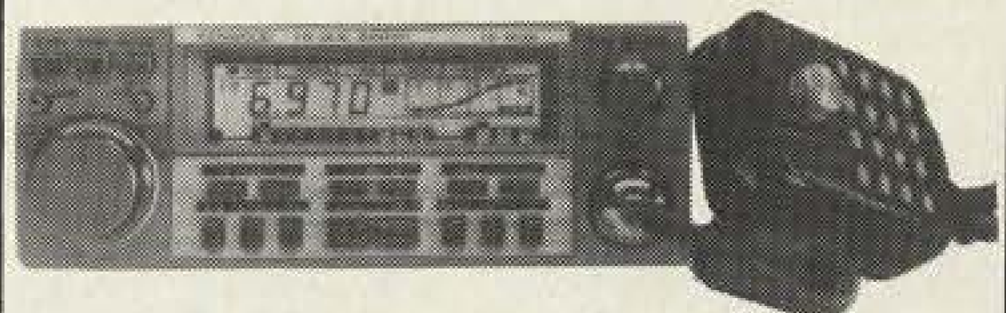

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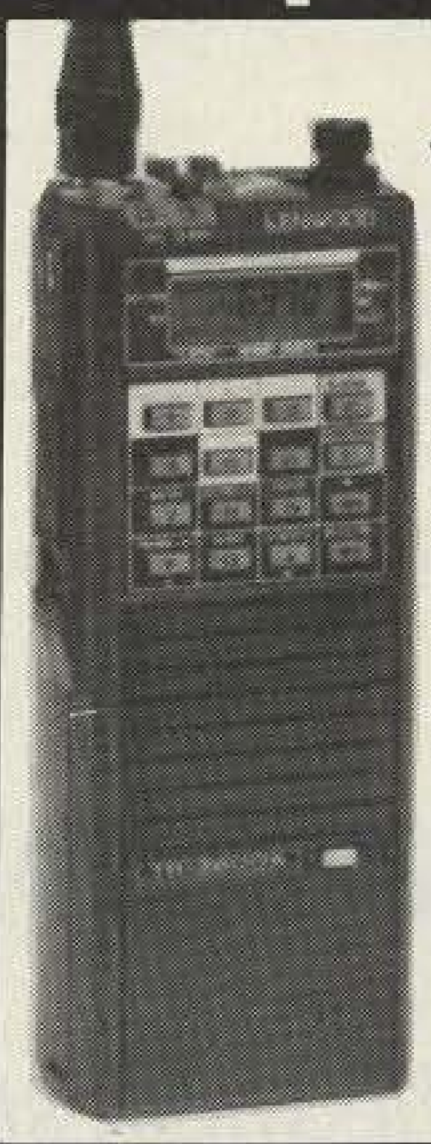

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Wheatstones Are Not Crackers!

Here's the slickest application of the Wheatstone circuit yet devised. The Nuller Bridge is the only instrument you'll need to adjust your antenna matching unit to peak performance.

My first exposure to and fright over a Wheatstone bridge was in high school physics class more than fifty years ago. The many knobs, an ultra-sensitive string galvanometer, formulas, and multiplying factors that would choke a horse (combined with the dire warning from the instructor, *"Don't peg the meter!"*) kept me turned away from bridges for years.

Later experiences were different. I learned that a simply-designed, accurate rf bridge circuit can easily be built from readily-available parts and that it will allow you to tune up your matching unit properly without radiating any appreciable power while at the same time keeping your transmitter swr at 1:1. In addition, a provision can be made to first tune up your transmitter into your dummy load without radiating any rf power at all and also to monitor your relative power output. And lastly, when you are all tuned up, with a flip of a switch your transmitter can be connected directly into your tuner/antenna system, and again your meter monitors relative power output.

All of this can be accomplished with my "Nuller Bridge" without ever once thinking of actual values of swr or perhaps worrying about what it means!

Good accuracy for the bridge circuit is easily accomplished. First, 47-Ohm, ½-Watt, 5% carbon resistances are readily available, so if we built a bridge using them we would have a good 47-Ohm bridge. However, as almost all of our present-day equipment is based upon a 50-Ohm impedance value, we will design for that figure.

It would be possible to file down the 47-Ohm resistors to 50 Ohms, but there is a much easier way. In the theoretical bridge circuit of Fig. 1, if we shunt one of the 47-Ohm resistances (RD) with a resistance (RE) of 736 Ohms, we find that the equivalent parallel resistance (RB) would be equal to 44.18 Ohms. ($RB = 47 \times 736/(47 + 736) = 44.18$.) And now, using the basic bridge equation, where RX is the unknown resistance, $RX = (RA \times RC)/RB = (47 \times 47)/44.18 = 50$ Ohms.

Well, since I did not have a 736-Ohm resistor available, I just picked out a standard 680-Ohm, ½-Watt, 5% carbon resistor out of my

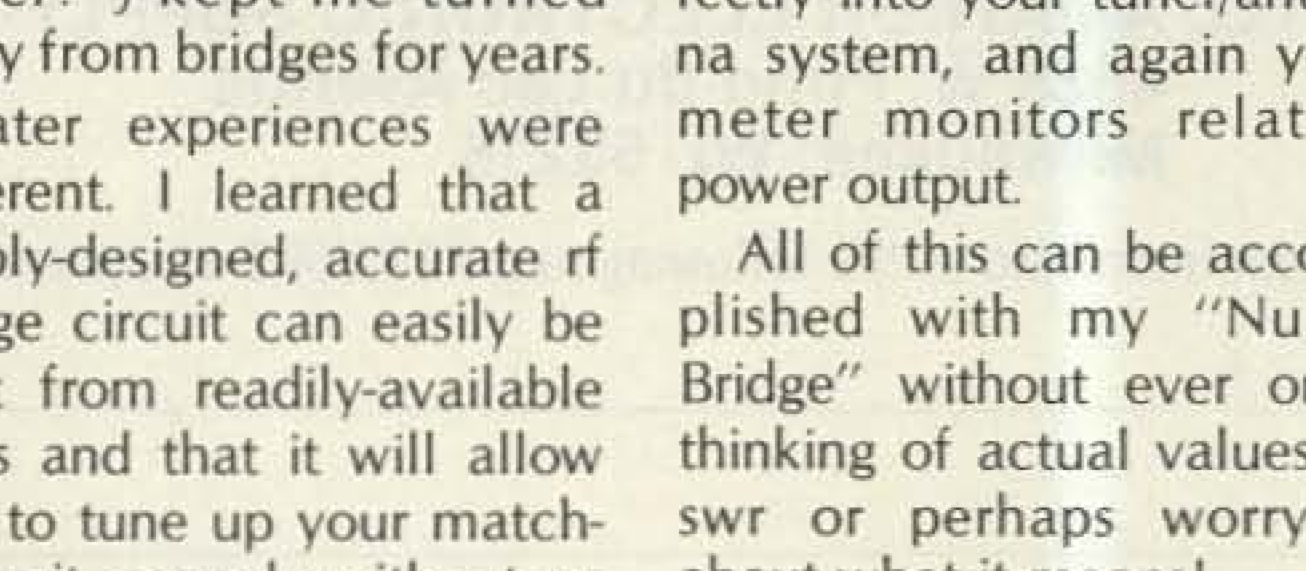


Fig. 1. A theoretical 50-Ohm bridge.

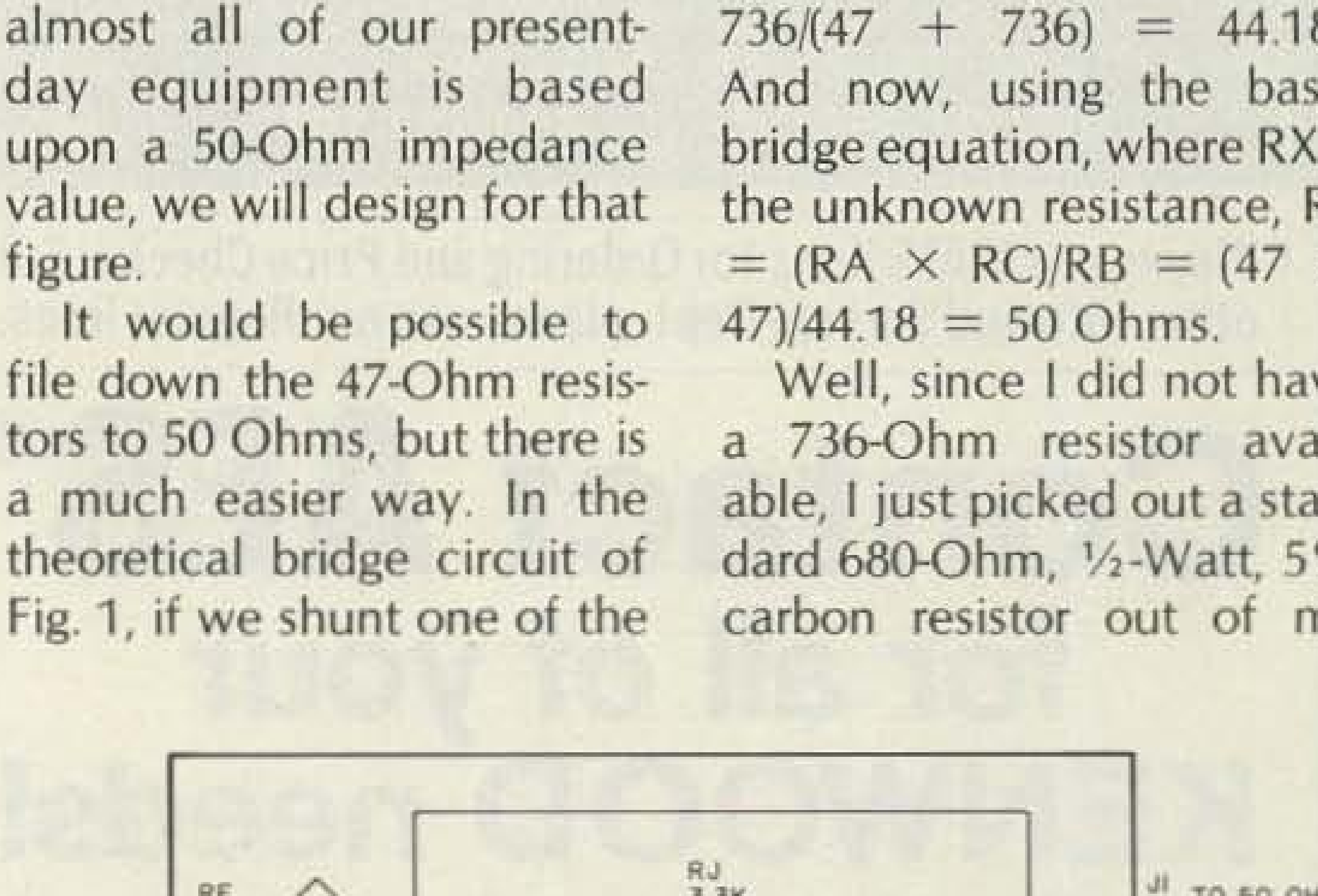


Fig. 2. Schematic of a more practical circuit.

stock and found that then RB would be 43.96 Ohms. Substituting into the basic bridge equation, we find that RX = (47) (47)/43.96 = 50.25 Ohms. This value was so close to the original design value of 50 Ohms as to be indistinguishable in any tests I could make.

Another reason why this basic bridge circuit is accurate is that it contains no inductors or capacitors and hence is frequency-insensitive. If you look at the diagram of a conventional in-line swr meter, you will see its complexity; my own experience of trying to build one to the accuracy I wanted proved quite frustrating. In comparison, the simplicity, ease of construction, and accuracy of the Nuller Bridge were a pleasant surprise, particularly as it does so much more for you than an swr meter does in tuning up your rig.

Let me emphasize that because this unit is not an swr meter, it requires no swr scale or elaborate calibration procedure. And if we think a bit more, we realize that when we tune up our transmitter through our antenna tuner, we are really interested only in obtaining an impedance match. Since the Nuller provides an accurate impedance match, why worry about swr? And as the feature of the Nuller is to allow the tuner to tune up for an impedance match without allowing your transmitter swr to be more than 1:1, then there is absolutely no reason to be concerned in any way with swr.

So with this simple unit we have finally laid to rest the bogey of swr tune-up problems. It would have been possible, with extra circuitry, switching circuits, and calibration techniques, to make the scale read swr, but as it would only complicate its operation and provide no functional purpose, why not entirely break the hold that swr seems to have had on so many of us?

The circuit is shown in Fig. 2. It was designed for use with my Yaesu FT-101B with a key-down power output of about 100 Watts. Because the circuit is so extremely simple, it can be readily modified for use at higher powers by using higher values of resistance for the voltage-dropping resistances feeding the bridge circuit.

Operation of the unit is best explained by referring to the diagram shown. First, place switch S2 in the tune position. RK is an ordinary linear 50k variable resistor with a switch, S1, that opens when the knob is fully counterclockwise, just like the volume control on most radio and TV sets. In the counterclockwise position, all 50k Ohms of resistance are in the metering circuit.

As switch S1 is now open, the input of our antenna tuner is disconnected from the bridge circuit.

Also, with switch S2 in the tune position, the dummy load is connected directly to the transmitter. The voltage from the dummy load is applied to the bridge circuit through the dropping resistances, RJ and RH, which are connected in parallel.

The bridge is now unbalanced because S1 is open, and the microammeter will show the voltage developed across bridge points X-Y after it is rectified by the diode, D1. So now the meter shows an output that is a function of the power in the dummy load.

This feature is an advantage, as even though you could watch for your plate-current dip and adjust your transmitter power-output control, you now also have an rf monitor right at the dummy load, and during this stage of transmitter tune-up your antenna tuner is disconnected and you do not radiate any power out. Naturally, as your transmitter is connected only to your dummy load, your swr at the transmitter is 1:1.

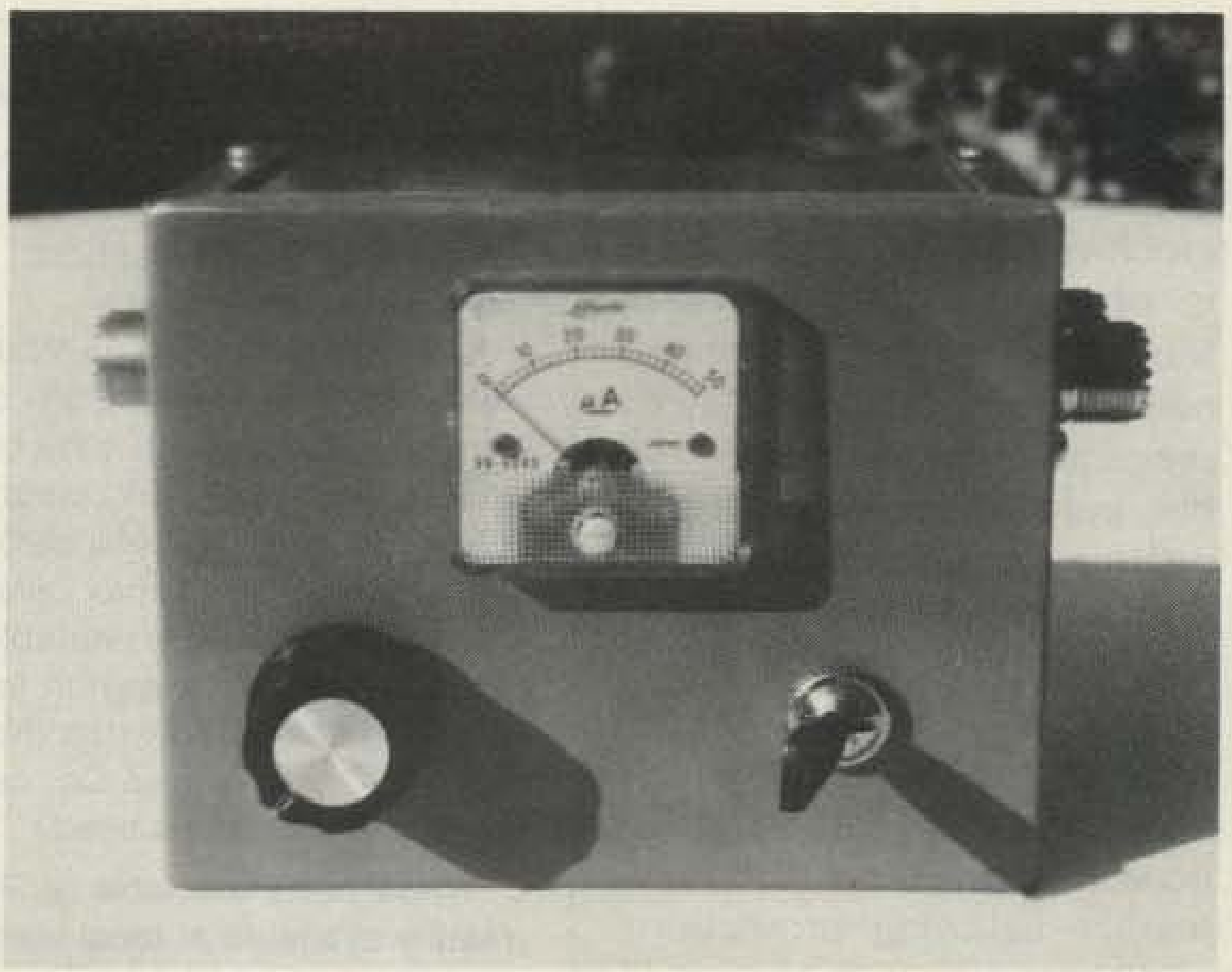


Photo A. The finished Nuller Bridge.

Now, if you turn the control knob of RK in the clockwise direction, switch S1 closes, the antenna tuner is now connected to the bridge circuit, and RK becomes the sensitivity control for the meter-nulling circuit. Now all you have to do is adjust your tuning unit until your meter reads zero, and your matching antenna system is tuned up to fifty Ohms. During this tune-up process, switch S2 is still in the tune position so that your transmitter is still loaded into the dummy load; the swr at the transmitter is still 1:1. And now if switch S2 is switched to the transmit position, the transmitter is connected directly into the antenna tuner which is already properly adjusted, and you can go on the air.

My only precaution is the common-sense one: It is best to turn your transmitter-output control to minimum when switching S2 to avoid possible momentary transients. This is a general safety precaution in switching all rf circuits carrying appreciable power.

Now, with switch S2 in the transmit position, the voltage-dropping resistance, RM, provides voltage to the bridge, which is again unbalanced because the antenna-tuner input is no longer connected to point Y on the bridge. As before, the bridge voltage across points X-Y is rectified and fed through the diode to the meter and provides a power-output monitoring system; at this time, RK acts as a sensitivity control.

The two fixed capacitors, C1 and C2, and RF provide a filter circuit to electrically isolate the metering circuit from any rf from the bridge circuit. None of the values of any components is critical, and I just used what I had available.

The only special care I took when building the unit was to place jacks J1 and J2 on one side of the box and J3 at the other side, as shown. The components were just soldered to an ordinary strip connector and all grounds brought together at one point before grounding to the chassis. The three jacks were grounded only to the case, as the metal provided sufficient conductivity without any need for additional wire connections between them. Although I was fortunate in having picked up a small 50-microampere meter at a hamfest for fifty cents, any 50-microampere meter will operate satisfactorily. The unit worked exactly as planned with no problems encountered.

When I am through using my transmitter, I switch S2 back to the tune position and then turn RK counterclockwise so that switch S1 is open. This isolates the transmitter from the antenna-tuner system and is a nice precaution to avoid possible induced voltages from nearby electrical lightning discharges. (Florida leads the nation in electrical storms and every method of protection is desirable.) However, this method is in no way a substitute for your regular lightning protection methods.

Parts List

Chassis box, 4 × 5 × 3 inches*
D1—1N34A diode*
C1, C2—.005-uF capacitors
M—0-50 microammeter
RA, RC, RE—47-Ohm, ½-Watt, 5% carbon resistors*
RD—680-Ohm, ½-Watt, 5% carbon resistor*
RJ, RH—3.3k, 2-Watt, 10% carbon resistors
RM—5.1k, 2-Watt, 10% carbon resistor
RF—3.3k, ½-Watt, 10% carbon resistor
J1, J2, J3—SO-239 coax connectors*
RK—50k linear taper, variable resistor, 271-1716*
S1—Potentiometer switch for RK, 271-1740*
S2—6-Amp DPDT switch (Note: For higher powers, a heavy-duty, G. C. Electronics Co., catalog number 35-144, 10-Ampere DPDT switch can be used.)

* These parts available at Radio Shack. All other parts were readily available at local electronics stores.

In addition to ensuring that your transmitter tune-up swr is always 1:1, the unit has another major advantage. When using the ordinary method of tuning up, with your transmitter directly coupled through your matching unit to your antenna, it is easily possible to find combinations of settings on your matching unit that can either present series-resonant circuit conditions to your transmitter or, in other cases, produce impedances much higher than 50 Ohms. Either case can be dangerous to your expensive equipment. This unit eliminates that possibility.

Another feature is that when tuning up directly into your matching unit, there is interaction between your transmitter's output controls and the controls on your tuner that often make you wish you were an octopus. This unit also eliminates this interaction problem.

In my own case, just for fun, I borrowed a Bird wattmeter from a friend, calibrated the unit for power output vs. meter reading for the dummy-load position, drew a curve, and pasted it on the back of the unit for reference. There is no real need to do this, but it is a quick way to find out if your rig is putting out properly if trouble develops.

No decals were pasted on the unit. (At age 72, I find it hard to line up the letters and make them stick to the shiny grey enamel of the small chassis.) Besides, with only two controls, the operation becomes almost automatic after using it a few times.

The ease of construction of the unit lends itself to all amateurs, and its utility solves all of the vexing swr problems previously encountered. ■

References

"The Telematch," Byron Goodman and Walter Lange, *QST*, February, 1965.
"Tune Up Swiftly, Silently, and Safely," William Vissers, *QST*, December, 1979.

BACK ISSUES

Stan Gibilisco W1GV
PO Box 144524
Coral Gables FL 33114

A New Angle for Dipoles

Stand them on end! Sounds odd, but W1GV presents an excellent case for HF vertical dipoles.

Vertical antennas have always fascinated me. Many people don't think they work well or have tried them and had marginal results. But the vertical is a temperamental antenna. It has to have what it needs in order to do its thing. A well-designed vertical with an excellent ground plane will provide DX performance comparable to much larger and more expensive systems installed in less optimal places.

Recently I got the opportunity to stay in a home on the ocean. A thought came to me: salt-water ground plane. Another thought: vertical needing no radial system. A third idea: vertical dipole, giving 3-dB gain at an almost horizontal angle of radiation over a huge pond of highly conductive ocean. How could it fail?

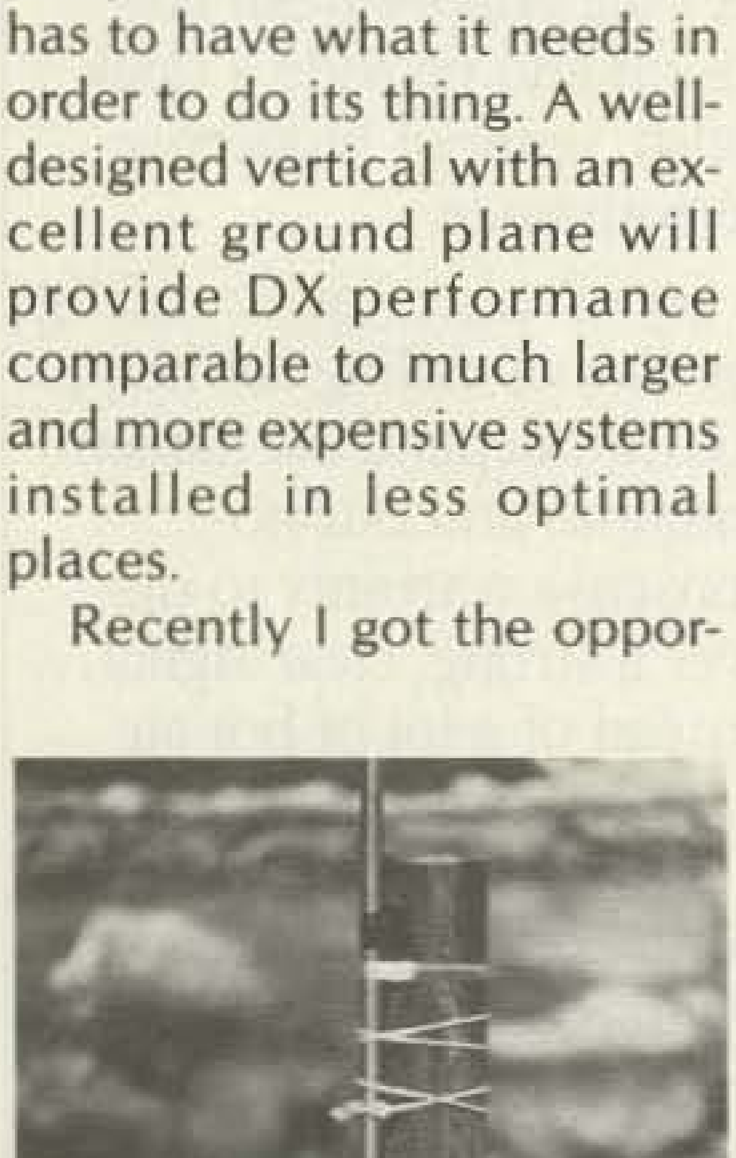


Photo A. The base mount used at W1GV/4 was crude but efficient.

Vertical Dipoles

Most hams think of a vertical antenna as a quarter-wave device, requiring a good ground system and radiating much of its energy in a horizontal plane. All three of these ideas can be challenged. You don't have to use a quarter-wave radiator, you do not necessarily need a good earth ground, and a vertical will not always have good low-angle radiation.

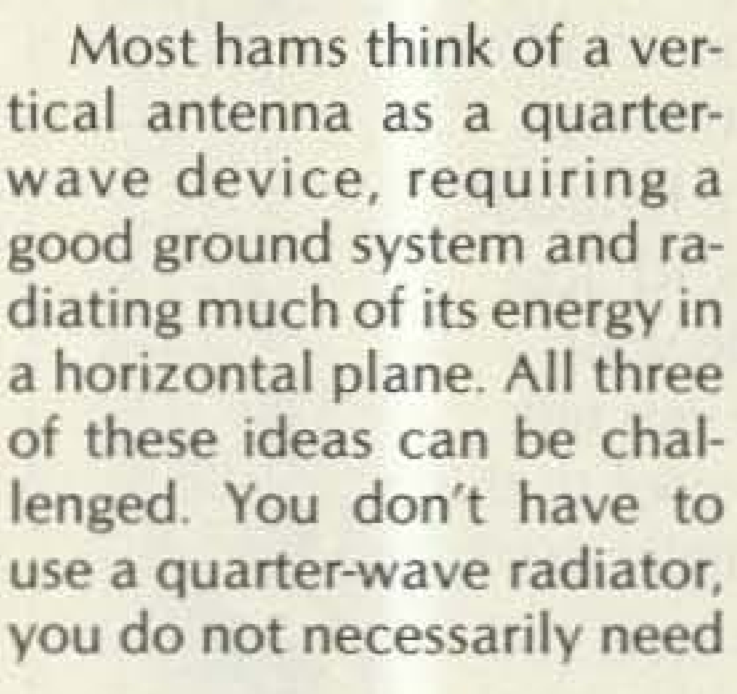


Fig. 1. Configuration of a centerfed, balanced, vertical dipole.

We all know the general radiation pattern of a half-wave dipole. Maximum radiation occurs perpendicular to the wire, and the least radiation is in line with the wire—assuming the antenna is straight. If a dipole is set up in an east-west direction, for example, the best radiation will occur in north-south directions (generally) and the least in the east and west directions. A lot of signal also goes up into space at high angles; quite a lot may even go straight up, and that doesn't do you any good at all. The same pattern holds for receiving.

For some reason, it doesn't often occur to people that they can turn the dipole sideways. Perhaps that is because the idea seems aesthetically inelegant: The feedline would have to come out from the center of such an antenna and be supported horizontally (Fig.1); it would look funny. Well, so what?

A half-wave vertical dipole is impractical for some hams to install because of its sheer height. At a frequency of f MHz, the height must be (in feet) 468/f, approximately, for half-wave operation. This is practical at frequencies above about 10 MHz for most of us; it is a challenge at 7 MHz, and almost an impossibility at 3.5 MHz. Don't even think about the idea at 1.8 MHz unless you live on a ranch and have connections with the FAA. I decided, therefore, to build the antenna for operation at frequencies above 10 MHz.

A dipole antenna can (and ideally should) be fed with a balanced, open-wire feedline. This is no less true for a vertical dipole than for a horizontal one. I decided to use parallel-wire line with this antenna, in conjunction with a matching network, to obtain multiband operation.

Dimensions

The physical dimensions of this antenna are shown in Fig. 2. The structure is slightly less than 20 feet high and has capacitance hats at both the top and the bottom. The capacitance hats effectively increase the length, so that the antenna is resonant (as a half-wave radiator) near 14 MHz. The capacitance hats also reduce end effects and broaden the bandwidth at the resonant frequency.

The antenna is fed with TV-type ribbon line (the best I could find). The length is not critical, except, of course, it should be as short as possible to minimize loss. Certain lengths may result in difficulty "loading up" the system at some frequencies; this can be eliminated by adding or subtracting a few feet of line. This will be discussed in more detail later.

The radiator was placed about 4 to 6 feet (depending on tides) above the level of the water. Because of the vertical orientation of the radiator, there is more capacitance effect in the bottom half of the antenna than in the top half. This causes some unbalance, but I didn't worry about it. (It did not seem to harm the performance of the antenna.)

The line was run away from the antenna at a right angle—at least as near to a right angle as possible—all the way to the station. This is always advisable with any dipole antenna; it helps to maintain electrical balance. The line at W1GV/4 was about 60 feet long, but, of course, it is desirable to have the shortest line length possible to minimize loss.

Theory of Operation

The primary objectives in building this antenna were: (1) to obtain a low angle of radiation at frequencies from about 10 to 30 MHz, (2) to get relatively good efficiency, and (3) to have physical ruggedness and fairly small size. I think this antenna meets all these requirements very well. And it doesn't cost much to build.

The antenna works as a half-wave dipole around 14 MHz. At higher frequencies, the current loops move outward from the feedpoint, as shown in Fig. 3. At 28 MHz,

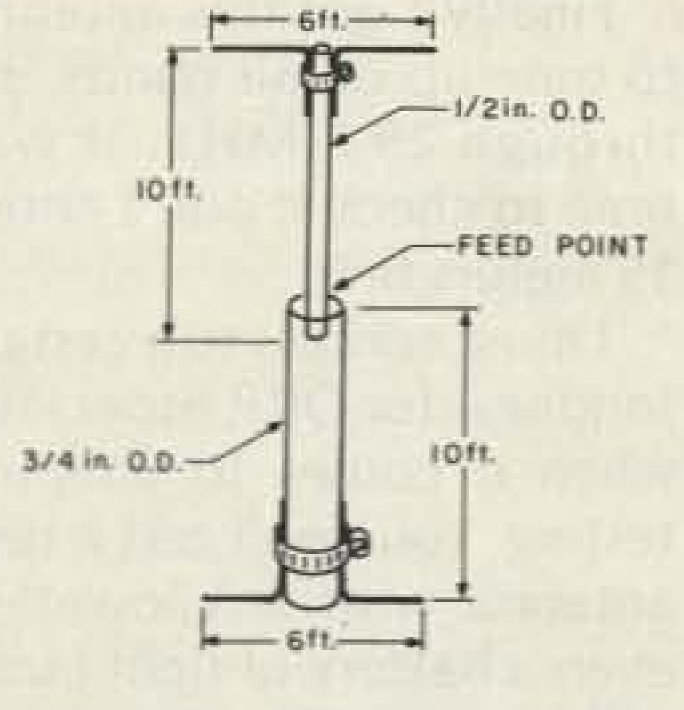


Fig. 2. The design used at W1GV/4 employed capacitance hats. The overall height was 20 feet minus 2 inches of overlap at the center.

the antenna is effectively a vertical, 2-element collinear. This produces a theoretical gain of 3 dB over the field strength at 14 MHz. The presence of the salt-water ground plane, nearly perfect, should result in about 2 dB more gain than would be had if the antenna were in a free space. One could expect that this antenna would perform spectacularly at 14, 21, and 28 MHz, and this expectation proved well founded.

You might wonder why I have paid no attention to swr. The reason is that parallel-wire line has very low loss, and even if the swr is quite high, this loss remains low. Ordinary TV ribbon line is less lossy, for a given swr, than the finest RG-8/U coaxial cable. I would imagine that the swr is around 5:1 on the line at 14 MHz; it is probably higher at 21 MHz and 28 MHz, but not much. I would have preferred to use open-wire (ladder) line for this antenna since it has even lower loss than TV ribbon, but in this particular isolated tropical paradise, such a rarity simply cannot be found.

One note: When using TV ribbon with a fairly high swr, you can't get away with high power. You would fry the line at current loops, and arcing would be very likely at voltage loops. A power output of about 150 Watts is the highest I would dare employ.

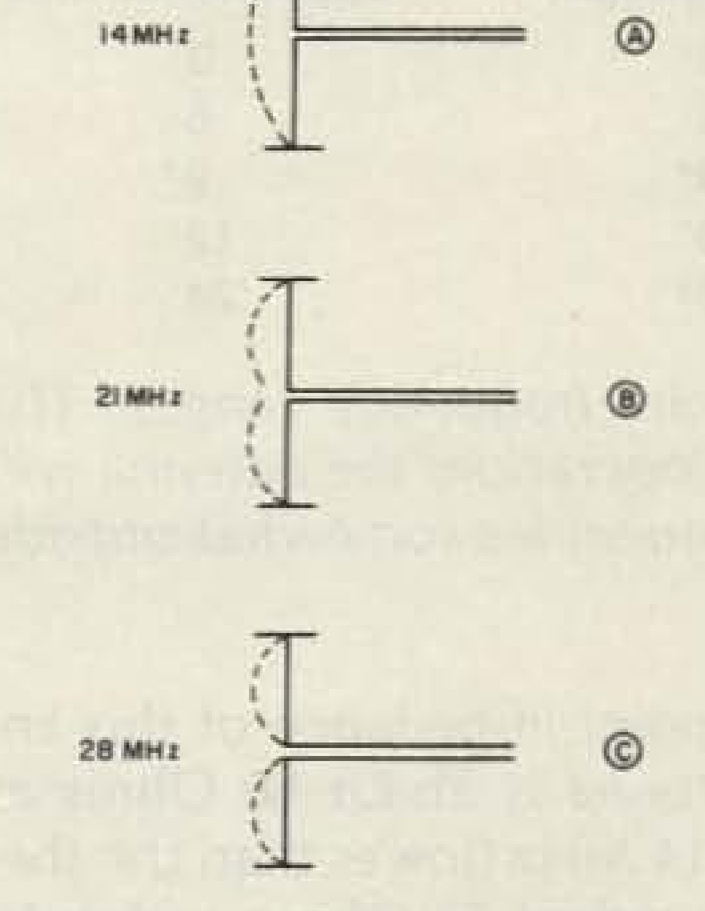


Fig. 3. Current distribution (theoretical) for the antenna at 14, 21, and 28 MHz. Some gain occurs at 21 and 28 MHz as a result of the dual current loops.

Construction

Aluminum tubing would be ideal for constructing this vertical dipole. I chose galvanized-steel electrical conduit for two reasons: (1) This area can be quite windy at times, and (2) none of the hardware stores nearby had any aluminum tubing. A complete parts list is given.

The bottom section of the antenna is identical to the top section except that 3/4-inch tubing is used on the bottom and 1/2-inch tubing is used on the top. The two sections do not telescope perfectly; there is some clearance. Wrap the lower 2 inches of the top section with plastic electrical tape until the sections telescope perfectly. Insert the top section 2 inches into the bottom section, and put more electrical tape just above the top of the bottom section to keep the top conduit from sliding down. This provides a mechanically strong center insulator (Fig. 4).

The top and bottom capacitance hats are made by first cutting each of the aluminum "slats" in half, giving four 3-foot sections. One end of each section is then bent at a right angle (Fig. 5). Hose clamps are used to attach the slats to the ends of the conduits (Fig. 6). The

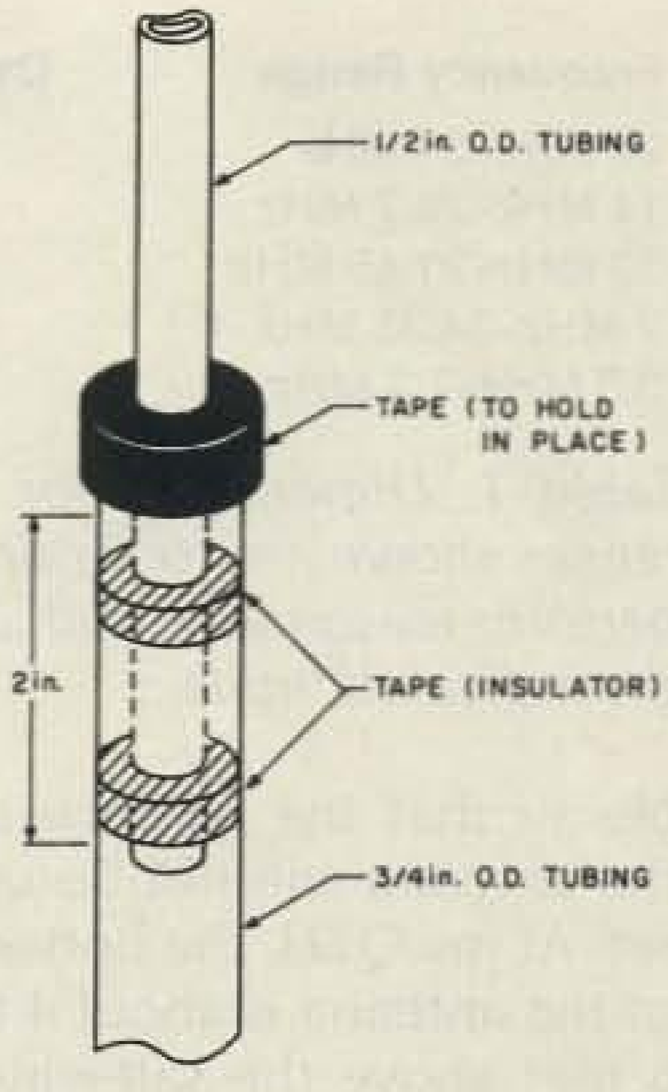


Fig. 4. Construction of the center (feedpoint) insulator.

completed antenna looks very much like a capital letter I—in fact, if you put it together right, exactly!

The parallel-wire line is attached to the feedpoint, or the center of the antenna, using hose clamps. It is a good idea to tin the ends of the feedline wires, especially if you live in a place where corrosion could be a problem (such as this QTH). It is best to wrap the contacts with tape before putting on the hose clamps. After the hose clamps have been secured over the insulated contacts, twine or electrical tape should be used to prevent undue strain on the wires at the feedpoint (Fig. 7). Plug the top of the antenna with the cork.

These procedures completed, the antenna is ready to be mounted. There are numerous ways of mounting a vertical antenna, and the particular method you use is up to you. I roped the base of the antenna to a wooden pole on the dock, using small wooden blocks as insulators (see Photo A). This is a rather sloppy way to do it, but I was more interested in DX than aesthetics. The main consideration is that the base of this antenna is not at a current loop but at a current node (voltage loop). This makes it essential that the base mounting have as little capacitance as possi-

Frequency Range	Overall Height	Overall Width of Capacitance Hat
28 MHz-54 MHz	10′	3′
14 MHz-29.7 MHz	20′	6′
10 MHz-21.45 MHz	30′	9′
7 MHz-14.35 MHz	40′	12′
3.5 MHz-7.3 MHz	80′	24′

Table 1. Dimensions for various frequency ranges. The ranges shown are for optimum operation; the antenna will perform reasonably well at frequencies somewhat outside the indicated limits.

ble so that the balance of the antenna will not be upset. At my QTH, the bottom of the antenna is about 4 to 6 feet above the salt-water ground plane—sufficient clearance to minimize imbalance that might be caused by capacitance between the ground plane and the bottom end of the antenna.

Having strung the feedline from the antenna to the station and having made sure that the line ran away from the antenna at a right angle for as great a distance as possible, the testing phase began.

Testing

To my dismay, the antenna failed at first to tune up on the fundamental band of 14 MHz. It tuned up fine on 21 and 28 MHz. It refused to accept power at 7 MHz, but to my astonishment, it was possible to get a very low swr at 3.5 MHz.

Open-wire lines, although relatively low in loss even when the swr is high, have a peculiar idiosyncrasy. The impedance at the station end of the line can vary tremendously depending on the length of the line. I would imagine that the feedpoint impedance of this antenna is about 60 Ohms at 14 MHz (lower than the theoretical 73 Ohms, owing to the capacitance hats).

The TV ribbon has a characteristic impedance of 300 Ohms. This means that the swr is 300:60, or 5:1. If the feedline were exactly 1/2 wavelength long, the impedance at the station end would be 60 Ohms, a manageable value. But it could range as high as 1,500 Ohms (300 x 5) or as low as 60 Ohms (300/5). Many transmatches will handle impedances of several hundred Ohms, but it is expecting quite a lot if you want one to match an impedance of 1,500 Ohms. I concluded that the line length was such, at 7 and 14 MHz, as to result in an impedance too high for my transmatch to deal with. This problem proved to be fairly simple to solve: All I had to do was cut the line length by a few feet. I did this by routing it through a different window. Adding a few feet of line would have worked just as well, but it is always desirable to minimize the line length to get the least amount of loss.

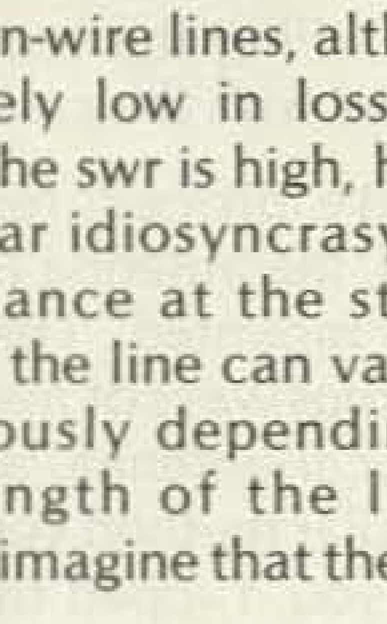


Fig. 5. The aluminum slats are bent at one end to facilitate attachment to the top and bottom of the antenna.

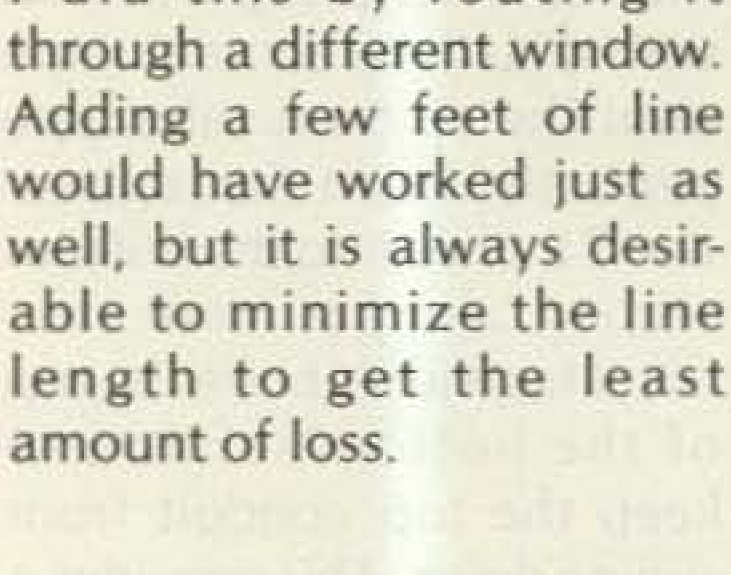


Fig. 6. Physical attachment of the slats.

Finally I got this antenna to tune up on all bands, 3.5 through 29.7 MHz. It was time to check it out. I chose 15 meters first.

I must confess to a certain fondness for QRP, especially when it comes to antenna testing. You don't test a new antenna with a kilowatt—even a battery of light bulbs will get some DX when using that much power. You don't use even 200 Watts output, nor 100 Watts, nor, in my opinion, 50 Watts. If you want to find out how well an antenna really works, you use very low power—something like 5 Watts. That is the output power I employed to test this antenna.

Caribbean DX came easily on 15 meters during the daytime. The ideal ground plane, a southeastern exposure, and the low angle of radiation worked together to give me 589 and 599 reports consistently on CW. Even from "stingy" stations which had no compunction about giving out 549 or 559 reports to their contacts (DX stations don't have to be generous), I got 589 and 599 reports—with five Watts.

On 20 meters, the situation was comparable.

On 40 meters, contacts were harder to make. I did not expect that this antenna would work very well on 40 meters since it was originally designed to work at 10 MHz and above. (I don't have 10-MHz capability yet, so I could not test this antenna at the 30-meter paradise.) I did have a few rag-chews amidst the heterodynes of the shortwave broadcast stations, but the reports were marginal.

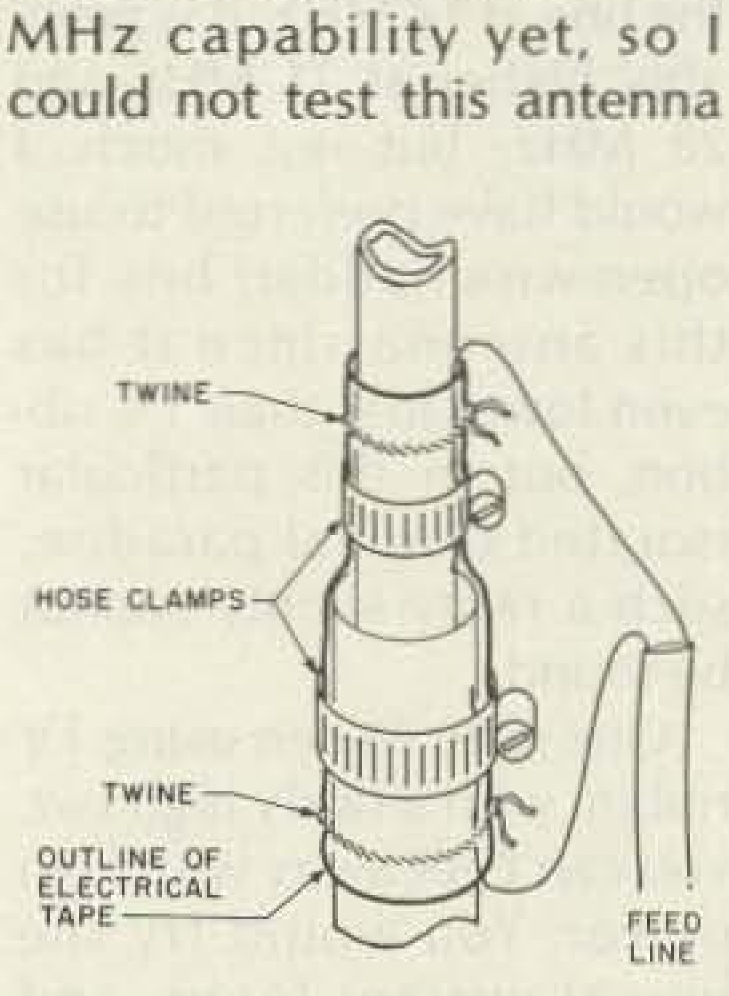


Fig. 7. The feedline is connected to the center of the antenna using hose clamps and electrical tape (see text for details).

Using this antenna at 3.5 MHz gave no surprises. The fact that it tuned up was evidently a coincidence, resulting from the line length and the length of the antenna elements. A few contacts were made, but with a 20-foot antenna and 5 Watts of output power, you wouldn't expect spectacular reports, and they weren't. All of the stations I contacted, moreover, were in the continental United States, opposite the salt-water exposure.

When I tried to test this antenna on 28 MHz—where it should have a theoretical gain of 5 to 6 dB—I had a problem. There was no one on the band. I checked the sun with a telescope and found a possible reason. Its yellow disk was as perfect as could be. Not a spot on it.

Conclusions

I began with the belief that there could be no reason why this antenna design should not work, at least at frequencies of 10 MHz and above. Test results have shown that the antenna does indeed work.

Larger versions of this antenna can, of course, be built. In the ideal case, the antenna height should be between 1/2 and 1 wavelength at the desired operating frequency. A height of less than 1/2 wavelength would result in reduced radiation resistance and, therefore, lower efficiency. A height of more than 1 wavelength would cause the angle of radiation to increase, and this would be detrimental to DX operation. This antenna, whatever its size, is therefore workable over only a 2-to-1 frequency range for optimum DX.

Capacitance hats are not really necessary with this an-

Parts List

1	10′ steel or aluminum conduit, 1/2″ o.d.
1	10′ steel or aluminum conduit, 3/4″ o.d.
2	Aluminum "slats," 6′ long by 3/8″ wide
4	1″ hose clamps
1	Roll electrical tape (plastic)
1	Base mounting apparatus (up to builder how to mount)
1	Cork for plugging the top
1	Length of parallel-wire line

tenna, but I have always believed in using them because they increase the bandwidth of any antenna. They also lessen the physical length necessary to get half-wave resonance on a given frequency. Some physical dimensions of this antenna, for various frequency ranges, are given roughly in Table 1. You might want to build an antenna similar to this one for operation at frequencies of 7 to 14 MHz, for example, or even 3.5 to 7 MHz if you happen to have the real estate.

Don't forget that while the optimal DX frequency range of this antenna is 2 to 1, it can function very well above the maximum frequency and below the minimum. A good radial system consisting of wires buried in the ground or run along the surface of the earth will enhance the performance (unless you happen to live on the shore of a large body of salt water, in which case radials aren't really needed at all).

I would recommend the use of open-wire ladder line and not TV ribbon, if you can find such line in your locale.

A good transmatch is an absolute necessity.

It is also helpful if you have neighbors who don't mind the looks of a bizarre antenna such as this one. Who knows—you might be communicating with hostile aliens from another galaxy. ■

K. C. Jones KA8RCJ
620 Meadow Drive
Newark OH 43055

Six for Two

Get range-tested 12-dB gain for under $5! K.C. Jones engineered this 2m delta beam for maximum bang per buck.

Here it is, just what the world needs, another article on two-meter antennas. It has been so long since STS-9 touched down that one would think enough has been said about the construction of two-meter antennas for working the shuttle. Well, I wanted to get my two cents in before I consider the case closed.

I had quite a lot of fun building this antenna and I learned a little in the process. One of the things I learned was that in ham radio it is not necessary to buy when you can build—and the learning experience is great. I will show you the somewhat unusual way I built this antenna while spending very little money.

My need for a two-meter antenna with gain and directivity came about in the same way it did for many others . . . the scheduled launch of STS-9 was drawing nigh. Since money is always tight in our household, my only options were to build an antenna or forget the idea of working the shuttle entirely.

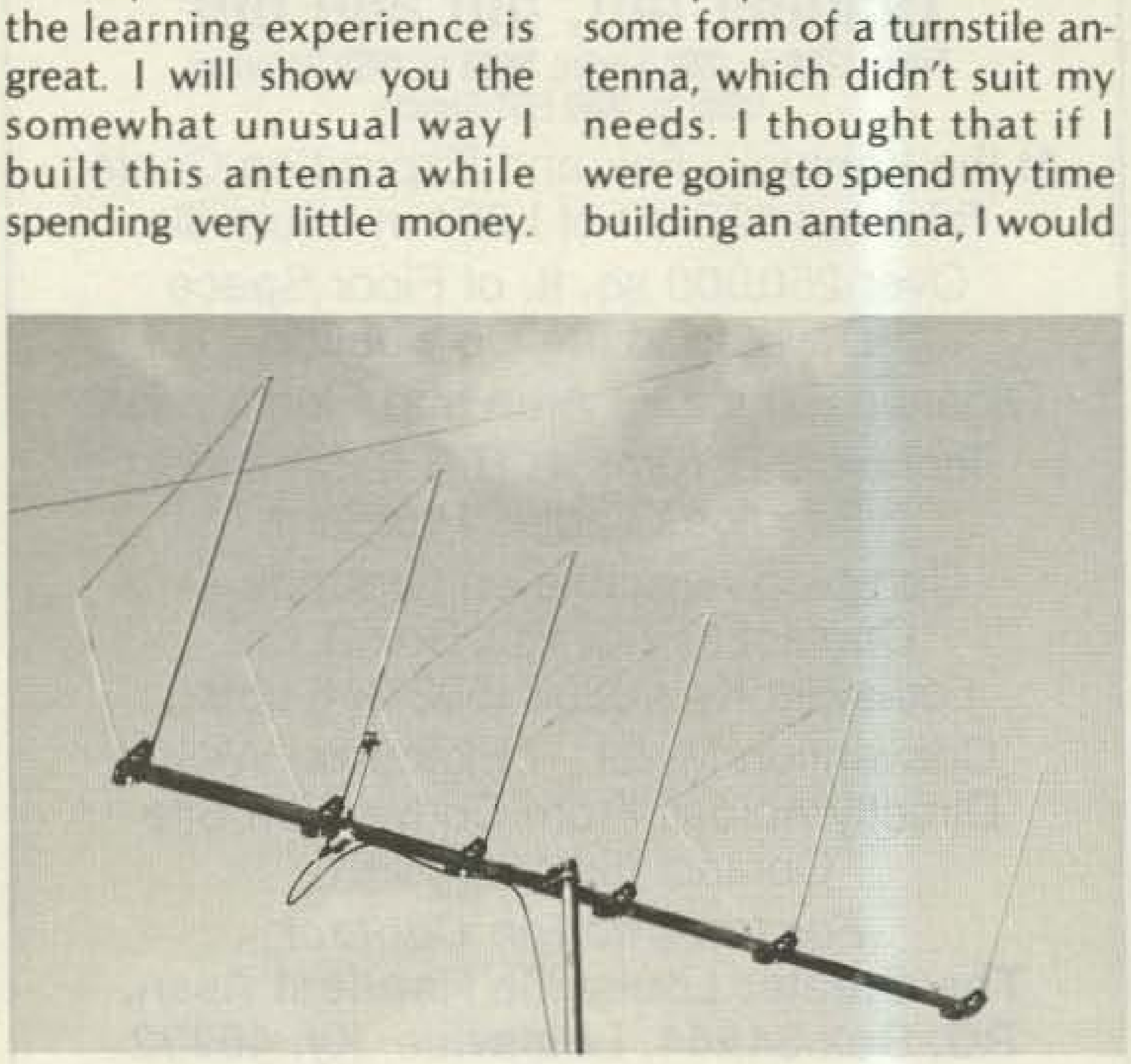
Nearly all of the ham publications at the time contained an article about building an antenna for working the shuttle. The most popular seemed to be some form of a turnstile antenna, which didn't suit my needs. I thought that if I were going to spend my time building an antenna, I would like to be able to use it for some other purpose besides the shuttle.

Remembering an old TV antenna in the attic and finding an old 1970 *ARRL Antenna Book* brought about interesting possibilities. I had visions of some sort of beam antenna built entirely of salvaged parts from the TV antenna. A simple yagi would do the job, or maybe a quad for both vertical and horizontal polarization. But for some reason, the three-element delta-loop configuration in the book caught my eye.

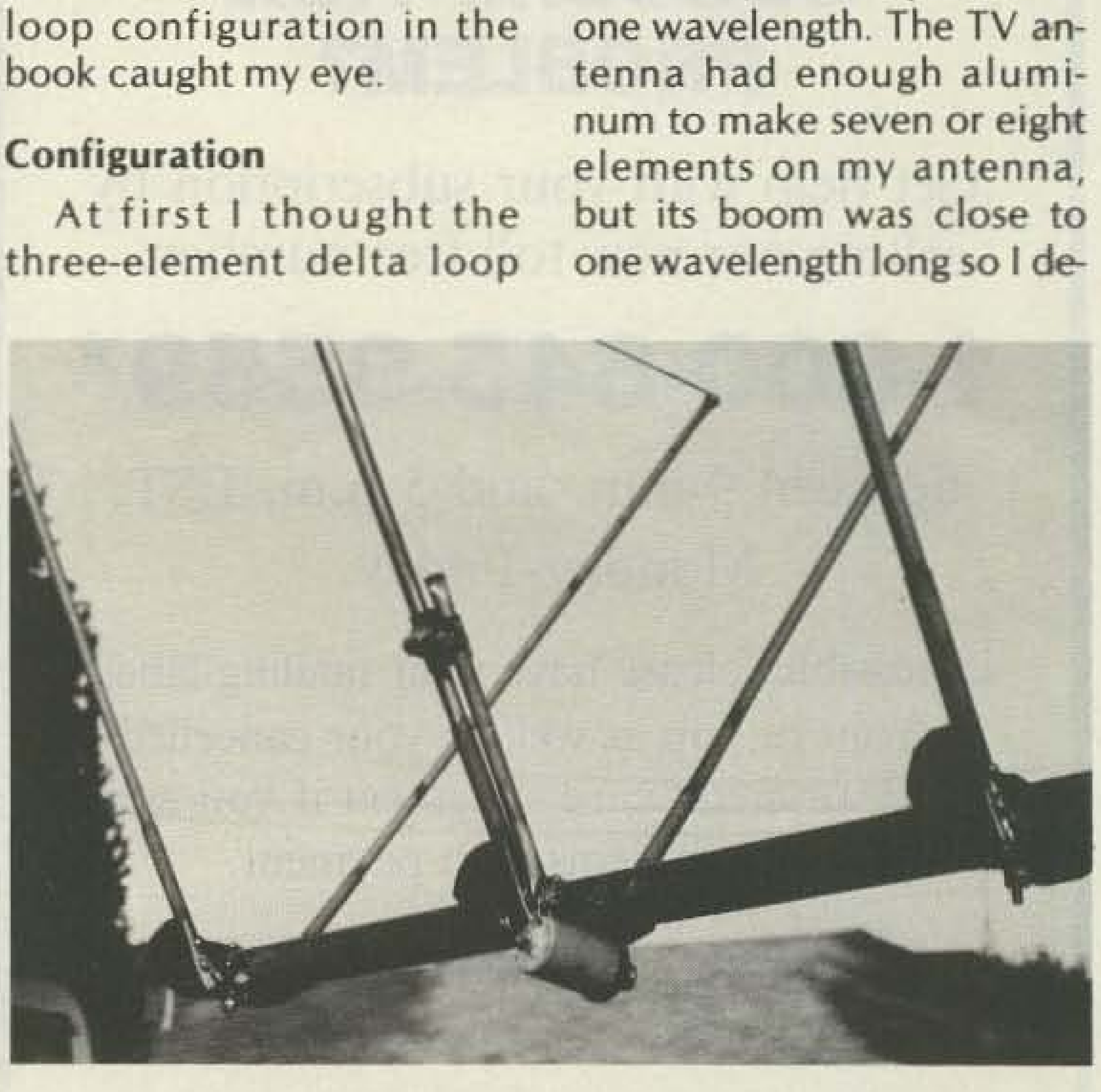
Configuration

At first I thought the three-element delta loop would be the antenna that I would build; however, I soon realized that five or six elements would be possible with the amount of aluminum that could be salvaged from the TV antenna. The first step I took was to come up with a design on paper.

A graph in chapter four ("Multi-Element Arrays") of the *Antenna Book* showed that the length of the boom of a five-element yagi should be just under one wavelength and a six-element should be just over one wavelength. The TV antenna had enough aluminum to make seven or eight elements on my antenna, but its boom was close to one wavelength long so I de-



The six-element delta-loop antenna for 146 MHz.



The gamma match. There is a variable capacitor enclosed in the film can.

cided on building the delta loop with six elements.

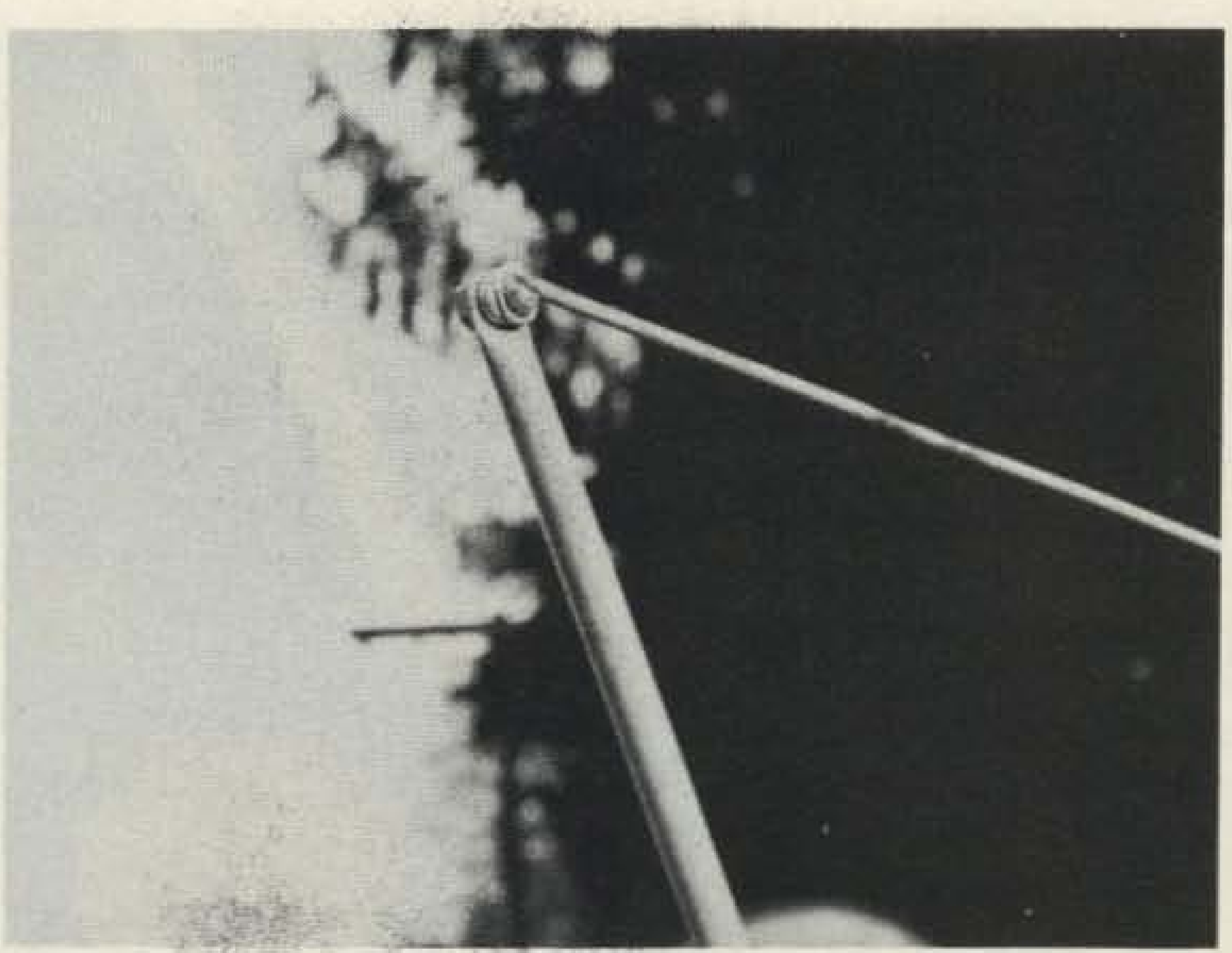
Now that I knew I would use six elements, finding the size of each element was the next bridge to cross. The *Antenna Book* showed the distance around the driven element to be 82 inches. This was arrived at by using the formula, length in feet = 1000/f (where f is the frequency in MHz) found in the chapter dealing with rotatable antennas. I made the reflector five percent larger than the driven element, using the formula, length in feet = 1050/f, and by using the formula, length in feet = 950/f, the first director was made five percent smaller. The sizes of these elements followed closely the sizes of the elements described in the article in the *Antenna Book*.

Now I had three directors to add. I knew the additional directors would decrease in size from the driven element, but not at the same five-percent rate. I made director #2 eight percent smaller than the driven, director #3 ten percent smaller, and director #4 eleven percent smaller than the driven element.

Here is a list of formulas for the length of each element, giving the distance around the loop in feet:

Reflector	—1050/f
Driven	—1000/f
Director 1	—950/f
Director 2	—920/f
Director 3	—900/f
Director 4	—890/f

The angle at the base of the loop should be 65 degrees, according to the article; the other two angles will be equal at 57.5 degrees each.



The ends of each outside element were flattened so that the top piece could be attached with 10 x 24 machine screws.

Now I had six elements. The next question was where to place them on the boom. The reflector and last director were easy, one on one end and one on the other. For the spacing of the other elements, I had to go back to the *ARRL Antenna Book*. In the chapter on "Multi-Element Directive Arrays," I found a table showing optimum element spacing for multi-element yagi arrays. In this table, the formula for the minimum and maximum distances between elements was given. The only thing I had to do was to choose a formula that stayed within the table's guidelines. I also had to remember that the spacings between all the elements had to add up to the length of the boom.

Keeping the above in mind, here are the formulas I came up with for the element spacing on my six-element delta loop, where L = wavelength in inches.

Reflector/Driven	= .17L
Driven/Director 1	= .15L
Director 1/Director 2	= .17L
Director 2/Director 3	= .22L
Director 3/Director 4	= .28L

Fig. 1. shows the antenna that I was going to build. (The formulas were used as starting points and the actual spacing varied slightly.)

Construction

Now that I had an idea on paper, the next step was to try to build the antenna, but first, I had to disassemble the TV antenna. It was put together almost entirely with rivets, easy to drill out to remove the elements. Everything worthwhile was salvaged. The phasing harness was made of heavy aluminum wire which I carefully straightened out and used later to make the top section of each delta loop. The wire was carefully measured out, for when I finished cutting the pieces that I needed there were only four inches left! One of the plastic insulators which was used on the phasing harness was later fashioned into the spacer for the gamma match.

When I removed the molded-plastic brackets which attached the elements to the boom, I discovered that these same brackets could be reworked to hold the elements in the vertical position rather than horizontal, as on the TV antenna.

Having already figured the dimensions of each of the six loops, I began to cut the elements that were removed from the TV antenna to form the outside elements of each loop on my antenna. The ends of the elements that had been attached to the brackets had been reinforced originally, so I used the same end to attach to the reused bracket on my antenna. The other ends were then flattened so that holes could be drilled in the flat portion to accept screws. After cutting and drilling, the outside elements were cleaned on a buffer to remove the oxidation from all the areas where a connection would be made.

Now each pair of outside elements was mounted to a plastic bracket. Originally done with a rivet, I used 10 x 24 machine screws. At this time each element looked as shown in a), in Fig. 2. Next, I took the heavy aluminum wire which was so carefully cut earlier and

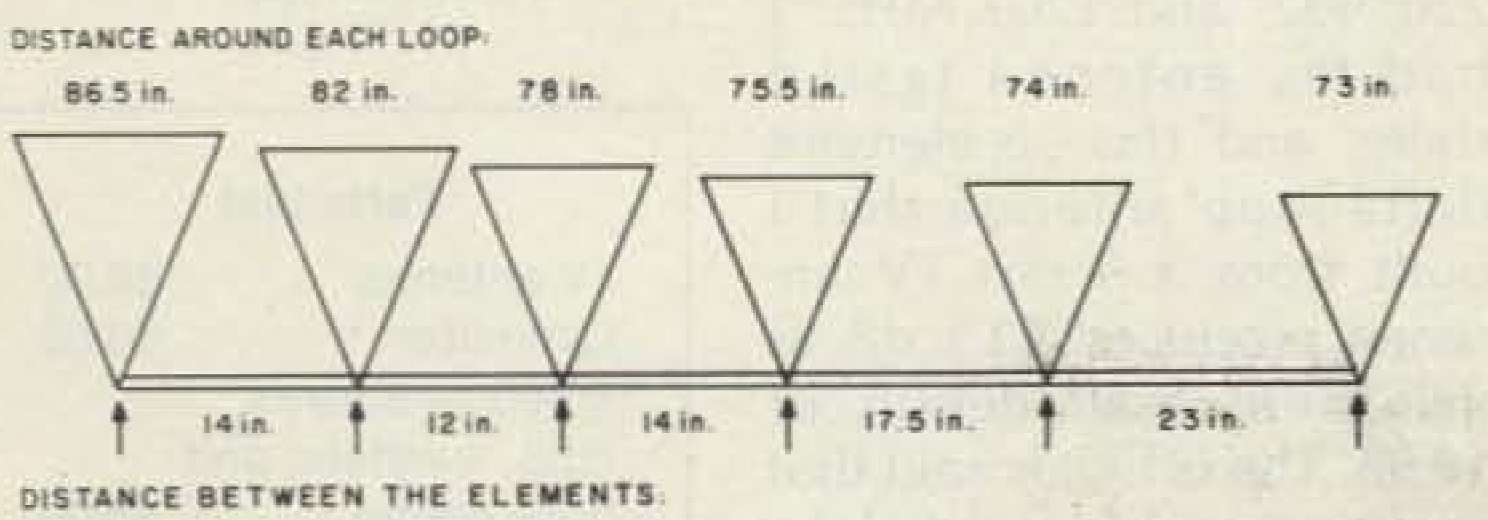


Fig. 1. Here are the dimensions I came up with to build the six-element delta loop.

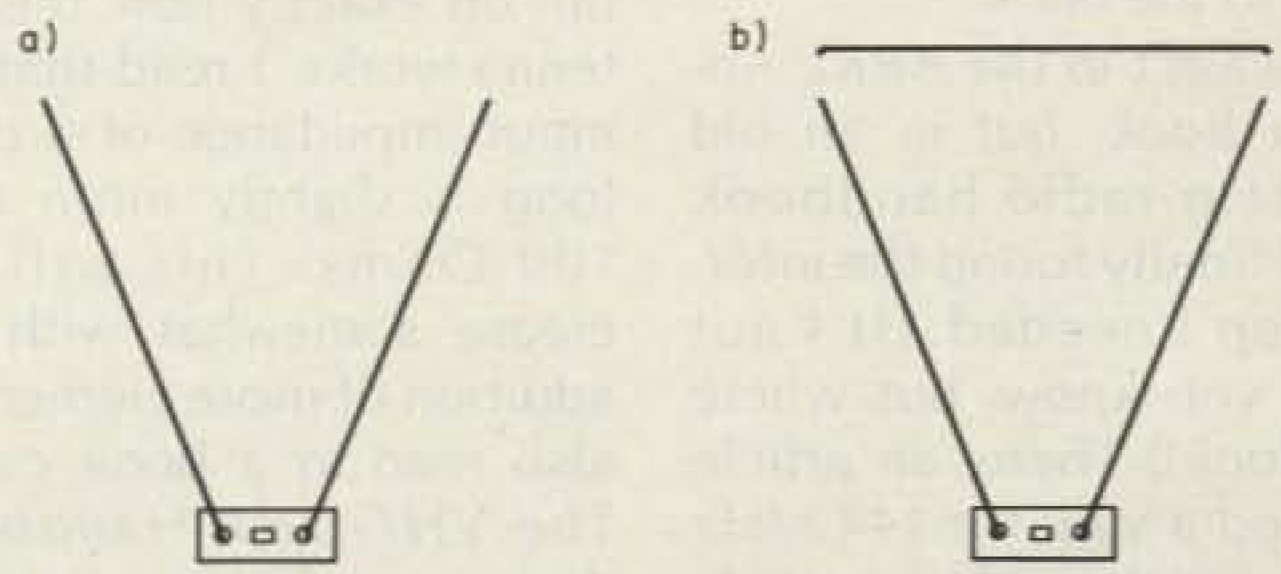


Fig. 2. With eyes formed in the ends of the horizontal pieces, they are attached to the ends of the outside elements, which were flattened and drilled earlier.

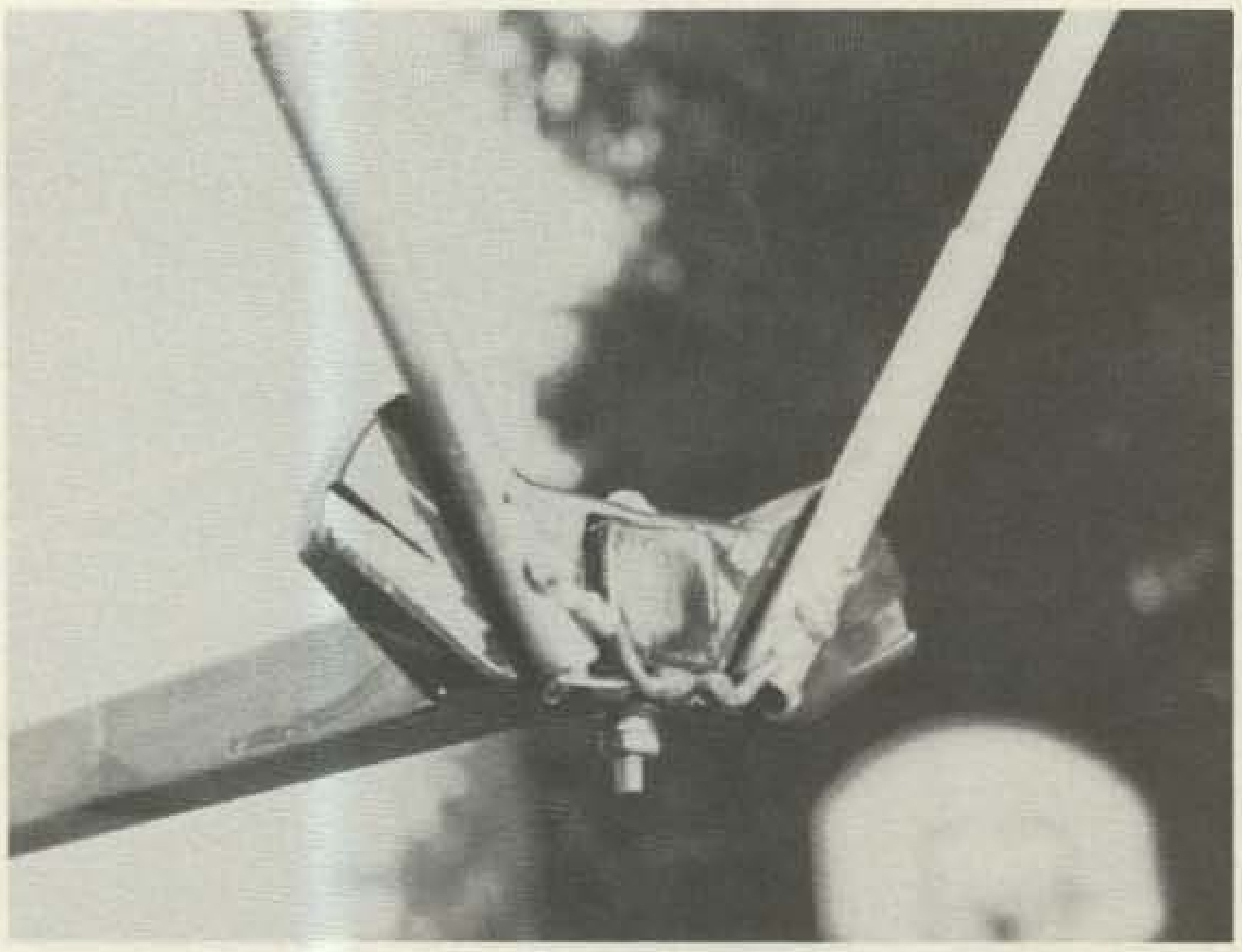
formed small eyes in the ends of each wire. Then each piece of wire was attached as the top horizontal piece of the element it was cut for. This also was done with 10 × 24 machine screws—see b) in Fig. 2.

Now that I had six complete elements, I drilled the boom at the points mentioned earlier. The boom and each plastic bracket were drilled so as to accept a 10×24 screw. Next, I slid each element onto the boom to its proper location.

Since each outside element was mounted to plastic, each loop was open at the bottom. Also, each element was insulated from the boom. To close each loop, I used #14 primary wire. At this time I also made each element common to the boom with the same wire. This was done simply because the article in the *Antenna Book* showed that the elements of the delta loop were all common to the boom. (At some later time I plan to make each element insulated from the boom to see what, if any, changes occur.)

Now that each element was mounted to its proper position on the boom, I had to figure a way to feed the antenna. The article showed that one way was with twinlead. This would not be acceptable for me as I had no way of matching it. The article also showed the antenna being fed through a gamma match made of RG-8 coax. I tried this, but it proved to be difficult to work with. After fumbling around with some other ideas, I decided to go back to the book.

It wasn't in the *ARRL Antenna Book*, but in an old amateur-radio handbook that I finally found the information I needed. (It's not what you know, but where you look!) There, an article showed a yagi for 144 MHz being fed through a variable capacitor (50 pF) and a gamma rod five inches long. I found a capacitor in the junk box that I thought was around 0 to 30 pF, and the gamma rod was made from a piece of aluminum element from the TV antenna.



A view of the bracket. Note the #14 wire strap that closes the loop and makes the element common to the boom.

The capacitor should have sufficient plate spacing to handle some power. The five-inch gamma rod didn't tune quite the way I thought it should, so a seven-inch gamma rod was tried and seemed to give the proper match. I used a plastic insulator from the phasing harness on the TV antenna as a standoff for the gamma match and a hose clamp as a shorting strap. The variable capacitor was sealed in a plastic 35mm film can.

At this time I sealed all connections with spray-on clear lacquer. This included spraying the film can to make it air tight.

Theory

I am not an engineer, so I won't try to go into any detail on exactly how this antenna works. I read that the input impedance of a delta loop is slightly more than 100 Ohms. This will decrease somewhat with the addition of more elements. I also read in a book called *The VHF-UHF Handbook* that a good rule of thumb for finding the size of the variable capacitor on a gamma match is to allow 15 pF per meter of wavelength. This followed closely with what I used on my antenna.

The size of the driven element doesn't need to be exact because, like a quad, the delta loop seems to be broadbanded. All of my calculations were based on an antenna for 146 MHz, and the antenna was built and tuned to 146 MHz. A 30-Watt rig was used, and a wattmeter that read in reflected power, not swr. At either end of the band there was only a very slight amount of power being reflected, with the wattmeter showing a full 30-Watt output. Using a field-strength meter, there seemed to be a very narrow pattern off the front of the antenna and a small lobe off the back. I have not yet tried to draw a pattern of the antenna.

An antenna range was set up at the '84 Dayton Hamfest on Sunday of that event, by a group testing forward gain of home-brew and commercial antennas for 144, 220, 432, and 1269 MHz. I had my antenna tested there, and this six-element delta-loop antenna that I built from a scrap TV antenna produced 12.1 dB of gain with a gain density of 10.98. The officials said that the range produced slightly-higher-than-actual results for short-boom yagis. At any rate, I was very pleased with how well the antenna performed, and I also won a prize for the home-brew 144-MHz category.

Conclusion

This antenna is not original in design; the delta loop has been around for a long while. The formulas I used for element size and spacing can be found in books that could be in any ham's library. The point I wanted to make was that I took an old TV antenna that was destined for the trash can, did some research, worked out a few design problems, and built an antenna that performs as well as one costing ten times as much or more. I learned some things about antennas and about problems associated with VHF that don't occur at HF.

There are plenty of unused TV antennas in the air today with the ever-growing use of cable services. As a matter of fact, just about a month ago I took down a TV antenna for a friend, and the only fee was that I got to keep the antenna and the 30-foot mast pipe. I plan to make a seven-element yagi out of this antenna. With just a little looking around, one old TV antenna can be found to turn into a nice beam antenna for the VHF or UHF bands.

By the way, the "ham-in-space aficionados" have probably already checked out my call, but for the rest of you who might be reading this, no, my call was not one of those heard by Owen Garriott in the spacecraft, *Columbia*. I was, however, able to copy him on two separate passes across the Midwest!

Not too bad! ■

Parts List

TV antenna	$0.00
Capacitor	$0.00
Machine screws, nuts, washers, and hose clamp	$5.00
Total	$5.00

Dr. Frankenstein's CB Beam

Ravage the countryside with ten-meter rf! Create your antenna with refuse from the Citizen's Band graveyard.

Robert Matthews KA3JOM
1910 Altavue Road
Baltimore MD 21228

After receiving so many inquiries and letters from numerous countries throughout the world asking about the design and dimensions of my 10-meter antenna, I decided that it was time to write an article and reveal the facts about this unique piece of hardware. So, if you enjoy serious 10-meter DXing, read on.

The 10-meter band has always been my favorite band for good DX contacts. It has plenty of operating space with its 2 MHz of band spectrum. The 10-meter band is one of the best DX bands during the peak sunspot cycle, and during low sunspot activity it offers very good daytime DX propagation—provided you have an adequate antenna system.

If you're a Novice or have just upgraded to General class and have not yet decided which transceiver you would like to purchase, 10 meters offers a possible cheap solution: working QRP with a converted Citizens Band SSB transceiver. If you do not own one, they can be found at hamfests at reasonable prices.

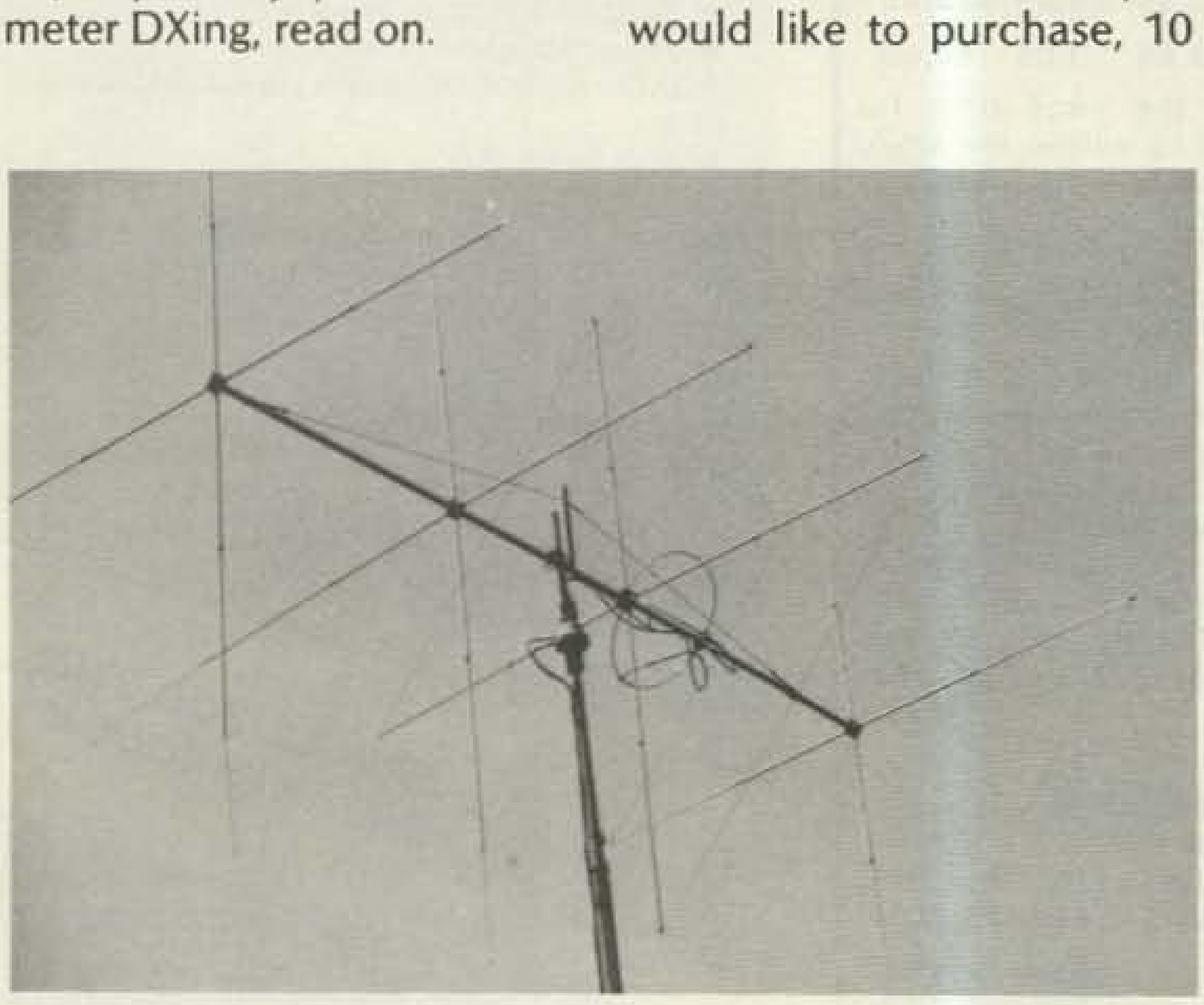


Photo A. The CB to 10-meter beam.

Living in a highly populated residential area, with television Channels 2 and 5 being watched regularly by neighbors, presented a problem for me with TVI complaints whenever I cranked up the amplifier on 10 meters. Every effort was made to tame the TVI which my amplifier caused, but the end result was that my signal was overpowering that of the television stations located forty miles away.

Thinking of how to increase my gain and directivity for DX communications on 10 meters led me to put the amplifier in the closet for a while and concentrate on a highly efficient antenna for my 10-meter operations. Obviously I couldn't erect a monstrous beam on a small residential lot, so whatever antenna I would choose to erect would have to have each element operating to its maximum efficiency.

The antenna I chose to build was a compromise between two of the leading directional antennas used in the 11-meter Citizens Band. These two antennas were manufactured by the Avanti Antenna Company: the PDL 2 and the Moonraker 4.

I chose the PDL 2 design for my driven element because of these factors:

- It is an actual 1½-wavelength antenna, claiming 5 dB gain over a ½-wave dipole.
- The system is easily adjustable with the gamma rods.
- The PDL 2 offers vertical as well as horizontal polarization.
- The end-to-end length of the element is only 13 feet.

The reflector was of quad design similar to that which is used with both the PDL and Moonraker.

The two directors used were yagi design as used in the Moonraker antenna. The use of quad directors did not show any benefits as far as gain or directivity, so the yagi-style directors from the Moonraker were utilized to keep antenna weight and size to a minimum.

Construction

Both the Moonraker 4 and the PDL 2 booms were used. Assemble the three Moonraker boom sections together to form a total length of 186 inches end to end. Do not fasten these sections until all elements and the mast mount are in place. The PDL boom section can be joined to the Moonraker boom with a wooden dowel or a short (two-foot) section of 1½-inch-diameter aluminum tubing.

Slide both boom sections together over the dowel (or the tube) until they meet. Drill 1/8-inch diameter holes in the ends of the booms; drill a total of six holes, three for each boom end. Make the holes about 120 degrees apart and about six inches from the seam where both booms are joined together. Refer to Fig. 1.

From the short PDL end of the boom assembly, measure exactly 36 inches from the end of the boom. Place a mark at this measurement with a scribe or marking pen. With a hacksaw, saw off this measured 36-inch piece of boom section and discard it. Now your entire boom length should be 207 inches end to end.

Assemble the quad reflector arms as per the PDL 2 instructions. The new length of wire for the reflector will be a total of 442 inches. Measure and mark your wire carefully. This will give each side 110.5 inches. Before tightening the hose clamps on the fiberglass spreaders, make sure that the quad reflector is not bowed due to over tension.

The PDL driven element is assembled as per the PDL instruction manual except for these minor changes: Measure the outer ½-inch aluminum elements from the flat end in and mark at 40 inches. Slide the outer tubing into the 5/8-inch inner tubing to this mark. Measure all four elements in this manner.

Next, the wire for the driven-element assembly must be measured. The wire will have a measurement end to end of 437 inches. This will give each side 109.25 inches. Measure this carefully. Adjust for proper tension as before in the reflector assembly.

Now, from the end of the boom which was sawed off, measure in exactly 87 inches. Place a mark at this point and drill a 1/8-inch hole in the boom. This will be used to anchor the plastic hub of the driven element to the boom assembly.

Temporarily slide off the larger 1¾-inch boom section from the Moonraker to allow installation of the driven-element assembly. Now hold up the boom, and from the end opposite to the one sawed, slide the assembled driven element onto the boom, with the globe-matching section going on first. Align the 1/8-inch hole in the boom with the hole in the plastic hub. I secured the plastic hub by using a 1¾″ × 1/8 sheet-metal screw. Next, tighten the metal hub of the globe section. When all is tight, reinstall the larger boom section which was removed.

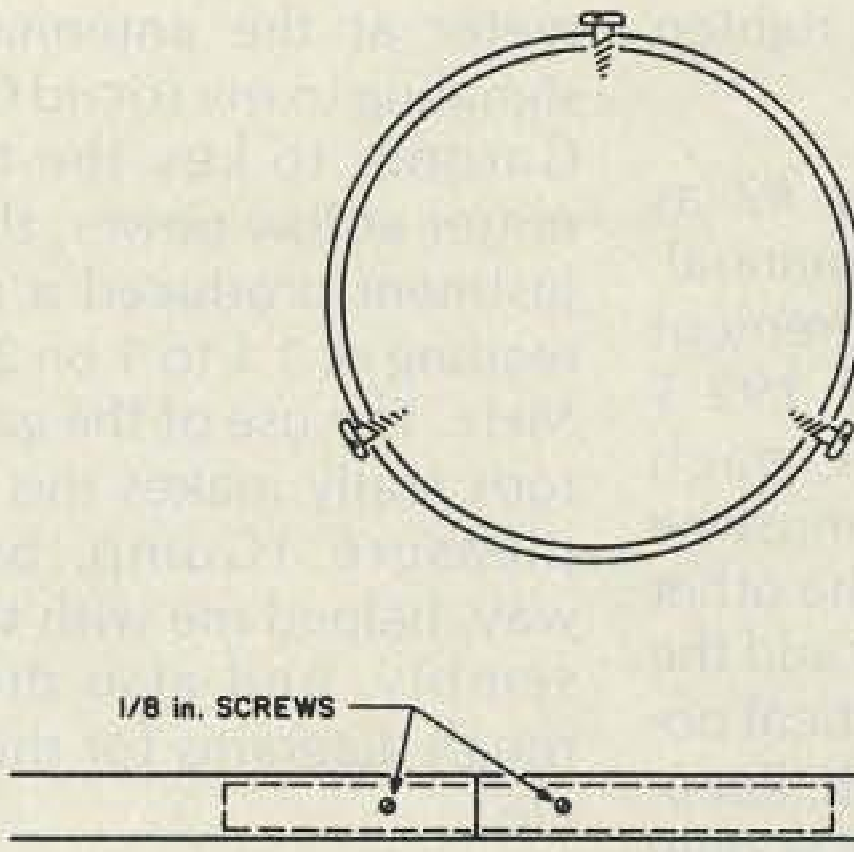


Fig.1. The booms are joined together with a section of dowel.

Now, from the sawed end, slide on the reflector and align the elements with those of the driven element. Tighten the hub, but make sure you have about half an inch of clearance from the hub to the edge of the boom.

After both elements are aligned, tighten all bolts securely. Now measure exactly 26 inches from the plastic hub out towards the front. Place a mark at this point on the boom. Next, slide on the mast mount from the Moonraker and center it at the marked point. Align the mast mount with the elements on the boom and tighten.

Next, assemble the two Moonraker directors as per the Moonraker instruction manual. Before tightening the hose clamps to secure the outer elements, label one element assembly #1 and the other assembly #2. Next, with a tape measure, set the element length of director #1 to 195 inches tip to tip. If you wish to retain the vertical elements, do the same with the other two elements on the hub.

If you wish not to have vertical polarization, then assemble the hub with all four of the 36-inch elements but use only the two outer elements in place for the horizontal polarization. After the tip-to-tip measurement of 195 inches is made, tighten the two hose clamps.

Next, slide the #1 director assembly onto the boom. Measuring it a distance of 56 inches from the plastic hub, align the #1 director with the

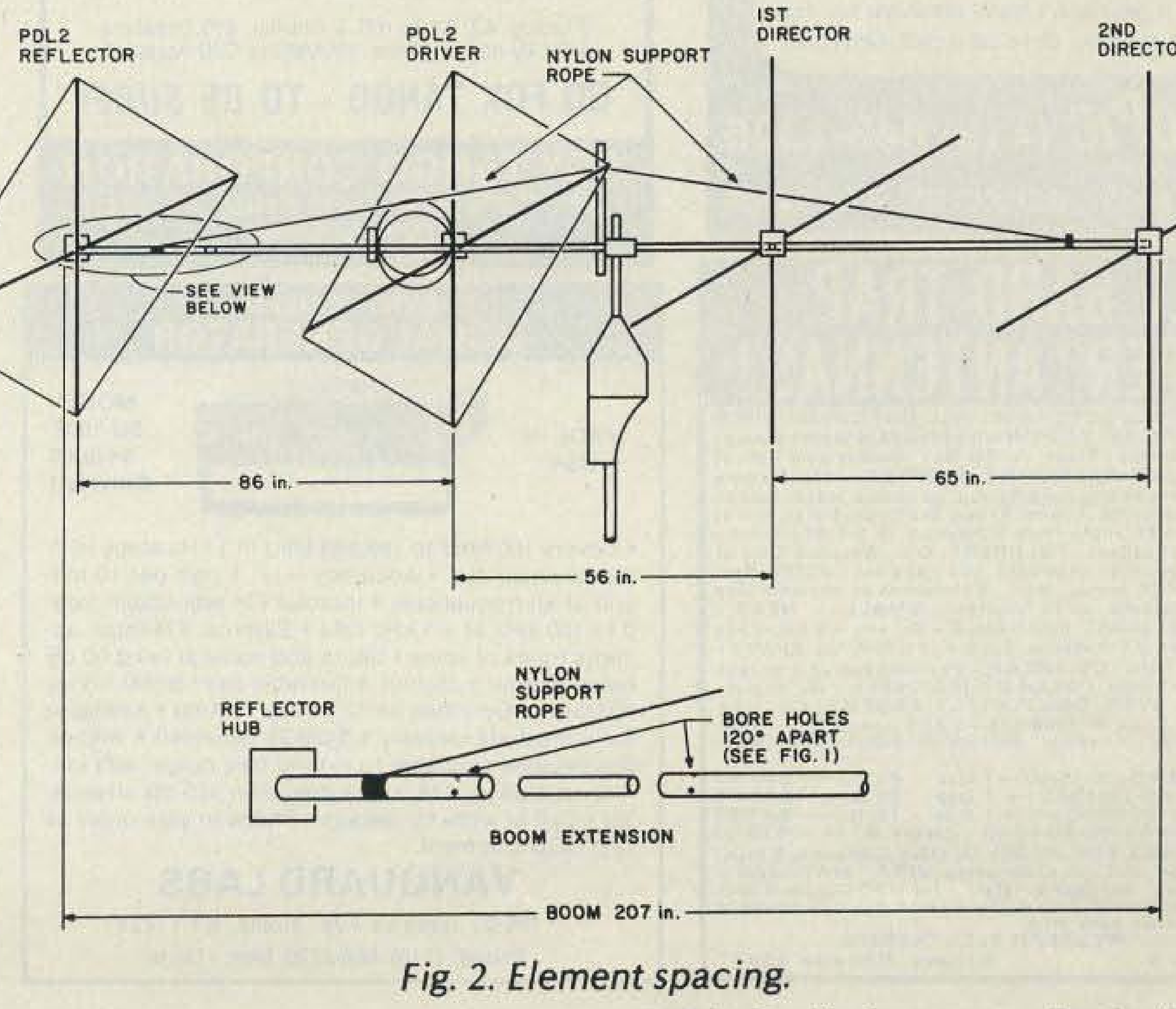


Fig. 2. Element spacing.

driven element and tighten it securely.

Assemble director #2 as per the instruction manual. The tip-to-tip measurement of this element is 192.5 inches. Remember, each half of an element must be the same length as the other half. Again, you may add the two elements for vertical polarization if you wish, keeping in mind that this is only an option, not a necessity.

Next, with a tape measure, measure a distance of 65 inches out from the #1 director. Make a mark at this point with a scribe. Slide on the #2 director assembly, align it with director #1, and tighten it to the boom at the point marked.

Adjustments

This completes the construction of the antenna assembly. Next comes the fun part, adjusting the swr. This is not really a big chore, though. After placing an swr meter at the antenna and signaling to my friend Gump Gardner to key the transmitter at low power, the adjustment produced a meter reading of 1.1 to 1 on 28,600 MHz. The use of the gamma rods really makes this job a pleasure. (Gump, by the way, helped me with the assembly, and also did the rough diagrams for this article.)

The shack installation was composed of RG-213/U; this cable has a velocity factor of .66 and is a good quality coaxial cable. The distance from the shack to the top of the tower was measured along with a few feet for slack. The total distance in coax was made in half-wave multiples. (492 × .66)/f = half wavelength of coax with a velocity factor of .66.

Now that we have most of the hard work done, it's time to get into the control seat and see just how well everyone else on the band can hear us with our new antenna; after all, isn't this what we're really concerned about?

The first station I heard was a CE7. Report was 59, not bad for only 50 Watts output. Next I received a ZL1. His report was 53, still not bad for the low wattage that I was running. Next station to call was a W7 in Arizona; the report he gave was 58 and loud and clear modulation.

Conclusion

Well, after having my converted CB beam up for over a year now, I must say that I'm pretty pleased with the results. Not only is the antenna working very well, but I am surprised when many of the hams I talk with begin asking me questions about the construction of my antenna. Many stations, especially the Europeans, send questionnaires along with their QSL cards. I knew that the antenna was working well for me, but I guess I really didn't realize how well others were receiving me and how interested they would be after learning that my output was only 50 Watts PEP.

The antenna is very broadbanded: 28.0 through 29.6 MHz. The highest the swr reached was 1.6 to 1. An amazing thing I discovered also was that the antenna had an swr reading of 1.7 to 1 on 21.2 MHz. The directivity wasn't as good on 15 meters, but it amazed me to have such a low swr on this band.

I hope that this article will answer a lot of questions for those of you wishing to build a good beam antenna for 10 meters. Anyway, it just goes to show that you don't need a big amplifier to talk where you want to—just a darn good antenna. Good luck and happy DXing! ■

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SEPTEMBER 8: The 43rd annual Findlay Hamfest, sponsored by the Findlay Radio Club, will be held at the Hancock County Fairgrounds on Sunday, September 8, 1985, from 6:30 am to 5:00 pm. Advance tickets are $3.00; $4.00 at the door. Cut-off for advance tickets is September 1. Tables are $6.00 each. Outdoor flea-market spaces are $3.00 each. Talk-in on 147.75/.15. For more information, write to the Findlay Radio Club, PO Box 587, Findlay OH 45839. BNB361

PRIME SPACE on the classroom wall awaits your super QSL. In return we might send you our QSL of the Week Award. Send your card today and no matter what you will get hung in the Big Apple. WB2JKJ's Crew at Junior High School 22 on Manhattan's Lower East Side wants your wallpaper. BNB362

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FOR SALE: Heath HW-101 with power supply, $225. HBO descrambler filter schematic, $2.00. Send an SASE to J. C., PO Box 6349, Evansville IN 47712. BNB365

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SPECIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received by 73 Magazine *by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial Offices,* 73 Magazine, *Pine St., Peterborough NH 03458.*

TRUMANSBURG NY
AUG 24

The TCARC will sponsor the Fingerlakes Hamfest and Giant Flea Market on Saturday, August 24, 1985, at the Trumansburg Fairgrounds, Route 96, 12 miles north of Ithaca NY. There will be a $2.00 donation at the gate (children under 12 are free). Flea-market parking is $1.00. Indoor tables are $5.00. Talk-in on .37/.97 or .52 simplex. For further information, write TCARC, c/o David G. Flinn, 866 Ridge Road, Lansing NY 14882; (607)-533-4297.

MARSHALL MI
AUG 25

The sixth annual Trunk and Trailer Bash will be held on Sunday, August 25, 1985, from 8:00 am to 3:00 pm, at the Calhoun

County Fairgrounds, Marshall MI. Donation is $2.00 per space and tables are $3.00. Overnight camping is available for an extra charge. For more information, contact CARES, c/o Earl K8UCQ, 110 Perrett Road, Marshall MI 49068; (616)-781-5555.

SEWELL NJ
AUG 25

The Gloucester County Amateur Radio Club will sponsor Hamfest 85 on Sunday, August 25, 1985, from 8:00 am to 4:00 pm, at Gloucester County College, Sewell NJ. Setup is at 7:00 am. Tickets are $2.50 in advance and $3.00 at the gate. Features include a flea market and displays of amateur-radio and computer equipment. Food and refreshments will be available. For information or advance tickets, write to GCARC, PO Box 370, Pitman NJ 08071.

OK CORRAL
TOMBSTONE AZ
AUG 31–SEP 2

Special-event station W7GV will operate from the 4th annual Rendezvous of the Gunfighters, on Labor Day weekend, from the OK Corral, Tombstone AZ. The OK Corral was the site of the shoot-out between the Earp and Clanton factions in 1881. W7GV is the oldest active amateur-radio call in the state. Operations will begin at 1500 UTC, August 31, and will run through 2200 UTC, September 2. Frequencies will be: SSB—28680, 21380, 14280, 7280, and 3730; CW—21130, 7130, and 3730. A certificate will be awarded to all who work W7GV, as well as SWLs. Please send a large 8-1/2 × 11 SASE (40 cents postage) to W7GV, PO Box 36032, Tucson AZ 85741.

LABOR DAY SAFETY
AUG 31–SEP 2

The Tri-City ARC will operate special-event station KA1BB from the Waterford CT I-95 weigh station to promote safe Labor Day holiday auto travel. This event is in conjunction with the third annual Stay-Awake Coffee Stop sponsored by BSA Troop 24 of Niantic CT. Mobile operators are especially encouraged to call. Operation will be from 1700 UTC, August 31, 1985, through 2300 UTC, September 2, 1985, on 14.295, 7.245, and 3.895 MHz phone and 7.130 MHz CW. Talk-in to the coffee stop will be on 146.52 simplex and CB channel 19. QSL via Tri-City ARC, PO Box 686, Groton CT 06340. For further information, please contact Bob Dargel KA1BB, 8 Willow Lane, East Lyme CT 06333; (203)-739-8016 or (203)-446-7325.

BLOOMINGTON IN
SEP 1

The 8th annual Bloomington Hamfest will be held on Sunday, September 1, 1985, from 8:00 am until 2:00 pm, at the 147.18/.78 repeater site, 2335 Vernal Pike off SR 37 bypass. Admission is $2.00. Food will be available. There will be no charge for selling; bring your own table. For FCC VE exams, contact K9PS for details and exam times. For further information, send an SASE to Bob Myers K9KTH, 306 S. Fairview St., Bloomington IN 47401; (812)-332-1105.

LARAMIE-CHEYENNE WY
SEP 6–8

The SHY-WY ARC, the University of Wyoming ARC, and the Northern Colorado ARC will sponsor the sixth annual High Plains Ham Roundup on September 6–8, 1985, in the Medicine Bow National Forest, Yellow Pine Campground, 14 miles east of Laramie, or 35 miles west of Cheyenne, on Interstate Highway 80. Features will include a potluck supper, swapfest, packet-radio demonstration, hat-decorating contest for XYLs and YLs, musical entertainment, and campfire sing-along. There will be no registration fees except a modest Forest Service charge for campers. Talk-in on 146.22/.82 and 146.25/.85. For further information, write to KØHRS, 2204 Vassar Avenue, Fort Collins CO 80525.

WINDSOR ME
SEP 7

The Augusta Emergency Amateur Radio Unit will sponsor the 1985 ARRL-sanctioned Windsor Hamfest on Saturday, September 7, 1985, at the Windsor ME Fairgrounds. Gate donation is $1.00, and camping is $3.00 per night or $5.00 for two nights. There will be a flea market, programs, speakers, commercial distributors, light meals, and the traditional Saturday bean and casserole supper. Talk-in on 146.22/.82. For further information, contact Ron Dishman N1CMZ, 37 Marlboro Avenue, Augusta ME 04330; (207)-623-8351.

UNIONTOWN PA
SEP 7

The Uniontown Amateur Radio Club will hold its 36th annual Gabfest on Saturday, September 7, 1985, on the club grounds located on the Old Pittsburgh Road, just off Rt. 51 and the 119 bypass, in Uniontown PA. Registration is $3.00 each or 2 for $5.00. There will be free parking, free coffee, and free swap and shop with registration. There will be plenty of good food at the refreshment stand. Talk-in on 147.645/.045 and 144.57/.17. For further information, contact UARC Gabfest Committee, c/o John T. Cermak WB3DOD, PO Box 433, Republic PA 15475; (412)-246-2870.

BATTLE OF LAKE ERIE
SEP 7–8

The Radio Association of Erie will operate special-event station W3GV on September 7–8, 1985, from 9:00 am to 9:00 pm on Saturday and from 9:00 am to 5:00 pm on Sunday, to commemorate Commodore Oliver Hazard Perry's victory at the Battle of Lake Erie during the War of 1812. Frequencies are 7.235 and 14.235 (phone) and 7.090 and 14.090 (CW/RTTY). For a special QSL, send a business-size SASE to W3GV, 380 Young Road, Erie PA 16509. DX stations use the W3 QSL bureau.

HANCOCK COUNTY OH
SEP 8

The Findlay Radio Club will sponsor the 43rd annual Findlay Hamfest on Sunday, September 8, 1985, from 6:30 am to 5:00 pm, at the Hancock County (Ohio) Fairgrounds. Tickets are $3.00 in advance and $4.00 at the door. Tables are $6.00, and outdoor flea-market spaces are $3.00. Talk-in on 147.75/.15. For more information, contact the Findlay Radio Club, PO Box 587, Findlay OH 45839.

WILLOW SPRINGS IL
SEP 8

The Bolingbrook Amateur Radio Society will hold BARS Hamfest 85 on Sunday, September 8, 1985, at Santa Fe Park, 91st Street and Wolf Road, Willow Springs IL. Admission is $2.00 in advance and $3.00 at the gate. Overnight parking will be available. Food will be available. Talk-in on 147.33/.93 and 146.52. For more information, contact Ed Weinstein WD9AYR, 7511 Walnut Avenue, Woodridge IL 60517; (312)-985-0527.

MONETT MO
SEP 8

The Ozarks Amateur Radio Society will sponsor the 4th annual Ozark Amateur Radio Club Congress and Swapfest at City Park, junction of US Highway 60 and Missouri State Highway 37, Monett MO, on Sunday, September 8, 1985. There will be a swapfest at 11:00 am and a buffet dinner at 1:00 pm. No tickets are necessary. All amateurs and families are welcome. Talk-in on 146.37/.97 MHz, 146.52 MHz, and 7.250 MHz. For more information, write or call the Ozarks Amateur Radio Society, Box 327, Aurora MO 65605; (417)-678-5330.

GREAT SALT PLAINS LAKE
SEP 8

The third annual Great Salt Plains Ham Social (serving the Oklahoma-Kansas state line area) will be held on September 8, 1985, at the community building on the south side of Great Salt Plains Lake. Free swap tables and refreshments will be available. Talk-in on 147.90/.30. For more information, contact Steven Walz WA5UTO, PO Box 222, Cherokee OK 73728; (405)-596-3487.

OLD BRIDGE NJ
SEP 8

The Old Bridge Radio Association will hold its annual OBRA Auction on Sunday, September 8, 1985, beginning at 9:00 am (8:00 am for sellers), at the Knights of Columbus Hall on Pace Street, Old Bridge NJ (seven miles south of NJ Turnpike Exit 9 on Route 18). Talk-in on 147.120/.720 and 146.520 simplex. This is *not* a flea market. For more information, send an SASE to WA2JAJ.

BUTLER PA
SEP 8

The Butler County ARA will sponsor a hamfest on Sunday, September 8, 1985, from 9:00 am to 4:00 pm, at the Butler Farm Show Grounds, Roe Airport, Butler PA. Admission is $1.00, with children under 12 going free. There will be plenty of parking; overnight campers are welcome. There will be a free outside flea market; 8-ft tables will cost $5.00. Talk-in on 147.96/.36. For more information, contact Hamfest Chairman, PO Box 1787, Butler PA 16003.

QUEENS NY
SEP 8

The Hall of Science Amateur Radio Club will sponsor a hamfest at the Hall of Science Parking Lot, Flushing Meadow Park, 47-01 111th Street, Corona, Queens NY, on Sunday, September 8, 1985, from 9:00 am to 4:00 pm. Donation will be $3.00 for buyers; $5.00 per space for sellers. Talk-in frequencies are 144.250 simplex link, 223.600 repeat, 445.225 repeat. For further information, contact John Powers KA2AHJ at (718)-847-8007 or Arnie Schiffman WB2YXB at (718)-343-0172.

MISS AMERICA
SEP 10–14

The Southern Counties Amateur Radio Association, Inc., will again sponsor special-event station K2BR during the Miss America Pageant week in Atlantic City NJ, from Tuesday, September 10, 1985, to Saturday, September 14, 1985. Frequencies will be 25 kHz inside General phone bands, with CW 65 kHz up from the lower band edges. Novice frequencies will be 7.125 and 21.250 MHz. QSL with an SASE via SCARA, Box 121, Linwood NJ 08221.

JOHNNY APPLESEED
SEP 12–14

The Columbiana County ARC will operate special-event station N8DKX on September 12–14, 1985, from 2200 UTC to 0100 UTC each day, to commemorate the annual Johnny Appleseed Festival in Lisbon OH. Operation will be 10 to 20 kHz up from the bottom edge of the General-class phone bands. For a certificate, send a QSL and an SASE to N8DKX, 6008 Camp Boulevard, Lisbon OH 44432.

MICHIGAN TECH
SEP 13-22

The Michigan Technological University Amateur Radio Club will operate special-event station W8YY on September 13-22, 1985, to celebrate the University's centennial and the MTUARC's golden anniversary. Frequencies are as follows: CW—3.745, 7.145, 10.145, 14.070, and 21.445; phone—1.845, 3.995, 7.285, 21.445, and 144.200; RTTY—3.625, 7.095, and 14.095; OSCAR when in range. For a commemorative certificate, send QSL and a large SASE to Debbie Parmer, c/o W8YY, W. Wadsworth Hall, MTU, Houghton MI 49931.

BEAR BRYANT
SEP 14

The West Alabama Amateur Radio Society (WAARS) will operate special-event station W4DAT on Saturday, September 14, 1985, in remembrance of the greatest college football coach in history, Paul "Bear" Bryant. The Bear Bryant Station will operate from the campus of the University of Alabama from 1300 UTC to 2400 UTC. Phone frequencies will be the bottom 25 kHz of the General 40-10-meter phone bands. WAARS will also work Novices on the bottom 25 kHz of the Novice bands. For further information, write to the West Alabama ARS, PO Box 1741, Tuscaloosa AL 35403.

NIAGARA FALLS NY
SEP 14

The 1985 Ham-O-Rama will be held on Saturday, September 14, 1985, at the Niagara Falls International Convention Center, Niagara Falls NY. General admission will be $3.50 in advance (before August 24) and $5.00 at gate. Outside flea-market spaces are $5.00. Inside flea-market tables are $15.00. Features include new-equipment displays, computer displays, technical programs, FCC exams, net and association meetings, and the annual W2RUF memorial code-proficiency test. (For more information about the proficiency test, call Kevin WA2FKV at (716)-834-3042 after 6:00 pm.) Talk-in on 146.31/.91 and 146.52 simplex. For further information, contact Nelson Oldfield, 126 Greenaway Blvd., Cheektowaga NY 14225.

MOUNTAIN STATE AWARD
SEP 14-15

The Logan County ARC will hold its fifth annual "Mountain State Award" expedition from a West Virginia mountaintop in Logan County from 1600 UTC, September 14, 1985, to 0200 UTC, September 15, 1985. Phone operating frequencies will be approximately 25 kHz from the low end of the General 80- and 40-meter phone bands, as propagation allows. The callsign will be KJ8E. A handsome 8″ × 10″ certificate will be awarded to all contacts submitting a QSL and a legal-size SASE to Robert T. Johnson W8VEN, PO Box 320, Stollings WV 25646.

USECA
SEP 14-15

Members of the Utica-Shelby Emergency Communications Association will operate two special-event stations from 1300 UTC on Saturday, September 14, 1985, to 0400 UTC on Sunday, September 15, 1985, to celebrate the first air-to-ground public telephone service which was inaugurated between Chicago and Detroit in 1957. KA8KTV will be on 80, 40, 20, 15, and 10 meters, depending on propagation. CW will be in Novice portions only, except on 20 meters. K8QLM will be on 147.18/.78. A special QSL will be sent out to all stations making contact with either of the 2 stations on either day using any mode. A special certificate will be awarded to stations that make contact with the same station operator on 2 different days, 2 different bands and/or 2 different modes. Send a large SASE to USECA, PO Box 291, Utica MI 48087.

CINCINNATI OH
SEP 15

The Greater Cincinnati Amateur Radio Association, Inc., will sponsor its annual hamfest on Sunday, September 15, 1985, at Stricker's Grove on State Route 128, one mile west of Venice (Ross), Ohio. There will be exhibits, booths, food and refreshments, a flea market, music, talks, a hidden-transmitter hunt, and a sensational air show. Admission and registration will be $5.00. For information, contact Lillian Abbott K8CKI, 317 Greenwell Road, Cincinnati OH 45238.

NEW KENSINGTON PA
SEP 15

The Skyview Radio Society will hold its annual hamfest on Sunday, September 15, 1985, from 12:00 noon to 4:00 pm, at the club grounds, Turkey Ridge Road, New Kensington PA. Admission is $2.00 ($4.00 for vendors). Talk-in on 146.04/.64 and .52.

PENNSAUKEN NJ
SEP 15

The South Jersey Radio Association will hold its 37th annual hamfest on Sunday, September 15, 1985, at the Pennsauken High School on Hylton Road, Pennsauken NJ. Admission is $2.50 in advance and $3.00 at the door. Gates will open at 8:00 am. Tailgating spaces are $5.00 each. There will be refreshments and food in the school cafeteria. Talk-in on 145.29/144.69. For more information, contact Fred Holler W2EKB, 348 Bortons Mill Road, Cherry Hill NJ 08034; (609)-795-0577.

NEWTOWN CT
SEP 15

The Candlewood Amateur Radio Association (CARA) will hold its annual flea market at Edmond Town Hall, Main Street (Route 6), Newtown CT, on Sunday, September 15, 1985, from 10:00 am to 4:00 pm (dealers may set up at 9:00 am). Admission is $2.00; tables are $7.00; tailgating is $5.00. Talk-in on 147.72/.12 or .52 simplex. For table reservations, send a check or money order to CARA, PO Box 143, Bethel CT 06801. For further information, contact Gene Marino W1IDH, Valley View Road, Newtown CT 06470; (203)-426-8852.

MT. CLEMENS MI
SEP 15

The L'Anse Creuse ARC will present its 13th annual Swap and Shop on Sunday, September 15, 1985, at the L'Anse Creuse High School, Mt. Clemens MI, from 8:00 am to 3:00 pm. Tickets are $1.00 in advance, $2.00 at the door. Trunk sales are $4.00 per space; tables inside are $8.00 each. Talk-in on 147.69/.09 and 146.52. For tickets or table reservations, send an SASE to Maurice Schietecatte N8CEO, 15835 Touraine Ct., Mt. Clemens MI 48044; (313)-286-1843.

LITTLE BROWN JUG
SEP 18-19

The Delaware County (OH) Amateur Radio Association, Inc., will operate Little Brown Jug special-event station W8QLS on Saturday and Sunday, September 18-19, 1985, from 9:00 am to 8:00 pm, from the Delaware County Fair. Frequencies are 3860, 7235, and 14,235 (plus or minus). To QSL, send an SASE to W8QLS, c/o Staff Stafford NJ8F, 5987 Dublin Road, Delaware OH 43015.

GREENSBORO NC
SEP 19-21

The Personal Computer and Standard Computer Interfacing for Scientific Instrument Automation Workshop, sponsored by Virginia Tech, will be held September 19-21, 1985, in Greensboro NC. The cost is $450 for the three-day session. This is a hands-on workshop, with each participant wiring and testing interfaces. The course will be directed by Mr. David E. Larsen and Dr. Paul E. Field. For more information, contact Dr. Linda Leffel, C.E.C., Virginia Tech, Blacksburg VA 24061; (703)-961-4848.

HOUSTON TX
SEP 20-22

Houston Ham Conventions, Inc., will sponsor Houston Com-Vention 85 from Friday, September 20, 1985, through Sunday, September 22, 1985, at the Stouffer Greenway Plaza Hotel, Southwest Freeway (US 59) and Edloe Street, five miles southwest of Houston TX. Registration opens at 5:00 pm Friday night. Saturday hours are 8:00 am to 5:00 pm; Sunday hours are 9:00 am to 3:00 pm. Features include an indoor flea market, forums, commercial exhibits, alternate activities, and a Saturday-night Texas BBQ dinner. Parking is free. For more information, call (713)-333-1466.

GRAND RAPIDS MI
SEP 21

The Grand Rapids Amateur Radio Association will hold its annual Swap and Shop on Saturday, September 21, 1985, at the Hudsonville Fairgrounds. There will be dealers, an indoor sales area, and an outdoor trunk swap area. Gates will open at 8:00 am. Talk-in on 146.16/.76. For more information, write to the Grand Rapids Amateur Radio Association, PO Box 1248, Grand Rapids MI 49501.

SEBASTOPOL CA
SEP 21

The Sonoma County Radio Amateurs, Inc., will sponsor its third annual ham-radio flea market on Saturday, September 21, 1985, from 8:00 am to 2:00 pm, at the Sebastopol Community Center, 390 Morris Street, Sebastopol CA (5 miles west of Santa Rosa just off Highway 12). This is the largest ham flea market on the north coast. Admission and parking are free. Tables are $6.00 at the door or $5.00 in advance. Vendor setup starts at 7:00 am. Talk-in on 146.13/.73. Features include a radio clinic, exhibits, refreshments, and an auction at about noon. For further information or tickets, write SCRA, Box 116, Santa Rosa CA 95402.

HARTFORD CT
SEP 21-22

The Connecticut DX Association and the Newington Amateur Radio League will celebrate Connecticut's 350th anniversary by operating special-event station KW1V from the grounds of the State Capitol in Hartford CT, on Saturday and Sunday, September 21-22, 1985, on the General and Advanced US phone bands. Operation will be from 1400 UTC on September 21 to 0100 UTC on September 22, and from 1400 UTC to 2100 UTC on September 22. For a special QSL card, send a #10 SASE with 39 cents postage to Dave Rose KW1V, 13 Long Crossing Road, East Hampton CT 06424.

BEREA OH
SEP 21-22

The Cleveland Hamfest and Computer Show will be held on Sunday, September 22, 1985, from 8:00 am to 5:00 pm, at the Cuyahoga County Fairgrounds, Berea OH. Admission is $3.00 in advance and $3.50 at the gate (under 12 free). Indoor tables are $10.00 for an 8-foot space and $8.00 for each additional 8-foot space (includes table and chairs; set up Saturday 12:00 to 5:00 pm and Sunday from 6:00 am on). Outdoor flea-market spaces are $4.00 each (overnight parking will be available). Features include commercial exhibits, NASA displays, speaker programs on AMSAT, DX, packet, and FCC, walk-in license exams, non-ham activities, and free parking. A banquet will be held on Saturday, September 21, 1985, with cocktails at 6:00 pm and a buffet dinner at 7:00 pm, at the Bagley Hotel Ballroom, 17000 Bagley Road, Middleburg Heights OH (just east of the I-71/Bagley Road interchange). For banquet reservations, call Barbara Ernest N8DAD at 327-3914. For advance hamfest tickets or further information, write to the Cleveland Hamfest Association, PO Box 93077, Cleveland OH 44101.

VIRGINIA BEACH VA
SEP 21-22

The Tidewater Radio Conventions, Inc., is sponsoring the 1985 ARRL Virginia State Convention and 10th annual Amateur Radio/Computer Fair on Saturday and Sunday, September 21 and 22, 1985, from 9:00 am to 5:00 pm, at the Virginia Beach, Virginia, Pavilion. Advance admission tickets for both days are $5.00. Tickets at the door will be $6.00. Flea-market tables will be $5.00 for one day, $8.00 for both days. Featured activities include dealers, special displays, forums, computer equipment, ARRL license exams, free XYL bingo, and movies for the kids. For information and tickets, write or call Jim Harrison N4NV, 1234 Little Bay Avenue, Norfolk VA 23503; (804)-587-1695.

BRAINERD MN
SEP 21-22

The Paul Bunyan Wireless Association will operate a special-event station from 1500 UTC on Saturday, September 21, 1985, to 2100 UTC on Sunday, September 22, 1985, from the Paul Bunyan Festival near Brainerd MN. Phone and CW operation will be in the lower part of the General-class 80-10-meter bands. For a commemorative QSL, send an SASE to the Paul Bunyan Wireless Association, PO Box 354, Pequot Lakes MN 56472.

PEORIA IL
SEP 21-22

The Peoria Area Amateur Radio Club will sponsor Superfest 85 at the Exposition Gardens, W. Northmoor Road, Peoria IL, on Saturday and Sunday, September 21-22, 1985. Gates open at 6:00 am; the commercial building will open at 9:00 am. Admission will be $3.00 in advance and $4.00 at the gate. Children under 12 are free. Activities will include amateur-radio and computer displays, a huge flea market, FCC exams for all classes on Saturday only, and a free bus to Northwoods Mall on Sunday. There will be full camping facilities on the grounds. Talk-in on 146.16/.76 (W9UVI). Information or reservations are available for an SASE to Superfest 85, PO Box 3461, Peoria IL 61614.

YORK PA
SEP 21-22

The York Hamfest Committee will present its annual hamfest on Saturday and Sunday, September 21 and 22, 1985, at the York Fairgrounds, State Route 74, York PA. Registration will be $2.00 on Saturday, $4.00 on Sunday, or $5.00 for both days. XYLs and junior ops under 12 will be free. There will be a Saturday-evening banquet ($10.00—by advance registration only). Tailgating (10-foot space) will be $4.00/day or $6.00 for both days. Indoor display area tables will be $5.00 and up per day. Vendor setup will be at 6:00 am and registration will be at 8:00 am both days. For more information or reservations, contact the York Hamfest, Box W, Dover PA 17315.

NEW BERLIN IL
SEP 22

The Sangamon County Fair Association will sponsor the 10th annual New Berlin Hamfest on Sunday, September 22, 1985, from 7:00 am to 3:00 pm, at the Sangamon County Fairgrounds in New Berlin IL. Admission and flea-market setup is free and talk-in will be on 146.52 and 146.88. Food and drink will be available. The hamfest will be held rain or shine. For more information, contact Al Swettman K9QFR, Box 2, Pleasant Plains IL 62677; (217)-626-1634.

OLD WESTBURY NY
SEP 22

The Long Island Hamfair will be held on Sunday, September 22, 1985, at the New York Institute of Technology, on Route 25A, Northern Boulevard, Old Westbury NY (1/2 mile east of Glen Cove Road). General admission is $3.00. Wives, children, and sweethearts are free. There will be a $5.00 charge per car space for exhibitors. Talk-in on 146.85. For further information, call Hank Wener WB2ALW at (516)-484-4322 (nights) or Bob Reed WB2DIN at (516)-221-8116.

WOONSOCKET RI
SEP 22

The Rhode Island Amateur FM Repeater Service, Inc., will hold its annual fall flea market on Saturday, September 22, 1985, beginning at 9:00 am, at the American Legion Fairmont Post 85, 870 River Street, Woonsocket RI. Admission is free. Flea-market spaces are $5.00. An auction will begin at noon. Talk-in on .34/.94 and .52 simplex. For more information, contact Richard Fairweather K1KYI, 127 Sherman Farm Road, Harrisville RI 02830; (401)-568-3468.

GAINESVILLE GA
SEP 22

The 12th annual Lanierland ARC Hamfest will be held on Sunday, September 22, 1985, beginning at 9:00 am, in the Holiday Hall of the Holiday Inn, Gainesville GA. There will be free tables and an inside display area for dealers reserving in advance. There is a large parking lot for the free flea market. There will be many activities and a ladies country store. Novice through Extra walk-in exams will begin at 9:00 am. Talk-in on 146.07/.67. For information or reservations, contact Paul Watkins W4FDK, Route 11, Box 536, Gainesville GA 30501; (404)-536-8280.

WILLIMANTIC CT
SEP 22

The Natchaug Amateur Radio Association will sponsor its annual giant flea market on Sunday, September 22, 1985, from 9:00 am to 4:00 pm, at the Elks home, 198 Pleasant Street, off Rt. #32, Willimantic CT. Admission is $2.00. Children under 16 will be admitted free. Advance reserved tables inside or outside will cost $5.00 each; at the door they will cost $7.00. There will be ham gear, CB, audio, parts, surplus items, computers, plus much more. There will be food and drinks. Talk-in frequencies will be .52 direct and 147.30/.90. For information, please contact Ed Sadeski KA1HR, 49 Circle Drive, Willimantic CT 06226; (203)-456-7029 after 4:00 pm.

WICHITA KS
SEP 22

The Wichita Amateur Radio Club will sponsor its annual hamfest on September 22, 1985, at Camp Hiawatha, 1701 West 51st Street North, Wichita KS. There will be a flea market, programs, and commercial exhibits. For further information, contact Gary Vreeland NDØT, 1920 S. Santa Fe, Wichita KS 67211.

ATLANTA GA
SEP 27-29

DXPO 1985 will be held on September 27-29, 1985, at the Lanier Plaza Hotel, I-85 and Monroe Drive NE, Atlanta GA. Registration will be $49.50. Some of the premier attractions will be: John Devoldere ON4UN, holder of 5BWAZ #1 and author of several books; Rusty Epps W6OAT of the recent FOØXX Clipperton DXpedition, and the first presentation of Carl and Martha Henson's expedition to 3C1. For information or reservations, contact Grover Meinert KC4BX, 720 Starlight Lane NE, Atlanta GA 30342.

ELMIRA NY
SEP 28

The Elmira Amateur Radio Association will sponsor the tenth annual Elmira International Hamfest at the Chemung County Fairgrounds on September 28, 1985. Gates will open at 6:00 am and the hamfest will continue until 5:00 pm. Tickets will be available at the gate, or in advance from Steve Zolksky, 118 East 8th Street, Elmira Heights NY 14903. Among the day's activities will be an outdoor flea market, indoor dealer displays of new equipment, and breakfast and lunch served on the premises. For further information, contact Don Estus, 42 Maplehurst Park, Horseheads NY 14845; (607)-739-4807.

ANNISTON AL
SEP 28

The annual Anniston Hamfest will be held on Saturday, September 28, 1985, at the Anniston National Guard Armory, from 8:00 am to 3:00 pm. Admission and parking will be free. Coffee and doughnuts will be free until 8:30 am. All tables are indoors and are $5.00 each. FCC exams will be administered. Talk-in on 147.64/.04. For further information, contact Jim Vice, Route 1, Box 462, Alexandria AL 36250; (205)-820-0638.

SANTA FE NM
SEP 28-29

The Northern New Mexico ARC will sponsor the Northern New Mexico Hamfest on Saturday and Sunday, September 28-29, 1985, at the all-weather facilities of Camp Stoney, 8 miles east of Santa Fe NM. Licensing exams will be held on Saturday morning and the aspencade color tour will be held on Saturday afternoon. Free overnight camping is available (no hookups). From 8:00 am to 3:00 pm on Sunday will be the tailgate flea market and dealer displays. A hot dog lunch is included in the admission price: $3.75 for adults and $1.75 for children. Talk-in on .52 and local repeaters. For more information, send an SASE to NNMARC, Route 3, Box 95-15, Santa Fe NM 87501.

GRAYSLAKE IL
SEP 28-29

The Chicago FM Club will sponsor Radio Expo 85 on Saturday and Sunday, September 28-29, 1985, beginning at 9:00 am, at the Lake County Fairgrounds, Routes 120 and 45, Grayslake IL. The flea market will open at 6:00 am. Admission (good for both days) is $3.00 in advance; $4.00 at the gate. Reserved indoor flea-market tables are $5.00 per day; electricity is $3.00 per day. Features include displays by manufacturers, seminars, technical talks, and alternate activities. There will be free parking and overnight camping. Talk-in on 146.16/.76. For advance tickets, table reservations, or more information, send an SASE to Radio Expo 85, Box 1532, Evanston IL 60204; (312)-582-6923.

SUTTON NH
SEP 29

The Connecticut Valley FM Association will hold its 9th annual hamfest and flea market on September 29, 1985, at King Ridge Ski Area in Sutton NH, from 9:00 am to 5:00 pm. General admission will be $2.00; dealer and flea-market setup will be $3.00. Food will be available on the premises. Overnight camping will be available for self-contained units only (no hookups). Take Exit 11 off I-89. Talk-in on 146.76 or 146.52 simplex. For more information, contact Francis Callahan KA1BWE, PO Box 173, East Wallingford VT 05742.

LOUISVILLE KY
OCT 4-6

The 1985 National ARRL Convention will be held on October 4-6, 1985, at the Kentucky Fair and Exposition Center (Exit 12 off of I-264), Louisville, Kentucky. Admission is $5.00 in advance and $6.00 at the door (12 and under are free). Features include a 200,000-square-foot indoor exhibitors' and flea-market area, ARRL forums, packet radio, AMSAT, FCC, National Weather Service, and alternate activities. For more information, contact the Greater Louisville Hamfest Association, PO Box 34444, Louisville KY 40232; (502)-368-6657.

TORRINGTON CT
OCT 5

The CQ Radio Club of Torrington will hold its annual flea market on Saturday, October 5, 1985, from 9:00 am to 3:00 pm, at the East Albert Street Recreation Building, Torrington CT. Admission is $1.00. Tailgating space is $5.00 and dealer tables are $7.00 each. Talk-in on 146.955. For more information, contact Donald Taylor KA1GKJ, PO Box 455, Watertown CT 06795.

WARRINGTON PA
OCT 5-6

The Pack Rats of the Mt. Airy VHF ARC cordially invite all amateurs and friends to the 9th annual Mid-Atlantic VHF Conference on Saturday, October 5, 1985, at the Warrington Motor Lodge, Route 611, Warrington PA, and our 14th Pack Rat Hamarama on Sunday, October 6, 1985, at the Bucks County Drive-In Theater, Route 611, Warrington PA. Admission to the flea market is $5.00, with selling spaces $8.00 each. The gates will open at 6:00 am. Advance registration for the Conference is $4.00. For further information, write to Hamarama 85, PO Box 311, Southampton PA 18966, or call Lee A. Cohen K3MXM at (215)-635-4942.

YONKERS NY
OCT 6

The Yonkers Amateur Radio Club will sponsor its Electronics Fair and Giant Flea Market at the Yonkers Municipal Parking Garage, corner of Nepperhan Avenue and New Main Street, Yonkers NY, on Sunday, October 6, 1985, from 9:00 am to 4:00 pm, rain or shine. Admission will be $3.00 per person, with children under 12 free. For sellers, parking spaces will be $7.00; bring tables. There will be live demonstrations all day long, including amateur radio, computers, mini-theater, satellite TV, CB radio, etc., and a giant auction at 2:00 pm. There will be unlimited free coffee all day, plus free parking. For more information, call (914)-969-1053.

COLUMBIA MD
OCT 6

The Columbia Amateur Radio Association will hold its 9th annual hamfest at the Howard County Fairgrounds (15 miles west of Baltimore, just off I-70 on Route 144, 1 mile west of Route 32) on Sunday, October 6, 1985, from 8:00 am to 3:30 pm. Admission is $3.00 (spouses and children are free). Outdoor tailgating will be $5.00; tables $6.00. Fee for indoor tailgating will be $6.00 if received by September 30 and $8.00 after September 30. Food will be available. Talk-in on 147.735/.135 and 146.52. For table reservations or information, write Mike Vore W3CCV, 9098 Lampskin Lane, Columbia MD 21045; (301)-992-4953.

LIMA OH
OCT 13

The Lima Hamfest will be held at the Allen County Fairgrounds, Lima OH, on Sunday, October 13, 1985. Directions: one mile east of I-75, Exit 125A, on Route 309 and Route 117. Advance tickets are $3.00; $3.50 at the door. Tables are $6.00; half tables $3.50. For reservations, send an SASE and check to NOARC, PO Box 211, Lima OH 45802. License exams will be given. For exam information, contact NC8F at the above address.

WIA 75TH ANNIVERSARY

The Wireless Institute of Australia, the world's first radio society, will celebrate its 75th anniversary during 1985. The WIA 75 Award will be available during the period from March 1, 1985, to December 31, 1985. To qualify, amateurs (and SWLs) need to contact (log) 75 members of the WIA. A contact will be valid only if the WIA member's individual membership number is logged. No more than 30 WIA members may be logged in any one callsign area. Send a log extract of the 75 members contacted and $2.00 (Australian) to WIA 75 Award Manager, Wireless Institute of Australia, 412 Brunswick Street, Fitzroy 3065, Victoria, Australia.

HAM HELP

I need a service manual and schematics for a Singer/Gertsch FM-9 service monitor with an FC-3 frequency converter.

Geoff Fors WB6NVH
PO Box 2946
Carmel CA 93921

I need schematics and manuals for a UHF Motorola HT-220 and VHF MT-500. I also would like to contact someone who has converted the MT-500 to the amateur bands.

Ray Lukaszewicz WD8RCL
20610 Alaminos Dr.
Saugus CA 91350

Does anyone have back issues of the *TAP* newsletter for sale or copy? I will gladly pay all costs, including shipping.

Sgt. Al Muick N5HZG
PO Box 266
Lawton OK 73502-0266

I need a construction/calibration manual (with schematic) for a Sabtronics model 2000 DMM. I will pay copying cost and postage or copy it myself and return original.

John Rusinko
38A Union Ave.
Little Falls NJ 07424

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Pikesville MD 21208

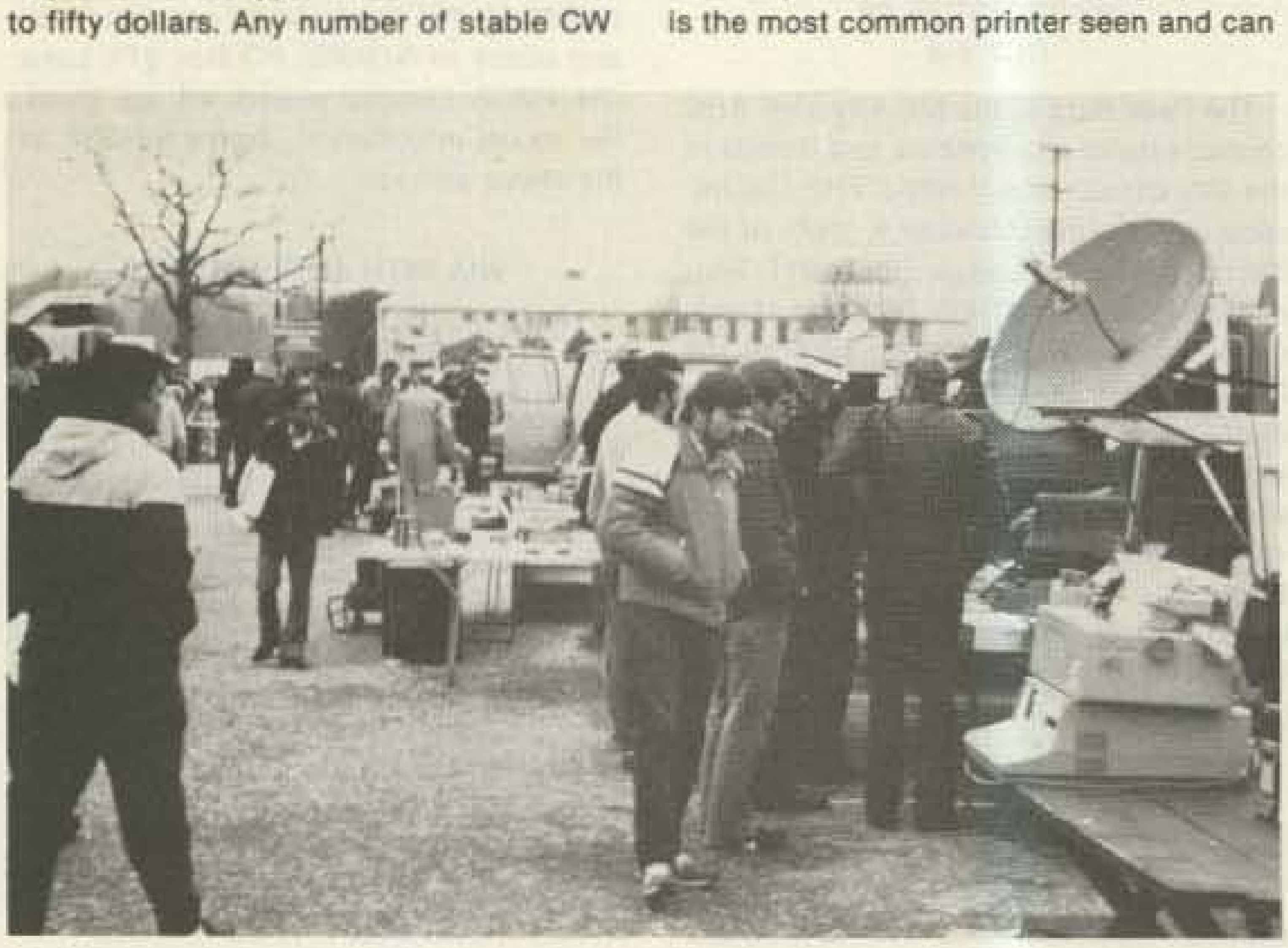
For the last few months I have been looking at several simple, that is, cheap, ways to get onto RTTY. As with any other aspect of our hobby, there are all kinds of ways to approach any mode. This allows access for just about any budget. This month's column shall put the cap on that line.

You see, I was leafing through a medical computer catalog (believe me, they have proliferated like new antibiotics since the personal-computer invasion), and I saw a plug and cable listed for more than $25. Now, I knew that I had seen that assembly somewhere else, so I checked a Radio Shack catalog, where I saw the same deal for one-quarter the price. While you may get what you pay for, you don't always have to pay as much as you think. Same thing in RTTY—it is not a rich ham's diversion.

The photo this month shows one place to pick up bargains—at a local hamfest. This photo is from the Greater Baltimore Hamboree and Computerfest, sponsored by a local club here in Baltimore, and is representative of many other such gatherings throughout the amateur community. Want to get on radioteletype? Wandering through the aisle one could find an older, very reliable Teletype® machine for twenty to fifty dollars. Any number of stable CW transmitters, the type that was popular with the Novice crowd years ago, were also available. A Globe Chief, Viking, or one of the Heath series is almost always around, often for a song. Add a receiver, unless you have one (you are a ham, aren't you?), and you could be on RTTY for under a hundred bucks! Rich man's hobby? Like fun!

To get that transmitter on FSK, you could use the AFSK circuit published here two months ago, if it is a stable, well-filtered sideband rig. However, the older CW-only transmitter run by an internal or external vfo (variable frequency oscillator) requires a different tack. My favorite version of the venerable shift-pot circuit is shown in Fig. 1. This simple little circuit remains the quickest way to get a transmitter onto FSK and still costs only a few dollars, even if you have to buy all the parts!

Oh, when you go looking for machines, you may be confused by the designations given to them. The most popular teleprinters were produced by the Teletype Corporation and bear a numerical model number as their identifying name. To help you out, the Model 12 is the earliest machine you are likely to see. It is an old workhorse, is limited to 45.45 baud (also called 60 words per minute or 60 speed), and like all of the "five-level" machines I will mention, uses a five-bit Murray code, with one start and 1.42 stop bits. The Model 15 page printer is the most common printer seen and can



The outside flea-market area at the Greater Baltimore Hamboree and Computerfest.

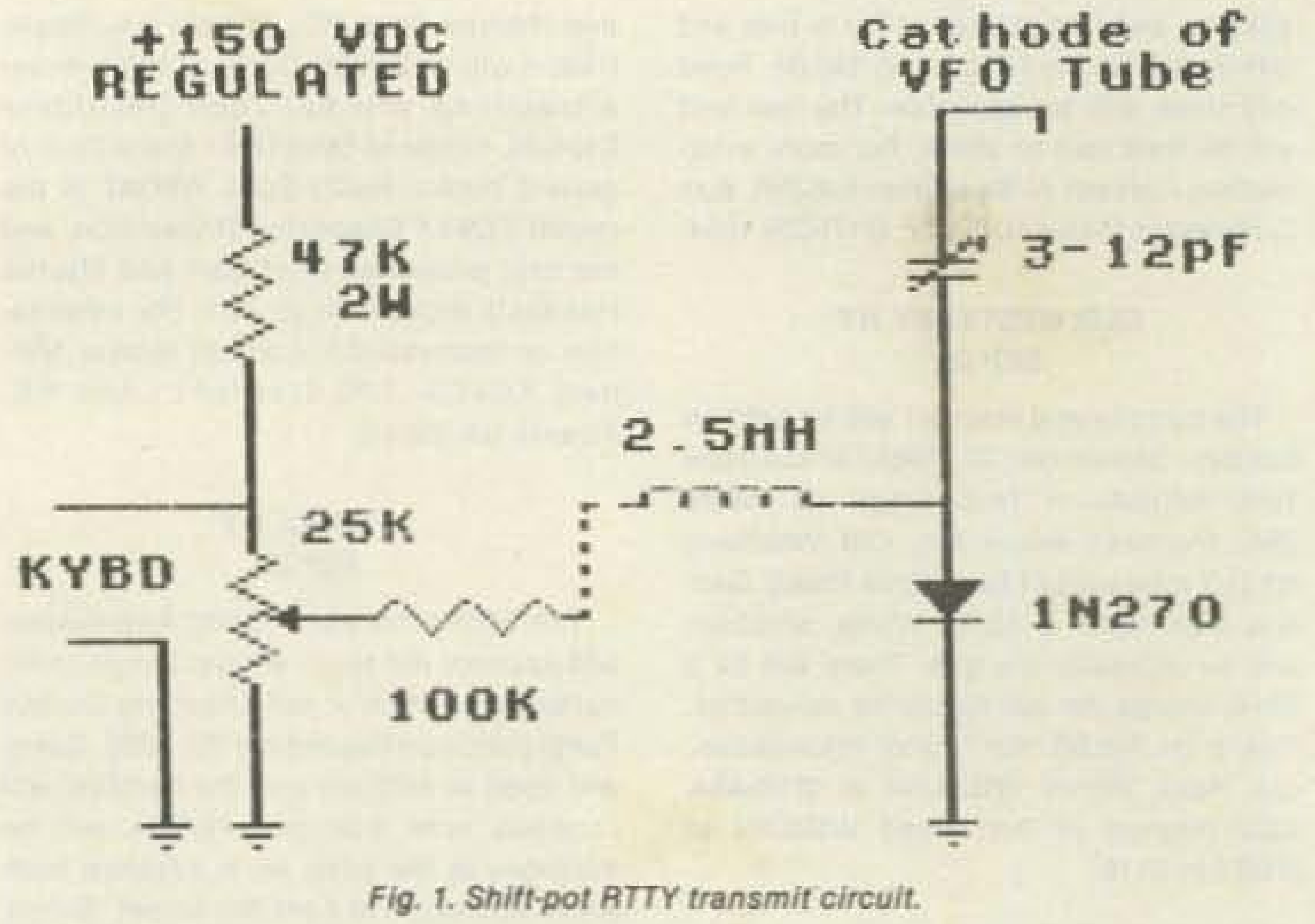


Fig. 1. Shift-pot RTTY transmit circuit.

run 75 speed with the proper gearing. The next most popular configuration combines a Model 15 page printer with a Model 14 reperforator and transmitting distributor and calls the whole gemisch a Model 19. Next up the line is the Model 28, which is an integrated unit capable of communicating at 100 wpm, along with 60 and 75. The most modern Murray machine you are likely to see is the Model 32, which is the Murray version of the popular ASCII Model 33 machine. I will also note that there is a light-duty machine, the Model 26, which will occasionally surface, but most amateurs tend to avoid it like the plague.

Teletype machines that use the ASCII character set that are likely to pop up on the surplus market are the Models 33 and 35. The Model 33 is the common computer workhorse, sort of the Model 15 of the computer set, and is seen in a variety of interfacing configurations. The Model 35 is an ASCII version of the Model 28 and is just as reliable. Both of these machines are normally configured as 110-baud 7-bit ASCII machines, with one start and one stop bit.

I am often hesitant to recommend, or even mention, commercial enterprises and outlets for RTTY equipment. However, several readers have passed along one name, so I shall pass it to you, with my usual *caveat emptor*. For many years, Typetronics, in Ft. Lauderdale, Florida, has been a source for hard-to-get RTTY parts. Ranging from complete printers to levers, gears, and cogs, all the way to manuals, it would seem that this is one place to at least investigate. I have not seen a catalog in quite a while, so I don't know what's new there, but for those of you who have been asking where to get a keytop or function lever, this may just be the place. Drop them a note at Typetronics, Box 8873, Ft. Lauderdale, Florida 33310, and be sure to tell them that you read about them in "RTTY Loop."

As always, I have been enjoying your letters and E-Mail, via CompuServe, over the past month. I have been trying to get better at answering each and every one as soon as possible. If you have sent me a question on CompuServe, you should have a reply within a few days. Letters take me a bit longer, but if more than a month has elapsed, one of three things has happened: You did not send in a self-addressed stamped envelope, the postal service screwed up on one side or the other, or I am holding the letter for more information or assistance. Send another note if you think it's been too long—there's always the outside chance that the dreaded fourth possibility has taken place—your letter is lost on my desk! Once again, send your letter to the address above, or E-Mail on CompuServe to me at ppn 75036,2501.

Yes, the reprint series is alive and well. There are now seven or eight in the series, with more being added when I get the time. Feel free to send a self-addressed stamped envelope for the latest list, even if you have requested one before—I know it changes!

Your input on various computer RTTY programs has been most gratifying. We will start next month with a review of all you have related on one computer type and move on monthly to cover them all. No, what I say will not be cast in concrete, so if you disagree with the findings related, let us hear from you, we will all benefit. What's that you say, which computer will we cover first? Well, the answer is obvious from previous columns, I think, but if you can't figure it out, I guess you will have to wait for the next issue of *73* and find the answer right here in "RTTY Loop."

FUN!

John Edwards KI2U
PO Box 73
Middle Village NY 11379

SOLID-STATE STICKLERS

It's hard to believe how solid-state devices have changed our way of life. I'm writing this column on a microprocessor-driven computer while listening to a transistorized radio. My office has an LED-type clock and a microprocessor-equipped printer, answering machine, television, calculator, and telephone. After I finish writing for the day, I'll probably go for a spin in my car, which features a solid-state ignition system and its own on-board microprocessor that controls the vehicle's performance and fuel economy.

As I explained last month, when I first got into ham radio, tubes were everywhere. Today, you can't find a rig of any sort that doesn't come chock-full of mysterious little black and silver blocks with dozens of mysterious, silver- or gold-plated leads. Of course, you also can't find a rig of any sort that was built in America. But that, as they say, is another story.

Anyway, with solid-state components dominating our hobby and lives to the extent they do, it's about time "Fun!" devoted a column to these devices. Here goes.

ELEMENT 1
MULTIPLE CHOICE

1) In a TTL-type circuit, the multiple-diode cluster of the diode-transistor logic circuit is replaced by a:

1) tube
2) multiple-emitter transistor
3) single-emitter transistor
4) grounded-emitter transistor

2) A silicon-controlled rectifier is also known as a:

1) CPU
2) logic chip
3) triac
4) thyristor

3) Which of the following is *not* a liquid-crystal type?

1) nematic liquid-crystal
2) smectic liquid-crystal
3) isotropic liquid-crystal
4) calcified liquid-crystal

4) How many bits of memory does a 16-bit memory chip *really* have?

1) 16,000 bits
2) 15,884 bits
3) 16,384 bits
4) 16,281 bits

5) Selenium rectifiers were first developed around:

1) 1880
2) 1910
3) 1930
4) 1950

ELEMENT 2
TRUE-FALSE

	True	False
1) A zincite detector was an early kind of semiconductor diode.	____	____
2) An LED is a type of transistor.	____	____
3) Field-effect transistors were developed before bipolar transistors.	____	____
4) TTL chips require a 12-volt power supply.	____	____
5) CMOS RAM is usually nonvolatile	____	____
6) Flip-flops are logic devices.	____	____
7) Linear ICs are digital devices.	____	____
8) Blue LEDs are fairly common	____	____
9) A klystron is a type of microwave transistor.	____	____
10) Tin is a semiconductor material	____	____

ELEMENT 3
MATCHING

Match the solid-state device in Column A with the description in Column B.

Column A	Column B
1) 6502	A) Small-signal PNP transistor
2) 1N34A	B) Large-signal PNP transistor
3) 2N1491	C) Motorola 16-bit microprocessor
4) 2N5461	D) Small-signal NPN transistor
5) 68000	E) IGFET
6) 2N406	F) MOSFET
7) 40600	G) Motorola 8-bit microprocessor
8) 2N441	H) Semiconductor diode
9) MPF122	I) P JFET
10) 2N706A	J) N dual-gate FET
	K) Large-signal NPN transistor

ELEMENT 4
FILL IN THE BLANK

1) CMOS stands for ______metal-oxide semiconductor.
2) PROM stands for ______read-only memory.
3) An avalanche diode is used at ______ frequencies.
4) The region in a semiconductor that has an abnormally high resistance level is called the ______layer.
5) The development of a transverse electric field in semiconductor material is called the ______effect.

THE ANSWERS

Element 1:
1—2, 2—4, 3—4, 4—3, 5—3.

Element 2:

1—True	A crystal detector.
2—False	Diode, as in light-emitting diode.
3—False	It's the other way around.
4—False	Five volts.
5—True	That's why it's often used in portable computers.
6—True	Used as counting devices in computers.
7—False	They respond to analog signals.
8—False	They are difficult and expensive to make.
9—False	A klystron is a tube.
10—True	Along with selenium, boron, germanium, and other elements.

Element 3:
1—G, 2—H, 3—K, 4—I, 5—C, 6—A, 7—J, 8—B, 9—F, 10—D.

Element 4:
1—complementary
2—programmable
3—microwave
4—barrier
5—Hall

SCORING

Element 1:
Five points for each correct answer.
Element 2:
Two and one-half points for each correct answer.
Element 3:
Two and one-half points for each correct answer.
Element 4:
Five points for each correct answer.

How did you do?

1-20 points—Your brain is probably solid-state
21-40 points—Hooray for the age of tubes
41-60 points—Have built a code-oscillator kit
61-80 points—Replaced your CRT with an LCD
81-100 points—Cold to the touch

BE MY GUEST

Guest Editorial by Bill Pasternak WA6ITF

HIDING BEHIND 20 KHZ

If the League's Board of Directors had ever envisioned the furor that their endorsement of a 2-meter repeater band plan has brought about, I doubt if they would ever have given the plan their blessing. But hindsight is wonderful, and what's done is done.

In a way, the Board did those involved in the coordination of 2-meter repeaters a favor. For years, there had been a definite adversarial relationship between the proponents of two different forms of 15-kHz plans, but thanks to the ARRL Board, there was a new official kid on the block. He was born in 1978 in Seattle, Washington, and nobody gave him the slightest chance of survival if he ventured away from this retreat surrounded by the Cascade Mountains. But the kid did escape. First he went east to Michigan, then south to Texas and Alabama. Now he has put his two cent's worth into the way things are done in western Pennsylvania and Georgia. Rumor has it that he is also heading west to Hawaii. Well, the kid is making a bit of a name for himself, but in the process he is giving the 15-kHz folks a chance to evade the real issue: How many repeaters is enough on 2 meters?

The 20-kHz issue came at just the right time. So much attention is being paid to it that little attention is going elsewhere. After all, this 20-kHz thing is a threat to the status quo! We can't have that.

In the big cities there are more useless and unused "ego boxes" per square inch than can be found anywhere else in the world. According to the ARRL, there are now almost 6000 repeaters operational on 2 meters. Not paper boxes, but repeaters with actual hardware that goes "kerchunk" in the night. Thats a heck of a lot of repeaters for any one band and in any one country! And, you might think that 6000 would be enough, right? Wrong! If trends continue, we could hit the 7000 mark within a year or two. The question is, do we want to have 7000 repeaters on two meters? Is it a record we can be proud of, or one that shows our inability to be efficient in the use of spectrum for interference-free communication? Surely, 4, 5, or 6 machines all on the same channel and serving the same geographic and demographic area cannot be said to be providing interference-free service!

So, coordinators out there in toyland, keep playing your silly game as though it really had meaning. Keep up the facade of being riled about the 20-kHz schism. It's the best excuse yet for not solving your problem of overcrowding that was brought your way by submitting your will to the ego of others. Keep looking for nooks and crannies in which to put yet another "ego box." You may be able to keep running from the inevitable for another few weeks or months, but one of these days you will have to say, "No! We have no more room!" Then what? Will you have the fortitude to do it, or will you simply steal away into the night like so many before you? 15 kHz versus 20 kHz isn't the real question. Doing what's needed is, even if it means saying, "No" to your closest friend. Only then will frequency coordination of repeaters have any meaning in amateur radio.

Bill Pasternak WA6ITF is the Network Director for Westlink *and a frequent contributor to 73.*

LETTERS

TVI TERMINATED

To Bradley Wells KR7L

I wanted you to know that your article ("Wrap Up TVI," November, 1984) helped solve a very troublesome TVI problem that began when a next-door neighbor installed a new TV antenna which used a coaxial transmission line.

Low-pass and high-pass filters cut the interface down to a minor herringbone effect when I operated on 20 meters but were of no help in correcting a front-end overload problem when I transmitted on 40 meters.

I suspected my vertical antenna, so I erected a dipole under the eaves of my house, some 60 feet from the receiving antenna, and with my entire house between the dipole and the TV system. The blanking persisted.

Today I installed an rf choke made from a discarded TV yoke and several turns of coax as your article suggests. The neighbor now reports minimal to no interference regardless of which antenna I use for transmitting!

Incidentally, I've never had a bit of trouble with any of the four TV receivers used in my house, all of which are fed with 300-Ohm line.

Carl Steavenson K6WZ
Sylmar CA

LADDER-LINE LOVER

I very much enjoyed "So Why Do They Call It Wireless?" in the March, 1985, issue. I have been using this antenna and preaching its virtues ever since reading "The Easy Way" by WB5IIR two years ago. Surprisingly, I have encountered considerable hostility to the idea and on occasion have been dismissed with comments like, "why don't you just use coax like everyone else?" or "tuners are no good."

The article's breakdown of wavelength multiples for 10, 15, 20, and 40 meters when feeding an 80-meter half-wave dipole is correct except for that oddball ham band, 15 meters (which is really only 14 meters long). For an antenna length of 126 feet, a 21.225-MHz signal is about 2.7 wavelengths, not 3 wavelengths. That happens because 15 meters is an odd multiple of the others, a delightful fact which allows us to feed a 15-meter signal to a 40-meter dipole through low-impedance coax. But the real magic happens when we change to high-impedance feedline, for then we can feed all signals to one antenna.

In my installation I have avoided using an antenna length which is resonant on any of the ham bands, not because I don't like the very low feedpoint impedance at the primary frequency, but because I don't like the very high feedpoint impedance at even multiples of the primary. For example, a 66-foot centerfed dipole offers less than 100 Ohms of feedpoint impedance to a 40-meter or 15-meter signal, but 5,000 to 10,000 Ohms to a 20-meter or 10-meter signal. By cutting my antenna away from resonance, I only have to deal with feedpoint impedances of about 1,000 or so Ohms, which my twinlead and simple tuner can easily handle. How far away? A few feet will do. The only concern is to avoid even multiples of 8 feet or 11 feet in order to avoid high feedpoint impedances on some frequencies. As always, odd multiples are okay.

Any antenna longer than ¼ wavelength can be made to resonate with acceptable efficiency, so I have chosen 70 feet for my QTH. That length is just a little longer than ¼ wavelength of 80 meters, is not an even multiple of 8 or 11 feet, fits between two trees, and has provided me with excellent contacts on 10 through 80 meters. Similarly, 36 feet would work nicely on 10 through 80 meters in situations where 70 feet isn't practical. A big bonus is that MARS and CAPS signals can be transmitted by those so authorized, and the pleasures of shortwave listening are greatly increased by using a tuned antenna.

Scott H. Ketcher KF4FJ
Miami FL

160-METER MIDGET

Since publication of my article describing a horizontal loop antenna for 40 meters ("A Space-Saver Seven Megger," January, 1985, page 44), I have discovered that the antenna will work on 160 meters. I believe that the coax transmission line transforms the impedance of the loop at about 1850 kHz to approximately 50 Ohms. I conducted an experiment in which I measured the vswr (voltage-standing-wave ratio) of the antenna at the transmitter end of the transmission line, first with the original transmission line which is about 50 feet long, and again with an additional 40 feet of transmission line added.

The antenna is rather narrowbanded and the addition of 40 feet of transmission line reduced the minimum vswr from 1.2:1 to 1.0:1 and supports my theory that the transmission line is indeed acting to change the impedance of the loop to a value of about 50 Ohms.

This is definitely not a DX antenna, but from my Ohio location I have worked a number of stations in the recent 160-meter contests. Several of these stations were as far away as Florida and Oklahoma—not too bad for a midget 160-meter antenna, most of which is only about eight feet off the ground!

H. H. Hunter W8TYX
Columbus OH

FIELD DAY '85

The subject of Field Day came up at the weekly meeting of the Friday Amateur Radio Technical Society (FARTS). I suppose it doesn't make any difference who brought it up, but it sure caused a lot of stares in the Beaver Brook Yacht Club (alias Mac's Place) in Keene, New Hampshire.

After much discussion, the majority of the membership decided it was time for another maximum (or was it minimum?) effort. Since there were no volunteers to chair the Field Day Committee, the membership, in its truly democratic way, decided that the officers should run the effort. Oops, I should say "officer" because there is only one officer, the president.

"Who's the president this week?" asked Bob K1XR. Nobody could remember, so it was decided to elect a new one. Someone (name withheld to protect the guilty) nominated Jeff WB8BTH, who had not been to a meeting in several weeks. Needless to say, Jeff was elected.

Someone finally got up the nerve to tell Jeff and he looked to the sky and said, "Why me?" After he got over the shock, Jeff started soliciting help over the 147.375 "Keene Machine." He got quite a few suggestions as to what he could do with Field Day, and some were even helpful. Chuck KA1MTM volunteered his 10–80 vertical. I remembered that the site we would use had a pond next to it and if the vertical were mounted on a pipe in the pond, we would have a great ground plane. I mentioned that fact. "You got it, Arnie!" said Jeff. Open mouth, insert foot, chomp, chomp. Now it was my turn to look up at the sky.

During the following weeks (or was it week?), many items were donated/manufactured/repaired/procured for the cause. Antennas built were a 160/80/40-meter dipole and a three-element wire beam for 40 meters. An 80/40-meter dipole was left over from a previous Field Day, so we used it for the Novice/Technician station. A tribander was donated by Larry WB9RRT, as well as a 2-meter Ringo Ranger for packet and 2-meter and 432-MHz beams for OSCAR.

Bright and early (well, maybe not too early for some) Saturday morning, June 22, the effort came together at the Meadowood County Area Fire Department practice site south of Troy NH. There were quite a few surprises that day, some not even ham related. First, when we arrived there were already about 10–15 non-hams there. Ah! Lots of help! Not so. They were there to practice smoke inhalation, at least that was what it looked like to me. Later on, more people in cars drove up honking their horns. Ah! More help! Not so again. A wedding reception was being held in the muster hall. Oh, well.

One very distinctive thing about the practice area is an approximately 50-foot fire tower made up from three power poles, a perfect location for a beam and wire antennas. Luckily, Jeff had asked Bob, a member of the fire department, if the ladder truck could demonstrate its capabilities on Saturday and Sunday.

The ladder truck demonstration allowed Larry WB9RRT, Lennie WA1UNN, Craig N1ACH, and Dave N1BBD a chance to climb the tower in style and mount the tribander, 160/60/40 dipole, and the end support rope of the 40-meter beam.

At the same time, Chuck and I were busy trying to stay dry while mounting the vertical on a 15-foot mast driven in the mud of Bowker Pond. I am happy to say that we accomplished both. The Leaning Tower of Pisa has nothing over our installation.

Once the tower end of the 40-meter-beam rope was secured, Steve KA1MTD and Dave WA1SOZ attached the elements and raised the other end to a flagpole. After this installation was completed, the Novice 80/40 dipole was raised and tuned to the Novice portion of the bands.

Power for this operation was supplied by a 5000-Watt surplus generator, driven by a Crosley 4-banger, and a 3500-Watt Sears generator. Our thanks to Walt WA2VSN and Dale KA1CPZ for the use of the long electrical cables that allowed us to operate away from the noise of the generators.

Dawn K1TQY had volunteered early in the development stages to shop for and transport the food the team might consume in the effort. Sure enough, she showed up with the goodies and was helped in the storage by Kathy KA1MTC and Gerry KA1AKI. And what would we have done without one of our first volunteers, Scott WA1YTW, who handled publicity and bartending. I am able to say that he did very well in one of the two jobs—the most important one, of course.

While the antennas were being assembled and erected, the operating stations were being set up. One station used a Kenwood TS-830, a Ten-Tec 425 amplifier, and a DenTron tuner. This station used the tribander and 160/80/40 dipole antennas. The second station used another Kenwood TS-830 and a Heathkit 221 amplifier. Its antennas consisted of the 40-meter wire beam and the 5-band vertical in the lake. The Novice/Technician station used an ICOM IC-701 and an 80/40-meter trap dipole.

The time had finally arrived: 1559Z, June 22. Everyone was ready... well, almost. Hey Jeff, what callsign are we using?" Oops. We had used W1XU last year, but Jim was unable to attend this year. Nobody volunteered their callsign due to possible greetings from Uncle Charlie. We then noticed that Bob K1XR was not in attendance yet, so the membership voted, and Kilo One X-Rated was on the air.

The first station needed the most electrical power because the Ten-Tec 425 is capable of 1500 Watts out. This station was run by the 5000-Watt generator. The second station and the Novice/Tech station were run with the 3500-Watt generator. There was a bit of trouble getting the big generator started, but once it got going, it was shut down just once during the operation to check the oil. One quart was added and the rig was started again. The 3500-Watt generator was shut down about every 2½ hours for fuel and oil check. Its only problem was not starting after one refueling, but cleaning the spark plug seemed to solve the problem and it ran fine the rest of the time. Both generators ran with about a 5-to-10-volt fluctuation during operation which did not appear to cause any equipment or operating problems.

It was decided not to have a station operating schedule. It appeared to work out very well until the wee hours of the morning when the operator of the second station went to sleep at the switch. I would like to apologize for the continous keydown signal caused by forehead-on-key operation. After mentioning all those who set up, I feel I should also mention those who operated the equipment at one time or another: Jeff WB8BTH, Larry WB9RRT, Arnie N1BAC, Bob K1XR, Craig N1ACH, Bruce WA1YZN, Troy KA1IRV, Perry KW1O, Chuck KA1MTM, Gerry KA1AKI, Dale KA1CPZ, Steve KA1MTD, Dave WA1SOZ, and Dave N1BBD.

What would a Field Day be without visitors? I would like to thank the following for their support and maybe next year we can get them to come and operate also: Joe WB1AMI and XYL, Lem K1IOJ and XYL, Warren WA1RLO (he did help take down the antennas), Snookie KA1DE and son Todd KA1MLV, and lastly, Grahm Brusie, a non-ham, but hopefully not for long.

I would like to give special thanks to Jack Burnett, Frank Cordelle, Dianne Ritson, and Linda Drew of *73* for their special talents. Without them, the cover of this issue and this report would not have come about. Also, thanks to the Meadowood County Area Fire Department for the use of their site and equipment.

It certainly appeared that all had a good time, which is one thing I really enjoy about Field Day. We weren't trying to beat anyone, we were just showing the public that hams are able to operate during difficult situations as well as have fun while doing it.

It appears to me that I should start attending more meetings of the Friday Afternoon Radio Technical Society, especially during the months of April, May, and June. Who knows who the president will be next year.

Arnold "Arnie" Johnson N1BAC
N. Swanzey NH

SATELLITES

USING THE AO-10 APOGEE PREDICTIONS

Apogee predictions for the month of September are provided for three sections of the United States: Washington DC at 39N 77W, Kansas at 39N 95W, and California at 38N 122W. Times are in UTC and apogee in this case is mean anomaly 128 rounded to the nearest whole hour. Use the chart as a guide in aiming your antenna, then fine-tune the azimuth and elevation values to peak the satellite's beacon signal. If you require more accurate orbital predictions, contact AMSAT at PO Box 27, Washington DC 20044.

			WASH		KANSAS		CALIF	
ORBIT	DAY	TIME	AZ	EL	AZ	EL	AZ	EL
1998	1	0100	122	4				
2000	2	0100	120	0				
2001	2	1200					240	2
2003	3	1200					234	4
2005	4	1100					226	11
2007	5	1000			239	2	217	18
2009	6	1000			233	3	211	19
2011	7	0900	239	0	225	11	200	24
2013	8	0800	231	8	216	18	187	27
2015	9	0800	225	9	209	18	181	25
2017	10	0700	216	16	198	23	168	25
2019	11	0600	206	21	186	26	156	23
2021	12	0500	194	26	173	27	144	19
2023	13	0500	188	24	168	23	140	14
2025	14	0400	175	25	155	21	131	9
2027	15	0300	162	24	144	18	122	2
2029	16	0300	157	20	140	13		
2031	17	0200	146	17	131	7		
2033	18	0100	136	12	122	1		
2035	19	0100	132	7				
2037	20	0000	124	1				
2040	21	1100					237	1
2042	22	1000					230	8
2044	23	1000					224	10
2046	24	0900			236	0	215	17
2048	25	0800			229	8	204	22
2050	26	0800	236	0	223	9	198	21
2052	27	0700	229	6	213	16	186	24
2054	28	0600	220	13	203	21	173	25
2056	29	0600	214	14	196	20	167	22
2058	30	0500	204	19	185	23	156	20

BE MY GUEST

What follows is the text of the ARRL's petition to the FCC requesting an expansion of Novice privileges. The Commission has received several petitions covering roughly the same area, and any Notice of Proposed Rule Making (NPRM) that the FCC generates will likely be a synthesis of all of them. However, we feel that the League's proposal embodies the heart of the issue and that the NPRM will contain most of the items requested in this petition. Please read it carefully. A vote against expanded Novice privileges will be a vote against amateur radio. Don't let that happen.—Ed.

RM-5038

The Amateur Radio Relay League, Incorporated (the "League"), the national association of amateur-radio operators licensed by the Commission, hereby respectfully requests that the Commission issue a Notice of Proposed Rule Making looking toward amendment of the Amateur Radio Service Rules (47 C.F.R. Part 97) to enhance the operating privileges of Novice-class amateur-radio operators. In support of this Petition, the League states as follows:

Introduction

The Amateur Radio Service has always been self-reliant in terms of attracting newcomers to its ranks. Commission figures show an influx of 17,392 new Novice licensees from October 1, 1983, through September 28, 1984, comprising the bulk of a total of 18,800 new licensees of all classes during that period. Obviously, the Novice-class amateur license is the first exposure of most newcomers to amateur radio. Unfortunately, the privileges presently available to Novice-class amateurs create a somewhat frustrating experience for many Novices for the reasons discussed below. As a result, a significant number of Novice-class licensees do not maintain their amateur licenses and/or do not upgrade their license class.

Presently, the extent of Novice frequency privileges are 50 kHz at 3.7-3.75 MHz (80 meters), 50 kHz at 7.1-7.15 MHz (40 meters), 100 kHz at 21.1-21.2 MHz (15 meters), and 100 kHz at 28.1-28.2 MHz (10 meters). Morse-code telegraphy is the only operating mode permitted. Even if one is sufficiently interested in Morse-code operation to utilize the full extent of Novice privileges presently available, propagation conditions are now so poor on the two highest-frequency Novice subbands (10 and 15 meters) that, except for local communications, operation is largely limited (and will be so for the next four or five years) to the 40- and 80-meter bands. During the evening hours, the times of greatest amateur activity, the entire 40-meter Novice band is occupied by high-powered international broadcast stations. In the 80-meter band, Novices are faced with increasing competition and interference from Canadian telephony operation below 3750 kHz. Although there are "gaps" which exist between these stations in which experienced telegraphy operators can and do effectively communicate, the same conditions significantly inhibit and frustrate Novice-class licensees.

Given the crowded state of all amateur bands below 21 MHz, and the need to protect privileges that have been earned by holders of the General and higher classes of amateur license, there is little that can be done in these bands to alleviate the difficult conditions facing the Novice radio amateur. Yet, something must be done to increase the attractiveness of this class of license if the Amateur Radio Service is to continue, in future decades, to fulfill its basis and purpose as set forth in the Commission's Rules (47 CFR 97.1). The result is that many Novices lack the incentive to upgrade to a higher class of license, for they have not experienced a sufficient taste of amateur-radio operating to develop a thirst for greater privileges. While Morse-code communication always has been, and no doubt always will be, an important part of amateur radio, it is appropriate even at the beginner level for amateurs to be exposed to other operating modes. (The Commission recognized this when the Novice license was established in 1951, by granting voice operating privileges in the 145-147-MHz band. At the time the Novice license was a one-time, one-year, nonrenewable license, and many Novices who used their voice privileges found that their skills had not developed sufficiently in one year to permit them to upgrade. The privilege was withdrawn on November 22, 1968. Now that the Novice license is renewable, with a ten-year term, this situation no longer applies.) The League's proposal is to provide Novices with voice and data communications privileges sufficient to permit intercommunication with other local amateurs and to provide an occasional opportunity for the long-distance communications that give the Amateur Radio Service its "unique ability to enhance international goodwill." This enhancement of Novice privileges would provide greater motivation for amateurs-to-be to obtain their first license, without reducing the desire to upgrade by attaching too many privileges to what is, and should continue to be, an elementary license. A slight expansion of the syllabus for the Element 2 written examination is also proposed, to encompass basic data communications and voice operating procedures and concepts; the Novice examination would be expanded by ten questions to accommodate the additional material.

The League's Proposal

The first feature of the League's program is to add limited Novice digital communications privileges, to attract young people interested in computers and digital communications to amateur radio. Radioteleprinter and packet-radio privileges on 10 meters, between 28.1 and 28.3 MHz, are proposed, with A1A, J2A, F1B, and J2B emissions (1200 baud maximum). Given the expansion proposed, from 100 to 200 kHz, it is anticipated that a suitable band plan will be developed for the band to keep a large segment free for conventional manual Morse-code operation.

The same band provides an opportunity to permit limited low-power single-sideband operation at 28.3-28.5 MHz. It is anticipated that this would have minimal impact on other licensees. Telephony operation by General-, Advanced- and Extra-class licensees in that segment has not been extensive since the expansion of the telephony subband to include the 28.3-28.5-MHz segment. This is due to the general absence of long-distance propagation on the band since the segment was made available for voice operations less than one year ago. Thus, to permit telephony operation in that segment by Novice licensees would provide a limited, yet significant, enhancement of Novice privileges without inconveniencing other licensees. (This proposal is not unique worldwide. Novices in fifteen countries are permitted to operate telephony on 28 MHz in various segments, at various power levels. These countries include Argentina, Australia, Bolivia, Federal Republic of Germany, Greece, Hungary, Japan, Jordan, Lebanon, Mexico, Netherlands, Papua New Guinea, Spain, Sweden, and Uruguay.) Type A1A, J2A, and J3E emissions in this segment are proposed.

Some limited VHF FM repeater privileges should be accorded so that the large number of Novice licensees can be introduced to and put to use in public-service communications. The League proposes that Novices be permitted use of 220-225 MHz, all voice and data modes (including radiotelegraphy), with a power limit of 25 Watts output. Repeater operation by stations licensed or controlled by Novices would not be permitted. That is to say, a Novice licensee could not sponsor or be the trustee of one. For the same reasons, the League suggests that a portion of the 1240-MHz band, specifically 1246-1260 MHz, be made available to Novices, with a power limit of 5 W. This power limit is proposed so as to avoid concerns relative to rf energy exposure by inexperienced persons. The 1246-1260-MHz segment is proposed as a band which can be allocated with a minimum of delay and a minimum of disruption of existing operation.

The League suggests, at the time the proposed additional privileges are added, that the Element 2 examination syllabus be expanded to include basic digital and voice operating techniques. This is necessary in order that the examination content be commensurate with the privileges granted by the license class. In this connection, it would be proper to expand the Novice written examination to thirty questions and the question pool (PR Bulletin 1035A) to 300, to accommodate additional questions on operational aspects of the additional privileges available to Novice licensees. Present Novice licensees shoul_ not be required to submit to reexamination.

The League proposal is not intended to reduce in any way the operating privileges available to General-, Advanced-, and Extra-class licensees. Presently, Section 97.67(d) limits all licensees' operating power to 200 Watts PEP output when operating in Novice subbands. Given the relative absence of General-, Advanced-, and Extra-class operation on those frequencies, and because the instant proposal would allow Novice privileges on additional frequencies on which higher-class licensees have been permitted full-power operation, modification of Section 97.67(d) is proposed. Specifically, it is suggested that Novice-class licensees be permitted to operate on HF frequencies available to them at 200 Watts PEP output, 25 Watts at 220-225 MHz, and 5 Watts at 1246-1260 MHz. Other licensees would be permitted to operate at power levels permitted by their class of license. For other than Technician-class licensees, it is not proposed to continue to limit power of higher-class licensees when operating within Novice subbands.

With the additional privileges proposed, the Novice-class amateur license would become more attractive to newcomers to amateur radio, and more importantly, it would provide sufficient diversity of operating privileges to provide the entry-level licensee with an incentive to upgrade his or her license class and remain involved with amateur radio.

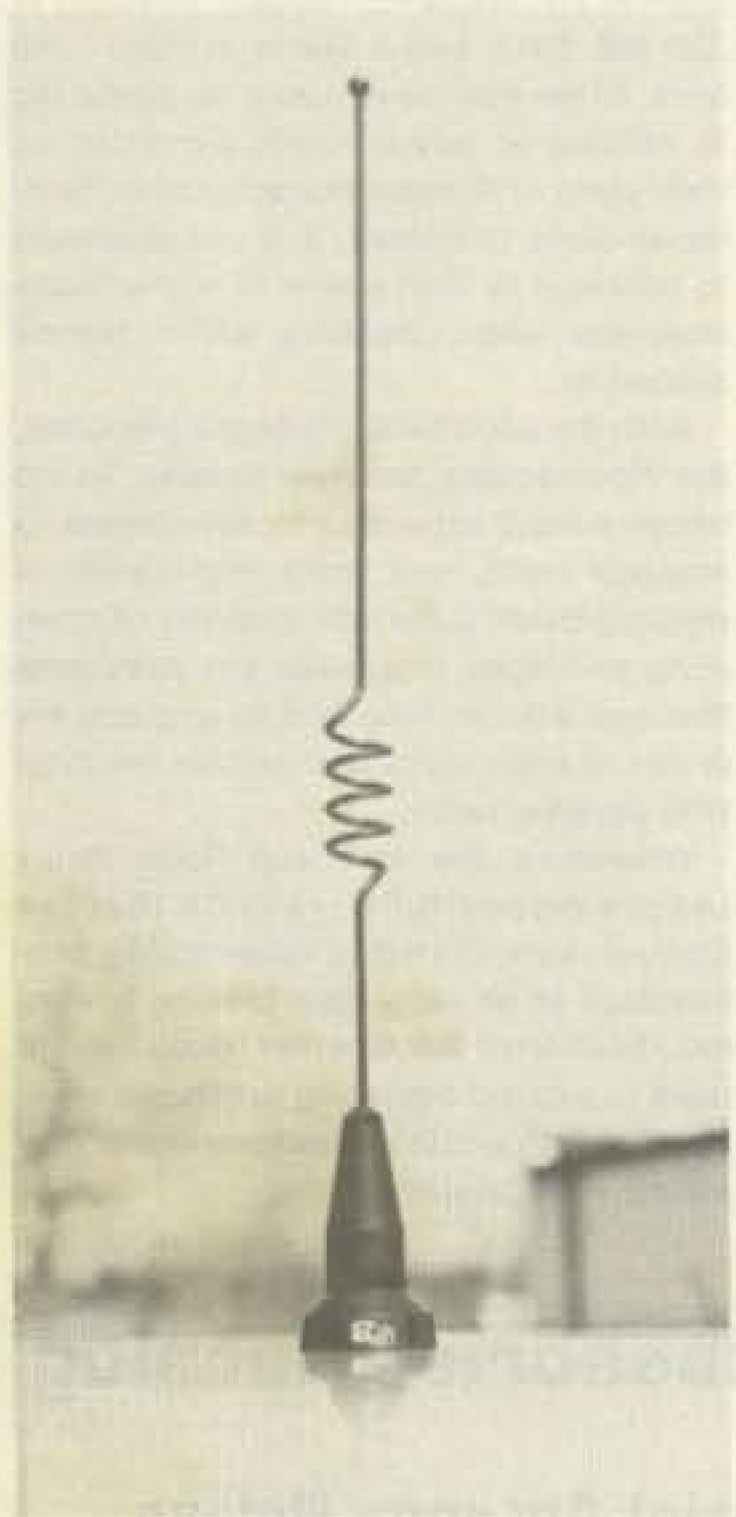
Wherefore, the American Radio Relay League respectfully requests that the Commission institute rulemaking proceedings at an early date looking toward modification of the Amateur Radio Service rules to expand operating privileges available to Novice-class licensees in the Amateur Radio Service.

NEW PRODUCTS

TEFLON™-CLAD ANTENNAS

Two new mobile antennas designed for cellular applications have been introduced by The Antenna Specialists Co. The new antennas feature black Teflon S-coated whips and adapters which provide additional protection for high-corrosion localities.

Model ASPD1860 is the Teflon S-coated version of the company's Model ASPD1850 standard roof mount. The 3-dB-gain antenna is furnished with a positive



Antenna Specialists' ASPD1860 cellular roof-mounted antenna.

male/female rf connection at the antenna base and 17 feet of A/S low-loss PRO-FLEX™ cable.

Model ASPRD911 is the black, Teflon S-coated, deck-mounted, elevated-feed antenna. The stanchion assembly and base also are black. Exhibiting 3 dB gain, the antenna covers the entire cellular spectrum without cutting or tuning. It requires no ground plane and therefore is especially appropriate for vehicles with fiberglass bodies. The antenna terminates with a female N connector and is supplied without cable.

For further information, contact *Marketing Department, The Antenna Specialists Co., 12435 Euclid Avenue, Cleveland OH 44106.*

BV ENGINEERING ANALYSIS SOFTWARE

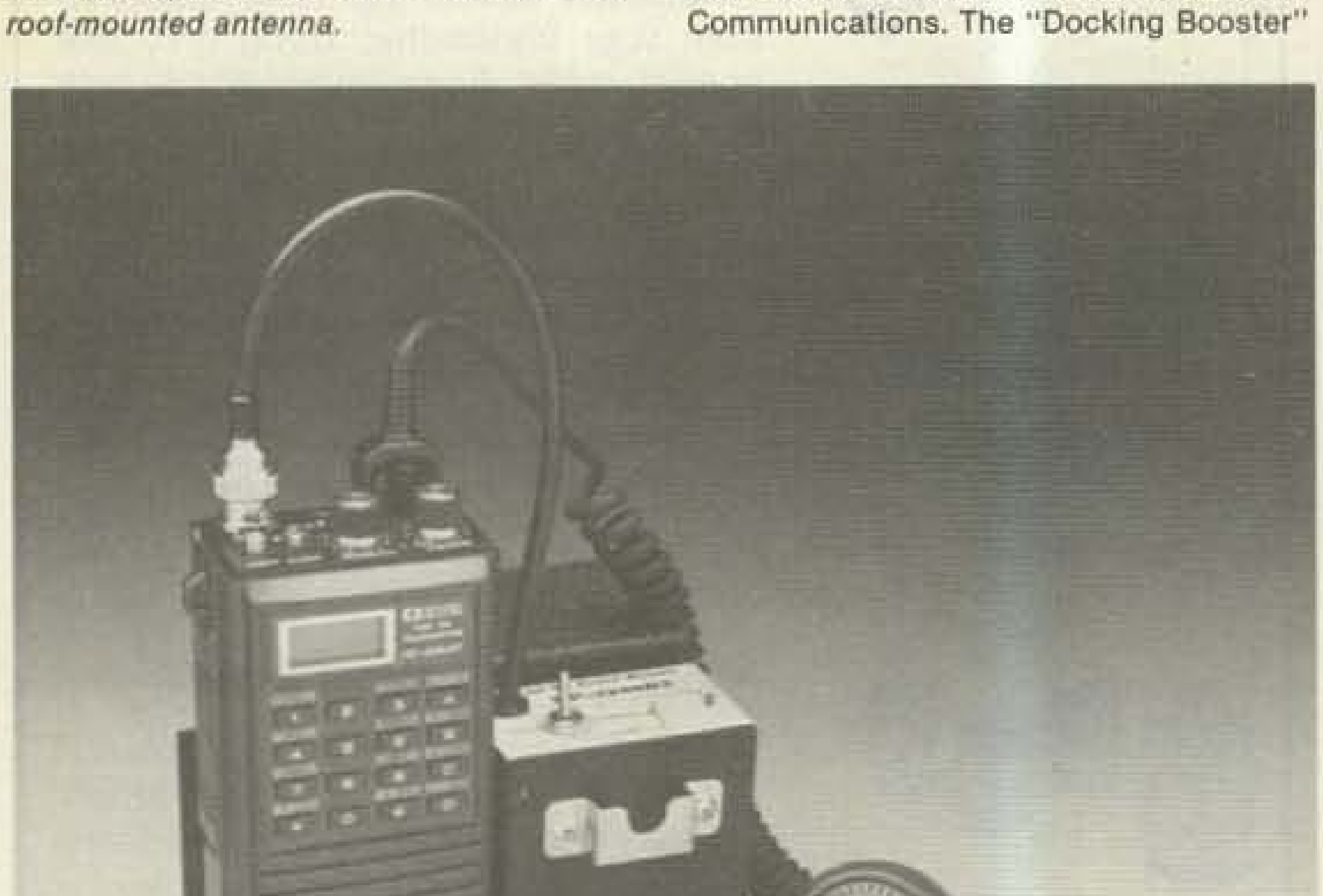
BVE's LOCIPRO software provides control-system and electronic engineers a simple means to quickly determine closed-loop system stability from open-loop transfer functions. LOCIPRO is a stand-alone computer program which quickly solves the locus of roots for systems up to 26th order and with ten loop elements. Output data can be vectored to a line printer or to a data file. All program inputs are free-format and menu-driven. All output files are compatible with other BVE programs, so you may add transient analysis and high-resolution graphics. LOCIPRO is available under MS-DOS, CP/M-80, and TRSDOS in 121 different disk formats.

For additional information and a free catalog, write *BV Engineering, 2200 Business Way #207, Riverside CA 92501.*

CMC COMMUNICATIONS DOCKING BOOSTERS

A new series of power boosters for hand-helds is now available from CMC Communications. The "Docking Booster" combines a 30-Watt power amplifier and a 16-dB-gain GaAsFET preamplifier to extend the range of your Kenwood, Yaesu, ICOM, or Standard HT. The Docking Booster is mounted on a convenient bracket that fits on most car doors and incorporates the amplifiers, a microphone clip, dc cabling, and a UHF external antenna connector. Separate models are available for 2m and 70-cm handie-talkies.

For complete details, contact *CMC Communications, Inc., 5479 Jetport Industrial Blvd., Tampa FL 33614; (813)-885-3996.*

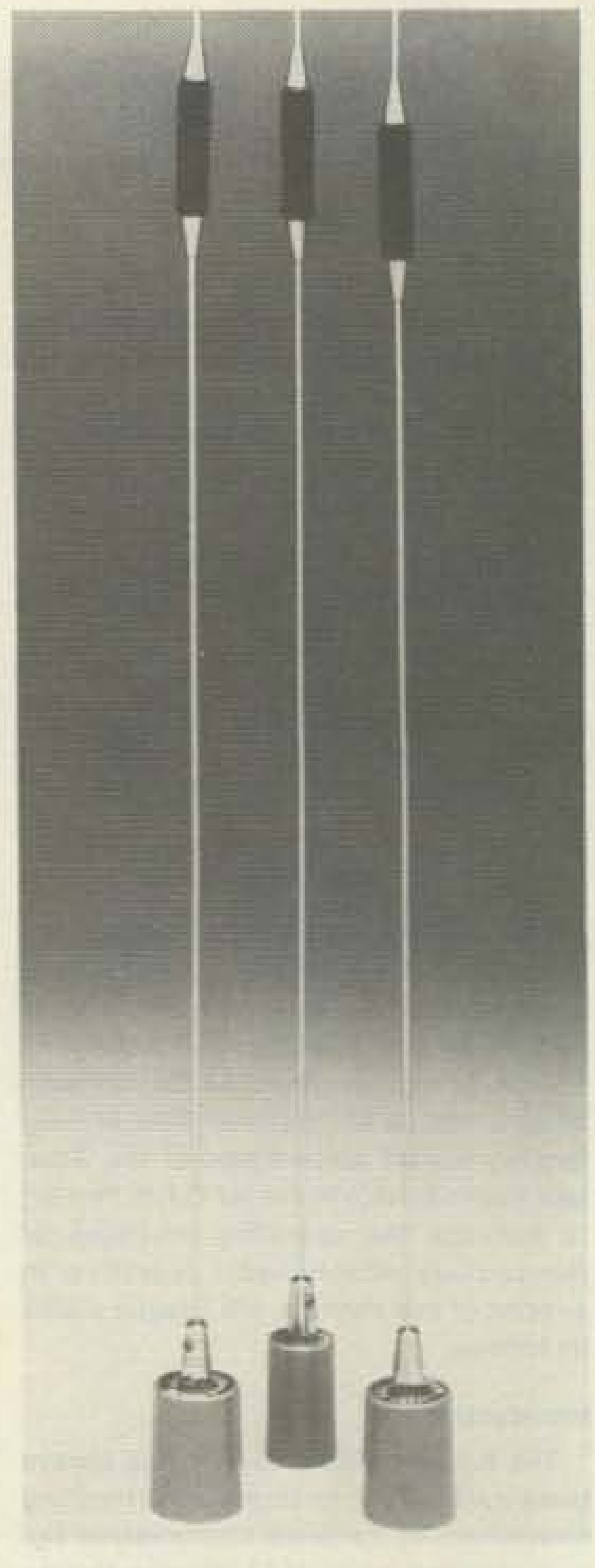


CMC's Docking Booster for HTs.

LARSEN DUAL-BAND MOBILE ANTENNAS

Larsen has announced a series of dual-band mobile antennas for the 2m and 70-cm amateur bands. The new design incorporates a half-wave element for 144–148 MHz and collinear elements for 440–450 MHz. The single antenna thus conveniently works on both bands. The self-resonating design doesn't require a ground plane, so the antenna is ideal for use in mobile and base applications using standard Larsen BSA-K hardware.

For complete details, contact *Larsen Electronics, PO Box 1799, Vancouver WA 98688; (206)-573-2722.*



Dual-band antennas from Larsen.

ALPHA DELTA TWIN-SLOPER ANTENNA

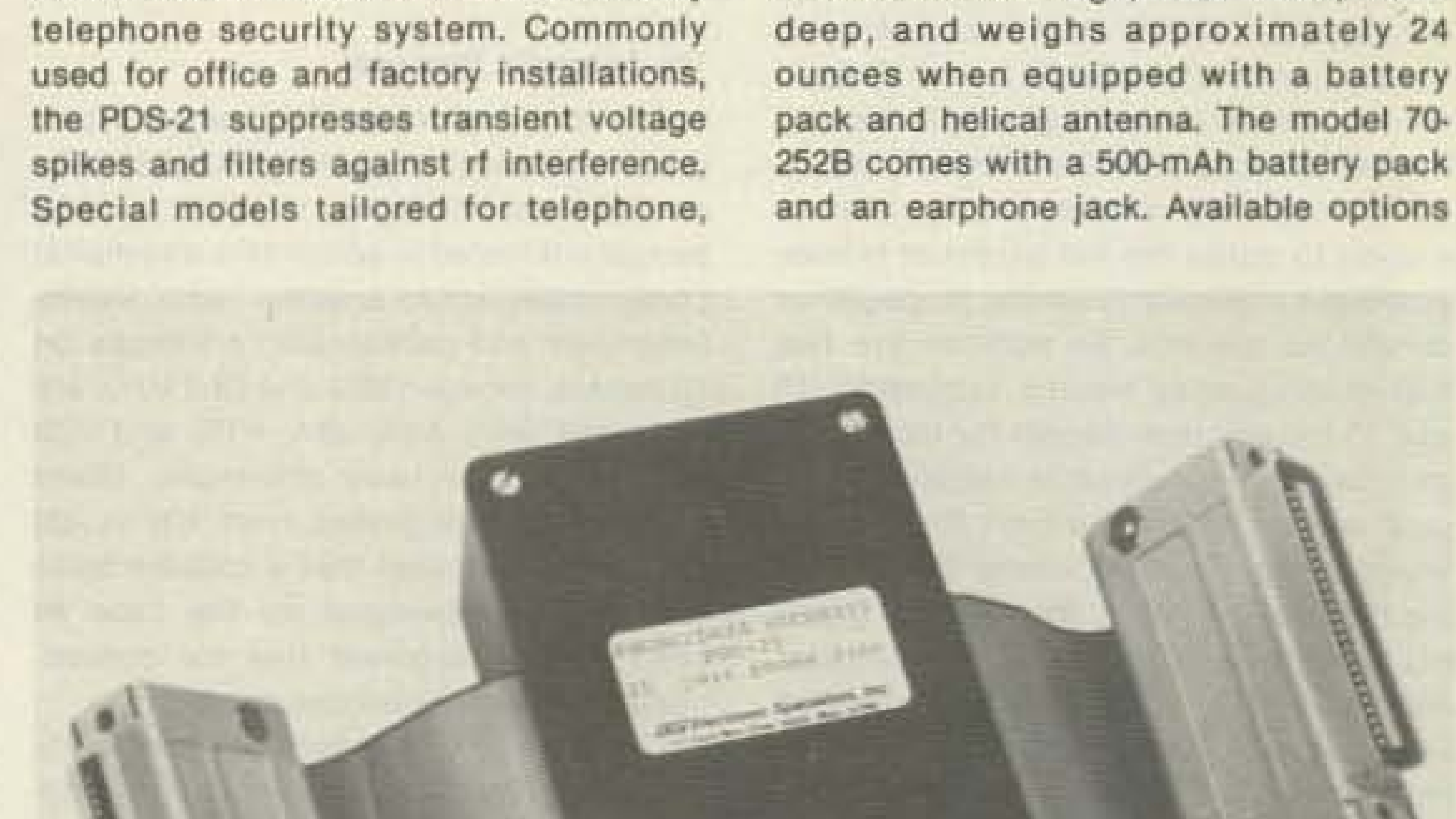
Alpha Delta Communications is now offering the DX-A twin-sloper antenna. Operating on 160, 80, and 40 meters, the antenna uses a tower or downlead as the counterpoise. One side of the antenna (33 feet long) operates on 40 meters, and the other side (80 feet long) is for 80 and 160 meters. The 80/160 leg is broken by an Iso-Res isolator/resonator coil (an rf choke) to provide the dual-band capability. The DX-A exhibits excellent low-angle radiation and can easily handle high power. The antenna comes complete with stainless-steel hardware, insulators, and support rope.

For more details, contact *Alpha Delta Communications, Inc., PO Box 571, Centerville OH 45459.*

PDS-21 TELEPHONE SECURITY SYSTEM

Electronic Specialists' product line now includes the Kleen Line PDS-21 secondary telephone security system. Commonly used for office and factory installations, the PDS-21 suppresses transient voltage spikes and filters against rf interference. Special models tailored for telephone, data, or remote-control applications may be ordered. One through twenty-five pairs may be accommodated.

For more information, contact *Electronic Specialists, Inc., 171 S. Main Street, PO Box 389, Natick MA 01760; (800)-225-4876.*



The PDS-21 telephone security system by ESP.

MIDLAND MOBILE

Midland Land Mobile Radio has announced a new four-channel UHF portable FM radio. The model 70-252B covers 450–470 MHz, with an output of 5 Watts. The radio is 6-13/16" high, 2-3/8" wide, 1-5/8" deep, and weighs approximately 24 ounces when equipped with a battery pack and helical antenna. The model 70-252B comes with a 500-mAh battery pack and an earphone jack. Available options

Midland LMR's model 70-252B UHF portable radio.

include tone-coded squelch, an earphone, a vehicular charger, and a one-, two-, or eight-unit desktop charger.

For complete details on Midland LMR's model 70-252B, contact *Midland LMR, Marketing Department, 1690 N. Topping, Kansas City MO 64120.*

ASD SOLDERING GUN

American Soldering Devices Corporation has announced their new model WG-1400 soldering gun. The WG-1400 features a dual-position trigger switch for high (140 Watts) and low (100 Watts) heat settings and a built-in spotlight to provide work-piece illumination. The heavy-duty tip may be readily tinned for soldering, or used dry for working with thermoset plastics.

For further information, contact *ASD Corporation, PO Box 24, Shirley NY 11967.*

AEA ATU-1000

Advanced Electronic Applications has announced the ATU-1000 Advanced Terminal Unit. The ATU-1000 combines Morse, Baudot, ASCII, packet, and AMTOR for complete HF RTTY operation. Both mark and space tones may be adjusted independently from 1000 to 3000 Hz, providing compatibility with all commercial and amateur tone pairs. For fixed-pair operation, an optional eight-pole bandpass pre-filter is selectable from the front panel. The CW filter is adjustable from 700 to 2500 Hz. Received-signal tuning is indicated by a discriminator-style LED bar graph with a selectable mark-only, space-only, and summed-mark-and-space display. A front-panel frequency counter shows the input mark-filter center frequency, the space-filter center frequency, the AFSK-generator mark or space frequency, or the frequency of the incoming signal. I/O may be accomplished via TTL, RS-232C, or current loop.

For more details on the ATU-1000, contact *AEA, PO Box C-2160, Lynnwood WA 98036; (206)-775-7373.*

The ATU-1000 from AEA.

HAMTRONICS PACKET AMPLIFIER

Hamtronics has announced a version of their 220-MHz power amplifier designed specifically for packet-radio use. Called the PPA-220, the new amplifier is similar to the Hamtronics LPA 2-40 but features increased gain (up to 50 Watts out with 2 Watts in) and a built-in PIN-diode antenna switch to limit T/R switching to only a few milliseconds. With its ultra-fast T/R switching, the PPA-220 is an ideal amplifier for inter-area 9600-baud packet relay stations.

For more information about this and other Hamtronics products, write or call *Hamtronics, Inc., 65 Moul Road, Hilton NY 14468-9535; (716)-392-9430.*

HEATHKIT HD-4040 TNC

The HD-4040 Terminal Node Controller (TNC) has been added to the amateur-radio product lineup at Heath Company. The HD-4040 is a version of the popular Tucson Amateur Packet Radio (TAPR) TNC which allows communication using terminal or computer control of any amateur-radio system. Packet radio ensures error-free communication and greatly increases communication speed. The HD-4040 has a built-in 1200-baud modem, and baud rates of up to 9600 are possible with an external modem. Both AX.25 and VADCG protocols are supported.

Three modes of operation are provided: a conversation mode which allows communication with another operator, a command mode which allows configuration of the TNC and the use of a variety of operating commands, and a transparent mode which is used when transferring files from one computer to another. A built-in beacon can be set to transmit a message at designated intervals.

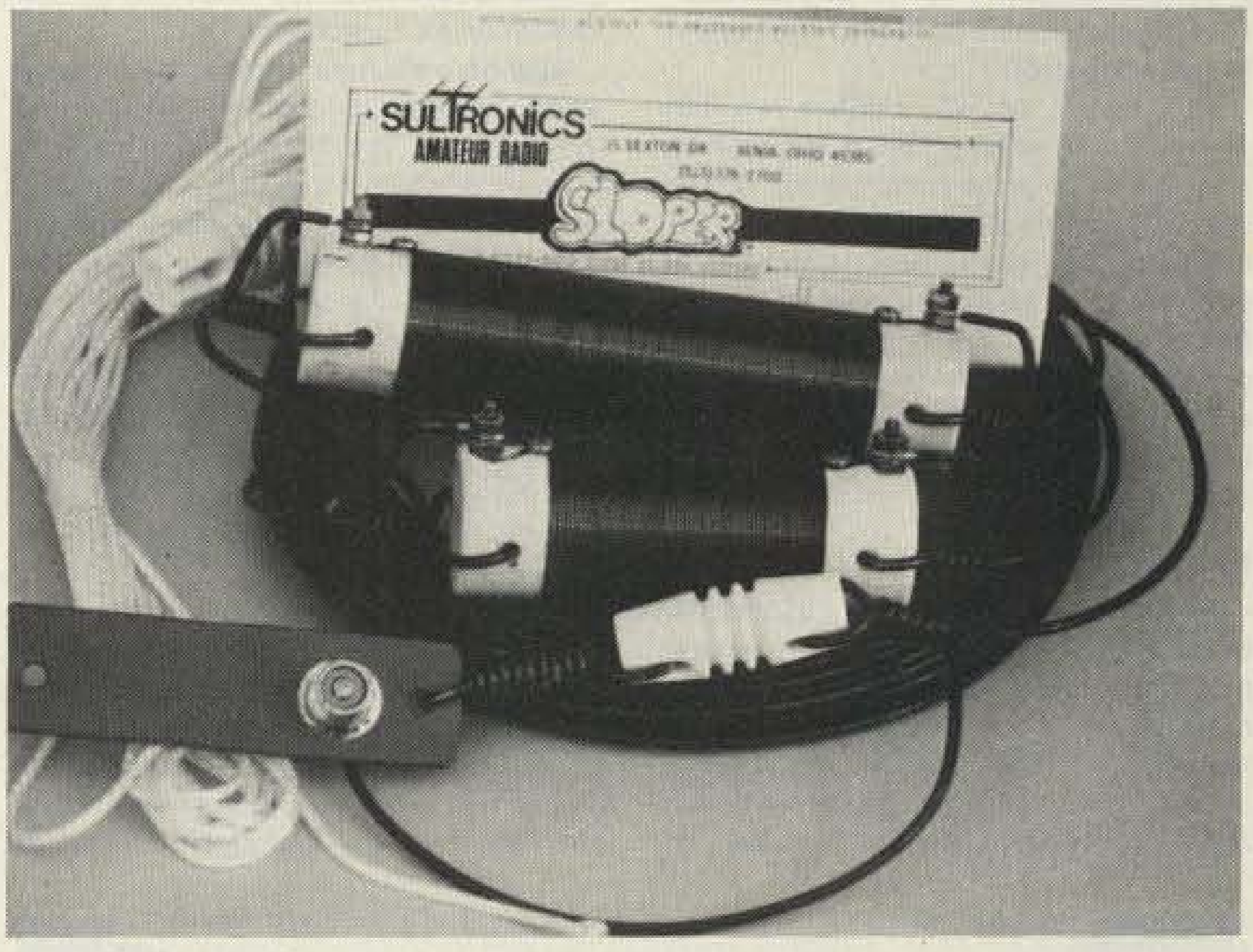
For more information about the HD-4040 TNC and a free catalog of Heath products, contact *Heath Company, Dept. 150-525, Benton Harbor MI 49022.* In Canada, write *Heath Company, 1020 Islington Avenue, Suite 3100, Toronto, Ontario M8Z 5Z3.*

SULTRONICS HF SLOPER

Sultronics Amateur Radio has introduced their HF Sloper series antennas for 160, 80, and 40 meters. The SS-2A Duoband Sloper, which is only 45 feet long, covers 80 and 40 meters, and the 60-foot SS-3A Triband Sloper handles 160, 80, and 40 meters.

Both models are trapless and feature a 50-Ohm coaxial feed, #12 solid copper wire, and a heavy-duty aluminum mounting bracket. The inherently low angle of radiation makes these models ideal for DX work when only a small antenna is appropriate, and both the SS-2A and SS-3A are useful for general-coverage SWLing.

For more details, contact *Sultronics Amateur Radio, 1587 US 68 North, Xenia OH 45385.*



The SS-3A Triband Sloper from Sultronics.

REVIEW

MFJ'S PORTABLE ANTENNA AND ANTENNA BRIDGE

Every active ham I've ever known has, at one time or another, found himself or herself in a real pickle concerning a suitable antenna. No, I don't mean at the home station usually (but it has happened there, too); what I'm getting at is the portable situation in a hotel room, a motel, at a vacation site, or even "hilltopping" in the car.

Let's take a f'rinstance that happened to me recently. I was forcibly ejected from my "shack" (the spare bedroom) because of some house guests...and I wanted to listen to my R-71A...but no antenna! Sure, I could have strung up a random wire over the picture frames, the doors, window sills, and a lamp shade or two ...and believe me I've done that before...but this time I decided to go the elegant route. Why did I choose to call it elegant? Bear with me a minute or two.

A few weeks ago, I ordered the MFJ-1621 Portable Antenna from MFJ Enterprises out there in Mississippi. It had arrived but I hadn't got around to trying it yet. It's really a *transmitting* antenna, unlike many of the so-called portable antennas you'll find here and there. It consists of a 54-inch telescoping whip mounted on a small black phenolic case that contains a built-in antenna tuner and a field-strength meter, *plus* 50 feet of coax *and* a PL-259 connector!

All I had to do was tighten two setscrews on the whip to hold it securely on a stud that projects from the top of the box. Well, since I didn't plan to transmit at this particular time, there was no need to slip the clear plastic tube over the extended antenna. (This is a safety feature provided to protect the operator when the antenna is being used as a transmitting antenna and is hot with rf, and it comes with the antenna.)

Receiving

To make a long story short, I quickly extended the antenna, connected it to the box, and plugged the coax connector into my ICOM R-71A general-coverage receiver. Voilà! This antenna covers only the 40-, 30-, 20-, 15-, and 10-meter amateur bands and I wasn't able to listen to the AMers on 75...but that didn't matter. I was in business.

The 40-meter band has several switch positions and, of course, a variable capacitor so that the entire band can be tuned and the antenna matched to frequency. By careful adjustment I was able to bring in stations throughout the entire range—and with surprisingly good signal strength, too.

There was no difference in the ease of tuning and matching on the other bands, either, and good signals were heard, even on 10 meters (somewhat of a rarity these days considering the state of the ionosphere and the MUF). You'll be interested to hear that there is considerable overlap, and that frequencies somewhat above and below the amateur bands can be tuned in easily.

You wouldn't expect the performance of a full-size outdoor antenna and neither did I, but I was absolutely pleased with what I did hear, and that included a lot of DX stations.

Transmitting

After the company had gone and I was back in my shack, I thought it might be appropriate to try the 1621 as an indoor antenna for transmitting, so I slipped the plastic sleeve over the metal whip and hooked up my transceiver.

Now here's where another MFJ device works really great—the MFJ-204 Antenna Noise Bridge. The bridge has a meter, a frequency-tuning capacitor and range switch, a resistance/impedance control, and provisions for either an internal battery or a battery eliminator so that it can be used on 115 V ac. Normally, you use the bridge by listening to the signal output on an accurately-calibrated receiver and setting it to the frequency you wish. Then you turn the resistance/impedance control for a meter null and read the antenna feedpoint impedance.

In this case, I wanted to adjust the MFJ Portable Antenna to 50 Ohms on the low end of 40 meters. Simplicity itself. First, I coupled the MFJ Noise Bridge to the receiver antenna-input jack and selected the proper frequency range, varying the frequency control on the bridge until I heard the signal in the receiver at the desired frequency. Next, I set the resistance/impedance control to 50 Ohms. Then I disconnected the bridge from the receiver and connected the coax fitting of the portable antenna to the noise-bridge fitting. The final step was to adjust the controls on the antenna until the noise bridge showed a null. This was so easy to do and so fast that it was done quicker than I can write about it here.

Then I disconnected the antenna coax fitting from the noise bridge and plugged it into the transceiver, firing up the rig on the low end of 40 (yeah, yeah...I'm a CW nut...but you can do the same thing in the phone band if you wish).

Believe it or not, the rig was perfectly matched to the antenna, showing maximum output on the portable antenna's meter, and I managed to work quite a few stations with good signal reports. No, I didn't receive a report that I was pinning the S-meter on somebody's receiver, but I did get a fair share of 579 reports, two 589s and even one 599. Friends, it works!

Being the inquisitive type and not trusting to luck, I repeated the procedure on 20 meters with similar results. As you might expect, the frequency bandwidth on 20 is better than that on 40, so less retuning is necessary as you change frequency up and down the band. This is typical of any antenna, so no problem or unexpected situation here. If anything, stations came back more readily than on 40!

Conclusions

I am very well pleased with both pieces of equipment because they work so well and so quickly. You can carry the MFJ Portable Antenna with you in a suitcase, a briefcase, or a very small box...and the same goes for the MFJ Noise Bridge. Both will fit in an attaché case with room to spare, so there's no excuse for not carrying your transceiver with you wherever you go...because you can be on the air virtually instantly from almost any location.

I forgot to mention the fact that there's a frequency-counter input on the noise bridge, so you'll be able to adjust the frequency accurately if you don't want to use the receiver for the same purpose. The bridge covers a frequency range of at least 160 through 10 meters, so it should be just right for any HF operation you may contemplate. Another great feature is its independence of the power mains, allowing you to take it up to the roof or out to the antenna in the "back 40" without dragging a power cord with you.

The bridge does not read reactance because to provide that feature MFJ would have had to make it more expensive. However, a resistive reading is all that I needed for my adjustments, and I think that you'll find that the case with your own experiments.

Price and Availability

The MJF-1621 Portable Antenna is available from your dealer or from *MFJ Enterprises, Inc., Box 494, Mississippi State MS 39762*, and the price is $79.95. The MFJ-204 Antenna Bridge also costs $79.95.

Jim Gray W1XU
73 Staff

MFJ-1621 Portable Antenna.

MFJ-204 Antenna Noise Bridge.

BILAL ISOTRON 20

"Why that's just a little feller," said one of my friends when he saw the Bilal Isotron 20 antenna for the first time. Sure enough, it *is* just a "little feller" in size, but its performance belies its appearance. Remember David and Goliath?

Last October, I reported on the Isotron 40 and the excellent results it produced for me on that band. Anticipating a need for a 20-meter antenna to support my desire to have a small, efficient, and easily-erected antenna for use away from home, I asked Ralph Bilal to send me the Isotron 20.

Once again, I wasn't disappointed. The Isotron arrived via UPS in a rugged box with all the components neatly packed and carefully preserved by lots of wrapping material and some rugged plastic envelopes containing the nuts and bolts. Ralph takes the trouble to tape things down inside the box so they won't rattle around, and he includes assembly diagrams and instructions...not just for the antenna that's in the box, but also for the other antennas he makes.

Assembly took only a few minutes, perhaps because of the familiarity I had with the Isotron 40, but probably because it's so simple and has so few parts. Here again is a coil wrapped around a rugged plastic rod, a capacity plate, a smaller tuning plate, an rf chassis connector that mates with your standard PL-259 coax fitting, and a few bits of connecting wire with their solder lugs. Maybe ten minutes at the very most to put it all together...and when you're finished, you have, well, something that doesn't look much like an antenna or anything else you've ever seen, for that matter. My Grandma used to say "pretty is as pretty does," and the Isotron antenna does very well, indeed.

At first, I mounted it on a piece of TV mast tubing (and there is a fitting on the antenna for exactly that kind of mounting) and placed it some 10 feet outside the wall of my house about five feet off the ground. (This was partly due to the fact that I didn't have a longer piece of connecting coax made up and used what I had. Mistake! Even I should have realized that this is the worst possible situation for an antenna—five feet off the ground and shielded by proximity to a house.) It tuned okay—with a bit of fussiness to get resonance, largely because of capacitance-to-ground effects. I had expected miracles, but none were being handed out that day and the antenna disappointed me. (Perhaps I ought to say that I disappointed Ralph by doing something that I knew better than to do.)

The next step was to put the TV mast up on the roof of the house attached to a chimney mount and to run a suitable length of coax to the transceiver. I used the MFJ Antenna Bridge to make a preliminary tune-up, setting the impedance at 50 Ohms, and found the best setting of the Isotron to be very, very close to this.

Now the antenna began to perform as it should! Stations from all over the world came roaring in (twenty was good that day). Tentatively, I called a CQ, not expecting much from this teeny little lump of inductance and capacitance... surprise! Right away an answer...589 from southern USA. Then, over the next hour, literally dozens of stations: England, Germany, USSR, France, Canada, Italy, and so on until I tired of the game. Switching between my standard 14AVQ and the Isotron 20, I found as much as two S-units difference and as little as no difference between the two antennas. Typically, when conditions are good, small antennas often perform as well as larger ones. When conditions are poor to marginal, then the larger antenna works best.

However, I should tell you that even though it is a compromise, the Bilal Isotron antenna does work well. You won't ace out any of the Big Gun DX stations, but then you didn't expect to, did you? For a Field Day portable antenna, a vacation antenna, or for a condo or apartment location, you'll find the Bilal antenna a good one. In fact, for the travel trailer or RV owner, I believe it would be nearly ideal. It is inconspicuous, does not look like an antenna (thereby not arousing suspicious neighbors), and does perform. You can cover all of the CW portion of the twenty-meter band or all of the phone portion with two different settings. You must tune it *very* carefully for best match to the 50-Ohm transceiver output, but a little patience here will reward you handsomely.

The Isotron 20 may be obtained through your dealer or direct from the *Bilal Company, S.R. 2, Box 62, Eucha OK 74342.* The price is $49.95 plus $3.50 shipping, packing, and handling charges. If you have any specific questions about this antenna or any of the other Bilal space-saving antennas, you'll find Ralph to be obliging and knowledgeable. Call him at *(303)-687-2837 or (918)-253-4094.*

Jim Gray W1XU
73 Staff

MAIL-ORDER ANNIE

There's a song from my college days written by the late Harry Chapin. It's a tale of a pioneer in the new West who has sent for a mail-order bride. When she steps down from the stagecoach she's far from a beauty, but to the lonely pioneer she's the best thing that ever happened to him. Her name was Annie.

I doubt if Harry Chapin was interested in antenna design, but if he had been, I think he might have written his *Mail-Order Annie* about the antenna-analysis program available from Sonnet Software. It's available for the Apple II series and the Commodore 64.

Contrary to the beliefs of some, inexpensive computers are very powerful when matched with well-written software. The past several years have seen many programs released for amateur-radio applications, but few really put the hardware to the test. Mail-Order Annie does!

Annie might best be described as a simulator. It might not have the same graphic appeal of Flight Simulator, but it allows quite realistic simulations of many different antenna systems and allows for the effects of real ground if desired. The results of the program are a table of figures and a polar graph showing the radiation pattern. Both results can be displayed on the screen or sent to a printer.

Most antenna programs allow little more than the design of dipoles, quads, yagis, and single-element verticals. Annie can analyze an antenna system with a theoretical limit of 65,536 elements! That would make a dandy antenna for the next competition.

Learning to operate Annie will take a while. The menu selections and the accompanying 54-page manual are well designed. This program goes beyond my own knowledge of antenna design, and I had to study the examples carefully. This is a function of my own lack of experience and not a shortcoming in Annie.

The detailed instructions lead you through an analysis of a standard dipole with and without the effects of ground, a sloping dipole, an inverted vee, a 1/4-wave and 5/8-wave vertical, phased verticals, and a 3-element yagi. The results of simulating different antennas can be very dramatic. Without ever walking outside you can try out various configurations and predict the results.

Annie seems well suited for use in advanced theory classes where it isn't very practical to construct several antennas and test them all in a very short period of time. In fact, a wise program coordinator for your club would do well to find someone who has Annie to demonstrate it one night. It's guaranteed to hold everyone's attention.

You can superimpose several patterns on the same grid for comparison purposes. The resolution of the polar graph is quite good. Though the curves become a bit jagged at times, the results utilize the high-resolution capabilities of both the Apple and Commodore computers.

One of the few drawbacks to Annie is the lack of printing routines to accommodate various printers. Like many programs for the amateur community, this one is written by a fellow amateur, Jim Rautio AJ3K. Jim wrote the print routine for his FX-80 printer, which means it doesn't work with the Commodore printers. All is not lost since the results of Annie can be saved to tape or disk and recalled at a later time. The stored plot can be recalled later on and printed using whatever graphics/hard-copy program you may have. The routine itself should not be difficult, and Jim is actively soliciting feedback from his users for various printer configurations. By the time you read this, additional information may be available.

Annie is 100 percent machine code. The computations are complex, but they breeze along at the maximum speed allowed by the 6502 processor. It's quite impressive to watch the plot appear before your eyes as Annie calculates the pattern.

Although my tower made it up before the bad weather, my 40-meter dipole is barely 15 feet off the ground. Annie has allowed me to sit in the comfort of the office all winter long with warm feet and take a look at several possible configurations for my dipole. Now that the weather is warm, I can configure my antenna without wasting time on some of the arrangements I had originally considered.

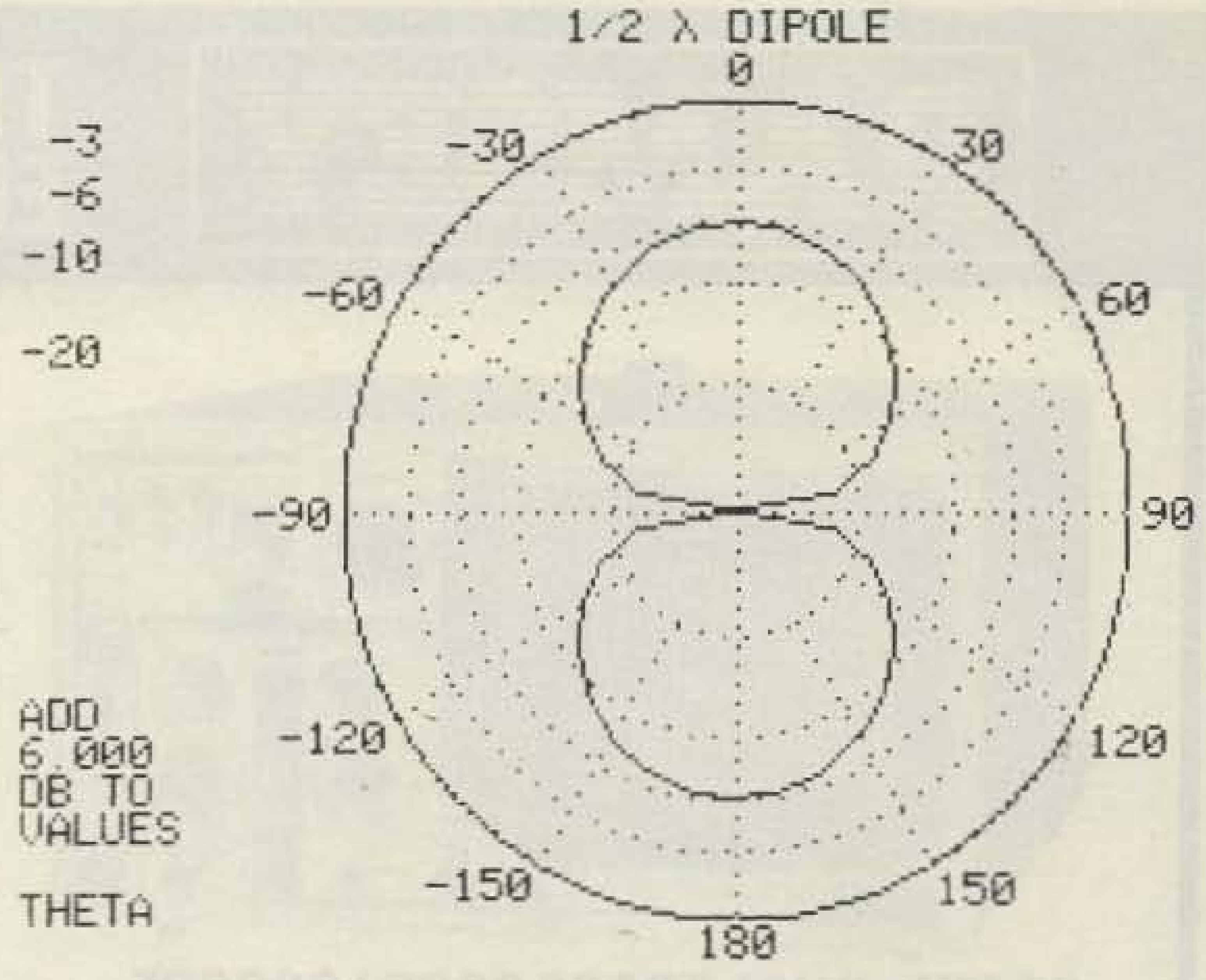


Fig. 1.

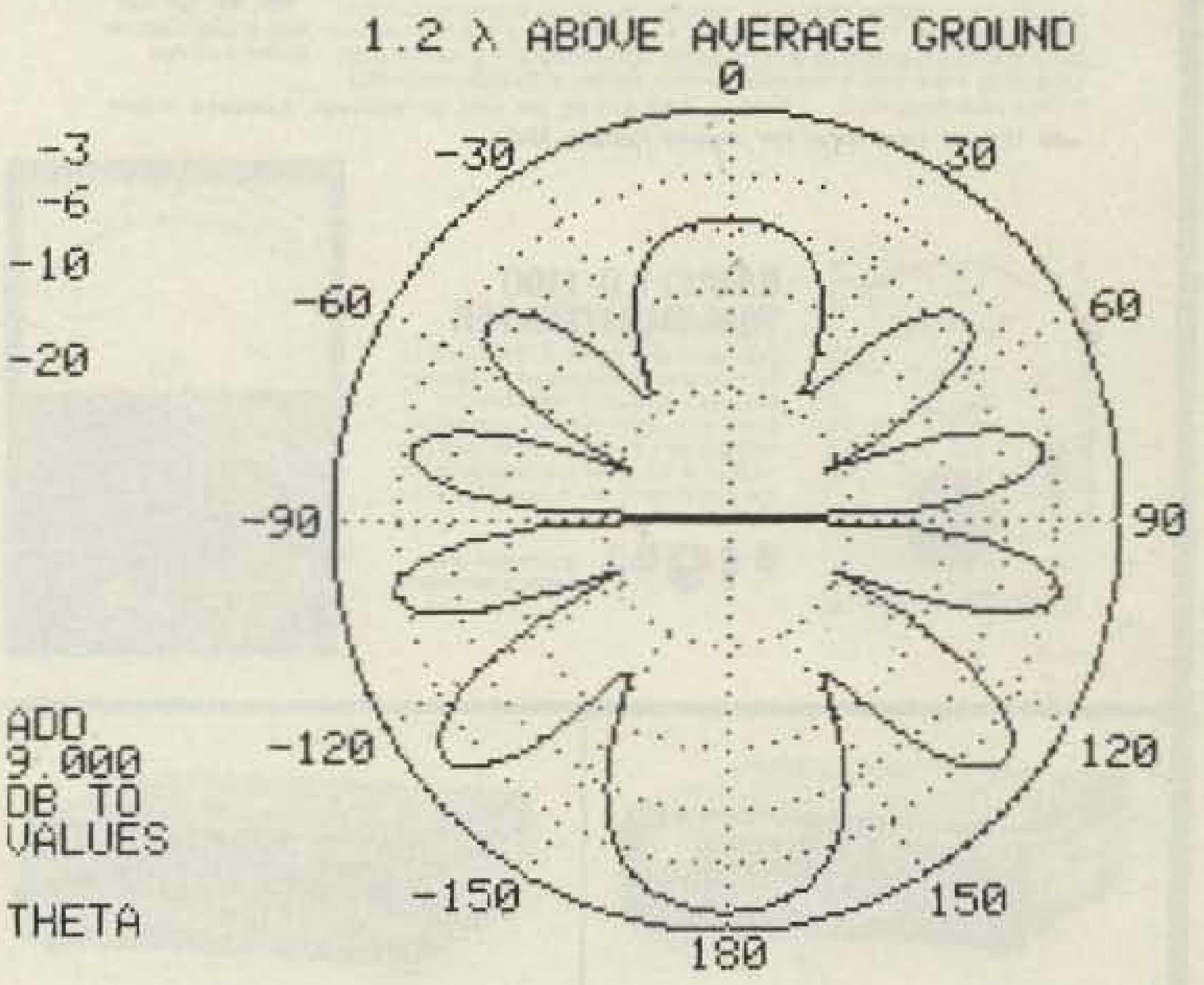


Fig. 2.

Annie is a well-thought-out and -implemented program deserving the highest marks. If you live and breathe antenna theory, it is a must. If you are like me and like to have someone/something else do the hard work for you, Annie is a welcome addition. Apple disk versions for the II or IIe are $49.95. The Commodore-64 version is available on disk or tape for $39.95.

Ordering by mail doesn't always result in the best experience. Mail-Order Annie, though, is as beautiful as they come. I wonder if when Harry Chapin sang, "All My Life's a Circle," he could have been referring to polar plots?

For more information, contact *Sonnet Software, 4397 Luna Course, Liverpool NY 13088.*

Jim Grubbs K9EI
Springfield IL

WHAT DO *YOU* THINK?

Have you recently purchased a new product that has been reviewed in *73*? If you have, write and tell us what *you* think about it. *73* will publish your comments so you can share them with other hams, as part of our continuing effort to bring you the best in new product information and reviews. Send your thoughts to Review Editor, *73 Magazine*, Peterborough NH 03458.

HAM HELP

I would appreciate a manual or schematic for the Hallicrafters SX-28 and SX-110 receivers and the Galaxy III transceiver.

Bill Richmond WD4CPQ
521 Rawlings St.
Louisville KY 40217

I need a schematic, parts list, and owner's manual for a model 70 Utility Tester, which was manufactured by Superior Instruments Co. I will be happy to pay for all copying.

Jess Jessen
Box 80
Tyler MN 56178

Needed: NAVSHIPS 0967-173-7010 Vol. 1, and 93788 Vol. 2.

Charles T. Huth WB8NLM
130 Hunter St.
Tiffin OH 44883

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(AND GIVES THEM TO YOU AS STANDARD EQUIPMENT!)

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440	$780	$980

FEATURES:

- SENSITIVITY SECOND TO NONE; 0.15 uV (VHF), 0.2 uV (UHF) TYP.
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- OTHER GREAT RECEIVER FEATURES: FLUTTER-PROOF SQUELCH, AFC TO COMPENSATE FOR OFF-FREQ TRANSMITTERS, SEPARATE LOCAL SPEAKER AMPLIFIER & CONTROL.
- CLEAN, EASY TUNE TRANSMITTER; UP TO 20 WATTS OUT (UP TO 50W WITH OPTIONAL PA).

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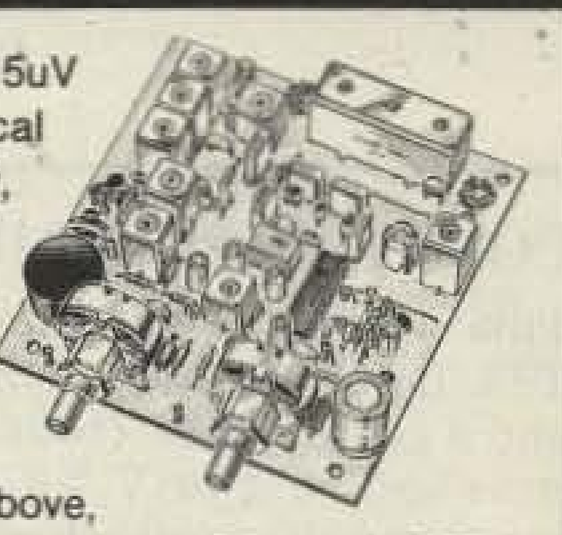
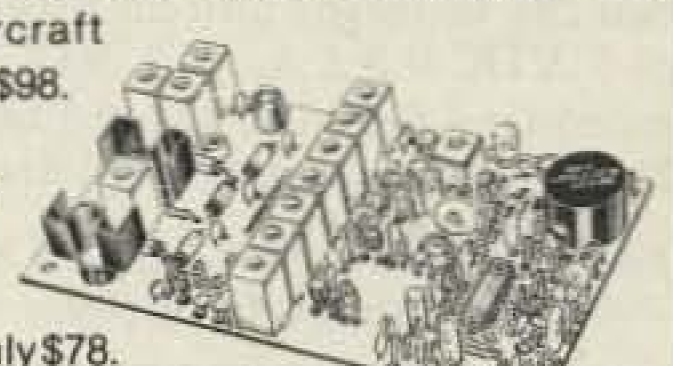


- **R144/R220 FM RCVRS** for 2M or 220 MHz. 0.15uV sens.;8 pole xtal filter & ceramic filter in i-f, helical resonator front end for exceptional selectivity, >100 dB at ± 12kHz, best available today. Flutter-proof squelch. AFC tracks drifting xmtrs. Xtal oven avail. Kit only $138.
- **R451 FM RCVR** Same but for uhf. Tuned line front end, 0.3 uV sens. Kit only $138.
- **R76 FM RCVR** for 10M, 6M, 2M, or 220. As above, but w/o AFC or hel. res. Kits only $118. Also avail w/4 pole filter, only $98/kit.
- **R110 VHF AM RECEIVER** kit for VHF aircraft or ham bands or Space Shuttle. Only $98.



- **T51 VHF FM EXCITER** for 10M, 6M, 2M, or 220 MHz. 2 Watts continuous, up to 3 W intermittent. $68/kit.
- **T451 UHF FM EXCITER** 2 to 3 Watts. Kit only $78. Xtal oven avail.
- **VHF & UHF LINEAR AMPLIFIERS.** For either FM or SSB. Power levels from 10 to 45 Watts to go with exciters & xmtg converters. Several models. Kits from $78.

NOW—FCC TYPE-ACCEPTED TRANSMITTERS & RECEIVERS AVAILABLE FOR HIGH-BAND & UHF. CALL FOR DETAILS.

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Models to cover every practical rf & if range to listen to SSB, FM, ATV, etc. NF = 2 dB or less.

VHF MODELS

Kit with Case	$49
Less Case	$39
Wired	$69

Antenna Input Range	Receiver Output
28-32	144-148
50-52	28-30
50-54	144-148
144-146	28-30
145-147	28-30
144-144.4	27-27.4
146-148	28-30
144-148	50-54
220-222	28-30
220-224	144-148
222-226	144-148
220-224	50-54
222-224	28-30

UHF MODELS

Kit with Case	$59
Less Case	$49
Wired	$75

Antenna Input Range	Receiver Output
432-434	28-30
435-437	28-30
432-436	144-148
432-436	50-54
439.25	61.25

SCANNER CONVERTERS Copy 806 MHz band on any scanner. Wired/tested ONLY $88.

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For SSB, CW, ATV, FM, etc. Why pay big bucks for a multi mode rig for each band? Can be linked with receive converters for transceive. 2 Watts output vhf, 1 Watt uhf.

For VHF, Model XV2
Kit $79
Wired $149
(Specify band)

Exciter Input Range	Antenna Output
28-30	144-146
28-29	145-146
28-30	50-52
27-27.4	144-144.4
28-30	220-222*
50-54	220-224
144-146	50-52
50-54	144-148
144-146	28-30

For UHF, Model XV4
Kit $99
Wired $169

Exciter Input Range	Antenna Output
28-30	432-434
28-30	435-437
50-54	432-436
61.25	439.25
144-148	432-436*

*Add $20 for 2M input

VHF & UHF LINEAR AMPLIFIERS. Use with above. Power levels from 10 to 45 Watts. Several models, kits from $78.

LOW-NOISE PREAMPS

Hamtronics Breaks the Price Barrier!

*

No Need to Pay $80 to $125 for a GaAs FET Preamp.

FEATURES:

- Very Low Noise: 0.7 dB VHF, 0.8 dB UHF
- High Gain: 18 to 28 dB, Depending on Freq.
- Wide Dynamic Range for Overload Resistance
- Latest Dual-gate GaAs FET, Very Stable

MODEL	TUNES RANGE	PRICE
LNG-28	26-30 MHz	$49
LNG-50	46-56 MHz	$49
LNG-144	137-150 MHz	$49
LNG-160	150-172 MHz	$49
LNG-220	210-230 MHz	$49
LNG-432	400-470 MHz	$49
LNG-800	800-960 MHz	$49

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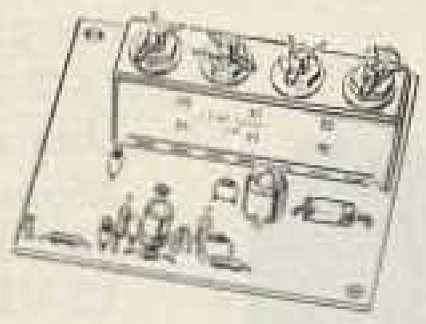

Model	Tuning Range	Price
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HRA-220	213-233 MHz	$49
HRA-432	420-450 MHz	$59
HRA-( )	150-174 MHz	$54
HRA-( )	450-470 MHz	$64

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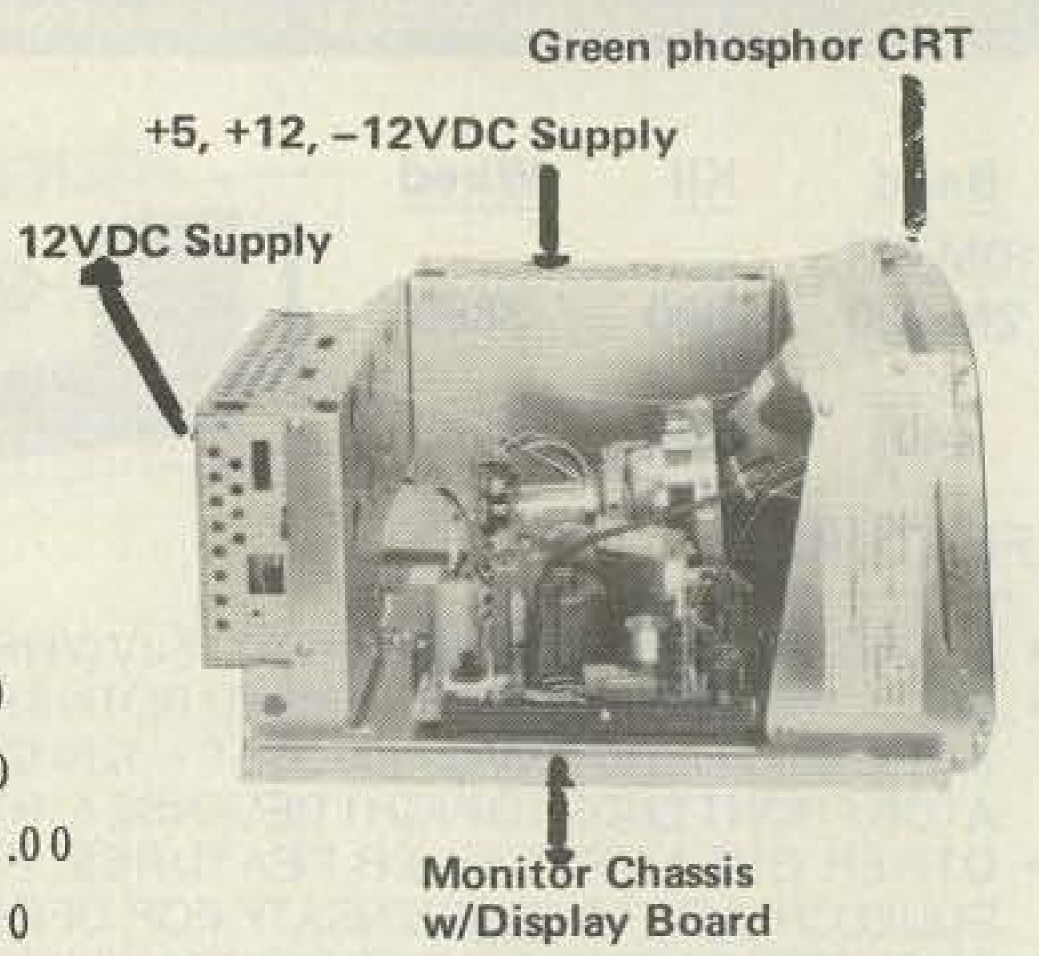
COMPUTER TERMINAL BUILDING BLOCK $50.00



This is a great beginning for a computer terminal. It is a brand new, Panasonic, 9" TTL input monitor complete with its own self-contained, switching power supply, and a removeable (four screws) triple output power supply. The whole assembly runs on 115/230 V, 50/60 Hz. Now for some specifics: 9" green phosphor, TTL input monitor, attached regulated 12 VDC, 1.5 A power supply used exclusively to run the monitor and an attached triple output switching power supply with outputs of 5 VDC @ 3.5 A, +12 VDC @ 500 ma, and −12 VDC @ 500 ma. The assembly has mounting feet and should be a snap to make a case for. Comes with hook up data. New, factory boxed. We are offering this to you 4 ways:

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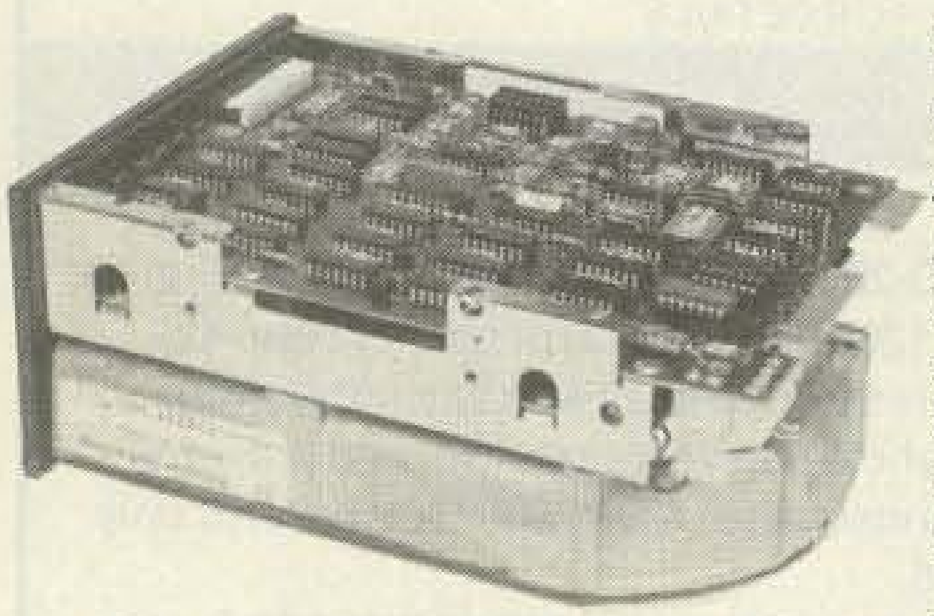

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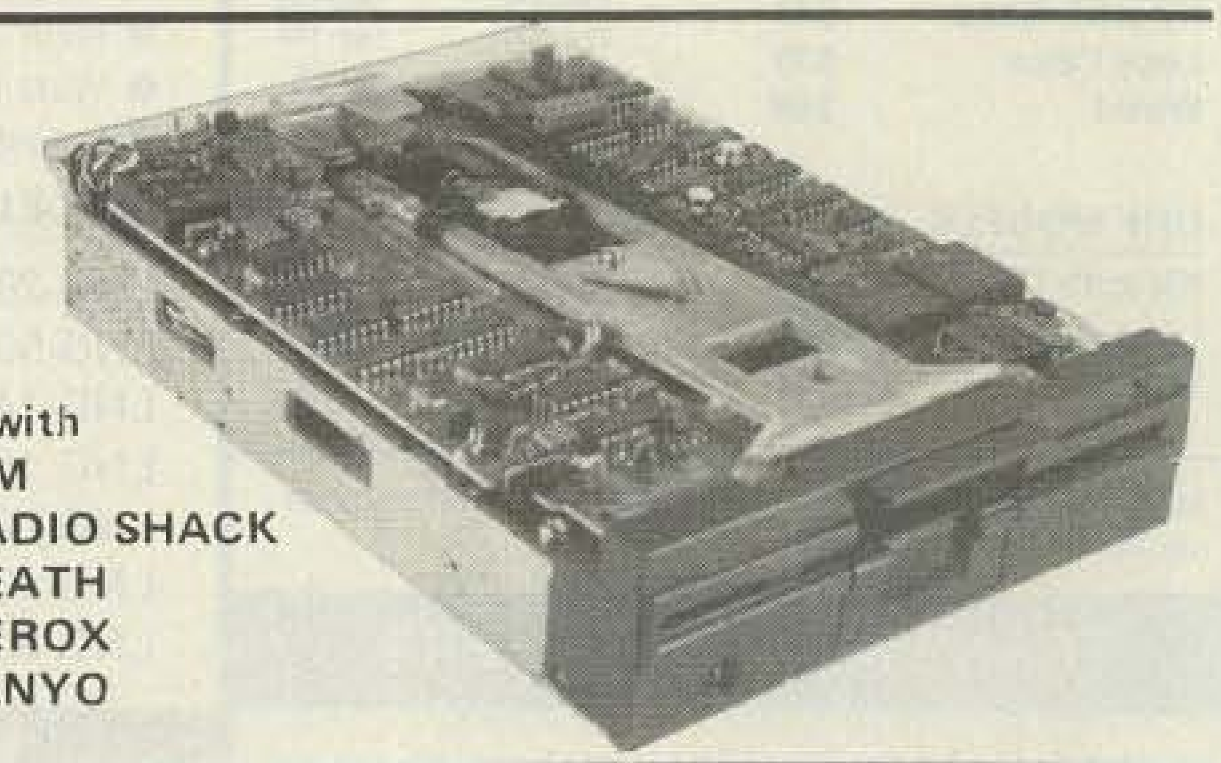
TI 99/4A Owners: *We are in the process of developing a Winchester Hard Drive subsystem for the Texas Instruments 99/4A. Please call or send SASE for further info.*

1/2 Height 1 MEGabyte Disc Drives



Here we go with another blockbuster buy on disc drives which should make the competion's head spin! We are offering brand new, Mitsubishi no. 4853, 1/2 height, 1 megabyte, mini floppy disc drives. These drives are beautiful. They are fully Shugart 34 pin compatible. All are double side, double density, 80 tracks per side units. Each runs on +5 vdc, .5 A and +12 vdc, .7 A. Just the drives to use with your IBM, Sanyo or other computer. Each order will come with schematics and pin out data.

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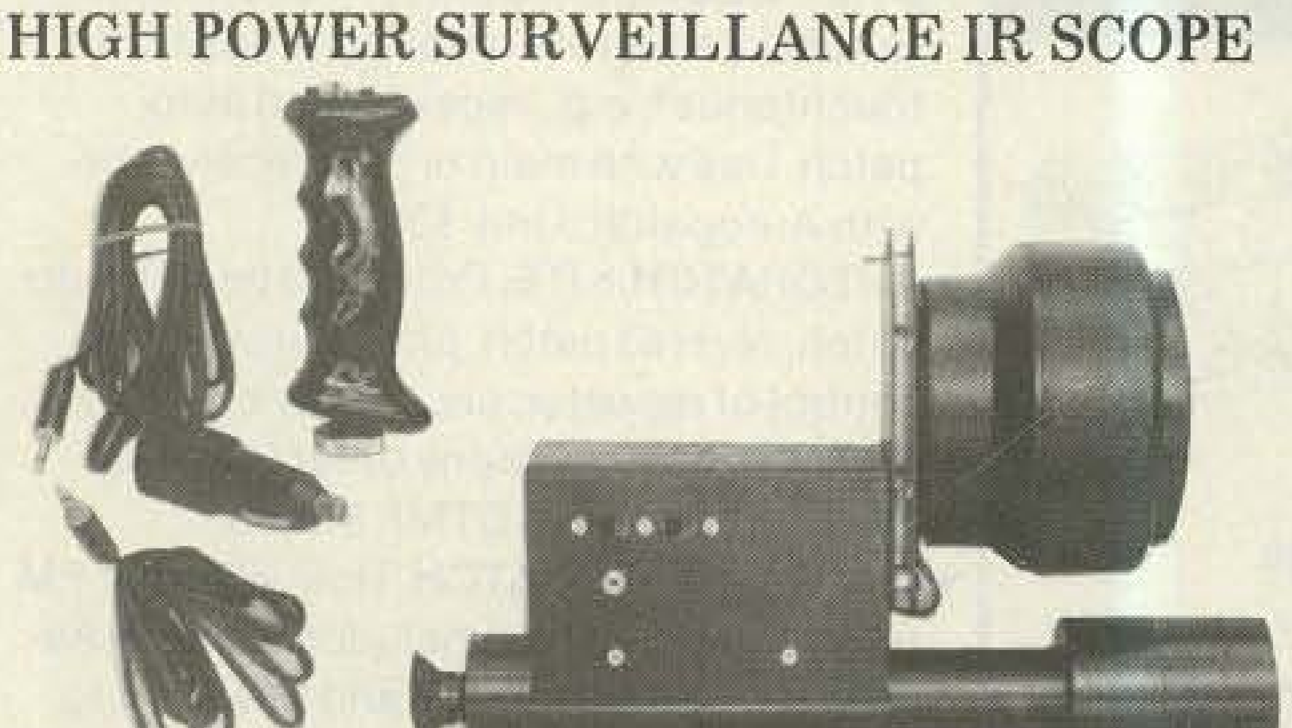

This Infra-Red scope was designed specifically for long range surveillance use. The built-in, totally invisible, 50 watt halogen lamp IR source is coupled with a premium grade type 6032 image converter tube, 265 mm f4.2 lens, and 16 power military spec., color corrected eyepiece make this an ideal unit for viewing of clandestine activities or animals. The scope is capable of detection at more than 300 feet, recognition at 300 feet and positive facial identification at 150 feet. It runs on 12 VDC which makes it ideal for mobile use. It comes with a removeable hand grip which allows for tripod mounting, 2 power cords for cigarette lighter or battery terminals, instructions and a 90 day warranty. Listed below are accessories which make this a very versatile instrument. The scope and accessories are new and guaranteed functional. Net wt. 5-1/4 Lbs.

IR Scope part no. ELD Shpg. Wt. 7 Lbs. $735.00 ea.

ACCESSORIES:

12 VDC GELL BATTERY for above. Shpg. Wt. 6 Lbs. $35.00

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BULLETIN

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CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

ARRL VHF QSO PARTY
Starts: 1800 UTC September 14
Ends: 0300 UTC September 15

Sponsored by the ARRL, the objective of this contest is to work as many amateur stations in as many different 2 × 1 grid squares as possible using authorized amateur frequencies above 50 MHz. Operating categories include: single operator multi- or single band and multi-operator. Single-band entries on 50, 144, 220, 432, and 1296-and-up categories will be recognized both in *QST* score listings and in awards offered. Contacts may be made on any and all bands without jeopardizing single-band-entry status. Such additional contacts are encouraged and should be reported. Multi-operator stations must locate all equipment (including antennas) within a circle whose diameter does not exceed 300 meters.

Retransmitting either or both stations or use of repeater frequencies is not permitted. Also, use of the national simplex frequency, 146.52, or immediately adjacent guard frequencies is prohibited. Only recognized simplex frequencies may be used, such as 144.90 to 145.10, 146.49, 0.55 and 0.58, and 147.42, 0.45, 0.48, 0.51, 0.54, and 0.57 MHz on the 2-meter band. Local-option simplex channels and frequencies adjacent to the above that do not violate the intent of the above or the spirit and intent of the band plans as recommended in the *ARRL Repeater Directory* may be used for contest purposes.

Stations may be worked only once per band for credit, regardless of mode. Crossband QSOs do not count. Partial QSOs do not count; both calls, the full exchange, and acknowledgment must be sent and received.

Fixed, portable, or mobile operation under one call from one 2 × 1 grid square only is permitted. A transmitter used to contact one or more stations may not be used subsequently under any other call during the contest period (with the exception of family stations where more than one call is assigned to one location by FCC/DOC); one operator may not give out contest QSOs using more than one callsign from any one location.

Only one signal per band at any given time is permitted, regardless of mode. While no minimum distance is specified for contacts, equipment should be capable of real communications (i.e., able to communicate over at least 1 km).

Multi-operator stations may not include QSOs with their own operators except on frequencies higher than 2.3 GHz. Even then, a complete, different station must exist for each QSO made under these conditions. Above 300 GHz, contacts are permitted for contest credit only between licensed amateurs of Technician class or higher using coherent radiation on transmission (e.g., laser) and employing at least one stage of electronic detection on receive.

A station located precisely on a dividing line between grid squares must select only one as the location for exchange purposes. A different grid-square multiplier cannot be given out without moving the complete station (including antennas) at least 100 meters.

EXCHANGE:

Grid-square locator (see January, 1983, *QST*, page 49). Exchange of signal reports is optional.

SCORING:

Count one point for each complete 50- or 144-MHz QSO, two points for each 220- or 432-MHz QSO, three points for each 1296-MHz QSO, and four points for each 2.3-GHz or higher QSO. The multiplier is the total number of different grid squares worked per band. Each 2 × 1 grid square counts as one multiplier on each band it is worked. Multiply total QSO points from all bands operated by the total number of multipliers for final score.

AWARDS:

Awards will be issued to the top single-operator score in each ARRL section, as well as top single operator on each band in each ARRL section where significant effort or competition is evidenced. Multi-operator awards will be issued for the top score in each ARRL section where significant effort or competition is evidenced. However, multi-operator entries are not eligible for single-band awards.

ENTRIES:

Entries must be postmarked no later than 30 days after the end of the contest and should be addressed to ARRL headquarters.

QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73* 80 Pine Street, Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

WASHINGTON STATE QSO PARTY
0100 UTC September 14 to 0700 UTC September 14
1300 UTC September 14 to 0700 UTC September 15
1300 UTC September 15 to 0100 UTC September 16

The twentieth annual contest sponsored by the Boeing Employees' Amateur Radio Society (BEARS) is divided into three operating periods, as shown. All amateurs are invited to participate. All bands and modes may be used, but no CW QSOs are allowed in the phone bands. Stations may be worked once on each band and more for contact points and more than once each band/mode if they are additional multipliers.

EXCHANGE:

QSO number, RS(T), and state, province, country, or Washington county.

FREQUENCIES:

Phone—1815, 3925, 7260, 14280, 21380, 28580.

CW—1805, 3560, 7060, 14060, 21060, 28160.

Novice—3725, 7125, 21150, 28160.

SCORING:

Washington stations score 2 points for each phone contact and 3 points for each CW contact, including contacts with other Washington stations. Multiply QSO points by the total number of different states, Canadian provinces, and other foreign countries worked.

All others score 2 points for each phone contact and 3 points for each CW contact with a Washington station. Multiply QSO points by the total number of different Washington counties worked (39 maximum). There will be an extra multiplier of one for each group of 8 contacts with the same Washington county for all non-Washington stations.

AWARDS:

Certificates will be awarded to the highest-scoring station (both single and multi-operator) in each state, Canadian province, foreign country, and Washington county. Additional certificates may be issued at the discretion of the Contest Committee. Worked Five BEARS Awards also are available to anyone working 5 club members before, during, or after the QSO party (unless previously issued). All QSO party entries will be screened by the Contest Committee for possible Worked Five BEARS Awards. Worked Three BEAR Cubs Awards are also available for working 3 Novice members. All BEARS Awards other than QSO party certificates are handled by Roy Brashear W7RJW, 5711 South 129th Street, Seattle WA 98178. (See page 28 of the August, 1979, issue of *73* for more details.)

CALENDAR

Sep 14-15	ARRL VHF QSO Party
Sep 14-16	Washington QSO Party
Sep 28-29	G-QRP-Club CW Activity Weekend
Oct 5-6	ARRL QSO Party—CW
Oct 6-7	Illinois QSO Party
Oct 12-13	Rio CW DX Contest
Oct 12-13	ARRL QSO Party—Phone
Oct 19-20	ARRL Simulated Emergency Test
Oct 19-20	Jamboree On The Air
Oct 19-20	Worked All Y2 Contest
Oct 19-21	Rhode Island QSO Party
Nov 2-3	ARRL Sweepstakes—CW
Nov 16-17	ARRL Sweepstakes—Phone
Dec 7-8	ARRL 160-Meter Contest
Dec 14-15	ARRL 10-Meter Contest
Dec 26-Jan 1	QRP Winter Sports—CW

FADCA>BEACON

THE FLORIDA AMATEUR DIGITAL COMMUNICATIONS ASSOCIATION NEWSLETTER

NEWSLETTER OF THE MONTH

The Florida Amateur Digital Communications Association (FADCA) receives September's prize for its outstanding publication, the *FADCA>BEACON*. You'll not find a great deal of information about FADCA in the *BEACON*, no minutes of the last meeting, no endless pleas for club participation. In their place is a flood of material about packet radio—reviews of new equipment, modification and construction articles, tips, and techniques, all packed into a volume that becomes more a reference book than a newsletter.

Gwyn Reedy W1BEL puts it all together each month, with a small army lending assistance. The many names that appear on the masthead include Brad Voss WB8PZE, Cheryl Voss, David Hunt, Jim Homan W4DPH, Phil LaMarche W9DVM, and Pat Shaughnessy KF4EF, all of whom help Gwyn produce this exceptional journal.

To enter your club's newsletter in *73*'s Newsletter of the Month Contest, send it to *73*, 80 Pine Street, Peterborough NH 03458, Attn: Newsletter of the Month.

ENTRIES:

Logs must show dates/times in UTC, stations worked, exchanges sent and received, bands and modes used, and scores claimed. Include a dupe sheet for entries with more than 200 QSOs. Each entry must include a signed statement that the decision of the Contest Committee will be accepted as final. No logs can be returned. Results of the QSO party will be mailed to all entrants and an SASE is *not* required. Log sheets and summary sheets must be postmarked no later than October 17th and sent to: Boeing Employees' Amateur Radio Society, c/o Willis D. Propst K7RS, 18415 38th Avenue South, Seattle WA 98188.

G-QRP-CLUB CW ACTIVITY WEEKEND

Starts 0900 UTC September 28
Ends 2300 UTC September 29

All radio amateurs interested in QRP are invited to take part in the club's Activity Weekend. No special exchange information was mentioned in the information provided by the club. The operating scheduled for this last weekend is as follows:

0900–1100 = 14060, 21060, 28060
1100–1300 = 3560, 7030
1300–1400 = 10106
1400–1700 = 14060, 21060, 28060
1700–1900 = 3560, 7030
1900–2100 = 14060
2100–2300 = 3560, 7030

Reports on the Activity Weekend are welcomed by Christopher J. Page G4BUE, Alamosa, The Paddocks, Upper Beeding, Steyning, West Sussex, BN4 3JW England.

Full details on membership of G-QRP-Club are available from the membership secretary, Fred Garratt G4HOM, 47 Tilshead Close, Druids Heath, Birmingham, B14 5LT England.

73 INTERNATIONAL

Each month, 73 brings you ham-radio news from around the world. In this collection of reports from our foreign correspondents, we present the latest news in DX, contests, and events, as well as keep you abreast of the technical achievements of hams in other countries.

If you would like to contribute to your country's column, write to your country's correspondent or to 73 Magazine, Pine Street, Peterborough NH 03458, USA, Attn: Perry Donham KW1O.

AUSTRALIA

Kirsti Jenkins-Smith VK9NL
PO Box 90
Norfolk Island
Australia, 2899

NORFOLK ISLAND

For the DX listener to pick up Radio VL2NI, conditions have to be exceptionally freaky. Norfolk Island's noncommercial and only broadcasting station transmits daily from 1830 UTC to 1130 UTC, running 18 Watts on 1566 kHz. It is designed to cover Norfolk Island "from coast to coast," all 15 square miles of it.

Back in the early sixties, the daily transmission only lasted ten minutes. The Administration switchboard operator would leave the switchboard to briefly tell us about the weather and any meetings or other community functions to be held. That was it.

Gradually, the time on air increased to half an hour, fitting in a few birthday greetings and sometimes a short request session. The broadcasts were popular. Listening was a *must* for anyone living on the island. A second transmitter was situated at the airport, and the OIC (officer in charge) there would entertain on Saturdays, playing popular music interspersed with progress reports about the weekly flight from Sydney.

As time went on, more people became involved with VL2NI. Volunteers from the community at large took over the job as announcers, stretching the transmissions to last until lunchtime. Then ministers from various churches would go in one day each week and present a religious program, so the station actually remained on air until 2:00 pm local time.

An old commercial receiver was put to use to pick up Radio Australia's shortwave program, which then could be relayed over VL2NI. This enabled everyone to, for instance, listen to world news without the need for a personal shortwave receiver. BBC and ABC (Australia) kindly made available ready-made programs on tape, thereby creating a variety in the daily broadcasts.

In later years, VL2NI became updated with modern equipment, operating FM and AM simultaneously.

A host of announcers ensures that the station is on air all day until 11:00 pm local time. VL2NI is a "one-man show." The announcer has to do it all him/herself—arrange the records or tapes to be played, read the news, answer the phone, pick up Radio Australia, and so on. None of the announcers is trained, but they seem to manage okay.

"Doing the broadcast" is only a sideline for them all. They have other work where they earn their real living, so each does only a few hours a week. We know this, so if a particular record comes to an end, followed by silence, we don't panic and kick our sets to make them work. We know the next announcer has been delayed but will be along shortly. We also understand when a record gets stuck on a chip for a while that the announcer has had to duck out somewhere, but will be back....

The staff is enthusiastic and willing. When funds are low and the budget is strained, they have on occasion banded together and arranged fundraising cabaret nights. We then have the pleasure of seeing our announcers live on stage, doing their own thing. Always a popular evening with the public.

Once a month, the island's population sits glued to their sets listening to the Legislative Assembly meeting which is broadcast live direct from the Assembly chambers. Needless to say, many people on the island become personally interested in the doings of our politicians. The evening following the meeting is thus set aside for a rebroadcast for those who missed the original and for those who want to check up to see if they heard right the first time.

Basically, the daily broadcasts are what they have always been. "News" consists of weather forecasts and notices of meetings, the ETA of ships and airplanes, with special early-morning broadcasts to inform lighterage workers when the ship is due to start unloading. Then there are birthday greetings and requests. The birthday request session is very popular, especially among the island's young. They are not influenced by what the media dictate people to like. Here "The Teddybears' Picnic" rates head and shoulders above any pop tune. Outsiders have even been known to wonder if it is our National Anthem.

The imported programs help in keeping the station going on an all-day basis, and when the opportunity is there, the staff will broadcast direct from various sports activities and other community functions.

A resident technician keeps an eye on the equipment, again as a sideline—he, too, earns his living elsewhere.

All in all, VL2NI is a true community radio station. By community effort it has become an important medium for binding the community together. We know who has a birthday, who has had a baby, who has passed on, what meetings are to be held, what the weather will be like, when a ship is due, when the plane is arriving, and when it is "departing back"—in the unique terminology used by VL2NI. We know what our politicians are up to and, reading between the lines as it were, we can make a guess at other things.

Many years ago reports from Europe indicated that VL2NI had been heard there. So you never know your luck. It would be interesting to know if anyone in recent times has happened to hear the station on air.

CYPRUS

Aris Kaponides 5B4JE
PO Box 1723
Limassol, Cyprus

During last March, the Cyprus Amateur Radio Society had its annual general meeting. At this meeting a new Council was elected as follows—Totos Theodossiou 5B4AP, president, Aris Kaponides 5B4JE, secretary, Pantelis Lytrides 5B4CF, treasurer, and four council members, Chris Demetriou 5B4EI, Thanos Apostolides 5B4CR, Sotos Miltiadou 5B4JX, and Sotos Metaxas 5B4LB.

Larry Day 5B4LD has undertaken the task of writing up the history of amateur radio in Cyprus. We wish him luck in his research and we are sure his work will be of interest not only in Cyprus but also abroad. We hope by the end of the year to give the readers of *73* a short summary in this column.

Andreas Mavrides 5B4LP, the well known DXer, was granted a special license to experiment with a crossband system using 2m (repeaters or simplex) and 10m. We are sure that many amateurs in Cyprus will benefit from it.

Again this summer, Cyprus repeaters R4 and/or R5 are linked with SV9 and SV5 via R3 in Heraklion, Crete, or simplex connections from SV to R4 and R5 in Cyprus. The system this year is slightly different. 5R4JX, instead of using the VOX system which he constructed last year, now has constructed an rf-activated switch with a short bleep at the end of an "over," which seems to operate better than the VOX used last summer for this link. Cypriot amateurs have made many friends in SV9 and SV5 using 2m in this way. This year also, besides the usual 4X and OD5 stations on our repeaters and also on simplex, we have met often on 2m friends from SU-land, such as Ezzat SU1ER, Maggi SU1MR, Bassiouni SU1BA, and Hosni SU1HK.

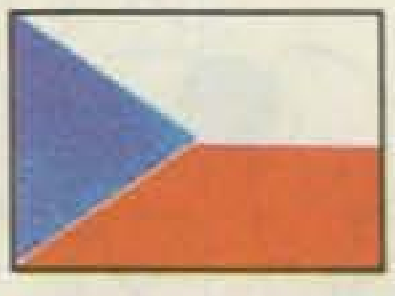
To celebrate the 25th anniversary of the Cyprus Republic, CARS has asked the licensing authority to give permission for all 5B4 stations to use the special prefix 5B25 followed by the regular suffix of each station. The period for its use is from August 16, 1985, until December 31, 1985. We are certain that the CARS application will have a positive response. It is worth mentioning that this will be the second special prefix ever used in Cyprus, the first one being 5BØ, which was given for World Communication Year, 1983.

Lots of radio amateurs from Europe are visiting Cyprus as tourists, and they want a temporary license. For visitors coming from EEC countries, the USA, and Commonwealth countries, all they have to do is to apply by letter to: Telecommunications Officer, Ministry of Communications and Works, Nicosia, Cyprus. In their letter they must enclose a photocopy of their license and their address of residence in Cyprus—hotel, etc. They must also send to CARS a photocopy of their license and the letter to the Ministry. This temporary license is free of charge and sometimes can be issued over the counter in Nicosia. So if somebody visits Cyprus, a call on R5 or R2 will raise up some 5B4 amateurs.

ZC4 stations from the British bases seem to be in great demand nowadays, so I will give some tips on where and when to find some of them. First, on the W7PHO net on 14.227 MHz, usually at 2100 UTC, ZC4AB and ZC4MR have a regular appearance. On this net, I spend some time myself, and it seems that 5B4 is still DX on 20m. Hi!!

On 15m, sometimes on Saturday afternoons around 1300 UTC on 21.270 MHz, you might find ZC4AM/P operating from the salt lake of Akrotiri, which is within the sovereign base area of Akrotiri.

Other active ZC4s are ZC4CZ and ZC4WW, and maybe also another couple or so from the Dhekelia base which cannot be heard from my QTH due to the skip distance.



CZECHOSLOVAKIA

Rudolf Karaba (OK3KFO ARC)
Komenskeho 1477/8
955 01 Topolcany
Czechoslovakia

QRP IN CZECHOSLOVAKIA

During the last three years, the following stations were occupied with operating QRP: OK1AIJ, OK1AMM, OK1DMP, OK1DOC, OK1DWG, OK1DZD, OK1FAO, OK1AR, OK1MBK, OK1MNV, OK2BEI OK2BMA, OK2BTT, OK2PAW, OK2SBJ, OK3YAC, OL1BBR, and ex-OL5AYF.

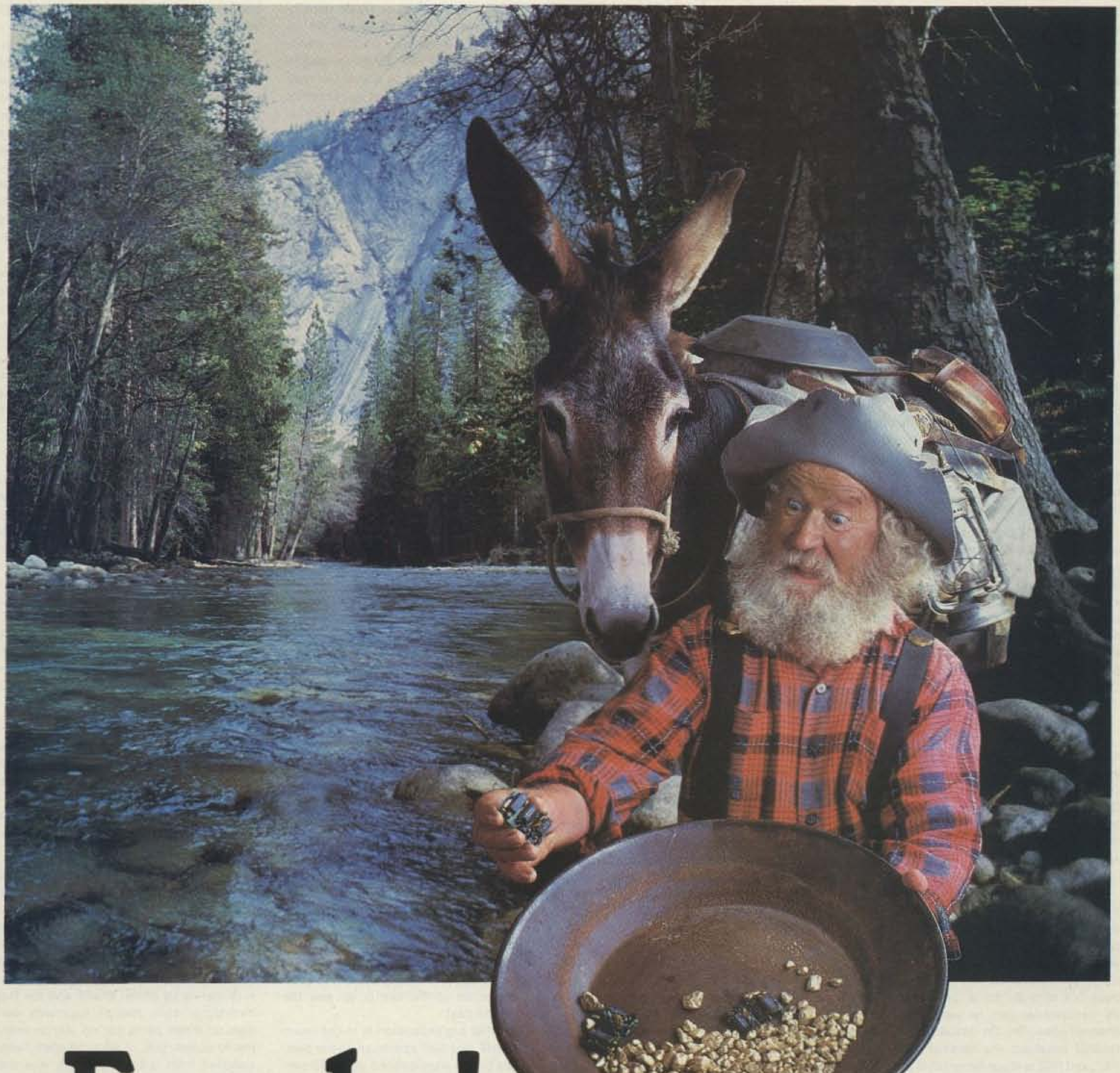
Among the most active hams is Pavel OK2BMA who has been operating QRP since 1979. He has made about 3,000 contacts altogether, with 100 DXCC countries on all shortwave bands. He uses his own homemade equipment. Jindra OK1AMM has also fulfilled the conditions for DXCC when operating QRP. Zdenek OK1DZD has been working on 3.5 and 14 MHz with a maximum output of 1 Watt. For the fulfillment of DXCC he lacks 25 countries. He has also been using homemade transceivers.

Another active operator is Karel OK1AIJ, who has been operating QRP since 1972, mainly on 3.5 MHz. He has made 5,000 contacts with various equipment with inputs of 1 to 10 Watts, and his contacts have been with more than 50 DXCC countries. In the 80m band, operating QRP, were the following stations: OK1FAO, OK1VLP, and OK1MNV. OK3YAO, operating QRP, has made 1,000 contacts in the 1.8–3.5-MHz band.

Among the telegraph fans in the contest on shortwave is Milan OK2PAW. Owing to his perfect operation, he has achieved remarkable results. He has been working on all shortwave bands using his own homemade equipment. In 1982, during a period of some months, OK2BEI made contacts with 50 DXCC countries and also a large number of DX contacts by using his 1-Watt transmitter. He was using the ground-plane antenna for the 14-, 21-, and 28-MHz bands. Milan OK1DMP has been working in the 14-MHz band with his 2-Watt transceiver and has devoted his time mainly to QRP contesting. He has been using the G5RV antenna and a dipole.

OL1BBR and OL5AYF devote their time to QRP in the 1.8-MHz band with 2- and 3-Watt inputs. They were working also with more distant stations. QRP activity is very high, mainly in the 1.8-MHz band, owing to the fact that in Czechoslovakia a very sensitive and perfect CW transceiver, the "M-160," began to be produced. The transceiver output is one Watt. Many stations have succeeded in making DX contacts.

The last weekend in February, 1985, was the CQ WW 160-meter SSB contest. Three members of the OK3KFO radio club, (Ivan OK3CUM, Milos OK3CZM, and Rudy OK3CMZ—the correspondent for *73*) have probably made the greatest number of



contacts in the 1.8-MHz band, operating SSB. In the contest, they were working with transceiver UW3DI (their own OK3CZM product) and a vertical antenna 28 meters high, with a total length of the radial system 2,000 meters. They made 1,200 contacts, 1,000 of which were with the USSR. (1.8 MHz is in a local band in the USSR, where there are a great many radio amateurs with various prefixes.) Under very bad conditions they succeeded in making contact with such stations as 9Y4VU, J87UEE, YV2IF, KV4FZ, UH8, UI8, UJ8, UM8, and six stations from USA.

In Czechoslovakia, the most successful hams for 1984 were recognized on December 5, 1984. The winners of the work on shortwave were the members of the OK1KRG radio club; on UHF, it was the OK1KIR radio club. Both clubs are in Prague, the capital of Czechoslovakia.

Recently, in Czechoslovakia, great attention was given to the location of the first contacts in the 160-meter band. For example, the first contact Czechoslovakia-England on 160 meters was made by OK1AA on May 5, 1946. In the morning he made contacts with G2KO and on the same day with stations GM5UT, G3SU, G6KP, G5RP, and GM3AL.

In the last few days I received the evaluation of the state contest held on the occasion of the 40th anniversary of the Slovak National Uprising—the contest was in the 1.8- and 3.5-MHz bands, operating CW/SSB. The winner in the category of individuals was Eduard Melcer OK3EY, and in the radio club contest, OK3KFO. Both are situated in the district of Topolcany in Slovakia.

ITEMS

During the improved tropospheric conditions of propagation in October, 1984, there were many contacts made between OK and G in the 145-MHz band, but only G4LAW was successful in making contact from an automobile with OK1KHI/P with a transmitter of 10 Watts and a quarter-wave antenna.

* * *

The satellites RS: At the beginning of 1985, the satellites RS5, RS7, and RS8 were working safely. RS7 was switched on only when operating "robot." RS5 was used occasionally for "codestore," and its robot was switched on. This robot has been out of order for a long period, but its transponder can be used as a one-channel converter. On January 13, Ondrej OK3AU upvalued the telemetry of RS5, RS7, and RS8 and confirmed that the state of the satellites is constantly good.

The output of RS8 in comparison with RS5 is a little lower, and the lesser sensitivity of the receiver is also visible; that, on the other hand, leads to a longer durability of the accumulator [battery]. A visible decrease of the source voltage, mainly during the overloading of the converter, is seen on RS5.

* * *

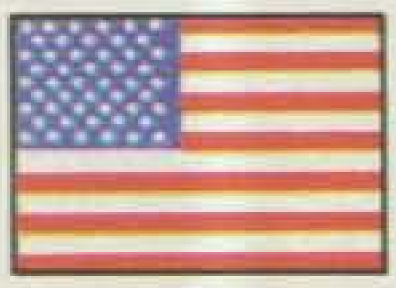
Every year, November 1 until November 15, a state contest of Czechoslovak hams in making contacts with Soviet stations (just like the contest on behalf of the Czechoslovak-Soviet friendship) is held. In the contest of individuals, OK1DNH had 1,118 points, OK1HCH had 813 points, and OK2JS had 811 points. In the contest of collective staitons, OK2RAB had 4,301 points, OK3KII had 1,145 points, and OK1KWE had 1,084 points.

* * *

RTTY: The radio club station, OK3KJF, in Bratislava, announced its 80th confirmed country, according to the list of DXCC, by operating RTTY with BY1PK, the radio club in Peking.

OK2SPS and OK2BJT, in Brno, have been producing a microcomputer system, mainly for RTTY and AMTOR, and eventually also for operating packet. As a directing microprocessor, the Z-80 has been chosen. They would like to make the acquaintance of other persons interested in this work.

In the Czechoslovak magazine, *Sdelovaci Technika*, there has been published an article about the use of a teleprinter as a printing machine for the ZX-81. OK1JT immediately made the necessary device and adjusted it for attachment to the transceiver and has also tested the device in operation. For the time being, a common machine has been used for reception, but during the recording of the received text, the answer is being prepared on the screen by means of the ZX-81. The answer is being broadcast automatically at one command.



GUAM

Edward L. Campbell KB6DAW/KH2
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HAFA ADAI FROM GUAM

I was reading the April issue and realized I had not seen anything on Guam in quite a while. I thought I would send a line or two to let the readers know that Guam is *active!*

The Mariannas Amateur Radio Club (MARC) is an active club. The club supports the island with communications for its island-wide activities. And MARC has just elected its new officers: president: John Conners KG6JIC, vice-president: David Chartier W1YRM, secretary: Edward L. Campbell KB6DAW, treasurer: Steve Shemenski KA8GVS. And our not elected but not forgotten island bureau manager is Joe Frekot AH2G.

Here are some of our more active hams. On SSB: WH2ACV, KG6RN, KG6JJH, AH2AN, KS0C, and myself; on CW: K0AX, KS0C, and AH2G; on OSCAR: W1YRM and KG6DX.

So there are many ways to contact the island. Also active was KD7P, who has left the island to return to the States. You might remember him on the Midway (KH4) DXpedition. And we all thank him for that.

In my first letter, I thought I would fill everyone in on things that I am hearing here in the Pacific. In the last couple of weeks, the States are being heard starting about 0300 UTC, with Central and South America to follow. At 0630 UTC, the HIDXA net starts with P29JS as net control. (He is also the president of the club.) There have been as many as 40 DX check-ins from around the world. Some of the check-ins are: BY5RA, VK9NL, VK0JC, KC6HA, TR8JLD, 9V1TL, A35SA, 5W1AU, and J37AH.

At about 0930 UTC, Europe starts to run on 15 meters. Then about 1100 UTC, Africa starts. I have a sked with my manager, ZS2DK, at 1130 UTC on 21.250 every Sunday. Then about 1330 UTC, the States start again. Most of the stations I hear are pointed to Europe, not knowing that the Pacific is running. I had a nice QSO with KV4AD and W2EMN/C6A at about 1230 UTC on 20 meters. Plus I try to catch the PHO net starting at about 1900 UTC on the weekends. Also on 14.215, the Pacific DX net starts with KB7QC and the group.

In the two years that I have been a ham, I have worked 205 countries and all 50 states. I have 136 countries confirmed. Being in the middle of the Pacific has its advantages.

Anyone who comes to Guam can find a lot of fun with ham radio. DX is usually open to some part of the globe. We do have two repeaters here on the island. They are on .64/.94 and .28/.88. So please bring your HT along if you come. Our club meets on the first Tuesday of each month, and all visitors are invited to come by. H44IA was our last visitor.

I hope to continue to bring you news from the Pacific and the island of Guam. If you hear any of us, please give us a call. We are always happy to rag-chew.

So 73 from Guam, "Where America's day begins."

ISRAEL

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Israel

Since our last column, there is quite a bit of news to catch up on.

REGULATIONS UPDATED AND LIBERALIZED

Beginning the first of May, a new table of frequency allocations and power outputs went into effect which has now brought the privileges of Israeli amateurs in line with those of hams from the most advanced countries.

The big item was the allowing of 1500 Watts output on all HF bands (excluding 10, 24, and 18 MHz where maximum output is 1 kW) for amateurs holding the Grade A license. Grade B licensees are now allowed 150 Watts out, and Novices 15 Watts out, gaining exemption from the need to be crystal-controlled and gaining the choice 7-7.05 section of the 40-meter band instead of the 20-kHz section held higher up in the band where they had to try to compete with horrendously powerful broadcasting stations. They retain their 21.1 to 21.15 segment of the 15-meter band and will now be able to purchase commercially-made QRP transceivers.

Thus, along with the United States and Britain, our power is defined by being the peak envelope power output instead of input power dc of the carrier as was the case in the past.

The other big expansion is in the realm of the UHF and SHF spectrum. In the past, only six bands were defined above 70 centimeters, but now there are ten: 1.2, 2.3, 3.4, 5.6, 10, 24, 47, 75-81, 142-149, and 241-250 GHz. As with 160 meters and the WARC bands, Grade A amateurs enjoy full frequency privileges, whereas Grade B licensees have narrower bandwidth in order to provide an incentive to upgrade.

Now, in the VHF and UHF spectrum, the Ministry of Communications had been cutting power outputs for all services in order to clean up the rf-saturated environments of the cities, where problems of intermod have all but become a way of life. Thus, on the 144- and 430-MHz bands, peak FM power output is now 250 Watts for Grade A and 100 for Grade B, but after considerable haggling, the Ministry made an exception for SSB and CW, so that the hardy band of EME and DX experimenters can use 1000 and 150 Watts output for Grades A and B, respectively.

Another point of interest is the deletion of the CW subbands, so that where the individual amateur uses what mode is left to his discretion and IARU recommendations. The one "loss," as it were, is making the 10-MHz allocation fit the IARU region one band plan—SSB will no longer be allowed here except under emergency conditions to protect human life or property.

The foregoing is, of course, a condensation of the main points of a Ministry of Communications circular. It must be stressed that these new regulations did not come on their own accord, all by themselves. Rather, they are the result of a small dedicated group of amateurs in the Israel Amateur Radio Club who labored intensely to submit a list of proposals to the Ministry and persistently bargained with government officials, at all times keeping an atmosphere of a cordial and businesslike relationship.

All the radio amateurs of all license classes in Israel gained greatly from the new regulations, and no longer can any amateur find a valid reason for not supporting his national organization. IARC dues for a year represent less than one percent of what I believe the average amateur has invested in his station, and thus it is an excellent low-cost insurance to protect this investment.

THE DEAD SEA EXPEDITION

In the April issue of *73*, I announced this expedition to the lowest spot on the face of the earth; it took place from the sixth through the thirteenth of that month. At the camp of 4X5DS (Dead Sea), a number of tents were set up. One housed a station driving a triband beam, and another was equipped to load a longwire for 160, 80, and 40 meters. Operators were 4X4AT, 4X6DW, 4X6LQ, 4X6KT, 4X6OM, 4X6FR, 4X6LD, 4X4MU, 4X6LB, 4Z4OL, 4Z4UK, 4Z4VH, 4X6KF, 4X6KJ, and DL9BBS, keeping the two stations going on CW, SSB, and RTTY.

Somewhat over 3300 contacts were made during the week, all continents, and some pretty rare places were contacted. Unfortunately, due to the poor conditions and difficult location (being located half a mile east of a 1000-foot-high cliff), few contacts were made with the United States.

4X4FU, manager of the Israeli QSL bureau, has reported that he has already processed *all* the outgoing cards for the expedition, the participants of the expedition having decided *not* to wait for incoming cards first to arrive and then answer them. The organization of the operation was mainly by Ahron 4X4AT and the Bat-Yam-Holon club, and all expenses were paid by those participating. Ahron asked me to stress that at no time were funds solicited from outside sources, and that QSLs were sent at the club's own initiative. In this way, he wanted to make this expedition an example of how he feels that all amateur projects of this sort should be carried out.

4X85WSE

Only two weeks after the Dead Sea operation ended, many of the amateurs responsible for the above set up a station at the week-long World Stamp Exhibition that took place at the Tel Aviv Fair Grounds, showing the visiting public *another* way of collecting countries. One of the highlights was the visit of the President of Israel, His Excellency Mr. Haim Herzog, to the pavilion and his receiving an explanation of how amateur radio fosters international goodwill.

NEW AMATEURS

In April, the Spring amateur-radio examinations were held by the Ministry of Communications. Although unfortunately many examinees came inadequately prepared, many did pass, and as a result we now have 29 new licensed amateurs in the country. In terms of callsigns being is-

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sued, we are now almost at the end of the 4X6s (two-letter suffixes, with Novices having an N inserted after the 6). The 4X6 prefix, of course, came after the 4X4s and 4Z4s were completed in 1965 and 1979, respectively. At this rate, it looks like our growth rate is continually increasing, and let's hope that we do not hit a slump.

THE IARC ANNUAL ASSEMBLY

On the thirtieth of May, the Israel Amateur Radio Club held its annual membership assembly at the Bar Ilan University just outside of Tel Aviv. A few hundred members were present for the giving out of awards, an open forum to air viewpoints and propose resolutions, and the election of a new board of directors for the coming year.

This year's assembly was noticeably quite low-key, with virtually no controversial issues raised and a clean bill of health given by the watchdog committee that was elected in order to report any deviations by the executive from our club's constitution.

Amongst the many awards given out, Yair 4X4GI was proclaimed Amateur of the Year, and the huge ovation given demonstrated the membership's overwhelming agreement. Since November, Yair has been voluntarily giving biweekly lectures to the amateur public on the subject of satellite communications under the auspices of AMSAT Israel. In addition to the many articles he has published on the subject, these lectures have broadened the knowledge of all attending, making the consciousness of this space-age mode of communications widespread amongst Israeli radio amateurs.

Elections were held, and the new executive is composed of 4X4s AT, GE, GT, GP, KM, MP, SH, and 4X6s LD, MP, KJ, and OM. In their first meeting they will divide the responsibilities amongst themselves. The membership committee consists of 4X4FR, 4X6s AS and KF, and on the new watchdog committee sit 4X4BR, 4Z4LY, and 4X4-487 (SWL). We all wish them success plus massive cooperation from the rank and file membership, without which their mission will be most difficult, if not impossible.

4X6MF

It is with great regret that we announce the passing of Dr. Steve Friedland 4X6MF (WA6DBP). Steve was responsible both for the setting up of the 4X6TU beacon on the 14.100-MHz international beacon net and the Israeli chapter of AMSAT. Working both abroad and at the Tel Aviv University, Dr. Friedland made many important contributions to the field of science. He will be sadly missed.

ITALY

Mario Ambrosi I2MQP
Via Stradella, 13
20129 Milano
Italy

The contest season is over, and even if the propagation has not been too good, it has given some good results on all bands and in particular on 40 and 80 meters. You can see in the photos two of the Italian top contesters, I3MAU and I2VRN.

Renzo I3MAU is always active in the most important events of the year; you can find him regularly in world top scores on a multi-single or multi-multi team. His antennas are always impressive—a two-element loop on 160 and 80 meters, a 4-element quad on 40, and 6-element monobander quads on 10, 15, and 20.

Renzo has found some problems in supplying power enough when all six stations are running. He has moved out of town to find space enough for his towers, and the power line is not enough for him. So he had to put some generators outdoors to give power to two of the stations. In the photo you see only his standard station, but when all his friends join him, the amount of gear is as impressive as his antenna farm.

Roberto I2VRN works mainly on 40 meters. At the present he is using a 4-element wide-spaced monobander that gives a lot of satisfaction. In a couple of months, a new monster should be on the air, a 6-element wide-spaced quagi on a boom 100 feet long. All elements are already prepared and the boom is being tested before it is mounted. The boom weight will be 500 pounds and the whole will weigh approximately 1000 pounds. Roberto and his friends had to study a particular kind of tower and a very sophisticated rotating system that includes a transmission with oil under the pressure of 10 atmospheres. (Sorry, but I do not know how to convert it into pounds-per-inch: It's too complicated.)

During the weekend of May 18 and 19, the first international Italian contest was on the air. The participation of stations out of Italy was a real surprise. The 20-meter band was crowded with stations coming from all over the world. We all had the opportunity to work a lot of USA stations as well as a lot of USSR, European, and Japanese hams. If you had any contact with I stations, please send your log. You will receive a participation certificate, and the first three US stations will also get a medal.

This contest also gave the opportunity to work IY1 and IY4 prefixes—the first one being the QTH from where Marconi did his work, while the second was his home QTH. Remember that all contacts you had with Italian stations during the contest are accepted for the Worked All Italian Provinces Award, without the need for you to receive the corresponding QSL card.

And still talking about awards, I1BSN has just received his last card for the 5BWAZ, worked all zones! Franco, an electronic engineer, made a lot of effort to get it and is now starting to concentrate on the 5BWAS; if you hear him, please help him!

LIBERIA

Brother Donard Steffes, C.S.C.
EL2AL/WB8HFY
Brothers of the Holy Cross
St. Patrick High School
PO Box 1005
Monrovia
Republic of Liberia

The Liberia Radio Amateur Association has done a public service—believe it or not!

We have proclaimed ourselves to be a public-service organization, and in all honesty we have been looking for something to do. It seems that the most we have been able to come up with is a weekly weather report up and down the limits of Liberia. This has been fun. We know the temperature and rainfall in all parts, and if there is a storm with lightning or a torrent of rain, we know all about it. We have records and averages from year to year. But—is this public service? Everybody knows that there is a rainy season and a dry season. When you report that it rained 227 inches in a given year, people may react, "Oh, that much?" but then they will say, "Well, I guess so."

In the history of amateur radio in Liberia, things have been done which were really great and which stand as a credit to the amateurs of Liberia and to the amateurs of the world. The story of the Lassa fever epidemic is a prime example. In recent years, however, our record is not so good, and in the case of the Mono River disaster, the amateurs were not there.

Then on Saturday, March 16, 1985, at seven hundred UTC, it happened. The amateurs received an official request to supply communication at the first annual Omega Run, which was sponsored by the American Women in Liberia. We went out with our HTs and demonstrated real amateur efficiency. We set up a base station (net control), then we deployed HT operators at strategic positions around the race course. Yours truly manned the half-way point (which was also a first-aid station) and had drinking water for those who felt the need for it. We had an operator at the hospital in town and had an ambulance on standby at the site of the race.

The Omega Tower is the highest man-made structure in Liberia (1100 ft.). It holds up one end of a dipole antenna which forms part of a worldwide navigation system. The antenna tower is supported by guy cables anchored along the circumference of a circle of 5 kilometers. The service road forming this circle served as the race course.

The American Women of Liberia are a very active group; they gather funds to be used for scholarships. They are interested especially in helping deserving students on the high-school level. Their work is effective and appreciated in Liberia.

The races were in no way designed for trained athletes. Participants were old and young, fat and lean, and even several that were handicapped. One brave soul did the whole length on one leg and a pair of crutches.

It was the job of the amateurs to monitor the whole course and report accidents. We were instructed to watch for symptoms of heat prostration because the day was very hot and participants were not in very good physical condition. In general, we reported on the progress of the race

Italian contester Renzo I3MAU.

I2AOX and I2VRN at I2LLD's shack.

and announced the times as the runners passed various points.

Everyone had a grand time. Some of the people who participated in the race ran, some walked, some rested now and then, but everyone finished. One race was 5 kilometers and one was 10. Entry fees netted thirteen hundred dollars for the sponsors, and the runners are already training for next year.

The work of the amateurs was appreciated and we have a letter from the American Women in Liberia to prove it. Anyway, it was a kind of a first. We pulled it off in true amateur tradition, and we are looking forward to next year.

ABOVE AND BEYOND

Peter H. Putman KT2B
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One of the questions that is most frequently asked by newcomers to the VHF/UHF spectrum pertains to feedline. I'm quite surprised to find as many hams as I do who spend several hundred dollars for a multimode transceiver for 2 meters, add on a 100-Watt amplifier, and then feed their 13-element beam with RG-8/X cable!

On the VHF/UHF bands, the transmission line can be the most critical link in the entire system. Cables that perform well on the HF bands can exhibit considerable loss at 220 and 432 MHz. And marginal types of cables at HF become virtually useless at 144 MHz. It's important to know what to use and when to use it in your VHF station—even if you're just running a small vertically-polarized beam on your rooftop to access the local repeater with your hand-held.

To begin with, rf currents travel on the skin of the conductor at these frequencies, not through it. At some point in the frequency range, it even becomes impractical to use a "solid" conductor as we know it to carry these currents, hence the use of waveguides at microwave frequencies. To further complicate matters, the dielectric used in coaxial cable (that is, the insulating material between the center conductor and shield) can also absorb a significant amount of rf energy as you go higher in frequency.

Finally, at higher power levels the cable itself may break down due to arcing over the dielectric. Many is the time I've seen conventional RG-8/U blown apart from being used with a kilowatt on two meters. The cable heats up due to absorption by the dielectric and eventually self-destructs. So what's the aspiring VHFer to do?

Not to worry! There is an excellent selection of coaxial cable on the market to fill the need of the VHF and UHF enthusiast at a reasonable price. These cables are reliable and easy to use. They use standard connectors (with the exception of hardline) and some exhibit very low loss characteristics for frequencies as high as 1296 MHz using soft-cable construction. These cables are readily available from many advertisers in *73*.

Before we delve into that, let's look at why you *can't* use certain cables if you expect to maximize your station's VHF/UHF performance. One typical popular cable is RG-58/U, also available as RG-58/AU. This small-diameter 50-Ohm cable works well as a feedline in short runs on 160, 80, and 40 meters. For many Novices and newcomers to the hobby, this might have been the first cable ever used in the station. With a rated loss of about 1.0 dB/100 feet at 7 MHz, it worked just fine.

Now our budding ham has gotten a Technician license and has put up a quick installation to access the local 2-meter repeater with a handie-talkie, using what might be an old piece of RG-58/U running about 100 feet out of the shack around the roof to a small 4-element beam. Driving this with his mighty 2 Watts, there is concern when no one comes back! A quick glance at the loss charts shows that RG-58/U exhibits 6 dB of loss at this frequency. Whoops! Our budding Technician might better call the repeater on the phone to make a solid contact, as only 500 milliwatts are being delivered to the antenna, which doesn't have all that much gain to begin with.

A conversation with one of the local experienced hams brings the suggestion that our Tech scamper on down to the nearest radio store and buy a length of RG-8/U cable instead. Okay, that's a better choice since conventional solid dielectric RG-8/U has about 2.5 dB of loss at 144 MHz and can also handle more power if needed. (This is assuming that our Tech has gotten smart and picked up a power amplifier of about 25-30 Watts!) This means that slightly more than half the power generated at the station is making it to the beam antenna.

Now, let's assume that our budding Tech has been reading the monthly amateur journals and has discovered the newer lower-loss cables such as Belden 8214, Saxton 8284, or Belden 9913. After deciding to make the necessary additional investment, he goes for the 9913 and now finds that his loss per 100 feet is only 1.5 dB! (And it ought to be for a price of 45 cents a foot, he thinks!)

This scenario could go on and on. Our budding Tech might decide to go crazy and put in 1/2" aluminum-jacketed hardline, which has just under 1 dB of loss at 144 MHz per 100 feet, or if he's got a rich uncle, shoot the works and put up 7/8" 50-Ohm hardline, which has the best loss figures—.65 dB per 100 feet at 144 MHz.

As you can see, there are many options available. The rule of thumb is to buy the best cable your budget can afford, since using a cheap cable after a $900 UHF multimode kind of negates your purchase. The most common complaints regarding the lack of performance of VHF and UHF transceivers from newcomers to these bands are usually caused by inadequate antennas and transmission lines! If you buy an IC-271H and a Henry 2002 1-kW 144-MHz amplifier, don't use conventional RG-8/U unless you want to give your neighbors a spectacular fireworks display from your rooftop!

Believe it or not, there are times when having a cable with high loss characteristics can actually be *useful* to the VHF/UHF enthusiast! For example, let's say you'd like to tune up a home-brew 100-Watt solid-state amplifier but don't have an adequate dummy load and don't wish to shock the airwaves with your signal (which might not be too clean yet!). You do have a small 25-Watt dummy load that works well, but that's it. No problem! Just find 100 feet of old RG-58/U and put connectors on both ends. Attach your 25-Watt dummy load to the far end and connect the other to your amplifier. The coax will take care of the first 6 dB (75 Watts) and your dummy load can handle the rest with ease. This technique is also useful for reducing the drive to some of the more popular high-power VHF and UHF amplifiers, such as the Henry series.

A quick glance at Table 1 will show what you can expect from the more commonly-available transmission lines used at VHF and UHF frequencies.

As you can see, selecting the right feedline for your needs can mean the difference between using your coax as a dummy load and making that contact on meteor scatter!

What you ultimately use is up to you and your station requirements. It's amazing how many folks rush in and buy equipment for the VHF/UHF bands without having some idea of what they'll use it for in the first place! A small amount of time spent before this initial purchase will help you not only to select the best equipment for your needs (we'll cover this in future columns), but also the best type of coax to use. You may be content to know that your Belden 9913 is delivering about 65 of the 100 Watts you're pumping into it to the 22-element yagi up on the tower. Or maybe you want to get every ounce of the power from your home-brew 6-meter kilowatt to the stacked 7-element beams on the roof, so you use 7/8" hardline.

The trick is to avoid putting yourself in a hole by losing all or most of your signal in the coaxial line. Note that I have referred only to coaxial transmission lines to this point; while balanced line or twin-lead may have a lower loss characteristic up to about 150 MHz, it just isn't practical for 99% of all amateur installations.

One final area to be touched on is the choice of connector, and there certainly are a lot of 'em! PL-259, BNC, type N, HNC, TNC, SMA—it begins to sound like a meeting of lobbyists with all those abbreviations! In practical use, however, most amateurs are familiar with three types of connectors: the standard PL-259, or "UHF" connector (what a misnomer!), the type-N connector (long a military standard), and the BNC miniature connector.

Most hams are acquainted with the UHF connector, more appropriately called the PL-259 or 83-1S series from Amphenol and other manufacturers. Believe it or not, this is *not* a 50-Ohm connector. However, we usually don't notice the difference at lower frequencies and they are rather easy to put on and cheap. But as the frequency climbs, the impedance "bump" that this connector creates in the transmission line can then translate into wasted power—as much as 2 dB at 432 MHz, if it is an inferior grade plug (usually with a cheap dielectric!). Some attempts have been made to cure this problem by using a Teflon™ dielectric, and these types of UHF plugs work much better at 144 and 220 MHz. I've just tested one of these plugs at 1296 with a 10-Watt amplifier and found it to have about 1.5 dB of loss at this frequency, which still isn't good enough.

The best choice? Type-N connectors, also known as UG-21. These are available from many sources including Amphenol and Kings. They are not all that expensive. They are comparatively easy to assemble, are watertight, and best of all are *true* 50-Ohm connectors! Replacing the previously-mentioned UHF connector at 1296 with a type N resulted in picking up that 1.5 dB back again! Type-N and UHF connectors are available to fit a wide variety of cables, from RG-58/U up to RG-8/U foam coax. The new 9913 works well with PL-259s, but the center #9 conductor must be filed down to fit a standard type-N connector.

The third connector mentioned was the venerable BNC connector, which many of you will recognize from your 2-meter HTs. This is sort of a miniature type-N connector and also looks like 50 Ohms. It too is watertight although somewhat more tricky to make up. These connectors are excellent for low-power applications (under 200 Watts) and make good choices for interconnecting cables. I use 'em at 432 and 1296 for portable stations, with short lengths of superior-grade RG-58/U or RG-146/U Teflon cable. These lengths are usually under 10 inches. Again, BNC connectors (or UG-88-type connectors) are commonly found from most major manufacturers.

If you choose to go the hardline route, there are many specialized connectors available which we'll touch on in later columns. Until next month, see you "Above and Beyond."

Loss in dB/100 ft.

Cable Type	50 MHz	144 MHz	220 MHz	432 MHz
RG-58/U (50-Ohm)	3.5	6	7.5	N.A.
RG-59/U (75-Ohm)	2.7	4.5	5.5	8
RG-8/A (50-Ohm)	1.75	3	4.5	6
RG-8/U (50-Ohm)	1.25	2	2.5	3.5
RG-11/A (75-Ohm)	1.75	3	4.5	6
Belden 9913 (50-Ohm)*	1	1.6	2.0	2.7
RG-17, 18 (50-Ohm)	.65	1.3	1.75	2.5
1/2" 75-Ohm hardline**	.6	1.2	1.4	2.2
1/2" 50-Ohm hardline	.5	1.0	1.2	1.75
7/8" 50-Ohm hardline	.35	.65	.9	1.3

Additional Notes

* Belden type 9913 is an unusual cable in that while it is basically a soft-type RG-8/U cable, it uses an air dielectric around a low-loss #9 conductor to achieve its low loss characteristics. The advantages of such a cable are not lost on those readers with VHF/UHF arrays on crank-up towers!

** 75-Ohm hardline is surprisingly easy to obtain. Many cable-TV operators discard short runs at the end of a long spool used for wiring up a street or a block of streets. These short runs can turn out to be as long as 200 feet, and the cable can be had usually for free just by asking. Many hams sell homemade connectors for this hardline using brass pipe fittings, and they are spotted at flea markets frequently! Although the impedance is not 50 Ohms, using this cable without a matching network often results in no worse than a 1.5:1 vswr (and due to manufacturers' inconsistencies, it's often lower than that!). Tube amplifiers will tune it with ease. This cable is a good choice at 220 and 432 MHz!

Table 1.

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Jim Gray W1XU
73 Staff

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AUSTRALIA						40	20	20			15	15
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G = Good, F = Fair, P = Poor.

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