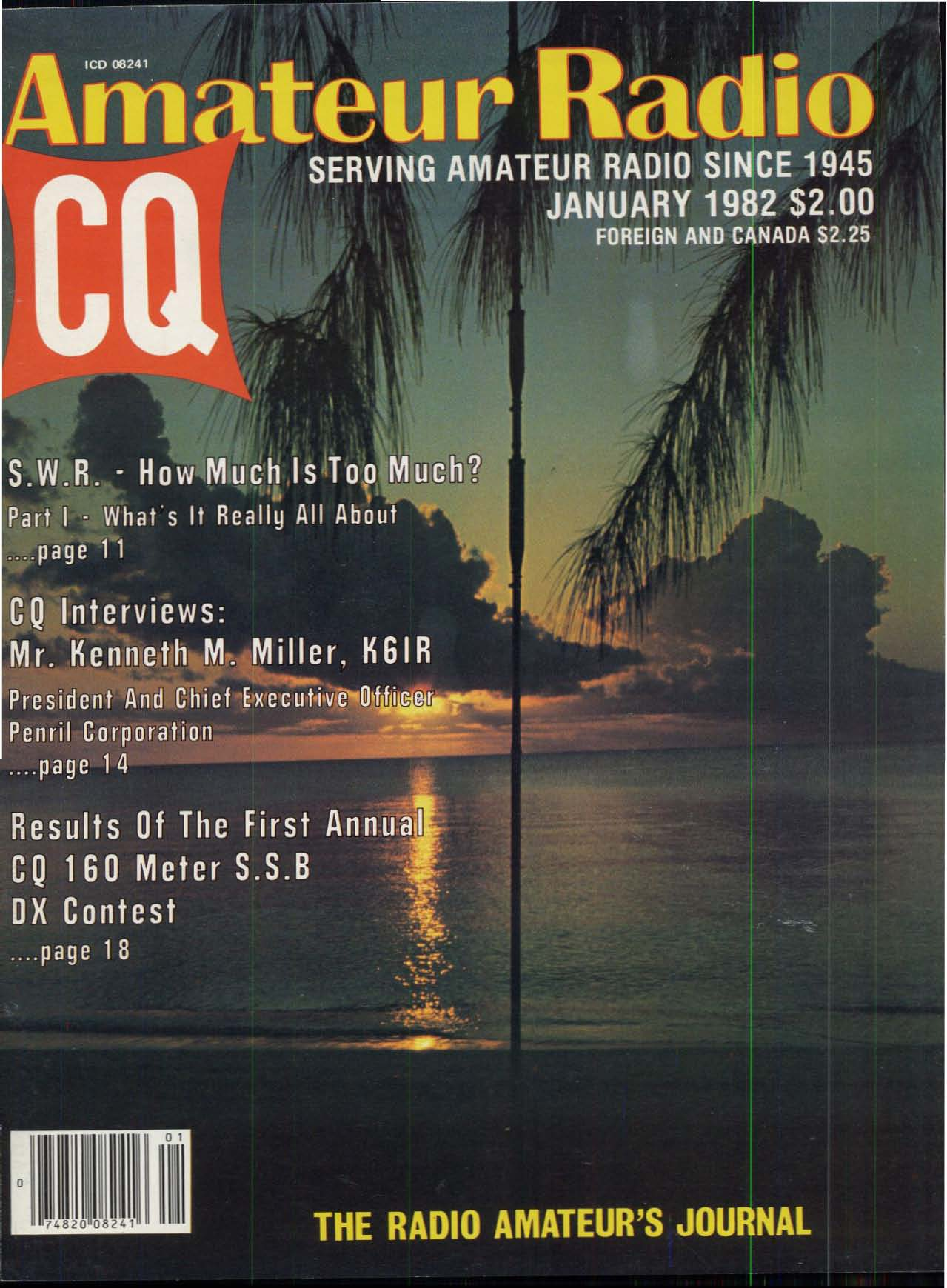

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CQ Amateur Radio

SERVING AMATEUR RADIO SINCE 1945
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S.W.R. - How Much Is Too Much?

Part I - What's It Really All About

....page 11

CQ Interviews: Mr. Kenneth M. Miller, K6IR

President And Chief Executive Officer
Penril Corporation

....page 14

Results Of The First Annual CQ 160 Meter S.S.B DX Contest

....page 18

THE RADIO AMATEUR'S JOURNAL

The TR-7730 is available in two variations: a 16-key autopatch UP/DOWN microphone (MC-46) version, and a basic UP/DOWN microphone version.

TR-7730

Miniaturized, 5 memories, memory/band scan

The TR-7730 is a very compact 25 watt, 2-meter FM mobile transceiver, reasonably priced.

TR-7730 FEATURES:

- Dimensions: 5-3/4 W x 2 H x 7-3/4 D, inches. Weighs 3.3 lbs.
- Extended frequency coverage, 143.900-148.995 MHz, in 5 or 10 KHz steps.
- 25 watts RF output power, with HI/LOW power switch.
- 5 memories for operation in simplex or repeater modes.
- Memory scan, plus automatic band scan.
- UP/DOWN manual scan on microphone (supplied).
- Four digit LED frequency display.
- S/RF bar meter. LED indicators for BUSY, ON-AIR, REPEATER offset.
- Tone switch for internal tone encoder (not Kenwood supplied).
- Offset switch, ±600 kHz. Non-standard offset uses fifth memory.

OPTIONAL ACCESSORIES:

- MC-46 16-key autopatch UP/DOWN microphone.
- SP-40 compact mobile speaker.
- KPS-7 fixed station power supply.

TR-8400

Synthesized 70-cm FM mobile rig

- Covers 440-450 MHz, in 25 KHz steps, with two VFOs.
- Transmit offset switch for ±5 MHz. Non-standard offset uses fifth memory.
- HI/LOW power switch selects 10 or 1 watt RF output.
- Similar to TR-7730 in other features, including five memories, memory scan, automatic band scan, UP/DOWN manual scan, four digit display, S/RF bar meter, LED indicators, tone switch, and same optional accessories.

- MC-46 16-key autopatch UP/DOWN microphone.

TR-9000

"New 2-meter direction"... compact rig with FM/SSB/CW, scan, five memories

The TR-9000 combines the convenience of FM with long distance SSB and CW. It is extremely compact . . . perfect for mobile operation. Matching accessories are available for optimum fixed-station operation.

TR-9000 FEATURES:

- FM, USB, LSB, and CW.
- Only 6-11/16 inches wide, 2-21/32 inches high, 9-7/32 inches deep.
- Two digital VFOs, with selectable tuning steps of 100 Hz, 5 kHz, and 10 kHz.
- Digital frequency display. Five, four, or three digits, depending on selected tuning step.
- Covers 143.9000-148.9999 MHz.
- Band scan . . . automatic busy stop and free scan.
- SSB/CW search of selectable 9.9-kHz bandwidth segments.
- Five memories . . . four for simplex or ±600 kHz repeater offsets and the fifth for a non-standard offset (memorizes transmit and receive frequency independently).
- UP/DOWN microphone (standard) for manual band scan.
- Noise blanker for SSB and CW.
- RIT (receiver incremental tuning) for SSB and CW.
- RF gain control.
- CW sidetone.
- Selectable RF power outputs . . . 10 W (HI)/1 W (LO).
- Mobile mounting bracket with quick-release levers.
- LED indicators . . . ON AIR, BUSY, and VFO.

OPTIONAL ACCESSORIES:

- PS-20 fixed-station power supply.
- SP-120 fixed-station external speaker.
- BO-9 System Base . . . with power switch, SEND/RECEIVE switch (for CW), memory-backup power supply, and headphone jack.
- MC-46 16-key autopatch UP/DOWN microphone.

PS-20 TR-9000 BO-9 SP-120

KENWOOD

TRIO-KENWOOD COMMUNICATIONS
1111 West Walnut, Compton, California 90220

TR-2500

BIG performance, small size, smaller price!

The TR-2500 is a compact 2 meter FM handheld transceiver featuring an LCD readout, 10 channel memory, lithium battery memory back-up, memory scan, programmable automatic band-scan, Hi/Lo power switch and built-in sub-tone encoder.

CONVENIENT TOP CONTROLS

TR-2500 FEATURES:

- Extremely compact size and light weight 66 (2-5/8) W x 168 (6-5/8) H x 40 (1-5/8) D, mm (inches), 540 g, (1.2 lbs) with Ni-Cd pack.
- LCD digital frequency readout, with memory channel and function indication.
- Ten channel memory, includes "M0" memory for non-standard split frequencies.
- Lithium battery memory back-up, built-in, (estimated 5 year life) saves memory when Ni-Cd pack discharged.
- Memory scan, stops on busy channels, skips channels in which no data is stored.
- UP/DOWN manual scan in 5 KHz steps.
- 2.5 W or 300 mW RF output. (HI/LOW power switch.)
- Programmable automatic band scan allows upper and lower frequency limits and scan steps of 5 KHz and larger (5, 10, 15, 20, 30 KHz... etc) to be programmed.
- Built-in tuneable (with variable resistor) sub-tone encoder.
- Built-in 16 key autopatch encoder.
- Slide-lock battery pack.
- Repeater reverse operation.
- Keyboard frequency selection across full range.
- Extended frequency coverage; 143.900 to 148.995 MHz in 5 KHz steps.

- Optional power source, MS-1 mobile or ST-2 AC charger/ power supply allows operation while charging. (Automatic drop-in connections.)
- High impact plastic case.
- Battery status indicator.
- Two lock switches for keyboard and transmit.

STANDARD ACCESSORIES:

- Flexible rubberized antenna with BNC connector.
- 400 mAH heavy-duty Ni-Cd battery pack.
- AC charger.

OPTIONAL ACCESSORIES:

- ST-2 Base station power supply and quick charger (approx. 1 hr.).
- MS-1 13.8 VDC mobile stand/ charger/power supply.
- TU-1 Programmable "DIP switch" (CTCSS) encoder.
- SMC-25 Speaker microphone.
- LH-2 Deluxe top grain cowhide leather case.
- PB-25 Extra Ni-Cd battery pack, 400 mAH, heavy-duty.
- BH-2 Belt hook.
- WS-1 Wrist strap.
- EP-1 Earphone.
- RF power amplifier. (To be announced.)

TR-7850

40 W, 15 memories/offset recall, scan, priority, autopatch (DTMF)

Kenwood's remarkable TR-7850 2-meter FM mobile transceiver provides all the features you could desire, including a powerful 40 watts output. A 25 watt version, the TR-7800 is also available.

TR-7850 FEATURES:

- 40 watts output, with selectable high or low power operation.
- 15 multifunction memory channels, easily selectable with a rotary control. M1-M13 ...memorize frequency and offset (±600 KHz or simplex). M14... memorize transmit and receive frequencies independently for non-standard offset. M0... priority channel, with simplex ±600 KHz or non-standard offset operation.
- Internal battery back-up for memories. Requires four AA Ni-Cd batteries, (not supplied).
- Extended frequency coverage, 143.900-148.995 MHz in 5 or 10 KHz steps.
- Priority alert. Beep alerts operator when signal appears on priority channel.
- Built-in autopatch encoder (DTMF). All 12 plus four additional DTMF signaling tones. (With simultaneous push of REV switch.)
- Autoscan of memories and entire band. Scan resumes automatically.
- Front panel keyboard.
- Compact size.
- UP/DOWN manual scan of entire band and memories, using UP/DOWN microphone (supplied).
- Repeater reverse switch.
- Separate digital displays for frequency and memory channel.
- LED S/RF bar meter.
- Tone switch.

Matching accessories for fixed station operation:

- KPS-12 power supply (for TR-7850)
- KPS-7 power supply (for TR-7800)

SP-40

Compact mobile speaker
Only 2-11/16 W x 2-1/2 H x 2-1/8 D (inches)
Handles 3 watts of audio

KENWOOD

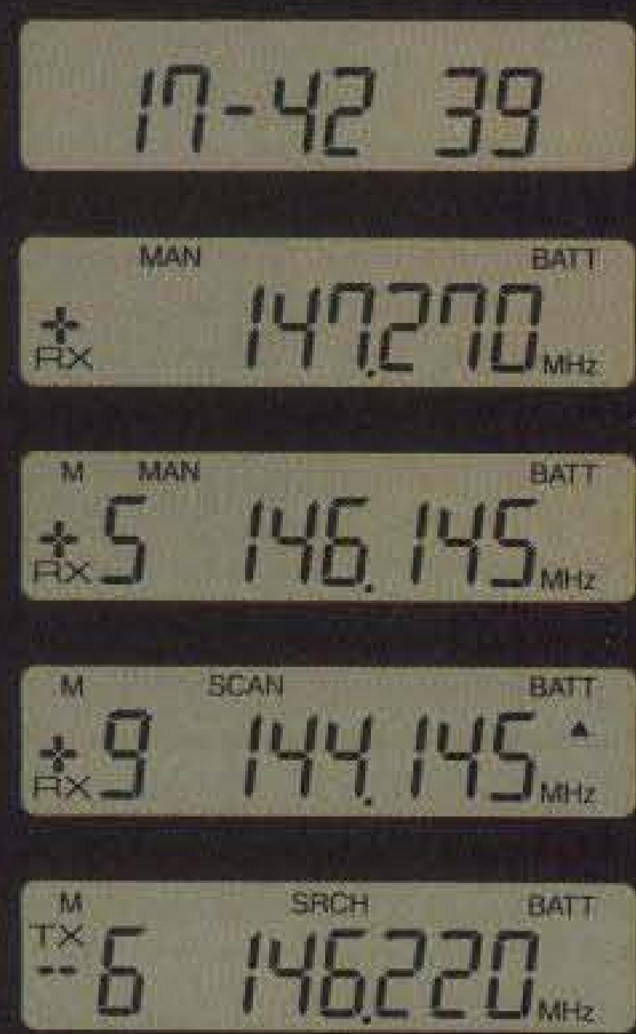
TRIO-KENWOOD COMMUNICATIONS
1111 West Walnut, Compton, California 90220

ST-144/µP, 2 Meter FM

It's Time!

■ It's time you got your share of the excitement of full-feature synthesized handheld operations. ■ SANTEC{nology zaps to the lead of the state-of-the-art in 2 meter handhelds with the new ST-144/µP. ■ Only SANTEC hands you all the up-to-the-minute features of this "clockwise" precision jewel.

■ The 24 hour format digital clock on the LCD display is uniquely SANTEC, and it typifies the thoughtful operator-oriented design incorporated throughout the ST-144/µP. ■ Not only does it give you accurate time checks whenever you want, but also it can display the time instead of the frequency, while this handful of radio continues to operate on your "favorite" frequency.



24 Hr Clock provides time of day even while the radio is turned off, or it can be selected by the front panel switch while in QSO.

Full Frequency Display showing offset selected, battery condition and current scan mode. At turnon, the contents of M-1 are loaded into the operating register, and the display looks like this.

The Memory Mode is indicated by the small "M" above "+", the "5" indicates that the data were stored in Memory 5 before recall. The "+" indicates that the + offset was stored with the frequency.

Memory Scan with "Priority Scan/Auto-Resume" has stopped on Memory 9 to listen for a few seconds.

Transmit is indicated on a minus 600 kHz offset from 146.820 MHz which was stored in M-6. Activity on Memory 6 was found by using the "Search" mode of Scan.

■ The 10 frequencies that you put into the memories are stored with your repeater offsets, and you can have them scanned, searched or instantly recalled at the touch of a button. ■ Memory 1 even gets priority treatment in the memory scan mode. ■ That's timely complexity made amazingly simple: and the high power option of 3.5W (nominal) is simply the greatest reach you've ever held in your hand.

■ "Battery saver" function by the computer to hoard battery power when the frequency is quiet ■ Programmed limits for both ends of bandscan ■ Simplified frequency entry only by keyboard ■ Full capacity, low impedance audio output to drive an external speaker ■ Wide band span for MARS, CAP, AF MARS: 142.00-149.995 MHz ■ Quick-change 500mAh battery ■ Separate level controls for MIC, TT, PL and DEV ■ & so much more that we don't have space to mention ■ SANTEC hands it all over, while others can't even give you the time of day.

All stated specifications are subject to change without notice or obligation.

Accessories for SANTEC Handheld Radios
clockwise from upper left:
- Leather Case (ST-LC)
- Base Charger & Power Supply (ST-5BC)
- Remote Speaker (MS-50S)
- Mobile Charger (ST-MC)
- Speaker Microphone (SM-1)

Sale of the ST-144/µP is subject to FCC certification: approval and availability expected January, 1982.

SANTEC

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CQ The Radio Amateur's Journal

ON THE COVER: In the throes of winter isn't it nice to contemplate operating from a tropical clime. This was the Cayman Island site of ZF2AH (WA6VNR stateside) during last year's CQ WPX C.W. Contest.

JANUARY 1982 **VOL. 38, NO. 1**

FEATURES

DEPARTMENTS

MASTHEAD

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Zero Bias

AN EDITORIAL

Recently we had an intellectual exercise here concerning the validity of the current Burma (XZ) operation. The League at this point has taken the position that these contacts are not valid for DXCC, and I can see their argument clearly in legalistic terms. In the strictest terms, the XZ stations are not licensed amateurs, not operating from a country that permits operation and so on. So in international terms, then, these operators would be called "pirates."

Well, these "pirates" do seem to act like other amateurs. Their procedure is no different than any other amateur's, they seem to be able to handle pile-ups, and they even QSL. For an illegal operation they sure draw a lot of attention on the bands. At recent hamfests you can spot the DXers and non-DXers alike asking each other "Did you work them?" and each knows exactly what the other means. Even though everyone seems to agree that the operation is technically illegal, everyone still seems to want to work them and most of all hang on to their QSL cards should there be a change of heart in Newington.

Well, philosophically one could argue both sides of the operation and still be right. You could even throw in some geopolitical implications and still be right. However, one thing does stand out: There really is a part of Burma that shows activity on the amateur bands. There really are amateurs or amateur-like operations going on. They do QSL and apparently receive QSLs. One cannot deny that this exists. The Burmese government has not seen fit to nor been able to close down the operation. If anything, the operation should get bigger due to some American "lend-lease" equipment being sent out.

The next question that should be asked here at *CQ* at least is whether or not *we* will consider accepting these contacts as valid for our Awards Program. It's not an easy yes or no.

Counterbalancing that consideration is the fact that we are now supposed to consider a four-story building in downtown Rome as a country separate from Italy. The country is called SMOM and is one of several SMOMs throughout the world. It is part of a very old organization called The Society of Malta and dates back to the time of the Crusades. This particular building came to my attention almost 20 years ago in connection with a non-amateur matter, and at that time it was unoccupied and being watched over by an elderly caretaker. Well so be it; the building technically is a country with sovereign status. The bands can hum with activity and people can now work SMOM, receive QSL cards, and apply for awards. This much is legal, and I guess we can expect DXpeditions to SMOM, and Italians and tourists lining up to give the world a "new" country. At least it's not a rock above water at high-tide; it is a building.

On the other hand, this whole condition got me thinking about the possibility of a stupendous coup. I think it could work and perhaps even be legal enough for Newington. Just suppose (let your mind really stretch for this one) that Dick, Jack, and I left the comfortable confines of Hicksville one day and took the train to the city (Manhattan). Armed with a telephone book and three fully-charged HTs, we could disperse around New York in a predetermined pattern and find every foreign embassy based in the city. With the UN here, the city is loaded with foreign missions and embassies. Well, technically, if we could gain access to just the door step, we would legally be on foreign soil. If we planned it out very carefully, we three could possibly work each other enough times from enough different locations for the three of us to apply for DXCC (single band, two meters) in one day. If we had enough time left over, we could even be generous enough to let the guys on the repeaters in on it too. We could probably bring this ultimate DXpedition in for under $20.00, unless we had to take a few extra taxi rides.

Legal? I think so, and probably we could make a case. Whether this is within the spirit of either the *CQ* Awards Program or the ARRL Awards Program is very questionable. Amateurs, like anyone else, delight in finding loopholes. Suddenly the "spirit" or "intent" is relegated to theologians, and the question becomes, is it legal or not? Incidentally, my stupendous idea is not new at all. From time to time this idea has appealed to and attracted many amateurs who have considered the possibilities. Sure there are safeguards against this actually happening, but every generation of amateurs has a few who would like to test it out again.

These comments and musings, however, do little to answer the question, is the XZ contact valid or not, and does simple sovereignty of a four-story building make for a new country? In the headlong rush to get on an Honor Roll and rack up countries, a person's judgment can get clouded to the point that the ends justify the means. In a crude and bungled effort, I think that the recent QSL card fiasco out of California was some sort of symbolic gesture along these lines. Perhaps a new order of re-think should be generated . . . just what is a country? If it is possible to work out a universally acceptable definition of what a country is and where it is *without* tying in what it's worth on an Award scale, then we may all be on to something.

Hypothetically, what is needed desperately in amateur radio is a universal set of guidelines. How to arrive at these guidelines is no easy chore, and certainly these guidelines cannot be arrived at unilaterally. What is needed is some sort of summit meeting, if you will, of those parties directly involved in DX programs and Awards Programs. Perhaps representatives from *CQ* and the ARRL could get together with counterparts from the DARC and JARL, for example, to hammer out universal criteria for countries and DX operations. It's a cinch that any one of us singly does not have the total answer. This is an area that affects all of us worldwide. It's about time that amateur radio grew up and faced the twentieth century. We can no longer afford the squabbles or pettiness and downright ludicrous discussions of country status. The rampant desire for a new country, any country, does not justify what has gone on in recent years.

We can all go on as before, which ultimately will water down all of our efforts for meaningful programs, and the search for new countries will become even more bizarre. This is a self-defeating approach to amateur radio and a lousy example for newcomers to follow. We can set the record straight if we want to and create a proud moment in our history.

If you're happy and content that a building and caretaker in downtown Rome is a country, while a country in the Orient is not (according to some), then leave well enough alone. If some of this is becoming silly and counterproductive to the "spirit" and "intent" of amateur radio, then let me know. Perhaps we can get a summit meeting going or at least get the groundwork started for one. It certainly is worth a try.

73, Alan, K2EEK

Our Readers Say

Hooray for RTTY

Editor, *CQ:*

It was indeed a pleasant surprise to see the November 1981 issue of *CQ* featuring RTTY. This mode of operation has obviously gained in popularity with the advent of the microprocessor controlled equipment. The number of advertisers in the ham magazines testify to the commitment of the industry to this phase of our hobby. Admittedly, I do miss the clatter of the Model 15, but certainly not the smell of the oil.

Robert A. Hart, WA7HRA
Hoodsport, WA

Novice Operation In Spain

Editor, *CQ:*

Re: "In My Opinion: A.M. Is Not Dead, Stop Trying To Bury It" by Byron Kretzman in the October 1981 issue. The reason you may be hearing more s.s.b. than you expected on 29.000+ is that the Novices in Spain, who use the prefix EC, are permitted phone operation only on 29.0 to 29.1. All of their other operation must be c.w. This attracts Europeans and stateside stations since it's fun and it's a way of obtaining the Worked All EA Provinces Award. Unfortunately, with conditions improving in the Fall, I think you'll find a lot of activity there until the band folds towards Europe in the summer.

Angel Garcia, WA2VUY
Hackettstown, NJ

Lew McCoy, A Winner

Editor, *CQ:*

Hooray for *CQ* and Lew McCoy. The article "The Frugal Fifteen" (*CQ*, August 1981) is a winner. It is finally an antenna article that is understandable, does not resort to needless calculus, and is likely to encourage building and experimentation.

The key is the FB illustrations. A very critical part of any homebrew antenna is the matching section. Lew shows exactly how to do it. No schematic will do the job the photos on page 9 have done.

Keep Lew's articles coming. How about a series of articles about matching sections and their particular application to Yagis?

Paul M. Bachorz, KB2T
Ballston Spa, NY

Will The Real K2RA Please Stand Up

Editor, *CQ:*

This is the real K2RA, and unfortunately for me, my K2RA call has been bootlegged on the air by some culprit named Jerry since 1978, mostly in contests and on the 20 and 10 meter s.s.b. bands. His location is unknown.

Please publish my K2RA call on your hot list of boot-legged call signs. This guy "Jerry" is using up all of my envelope credits at the QSL bureau in the North Jersey DX Association, and that's how I found out about him. I have enough DX cards confirming his contacts made with my K2RA call for me to get DXCC! I have notified the ARRL and the FCC. Mention that he can pick up most of his cards with my call sign (except for the ones I sent to the FCC). I will be glad to meet him.

D.M. Rager, Jr., K2RA
Buffalo, NY

QRP Handbook To Premier

Editor, *CQ:*

It was a pleasure meeting with you at the convention in Houston (October 1981). My only regret was the we did not have longer to talk.

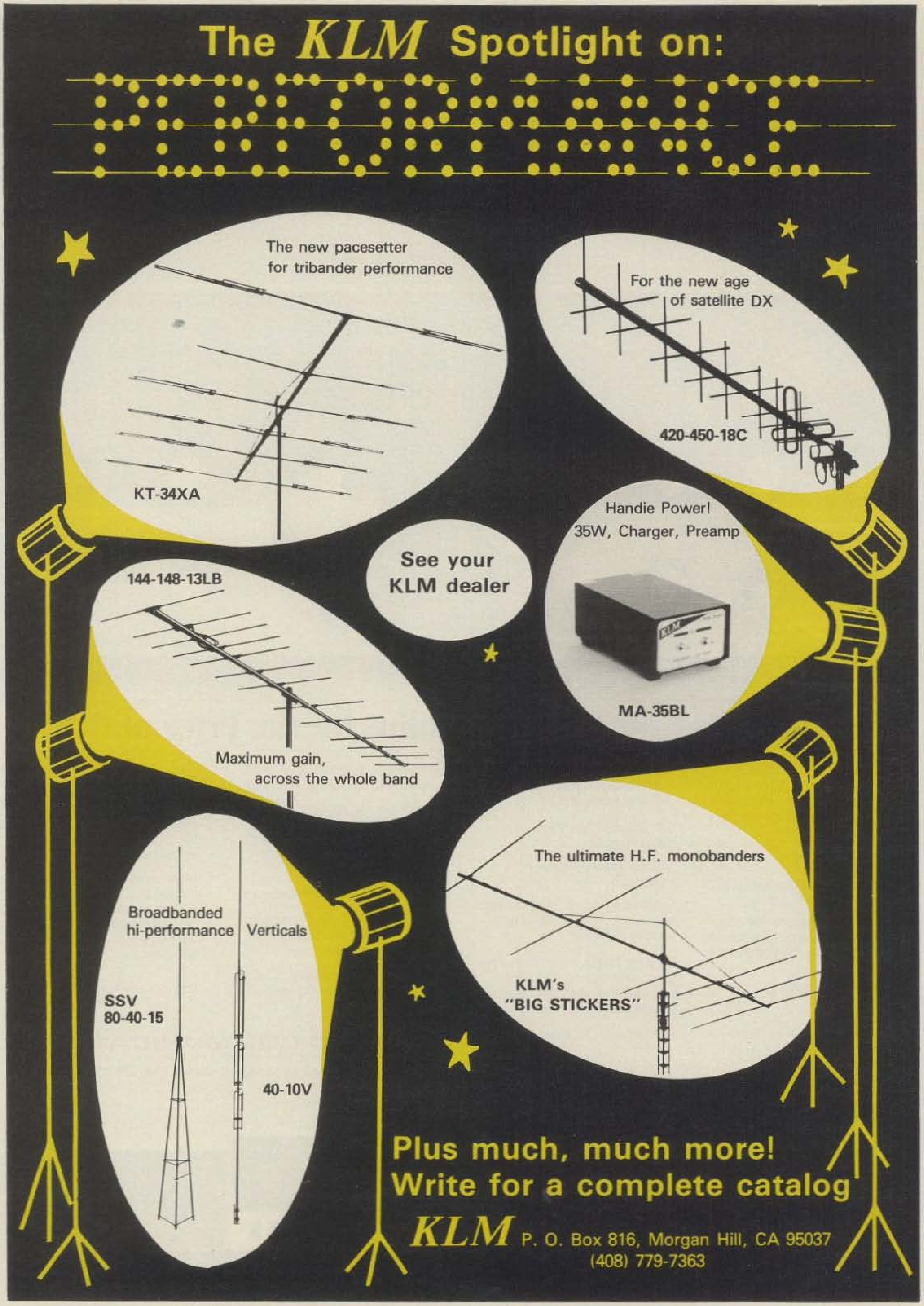
I appreciate your bringing me up to date on Ade Weiss's *QRP Handbook*. I plan to mention that in the next issue of the *Southwest QRPer*, a bi-monthly newsletter we put out down here in the 5th call district. Many of the QRP gang in this area are awaiting publication of that book with great enthusiasm.

Ade has accepted our invitation to be part of the QRP Forum at the ARRL National Convention in Houston in 1983, by which time the handbook should be well out. But it occurs to me that the convention might be a fine place for autographing of copies. We plan a reception for him and the others on the Friday evening of the convention; you'll get your invitation in the mail later, but save a slot for us.

I hope to see you and *CQ* again. I think you are doing the right thing in showing your colors at these gatherings.

Fred Bonavita, W5QJM
Austin, TX

(Ade Weiss's QRP Handbook *will be available in the Spring of this year, published by CQ. More details as the book progresses.—Ed.)*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From that indefatigable source who brought you the Monomatch and Ultimate Transmatch comes some more gems and a super construction project.

S.W.R—How Much Is Too Much?

Some Answers To An Often-Asked Question

Part I—What's It Really All About

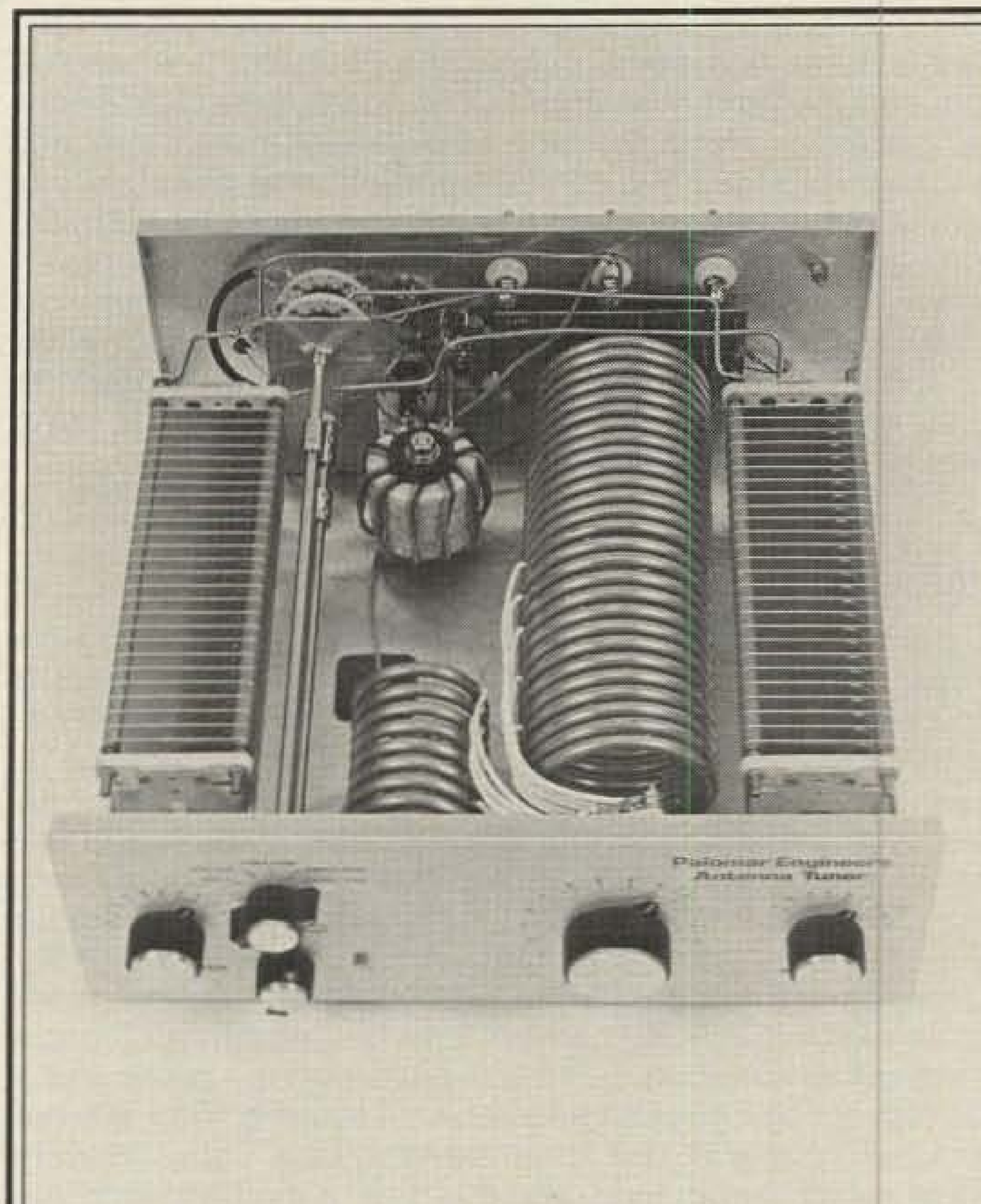
BY LEW MCCOY*, W1ICP

There isn't much doubt that one of the most frequently asked question by amateurs is just how high an s.w.r. one can tolerate. The answer to this question isn't a simple one, but we'll attempt to handle it in this article and do it as simply as possible. In addition, we will describe, in Part II, the construction of a combination s.w.r. and power bridge that anyone can build—cheaply.

Some Ground Rules

Let's first establish some ground rules or basic information so we'll all know what we are dealing with. **Standing Wave Ratio (S.W.R.)** is the ratio of maximum to minimum r.f. voltages on transmission lines. The ideal s.w.r. is a ratio of one, or as we say, one-to-one. When discussing antennas and feed lines, we must first understand that the s.w.r. is established by the feed impedance of the antenna and the impedance of the feed line used. **Impedance** is defined as the total opposition to alternating current (r.f.) by an electrical circuit, and usually is expressed in ohms. The impedance at the feedpoint of the antenna has two properties at resonance: ohmic and radiation resistance. A resonant half-wave dipole, a half-wavelength above ground, will have an impedance of approximately 70 ohms, and if we feed it with 70-ohm impedance line, the line and antenna impedance will match. In such a case, our s.w.r. would be 1 to 1.

However, life is never that simple. When an antenna is operated on some frequency other than resonance, *the impedance changes and becomes different than that of the feed line.* As an example of how this changes let's take a dipole for 80 meters and make it resonant at 3750 kHz, and further, let's assume the impedance is 50 ohms and fed with 50-ohm impedance coaxial line. At 3750 our s.w.r. will be 1 to 1, but at 3500 kHz or the other end of the band, 4000 kHz, the s.w.r. is likely to be over 10 to 1!



This shows the Transmatch designed by Palomar Industries, and it is typical of many of the better commercial units. There shouldn't be any doubt that this one will handle power!

*200 Idaho St., Silver City, NM 88061

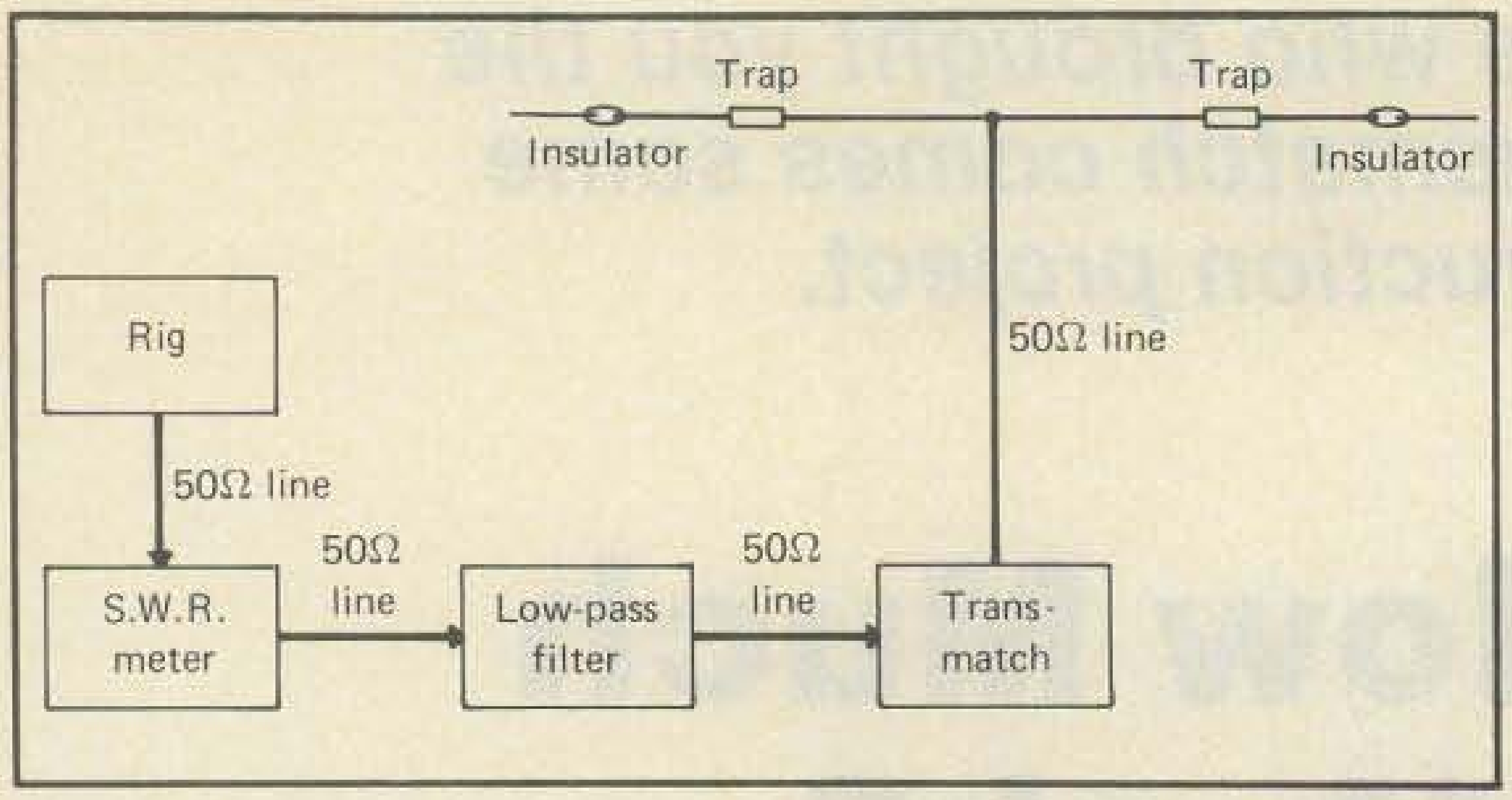


Fig. 1– This shows the typical hookup for a Transmatch installation. A low-pass filter should be installed between the power/s.w.r. bridge and the Transmatch. Contrary to some beliefs, the Transmatch does not have to be shielded for t.v.i. purposes. We'll discuss tune-up procedures in Part II of this article.

Modern-day transmitters would look at such a mismatch and immediately collapse! The problem with our antenna when it is operated off resonance is that *reactance* is introduced into the feedpoint. Reactance is expressed in ohms, but it isn't a real resistance. You cannot dissipate power in a reactance, but *the reactance acts just like a door or a gate and stops the flow of power into the circuit—in this case the antenna* (not actually the antenna, but rather the antenna system). The power doesn't want to enter the coax that is attached to the transmitter because of the reactance and mismatch that are present. Because of this reactance the final transmitter stage refuses to tune or load. It should be added that the presence of reactance causes the s.w.r. to rise.

The real key to our story is the problem of modern-day transmitters. They are designed to work into a 50-ohm load, and the manufacturer only permits very little deviation from such a load—maybe 2 to 1 mismatch, but not much more. This means that it is easy to mistune some amplifiers or transmitters and *ruin* the final stage if you don't *understand* what you are doing.

Very few amateurs use a resonant antenna. Sure, there are some amateurs who stay on one frequency all their amateur careers, but they are dog-gone few in number. Most of us jump around the bands or QSY up and down a band, and when we do, our s.w.r. changes accordingly. The degree of change depends on many, many factors, too many in fact to try to cover them all in detail in a single article.

High S.W.R. and Feed-Line Losses

In amateur radio, the most popular type of transmission line is coaxial line, usually of the 50-ohm impedance variety. The amount of power loss between your transmitter and antenna via the coax feed line depends on several factors: the length of the line, the quality of the line, the s.w.r. on the line, and the frequency in use are all factors in power loss. Rule number one should be the lower the s.w.r., the lower the amount of power lost. The higher the frequency, the higher the losses for any coaxial line, and—most important—a high s.w.r. at a high frequency can be very prohibitive as far as power loss is concerned. An example is RG58 cable at 2 meters, which has a loss of over 5 dB, which works out to about a three times power loss in 100 feet of coax. To put it another way, assume 100 watts output into 100 feet of line to an antenna. Only about 35 watts would reach the antenna, and that's for a matched line! Any mismatch would increase these losses dramatically. On the other hand, the loss for 100 feet of RG58 on 80 meters is insignificant—just a fraction of a decibel, and we can tolerate a relatively high s.w.r. without any appreciable power loss. In addition, we must also add another consideration. There are certain voltage ratings for coax lines and these are all based on an s.w.r. of 1. The higher the s.w.r., the higher the r.f. voltages. When running high power, it is easy to exceed the voltage ratings on badly mismatched lines and actually blow the line out! However, don't forget our earlier bugaboo. If we have a mismatch of over 2 or 3 to 1, we cannot tune the amplifier, so it puts us right back to square one. This leads us to the decision as to whether or not we should use a transmatch.

To Transmatch or Not To Transmatch? (And Which Kind?)

The answer to whether or not a Transmatch is needed (and believe it or not, it is a much argued question) is really rather simple. If your transmitter won't work with your antenna system, and we mean *tune* and *load*, then you need a Transmatch (or a different antenna system). Fig. 1 shows the typical hookup with a Transmatch in the line.

What is a Transmatch? It is simply an adjustable r.f. transformer (and reactance tuner-outer). The Transmatch is an electrical circuit that can be adjusted to take the unknown load that the antenna system presents and convert it to a pure 50-ohm load. Fig. 2 shows two of the popular types of Transmatchs. At "A" is the Ultimate Transmatch that uses a split-stator input capacitor and a roller inductor and has unlimited matching range. At "B" is another popular Transmatch that uses a single-section capacitor input and tapped inductor. Both types of circuits are made by several manufacturers, and either will do the job for you. Some manufacturers put more bells and whistles on their units, but basically they all do the same job.

How much loss can one expect to experience by adding a Transmatch? It depends on the quality of the components and how bad the mismatch is that you have to handle. With our original Ultimate Transmatch we had three percent loss working into a matched load (50 ohms, s.w.r. of 1), and the worst condition was seven percent loss (very high s.w.r.!).

Can one get by without a Transmatch using trapped or multiband antennas? Yes and no; it depends on the antenna system. In my own case, I am using a Hy-Gain triband quad. The s.w.r. is low enough on 20, 15, and 10 that I don't need a Transmatch. In other words, my amplifier tunes and handles the load without any problems. On the other hand, I have a trapped dipole on 80 and 40 fed with 50-ohm coax, and in this case, I definitely need a Transmatch. I have spent many hours experimenting with 80 meter trapped dipoles, coaxial dipoles, etc., and I have yet to see an antenna that would present an s.w.r. of less than 3 or 4 to 1 across the 80 meter band. And few, if any, present day rigs would handle such a mismatch.

Probably some amateurs would ask, "If you use a Transmatch with an 80 meter trapped dipole, why use the traps?" The answer to that is easy. An 80 meter half-wavelength dipole when used on 40 meters becomes a full-wave antenna. A full-wave antenna has a feed impedance on the order of 4000 ohms, which in turn means that with 50 ohm line, 4000/50 = 80, or an s.w.r. of 80 to 1! On the other hand, with traps the mismatch on 40 is slight, and the transmatch really becomes worthwhile.

Open-Wire Feed Lines

While few of the latter day amateurs are aware of the advantages of open-wire feed line, the subject certainly needs some discussion. The amateur population has become accustomed to the use of coax simply because it is so easy to handle. However, one should keep in mind that coax is a relatively high-loss line and has some of the other limitations we have covered. On the other hand, open-wire line, whether it is two-, three-, four-, or six-inch spaced lines, is an extremely low-loss line. This in turn means we can tolerate an extremely high s.w.r. without any serious problems. For example, a four-inch line (spacing between conductors) has a characteristic impedance of 500 to

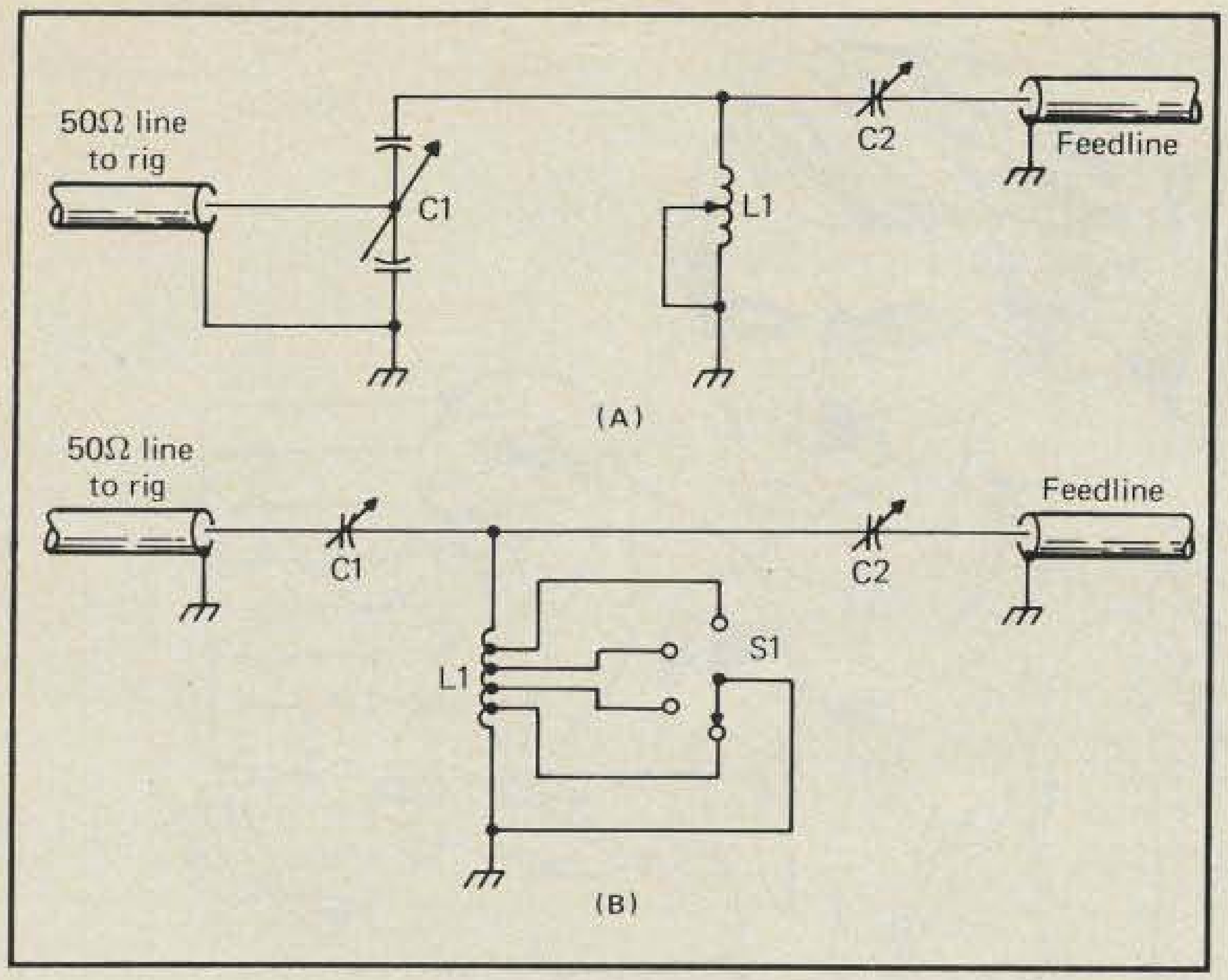


Fig. 2– At (A) is the circuit diagram of the Ultimate or Universal Transmatch. C1 is a split-stator capacitor with a value of 150 pf per section or more. L1 is a rotary inductor with minimum total inductance of 18 uH, and C2 should have a minimum value of 200 pf. These figures will provide coverage from 3500 kHz through 30 MHz. At (B) is the popular Transmatch configuration used by many manufacturers. Minimum values (C1 = 150 pf) are similar to the Ultimate. If high power is used with this circuit, S1 must be designed to withstand extremely high r.f. voltages. The primary difference between the two circuits is that the Ultimate has a wider matching range, and a match of 1 to 1 is possible with any load. However, only a slight "tailoring" of the antenna system would be required in order for the circuit at (B) to have the same match.

600 ohms. If we used our example of an 80 meter dipole, the 80 meter mismatch would be (using 500 ohms for line impedance) 500/70, or about 7 to 1 s.w.r., and for the 40 meter condition, 4000/500, or 8 to 1 s.w.r. One couldn't even detect losses of these magnitudes using open-wire line. And bear in mind that one can almost forget or ignore the overall length of any dipole for multiband use. Forget formulas. Make your antenna long enough to fit between your supports, feed it at the center with open-wire line (and use a Transmatch, of course), and you have an antenna that will work on any band. For years we used about 160 feet center-fed with four-inch line.

Also, if you go back through your antenna books, you'll find that long dipoles will exhibit some gain in some directions on the higher bands. Some of you will say "Fine, but where can I buy open-wire feeders?" We cannot answer that, but we'll do better and tell you how to make them, and that will only take a few sentences. Any wire between No. 12 to 20 is suitable, but we prefer No. 12 or 14; it is stronger. Spacers can be made from womens' plastic hair curlers or some polystyrene or PVC cut into strips and drilled. As to line width spacing, use whatever is convenient. The line doesn't have to be exactly two, three, four, etc., inches. In fact, in my setup I went from six-inch for part of the run to a post, then jumped to two-inch spacing to the house, and at the house wall came into the shack with some heavy duty 300-ohm twin-lead that ran to the Transmatch. I used 50 ohm cable between the rig and the Transmatch. Some amateurs may question the change in line impedances from the antenna using about 600 ohms, then to 400 ohms, and then down to 300 ohms. This is unimportant, because the feeders are inherently balanced so they cannot or should not radiate, and for that matter if they did, so what? They become a part of the antenna and probably give some vertical radiation! Keep in mind that radiated power isn't lost. It will probably go somewhere and work someone for you!

In any case, open-wire line should be considered because of the flexibility of the system. Oh yes, one more point because I don't like to answer mail if I can help it: "How short can my dipole be using open-wire line?" As a general rule of thumb try to make the dipole at least one-quarter wavelength long at the lowest operating frequency. In other words, a 40 meter dipole will do pretty well on 80. However, it can be shorter. The problem that arises is that the shorter you make any antenna for a given frequency, the lower the radiation resistance of the feedpoint. And the radiation resistance is the *useful* part of the feedpoint impedance. For example, a half-wave dipole has an impedance of 70 ohms. Two to three ohms of that is ohmic resistance, and the remaining 67 ohms is radiation resistance. To make it easy to comprehend, if we fed 70 watts into that antenna, 3 watts would be dissipated as heat and 67 watts would be radiated.

Knowing Where You Are

By now you should be able to understand how high an s.w.r. you can tolerate and still make your system work. You can see that trying to answer how high your s.w.r. should be is like trying to answer "How high is up?" Of course, you cannot find out what your s.w.r. is without some type of measuring equipment. There are two basic types of instruments available for the purpose. The first is a **reflectometer** such as the Monimatch, which is a low-priced device and is satisfactory for indicating a match, but is not too accurate for measuring s.w.r. A better circuit is the power reading bridge and s.w.r. indicator invented by Warren Bruene.

In the next issue of *CQ* we will describe construction of a power/s.w.r. bridge that will handle all your needs and do it at a price you can easily afford.

In this exclusive interview, Mr. Kenneth Miller, President and Chief Executive Officer of Penril Corporation, provides valuable insight into what today's student or professional engineer should be doing to enhance his or her career opportunities.

CQ Interviews:

Mr. Kenneth M. Miller, K6IR

President and Chief Executive Officer

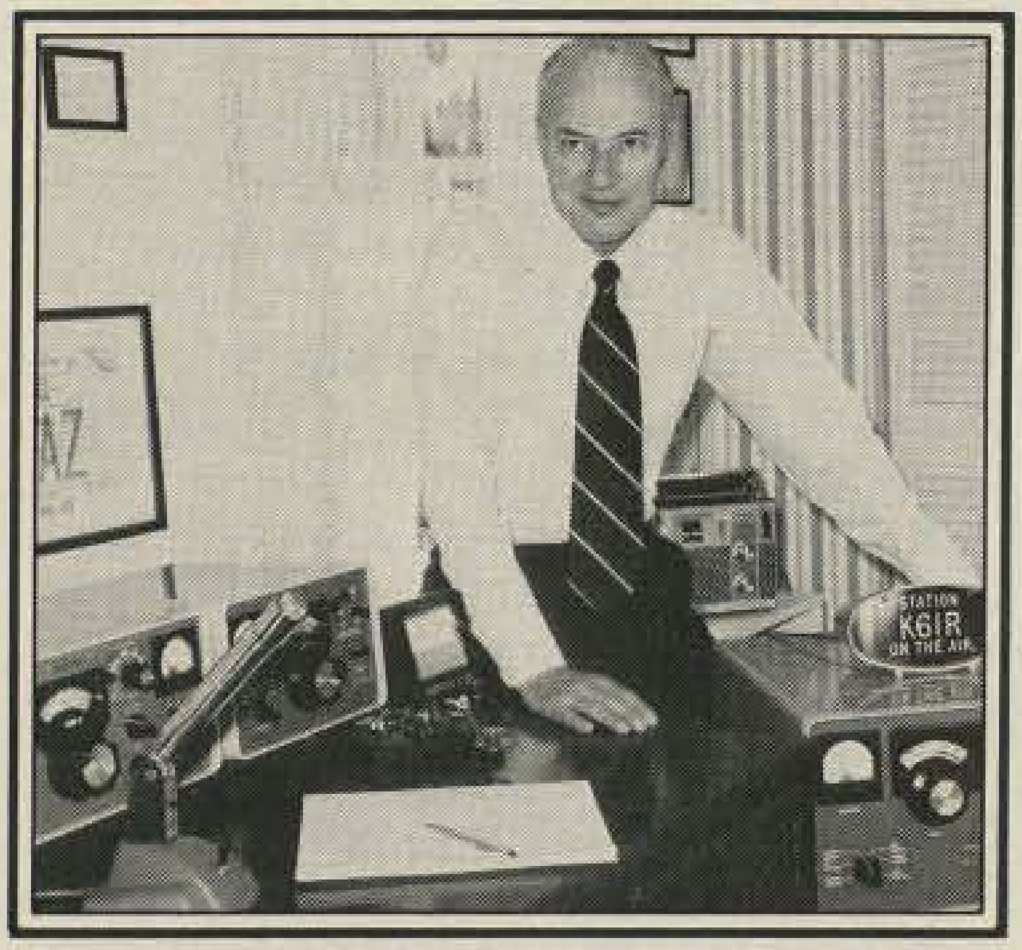
Penril Corporation

BY DR. THEODORE J. COHEN*, N4XX

Mr. Kenneth (Ken) M. Miller, K6IR, serves as President, Chief Executive Officer, and a member of the Board of Directors of the Penril Corporation. Penril, headquartered in Rockville, Maryland, has annual sales in excess of 40 million dollars per year in high-technology computer instrumentation and consumer electronic products, and it operates through divisions and subsidiaries in five states and Europe. Since joining Penril in 1973, when the company's sales were only one million dollars per year, Ken has made the company one of America's ten largest independent manufacturers of modems, a key component in digital data communications systems. Prior to joining Penril, Ken held high-level management posts with corporations such as Wilcox Electric, Computer Industries, Infonics, Lear Jet Corporation, the Metrics Instrument Division of The Singer Company, the Instrument Division of Schlumberger, and Motorola Aviation Electronics. He launched his career in electronics through a position with the Zenith Radio Corporation. Among his more significant accomplishments, Ken is credited with the development of the first automatic pilot for general aviation use (the famous L2); of ARCON, a life-saving Automatic Rudder CONtrol system for aircraft to prevent the deadly graveyard spiral; of the industry standard for low-frequency automatic direction finding systems (the Lear ADF 12); and of the world's first solid state Automatic Direction Finder (the Lear ADF 100). Ken was also responsible for the introduction of 8-track audio tape players and cartridges for use in the home and automobiles. Ken is a graduate of the Illinois Institute of Technology and of the University of California (Los Angeles). He has been a licensed amateur for over 40 years, and he has held a First Class Commercial Radiotelephone Operator's license continuously since 1940. He is also a licensed pilot, and counts flying and international travel among his "hobbies."

Together with his wife, Sally, and their four children, Ken makes his home in Rockville, Maryland.

Here, then, is our exclusive interview.



Kenneth M. Miller, K6IR, at his station. (Note the CQ WAZ 2-way S.S.B. Award.)

CQ: Ken, at what age did you become interested in amateur radio, and what led to your interest?

Miller: When I was 13 years old and a freshman at Lane Technical High School in Chicago, I was introduced to amateur radio by my father. At that time, he was a manufacturer of radio receivers. I joined the high school radio club, and in 1940, when I was 17 years old, I received my first "Class B" amateur operator and station licenses. A year later, I passed the test for a "Class A" operator's license, which permitted phone operation on the 20 and 75 meter bands.

CQ: Did your interest in amateur radio influence your educational goals?

Miller: Oh, yes! In fact, amateur radio was the primary motivator behind my drive to increase my technical and business skills. Because of my interest in radio, I attended the Illinois Institute of Technology. Furthermore, I borrowed just about every book dealing with radio and electrical engineering from the shelves of the Chicago Public Library. Later in my career, I moved to California, and while employed as Chief Engineer of the General Aviation Avionics Operation of Lear, Inc., I attended UCLA in the evening.

CQ: Then amateur radio had a profound effect on your professional career?

Miller: Without question! In fact, I was so enamored of the technical side of radio that I was almost embarrassed to receive money for my work as a technician with Zenith Radio. I enjoyed the work so much that I would have worked for nothing . . . which, of course, was neither realistic nor possible.

CQ: Have you always worked in the electronics industry?

Miller: Yes, every position I have held has been related in one way or another to high-technology electronics. I think nothing can compare to the satisfaction one feels in seeing the realization of an idea and the assembly of components into a finished product which serves the needs of thousands of people.

Amateur radio was the primary motivator behind my drive to increase my technical and business skills.

CQ: A recent study by the American Electronics Association projects that the number of new graduates needed each year through 1985 in electronics and computer science is about three times the number which will be graduated in the U.S. In your opinion, does this projection appear valid?

Miller: The percentage increase in engineering graduates required by a given company is closely related to the number of people employed by that company. For example, by 1985, companies with fewer than 50 employees will probably require about twice the number of technical professionals they currently employ. Concurrently, they wil develop a need for almost 300% more "para-professionals"—that is, for technicians and service engineers.

CQ: What about the other end of the spectrum . . . what will be the needs of the large corporations?

Miller: Companies with over 5,000 employees will probably develop a need for only 15% more professionals and for 7 to 8% more para-professionals.

CQ: So, the lack of trained engineers and so-called para-professionals (technicians and service engineers) could have a profound effect on our electronics and computer industries?

Miller: The growth of most American electronic companies is being restrained right now, in large part, by a shortage of our most critical resource, the trained mind. And the ability of the United States to maintain a leadership role in technical world markets is coupled directly to our ability to "grow our own" engineers.

CQ: Would you say that from a "supply and demand" standpoint a career in electronic engineering or computer science could prove lucrative?

Miller: Could be and is! Starting salaries for engineers have never been higher. In fact, they are higher than those in almost every other profession, with the possible exception of medicine.

CQ: Could you be specific?

Miller: Certainly. Current entry level salaries for junior and assistant engineers are close to $22,000 per year for a company with less than 50 employees and close to $21,000 per year for companies with over 1,000 employees. After about

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**Washington Correspondent*, CQ

I think nothing can compare to the satisfaction one feels in seeing the realization of an idea and the assembly of components into a finished product which serves the needs of thousands of people.

ten years, and assuming the engineer has an MS or PhD, salaries average around $40,000 per year at the under-50 employee company, and around $37,000 per year at the 1,000-plus employee company.

CQ: How about technicians? What are they paid?

Miller: Electronic technicians at the entry level start at around $14,000 per year in most companies. After five years of experience, they could earn $21,000 per year in a small company and about $17,000 per year in a large corporation.

CQ: Besides the salary rewards, can you give us any other reasons why today's young people should consider careers in electronics?

Miller: There are many reasons:

- a high social acceptance of engineers in one's community;
- an engineering background provides a great entre into high-level management positions;
- because of the rapidly changing and challenging nature of the electronics industry, there is an excitement associated with being on the leading edge of technology;
- the work environment is clean
- electronic engineers participate in one of the highest rate-of-growth industries known today;
- a background in electronic engineering exposes one to an infinite variety of related technologies (electronic medicine, space and oceanographic technologies, petroleum exploration, energy systems . . . the list is almost without end);

I really believe that nothing can compare with our electronics industry when it comes to just about every reward one could seek!

CQ: You mentioned the MS and PhD degrees above. Of what value is such a degree in electronic engineering or computer science (besides the obvious financial rewards of which you spoke)?

Miller: The value of an advanced degree depends on one's career objectives. For most people, the more education they have, the better they perform. And yet, we have all seen associates with minimal formal training compete well with those who are highly educated. As they say, "What you have is not as important as what you do with it." In the high-technology arena, I believe the "the more, the better" concept should be underscored when it comes to education.

CQ: In addition to technical subject matter, with what other subjects should today's electronic engineers and computer scientists be familiar?

Miller: Clearly, this depends on one's "bent." After practicing as a professional engineer for a short period of time, most people lean towards a specific aspect of the profession. Those who are chasing the big financial rewards, for example, would do well to obtain post-graduate skills in business administration.

CQ: Are you saying that an engineering degree and an MBA would make a good combination in today's environment?

Miller: It sure would be, for many. Having a business background tends to make engineers aware of the real objectives of their work—that is, not just to have technical successes, but to have business successes which can be measured through financial returns to the stockholders who pay their salaries. Then, too, the combination of an engineering degree and an MBA provides a smoother pathway to a management position as the engineer's career unfolds. By all means, go for an MBA!

CQ: But what about the engineer who wants to practice his or her chosen profession, but who is unable to work towards a higher degree?

Miller: Practicing engineers must stay abreast of newly unfolding technological developments if they are to continue to make significant contributions to the industry. Unfortunately, this is easier said than accomplished. Too many fine engineers develop well in a technical sense for up to 20 years or so. Then, if they aren't motivated to upgrade their skills, they fall behind in their technical capabilities.

"The more, the better" concept should be underscored when it comes to education.

CQ: I suspect, then, that you encourage your engineers to participate in "continuing education" programs.

Miller: Definitely! Technological evolution is taking place at an ever increasing rate, and we want our employees to stay on top of things. At Penril, we offer a 100% tuition reimbursement program to every one of our almost 1,000 employees. We encourage our technicians to become engineers and our engineers to obtain an MS or PhD degree. We would like all of our employees to go to school, and we're willing to pay for it! Quite a few have seen the wisdom in seeking more education, and they have taken advantage of this "earn while you learn" program.

CQ: If you were interviewing an electronic engineer or computer scientist at the BS level for a job in Penril, what mix of education and experience would you like to see?

Miller: I would like to see a good fundamental grounding (no pun intended) in scientific engineering and math principles, plus—and this is important—computer utilization smarts. To this foundation, I would add that the rounded technical professional should ideally offer:

- A good ability to understand human behavior—that is, to be able to coexist well with his or her peers, subordinates, and boss;
- A touch of biology, medicine, and psychology so that engineered products are shaped to match human and scientific needs;
- a reasonable grasp of the current government legislative regulations applicable to one's field of endeavor;
- a good feel for legal matters as they may relate to contract law, and, importantly, to product liability;
- a high level of communications skills so that one can explain design concepts to management and can "dumb down" complex technical matters to lay terms for others to understand;
- a superb feel for fundamental marketing principles so as to give engineered products "sales appeal" (pizzazz);
- a flavor for the international "landscape" so that one's designs meld well with the synthesis of world-wide developments and global influences—put another way, be aware of the competition, the markets, and the "smarts" required to crack these markets;
- a smidgeon of sociology, so that one's designed goods are acceptable to society;
- finally, a good sense of balance so as to know the right amount of each of the above "ingredients" to mix for any given situation.

CQ: Ken, how do you address the problem of rewarding superior engineers and scientists who do not wish to move into management (where pay has traditionally been higher), but rather, who wish to work in their chosen field?

Miller: This is a tough task for any company. However, the answer is to have in place a compensation program for non-

Kenneth M. Miller, K6IR, President and Chief Executive Officer of Penril Corp. (center), with one of his executives discussing Penril's new high-speed modem products in the company's assembly area.

management, career engineers whereby salaries can increase at a reasonable rate, and at the same time, incentives are made available to top producers who can then be rewarded in relation to their contributions. Such a compensation program is particularly useful and valuable in a publicly held company which is working in a growth industry.

There must be a correlation between compensation and productivity!

CQ: So, you reward your staff according to their productivity.

Miller: Of course. It is a basic compensation flaw to pay more money just because the calendar has ticked off another year. There must be a correlation between compensation and productivity (tangible results)!

CQ: In your opinion, does holding an amateur license carry as much weight in the electronics industry today, say, as it did 15 or 20 years ago?

Miller: Overall, no. The "appliance" operator is very much in evidence today. However, those amateurs who are truly involved in homebrew projects of an experimental nature are still in high demand. This is especially true of amateurs who are active in AMSAT, SSTV, microwave, digital data, and signal processing techniques. The demand for hands-on skilled amateurs is very high. The problem industry faces, basically, is that while the universe of amateurs is greater today than it was 15 years ago, the number of operators who are actively experimenting is much lower.

CQ: What interests you the most today in amateur radio?

Miller: DXing! I guess this stems, in part, from the international nature of my business. For example, my company has a power supply manufacturing plant in Switzerland. Many visitors to my home and business office from this plant and other overseas locations are amateurs. Thus, amateur radio provides an immediate "hurdle-jumper," for we already have something of interest in common. I view amateur radio as a catalyst which instantly melds different social, geographic, and ethnic backgrounds into one.

CQ: Do you find time to get on the air?

Miller: I sure do . . . usually in the early morning before going to the office, and again late in the evening before hitting the sheets. I operate primarily on 10, 15, and 20 meters s.s.b., although occasionally I go on c.w. I have 320 countries confirmed, and still QSL direct to every station worked for the first time. I find the DX pile-ups to be great fun, too. Their competitive nature reminds me of the jungle we call the business world.

CQ: Ken, before we close, do you have any other comments?

Miller: Only that I am forever grateful that my father introduced me to what was radio then, and is electronics today. It has been, and still is, both my vocation and my avocation. ■

Results Of The First Annual CQ 160 Meter S.S.B. DX Contest

BY DONALD McCLENON*, N4IN

Our first 160 S.S.B. contest was enthusiastically greeted throughout the world. Activity of at least 1289 W/VE's and 596 DX operators was recorded from logs received. This is a few more W/VE's than were in the C.W. contest, but far less DX. Some DX countries are not permitted s.s.b., and others did not know about the contest this time. We should do better next year. With this much activity, it is regrettable that only 3% of the DX stations and 7.5% of the active W/VE's sent in their logs. If you enjoy this contest, we must have your log to demonstrate interest, and convince *CQ* it is worth continued sponsorship.

Fifty-two countries, 49 states, and all provinces but NWT/YUK were active. Nobody reported an Alaska contact. Besides the three widely separated maritime mobiles (K3SXA/MM, K2KMC/MM, VK6MC/MM) all counting as countries, the following choice prefixes were on: EA, EA6, EA8, EA9, FM, GJ, HH, HI, HP, J7, OE, OH, PJ, SP, TG, UA, UA2, UA9, UB, UC, UG, UL, UO, UP, UQ, UR, VK, VP2A, VP2E, VP2V, VP9, VS5, YV, ZL, 8P6, 9H1. Even the usually rare states such as the Dakotas, Nevada, and Wyoming had several representatives, so lots of WAS totals increased.

World high score of 398,712 points was made by Pedro Piza, NP4A, followed closely by KV4FZ 337,029, top W/VE scorer W8LRL 127,350, WB3GCG 117,180, K5UR 107,066, VP2EV 78,480, WBØCMM 68,930, K8US 68,676, KØGVB 65,142, W9RE 62,384. Top ten scores in the W/VE Single Operator, DX Single Operator, and Worldwide Multi-Operator categories are shown in the score boxes.

Top QSO leaders were WB3GCG 757, W8LRL 733, K5UR 731, NP4A 558, K8US 554, W9RE 525, WBØCMM 517, KØGVB 481, KV4FZ 458, W4TMR 433, WAØTKJ 405. Outside W/VE, some high QSO figures not shown above were UP2BAW 296, UK2PRC 252, OK1KSO 204, VP2EV 169, G3SZA 132.

*3075 Florida Ave., Melbourne, FL 32901

Mary takes it easy after winning the Virginia award from NI4R.

KV4FZ has the highest multiplier of 77, followed by W8LRL 75, NP4A 74, WB3GCG 70, K5UR 67, N4KE 66, KØGVB 63, WAØTKJ 62, N4IN and WBØCMM 61, W9UP 60.

Countries worked leaders were OK1KSO 30; KV4FZ 28; G3SZA 26; UP2BAW 25; NP4A 24; W8LRL 22; OK1KPU 21; SP5IXI, UK2PRC 18; WB3GCG 17; SP5INQ 15; N4IN 14; N4KE, K5UR 13.

High W/VE stations in 10-point contacts were W8LRL 29; WB3GCG 20; N4IN, K5UR 17; N4KE 13; W4PZV, WBØCMM 12; K1KNQ, K2BQ 11; N1BBV 10. High DX stations in making 10-point W/VE contacts were NP4A 522, KV4FZ 418, VP2EV 158, K3SXA/MM 61, G3SZA 36, VK7BC 9.

The following numbers of separate stations were reported active from DX countries having more than 9 entrants: UB 159; UA 137; G 93; DL 29; UP 18; OK 12; UA9 10; OE, SP, UC, YU 9.

Many USSR DX contacts were missed by W/VE's because of lack of knowledge of their frequency restrictions. All USSR countries transmit s.s.b. from 1875 to 1950 kHz, and listen for DX from 1800 to 1810. They transmit c.w. from 1850 to 1950 with the same listening frequencies.

Some s.s.b. participants, new to contesting, did not realize they can lose 4 contacts for each unmarked duplicate we find (the dupe and 3 others) as a penalty. The same applies to phoney or not-made contacts. Stations not on our master list as having been worked by someone else are queried by mail, and many report no QSO. "If in doubt, throw it out," is the best policy. This time we sent a few warnings and invoked some penalties, but no one was disqualified.

Strong Caribbean signals operating in the DX window caused even more DX wipeouts than in the c.w. contest, since s.s.b. takes more bandwidth. These stations don't need the protection of the window, so we may have to invoke severe penalties up to disqualification if this situation exists next time.

Since the summary sheets carry a blank to show club affiliation, we totalled all 18 clubs who used it, with the results shown in the club listing. Potomac Valley Radio Club was far out in front, followed by Kansas City DX Club, and North Florida DX Assoc. These were the only ones over 50k points.

If any individual or organization wishes to sponsor a trophy for this contest, such as for top single op world score, top W/VE, top Europe, etc., please contact *CQ* Contest Chairman Frank Anzalone, W1WY, to work out arrangements.

The single and multi-op winner in each state, province, and country will receive a certificate. If you did better than the highest score shown for your area, you would have received one, if you had sent in your log. Do it next time!

Plan to enter next year's CQ S.S.B. 160 Meter Contest the last full weekend of February (Feb. 26, 27, 28), and before that the C.W. version the last full weekend of January (Jan. 29, 30, 31). Send s.a.s.e. to *CQ* magazine for log and summary sheets.

Make all those antenna improvements you have promised, and after next year's contest, send in your log, photos of yourself, antennas, or station, to add interest to the story.

73, Don, N4IN

TOP 10 W/VE SINGLE OP			
W8LRL	127,350	KØGVB	65,142
WB3GCG	117,180	W9RE	62,384
K5UR	107,066	W4TMR	49,390
WBØCMM	68,930	N1BBV	48,678
K8US	68,676	W3YOZ	45,704

Soapbox DX

Good contest. Look forward to more activity next year—*G3SZA.* Hope the s.s.b. part of this contest will continue every year. Made 3 new countries this time. Thanks to *CQ—SP5IXI.* Luggage foul-up delayed station setup. I'd like to put Anguilla on 160 for a C.W. contest—*VP2EV.* First time in a 160 contest—*TG9SO.* Many USSR stations wouldn't send contest numbers—*OK1KSO.* High-power station in DX window destroyed any chances to work the weaker DX signals—*KV4FZ.* My first try at your contest. Plenty of W stations heard, but they couldn't hear me over their QRM—*VK7BC.* Put up antenna 15 hours after contest started. 73 to contest committee—*UK2PRC.* Thanks to contest committee for a good one—*UP2BAW.*

Soapbox W/VE

Had only been on 160 two weeks. I am not a contester, but kept getting so many calls I got involved; it was fun—*AD1P.* This was one of the most enjoyable contests I have worked in. Everyone seemed to be having fun. Congrats to the contest committee—*WD5FJV.* Condx overall the

Iowa winner KØGVB at the base of his 65-foot top hat loaded conduit vertical. Gary has thousands of feet of radials, fences, etc., working with it.

pits, but got 2 new countries—*VE1BNN.* First VK ever worked on 160 answered my CQ—*WAØTKJ.* Lost many in QRM of two electric fences talking to each other—*N7SU.* New s.s.b. test went over well even with very poor DX conditions. Always a nice bunch participating in any 160 meter function—*W1BB.*

Wish I could have heard more of the 7's on in the contest (there were at least 101 of them—ed.)—*WB4ASW.* My first phone contest. Lots of fun, but QRM horrendous—*KØPK.* The contest was by far the friendliest we've worked in years—*VE2CAR.* Band kept fading in and out, and sore throat didn't help either, but hung in there—*KA7BTQ.* Not as good as the C.W. contest. Too many big guns with wide sigs holding "their" freq—*K1NBN.* Glad CQ finally sponsors a 160 phone contest. You have a winner. Now to get the band restrictions lifted—*K3IXD.*

Wish we could count as DX; many W's can't hear us due to W QRM. We are farther from many than the Caribbeans—*VE1BWW.* First time ever worked W1WY on s.s.b.!—*W8IMZ.* Worked one guy on his dummy load—*WB7TRU.* Very glad to see the contest a big success the first year. Thanks to all—*W8LRL.* Biggest thrill was working Melbourne, Australia from here in Melbourne, Florida—*N4IN.* Impressive signals from VK6HD, VK6RO, G3SZA, GI3OQR—*K5UR.* Between work and thunderstorms, didn't get in much

TOP 10 DX SINGLE OP			
NP4A	398,712	K3SXA/MM	24,960
KV4FZ	337,029	OK1KPU	7,560
VP2EV	78,480	(OK1JDX Op)	
UP2BAW	35,950	SP5IXI	5,634
G3SZA	31,863	SP5INQ	2,790
		VK7BC	990

Number groups after calls denote score, total QSOs, 10-point QSOs, multiplier, and DXCC countries worked. Multi-op scores follow single-op listings.

SINGLE OPERATORS

Connecticut					
W1WY	7,560	100	2	35	4
W1WEF	4,440	66	2	30	4
Maine					
K1NBN	12,558	145	4	39	6
Massachusetts					
K1KNQ	36,608	308	11	52	12
W1BB	1,716	23	4	22	6
New Hampshire					
N1BBV	48,678	387	10	57	11
Rhode Island					
AD1P	2,912	52	1	26	3
Vermont					
K1LPS	13,104	144	3	42	5
New Jersey					
WB2JGP	19,824	216	5	42	7
New York					
K2BQ	34,770	261	11	57	10
K5NA/2	2,464	32	6	22	7
Delaware					
WB3GXD	1,968	41	0	24	2
Maryland					
WB3GCG	117,180	757	20	70	17
W3YOZ	45,704	358	9	58	10
K3IXD	16,826	163	4	47	6
K3HPG	13,248	128	4	46	6
Pennsylvania					
W3AP	4,526	65	2	31	4
Florida					
N4IN	38,308	246	17	61	14
W4PZV	28,380	210	12	55	12
WD4RCO/4	22,788	179	8	54	9
K8UNP	13,524	123	6	46	8
Kentucky					
WB4OSS	26,394	229	5	53	7
North Carolina					
W4TMR	49,390	433	4	55	6
South Carolina					
AA4V	18,216	178	5	46	7
Tennessee					
N4ARO	30,464	248	6	56	8
KC4OV	22,736	216	4	49	6
Virginia					
NI4R	22,560	223	3	48	5
W4WWQ	17,600	156	5	50	6
N4MM	5,400	63	3	36	5
W4KMS	2,650	49	1	25	3
N4RA	2,226	49	1	21	3
Arkansas					
K5UR	107,066	731	17	67	13
Louisiana					
WD5DUD	4,970	63	2	35	4
Mississippi					
N5FG	8,424	88	5	39	6
New Mexico					
WD5FJV	14,220	142	4	45	6
K2QLY/5	8,820	89	4	42	6
Texas					
W5FIX	5,740	74	2	35	4
California					
KK6C	8,122	127	1	31	3
W6OUL	1,274	45	1	13	3
W6TYR	660	30	0	11	1
K6MO	418	15	1	11	2
AA6EE	32	4	0	4	1
Arizona					
WB7FDQ	26,208	228	6	52	8
WA7KPH	10,750	113	3	43	4
Idaho					
KA7BTQ	19,600	176	6	49	8
N7SU	9,520	116	5	35	7
Montana					
K7VIC	23,766	213	5	51	7
Nevada					
W7XZ	20,328	219	3	44	5
Oregon					
AB9O	26,622	237	6	51	6
K5MM/7	6,206	91	4	29	6
Utah					
N7DF	36,888	324	6	53	8
Washington					
K7IDX	10,664	104	5	43	6
KA7AUH	4,408	64	3	29	5
WB7TRU	3,738	85	1	21	3
W1MT	3,240	73	2	20	4
KK7F	962	33	1	13	3
Michigan					
N8AKY	19,968	180	3	52	4
KC8P	12,950	177	2	35	4
WD8OEV	12,408	124	2	47	4
KG8J	2,340	41	1	26	3
Ohio					
K8US	68,676	554	7	59	9
N8ATR	14,964	166	2	43	4
WB8PAT	11,264	120	2	44	4
W8IM	5,940	86	1	33	3
K8HF	1,764	38	1	21	3
N8TN	1,760	40	1	20	3
K8SVT	1,600	40	0	20	2
N8AXA	598	23	0	13	1
West Virginia					
W8LRL	127,350	733	29	75	22
Illinois					
WAØAVL	25,186	245	3	49	5
WD9IIX	12,654	159	3	37	5
WD9GGY	6,600	92	2	33	4
Indiana					
W9RE	62,384	525	8	56	9
Wisconsin					
W9UP	34,200	261	6	60	8
Colorado					
WBØCMM	68,930	517	12	61	10
Iowa					
KØGVB	65,142	481	9	63	11
Kansas					
WØIUB	11,234	129	2	41	4
Minnesota					
KØPK	13,152	125	3	48	5
Missouri					
WØUXI	26,000	248	3	50	5
New Brunswick					
VE1BWW	6,912	96	3	32	5
Nova Scotia					
VE1BNN	20,152	193	9	44	10
Quebec					
VE2FIT	1,050	35	0	15	2
Ontario					
VE3MFA	35,100	339	3	50	5
VE3BMV	12,616	158	2	38	4
VE3LNX	8,664	102	3	38	5
Colorado					
WBØCMM	68,930	517	12	61	10
Iowa					
KØGVB	65,142	481	9	63	11
Kansas					
WØIUB	11,234	129	2	41	4
Minnesota					
KØPK	13,152	125	3	48	5
Missouri					
WØUXI	26,000	248	3	50	5
New Brunswick					
VE1BWW	6,912	96	3	32	5
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VE1BNN	20,152	193	9	44	10
Quebec					
VE2FIT	1,050	35	0	15	2
Ontario					
VE3MFA	35,100	339	3	50	5
VE3BMV	12,616	158	2	38	4
VE3LNX	8,664	102	3	38	5
Anguilla					
VP2EV	78,480	169	158	48	10
Australia					
VK7BC	990	12	9	10	3
Czechoslovakia					
OK1KPU	7,560	75	0	21	21
(OK1JDX Opr.)					
Dominica					
J73D	20	2	0	2	2
Dominican Republic					
HI8VMA	76	5	0	4	4
England					
G3SZA	31,863	132	36	43	26
European Russia					
RA3DKE	819	20	0	9	9
Guatemala					
TG9SO	350	7	3	7	5
Lithuania					
UP2BAW	35,950	296	0	25	25
Maritime Mobile Region 2					
K3SXA/MM	24,960	67	61	39	7
Poland					
SP5IXI	5,634	65	0	18	18
SP5INQ	2,790	39	0	15	15
SP9DH	1,276	26	0	11	11
SP9EVP	816	21	0	8	8
Puerto Rico					
NP4A	398,712	558	522	74	24
Virgin Islands					
KV4FZ	337,029	458	418	77	28

MULTI-OPERATORS

Florida					
N4KE	52,800	348	13	66	13
Kentucky					
WB4ASW	27,784	290	3	46	5
Texas					
N5EM	16,884	181	5	42	7
California					
K6SE	37,848	296	9	57	10
Ohio					
KB8AC	35,530	295	7	55	8
W8IMZ	29,536	272	3	52	5
Illinois					
KB9OF	32,946	273	4	57	6
Kansas					
WAØTKJ	54,684	405	9	62	10
South Dakota					
KØCX	4,000	80	0	25	2
Quebec					
VE2CAR	40,248	359	7	52	9
Czechoslovakia					
OK1KSO	33,891	204	5	33	30
Lithuania					
UK2PRC	22,086	252	0	18	18

Check logs are gratefully acknowledged from the following: W6BYB/7, SP5AGT, UA3LDZ, NL5288-R04.

Multi-Op Station Crews

N4KE: N4KE, K4UTE. **WB4ASW:** WB4ASW, WB4ZBX. **N5EM:** N5EM, K5HGB, K5ZC, WA4EWV. **K6SE:** K6SE, N8UM. **KB8AC:** KB8AC, WA8EUK. **W8IMZ:** W8IMZ, W8ILC, N8BJQ. **KB9OF:** KB9OF, W9UVM, WD9DZV. **WAØTKJ:** WAØTKJ, WDØBNC. **KØCX:** KØCX, KØCXL, KØOTZ, KAØGGS, WØXH, WBØPWA. **VE2CAR:** VE2DAR, VE2DC, VE2DQO, VE2DRH, VE2EU, VE2GBB, VE2GDJ. **OK1KSO:** OK1JCW, OK1JKT. **UK2PRC:** UP2BBM, UP2BIL.

Club Scores

Highest scoring member is boldface when there are more than one.

Club Name	Members	Total Score
Potomac Valley Radio Club	K3HPG, W3YOZ, WB3GCG, N4MM, N4RA, **W8LRL**	311,108
Kansas City DX Club	**WA0TKJ**, WB0UXI	80,684
North Florida DX Assoc.	N4KE	52,800
Chateauguay ARC	VE2CAR	40,248
Utah DX Assoc.	N7DF	36,888
Yankee Clipper Contest Club	K1KNQ	36,608
Radio Club Chomutov	OK1KSO	33,891
Dayton Amateur Radio Assoc.	W8IMZ	29,536
Central Arizona DX Assoc.	WB7FDQ	26,208
Ill Wind Contesters	WA0AVL	25,186
Southeastern DX Club	WD4RCO	22,788
Ontario Contest Club	VE3BMV	12,616
Northern Ohio ARS	WB8PAT	11,264
Western Wash. DX Club	K7IDX	10,664
Club SP5KDV	SP5INQ	2,790
Overlook Mountain ARC	K5NA/2	2,464
Intercity ARC	K8HF	1,764
SP DX Club	SP9DH	1,276

time, but glad to be in it—*KC8P.* Enjoyed it very much and look forward to next year—*WA7KPH.*

First fone operation on 160. Will return next year with bigger ant—*KG8J.* Was surprised at all the activity—*W1WY.* One of the most enjoyable contests I've been in so far; just can't wait till next year—*W4TMR.* Biggest thrill was getting number one from VS5RP. My multiop partner N8UM flew back to Michigan Sat a.m., and worked him that night—*K6SE.* Lots of QRN but also lots of DX typical of *CQ* tests—*W9RE.* Amazed at how well simple antenna worked. Enjoyed the contest—*N8ATR.* Yes, Virginia, there is life on 160 after January! The contest ruined my reputation as a c.w. only operator, but there was lots of satisfaction in the number of "Ahhh Nevada" replies to my exchange—*W7XZ.*

NP4 and KV4 are NOT DX and should be disqualified for using the window. Polite requests to others to move were usually heeded—*KB8AC.* Best results at 4 a.m. when things were down to a dull roar. Hard to find a place where you can be heard between the big guns—*K1LPS.* Saturday night s.w.r. went to 10 while it was raining cats and dogs, so went to bed. CU next year—*KC4OV.* Had most enjoyable time in this contest—*WD9IIX.* Got so sleepy, skipped lots of numbers—*K7VIC.* Glad to get 2 new states and 2 new countries—*N5FG.*

Used BC antenna after sunset and got out great. Look for a serious effort next year—*K0CX.* Incredible conditions, but missed a lot taking wife to a Broadway show—*K2BQ.* This has to be your best contest. I'll be sure to catch it again next year—*KB9OF.* Enjoyed first *CQ* phone contest very much—*K8US.* Really had a great time in the contest. It got me started on 160 WAS—*K2QLY/5.* Very happy to make this many contacts and my first VK on 160—*K0GVB.* First time ever worked 160. Will work on a better antenna for next time—*WB3GXD.* Sore throat hampered my effort—*W8IM.* Enjoyed this phone test even tho missed some easy ones—*K7IDX.*

TOP 10 MULTI-OP

WA0TKJ	54,684	OK1KSO	33,891
N4KE	52,800	KB9OF	32,946
VE2CAR	40,248	W8IMZ	29,536
K6SE	37,848	WB4ASW	27,784
KB8AC	35,530	UK2PRC	22,086

CIRCLE 99 ON READER SERVICE CARD

Now that we have piqued your interest, jump in and test the water. This project is not too hard to build and will provide hours of enjoyment.

How To Build A Home-Brew ASCII Keyboard Controller

Part II—Construction

BY EDWARD J. WORNER, JR.*

This month we resume our discussion of the keyboard ASCII with construction details. Components are readily available from a variety of sources. Check the ads in *CQ* for likely sources of parts.

Controller Construction

A parts list for the keyboard controller assembly is provided in Table I. The total cost of the components for the controller (not including the keyboard assembly, wire, connectors, and mounting hardware) is about eighteen dollars.

The layout for the controller circuit board is not at all critical; photo 2 shows the way I layed out the components on a piece of P pattern perforated phenolic board. The terminals on the edge of the board designated B1 through B16, and the terminals C0, C1, C3, C4, C6, C7, C9, C11, C12, C14, C16, C17, C18, C19, and C20 are provided to simplify the connection of the keyboard buses to the board (see schematic, fig. 3). Terminals **A1** through **A8, CHARACTER READY, RESET, +5V,** and **GND** facilitate connection to the microprocessor, and they are also very useful for checkout purposes. Wire wrap is a good construction method for a circuit with this many connections. The discrete components can be mounted with T42 "flea" clips or T68 stakes. Two or more evenings will probably be required to lay out the board and wire it.

**1130 Crestmoor Drive, Boulder, CO 80303*

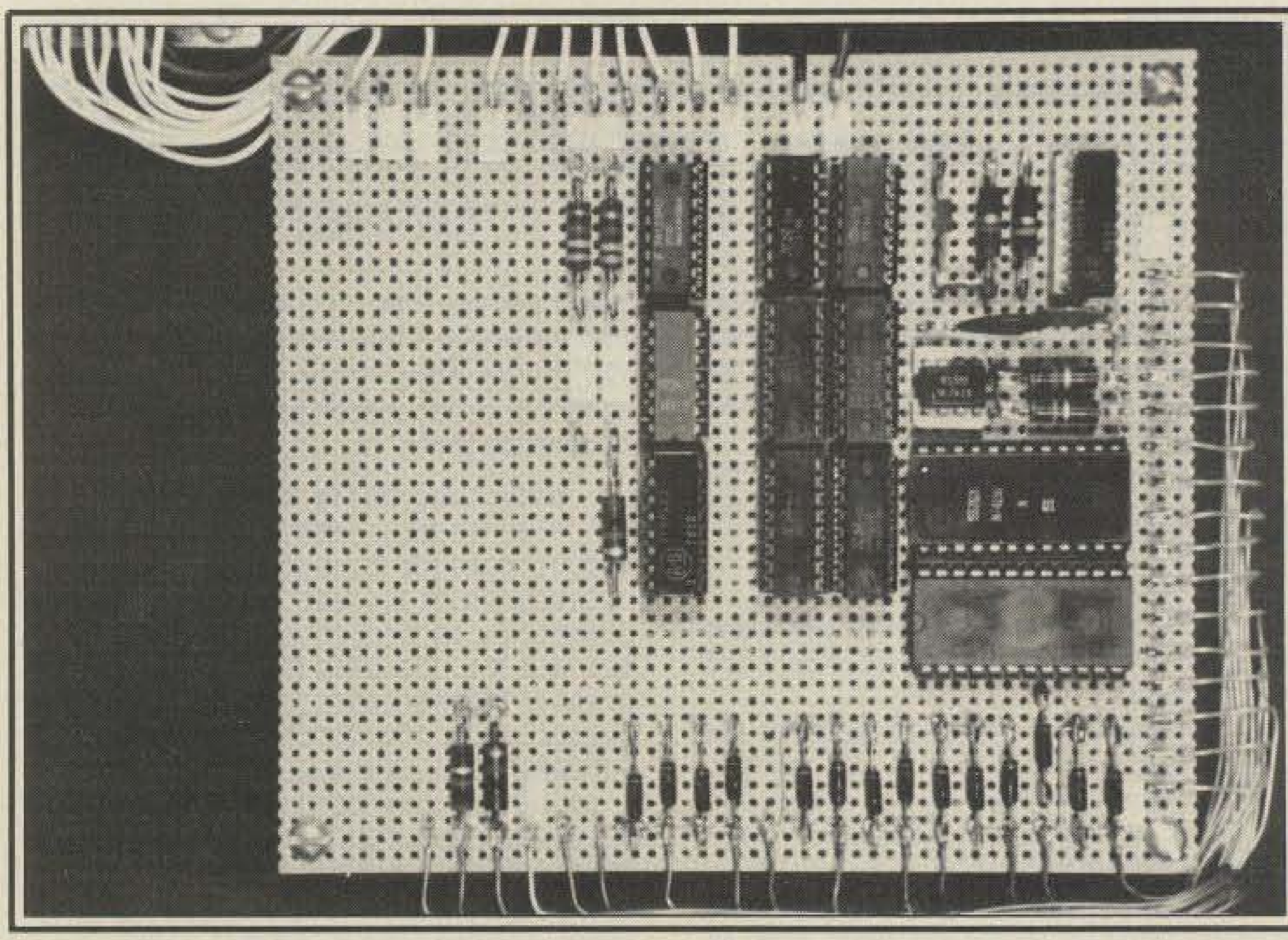

Photo 2– A top view of the keyboard controller circuit shows the layout used for the components. The circuit is built on a 4.75 by 5.25 inch piece of Vector™ phenolic P pattern board with 0.042-inch holes on 0.1-inch centers. This hole pattern nicely accommodates wirewrap sockets and terminals for the discrete components. Terminals are provided on the edge of the board to facilitate connection to the keyswitch assembly and computer.

A voltmeter and a logic probe are recommended for circuit checkout. After the controller circuit board is complete (including all discrete components), install the two DIP resistor packs and apply power to the board *with no integrated circuits installed.* Use the voltmeter to confirm the correct wiring of all Vcc (5 volt) and ground connections to the IC sockets. Pins routed to Vcc through pull up resistors should also measure about five volts. To check the ground connections, hook the positive meter lead to Vcc and probe the grounded connections with the negative lead. A voltage indication proves that these connections are really

PARTS LIST

Part	Type	Description	Notes
IC1, IC2	74193	Binary Counter	16 Pin
IC3	555	Timer	8 Pin
IC4	74150	Data Selector	24 Pin
IC5	74154	Data Multiplexer	24 Pin
IC6	7400	Quad 2 Input Nand Gates	14 Pin
IC7	74121	One Shot	14 Pin
IC8	74123	Dual One Shot	16 Pin
IC9, IC10	7475	Quad Latch	16 Pin
IC11	7474	Dual Flip-Flop	14 Pin
D1 thru D14	1N4148/1N914	Signal Diode	10 Ma
R1	100K	Resistor	¼W
R2, R18, R34, R37, R38	10K	Resistor	¼W
R3 thru R17	10K	DIP Resistor Pack-15 Resistor	16 Pin
R19 thru R33	10K	DIP Resistor Pack-15 Resistor	16 Pin
R35	15K	Resistor	¼W
R36	68K	Resistor	¼W
C1, C3	.001	Capacitor	Ceramic
C2	.01	Capacitor	Ceramic

Table I– The parts used in the keyboard controller are all readily available components. None are expensive. The values of the discrete components are not critical. Parts with five percent tolerance should work satisfactorily. The use of DIP resistor packs was a cost effective way to provide the large number of pull-up resistors required. Regular TTL IC circuits were employed because they are rugged and practically insensitive to static. But low-power Schottky ICs could be substituted to significantly reduce power consumption.

grounded and not just open circuits. After correct supply wiring to the IC sockets is confirmed, begin installing the ICs and use the logic probe to confirm proper signals as you proceed. *Always remember to turn off circuit power while installing or removing ICs.* Start by installing the 555 timer chip (IC3). Confirm the presence of the clock signal on pin 3. Then install the 74193 counters (IC1 and IC2), and confirm operation of the counter chain. A pulse train should be detected at the output of the last counter stage (IC2, pin 7). Install the 74121 one-shot (IC7) and confirm the presence of **KEY SENSE GATE** pulses on pin 6. Next install the 7400, 74150, and 74154 ICs (IC6, IC4, and IC5). At this point, grounding any B terminal on the controller board should cause the **KEY SENSE GATE** pulses to stop. Finally, install the 7475 latches (IC9 and IC10, 74123 one-shot (IC8), and the 7474 flip/flop (IC11). Now when any B terminal is grounded, some arbitrary ASCII code should appear at the output (terminals A1 through A8), and the **CHARACTER READY** signal should go high. **CHARACTER READY** should remain high when the jumper is removed. Grounding the **RESET** terminal should clear the **CHARACTER READY** signal. Any further checkout can only be accomplished practically after the keyboard is connected to the controller.

Keyboard Construction

The controller is designed to work with a keyswitch assembly that has a momentary single pole (two terminal) switch for each key. The commercial keyboard that I used cost about thirty dollars, and its layout is similar to the American National Standards Institute (ANSI) format. Table II shows a table of ASCII codes required for this type of keyboard. Keep in mind that the way the controller functions, *any* seven bit code combination can be generated by a given key, for upper *or* lower case. This unique feature allows keys such as **TAB**, which only responds in lower case, or **SPACE**, which responds with the same code in upper or lower case.

For my keyboard, I found that the pair of characters represented on any key were always conveniently ASCII upper- and lower-case equivalents. This is certainly more than a coincidence. It means that the lower four bits of their codes are the same, so only one key sense line had to be routed to any particular key's "output" terminal. All that was necessary for proper code generation was to ensure that the appropriate key strobe lines were routed to the other sides of the switches. For most keys, then, *two* strobe lines, separated by isolation diodes, are routed to their "input" terminals. It can be seen from Table II that with few exceptions the keys connected to a give pair of strobe lines also tended to fall into groups, and one pair of isolation diodes could be used to drive groups of up to fifteen keys. The keyboard you use may differ slightly from mine. Some alteration of key sense or strobe wiring may be necessary. Use Table II to determine which lines must go to the switches. Add separation diodes if necessary.

The wiring of the keyboard is probably the most time-consuming part of the construction project. Before starting the wiring, turn over the keyswitch assembly and use a scribe to engrave the character(s) for each key between the terminals

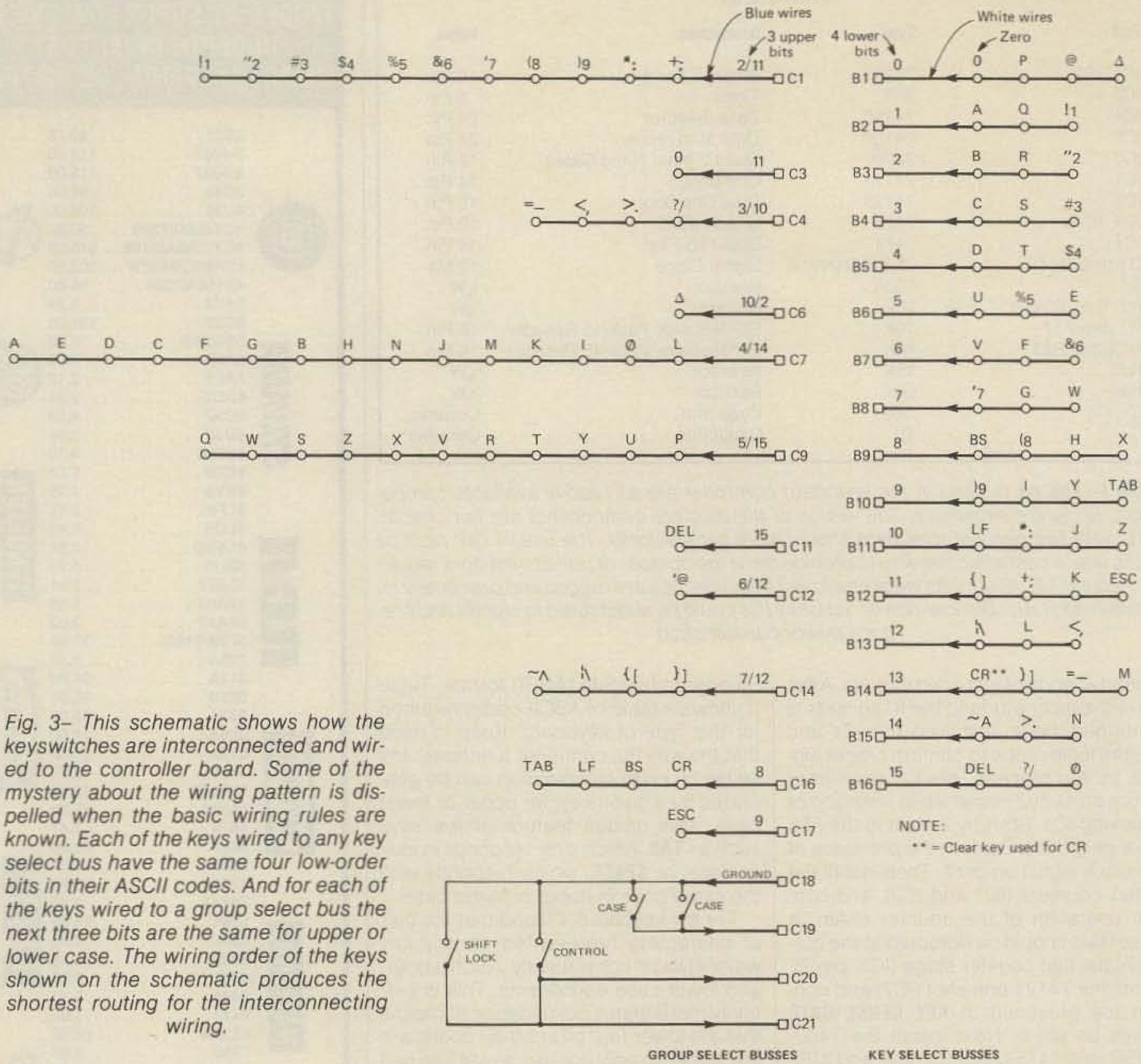

Fig. 3– This schematic shows how the keyswitches are interconnected and wired to the controller board. Some of the mystery about the wiring pattern is dispelled when the basic wiring rules are known. Each of the keys wired to any key select bus have the same four low-order bits in their ASCII codes. And for each of the keys wired to a group select bus the next three bits are the same for upper or lower case. The wiring order of the keys shown on the schematic produces the shortest routing for the interconnecting wiring.

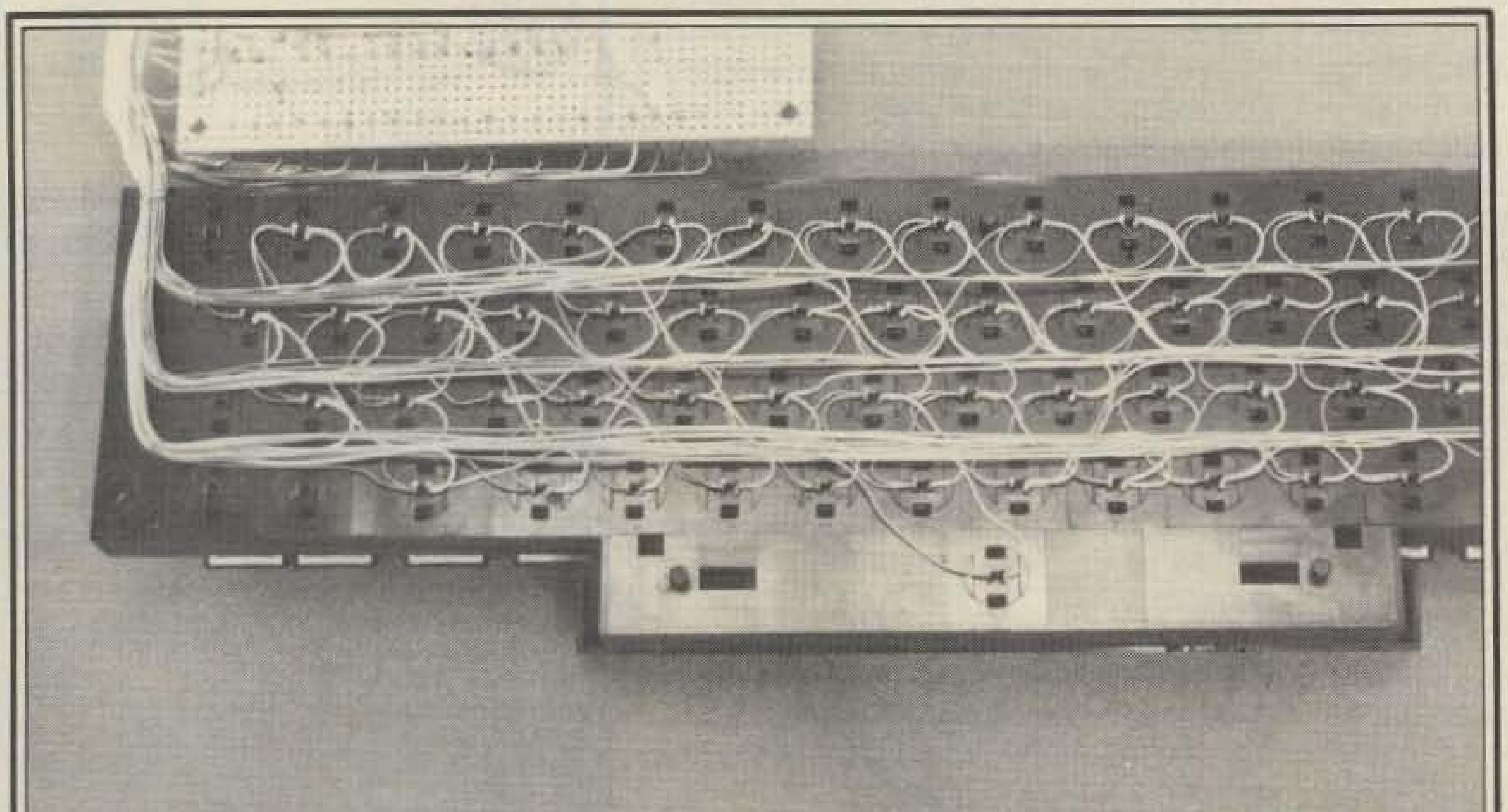

Photo 3– 28-gage wirewrap wire was used to wire the back of the keyswitch assembly and to connect it to the controller board. The solid wire was easy to route and stiff enough to stay in place. Using a different color wire for strobe lines and sense lines reduced confusion during wiring process.

of its respective switch. This will greatly simplify the wiring process to follow. Twenty-eight gage wirewrap wire proved to be a good choice for the keyboard wiring. Photo 3 shows the wiring of the keyswitch terminals on the back of the keyboard assembly. I used one color for the key sense lines (B connections), and a different color for the key GROUPS (C connections). Turn the keyswitch assembly face down on a folded cloth and begin wiring. Wire the keyswitches as shown in the schematics in fig. 3. The schematics show how the switches are interconnected into buses. Wire one terminal of each of the switches on a bus together. Then run an 18-inch wire from the last terminal on each bus for connection to the controller board. Put an identifying label on the end of each of these wires.

When the keyboard wiring is complete, use screws and spacers to mount the keyswitch assembly and controller board on a wooden base. To facilitate typing, the mounting surface should incline so that the faces of the keys are parallel with the tabletop. Mount the keyswitch assembly with rubber washers to reduce stress on the plastic frame. Next route the interconnecting wires from the keyboard to the respective B and C terminals on the edge of the controller board. If a connector will be used to interface with the computer, it can be wired at this time (the interface wiring for polled and interrupt operation is described in following paragraphs). The completed keyboard is then ready for final checkout.

Without connecting the computer interface, power the keyboard assembly (via the terminals on the edge of the controller board). Momentarily ground the **RESET** terminal to clear the controller. Then use the logic probe to monitor the **CHARACTER READY** signal, and press any key on the keyboard. When the key is pressed, the **CHARACTER READY** signal should latch high. The logic probe can then be used to check the ASCII code on terminals A1 through A8 (A8 is the most significant bit). Use Table II to confirm that the ASCII code agrees with the key pressed. Reset the controller by momentarily grounding the **RESET** terminal, and press a key while the upper-case key is depressed. Confirm that the correct upper-case ASCII code is generated at the interface. Finally, reset the controller again and press a key while the **CONTROL** key is depressed. Confirm that the **CONTROL** bit (high order bit) of the ASCII code generated is on. This concludes the preliminary checkout of the keyboard. The easiest way to confirm that all the other ASCII codes are correct is by using the computer itself after the controller is interfaced to it.

Polled Operation

The simplest way to use the keyboard assembly with a microprocessor is by employing a polled configuration. Fig. 4(a) shows the interface wiring required

CHARACTER		ASCII CODE		
		Four Upper Bits		Four Lower Bits
Upper Case	Lower Case	Upper Case	Lower Case	
		$2^7\ 2^6\ 2^5\ 2^4$	$2^7\ 2^6\ 2^5\ 2^4$	$2^3\ 2^2\ 2^1\ 2^0$
A	a	X 1 0 0	X 1 1 0	0 0 0 1
B	b			0 0 1 0
C	c			0 0 1 1
D	d			0 1 0 0
E	e			0 1 0 1
F	f			0 1 1 0
G	g			0 1 1 1
H	h			1 0 0 0
I	i			1 0 0 1
J	j			1 0 1 0
K	k			1 0 1 1
L	l			1 1 0 0
M	m			1 1 0 1
N	n			1 1 1 0
O	o			1 1 1 1
P	p	X 1 0 1	X 1 1 1	0 0 0 0
Q	q			0 0 0 1
R	r			0 0 1 0
S	s			0 0 1 1
T	t			0 1 0 0
U	u			0 1 0 1
V	v			0 1 1 0
W	w			0 1 1 1
X	x			1 0 0 0
Y	y			1 0 0 1
Z	z			1 0 1 0
<	,	X 0 1 1	X 0 1 0	1 1 0 0
=	-			1 1 0 1
>	.			1 1 1 0
?	/			1 1 1 1
`	@	X 1 1 0	X 1 0 0	0 0 0 0
!	1	X 0 1 0	X 0 1 1	0 0 0 1
"	2			0 0 1 0
#	3			0 0 1 1
$	4			0 1 0 0
%	5			0 1 0 1
&	6			0 1 1 0
'	7			0 1 1 0
(	8			1 0 0 0
)	9			1 0 0 1
*	:			1 0 1 0
+	;			1 0 1 1
{	[	X 1 1 1	X 1 0 1	1 0 1 1
¦	\			1 1 0 0
}	]			1 1 0 1
~	^			1 1 1 0
SPACE	SPACE	X 0 1 0	X 0 1 0	0 0 0 0
——	BACKSPACE	——	X 0 0 0	1 0 0 0
——	TAB	——		1 0 U 1
——	LINEFEED	——		1 0 1 0
——	CARR. RET.	——		1 1 0 1
——	ESCAPE	——	X 0 0 1	1 0 1 1
——	0 (ZERO)	——	X 1 1 1	0 0 0 0
——	DELETE	——	X 1 1 1	1 1 1 1

Table II– The table is set up according to the characters paired on the ANSI-style keyboard. The ASCII codes in the table are represented as eight bit values because that's the way they appear at the computer interface. But the ASCII code proper is just seven bits. The high-order bit, which is not actually part of the code, is represented by an X. For polled operation the high-order bit is the **CHARACTER READY** *flag, while for interrupt operation it simply relates the state of the* **CONTROL** *key when a character is typed. By differentiating between the four lower and three upper bits of the ASCII code, the table reveals the close relationship between ASCII code and the ANSI keyboard format. The lower four bits of the codes for the characters on each key are the same, and the keys fall into groups whose character codes have the same three high-order bits for upper and lower case. Compare the table with the keyboard wiring schematic in fig. 3 to see how these conditions dictate the way the keyboard must be wired to the controller strobe and sense lines.*

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CIRCLE 15 ON READER SERVICE CARD

Location	Code	Label	Instruction	Argument	Comment
008F	DB01	LOOP	IN	01H	Input from keyboard
0091	B7		ORA	A	Is MSB (CHARACTER READY FLAG) set?
0092	F28F00		JP	LOOP	No—wait till character ready
0095	DB01		IN	01H	Yes—reread character to ensure validity
0097	E67F		ANI	07EH	And mask away READY flag
0099	D30E		OUT	0EH	Clear CHARACTER READY flip-flop
009B	D30F		OUT	0FH	Output code to lights

Listing 1– This keyboard waiting routine written in 8080A assembly language is designed to be used with the polled operation configuration of fig. 4(A). The code shown can be inserted inline in a program or made into a subroutine.

for polled operation. Note that for this configuration the **CONTROL** bit of the ASCII code is sacrificed to provide a **CHARACTER READY** flag right in the controller's data word. To do this, the **CHARACTER READY** signal from the controller is simply substituted for the most significant bit of the ASCII code. A standard three-state buffer should be used to connect the ASCII code word to the eight bit microprocessor data bus. A simple keyboard waiting routine written in 8080A assembly language is provided in Listing 1. The loop at the top of this program reads the keyboard repeatedly until the most significant bit of the ASCII code is found to be on, signaling a keystroke. Examination of the propagation delays for the 74121, 7474, and 7475 show that it may take up to 75 nanoseconds from initiation of the keystroke one-shot, before either the ASCII **DATA** lines or **CHARACTER READY** signal are settled, and that either may be settled first. Since a race problem is indicated, the keyboard port is reread again after **CHARACTER READY** is detected. That takes a few microseconds, and it ensures that the ASCII **DATA** code is valid. The **CHARACTER READY** flag (the most significant bit) is then masked away to obtain the ASCII code itself. Finally, an **OUT** instruction provides the strobe necessary to reset the keyboard controller. Note that for polled operation the device output strobe used to reset the keyboard controller *should not* be the same strobe used to read the eight bit ASCII code. A short delay must be provided in the code to allow key "debounce" time and to ensure that the same keystroke is not detected twice by the computer (see the preceding keyboard debounce discussion). For debugging purposes I provided an additional **OUT** instruction which causes the ASCII code to appear on the binary lights of my microprocessor control panel.

Interrupt Operation

In this application the keyboard controller circuit really shines, because interrupt operation is the function that the circuit was really designed for. The interface wiring for interrupt operation is shown in fig. 4(B). In this configuration the **CONTROL** bit (most significant bit) of the ASCII code is routed to the data bus in normal fashion. The 8080A microprocessor requires a positive-going signal for an interrupt (the keyboard interrupt), and this signal can be obtained from the **CHARACTER READY** output. In a system where support chips such as the 8214 **Pr**iority **I**nterrupt **C**ontroller **U**nit (**PICU**) are used, it may be necessary to provide a negative-going interrupt signal. A negative-going signal can be obtained from the inverted output of the **CHARACTER READY** flip/flop (IC11, pin 6).

When a **CHARACTER READY** interrupt occurs, there is always a short delay involved in acknowledging the interrupt and vectoring to the interrupt handling routine. In an 8080A-based microprocessor this delay amounts to about 10 microseconds. Therefore, race conditions between the **CHARACTER READY** and ASCII **CODE** signals are conveniently avoided, and the eight bit ASCII code is always stable by the time the interrupt handler gets around to reading it.

The 10 microsecond response time delay described above provides an additional benefit. Recall that a small delay is necessary between the appearance of **CHARACTER READY** and **RESET**. This delay avoids any possibility of the retriggering of the **CHARACTER READY** flip/flop by keyswitch bouncing *during the 10 microsecond* **KEY SENSE GATE**. Since the interrupt handler does not input data from the ASCII data port until 10 microseconds or more after the interrupt occurs, it is permissible to use the ASCII **DATA READ** device select strobe itself to reset the keyboard controller as well. This eliminates the necessity of using another output device select as a reset strobe. Note that the duration of the inherent interrupt response delay is just barely adequate, and it may be advisable to extend this delay a few microseconds by inserting delay code in the handler before the ASCII data read.

A keyboard interrupt handling routine is required which will accept each character as it is typed. Usually such handlers are message oriented. They store the ASCII characters in a memory buffer until a carriage return is encountered. Then they signal the main line program with a flag that a message is ready for processing. The handler may also echo the typed characters on a display device as they are input.

Further Possibilities

As can be seen in fig. 1 (see Part I of this article, *CQ*, December 1981), not all of the strobe lines are wired to keyboard switches. The unused lines could be wir-

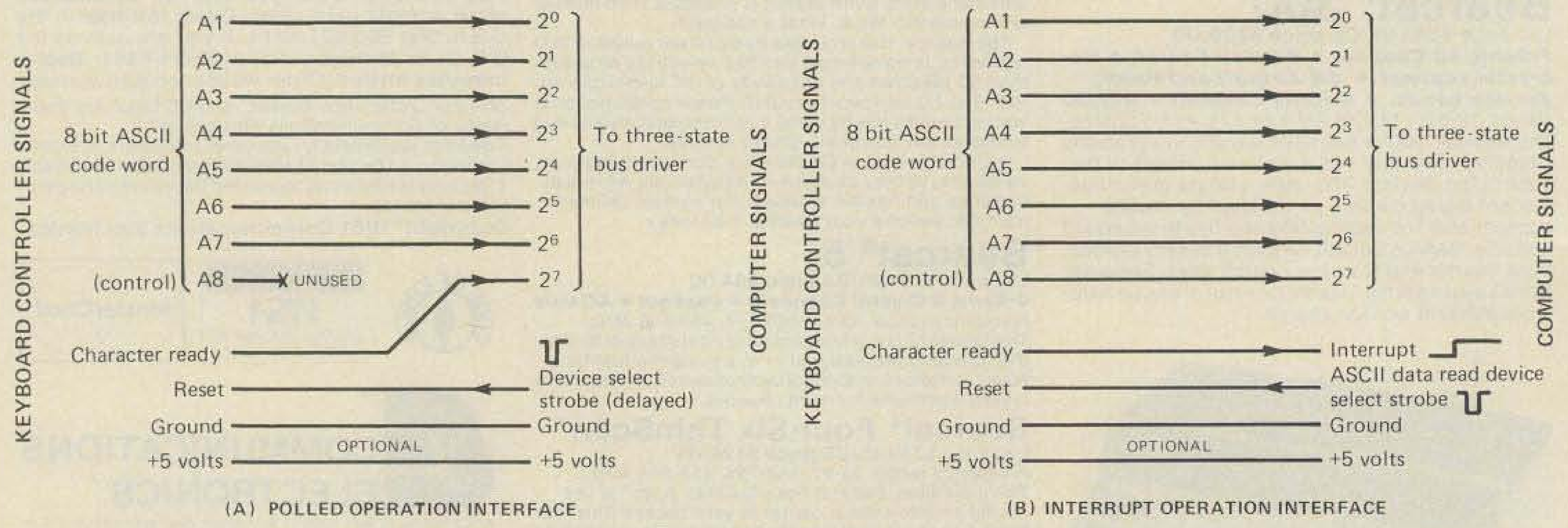

Fig. 4– The keyboard controller's interface to the computer is very versatile. With only slight changes in wiring, the keyboard can be used in either polled or interrupt configuration. The primary difference is that for polled operation the **CHARACTER READY** *signal appears in the data word as a flag (4A), while for interrupt operation the* **CHARACTER READY** *signal is used as an interrupt (4B). In either case a device select stroke is used to reset the controller.*

ed to other special switches, and the codes they would generate would be unique. For example, a hex keypad could easily be added to the keyboard. In this case the "ONE" output line from the 74154 (pin 2) would be used as a strobe for the sixteen hexadecimal keys on the pad. One of these keys would be added to each of the sixteen **KEY SELECT** buses (hex codes 0 through F respectively). Thus, the addition of only seventeen connecting wires would be required for addition of the hex keypad. Note that the codes provided to the computer would be the hexadecimal codes 10 through 1F, and it would be necessary to mask the 2^4 bit away with the computer to obtain the binary values for each hex key.

Other unused codes could be invoked by spare keys on the keyboard, *or other switches or switch mechanisms.* In this way unique codes would be generated which would signal the computer to perform special functions such as rebooting or invoking debug functions. If the controller is being used in interrupt mode, the keyboard interrupt can do double duty as a keyboard interrupt handler, and as a general-purpose switch interrupt handler. The additional switches or sensors employed would of course have to provide momentary "closures" for proper operation.

Although the keyboard controller circuit that has been described here is configured to produce ASCII character codes, the design of the circuit offers a number of interesting possibilities for generation of different codes. By modifying the way the keyboard switches are wired to the controller board, the circuit can be set up to generate any code the user would wish, such as Baudot or the European CCIT code. Table II shows the table of binary codes for ASCII characters that I used to define my keyboard to controller interconnections. By setting up a similar table for another code, the user can resolve the wiring required for that code. A little thought will reveal how to interconnect the keyboard and controller to obtain the correct code from each key. All that is necessary is to ensure that the strobe and sense lines associated with any given code are routed to the appropriate key switch. Note that separation diodes will be required on some strobe lines when a multiple-case keyboard is used. Trying to use a multiple-case ANSI format keyboard with a code that is not ordered like ASCII could require a very large number of separation diodes and make the wiring unduly complex. In this case, I would recommend re-marking the keyboard so that there is only one code per key, or pairing characters accordingly.

I have even had an inquiry as to the possibility of using the controller circuit to generate a form of binary coded Morse code which could be used to drive a special c.w. transmitter keying circuit, and there is no reason why this could not be done. With slight modification a keyboard and controller could easily be constructed which would generate the full International Morse code in eight bits by apportioning five bits for the dot and dash pattern, and three bits for the count of dot/dash elements. This would provide the full alphabet, numbers, procedure codes, and punctuation. The punctuation codes actually require six dot dash elements. Therefore, the dot/dash counts six and seven would cause the computer to append a sixth element as a dot or dash respectively, as required.

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2. Lancaster, D. *TV Typewriter Cookbook*, Chapter 6, Howard W. Sams & Company Inc., Indianapolis, IN, 1978. This is an excellent introduction to communication codes and methods of polling keyboards electronically.

Acknowledgement

I wish to thank my wife, Pat, for producing the photographs used in this article.

About the Author

Ed Worner is a Member of the Technical Staff of Ball Aerospace Systems Division in Boulder, Colorado. Ed holds an Associate Degree in Electronic Engineering, and he has been engaged in aerospace work for twenty years. His personal interests include electronics, microcomputing, archaeology, woodcarving, and astronomy.

Glossary

Prescaler - A circuit preceding a digital counter which divides the incoming pulses by a constant. A one flip/flop stage prescaler divides the pulses by two.

IC - An acronym; Integrated Circuit. Microminiature circuitry containing semiconductor and passive components within a single package. Usually constructed on a common substrate.

DIP - An acronym; Dual In-line Package. An industry standard for packaging of integrated circuits.

ASCII - An acronym; American Standard Code for Information Interchange. An 8 bit alphanumeric code.

ANSI - An acronym; American National Standards Institute. Pertaining herein to a standardized format for a typewriter keyboard.

Using contests to work DX is a quick way to pick up your country count. It's also a good way to have more fun with amateur radio.

THE INS AND OUTS OF WORKING DX

BY BILL KENNAMER*, K5FUV

Nothing fires my operating desire like a major contest. Working many stations during a weekend is a lot of fun, especially when many of those contacts seem like old friends from similar contacts in years past. Contacts can come at breakneck speeds during peak hours, and weird propagation paths can be checked out at other times. Excitement runs high all weekend, and the euphoria propels through the months until another major contest comes along.

DX contests bring out a substantial amount of activity that might be quite rare at other times during the year. Many Carribean islands never see the activity during the rest of the year that they will see during a contest. Several rare countries have appeared in recent years specifically for a contest operation. A good example was the ZL1AA/K Kermadec operation in 1977. Here they were worked on two bands with a tri-bander at 25 feet. Many other expeditions to rare places have come about due to the desire to put out a rare multiplier and work lots of QSOs during a contest. Certainly this is the place for a beginning DXer to work many new countries at one time. In fact, it's not a bad place for someone with a country count in the mid to high 200's to pick up a new one. As of the Radiosport contest in 1981, I personally have not worked any contest for 12 hours or more without working at least one new country, and that new one put me at 281 worked. Checking my QSLs submitted for DXCC credits found that 80% of those submitted were for QSOs during some contest. DXers cannot afford to turn up their noses at contests, for they will find more rare and semi-rare countries in less time than in any other operating period.

To get into this fun thing and build your country count at the same time, turn back to W1WY's Contest Calendar column in *CQ* each month and learn to use it. Frank has compiled a list of contests and rules and a short synopsis of the rules, dates, and the contest exchange information. By looking through the calendar, you can probably find a contest which will be of special interest to you. If you're short of Asian contacts, perhaps the **All-Asian Contest** or the **Sea-Net Contest** would help you work some new Asian stations. The **Work All Europe (WAE) Contest** will provide many European contacts. And, best of all, these DX stations welcome the contacts. You will also find that these contacts will provide (in most cases) a ready QSL. Many DX stations have managers, and they will provide QSLs for contest QSOs. Just remember to follow the same return postage methods that you would normally use, or use the bureau.

When working these special directive contests, plan your operating times to allow for propagation to the area of interest. Then, learn the rules for that contest. Know what the exchange is, and know what stations may be worked for contest points. If you plan to go up and down the band calling stations that are in the contest, keep a dupe sheet. A dupe sheet is an alphabetical list of stations worked, and may save you an embarrassing moment later on.

The most important thing to know in a contest is the required exchange. This is true of even the most casual operation, as a serious competitor doesn't have the time to stop and explain the rules. So be sure you know the required information to be passed between contestants. The best thing to do is to memorize the exchange. Then you are free to concentrate on the other essentials of the contest operation.

Now that you have a log sheet (UTC is a must), a pencil, and a clock, you're ready to begin. At this point you can easily fall into one of the most basic pitfalls of the beginning contester. That pitfall is "cherrypicking." One of the worst things you can do is to go around looking for a really rare country. Why is this? Simply, many very rare DX stations don't want to start a pile-up of their own, so they go around calling people, too. If you stay close to one area, your chances of finding one are increased. Get serious about really working the contest and try to make as many contacts as possible in your allocated operating time, and good things will come to you. Just like they used to tell us in selling, numbers make the difference. The more numbers you have, the better your chances of coming up with something you need. A case in point: During the 1979 **CQ World Wide Contest**, I worked a JA station after having already worked several other JA stations. However, this particular JA asked me if I needed BV2A, who was on another frequency. Needless to say, I was down on that frequency in a hurry. However, had that JA station been passed over, another multiplier would have been missed.

One of the most important things to know is how to call a DX station. This is something that can be carried over into your day-to-day DXing to your advantage. Of course, the techniques required will vary from DX operator to DX operator, but most really good operators will work you faster if you give your call one time only, with standard phonetics, and then listen. At the 300 or so an hour rate that a good operator will use during the contest, giving your call more than once will have the DX station working two or three good operators right through you because you're too slow. This is, if he can hear. If he doesn't come back with an immediate response, an out-of-control pile-up could be triggered as someone tries to be the

**1310 Paris, Garland, TX 75040*

last one calling. This doesn't have to be at contest rates. Just give your call one time, and if you're beat, you're beat. You'll get your turn if the desired DX station isn't run off the band by a bunch of out-of-control callers. Remember, panic calling for a rare multiplier by a neophyte DXer can trigger the same kind of action by a Big Gun station in the same pile-up, and you can guess who'll win when the smoke clears five minutes later.

By the way, this is the time to mention the pet peeve of many DXpeditioners. This is the guy who gives his suffix only. Having been at the other end of a few pile-ups, I can verify that it really is a hindrance to have someone who's 90 dB over S9 to give his suffix only, because invariably as soon as he gives the exchange, he tries to run off without giving his prefix. Then he has to be asked, and at least two QSOs are wasted by the DX station. Always use your full call when calling a station.

Once the miracle of miracles occurs, and your call is recognized out of the pile-up, then is the time to give the exchange. If your full call was recognized, just give the exchange only; no extraneous garbage is necessary. If only your suffix is picked up by the DX station, then always give your full call after the exchange, as the DX station most likely didn't hear the prefix, and may not be positive on the suffix either. Please, don't repeat your exchange; don't say it twice at all unless the station you're calling asks you to. If he doesn't, he has it. If he needs anything, he'll ask.

After you've been into the contest for a while, you might like to call CQ. That's okay, and may work great for working those rare ones who don't like to start big pile-ups of their own. The thing to remember here is to keep your calls short, listen only for about five seconds, then call again. If you don't get a response in a minute or two, move on to something else. Just do what it takes to make contacts.

By the way, many complain of QRM during the contest. We have found in our observations that this stems from several areas. One of these is that people try to operate with their noise blanker on. Most noise blankers decrease the dynamic range considerably, and increase a receiver's cross-mod susceptibility considerably. Turn the blanker off and grit your teeth against the noise. Secondly, if the QRM is really heavy, use the attenuator. That's exactly why it comes on the unit anyway. Thirdly, many people are still trying to hear with a speaker. For serious radioing like DXing and contesting, it just can't be done. Use a good set of communications headphones, and your ability to hear will increase immeasurably.

And finally, a few notes about contesting in general. Notice that most everyone gives a 59 signal report. This is done mostly for convenience, but also most signals really are 59 just to be understandable above the QRM level. Listening through QRM is an art worth learning. With practice, you'll be able to hear most anything.

Among common gripes heard about contesting is that when a DX station calls someone who has been calling CQ, the station who called CQ won't leave the frequency to let others work the DX. This isn't a valid complaint. If a station is established on a frequency, then that is his frequency to use until he relinquishes it. This is how it is during weekday activities, so why should it be any different during the contest. If you want to work a rare one someone else just worked, go up or down a few kHz and call. Probably you'll get lucky.

Contesting without a doubt can become the most captivating part of the DX hobby. *CQ*'s own **World Wide DX Contest** has been the biggest single operating event in the world for many years. It takes place on the last full weekend of October for s.s.b., and the last full weekend in November for c.w. Plan now to join in the fun, and watch your DX contacts multiply.

Ever leave your headlights on overnight and wake up to find a dead car battery? K2SE gives us one less thing to worry about in these complex times with a simple headlight warning device.

A SIMPLE HEADLIGHT REMINDER

BY ED SOLOV*, K2SE

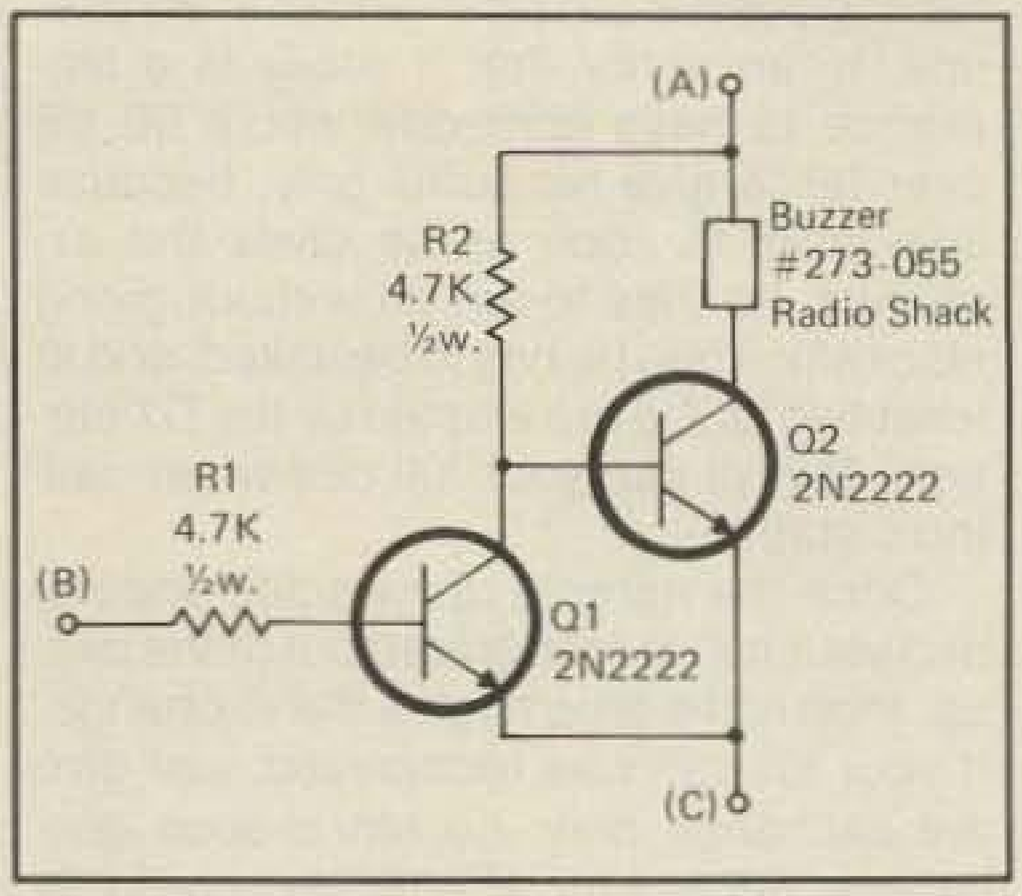


Fig. 1– The circuit for the simple headlight reminder.

Have you ever turned your car lights on during a rainy or foggy day's drive, parked the car at journey's end, and returned later to find a dead battery because you had forgotten to turn the lights off when parking? This little circuit goes together in a half hour, costs under three dollars, and hooks up to the car in a few minutes. With it the above scenario will never happen to you again.

Construction

The circuit schematic is shown in fig. 1. A convenient way to put the headlight reminder together is on a little piece of perfboard, wiring the few parts to push-in terminals. When the whole thing is built and hooked up, tape or clamp it to a convenient wiring harness under the dash near the fuse panel. All parts are garden variety Radio Shack items. Nothing is critical; use your junk box.

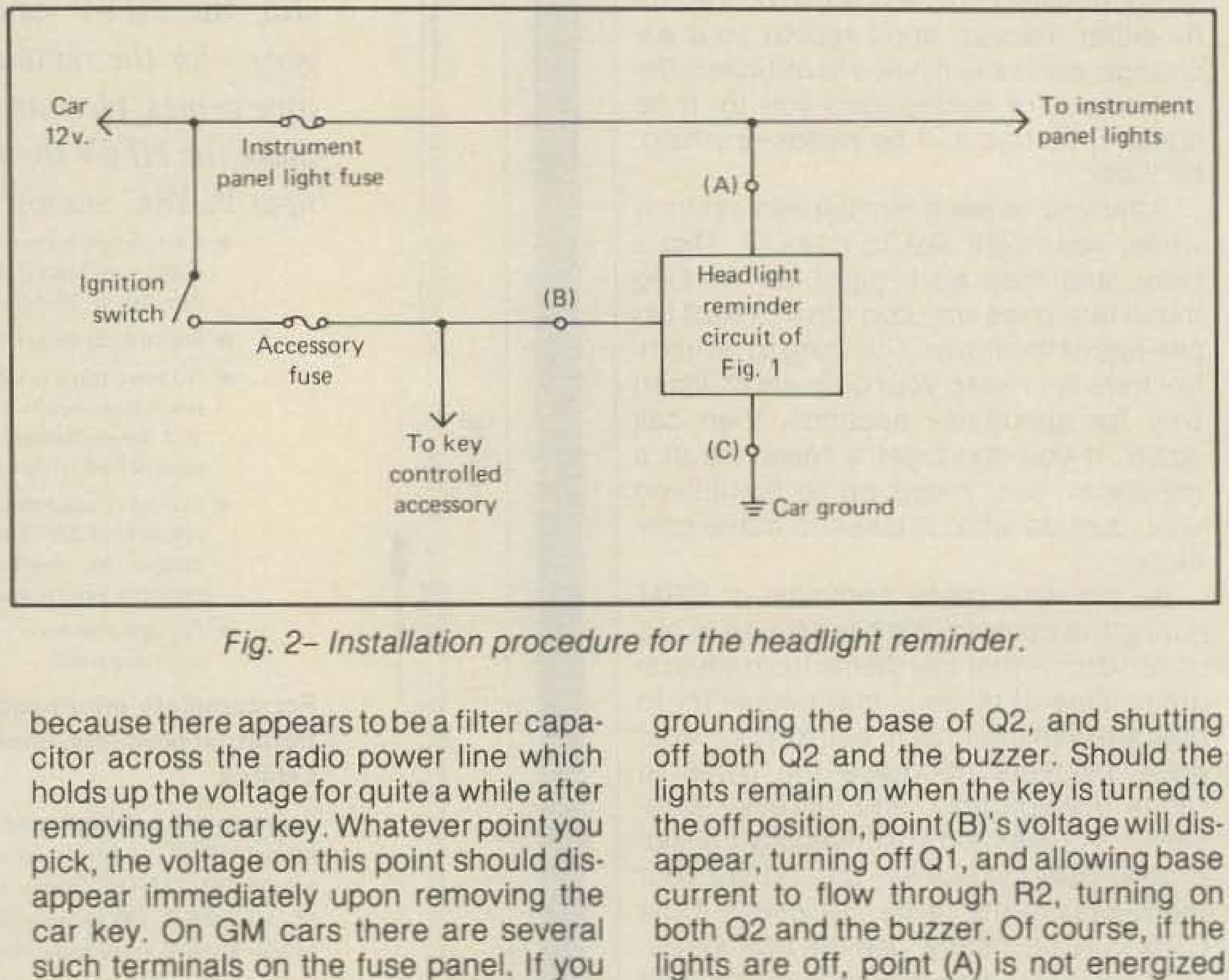


Fig. 2– Installation procedure for the headlight reminder.

Installation

You should be able to install the circuit right to the fuse panel. As shown in fig. 2, connect point (A) to the instrument panel light fuse on the load side of the fuse. Connect point (B) to some accessory terminal on the panel which is controlled by the ignition key. On some cars the radio fuse is a good place, but on others, such as a late model Chevy Malibu, it isn't, because there appears to be a filter capacitor across the radio power line which holds up the voltage for quite a while after removing the car key. Whatever point you pick, the voltage on this point should disappear immediately upon removing the car key. On GM cars there are several such terminals on the fuse panel. If you don't have a voltmeter or a test lamp, the reminder circuit itself can be used as a test set. Simply ground point (C), leave point (B) disconnected, and use point (A) to probe with. A "hot" terminal will sound the buzzer.

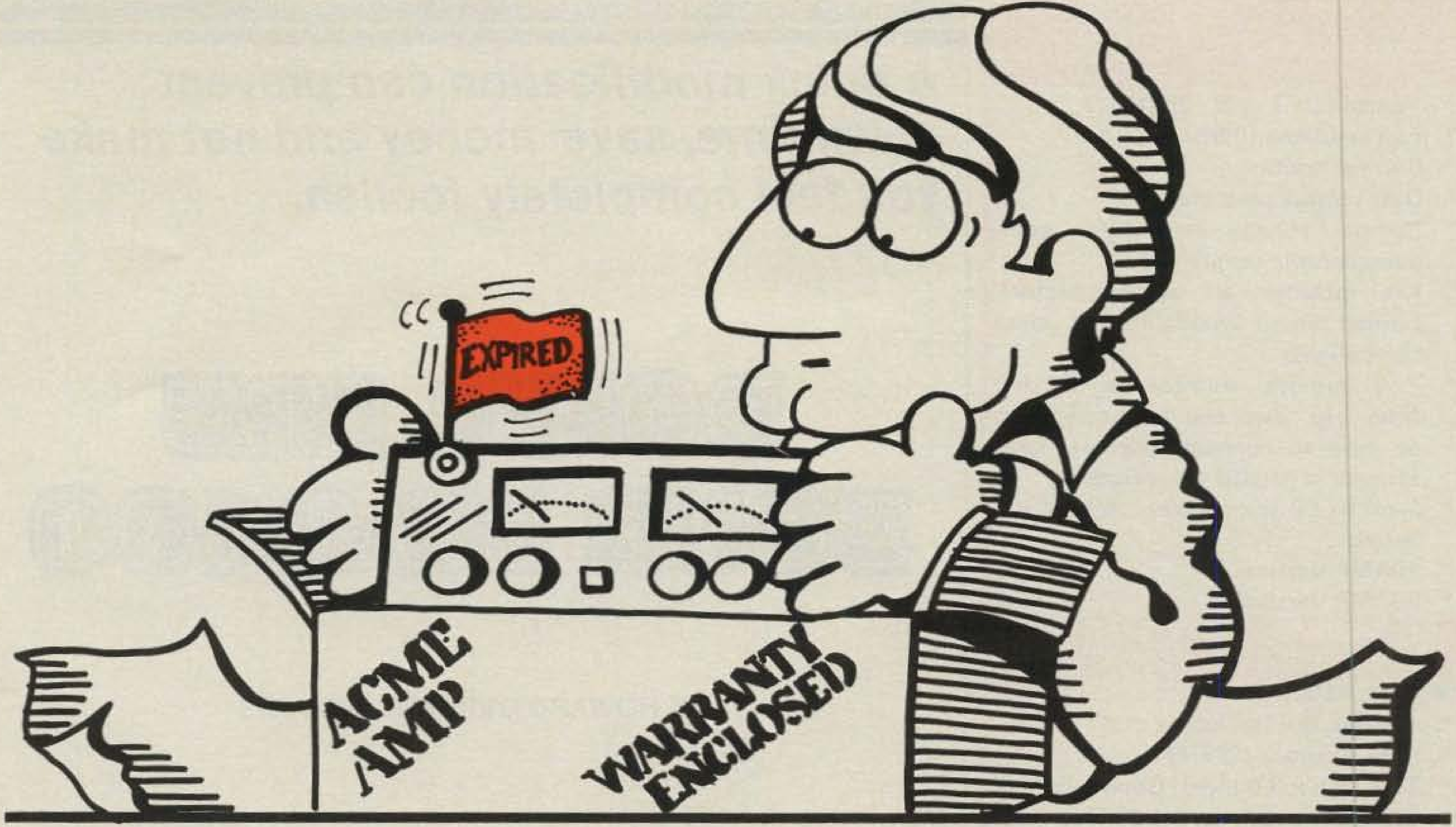
Operation

When the lights are on and the engine or ignition is on, transistor Q1 is on, grounding the base of Q2, and shutting off both Q2 and the buzzer. Should the lights remain on when the key is turned to the off position, point (B)'s voltage will disappear, turning off Q1, and allowing base current to flow through R2, turning on both Q2 and the buzzer. Of course, if the lights are off, point (A) is not energized and the whole circuit is inoperative.

Conclusion

I have built and installed perhaps a dozen of these circuits in my own and friends' cars and they have been 100% successful. Now on a rainy or foggy day I always turn on my lights without having to fear my absentmindedness leading to a dead battery.

*247 Andover Drive, Wayne, NJ 07470



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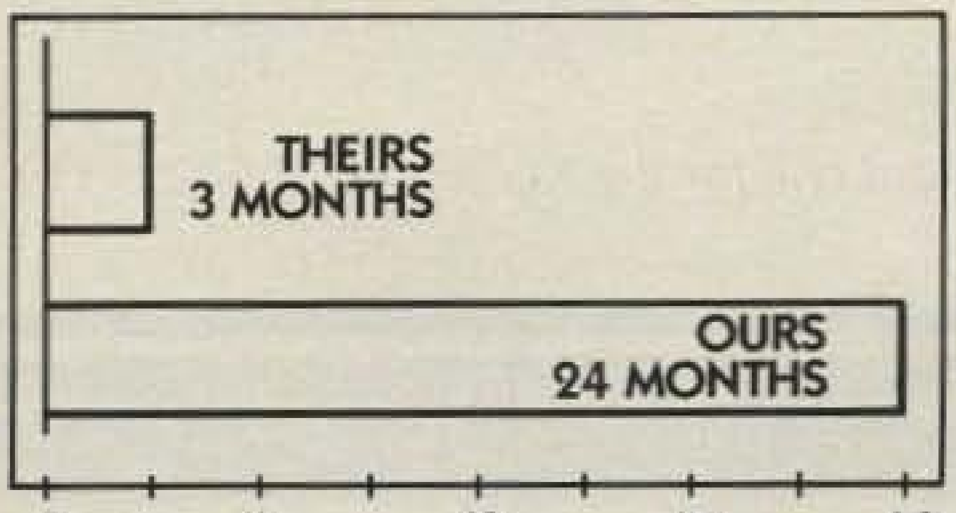

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A quick modification can prevent down-time, save money and not make you feel completely foolish.

DON'T FRY YOUR TR-2400

BY HOWARD GERBER*, WB5YWS

I was listening to my Kenwood while driving home from a vacation in the Ozarks. I decided to use my earphones, so I plugged them into the . . . whoops . . . charger jack. Two weeks later and $40 poorer, I now have a new choke in my transceiver.

If your TR-2400 hasn't had this problem, then you're lucky. From the schematic, fig. 1, you can see that the choke (L27) is in series with the negative lead of the battery pack. If the charger jack (J1) is accidentally shorted, 9.6 volts are placed across L27. In less than a second this choke vaporizes and you pay the bill.

To eliminate the problem without having to modify the circuitry of your radio, simply splice a rectifier in series with the yellow lead of your battery pack (anode toward the battery pack). Insulate this rectifier with some heat-shrink tubing.

The value of this rectifier isn't critical. I used a 1N4003, but any device with a PIV of at least 20 volts and a current capacity of at least 1 ampere should work.

When this modification is complete, your charging current will drop slightly (from 45 ma to 44 ma using the standard charger). This is a very small price to pay for protecting your rig. If I had only known this *before* my vacation!

**1031 West Forty Third, Houston, TX 77018*

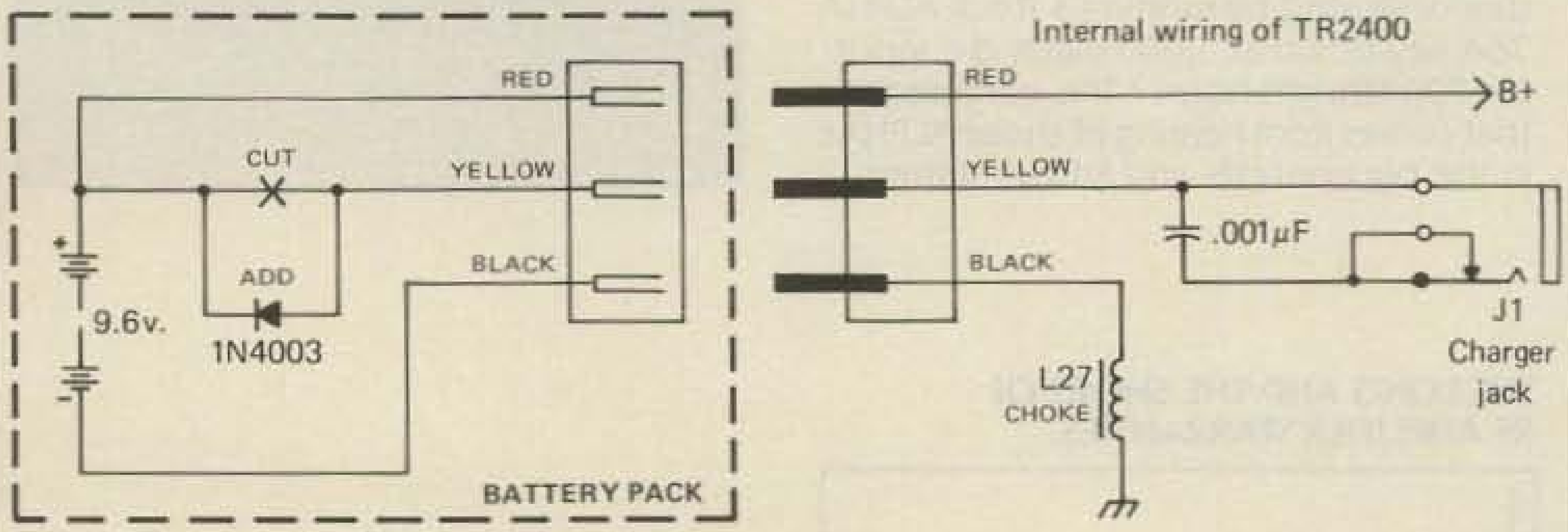

Fig. 1– The simple battery pack modifications for the Kenwood TR-2400.

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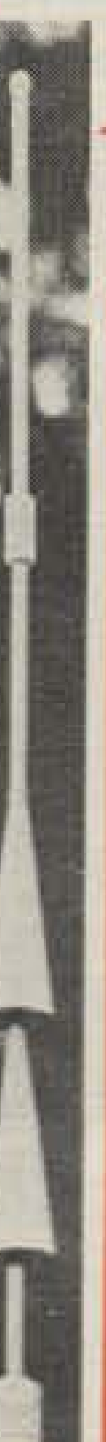

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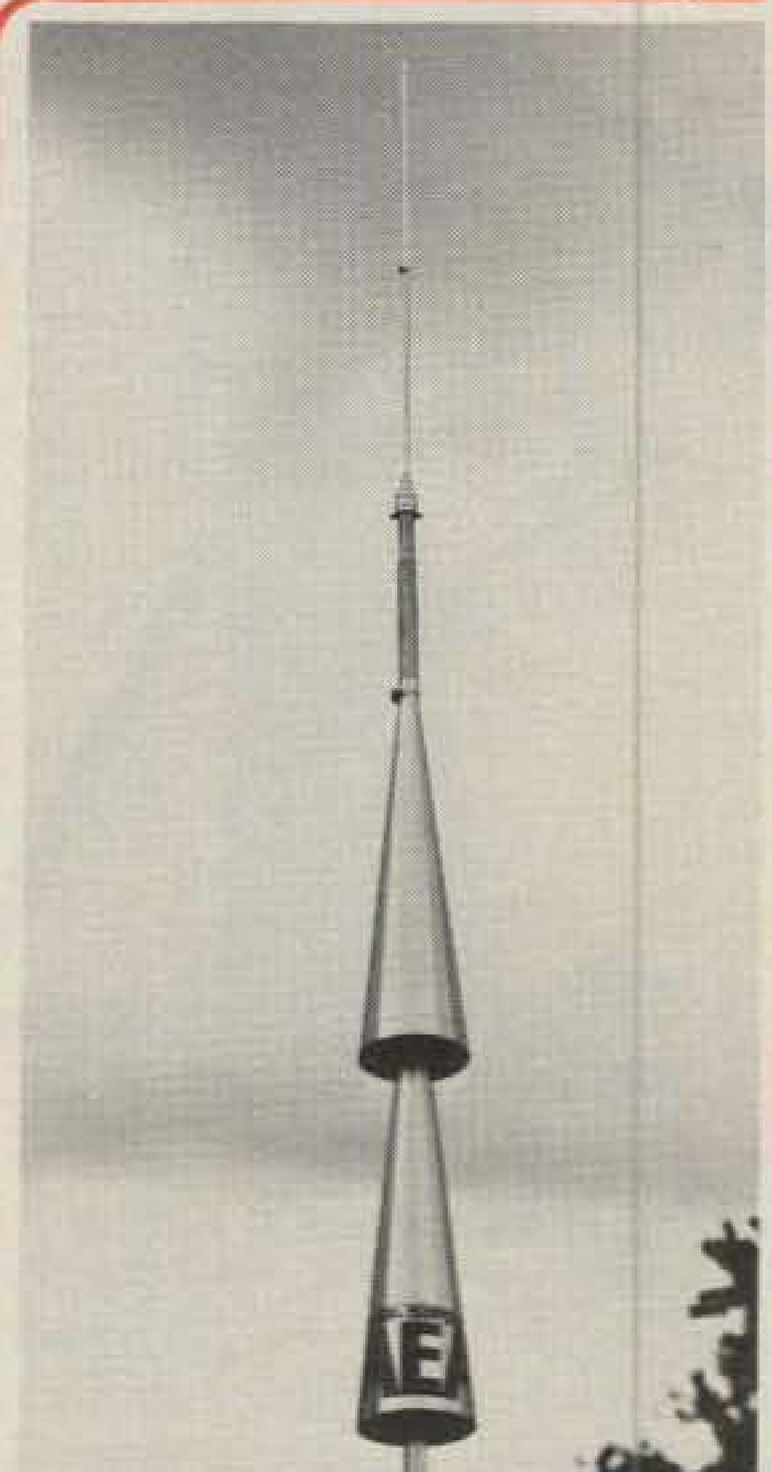

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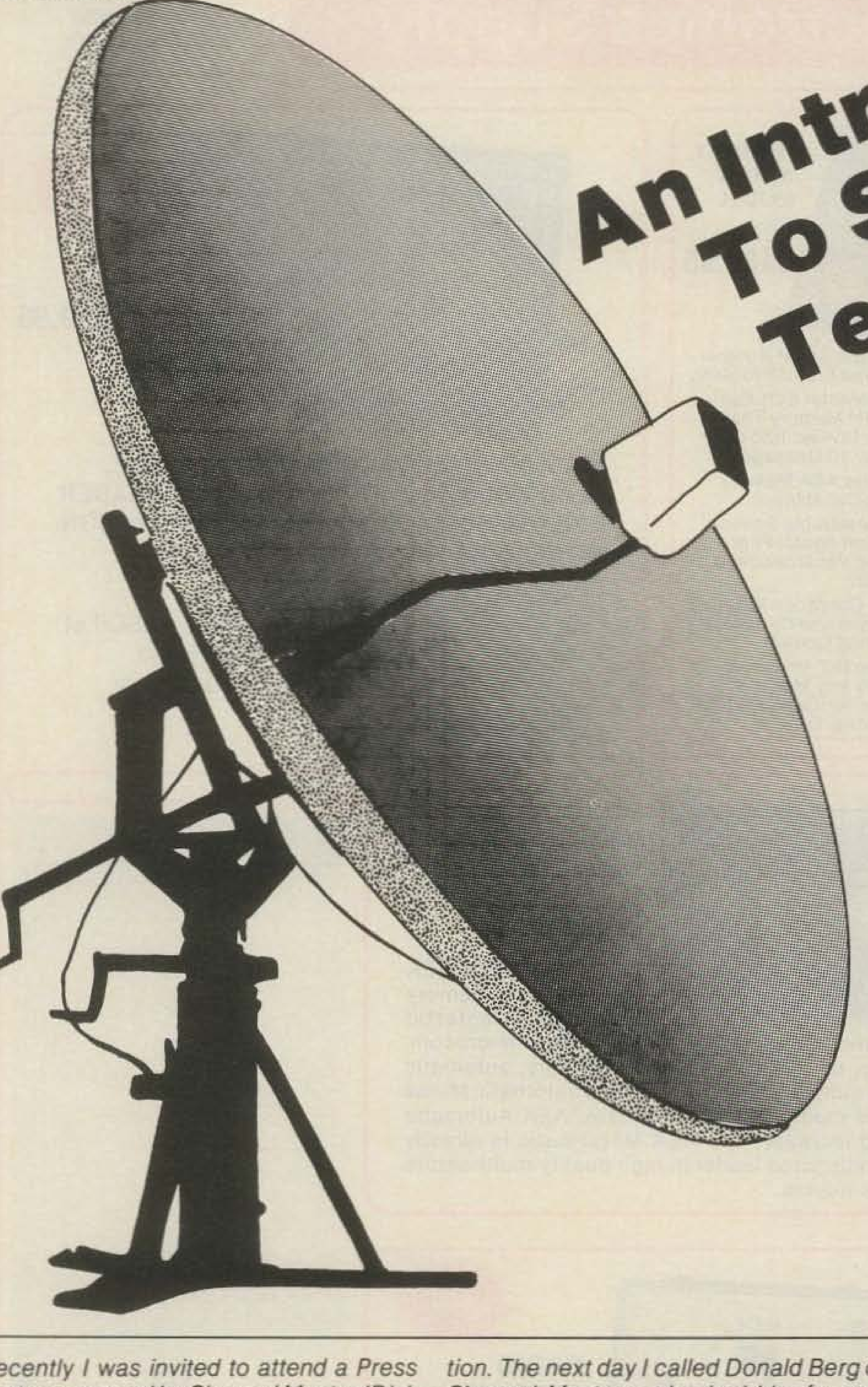
Cassegrain feed and LNA are not items designed for genetic engineering, but rather are terms in the lexicon of satellite TV reception. Take a few minutes and read all about it.

An Introduction To Satellite Television



BY DONALD BERG*

Imagine what it would be like to see the handful of TV stations you currently watch suddenly blossom into a dazzling array of over fifty program choices. Imagine further that among these choices are a wide selection of first-run movies, a dozen live sports broadcasts, nightclub acts from Las Vegas, and a whole evening full of commercial-free shows that have yet to appear on "regular TV." Imagine this kind of programming available 24 hours a day, every day, and you have imagined the incredible world of satellite television reception.

With a satellite reception system you can watch a bullfight broadcast live from Mexico City. Spin the dial, and you can see the bobsled races from Grenoble. Choose from seven different professional football games, all live. If you're not in the mood for sports, you might try BRAVO, a channel for cultural entertainment. Or you might let the kids watch Nickelodeon, a station with continuous programming for children. And there's more—from Spanish language stations, to religious programming, to all-news broadcasting or adult movies. Satellite TV is truly a wonderland of entertainment, and thousands of households all over the world are enjoying its benefits.

Recently I was invited to attend a Press Party sponsored by Channel Master (Division of Avnet, Inc.). The purpose of this gathering was to introduce those attending to a new venture by Channel Master, namely satellite TV reception. By now most of you have been exposed to various forms of equipment and components available, so there is a fair degree of familiarity with some of the "buzz words" associated with satellite reception. One of the items contained in the press kit was a straightforward, easy to read and understand introduction to satellite reception. The next day I called Donald Berg of Channel Master and asked him for permission to publish the material in CQ *as a sort of primer on satellite reception. I think you will find it interesting and informative, going beyond the "buzz word" stage to some basic understanding of how it works. It will sure make reading the ads easier, whether you decide to build your own or think in terms of buying a system. While it's not the same as 20 meter DXing, it definitely is a new frontier in technology.*

—K2EEK

The Early Birds

In 1957, the Soviet Union launched the first manmade satellite, SPUTNIK. The whole world marveled at the achievement, as the tiny metal sphere circled the globe, beeping its prerecorded message in Morse code. A year later the United States launched a satellite named SCORE, built by the Air Force. SCORE

*Channel Master, Division of Avnet, Inc., Ellenville, NY 12428

was proudly announced as a major improvement over the Russian model, since it carried a voice recording of the President that welcomed the world to the "new space age." And the race was on.

In 1962, the first television picture was relayed by a satellite known as TELSTAR. This American "bird" became an object of fascination for millions. There was even a popular tune named after it. But TELSTAR, just as the previous satellites, was launched into an orbit fairly close to the earth, which caused it to circle the globe at a fairly rapid rate of speed. This, in turn, caused severe interruptions in its ability to function as a communications device. The satellite had to be tracked, and when it disappeared over the curvature of the earth, it was useless until it reappeared over the opposite horizon.

The first really effective communications satellite was launched in 1963. Manufactured by the Hughes Aircraft Corporation, it was named SYNCOM. The key to its effectiveness was the fact that it was launched into a "geosynchronous" orbit. A geosynchronous (geostationary or fixed) orbit is one which enables the satellite to orbit the earth at the same relative rate of speed as the earth's rotation.

It has long been known that objects that circle the earth at a great distance (high orbit) will travel at a speed slower than the rotation of the earth. The best example of this is the moon, which circles our planet at a distance of about 220,000 miles. It takes the moon 28 days to complete one trip. Satellites launched into low orbits, such as those of SPUTNIK and SCORE, will circle the earth at a rate much faster than the earth's rotation. Several meteorological birds currently make a trip around the world in about 90 minutes. The distance at which a satellite will become geosynchronous is 22,279 statute miles above the equator. Satellites in such an orbit appear to remain fixed in relation to a specific point on earth. All communications satellites presently in use are in geosynchronous orbits. That is what enables them to relay signals, uninterrupted, from one point to another.

SYNCOM was considered highly advanced for its time. It had the capacity to handle one TV channel and about 50 phone conversations. It hovered in a spot just above the equator, between Africa and South America. SYNCOM provided the first real-time (live) TV transmissions between North America and Europe.

In 1965, a group of nineteen countries got together and formed INTELSAT (The International Television Satellite Organization), in an effort to provide high-quality television, telephone and data communications from one continent to another. Today, there are over 100 countries in INTELSAT. The network has five satellites and over 250 ground stations. The satellites are currently of the so-called "Number V" class, indicating the fifth generation.

The Advantages Of Satellite Communications

No sooner had satellites proved their ability to deliver efficient and reliable long-range communications than they began to replace other circuits used for the same purpose. In a relatively short period of time, satellite communications grew from a simple but successful experiment into a complex series of networks comprising a multi-billion-dollar industry. Phone companies use satellites to carry thousands of long-distance calls, businesses use them for data communications, and all phases of the television industry employ satellites to relay their programming from point to point.

The growth has been tremendous, and there doesn't seem to be an end in sight. Satellites, it seems, have solved a number of problems inherent in other forms of long-range communications. There are four major advantages to using a satellite system:

1. Satellites are reliable. Their transmissions are virtually unaffected by changes in the weather, time of day or sunspot activity.

2. The microwave frequencies used by satellites allow bandwidths of sufficient capacity to transmit TV signals that won't fade periodically, such as HF radio signals will do.

3. Despite their high launching costs, satellites are by far the lowest cost means of medium- to long-distance communications, as compared with landline wires, underseas cables, and earth-bound microwave relay stations. These cost reductions increase still further when broadcasting a TV program to a multitude of receiving stations spread over a wide area (the continental U.S., for example).

4. Satellite picture quality is vastly superior to that of microwave relay stations (terrestrial repeaters), since the satellite system uses only one repeater.

From NAVSTAR, a 24-satellite navigational system, to MARISAT, a ship and aircraft communications network, satellites have consistently outperformed terrestrial links in the three vital areas of reliability, effectiveness and cost. These advantages, coupled with the "open skies" policies of the Federal Communications Commission (FCC), have created an overwhelming demand for more birds with greater capacities. Presently, there is a sizable waiting list for satellite services.

How Satellites Work

Satellite communications bring together some of the most sophisticated technologies in existence. Advanced computer systems, rocketry science, microwave electronics, space engineering and solar energy technology are all part of today's satellites. Stripped of all the mystique of their futuristic gadgetry, however, they are merely "unattended relay stations," posted like sentries in stationary orbits.

As previously mentioned, satellites operate in the microwave frequency range. This allows them the bandwidths necessary to handle several television channels and thousands of voice and data transmissions simultaneously. Most commercial communications satellites operate in the 4 and 6 gigaHertz (GHz) frequency range, also called the C-Band. A few birds use the 12 and 14 GHz range known as the Ku Band. The Ku band is used mostly by countries other than the U.S., with the exception of some data transmissions by SBS (Satellite Business Systems). At present, virtually all domestic satellite (domsat) television transmissions take place in the 4 and 6 GHz range. Specifically, the "uplink" signals beamed up to the satellite from the ground station are between 5.9 and 6.4 GHz (5900 to 6400 MHz). The satellite converts these signals to between 3.7 and 4.2 GHz (3700 to 4200 MHz) and sends them "downlink" to earth.

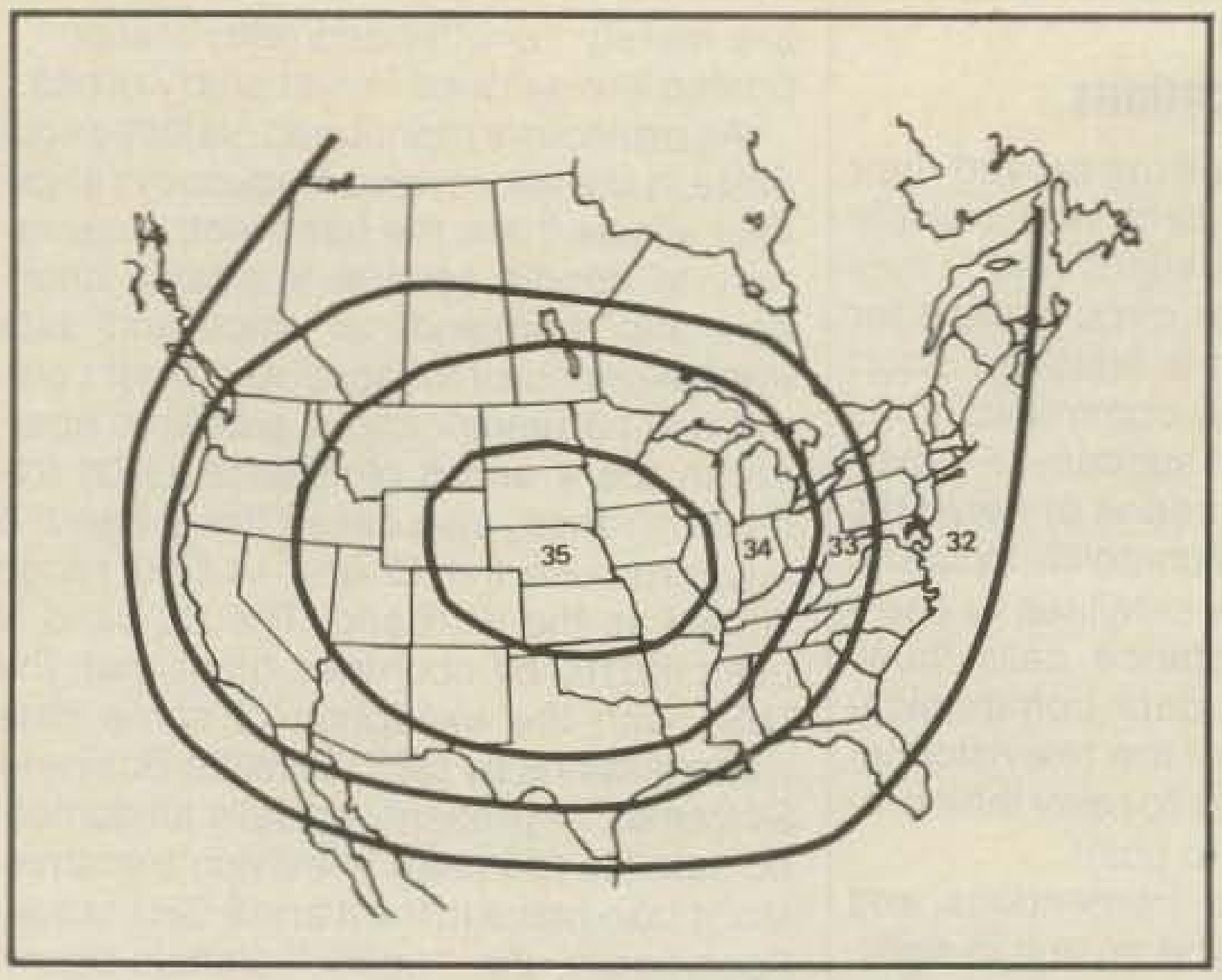
The satellite uses a series of repeaters (transponders) which "downconvert" the signals from the 6 to the 4 GHz range. This allows a two-way (duplex) communications, where the incoming and outgoing signals don't interfere with each other. This way, an effective relay is established.

If a satellite is equipped with a broad-beam transmitting antenna, called a "global beam," slightly more than one-third of the earth's surface will be covered by the signal from the satellite. If three such satellites are placed in orbit, equally spaced (120° apart) around the equator, the entire earth's surface will be covered, except for the polar caps. This would establish instant two-way communications between practically any two places on earth.

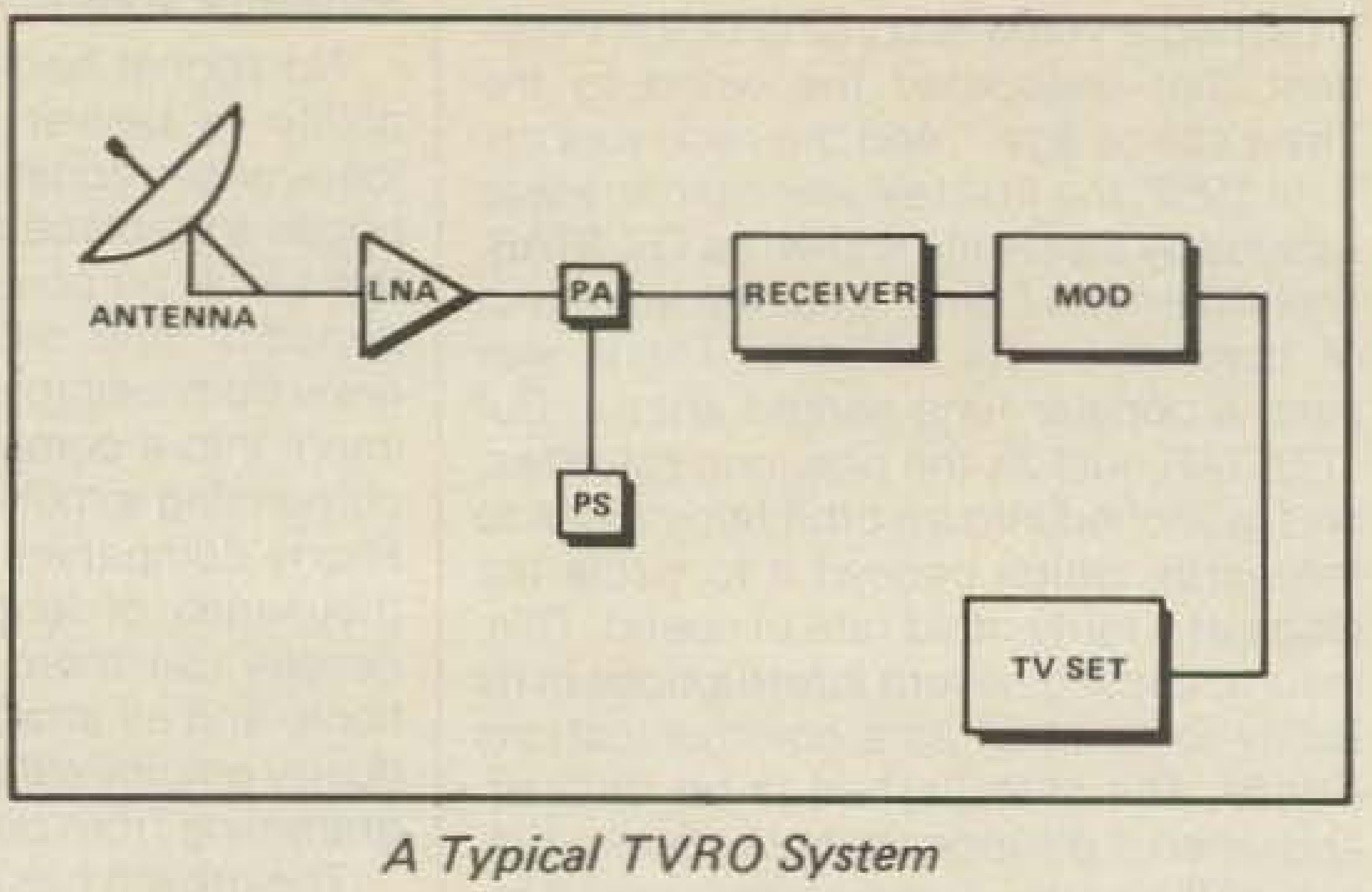
Typically, however, satellite transmitting antennas are highly directional, high-gain, narrow-beam antennas which are focused on a narrow area, like the lower half of the United States, for example. This avoids the problem of wasting the satellites' valuable solar power by radiating unnecessary signals into space. Another benefit of the narrow beam antenna is that it provides enough gain to reduce the satellite transmitting power requirements to just a few watts per channel.

The satellite receiving antenna is a fairly wide-beam "sculptured" antenna that covers the necessary frequency range with reasonable efficiency. It is a directional antenna, which processes received signals with a broadband (5.9 to 6.4 GHz) front end.

Since both of the satellite's antennas are directional, they both have a pattern. The center of this pattern, where maximum gain occurs, is called the "bore-sight point." The pattern of the transmitting becomes particularly important when attempting to determine the strength of a



Footprint for RCA Satcom I Satellite



A Typical TVRO System

satellite signal reaching the earth. As the transmissions leave the satellite, they form a beam that covers a specific area of the earth. The energy levels of this beam are called Effective Isotropic Radiated Power (EIRP), and they are distributed in a pattern where the signal is stronger in the center than at the edges. This pattern is referred to as a "footprint," and is shown on a map with contour lines that connect equal levels of EIRP together. This is called a footprint map and looks similar to a meterological survey map, where isobars connect equal levels of atmospheric pressure.

The levels of EIRP are expressed in "decibels above one watt" (dBW), and they tend to fall away from the center of the footprint pattern in descending values. A footprint map of the RCA satellite SATCOM I, for example, might show a boresight point strength of 35 dBW with concentric lines indicating 34 dBW, 33, 32 and so on, towards the outer fringes. These values do not take into account the "path loss" incurred between the satellite and the receiving antenna, but they are the most important indicators of available signal strength.

The Microwave Band

As you may have noticed, both the uplink and downlink frequency bands are 500 MHz wide. This permits twelve TV channels of 36 MHz each, with 4 MHz "guard bands" between them. The rest of the band is used for ground-to-satellite command signals, satellite-to-ground acknowledgement signals, and a couple of "beacons," to help ground control measure the exact position of the bird at any given moment.

Generally, a satellite can be expected to relay one TV channel per transponder, for a total of twelve within its assigned frequency range. Several satellites, however, such as SATCOM I and II, double the number of TV channels they can handle through a technique known as "opposite-sense polarization." What this does is to use the same 36 MHz-wide frequency for two separate channels by processing one with a horizontal polarization and the other with a vertical polarity. This "frequency re-use" has proven highly effective and will probably become standard with most future communications satellites.

Earth Stations

Earth stations either transmit or receive satellite signals. Some do both. Most stations, however, are for TVRO (Television Receive-Only). Transmitting stations tend to have the largest antennas, normally ten meters (about 30 feet) in diameter or more. The ten meter antenna has a beam width of less than one degree, so it is capable of transmitting with pinpoint accuracy. This is necessary to avoid interfering with satellites a few degrees away operating on the same frequency. A ten meter antenna also reduces the transmit power requirements to 1/200,000 of what would be required if an omnidirectional antenna were used.

The transmit power requirements for ground-to-satellite communications are in the neighborhood of 1 to 3 kilowatts (kW), plus the 50 to 60 dB gain of the antenna itself. This ensures high-quality (noise-free) input to the bird. This is vitally important to television transmissions in particular, since the satellite cannot really improve the signal it relays, and virtually all satellite TV signals are intended for rebroadcast or for distribution to paying customers of cable TV networks.

TVRO

TVRO stations fall into three basic categories, which can be identified primarily by size and complexity. Category One includes large-scale installations like military and major industrial communications stations. Large cable TV networks may also fall into this grouping. Category Two includes "medium to small" cable companies and other types of limited signal distribution systems, such as SMATV (Satellite Master Antenna Television) for motels, hotels and apartment complexes. Category Three is home satellite reception. The difference between categories, as mentioned, is primarily one of scale. The basic equipment for satellite reception is virtually the same for all TVRO installations.

Earth Station Equipment

Simplistically speaking, a TVRO station consists of an antenna, a low noise amplifier (LNA), a receiver, a modulator and a TV set. The antenna (usually a parabolic dish) provides tremendously high gain, which results in a signal that is approximately 100,000 times stronger than what a non-directional antenna would be able to deliver. Even with this extraordinary boost, however, the signal is still quite weak and must be amplified with a low noise amplifier. The LNA has the ability to magnify the signal another 100,000 times, without generating undue quantities of thermal "noise," which can appear on the screen as snow. The signal then goes to a special receiver (not a standard TV receiver) which "decodes" the microwave input, transforming it into its original mode of broadcast-TV picture and sound. This, in turn, is fed into a modulator, which acts as a miniature TV transmitter. The modulator transfers the signal to the television channel of your choice on your TV set.

Antennas

There are several configurations of antennas available for use with TVRO earth stations. They are the "horn," the spherical and the parabolic dish antenna. The latter is the most common. The functions of these antennas are identical. Specifically, each will receive the 3.7 to 4.2 GHz downlink signals, focus them to a point of concentration and feed them to the LNA. The overall performance of an antenna

system is referred to as G/T ("gee over tee"), which measures the gain over the noise temperature. The gain is expressed in decibels, and the noise is expressed in degrees Kelvin. The higher the G/T, the better the antenna performance.

While the horn antenna offers by far the greatest efficiency, it is unreasonably expensive at this time. Spherical antennas are fairly new, and still somewhat experimental. But, they look promising for the future, especially since they have the ability to receive more than one satellite, not by adjusting the antenna, but by changing the location of the LNA.

The more popular parabolic antennas come in two different styles: the prime focus feed and the Cassegrain feed.

The "feed" is the device on a satellite antenna that collects the concentrated signal from the dish and feeds it to the rest of the electronics in the reception system. With the prime focus feed antenna, the feedpoint is suspended above the dish as the focal point of the dish. This type of arrangement offers good G/T figures and excellent "sidelobe" performance. Sidelobe is the ability of the antenna to reject unwanted signals occupying the same frequency band. The prime focus antenna is suggested for use in areas of high microwave traffic, such as large cities.

The Cassegrain feed antenna uses a second reflector at the focal point to reflect the concentrated signals back into the center of the dish where the feed is located. The secondary reflector is shaped like a hyperbola and called a "hyperboloidal subreflector." The Cassegrain feed offers a somewhat higher G/T than the prime focus, but it is much more sensitive to extraneous signals. It should be protected against interference and used only where there are few other sources of microwave transmission.

When sizing antennas, the general rule is "the bigger, the better," but there are a number of variables to consider. As mentioned, the standard size for a transmitting antenna is about ten meters. With a parabolic dish this measurement means about thirty feet in diameter, which is also called the "aperture." Cable TV stations are required to have a minimum aperture of 4.5 meters for their TVRO antennas, according to FCC regulations. The homeowner should find that a three meter antenna will give him nearly perfect picture quality, provided that his LNA and receiver perform well. This is the major tradeoff. You can get away with a smaller antenna if you are willing to invest heavily in an LNA with extremely good noise figures. It should be noted, however, that all antennas less than eight feet in diameter will probably experience some sidelobe interference.

The LNA

The LNA is probably the single most important part of the reception system with regard to picture quality. There are three basic types currently in use:

1. The GaAs FET (usually pronounced as "gas fet") is the most common and least expensive. It is a transistor amplifier that uses gallium arsenide, field effect transistors.

2. The "Uncooled Parametric Amplifier" is a higher priced amp that contributes less noise than a GaAs FET. Areas of low signal strength (EIRP) may require the use of such an amplifier, also known as an "electronically cooled paramp" or a "non-cryogenically cooled paramp."

3. The "Cryogenically Cooled Parametric Amplifier" is an extremely expensive amp that is actually cooled to near 0° K (−459° F) by refrigeration equipment. Since this type of amplifier contributes the least amount of noise, it is used in areas where the signal is extremely weak. This type of LNA requires constant maintenance.

Some LNAs are rated by gain, but most are rated by noise temperature, expressed in °K. A highly effective LNA for use with a home earth station might have a rating of 120°K, provided there were no special reception problems to contend with. LNA noise temperature and antenna gain (primarily determined by antenna size) are the main determinants of overall system performance. This is where the G/T rating comes in. The G/T can be improved either by increasing the gain of the antenna (making it larger) or by reducing the noise temperature. The largest part of the noise temperature and the only part that can be changed easily is the LNA.

Some TVRO stations may use two LNAs. If the operator wishes to receive signals with "opposite-sense polarization" (previously mentioned), he can either use an antenna with a feed that can be rotated 90°, or he can feed vertically polarized signals through one LNA and horizontally polarized signals through another. In the latter case, the two LNAs are connected to the feed with a device known as an "orthomode coupler" (transducer).

Transmission Lines

At microwave frequencies, the conductors (transmission lines) used are either large-diameter coaxial cables or special pipes called "waveguides." At the focal point of a prime focus antenna is a waveguide which forms the feed. In almost all cases, waveguides are used to deliver the microwave signals to the LNA. To connect the LNA, located at the antenna, to the receiver, usually located indoors, several hundred feet of cable are normally required. Since the signal it carries is at a very high frequency, this cable must be low-loss coax. If the distance is relatively short (up to about 200 feet), half-inch or foam dielectric heliax cable can be used. If the distance is longer (200 to 500 feet), ⅞" air dielectric is required. To prevent moisture damage, dry air under pressure is fed into this cable at the terminating end. At the antenna end, a connection extends this pressurization to the LNA and the feed cavity.

The Receiver

Though the antenna and LNA are the chief determinants of the G/T, the receiver is responsible for the audio and video specifications (video bandwidth, response, gain, etc.). It is an extremely important component, and its quality must be carefully selected.

The first operation that the receiver performs is to select the particular transponder (channel) signal that is to be received. The LNA has amplified the entire 3.7 to 4.2 GHz range, and the receiver must select from this the 36 MHz that represents the desired channel. The second operation the receiver performs is to "downconvert" the 4 GHz signal to an intermediate frequency, normally 70 MHz. This may be accomplished in one step (single conversion) or in two (dual conversion).

The third receiver function is to "demodulate" the audio and video from the intermediate frequency. It does this in two stages. In the first stage, the "baseband," which includes the audio and video signals and sometimes additional subcarriers, is demodulated from the main carrier. In the second stage, the audio and the subcarriers are separated from the video signal. The audio and video are then processed (filtered, clamped, deemphasized) and fed to the monitor (or TV set) through a one-channel modulator.

There are three general types of satellite receivers available. The "fixed-tuned" receiver is intended to be tuned to one transponder channel only. The frequency is controlled by a crystal oscillator and can be changed only by changing the crystal. The "tunable" receiver uses a frequency synthesizer to control the frequency. It can be tuned to any of the 24 transponder frequencies by turning a dial. The third type of receiver is often called "switchable." It also uses a frequency synthesizer, but the frequency is usually preset by a selector switch or may be remotely controlled to select one of a group of specific channels.

The Modulator And Monitor

The final stage of satellite television reception, of course, is to get a picture. You can use a standard television set, or you may want to spend the extra money for a high-quality color monitor, like the ones used in broadcast studios. When you are using a standard TV set, you will need a modulator to feed the signal from the receiver into the appropriate channel. Satellite reception would normally be assigned to an unused channel on a TV set.

To Be Continued

DXpedition To

Navassa Island - Part II

BY RANDY ROWE*, NØTG

Navassa Island has come up in amateur circles for many years. There have been many notable DXpeditions to the island over the years, most of which have been chronicled in these pages. The DXpedition written about here, like the others, was done in what is commonly known as "the spirit of amateur radio." There was no ulterior motive nor financial gain to be had out of roughing it for a while. The group in this article in a sense "played the game by the rules"; they also had a good time and made a lot of other amateur happy by their being there. All of this is a preparatory thought to the postscript which follows this article. The postscript information was not part of the original manuscript, nor was it supplied by the author.—K2EEK

Early on Thanksgiving Day morning, November 23, 1978, NØTG, WØRJU, WØZH, ADØP, NØWL, and W6OIG gathered at St. Louis International Airport for the flight to Kingston, Jamaica. The sense of the end of the dream and the reality of this moment was felt in a very special way. We were really going on a DXpedition! No turning back now. A few hours later we were met at the Kingston, Jamaica Airport by Lloyd Alberga, 6Y5LA, and Sy Adler, K2KA. Sy, Joe, W2ORA, and Brownie, W2PAU, had flown down to Kingston the previous day. As the advance party, they worked to clear last-minute details on the boat and provisions. Most importantly though, Sy spent most of the day, while we, the WØ group, were traveling, in getting our 2,000 pounds of cargo cleared through customs in Jamaica. The cargo was shipped weeks in advance. After clearing customs, no easy task in itself, was the problem of getting it to a safe storage place until we were ready to load it onto the boat. Behind the scenes, making it all possible, was our good friend Lloyd, 6Y5LA.

One of the highlights of the trip for all of us was to have the honor of meeting Lloyd and Iris Colvin, W6KG

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and W6QL. We had learned in advance that the Colvins were at the same hotel at which we were staying in Port Royal Jamaica, at Morgan's Harbor Hotel and Beach Club. They were on a six month DXpedition tour, spending 30 days at a time at various stops in the Caribbean. Our first evening in Jamaica was celebrated by a banquet followed by operating as 6Y5 using the Colvin's equipment. The next morning, Friday, November, 24, Sy and I met with Lloyd, 6Y5LA, and began the long day of last-minute errands. Among other items, this included the grocery stores, picking up oil for the generators, borrowing chairs from the Jamaican Boy Scout organization, and checking on the boat. The boat originally was scheduled to be available to us for a Friday night departure. This was an ideal schedule, since the boat trip is a 14 hour ride. We would be at Navassa Saturday morning and have the weekend operation in time for the *CQ* World Wide CW contest. As it turned out, the boat did not become available until 24 hours later. There was a problem with the generator on the boat which caused some delay. Additionally, the captain had a slight schedule conflict. We were all eager to go and so this delay was a disappointment to everyone. In view of the delay, a couple of rigs were set up on the wharf at our hotel with dipoles dangling over the water at about 10-12 feet. It was amazing how effectively the antennas performed. We began spreading the word on the air from Jamaica that we would be at least one day late arriving on Navassa Island. Rather than arrive on Saturday, November 25, we were now expecting to arrive on Sunday, November 26.

On Saturday, we moved all 2,000 pounds of equipment and supplies from the storage area in the hotel to the dock area. I might mention here that holding down the weight during preparation was a constant concern on our part. It was a difficult matter and the weight grew. Not only did shipping costs run approximately $1.00 per pound, but we were concerned about handling and getting everything up and onto the island. Keeping a sharp lookout across Kingston Bay along with several telephone calls did not seem to expedite the arrival of the boat, the ANANCY III. Finally, about 5 p.m., we saw the boat chugging its way toward us. All of us were very excited and began to get our belongings in order in preparation for departure. The ANANCY III is an 85 foot commercial fishing boat. We had contracted the boat not only to transport us but also to stand-by off shore for the week. Daily, the boat crew brought our water and gasoline requirements to the island from their off-shore anchor location. Several more hours of delay, however, were ahead of us. As the boat was being loaded, the Port Authorities began an extensive ceremonial inspection procedure. We had to produce a detailed, itemized list of all the items in the shipping crates. Additionally, we had to explain to several officers just exactly what our purpose and plans were. I'm not sure they ever really believed that grown men were going to go out to an uninhabited rock and sit there for a week. Finally, after being released by the Port Authorities to leave Jamaica, we left Morgan's Harbor dock in Kingston Bay. Next, we made a stop close by to fill the three 50 gallon drums with gasoline for fuel for the generators. While filling the drums, we learned that one additional boat crew member was required and would join us soon. The wait was longer than we desired. The sun had disappeared below the horizon of the sea by the time we finally left the harbor at 8 p.m.

Most of us "inlanders" did not realize the sea could have so much movement, and you can imagine what happened. The trip, for the first several hours, was fairly calm and routine. During the middle of the night, however, the wind picked up, the rain began, and it became necessary to acquire shelter. The rain and wind developed into a very, very intense storm. The shelter, for some, consisted of wrapping themselves in a tarp and holding on. Most of us, though, crowded into the small cabin quarters. Designed to hold only four persons, it became quite cozy and hot. Some tried to lay down, lean in a corner, or prop themselves up on someone else's shoulder. Those not already seasick soon began to experience nausea.

It was a rough ride all night long. Early in the morning, however, as the sun came up, the storm had subsided and the sea became calm. As we came out of our cubby holes and from underneath tarps and straightened our bodies we sighted Navassa on the horizon. This brought new life and excitement to everyone. As we approached the island we began to keep a sharp lookout for Lulu Bay and the landing catwalk and ladder which dangles 40 feet over the sea. As most everyone knows, Navassa has no beach, but rather 50 to 100 foot rugged cliffs encircling the island. The U.S. Coast Guard had advised me prior to our departure from the states that they no longer used the landing site, and thus there was no longer any up-keep or maintenance. They warned of the possibility of the ladder not being usable. Prior to our departure, Tony, AD0P, Joe, N0WL, and myself fabricated a 50 foot long wire rope ladder for backup. We figured that if the regular ladder was not usable, somehow we would be able to attach ours to the steel beams of the catwalk. As we approached the island and found Lulu Bay, we were delighted to observe that the catwalk and ladder appeared to be in good condition.

I have been asked many times, "How did the island look when you neared it?" I was so seasick that anything stable looked good to me (hi). It was a very thrilling experience after two years of planning to be able to say, "We are here." Chills of excitement ran up and down our backs. The boat captain is to be credited for his navigational ability to locate the island on his first try. As others have described, the island looked like an upside down pie pan at a distance. As we neared, the roughness of the terrain became more obvious. The terrain is very, very rough. It is very difficult to explore the island because of this. Also, almost any place you look there are cactus growing. Their needles easily penetrate a leather boot; all of us received a few wounds. There was more shade on the island than I expected. The trees were, in many cases, large though scrubby, but they prevented sunburn.

Within forty minutes of landing, we had the first rig operating. Since I was the one who had been sick all night and was weak as a result, I had the honor of making the first contact. While Tony, AD0P, was setting up the generator, some of the other fellows strung a 20 meter dipole near the sea. About 40 yards back from the sea, the first rig was tuned up and set on a shipping crate for a table. I came on 14.205 MHz at 1645Z on November 26, 1978 and announced that Navassa Island was on the air. Immediately, it sounded as though the entire ham population was callng. The first contact was W4PTH. I took just a moment with the first station to verify time and to check my signal. Then I went QRZ listening up 5 to 10 kHz. From that point on the log books began to be filled. The 15th station I worked was K0DQV near my home QTH. I asked him to call all the XYL's and advise them we had arrived safely and were on the air.

For several hours to follow, in the 90°F sun, the equipment and supplies were transferred from the boat to the island. This was a very exhausting exercise for the fellows. Our cargo consisted of 2,000 pounds. A pully was rigged on the cantilevered catwalk, and cargo was hoisted in about 100 pound increments. It had been a long hard ride all night, and by now the heat, lack of food, and tasking work were taking their toll.

The next two stations were set up

Nearly 2,000 pounds of equipment and supplies ready to be shipped. Left to right are Tony, ADØP, Dave, WØRJU, Randy, NØTG, Myron, WØZH, and Joe, NØWL.

The shipping crates were designed so that they could also be used as operating desks. Here Randy, NØTG, operates the simulated setup on ARRL Field Day as a test prior to the DX-pediton. Equipment used was the same as that used for the DXpedition so that all problems could be anticipated and solved before the DXpedition.

next to the first station. We referred to this site as the lower site. It was about 40 yards inland from the sea. Three stations ran most of the time. The lower site was also our camp and living area.

Within 2 or 3 hours after the first station was completed, the next two stations were set up. Initially, dipoles were strung for all bands. Later in the afternoon, the tri-band beam was erected.

I'm not sure what the line-up was, except that it seemed stations were ready for us and the pile-ups were fierce. After an all-night, sleepless, seasick boat ride and working in the hot sun all day getting this site set up, everyone was very tired. The excitement, however, was so high the fellows did not even take time to eat. Finally, the day neared an end. Some of the fellows were eating, others operating, others resting, and each trading-off these various activities with one another. Plans were made for the journey the next day to the top of the island to set up the fourth station.

The next morning, several fellows under the leadership of Dave, WØRJU, went to the top of the island to select a station location. The climb to the top is very rugged, climbing about 200 feet over a distance of one-quarter mile.

A tri-band beam was erected at the top site. The station there operated 98% c.w. throughout the DXpedition. The station opened up on 20 c.w. by Dave, WØRJU. It was chaos. They were there waiting for us. All morning we worked the U.S. crowd. During the afternoon, we switched to 10 meter c.w., working a combination of U.S. and European stations.

Although none of us had any experience or equipment for OSCAR, there was a plea by the satellite users for us to activate OSCAR for a new country first-time-ever operation from Navassa. Bud, W6VPH, graciously loaned us the antenna and equipment. While we were persistent, we found the OSCAR operation to be a very difficult challenge. Thanks to Jon, W6OIG, who hung in there pass after pass, 33 stations worked Navassa. The first contact was made with W9MXC. This was accomplished on OSCAR 8 Mode A.

Prior to the DXpedition the 6 meter enthusiasts noted the increased openings on 6 meters. Navassa had never been activated on 6 meters. Joe, W2ORA, coordinated the 6 meter effort with the SMIRK organization who loaned us the 6 meter gear. Unfortunately, the band never opened the week we were there. Only one contact was made back to Jamaica on 6 meters with 6Y5RS. Joe gave it everything he could but just could not make propagation. Daily, Joe would call CQ to no avail.

Throughout the week the pile-ups on the h.f. bands were constant for the most part. A good deal of the time it was necessary to operate split frequency so that calling stations would not cover up our signal. I would guess our signal was not strong most of the time, since we took no linears and generally used dipoles. The rigs ran about 180 watts p.e.p.

A few times, when calls slowed down, I tried moving from the traditional DX frequencies in the Advanced Class frequency spectrum up to the General Class section. I could never get a pile-up started, and most of the fellows wanted to rag chew rather than make quick signal report exchanges.

The entire DXpedition went very smoothly. All of the equipment performed flawlessly. Except for the loan of an Atlas 350-XL by Atlas Radio, all other h.f. equipment was personal equipment.

Being aware of some of the QRM problems and heckling other DXpeditions experienced, we adopted several operating techniques that seemed to keep the restless ones relatively quiet. These procedures included giving the call sign after every contact, giving the other station's call sign clearly, providing QSL information often, and defining our listening procedures often. When we worked stations by districts or areas, we sensed the importance of giving equal time to each area and not deviating one iota from the announced procedure.

After 6½ days of operation the following statistics evolved:

Band	C.W.	S.S.B.	Total
6 meters	–	1	1
10 meters	1,431	3,577	5,008
15 meters	1,833	3,460	5,293
20 meters	2,861	4,672	7,533
40 meters	1,518	634	2,152
80 meters	554	1,531	2,085
160 meters	189	9	198
OSCAR	–	–	33
TOTALS:	8,386	13,884	22,303

C.W. = 37.6%
S.S.B. = 62.4%

Upon my return home I had the overwhelming experience of seeing how much mail from those requesting QSL cards had already arrived. Little did I realize at that time that for days to come over 500 pieces of mail per day would be delivered. Needless to say we got to know the postman very well. Even to this day, over a year after the DXpedition, about 20 requests for QSL cards come in every week.

It is a pleasure to send a confirmation, but I would like to express that it also can be very frustrating at times. Literally hundreds of QSL seekers list wrong GMT times on the card, other hundreds list local times rather than GMT, hundreds list the wrong date, others do not send s.a.s.e.'s. As I would give up trying to find a contact in the log, many many amateurs can thank my XYL, Sue, for an untiring, dedicated effort to confirm the contact by searching the log from cover to cover. I must admit that we underestimated the task of completing the QSLing chore. It took about five months to work the back log. We appreciate everyone's patience on this matter.

Our sincere appreciation is hereby expressed to the following organizations who directly supported the DXpedition: Atlas Radio Co., Northern California DX Foundation, Long Island DX Association, McDonnell Douglas Amateur Radio Club, Virginia Century Club, Rookies Amateur Radio Club, Southeastern DX Club, St. Louis Area Teleprinter Society II, St. Charles Missouri Amateur Radio Club, Egyptian Radio Club, Gateway Chapter Ten-Ten International, Suddeutche DX-Gruppe, St. Louis Suburban Radio Club, Mid-Mo Amateur Radio Club, SMIRK, Mississippi Valley DX and Contest Club, and the organized Japanese support via JH1VRQ.

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Postscript—Navassa Update

The following report on the geopolitical aspects of Navassa was received after Part I of this article appeared. While some of you may be aware of the HHØN operation and may even have worked them, most of us were unaware of the events leading up to it. This special report was compiled for CQ *exclusively.*

"It all started our innocently enough at a Radio Club of Haiti meeting in Port-au-Prince, when several young amateurs, in December 1980, decided to set up a DXpedition on Navassa. Bernard Rousseau, HH2B, Bernard Montes, HH2BM, Reginald Chauvet, HH2CR, Robert Gaillard, HH2JR, and Daniel Gregoire, HH2PW, made plans to go to Navassa in August.

"The group went through the generally accepted channels of applying to the U.S. Coast Guard for permission to come to the island (a dangerous approach by boat requires Coast Guard authorization), and the group also made application to the FCC for reciprocal calls. Both requests were being considered in the States.

"Suddenly, for reasons still unknown, the entire DXpedition became a political football, and from the original plan of an innocent and exciting trip, it took the grim image of a unilateral declaration of Haiti's sovereignty over Navassa. Haiti's President-for-Life, Jean-Claude Duvalier, authorized Haiti's air force to provide not only military helicopters to the group for transportation, but also his own, personal million-dollar executive helicopter. He authorized military pilots, and he also authorized the Haitian equivalent of the FCC 'CONATEL' to issue a Haitian call to Navassa and ignore the US-issued prefix. Mr. Antonio Rimpel, Director-General of CONATEL, responded to this executive order by assigning HHØN to the Haiti amateurs, who, in their newfound support and the heady experience of the commitment of the Haitian government, gruffly told foreign amateurs during QSO's preceding the expedition that 'We don't have to get US Coast Guard Permission, and we don't care what the ARRL thinks. This is a Haitian island.'

"With a flurry of publicity, the group, together with a camera crew from the government-operated 'Television Nationale,' assembled at the Port-au-Prince, Bowen Field Military Airport Saturday, July 18th, and loaded themselves and their gear aboard the aircraft for the easy, ½-hour flight. After making several passes about the island, to enable the TV crew to videotape the event, the helicopter descended and landed. Shortly after, another helicopter also landed, this one bearing the insignia 'US NAVY' on its side. Two Marine officer emerged, approached the Haitian group, and politely asked, 'Is this a scientific expedition?' The Haitians responded, 'Yes it is,' whereupon the American officers requested and obtained the names and addresses of all the Haitians. Wishing them luck, the Navy helicopter took off to a somber, gray missile carrier cruising just short of the horizon near the island.

"The Haitians, immediately following the departure of the US helicopter, hastily erected a large Haitian flag and proceeded to set up their equipment. During the claimed 8K contacts, the group frequently injected that the DXpedition was operating from the 'Haitian Island of Navassa.' The DXpedition closed down the following Saturday, and without incident, the Presidential helicopter returned the group to the capitol where they were met with much joy and embracing by other Haitian members of the Radio Club of Haiti, all of which was duly recorded on TV and shown to a wide audience the following week with the 'voice-over' always leading with 'The Haitian Island of Navassa.'

"It is not within the realm of this magazine to discuss who actually owns Navassa, or other political implications of the trip. It is unfortunate that amateur radio was, for one of the first times in history, 'used' for a political gambit.

"The American Embassy in Port-au-Prince, through its Political Officer, Jean Soso, decries the 'method' of establishing a claim by Haiti. 'The ownership of the Island of Navassa is still exactly where it stood before the trip,' she said.

"A group of amateurs certainly does not take the place of diplomatic negotiation over a disputed territory, and it is unfortunate that amateur radio was a pawn through this politicalization of a DXpedition."

The fancier the machine, the bigger . . . and funnier . . . the problems!

Taking Down The Repeater

BY EDWARD D. HESSE*, WB2RVA

"Well, Ernie, it's been great chatting with you like this."

"You're right, Joe. Charlie's repeater has pretty good coverage, as well as a good group of guys checking in. I enjoy being one of his control operators."

"Yeah, thanks to people like you, we've got the services of the repeater—covers all of Bugville as well as way out of town."

"And don't forget all the little things Charlie's got on this repeater, like autopatch, 10 meter link, weather information, and a lot of cute voice ID's. Well, Joe, I'm gonna shut it down now. It's kinda quiet, and I've got some things to do. We'll be talking with you some other time."

"Fine business, Ernie. I'll clear with you and let you take 'er down. WB2QRP, this is WB2QST clearing on WR2RPT. 73, Ernie."

"73, Joe. WB2QST, this is WB2QRP closing down WB2RPT."

Beep . . . beep . . . beep.

"Sounds like it's still up, Ernie. Carrier's still in there."

"You're right. Charlie keeps changing the touch-tone codes to keep the jammers away. I mislaid the most recent list of codes, but I think I can figure it out. Let's try this one."

Beep . . . beep . . . beep.

Hi, guy. Welcome to Charlie's place—WR2RPT, the hot spot of ham radio in Bugville. Five - two - zero on the dial. Come visit, anytime.

"Who was *that*, Ernie? Wow, what a sexy voice!"

"That was one of Charlie's ID tapes. Don't know exactly who she was."

"Well, it sure wasn't his sister or mother, I can tell you that."

"No comment. Let me try another combination of numbers and see if we can get this thing off the air. WB2QRP shutting down WR2RPT."

Beep . . . beep . . . beep.

. . . Heavy showers tonight, with strong easterly winds. High tide at Bugville Shores will be nine o'clock . . .

"In case you're wondering, Joe, that was Charlie's weather access. Kinda handy when you want to know what's coming. Let me try again and see if we can get this machine off the air."

Beep . . . beep . . . beep.

"I hear a dial tone, Ernie. Guess you brought up the autopatch."

"Yeah, guess I did. While it's up, is there anyone you want to call on the phone?"

"No, thanks. We're in the shack with the phone right here."

"Okay, let's try to really get this thing off the air. A few more numbers on the touch-tone pad and let's see where we go."

Beep . . . beep . . . beep.

"I think you brought up the autopatch again, Ernie. I hear a phone ringing."

"Oh, oh. I hope it's not what I think it is. I hope it's not the automatic dial of 911."

Bugville Police Department, Sergeant O'Kelly speaking.

"It's what I feared . . ."

Hello, who's there. What do you fear?

"Sorry, sergeant, we dialed you by mistake. We'll just say 73."

What's the address? 73 what?

Beep . . . beep . . . beep.

"I hope Charlie's not listening."

"Roger. If he is, I'll be one of his ex-control operators. Well, let's try some more numbers."

Beep . . . beep . . . beep.

"Are you out there, Joe?

"Joe, are you there?"

"Can you copy me now, Ernie? I'm on the output frequency."

"Why are you there?"

"I think you put it in PL, Ernie. I don't have PL in the rig, so I came in on the output. Try another beep . . . beep . . . beep."

Beep . . . beep . . . beep.

"How's it now, Joe?"

"Well, it's not down, but it's out of PL. You're getting there."

"Gotta get this repeater off the air. I've got things to do. One more time. Here we go."

Beep . . . beep . . . beep.

. . . so, Jack, we're just coming up to the toll booth at exit 14, and we'll send it back to you.

"Where did *he* come from?"

"I think you brought up the link over in Mudville, Ernie. We generally don't hear them unless someone brings up the link."

"Wow, let's get rid of the link real quick. Those Mudville people never cared for us since Casey got struck out by our pitcher.

"Let's try these numbers, Joe."

Beep . . . beep . . . beep.

Yes, old man, we are having a beautiful day here on Kaponga Reef. An old friend flew in for an hour's visit and we're using a 10 meter f.m. rig he will be taking back with him in about 10 minutes. Amazing how quiet 10 meter f.m. is here on Kaponga . . .

Beep . . . beep . . . beep.

"Don't know what that was all about. Some guy down by the beach parkway, I guess."

"Ernie, that was Kaponga Reef, the rarest DX in the world! You brought up Charlie's 10 meter link. Bring it back! Holy Smoke, *Kaponga Reef*!"

"Okay, we'll try again. Let's see—10 meter link. Let me try these numbers . . ."

Beep . . . beep . . . beep.

This is WR2RPT, now going off the air. We hope you like the services provided by Charlie, owner and trustee of the repeater. Count down with us! Ten . . . nine . . . eight . . .

"Ernie, it's going off the air. Get the 10 meter link *please!*"

"We're trying. We're trying."

Beep . . . beep . . . beep.

Seven . . . six . . . five

"Ernie, that didn't work! Try again *please*. Kaponga, Kaponga, do you copy WB2QST?"

Beep . . . beep . . . beep.

Four . . . three . . . two

"Ernie, one more shot at it *please!* I gotta work Kaponga Reef!"

"Think I got it this time, Joe. Yeah, I'm sure of it now."

Beep . . . beep . . . beep.

Hi, I'm Gwendolyn, and you just accessed my Daddy's repeater. He's Charlie, owner and trustee of . . .

"A-a-a-a-g-g-g-h-h!"

"Guess that was you, Joe, and not the guy on Kaponga. QRX a minute while I make a land-line to Charlie. If he's home, I'll get the new list of touch-tone numbers and . . ." ■

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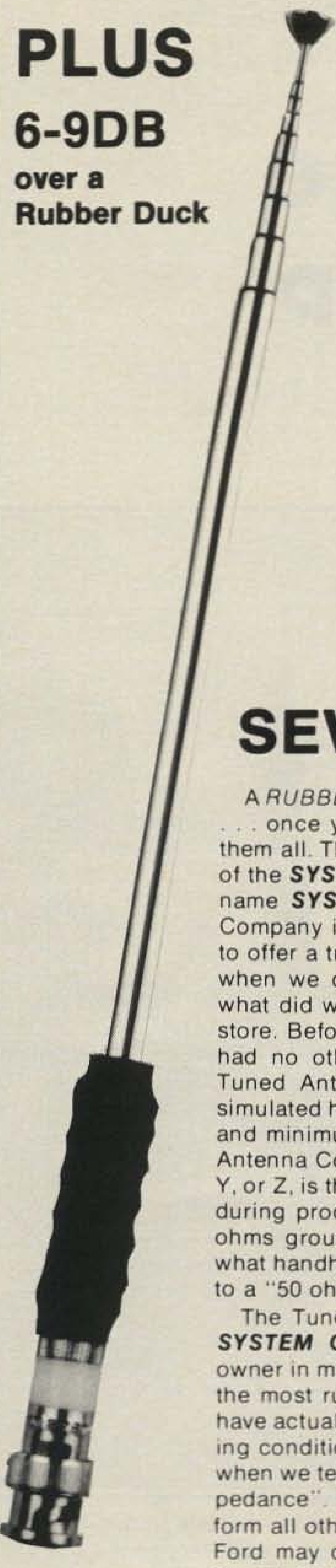

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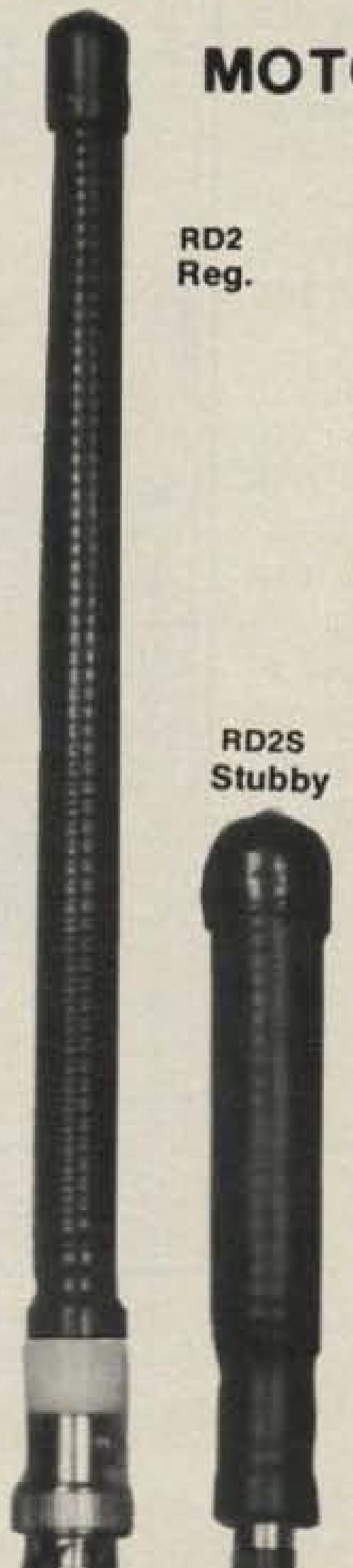

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CIRCLE 84 ON READER SERVICE CARD

Here's an interesting little device that will help you operate more efficiently until you fully automate your station.

Taking The Chore Out Of Tuning-Up

BY JOHN J. SCHULTZ*, W4FA

Someday, of course, all of us will have completely automatic stations where not a single knob or switch has to be manually manipulated. But, in the meantime, most of us are confronted by a multitude of knobs and switches that have to be manipulated during QSY operations. The numbers of such knobs and switches will vary from station to station, but many amateurs would be surprised how many are involved if one were to systematically list them. Also, if one made a real analysis of the situation by pretending to be an efficiency expert for a moment, one would be surprised at the average time consumed in making a few QSY's both within and between bands.

The little accessory described in this article will not provide an instant QSY capability for a station. But, it has been tried in a number of station installations in different forms and has been shown to take a considerable portion of both the physical chore and time requirement out of QSY operations. One might seriously like to consider investing the time necessary to build the accessory in return for the savings in time and effort achieved over a continuing, longer period of time as one continues to operate a station.

To make tune-up easier, one obviously has to consolidate the operations necessary. For the usual h.f. installation, tuning-up might involve the following sequence:

1. Reduce drive or carrier level prior to going into transmit mode.

2. Change mode switch to tune position or perhaps c.w. position.

3. Switch into transmit mode.

4. Adjust various tuning controls on transceiver, linear amplifier, or antenna tuner as drive or carrier level is slowly increased.

The tune-up circuitry described is housed in the small control box shown in the foreground. The control box also has some other handy features as mentioned in the text.

5. Return to receive mode, possibly reset transmission mode switch.

There is not much that one can do about step 4, above, unless a station is completely redesigned. But, most of the other steps can be "pulled together" so one is not reaching for various different switches or controls. The concept for doing this is shown in fig. 1. An audio oscillator is used for variable "carrier" level insertion in the s.s.b. mode as its output level is varied and fed into the microphone input of a transceiver (of course, it is not true carrier level control, but a single sine-wave audio signal fed into the microphone input of a transceiver will produce

*c/o CQ Magazine

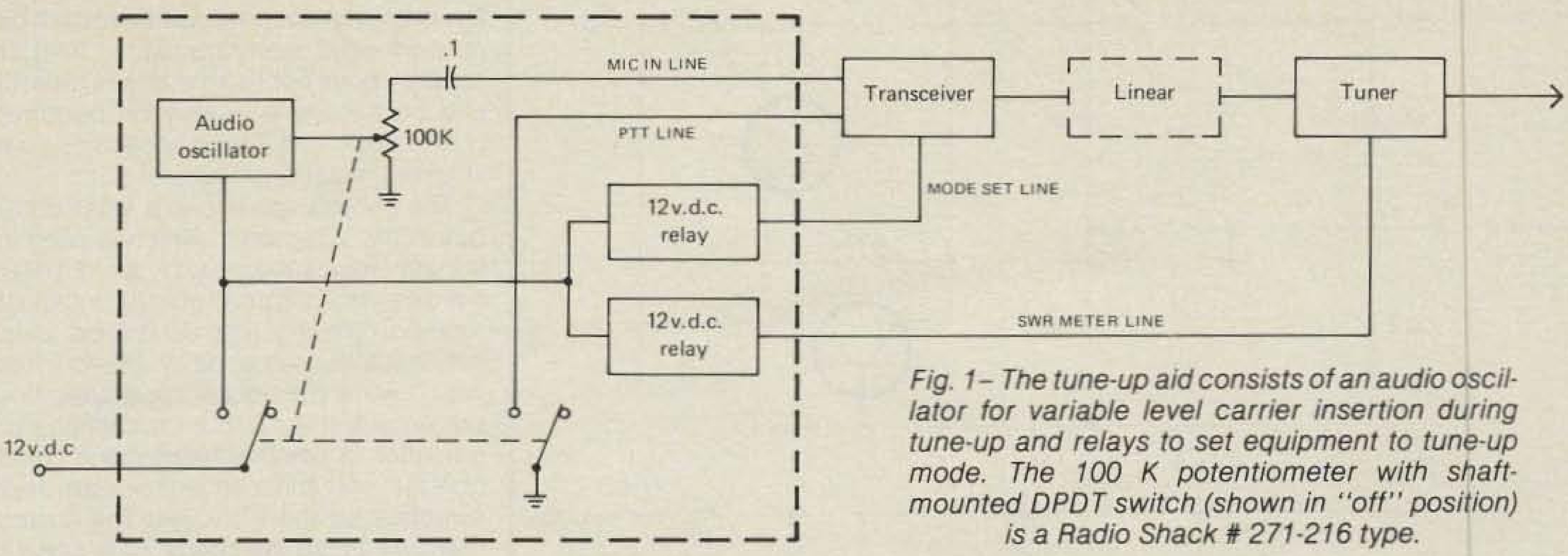

Fig. 1– The tune-up aid consists of an audio oscillator for variable level carrier insertion during tune-up and relays to set equipment to tune-up mode. The 100 K potentiometer with shaft-mounted DPDT switch (shown in "off" position) is a Radio Shack # 271-216 type.

a c.w. signal varying in amplitude linearly with the level of the audio signal). The potentiometer which controls the output level of the audio oscillator has a shaft-mounted DPDT switch. When the control is turned "on," one section of the switch activates the PTT line, and the other section both turns on the audio oscillator and activates one or more relays. As shown, one relay might be used to always set the transceiver in the s.s.b. mode. Of course, this function is superfluous for those who only operate s.s.b. The other relay is used to set the s.w.r. meter in a tuner (or an external one) to maximum sensitivity in the reflected power position or in the forward power position. The latter switching depends to a degree on the type of transmitting equipment being used. When using completely solid-state, no-tune equipment, the only unit left to be adjusted is an antenna coupler, and that adjustment is always made for the lowest s.w.r. (minimum reflected power). With some tube-type equipment one often prefers to have the s.w.r. meter set for forward power and make adjustments for a maximum forward power reading.

In any case, one now has a single knob control for several functions. When the control is turned on, the "ersatz" carrier level is at a minimum, the transceiver is set in the s.s.b. mode (if necessary), and the meter switching is ready for tune-up. As the carrier level is increased, the necessary tuning adjustments are made. Returning the control to its "off" position returns the transceiver to the receive mode and the carrier level to minimum for the next tune-up. What all this means in a practical installation is that if the station equipment is conveniently arranged, one can control the carrier level with one hand while making tuning adjustments simultaneously with the other hand. It really is amazingly quick and easy.

The practical realization of the circuitry to accomplish the concept shown in fig. 1 is not difficult. The relay functions basically just parallel the necessary switch contacts found in a transceiver or s.w.r. meter/tuner to accomplish the desired operation. A study of the schematic of a piece of equipment should readily show how this can be accomplished. The relays, of course, should be mounted in the piece of equipment where the switching is being done. In almost all cases only a light capacity relay is needed, and a miniature 12 v.d.c. type such as the Radio Shack RS 275-003 is ideal.

As for the audio oscillator, one can possibly find a module type that is satisfactory, or can easily assemble one from components. In any case, the oscillator must absolutely be of the single-frequency type with very low distortion. Two suitable circuits are shown in fig. 2. Both produce a single tone of about 800-1000 Hz (depending upon the tolerances of the components used). The circuitry at (A) is built around a Twin-T frequency determining network and requires no adjustments. Its distortion should be around a few percent. The circuitry at (B) is that of the usual phase-shift oscillator. An adjustment is provided so one can set the oscillator for minimum output distortion, but to do so one should have access to a good oscilloscope or preferably a distortion analyzer. The zener regulation shown is also necessary if the output distortion is to remain at a minimum while the main supply voltage might vary. Note also that the circuits contain filtering for r.f. protec-

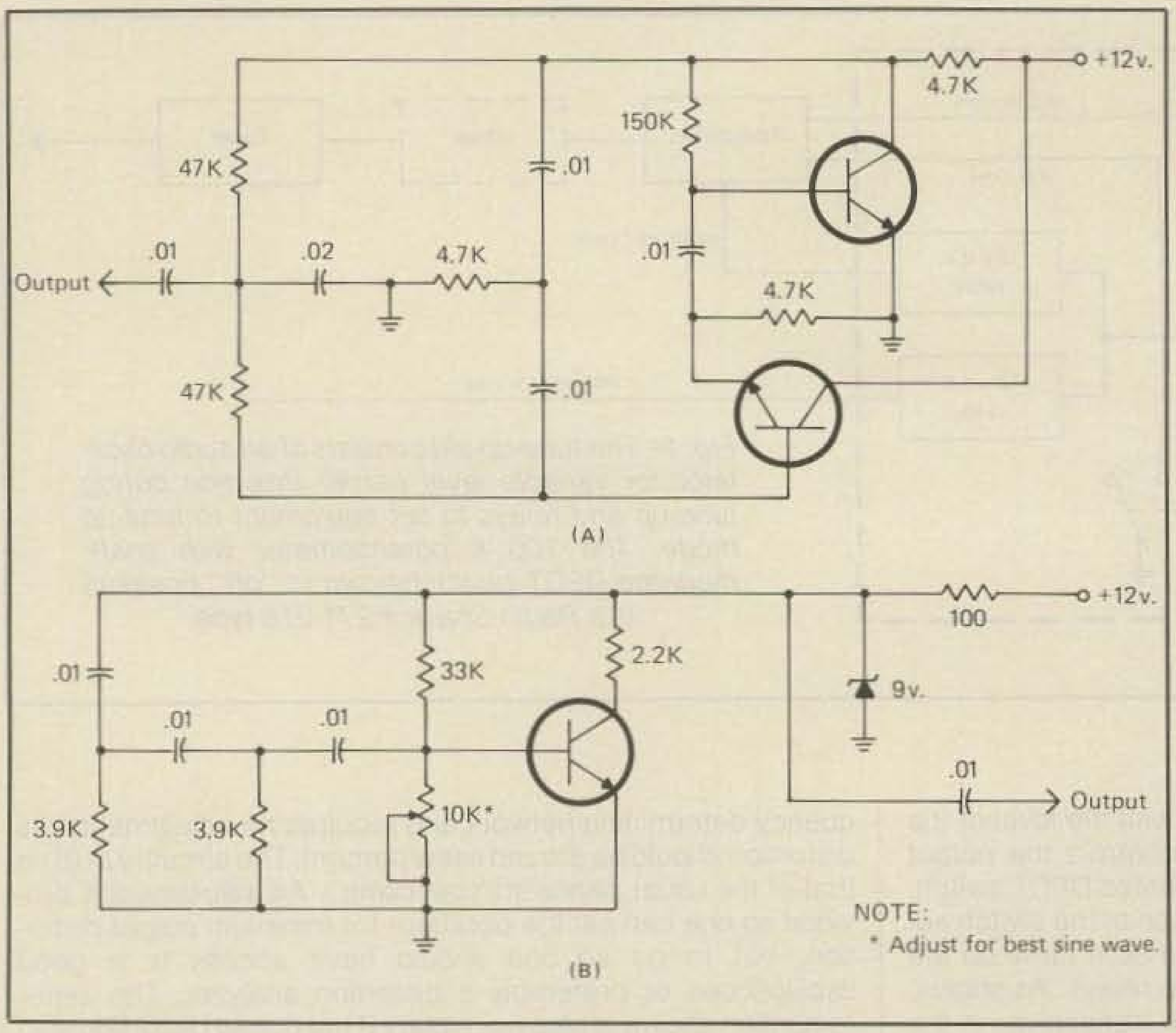

Fig. 2– Two simple, fixed frequency RC sine-wave oscillators, either of which would be suitable for use with the tune-up aid. A Twin-T network is shown at (A) and a phase-shift type at (B). Both should be shielded, and miniature RFC's (500 uh to 1 mh) should be placed in series with the output and supply leads. All transistors are Radio Shack 276-2013 or the equivalent. All capacitors are Polystyrol type (do not use ceramic).

tion, since the whole value of building a low distortion oscillator will be lost if it cannot perform properly in a high r.f. field. The circuitry does not require any PC board. It can be assembled easily on perforated board stock and then placed in any well-shielded metal enclosure.

The photograph shows a small control box in the foreground which is used in a station installation with an FT-107M transceiver. This control box contains the tune-up circuitry just described, plus it consolidates some other station items which were previously separately housed. Among them are a microphone preamplifier, a speaker/headphone volume control, and the necessary scan mode switches for the FT-107M. The arrangement of these functions in a separate control box has proven to be very handy during station operation, since one then has one hand free for tuning the transceiver's main dial, while the remote volume control allows quick adjustment as stations of varying strength are encountered. Or, if the remote scan switches are used for tuning, one then has the other hand free for features such as selectivity adjustment on the transceiver. The complete diagram of the control box is not presented, since it is tailored to a specific transceiver. But, if one does build the basic tune-up accessory described, one might give some thought to designing a similar control box tailored to one's own installation.

You still have enough time before the Contest to put one of these together and get in on the fun.

A Quick and Easy 160 Meter Antenna (With Multiband Capabilities)

BY DAVE INGRAM*, K4TWJ

The 160 meter band has traditionally been one of amateur radio's more fond links with both classic-style amateur activities and relaxed on-the-air casual operating practices. Indeed, a nostalgic ring straight from the golden age of yesteryear is almost perceptible in the static bursts and noise rumbles on this unique amateur band.

The recent frequency expansions and increase of power levels affecting 160 meters promise to escalate future interest in this band. The newcomer to "Top Band," however, should remember to study current 160 meter allocations for his particular area before blindly jumping into action near some possibly taboo frequency range. In addition to the few remaining restricted areas of 160 meters, all U.S. amateurs should refrain from transmitting in the "DX window" situated between 1825 and 1830 kHz. Foreign stations employ this "window" for transmitting a clear signal, while specifying their receiving frequency (which usually falls between 1800 and 1825 kHz). An adopted "gentleman's agreement" for the range of 1800 to 1825 kHz separates c.w. activity in the 1800 to 1812 kHz range and s.s.b. activity in the 1812 to 1825 kHz range. Could there be any justifiable doubt as to the more recent regeneration of enthusiasm for this lowest frequency amateur band? We might simply suggest try it; you'll surely like it!

The Top Band Radiator

The dilemma of erecting and tuning an efficient antenna for 160 meters can be an overwhelming obstacle for many amateurs. Verticals are the preferred radiators, but their height and physical construction create problems for the amateur with restricted time and finances. Longwire antennas, however, provide a very acceptable compromise, particularly when at least one quarter of their overall length is vertically polarized.

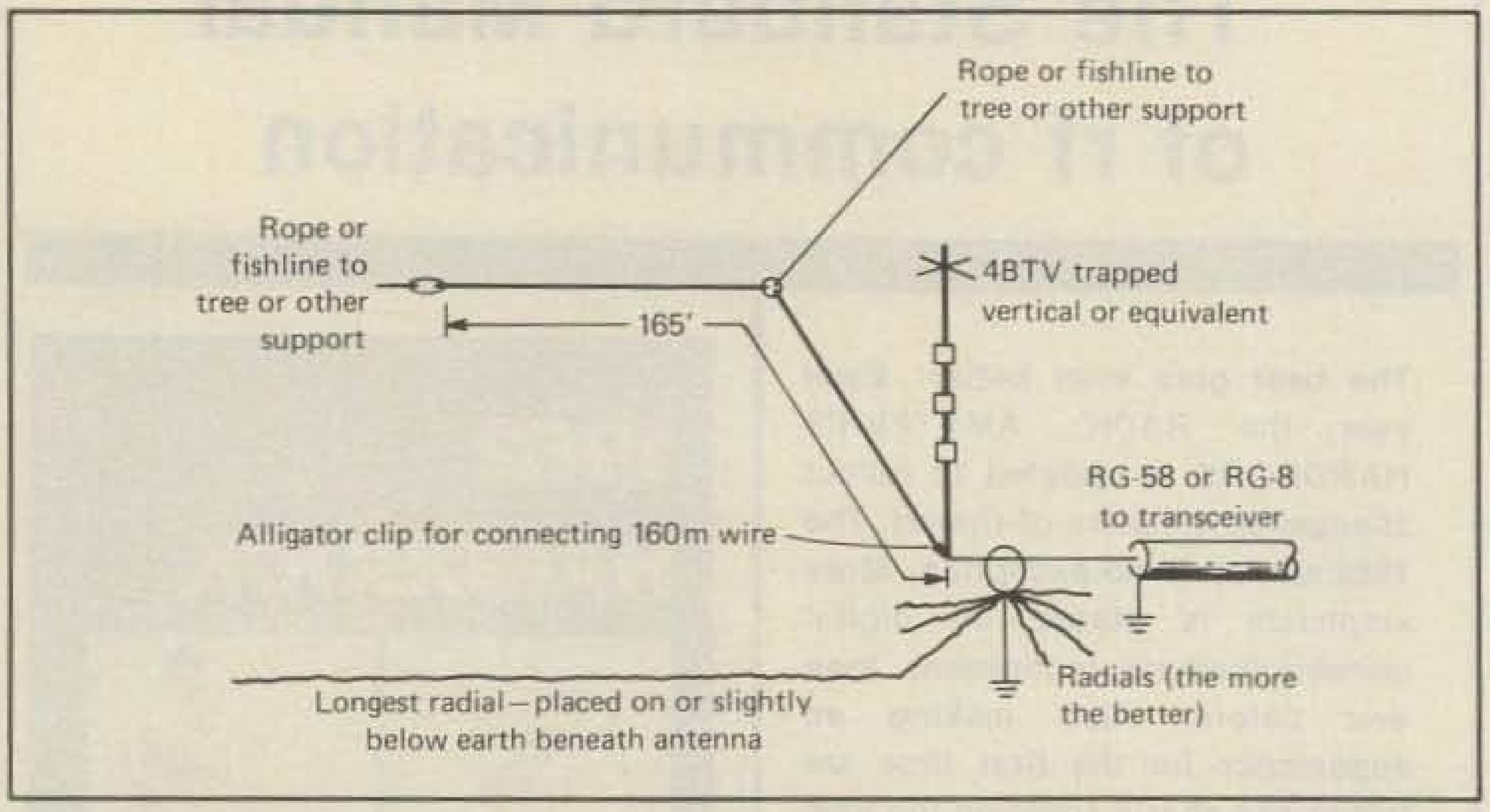

Fig. 1– The quick and easy 160 meter antenna starts out as a multiband vertical radiator. The addition improves overall antenna performance. A 365 pf to 750 pf variable capacitor can be inserted between the alligator clip end and the vertical radiator if tuning problems are encountered. Note that the vertical mounts on a ground rod, but the radiator is insulated from the ground proper.

The 160 meter antenna described in this article is a cross-combination of the popular W1BB inverted L and a reduced-sized vertical antenna. The idea was conceived out of necessity (getting an efficient radiator up and tuned within a mere hour's time before the annual *CQ* 160 Meter Contest), yet the creditable performance has resulted in permanent use of the antenna by myself and several other amateurs. A sketch of this simple antenna is shown in fig. 1. An approximate 165 foot length of antenna wire is erected with as much of its length as possible situated in a vertical or semi-vertical position. The horizontal section's end is affixed to an insulator and supported by a nearby tree, tower, etc. The vertical section's end (which, in the W1BB design, connects through an approximate 750 pfd variable capacitor to a 50 ohm coaxial cable) is then connected to the feedpoint of a multiband vertical antenna. Since the vertical's associated coax cable and ground system is thus utilized, the 160 meter antenna construction is complete. If tuning of the 160 meter is required, the wire's length should be varied at the feedpoint (point of connection to the vertical antenna). An s.w.r. of 1.4 to 1 or less should be obtainable at the resonant frequency (*example:* 1820 kHz), with reasonable frequency excursions causing s.w.r. rises of less than 2 to 1 (example 1801 or 1840 kHz). The vertical antenna used in my particular case is the Newtronics 4BTV 40 through 10 meter trapped antenna, ground mounted with approximately 25 radials of approximately 30 foot length (not the most effective radial system, but the best I can presently muster).

It should be realized that the overall effectiveness of any vertical antenna, and any 160 meter antenna, is directly related to the ground system utilized. A single 6

*Eastwood Village No. 1201 So., Rt. 11 Box 499, Birmingham, AL 35210

foot rod or mere connection to a cold-water pipe isn't sufficient. Radials of at least a quarter wavelength for the lowest frequency should also be used (the more the better!). Any kind of wire can be used—old guy wires, old antenna wire, hookup wire, unwound transformer wire, etc. Metal objects lying on the ground, such as tin sheets, old TV antenna, etc., can also be connected to the radials' ends for more "surface area" (burying those objects is also worthwhile). At least one of the longest radials should be placed below the 160 meter antenna's horizontal section. This wire doesn't necessarily need to be buried; it may be laid on the ground proper (don't insulate this wire from earth, however).

The 4BTV vertical used in my particular case isn't a set-in-concrete prerequisite for the 160 meter radiator. A 20, 15, and 10 meter vertical was also tried and used with similar results. Since exciter-only power levels are used on 160, and the verticals tried were rated at 2 kw, no trap degraduations were experienced. The prime key to this antenna is thus to open-mindedly experiment with what you have available, and use an indoor antenna tuner should the s.w.r. rise above 2 to 1 (we've seldom encountered this).

Installation Notes

One of the quickest and easiest ways of erecting this antenna involves the careful use of a slingshot or "wrist rocket." After a few practice shots, tie a lightweight fishing line onto a metal object and shoot it over the desired tree limb. Next tie the fishing line to the antenna wire and pull it into position. A desirable length for the wire's vertical section is 45 feet; however, vertical lengths of 25 feet have produced good results. The antenna should, naturally, be situated as high and in the clear as possible. A slight amount of directivity in the direction of the wire's horizontal length will be noticed with this antenna. The directivity isn't substantial; however, its existence may assist consideration of antenna location.

Summary

The 160 meter antenna described in this article has proven itself through both local and DX contacts on "Top Band" (we filled several log sheets with 1000-mile-plus QSO's during the antenna's first weekend of use). The over-one-quarter wavelength employed (165 feet) allows easy impedance matching and tuning. As an extra bonus, we found the 160 meter wire could be left connected to the vertical during 20 and 15 meter operations (it actually helped!). Operations on other bands required removing the 160 meter wire. Although we haven't tried applying this extended-quarter-wavelength wire idea to 10 or 20 meter whips for 40 or 80 meter activity, the possibility holds merit. Here's hoping you enjoy the simple skywire, and it brings good DX returns!

Here's a simple, stable, bandswitching (if desired), wide-range, v.f.o., using easily obtainable parts.

The Franklin V.F.O.— With JFETS

BY JAMES D. PARK*, VE7IW

Sooner or later, everyone building and experimenting with radio-frequency electronic circuits comes up with a requirement for a good variable-frequency oscillator (v.f.o.). Whether it's in a transmitter, receiver, or piece of esoteric test equipment, the main electrical requirements are the same.

Some time ago, I was faced with the necessity of building a v.f.o. to drive a QRP, solid-state, c.w. rig. Along with the usual requirements of a v.f.o., the design had to be reasonably cheap and simple. Even more important, the v.f.o. had to have direct output on two or three bands, as there was no frequency multiplication in the little c.w. rig.

Over the years, a great many r.f. oscillators have flowed from the basement workshop: Armstrong, Hartley, Colpitts (series and parallel resonant tanks), Vackar, etc. Building a v.f.o. can still be a great deal of fun, but it's nice to try something different for a change.

Back in the days of tubes, an oscillator called the "Franklin" enjoyed a period of popularity. It usually employed a high-mu duo-triode, with the positive feedback loop around both amplifier stages. The advantages of the circuit included very loose coupling between the oscillator parallel-resonant tank circuit and the triodes, made possible by the cascaded gain of two oscillator stages. Getting the required 360-degree phase shift for oscillation by using two common-cathode stages eliminated having a feedback network connected directly across the tank circuit and partially controlling its resonant frequency. Resistive loading of the triodes gave cheap, simple, fairly broadband circuits.

For years, this general scheme was used in high-quality audio oscillators, such as the Wein Bridge, Bridge-T, etc., but it was far less often used at radio frequencies. It is, of course, a natural!

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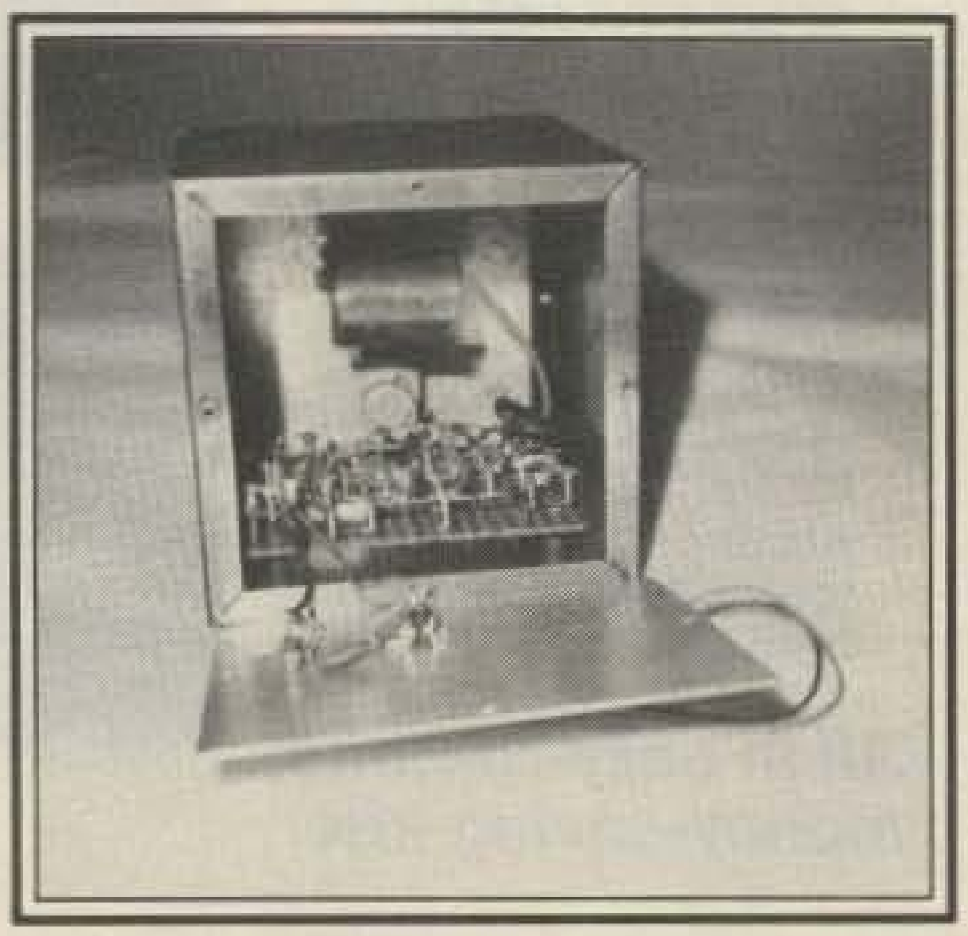


An interior view of the Franklin v.f.o. showing the tank coil on top and the Vector board construction below.

Experimentation

It was decided to use N-type JFETS as the active devices in the v.f.o. and to include a buffer stage. The high input Z of the JFETS makes for circuit simplicity and minimizes loading of the tank circuit and the following stages. Some type 2N5163's were on hand and, having given excellent results in many different oscillator circuits over the years, were put into service once again.

A few preliminary experiments indicated it was possible to run the first and second 2N5163 stages with supply voltages between 12 volts and 18 volts (with collector voltages of at least 8 volts), individual collector currents in the low-milliampere range (2 to 5 ma), and, in a cascaded, common-source amplifier, have an overall voltage gain greater than 100 times. (Maximum d.c. power input to either JFET was 40 milliwatts.) As one of the chief requirements of any good v.f.o. is to always limit the power input to the oscillator tubes, bipolar transistors, or JFETS to the minimum, compatible with easily-sustained oscillation, the preliminary tests were encouraging. See fig. 1.

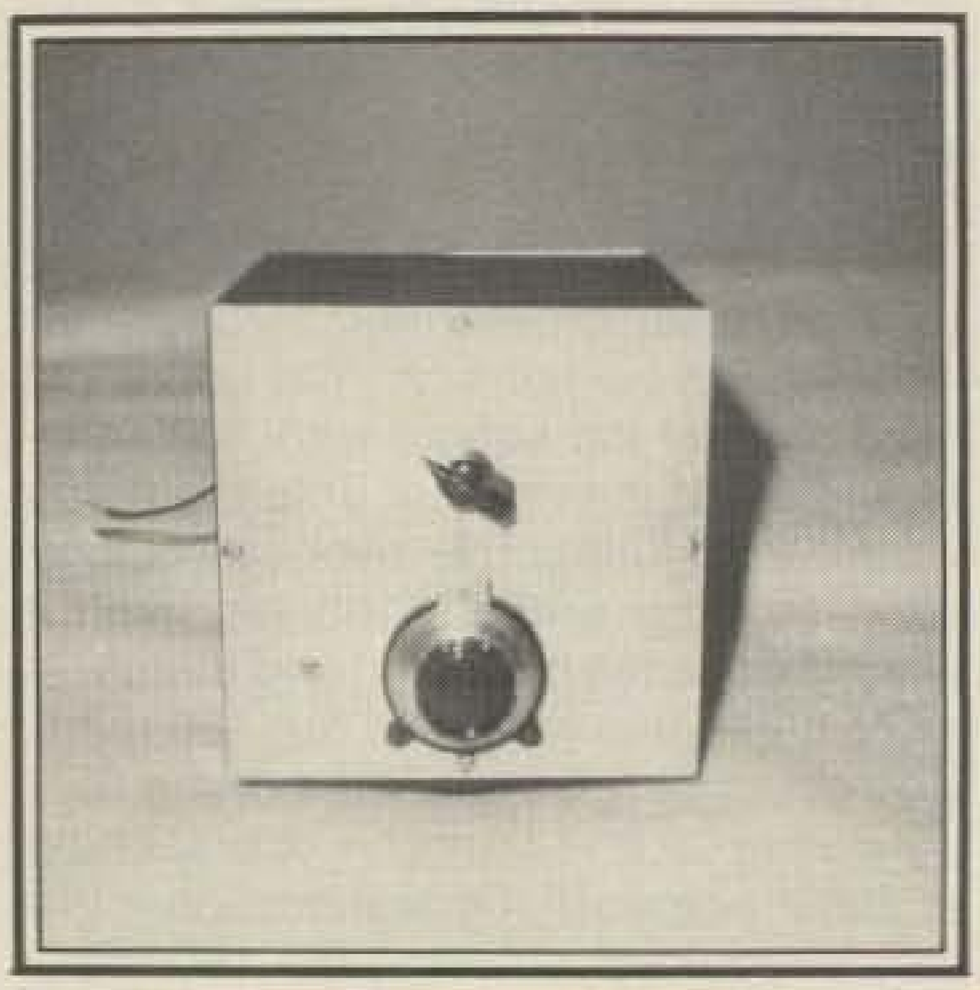
The range of practical collector load resistors ran from about 1.5K to 3.3K. The source resistors necessary to keep the collector currents down in the 2 ma to 5 ma range ranged from 470 ohms to 680 ohms, depending on the operating characteristics of the individual JFETS.

Now, to test the circuit for use as a high-frequency oscillator, it was only necessary to install a high-Q, parallel-resonant tank circuit between the gate of Q1 and ground, and to connect the positive-feedback loop from the collector of Q2 back to this same tank. To give a little latitude for experimentation, the feedback capacitor from Q2 to the tank and the coupling capacitor from the tank to the gate of Q1 were, temporarily, air-dielectric variables. See fig. 2.

The tank circuit was tuned to 80 meters and power applied to the circuit. It oscillated vigorously immediately. The variable feedback and coupling capacitors were then adjusted until they were at minimum capacity. The circuit still oscillated, and at this point, the variable capacitors were replaced with high-stability, tubular ceramics of 2 pfd each.

It had been decided to operate the JFETS class A for minimum output waveform distortion and, therefore, low harmonic content.

Long-term frequency stability on 80 meters was comparable to a tube-type s.s.b. transceiver used as a monitor. Out-



The front view of the finished v.f.o., although stark (with only two controls), could be dressed up with decals. The top pointed knob is the bandswitch. Below that is the vernier which tunes the tank.

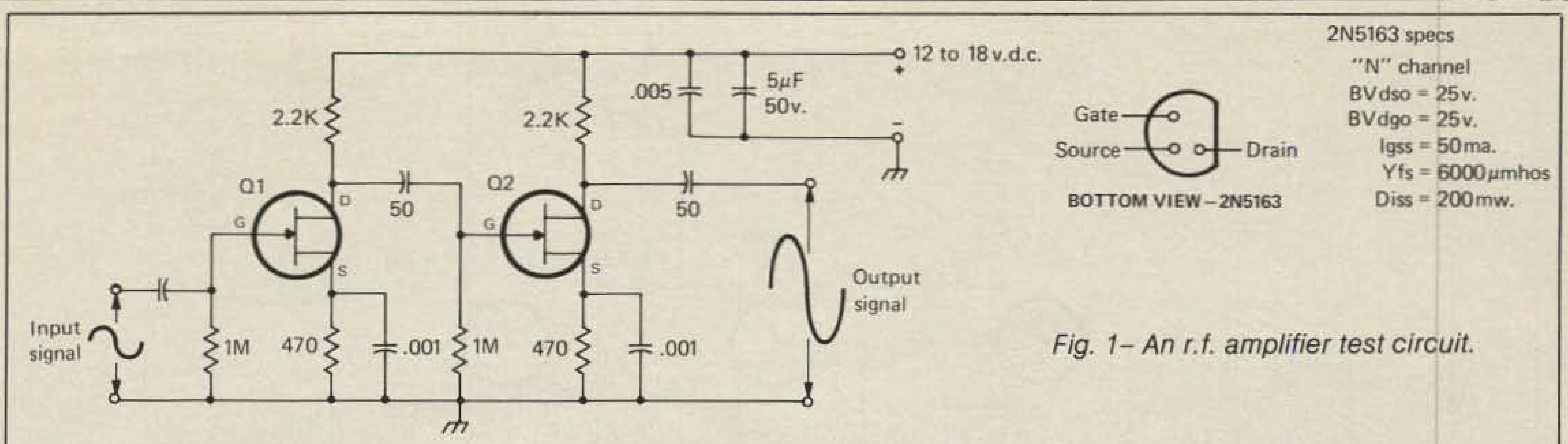


Fig. 1– An r.f. amplifier test circuit.

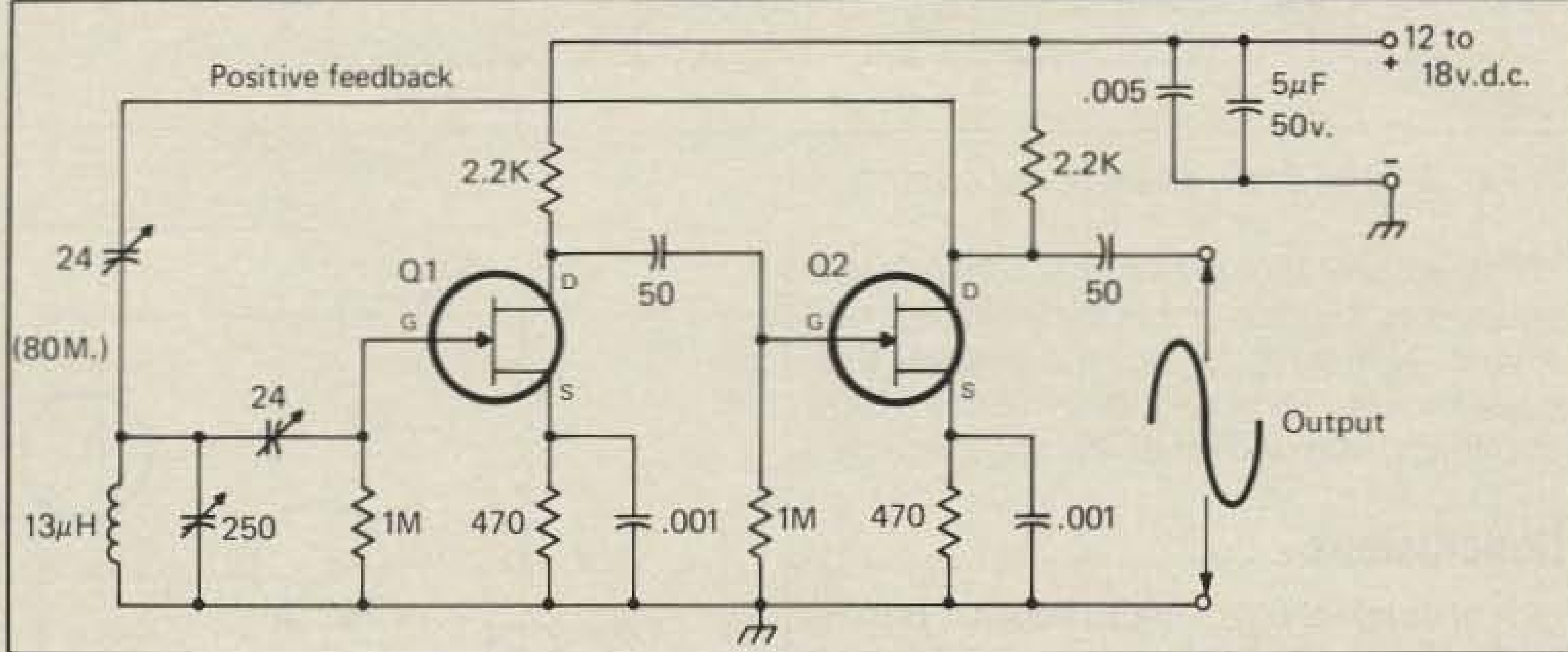


Fig. 2– The experimental oscillator.

put waveform on a scope looked very clean.

Further tests were now carried out by switching to coil taps for 40, 20, and 15 meters. Oscillation occurred on each band with relatively-large values of 'C' in the tank.

At this point, initial results were so promising that the circuit in fig. 3 was constructed.

Construction

The v.f.o. and buffer (Q3) were built in a 6" × 6" × 6" metal box, with r.f. output leaving the enclosure via a phono jack, or coax jack, and coaxial cable.

Referring to fig. 3, it can be seen that a tuning diode or varicap was used to tune the v.f.o. A 50 pfd or 100 pfd (depending on desired frequency tuning range) air variable of sturdy construction with good bearings can be used in its place and the diode bias circuit completely removed. The air variable will probably have a higher Q and better frequency stability with temperature change, but with the varicap it would be possible, if so desired, to couple in a modulating voltage through a capacitor to the diode and have an f.m. signal output from the unit.

The 25 pfd air trimmer is used to set the band edge versus the dial calibration.

Needless to say, if only one band is desired, no taps are necessary on the tank coil and only one parallel fixed capacitor will be required. Best frequency stability will, of course, be on 80 meters.

The usual precautions should be taken during construction, particularly mounting the coil securely and at least its diameter away from the metal enclosure to maintain its Q. Nothing should be loose inside the box.

The unit shown in the photographs had the coil mounted just behind a ceramic band switch, just as it was when it was in the plate circuit of a band-switching 6146 power amplifier. The coil was an old B. & W., 75 watt, transmitting type, originally specified as being for use on 40 meters. Coil details: Diameter - 1.6", Length - 2", Number of turns - 23, Wire size - number 16, Inductance - approx. 13 uh. On 40 twelve turns were used, on 20 seven turns, on 15 four turns.

The front photograph of the unit shows the band switch and directly beneath it one of those small, ubiquitous, Japanese-made, 4:1, vernier dials. In this experimental unit the 25K, linear, bias pot used to tune the tank was mounted on a small, heavy, metal bracket behind the tuning dial. The pot should be clean and smooth in operation. The electrical and mechanical characteristics of any pot used must be just as stringent as those of the variable capacitor it replaces!

All the other components were mounted on a 3" × 4¾" piece of Vector board, which was itself mounted on ¾" standoffs at the back of the metal enclosure.

All wiring was done using spring-loaded, push-in-type connectors to facilitate experimentation. If this method of wiring is used, the board and connectors should be new so there is no movement of the connectors in the holes. A printed circuit would probably work well and be mechanically more stable.

Any reasonable type of circuit fabrication can be used, keeping in mind the requirement that the frequency-determining components must be mechanically stable.

The JFETS were mounted in Vector sockets, again to allow experimentation and also to allow some selection of 2N5163 with regards to device gain versus average drain currents.

At the rear panel of the unit the output r.f. jack can be seen and also the filtered and regulated d.c. input, in this case from a 20-volt supply. A short length of RG 174 connects the jack to the drain output circuit of Q3.

If a lower-Z output is desired, with its lower voltage, simply lift the ground end of the source bypass of Q3 and take the output in series with this capacitor. (Remove drain resistor.)

Fig. 3 shows a number of components marked with an asterisk. The actual values of these components will depend on the bands or band desired, and the tuning rate and frequency coverage desired within the band(s). Specific examples are given in the section on measurements.

It should be noted, however, that bands higher than 80 meters will require less fixed, parallel capacity across the tank, and will require the use of two tuning diodes in series and/or a smaller capacity between the coil and the tuning diode to cut frequency coverage down to just an amateur band or part of one.

The values shown in fig. 3 are for 80 meter coverage. The tuning diode was an old Radio Shack (RS 272) 1345 unit, capacitance from 15 to 60 pfd at bias voltages from 0 to 20 volts. Two of these were used in parallel on 80. The diode is claimed to be similar to devices such as 1N3182, V33, 1N5450 and MV834.

A soft rubber pad, or feet, should be installed under the metal box to cushion it and damp out mechanical shocks (such as those generated by a brass-pounder!).

A smaller metal enclosure could have been used with a little fiddling of the layout. Certainly, an enclosure with a removable top would make testing and experimenting with the circuit much easier.

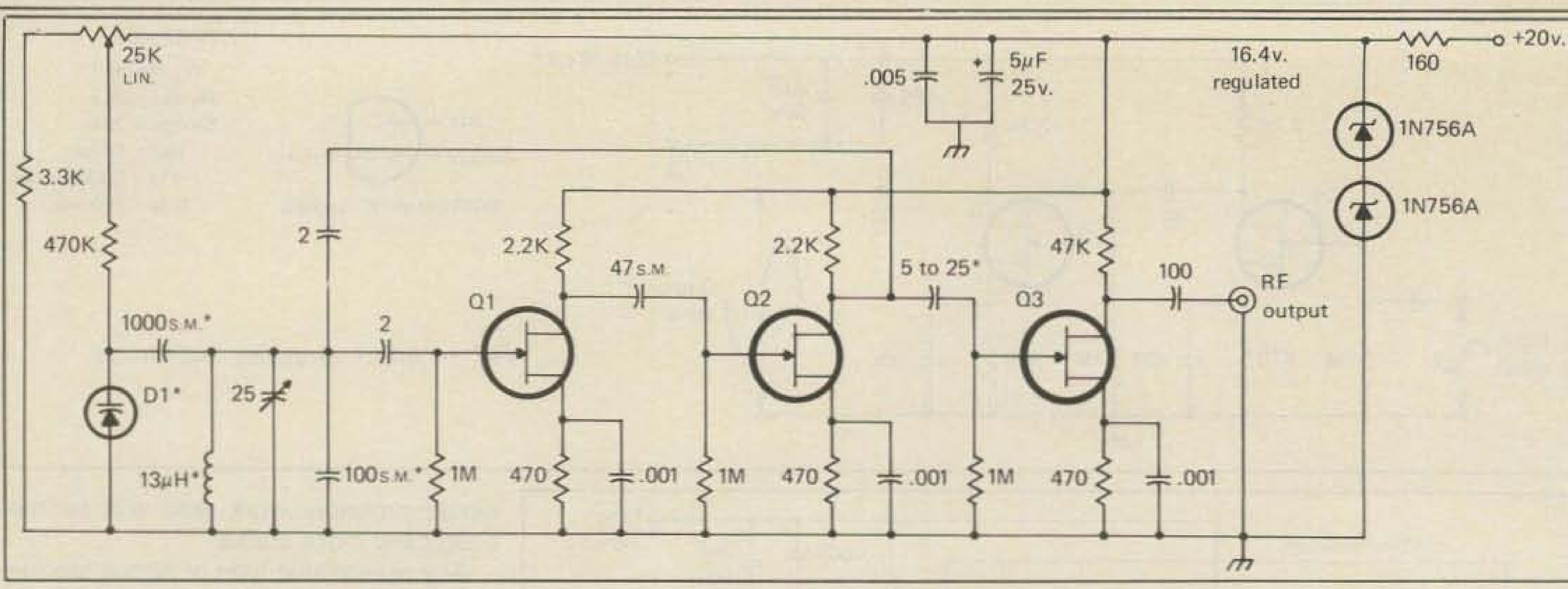


Fig. 3– The final, operational circuit.

Adjustment

Measure resistance from Vcc plus to minus (power off!). It should be at least in the hundreds of ohms, and probably around 1K ohms. If not, find the short. Apply power. Measure the d.c. drain voltages of Q1, Q2, and Q3. These should be around plus 8 volts. If not, it may be necessary to increase or decrease the size of the source resistors and perhaps also to the drain resistors, depending on how far the drain voltage is from this norm. In some cases, it is simpler to just substitute a different 2N5163. The range of source resistance is from 470 to 680 ohms and drain resistance from about 1.5K to 4.7K ohms, with 470 and 2.2K ohms the most common values.

Total d.c. current should be around 20 ma with a voltage to the drain resistors of 16 volts or so.

By now, the circuit should be oscillating strongly. Depending on your facilities, check for r.f. output with an r.f. probe and voltmeter, or listen on a nearby receiver, or better still look at the signal on a wideband triggered scope. Using the receiver approach, the signal should sound clean, without noise, hum, or strong harmonics. Removing the receiver antenna, if necessary, should provide an S-9 test signal. If the receiver has good frequency stability, it will also give you an idea of how good the stability of the v.f.o. is and will point out any problems.

If necessary for break-in operation, Q2 can be keyed in the source circuit with a small amount of resulting chirp.

The source circuit of Q3 keys cleanly, and the oscillator stages produce only around an S-2 signal in a nearby receiver when the unit is "buttoned up." This allows break-in on all but very-weak signals with no chirp at all.

Finally, the coupling capacitor between the drain of Q2 and the gate of Q3 was reduced to 5 pfd on 80 meters to stop driving Q3 into gate-leak bias and nonlinearity. If desired, on the higher bands this capacitor can be made larger, up to the point where the maximum undistorted voltage output the unit is capable of is obtained. Needless to say, the smaller this capacitor is, the better the isolation of the oscillator from external loading.

Conclusions

A great deal more could be said, but by now anyone with any knowledge of v.f.o.'s will have the message. Different tuning diodes (or a variable capacitor), bias-voltage ranges, fixed parallel capacitors, and inductor values can be experimentally arrived at to give whatever frequencies, tuning ranges, and tuning rates desired.

The unit can be made to work with 12–13.8 volts regulated d.c. by changing source and load resistors of Q1, Q2, and Q3.

It was intended to test MPF 102 JFETS in the circuit because of their popularity (and despite their lower gain). However, a parts supplier substituted type 2N5485 instead. A quick test on 40 meters using the original circuit and parts values with 2N5485 at Q1, Q2, Q3 gave instant oscillation, but the source and drain resistors would have to be changed for optimum operation with maximum undistorted drain-voltage swings.

As much information as possible has been included throughout this article, not to bore the "old hands," but to try and lure a few newcomers into building something that is both interesting and useful.

Finally, it is presumed that the unit is to be used in a friendly environment, temperature-wise. As always, temperature changes and the resulting changes in the physical dimensions of the coil winding will have their usual detrimental effect on frequency stability. Anything that minimizes temperature change in the box maximizes frequency stability!

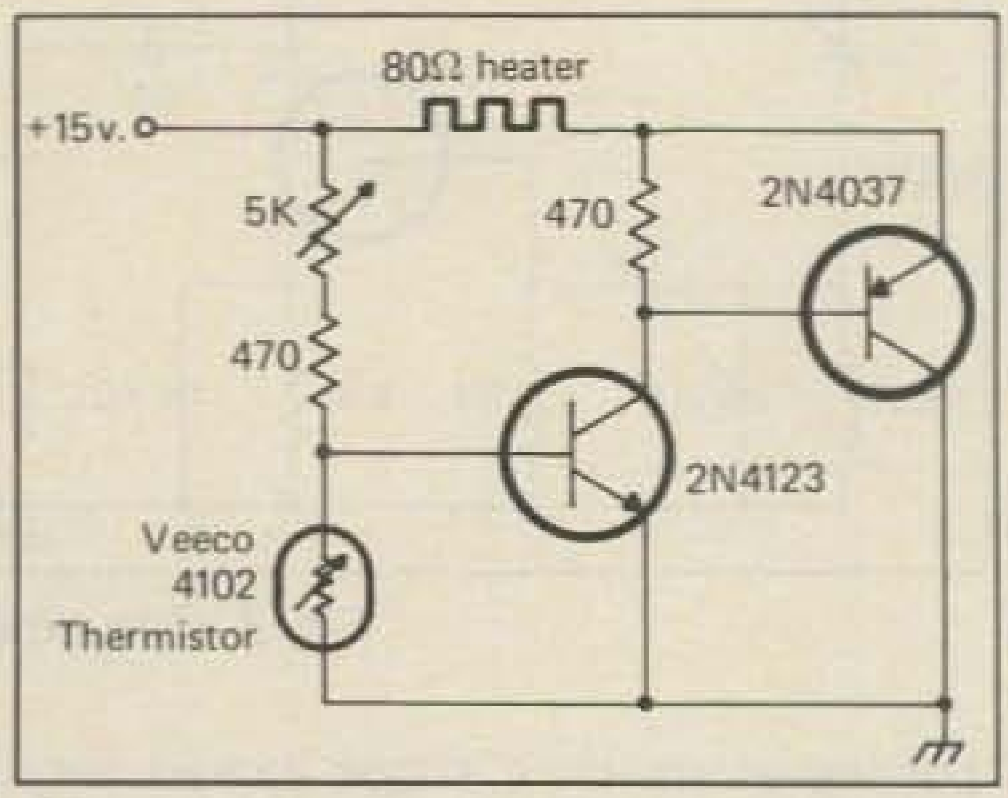


Fig. 4– A thermistor proportional temperature control system.

Where to now?

Well, in line with the above re temperature, and considering there is still room in the box, it would seem very worthwhile to come up with an artificial environment for the circuit. Why not a really superior v.f.o.? "Math's Notes," *CQ* magazine, November 1978, featured "Temperature Control of Electronic Circuitry." The "thermistor proportional control system," would seem to be made for this v.f.o. enclosure. See fig. 4.

With the box insulated with Fibreglass or Styrofoam, and with the above circuit enclosed, greater things should be possible, particularly if the v.f.o. is left "on" at all times.

Sounds like a good chance for some more experimentation and fun. It'll probably end up as a 2 meter, f.m., v.f.o. working up around 18 MHz! ■

Measurements

Inductor	Parallel C	Varicaps	Diode bias	Tuning Range	Peak Output
13 uh	100 pfd.	2 in par.	2.2–11.2V	3.5–3.850 MHz	5.9V–6V r.f.
6.5 uh	100 pfd.	2 in ser.	"	7.0–7.2	3.8V–4V
6.5 uh	60 pfd.	1	"	7.0–7.3 (plus)	
3.5 uh	25 pfd.	2 in ser.	"	14.0–14.350(plus)	2V

Here's how K1PCK combined two interests—sailing and amateur radio. This little antenna can be installed in a jiffy.

A 10 Meter Antenna For Maritime Mobile

BY JAMES M. MORAN*, K1PCK

High sea adventure and amateur radio naturally seem to go together. Both are modes that carry the spirit to those romantic far-away places. I have had the opportunity to combine both adventure modes into an ideal vacation plan aboard one of New England's many sailing schooners.

Today's solid state rigs present no serious space problems for the vacationing maritime mobiler. However, the antenna needs required by this high adventure are quite another story. To help overcome the restrictions that the salty amateur adventurer is faced with, I designed the following plans for what I call the Tall Ships' 28 MHz vertical dipole. The following instructions are for an antenna whose resonant frequency is cut for the lower c.w. portion of the 10 meter band. Other useful frequency specifications appear at the end of this article.

The rigging of a schooner is complex. It requires neatness and orderliness to sail properly. In designing my maritime mobile antenna, I had to take these restrictions into consideration and come up with an antenna that would fit into a small area on the mast where it would not interfere with the proper sailing of the ship. Vertical polarization is ideally suited to these restrictions, because a vertically polarized dipole mounted one wavelength above ground, or in this case saltwater, gives the best low-angle radiation for omni-directional DX work. Also, with the use of loading coils, the compactness of this 5-foot dipole allowed parallel mounting to the wooden mast. It should be obvious that this type of antenna will only work with a nonconductive mast.

Before beginning this antenna project, you will need the following materials:

RG8 or RG58U feed line, any length, and two male coaxial connectors.

20 to 30 feet of No. 10 insulated copper wire.

*300 Boutelle St., Fitchburg, MA 01420

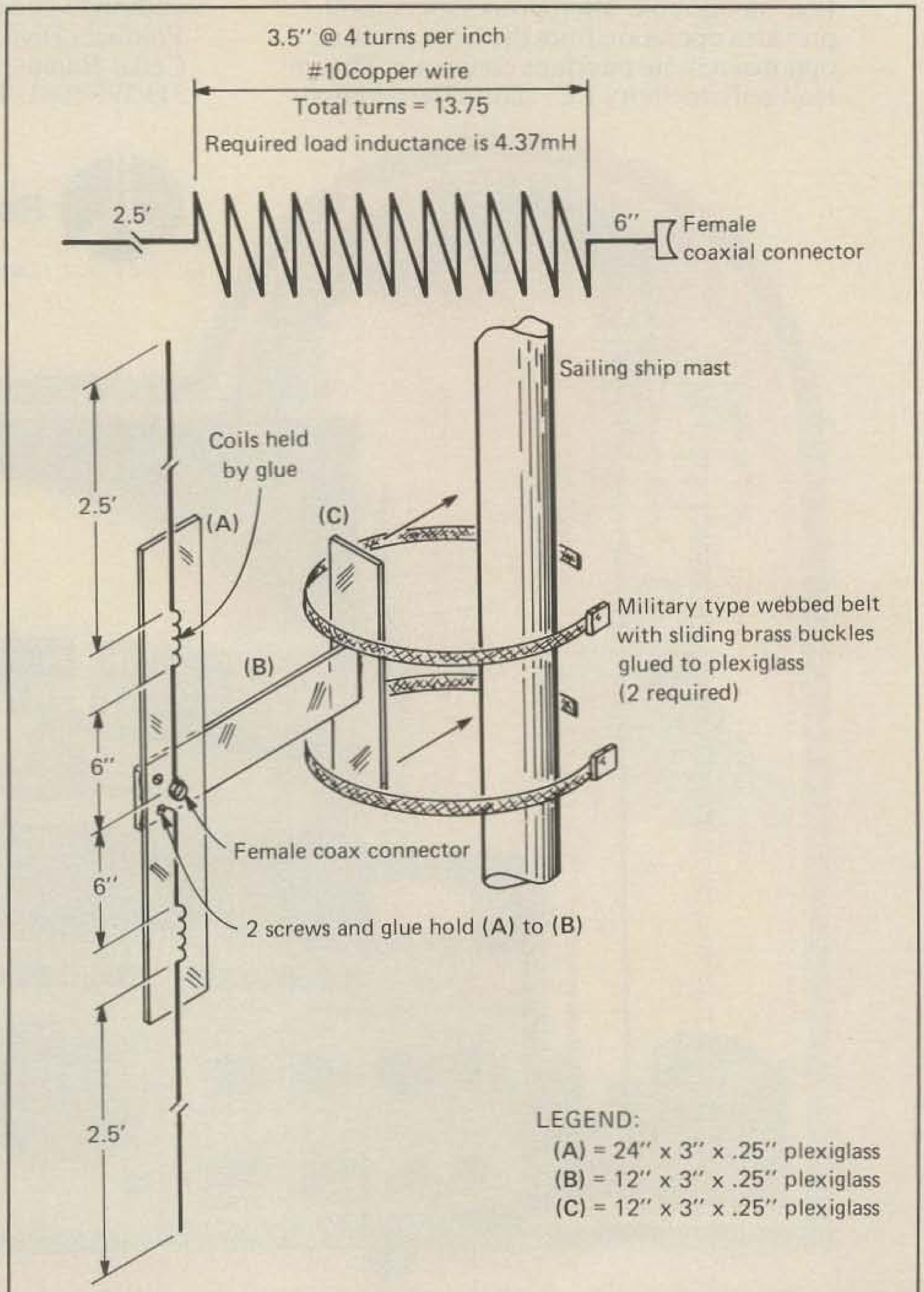


Fig. 1– The simple construction details for the maritime mobile 10 meter antenna.

1 female coaxial connector.

1 4′ × 3″ length of plexiglas, ¼ inch thick.

1 tube of plastic cement.

2 military-type, cloth, webbed belts (the kind that have the sliding brass belt buckles).

2 nuts and bolts with washers, size optional.

2 flat-headed wood screws no bigger than ⅛ inch in diameter and no longer than ¾ inch.

The tools that are required are a screwdriver, hacksaw, rat-tailed file, 2-inch diameter coil form, wire snips, and a drill with ⅛-inch and ¼-inch bits—nothing special, just common tools found around the shack.

Because the antenna is self-supporting, it requires the use of heavy-gauge wire—in this case No. 10 insulated copper wire, similar to the Bell Telephone Company's grounding wire. This wire has the proper stiffness for an antenna of this length mounted vertically and is also pliable, allowing for the winding of the inductor coils.

To begin the project, cut the antenna wire into two equal lengths. From one end measure 6 inches in, and on the 2-inch coil form begin winding the coil at 4 turns per inch, for a total of 13¾ turns. The coil should be about 3½ inches long. The required load inductance of the antenna is 4.37 microHenrys.

Measure 2½ feet from the coil end of the wire, and cut the excess wire off. Repeat the above for the second leg of the dipole. When you have made both legs of the dipole, attach the female coaxial connector—one 6-inch end to the center conductor and the other 6-inch end to ground.

Next cut the plexiglas into the following lengths: one piece 2 feet long and two pieces 1 foot long. In the center of the 2-foot-long piece drill two holes. At the end of one of the 1-foot long pieces drill two identical holes. Glue and then bolt these two pieces together so that they form a letter "T". At the foot of this plexiglas "T" drill two ⅛-inch holes 1 inch apart into the ¼-inch edge, and two equally spaced holes into the remaining 1-foot length of plexiglas at its center. Connect the two pieces together with the wood screws and plastic cement. What you should have is a free-standing plexiglas "T".

Next find the center of the two webbed belts, and glue them with lots of cement to the flat end sides of the "T's" base. You may also wish to bolt these to the "T" as well, but if you do, you will have to use flat-headed bolts and counter sink them into the plexiglas. This could possibly weaken the connection and also scratch the finish on the mast.

When the glue is dry you will have the frame on which your dipole will be mounted. The webbed belts will easily attach to a schooner's mast without marring its finish.

Next drill a ¼-inch hole into the center of the now doubly thick plexiglas where the center of the dipole and the center of the "T" will meet. With a rat-tailed file widen this hole so that the female coaxial cable fitting can be mounted and bolted into it.

To attach the antenna to the plexiglas frame, lay the antenna parallel and center to the upper cross piece of the plexiglas frame and glue the two coils onto it. This will require a solid, flat area to prevent the glue from running. Use lots of glue, the more the better. When the glue is dry, you will have a solid, durable vertical dipole that will withstand the high winds found off the New England coast.

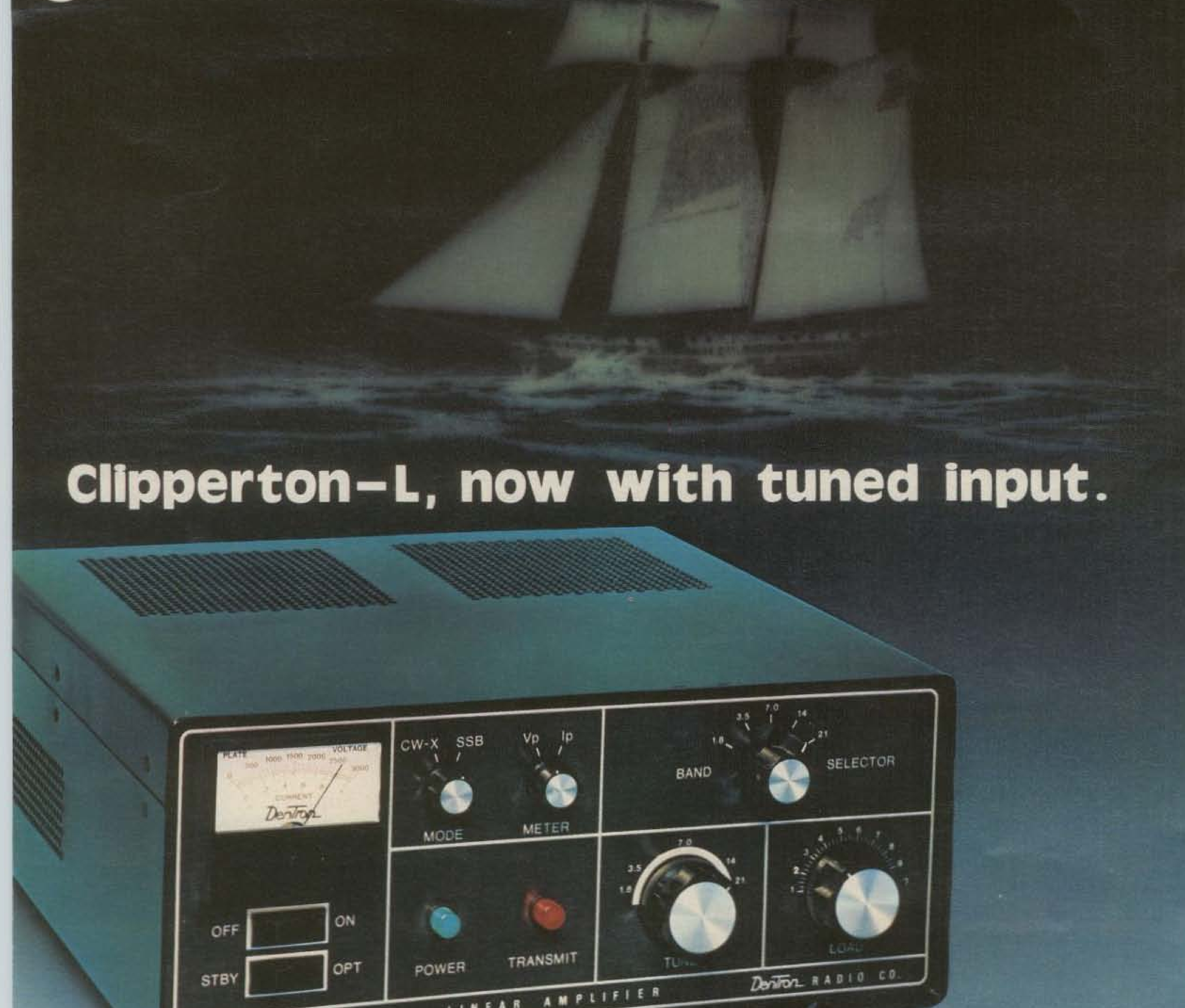
Remember when mounting your antenna to get it as high as possible above the water. Vertically polarized dipoles work best when mounted at one full wavelength above ground. Use electrical tape to secure the floppy ends of the belt and to secure your feed line. Floppy feed lines and accessories are not welcomed aboard any ship.

If you wish to use your rig aboard a chartered vessel, you first will have to get the permission of the captain. He will need assurance that your rig will not interfere with his navigational aids and communications equipment.

Let me know how your antenna works out. Happy sailing!

The best amplifier value just got better....

Clipperton-L, now with tuned input.



Clipper ships sailing to foreign shores. Sixteen amateurs primed for adventure, coming together as the first group in 20 years to set foot on the remote French Island, Clipperton. Their goal: 30,000 QSO's in just 7 days.

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CIRCLE 132 ON READER SERVICE CARD

CQ SHOWCASE

CES 500SA Autopatch

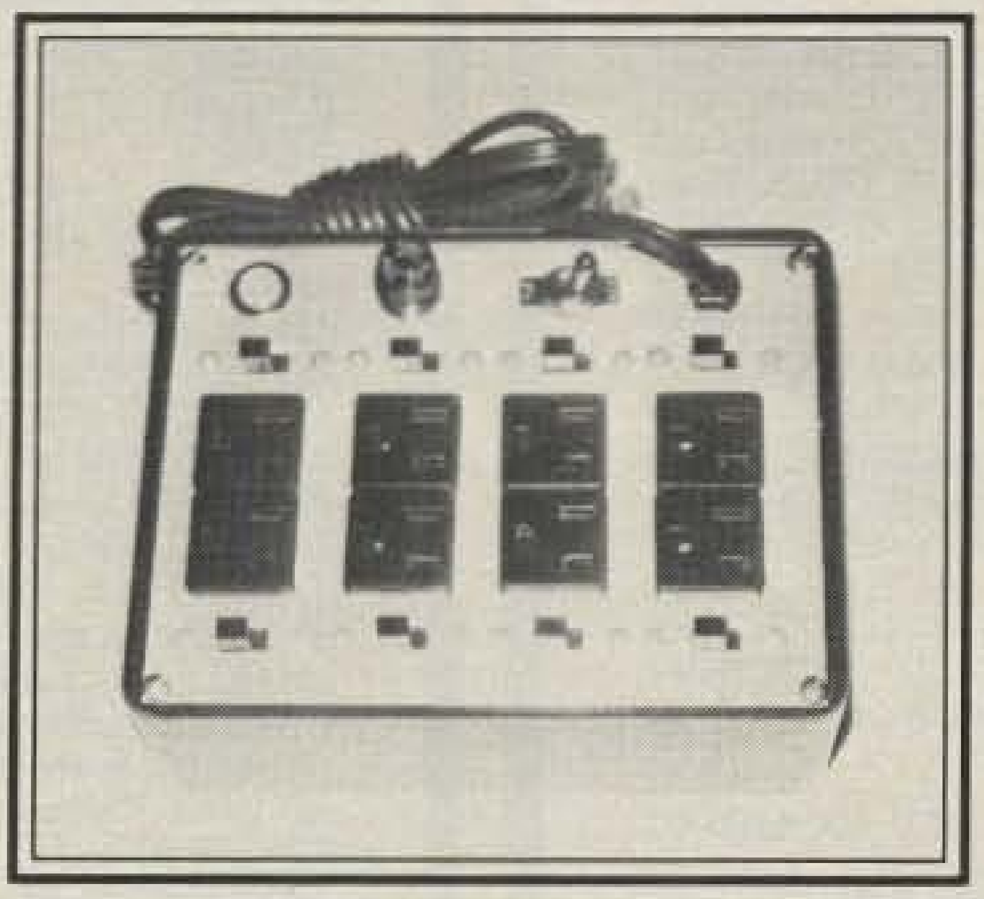
The CES 500SA Simplex Autopatch provides positive radio operator control and eliminates telephone VOX circuits with a proprietary noise-gated sampling circuit. Suggested application modes for the Model 500SA include mobile/remote base to telephone line via Simplex base; mobile to mobile via phone-interconnected base stations (for extended range); and telephone line to mobile/remote base.

Simple base station equipment (an f.m. transmitter/receiver or transceiver) is required, but no duplexer or repeater equipment is necessary. Normal base station equipment remains fully operable. A front panel switch on the 500SA selects base or patch mode operation. For more information, contact CES, Inc., P.O. Box 507, Winter Park, FL 32790, or circle number 106 on the reader service card.

SuperFox Radar Detector

The all new SuperFox Remote black control box contains new control panel knobs for volume and squelch. To make the unit less conspicuous under the dash, the front portion of the box has been changed to a black finish. Better weatherproofing seals have been added in the remote receiver portion for both the lens and cable boot. The remote portion's lens color has been changed to black for increased concealment when positioned behind the vehicle's grille. SuperFox Remote is Fox's original super-heterodyne radar warning system, incorporating increased signal sensitivity with decreased visibility.

In addition, Fox offers SuperFox Vixen, one of the smallest super-heterodyne radar detectors. Vixen is a single unit dash or visor mount, easily hooked-up or removed, and small enough to carry in a coat pocket. For more information, contact Fox Marketing, Inc., 4518 Taylorsville Road, Dayton, OH 45424, or circle number 108 on the reader service card.



Kalglo Electronics "Spike-Spiker"™

The "Spike-Spiker"™ is designed to protect sensitive and expensive electronic equipment such as ham radios and transmitters from power line transients and high voltage surges. It provides r.f. "hash" filtering between the electronic device and motorized equipment in the vicinity. The units are available in three models: the Deluxe Power Console, which comes equipped with 8 individually switched 120 v.a.c. outlets divided into 2 rows of separately filtered circuits, a main on/off switch, fuse, and indicator light; and the Mini-I and Mini-II models, which are 2-socket wall-mounted versions of the Deluxe Power Console. All units are prewired.

For more information, contact Kalglo Electronics Company, Inc., Colony Drive Industrial Park, 6584 Ruch Rd., East Allen Twp., Bethlehem, PA 18017, or circle number 107 on the reader service card.

Stellmaker Etching System

Stellmaker Enterprises has designed a power etching system that includes an air pump, air disperser, base with support for 4½-pint plastic tank with cover, mounting screws, and all necessary instructions. This compact system will etch PC boards up to 6" × 6", which is the size featured in most magazine articles. The acid agitated by the air pump makes for fast and more even etching.

This kit for $34.50 plus $3.50 for postage and handling is available from Stellmaker Enterprises, 250 Pequot Trail, Westerly, RI 02891, or for more information, circle number 105 on the reader service card.

TEN-TEC 2 KW Antenna Tuner

The Ten-Tec 2 kw antenna tuner/s.w.r. bridge/power meter uses a reversible "L" configuration with a silver-plated roller inductor, high-voltage variable capacitor, and selectable fixed capacitors for greater versatility in impedance match-

no-65-66

ing. The design automatically provides a low Q, minimum loss path when properly adjusted. Power ratings are 2 kW p.e.p. and 1 kw c.w. Frequency range is 1.8–30 MHz. Model 229 matches conventional 50 ohm unbalanced outputs of transceivers or linear amplifiers to a variety of balanced or unbalanced load impedances. Antennas such as dipoles, inverted "V"'s, long random wires, windoms, beams, rhombics, etc., can be matched. A built-in balun converts one antenna to a balanced configuration if desired.

The built-in s.w.r. bridge and dual-range power meter indicates s.w.r. from 1:1 to 5:1 and power from 10 to 2000 watts. Front panel controls are variable capacitor with spinner knob, roller inductor with spinner knob, 11-position bypass/hi-lo capacitor select switch, 4-position antenna selector switch, s.w.r. sensitivity, forward/reverse switch, 2000/200 watt power range switch, and s.w.r./power meter switch. Rear panel includes coax input connector, four coax antenna connectors, three thumb-screw-type connectors for single wire and balanced line, ground connector, and 12V dc input for dial lighting power. Size is 6½" H × 12¾" W × 13½"D. Weight is 9 lbs. Model 229 amateur net price is $249. For more information, contact TEN-TEC, Highway 411 East, Sevierville, TN 37862.

a monthly feature by
BILL WELSH, W6DDB

Novice

"HOW TO" FOR THE NEWCOMER TO AMATEUR RADIO

Help For Beginning Amateurs

If you need help getting started in amateur radio, we may be able to give you the name, callsign, address, and telephone number of someone in your area who has volunteered to provide such assistance. The present list shows 80 people in 33 states. If you want to find out whether or not one of these volunteers is available in your area, send your information request to me. Use the California address printed in this column and enclose a self-addressed, stamped envelope.

If would be greatly appreciated if experienced amateurs who are willing to help newcomers would let me know about it and send their name, callsign, mailing address, and telephone number to be added to this list.

One of these active volunteers is Paula Franke, WB9TBU, of Beecher, Illinois. As a result of a Novice column item, she received requests for help from four people. She got one person together with a closer amateur who is providing the needed help. One of the other three newcomers, Jim Anderson, is now licensed and operating as KA9KGU. Paula's mother passed the Novice test and she will be on the air by the time this item is printed. Paula has an aunt who needs help getting started. If you live close and are willing to provide assistance, please contact Ruth Pastor, P.O. Box 44, Copake, New York 12516.

Your participation is needed to expand this vital free service. If you need help, ask for it. If you will provide this type of assistance, please let me know.

American Amateur Radio Population

The 30 June 1981 Amateur Geographical Report by the FCC's Private Radio Bureau shows 400,000 operators in their master file and active records for 388,428 stations.

2814 Empire Ave., Burbank, CA 91504

Chris Vecchio, KA3EXF, of Broomall, Pennsylvania has been licensed for more than one year, but he did not become active until March 1981. CQ *magazine got him started, and he has contacted more than 30 states and 3 countries since he accepted code as a challenge instead of an obstacle. His shack is fondly referred to as the dungeon. His station includes a Kenwood TS-520E Transceiver, 80 meter dipole, 40 meter vertical, 15 meter dipole, and 10 meter groundplane. Chris is 16 years old, and he has paid for his entire station out of income he earned delivering the* Philadelphia Bulletin.

The most populous amateur operator states are: California, 53,033; New York, 26,666; Texas, 23,215; Florida, 21,512; Ohio, 21,208.

The least populous amateur operator states are: Wyoming, 854; Delaware, 939; Vermont, 948; North Dakota, 962; South Dakota, 1,127.

The difference between your chances of contacting amateurs in the five highest and lowest amateur population states is about 30 to one, since 36% of the amateurs live in the highest amateur population states, and just 1.2% of them are in the lowest amateur population states. If it seems hard to contact amateurs in states such as Delaware and Vermont, you are experiencing normal difficulty. Fortunately, these states with relatively few amateurs have a few extremely active operators.

The percentage of operators for each class of license is as follows:

License Class	Total	Percentage
Novice	78,306	19
Technician	74,643	19
General	126,872	32
Advanced	91,817	23
Extra	28,364	7

Less than 2% of the stations are club, military recreation, RACES, or secondary stations.

More than 13% of the American amateurs are in California. I think I should stop instructing amateur radio licensing courses in California and transfer my efforts to Wyoming or the Dakotas. I have helped license more amateurs than exist in those states. To put this situation more clearly in focus, I had more licensing-course students in one 5-year span (1956–1961) than there are licensed amateurs in these 5 states.

British Callsigns

The number of British amateurs has doubled in the past 12 years, causing United Kingdom Home Office personnel to consider abandoning the present system in which the callsign prefix identifies each British Isle country. As examples, GI, GM, and GW are Northern Ireland, Scotland, and Wales, respectively. They considered initially sequencing through callsigns using the GA prefix, after the last Class B License callsign (G8ZZZ) is issued. Instead, they decided to keep the existing distinctive system and to issue G6 prefixes in future Class B Licenses.

In announcing their decision on this matter, they made a comment that sounds as though it could have been taken from one of my licensing course lectures; they said, "One of the minor tragedies of amateur radio in recent years has been the breaching of the conventions surrounding international prefixes—notably by the American FCC, which has largely destroyed the 'district' identification feature of American callsigns as well as confusing the position in U.S. overseas territories." Amen.

Computer Books

I have received a few letters asking for information about books that can be read to help amateurs learn basic facts about computers. I am far from being a computer expert, and any books on this subject that I can understand have to be simple. I am able to recognize good writing when I read it. The best introductory computer textbook I have seen is, *The Basic Handbook*, which is available from CompuSoft Publishing, P.O. Box 19669, San Diego, California 92119. The second edition of this book should be available about the time this item is printed.

If you really get infected by the computer bug, you may want to know that CompuSoft also publishes *Learning Level II*, which appears to be a sequel to Radio Shack's *TR-80 Level I* book. All three of these books were written by Dr. David A. Lien, W6OVP, the former Dean of Mathematics and Physical Sciences at Grossmont College. Dave now works full time writing computer-related books. His present task is writing a book that is modestly entitled *Controlling the World with your TRS-80*, which is expected to be available by now.

Parts Catalog Available

If you want a free copy of a 96-page, 7¼" × 10⅞" catalog, send your request to ETCO Electronics, North Country Shopping Center, Route 9 North, Plattsburgh, New York 12901. This catalog contains good buys on many things that are used by amateurs. Typical items include antennas, batteries, battery chargers, bulbs, capacitors, chemicals, connectors, crystals, dials, dialcords, fans, filters, headphones, insulators, knobs, lugs, microphones, panel meters, plugs/jacks, potentiometers, power supplies, relays, resistors, sockets, speakers, switches, test equipment, tools, transistors, tubes, and wire/cable. I refer to such catalogs almost as often as I use textbooks, which is often.

USS Kidd Amateur Radio Station Planned

Bob Leach, W4OWI, advises that the WW II Destroyer *USS KIDD* will soon be permanently docked at Baton Rouge, Louisiana. A local club plans to install and operate an amateur radio station aboard this ship. Novice band operation will be encouraged, and a special QSL card will be a nice permanent reminder of a contact. Additional information is anticipated as this project progresses.

Bob is 67 years old and he enjoys working the Novice bands. This Advanced licensee savors each contact. He advises non-amateurs to get licensed and to become active. A reasonable amount of effort to obtain a license and set up a station makes the whole world available to you, and Bob urges you to take advantage of this remarkable opportunity.

Madeline Loiacano, KA2ILI, of Frankfort, New York, is the mother of a 3-year-old daughter and a 13-year-old son. Madeline is a Service to Military Families case worker at the Mohawk Valley American Red Cross Chapter in Herkimer, New York. She works the normal off times (including nights, weekends, and holidays) serving 56 towns. Despite her long work hours, she has found time to make more than 500 contacts during her first year on the air, including several with foreign amateurs. Her station includes the Ten-Tec 509 Argonaut Transceiver, a matching 50 watt output Ten-Tec linear amplifier, and a CB vertical antenna used with an antenna tuner. Madeline likes to ragchew (chat) using code and she avoid DX (foreign) station pileups. She obtained her Novice license in April 1980, upgraded to General in January 1981, and is preparing to upgrade to Advanced. Madeline likes long chats, and many of her contacts are more than one hour long, with some of them about three hours long. She enjoys reading CQ magazine and I suspect that she may get her husband to become an active amateur.

QRP Club Member QSL Cards

The May 1981 Novice column provides a good introduction to the QRP Amateur Radio Club International. That article apparently is of interest to many amateurs, as evidenced by comments still arriving. I have learned that QRP ARCI members may purchase special cards from Certified Communications, 4138 South Ferris, Fremont, Michigan 49412. Each order should clearly show one's name, callsign, mail address, city or town, county, state, zip, and QRP ARCI membership number. The cost of these cards is $19.95 (plus $2.50 shipping) for 1000 cards, or $22.45 total. Naturally, the cost per card decreases if an order is for a larger quantity of identical cards. The total prices (including shipping charges) for 2000, 3000, 4000, and 5000 cards are $38.40, $54.85, $68.85, and $83.75, respectively. As is typical of all QSL printers, this company has a variety of other cards available, and information on them can be requested by writing to the address already listed in this item. Enclose 75 cents for a complete set of sample, if they are desired, and send your request to Certified Communications.

The advertising section at the back of each *CQ* contains information about many QSL card printers. If you want to receive a lot of cards, you must send them. If you do not have QSL cards, I advise you to get an adequate supply (500–1000) of them.

Converting CB Gear For 10 Meter QRP Use

Press Jones, N8UG, has a useful 20-page booklet that primarily covers converting 11 meter CB transceivers and antennas for use on the 10 meter amateur band. If your financial situation is like mine, you are probably not able to buy amateur equipment, even at used-gear prices. If this is so, you should consider the possibility of getting on 10 meters with modified CB equipment. You can do it for just $35 to $100, with the average cost being about $50. The pamphlet is about 4" × 8¼", and it will fit into a standard number 10 (business-size) envelope. If you want a copy, you should request it from Certified Communications, 4138 South Ferris, Fremont, Michigan 49412, telephone 616-924-4561. The usual self-addressed, stamped envelope (s.a.s.e.) would be appreciated. If you want a copy of the *CB Conversion Booklet*, include 25 cents with your request and s.a.s.e. sent to Certified Communications.

Low Power Novice Band Net

QRP ARCI President Thom Davis, K8IF, advises that John McNeil, WA2KSM, is running the Transcontinental Novice Net Monday evenings on 21,110 (plus-or-minus 5) kiloHertz, starting at 2300 UTC. During daylight savings, this is 7 p.m., 6 p.m., 5 p.m., and 4 p.m., for EDST, CDST, MDST, and PDST, respectively. During standard time, this net starts at 6 p.m., 5 p.m., 4 p.m., and 3 p.m. for EST, CST, MST, and PST, respectively.

Additional Code Practice

Worldwide sources of code practice are detailed in the October and November 1980 Novice columns. Readers continue to send additions and corrections to that article, which I am glad to receive. An additional code practice source is the transmissions of the Brass Pounders Amateur Radio Club (WB3IVO). The Tuesday and Saturday transmissions are on 3560 kHz, starting at 0200 UTC. The Saturday and Sunday drills are on 7060 kHz, starting at 2000 UTC. Code speed runs range from 20 to 60 w.p.m., so this is not beginner's practice. Nevertheless, some readers can make use of these high-speed runs. Each session lasts about 45 minutes. These transmissions should be heard well in the Northeastern part of our country; listen for them.

73, Bill, W6DDB

SEMICONDUCTORS SURPLUS

DIODES

HEP 170
2.5 A, 1000 PIV
.20 ea., 100 for $15.00

HVK 1153
25 mA, 20,000 PIV
$1.00 ea., 10 for $8.00

Motorola MA 752 Rectifier
6 Amps, 200 PIV
4/$1.00

High-voltage diode EK500
5000 Volts, 50 mA
2/.99 each

DG-1005
1.5 A, 1000 PIV
.15 ea., 100 for $12.00

SCMS 10K
15 mA, 10,000 PIV
$1.69 ea., 10 for $12.50

Fairchild LEDs
FLV 5007 & 5009 red.
Case type TO-92.
6/$1.00

Motorola SCR
TO-92 Case, 0.8 Amp, 30 V.
Igt 0.2 Vgt 0.8.
Same as 2N5060.
4/$1.00 or 100/$15.00

IC'S

MC4000P	5.09
MC4000L	7.30
MC4001P	9.60
MC4002P	4.96
MC4002L	7.30
MC4006P	5.99
MC4006L	8.33
MC4007L	8.43
MC4008P/74408P	4.24
MC4012P/74412P	7.16
MC4012L	9.55
MC4015P/74415P	5.81
MC4015L/74415L	8.25
MC4016P/74416P	6.89
MC4017P/74417P	6.89
MC4018P/74418P	6.89
MC4018L/74418L	10.05
MC4019P/74419P	6.89
MC4019L/74419L	10.05
MC4022P	5.41
MC4023P	7.79
MC4024P	3.92
MC4044P	3.92
MC4050P/74450P	12.25
MC4060P	5.32
MC4062P	3.43
MC4000F	8.87
MC4006F	8.33
MC4007F	8.43
MC4008F	6.16
MC4060F/74460F	7.57
MC4062F	7.00
MC4300C	8.20
MC4306L	9.05
MC4307L	11.09
MC4312L	10.67
MC4318L/MC54148L	11.40
MC4322L	8.61
MC4350L/MC54450L	17.16
MC4300F	10.00
MC4307F	10.99
MC4316F	13.55
MC4322F	10.40
MC4323F	13.87
MC4350F	20.89
MC4362F	7.75
-MC1303L	1.00
MC1306	1.27
MC1311	

MC1330	2.50	LM312H	2.70
MC1350	2.50	LM319H	1.95
MC1351	1.43	LM319N	1.25
MC1352	1.37	LM324N	1.59
MC1358	2.50	LM339N	.99
MC1359		LM342N15	.69
MC1393	1.76	LM348N	1.85
MC1408L6	2.75	LF351/TL081	.60
MC1414L	1.83	LF355	1.31
MC1414P	1.29	LM358	.99
MC1435L		LM376	
MC1436G	4.40	LM377/ULN2278	2.95
MC1437	2.25	LM380	2.50
MC1439	3.57	LM381	1.95
MC1461		LM386	1.75
MC1468L	5.33	LM387	1.00
MC1469R	5.65	LM393	
MC1496P	2.50	NE527	
MC1511G		NE531T/RC4531	3.95
MC1535G	18.19	NE540L	6.00
MC1539G	5.40	NE555Y	.39
MC1550G	1.61	LM555H	2.00
MC1552G	11.61	LM556CJ	1.42
MC1558L	1.68	LM565CH	1.75
MC1560R		LM567V	.99
MC1569RB2	10.49	LM/UA703	.89
MC1590G	6.99	LM709H	1.00
MC1709CG	.97	LM711N	.79
MC1710G	1.79	LM715	.79
MC1711CL	1.03	LM723CH	
MC1712CP	3.35	LM741CN/Y	.56
MC1723CP	.67	LM741CH	1.01
MC1733CL	1.35	LM747CT	.99
MC1741G	1.50		
MC14528B	2.04	LM748CN	.59
MC14530BCP	1.22	LM/UA749	
		LM1310N/ULN2110	1.95
LM101AH		LM1391N	
LM108AH	8.83	LM1458V	.59
LM111H	8.73	LM1514J	
LM139A	12.13	LM1889	6.70
LM202H		LM2901/SL61638	1.39
LM205		LM3900/CA3401	.84
LM211	4.43	LM4250CH	1.84
LM258	2.15	CA3011	
LM270		CA3046	1.30
LM301AP/H	.69	CA3085	
LM304H	1.20	CA3086	1.04
LM307N	.55	CA3140	1.24
LM308H	1.00	LM3146	2.00
LM310H	1.10		
LM311V	.89		

NEW TRANSFORMERS

		Price each
F-18X	6.3 VCT @ 6Amps	6.99
F-46X	24V @ 1Amp	5.99
F41X	25.2VCT @ 2.8Amps	6.99
P-8380	10VCT @ 3Amps	7.99
P-8604	20VCT @ 1Amp	4.99
K-32B	28VCT @ 100 MA	4.99
E30554	Dual 17V @ 1Amp	6.99

TRANSFORMERS

$9.99 each
#2899652-01
26.8 VCT @ 660 MA
21.9 VCT @ 1.1 Amps

$12.99 each
#2099459-00
28 V @ 1.5 Amps
9.6 V @ 9 Amps
16.8 V @ 300 MA

$1.99 each
#18000711P
24 V @ 100 MA

ZENER DIODES

Motorola - 500MW 4 for 1.00

1N746A	1N755A	1N965B
1N747	1N756	1N966B
1N748A	1N756A	1N967B
1N750A	1N757A	1N968A
1N751A	1N758A	1N969B
1N752A	1N759A	1N972
1N753A	1N963B	1N978B
1N754A	1N964B	

ARCO CAPS

304	100-550pF	1.50
400	.9-7pF	1.00
402	1.5-20pF	1.00
420	1-12pF	1.00
423	7-100pF	1.00
426	37-250pF	1.01
464	25-280pF	1.00
465	50-380pF	1.39
467	110-580pF	1.03
469	170-780pF	1.40
4615	390-1400pF	2.02
404	8-60pF	1.00
405	5-80pF	1.00
422	4-40pF	1.00
424	16-150pF	1.00
427	55-300pF	1.00
462	5-80pF	1.50

NEW & USED BCD SWITCHES
3 switch with end plates
$8.99 New $6.95 Used

NEW GE OPTO COUPLERS
4N26 .69 ea. or 10/$5.00

MICRO-MINI WATCH CRYSTALS
32.768 Hz $3.00 each

TRANSFORMERS

#70169-2............. 4.99 each
26 VCT @ 1 Amp and
2.5 V @ 1 Amp

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Battery.................... 4.29

New MCM Moving Coil Tach
Generator
Model M100.......... 8.99 each

New Mallory Mini Sonalert
Model #SC-18. Works at 12 VDC
3500 Hz.............. 4.69 each

New T.V. Colorburst Crystals
3.579545............... .99 each

WIDEBAND RF TRANSFORMERS

Tyep T16-1............6.50 each

	Insertion Loss
.3 to 120 MHz	3dB
.7 to 80 MHz	2dB
5 to 20 MHz	1dB

RF Power Device

MRF454 Same as MRF458
12.5 VDC, 3-30 MHz
80Watts output, 12dB gain
$19.90 ea.

CIRCLE 140 ON READER SERVICE CARD

IC'S

Series 74S	
74S00	.59
74S02	.59
74S03	.59
74S04	.59
74S05	.59
74S08	.79
74S10	.59
74S11	.59
74S20	.59
74S22	.69
74S30	.59
74S37	.99
74S38	.99
74S40	.69
74S64	.89
74S65	.89
74S74	1.49
74S83	
74S86	1.69
74S112	1.39
74S114	1.39
74S124	3.75
74S133	.89
74S134	1.90
74S138	3.95
74S139	3.95
74S140	1.29
74S151	1.95
74S153	2.75
74S157	2.70
74S158	2.70
74S163	3.75
74S164	2.75
74S174	3.75
74S175	3.75
74S181	9.50
74S189	6.95
74S194	3.25
74S195	2.99
74S200	8.95
74S240	8.95
74S241	8.95
74S251	2.49
74S257	2.49
74S260	.99
74S280	3.95
74S283	
74S287	3.95
74S373	3.49
74S374	3.49
74S474	9.00
Series 74	
7400	.39
7401	.49
7402	.27
7403	.27
7404	.27
7405	.28
7406	.28
7407	.28
7408	.31
7409	.28
7410	.27
7411	.34
7412	.34
7413	.44
7414	.90
7416	.34
7417	.34
7420	.27

7423	.34
7425	.34
7426	.34
7427	.34
7428	.34
7430	.28
7432	.34
7433	.34
7437	.34
7438	.34
7439	.39
7440	.29
7441	.99
7442	.99
7443	.99
7445	.99
7446	.99
7448	.84
7449	.99
7450	.28
7451	.28
7453	.28
7454	.28
7460	.44
7470	.39
7472	.42
7473	.41
7474	.42
7475	.42
7476	.42
7480	.64
7483	.60
7485	.70
7486	.44
7489	1.80
7490	.99
7491	.70
7492	.77
7493	.54
7494	.77
7495	.70
7496	.77
7497	.77
74100	1.04
74105	.37
74107	.58
74109	.37
74116	2.30
74120	2.00
74122	.64
74123	.64
74125	.49
74126	.62
74132	.74
74141	.74
74145	.67
74148	1.25
74150	1.04
74153	.72
74154	1.24
74155	.87
74157	.74
74158	1.70
74161	1.00
74163	.92
74164	1.02
74165	1.02
74166	1.25
74172	6.00
74173	.84
74174	.94
74175	.94
74177	.90
74180	.80

74181	1.80
74182	.80
74185	2.00
74186	10.00
74190	1.20
74191	1.20
74193	.90
74194	.90
74195	.90
74196	.90
74197	.90
74273	1.10
74279	.84
74283	2.20
74298	
74366	.73
74367	.84
74368	.84
Series 74LS	
74LS00	.40
74LS01	.33
74LS02	.33
74LS04	.44
74LS05	.33
74LS08	.44
74LS09	.43
74LS10	.33
74LS11	.44
74LS14	1.30
74LS20	.31
74LS21	.43
74LS27	.44
74LS30	.31
74LS32	.44
74LS37	.84
74LS38	.44
74LS42	.84
74LS49	1.43
74LS51	.31
74LS54	.40
74LS73	.50
74LS74	.64
74LS75	.73
74LS76	.50
74LS85	1.24
74LS86	.50
74LS90	.80
74LS93	.80
74LS95	.93
74LS96	1.03
74LS107	.50
74LS109	.50
74LS112	.64
74LS123	1.24
74LS125	.94
74LS132	.84
74LS138	.94
74LS139	.68
74LS145	1.30
74LS151	.84
74LS153	.84
74LS155	1.24
74LS156	1.04
74LS157	1.04
74LS158	.80
74LS160	1.03
74LS161	1.20
74LS163	1.03
74LS164	.94
74LS165	.94
74LS173	.94
74LS174	1.04
74LS175	1.04
74LS181	2.25

74LS191	1.20
74LS193	1.03
74LS194	1.20
74LS195	1.00
74LS196	.94
74LS197	.94
74LS221	1.54
74LS240	3.04
74LS244	3.00
74LS245	8.95
74LS251	1.84
74LS253	1.03
74LS257	1.03
74LS258	1.03
74LS259	3.00
74LS266	.64
74LS273	1.80
74LS282	
74LS283	1.15
74LS293	2.00
74LS298	1.34
74LS323	4.79
74LS353	1.70
74LS366	1.04
74LS367	1.04
74LS368	1.04
74LS373	2.80
74LS374	2.80
74LS378	1.33
74LS393	2.00
74LS670	2.34
4001	.34
4002	.34
4007	.34
4009	.64
4011	.34
4012	.34
4013	.54
4015	1.44
4017	1.24
4021	1.54
4023	.42
4024	.84
4025	.43
4027	.84
4028	1.04
4029	1.34
4030	.74
4040	1.34
4046	2.30
4049	.74
4050	.74
4052	1.15
4060	1.44
4069	.44
4081	.40
4093	1.04
7520L	1.35
75107	.84
75108	.84
75113	2.25
75115	
75123/8T23	1.49
75151	
75154	2.00
75350	
75368	2.95
75369	
75427	
75451	2.10
75452	2.10
75454	2.10
75480	
75492	.93

TUBES

6KD6	5.00
6LQ6/6JE6	6.00
6MJ6/6LQ6/6JE6C	10.00
6LF6/6MH6	6.60
12BY7A	4.00
2E26	4.69
4X150A	29.99
4CX250B	45.00
4CX250R	69.00
4CX300A	109.99
4CX350A/8321	100.00
4CX350F/J/8904	100.00
4CX1500B/8660	300.00
811A	20.00
6360	4.69
6939	30.00
6146	7.95
6146A	9.00
6146B/8298	9.99
6146W	12.95
6550A	10.00
8908	14.00
8950	13.00
4-400A	145.00
4-400C	145.00
572B/T160L	44.00
7289	39.99
3-1000Z	229.00
3-500Z	141.00

ATLAS FILTERS

ATLAS CRYSTAL FILTERS FOR ATLAS HAM GEAR

Your Choice

$15.95 ea.

5.645 - 2.7/8
5.595 - 2.7 USB
5.595 - 2.7/8/L
5.595 - 2.7 LSB
5.595 - .500/4
9.0 - USB/CW

Johnson AIR Variables

$1.00 each

T-3-5	1 to 5 pF
T-6-5	1.7 to 11 pF
T-9-5	2 to 15 pF
189-6-1	.1 to 10 pF
189-502-Y	1.3 to 6.7pF
189-503-105	1.4 to 9.2pF
189-504-5	1.5 to 11.6pF
189-505-5	1.7 to 14.1pF
189-505-107	1.7 to 14.1pF
189-506-103	1.8 to 16.7pF
189-507-105	2 to 19.3pF
189-508-5	2.1 to 22.9pF
189-509-5	2.4 to 24.5pF
545-043	1.8 to 11.4pF

1/4 x 2 1/2" shaft
$2.50 each

193-10-6	2.2 to 34 pF
193-	1.5 to 27.5pF
193-	.6 to 6.4pF

$1.00 each

160-107-16	.5 to 12 pF
193-10-9	2.2 to 34 pF
193-10-104	2.2 to 34 pF
193-4-5	3 to 30 pF

TRIMMER CAPS

Sprague. Stable Polypropylene.
.50 each or 10/4.00
not sold mixed
1.2 to 13pF
2 to 30pF
3.9 to 18pF
3.9 to 40pF
3.9 to 55pF

UNELCO CAPS

6.8pF	47pF
8.2pF	62pF
10pF	120pF
12pF	160pF
13pF	180pF
14pF	200pF
20pF	240pF
24pF	380pF
33pF	470pF
36pF	1000pF
43pF	- 350V

$1.00 each

High Voltage Caps

30 MFD @ 500 VDC	1.69
22 MFD @ 500 VDC	1.69
100 MFD @ 450 VDC	2.29
150 MFD @ 450 VDC	3.29
225 MFD @ 450 VDC	4.29
420 MFD @ 400 VDC	
600 MFD @ 400 VDC	
.001/1000pF @ 10 KV	.89
.001 @ 3 KV	4/1.00
.0015 @ 3 KV	3/1.00
.01 @ 4 KV	.79
.01 @ 1.6KV	4/1.00
.01 @ 1 KV	6/1.00

CRYSTAL FILTERS

EFCL455K13E	3.99
EFCL455K40B2	2.99
FX-07800L, 7.8 MHz	12.99
FHA103-4, 10.7 MHz	12.99

J-Fet

J310 N-CHANNEL J-FET 450 MHz
Good for VHF/UHF Amplifier,
Oscillator and Mixers 3/$1.00

2822 North 32nd Street, #1 • Phoenix, Arizona 85008 • Phone 602-956-9423

SEMICONDUCTORS SURPLUS

CHOKES

.1-3 uH	2.99
VIV .15 .15 uH	2.99
VIV 150 150 uH	2.99
5-20 uH	1.69
Variable coil 10-80 uH	2.99
Transformer dual 8.8 uH	1.00
.47 uH	1.00 ea. or 10/7.50
.68 uH	1.00 ea. or 10/7.50
1 uH	1.00 ea. or 10/7.50
1.2 uH	1.00 ea. or 10/7.50
1.5 uH	1.00 ea. or 10/7.50
2.2 uH	1.00 ea. or 10/7.50
2.7 uH	1.00 ea. or 10/7.50
3.3 uH	1.00 ea. or 10/7.50
6.5 uH	1.00 ea. or 10/7.50
7.5 uH	1.00 ea. or 10/7.50
10 uH	1.00 ea. or 10/7.50
15 uH	1.00 ea. or 10/7.50
20 uH	1.00 ea. or 10/7.50
22 uH	1.00 ea. or 10/7.50
33 uH	1.00 ea. or 10/7.50
39 uH	1.00 ea. or 10/7.50
47 uH	1.00 ea. or 10/7.50
50 uH	2.99
56 uH	1.69
62 uH	1.00 ea. or 10/7.50
68 uH	1.00 ea. or 10/7.50
100 uH	2.99
120 uH	1.69
185 uH	1.00 ea. or 10/7.50
538 uH	1.00 ea. or 10/7.50
680 uH	1.00 ea. or 10/7.50
1000 uH	1.00 ea. or 10/7.50
1630 uH	1.50
.1 mH	2.99
.2 mH	2.99
.22 mH	2.99
.27 mH	2.99
.33 mH	2.99
.39 mH	2.99
.240 mH	2.99
1.2 mH	2.99
1.5 mH	2.99
1.65 mH	2.99
1.75 mH	2.99
1.9 mH	2.99
1 mH	1.69
1.88 mH	3.99
2 mH	2.99
2.4 mH	2.99
2.5 mH	1.00 ea. or 10/7.50
2.7 mH	2.99
3.0 mH	2.99
3.6 mH	2.99
4.3 mH	2.99
4.7 mH	2.99
5 mH	2.99
5.11 mH	2.99
6 mH	2.99
7.2 mH	2.99
8.25 mH	2.99
8.28 mH	2.99
8.6 mH	2.99
10 mH	2.99
12 mH	2.99
15 mH	2.99
17 mH	2.99
19.6 mH	2.99
20 mH	2.99
20.5 mH	2.99
22.6 mH	2.99
24 mH	2.99
27.4 mH	2.99
28.7 mH	2.99
29.9 mH	2.99
30 mH	2.99
36 mH	2.99
36.5 mH	2.99
40 mH	2.99
40.2 mH	2.99
43 mH	2.99
47 mH	2.99
50 mH	2.99
59 mH	2.99
60 mH	2.99
71.5 mH	2.99
78.7 mH	2.99
86 mH	2.99
100 mH	2.99
120 mH	2.99
150 mH	2.99
175 mH	2.99
200 mH	2.99
205 mH	2.99
237 mH	2.99
240 mH	2.99
300 mH	2.99
360 mH	2.99
390 mH	2.99
430 mH	2.99
500 mH	1.50
600 mH	2.99
1000 mH	2.99
1.5 Hy	2.99
2.0 Hy	2.99
2.5 Hy	2.99
3.0 Hy	2.99
5.0 Hy	2.99
10 Hy	2.99

E.F. JOHNSON TUBE SOCKETS

#124-0311-100 .... 6.99 each
For 8072 etc.

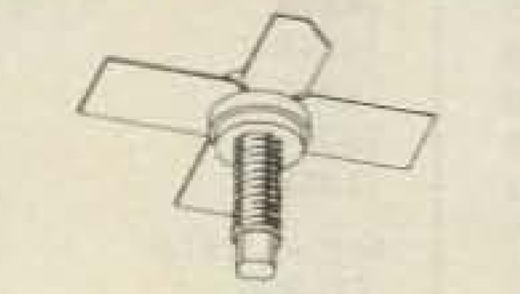
#124-0107-001 .... 13.99 each
For 4CX250B/R, 4X150A etc.

#124-0111-001 .... 4.99 each
Chimney for 4CX250B/R and 4X150

#124-0113-001 and 124-0113-021
$12.99 each
Capacitor for #124-0107-001

#123-209-33 Sockets....6.99 each
For 811A, 572B, 866, etc.

RF Transistors



MRF203	P.O.R.
MRF216	31.00
MRF221	10.90
MRF226	12.65
MRF227	3.45
MRF238	12.65
MRF240	15.50
MRF245	34.00
MRF247	34.00
MRF262	9.20
MRF314	20.70
MRF406	13.80
MRF412	25.30
MRF421	36.80
MRF422A	41.40
MRF422	41.40
MRF428	46.00
MRF428A	46.00
MRF426	15.50
MRF426A	15.50
MRF449	12.65
MRF449A	12.65
MRF450	13.80
MRF450A	13.80
MRF452	15.00
MRF453/GE185	17.25
MRF454	19.90
MRF454A	21.83
MRF455	16.00
MRF455A	16.00
MRF458	19.90
MRF472	1.00
MRF474	3.00
MRF475	2.90
MRF476/C1306	2.90
MRF477	11.50
MRF485	3.00
MRF492	23.00
MRF502	1.04
MRF604	2.07
MRF629	3.45
MRF648	33.35
MRF901	2.15
MRF902	8.00
MRF904	3.00
MRF911	3.00
MRF5176	3.00
MRF8004	2.10
BFR90	1.30
BFR91	1.65
BFR96	2.20
BFW92A	1.15
BFW92	1.00
MMCM918	14.30
MMCM2222	15.65
MMCM2369	15.00
MMCM2484	15.25
MMCM3960A	24.30
MWA120	10.00
MWA130	10.00
MWA210	10.00
MWA220	10.00
MWA230	10.00
MWA310	10.00

TRIMPOTS

Thumb wheel type.
.39 each or 10/2.50
not sold mixed

100	20000
150	25000
200	50000
250	200K
500	250K
1000	500K
1500	750K
2000	2 megs
2500	2.2 megs
5000	3 megs
10000	5 megs

CB type crystals

$2.50 each

51-T

T1	T15	T28
T2	T16	T29
T3	T17	T30
T4	T18	T31
T5	T19	T32
T6	T20	T33
T7	T21	T34
T8	T22	T35
T9	T23	T36
T10	T24	T37
T11	T25	T38
T12	T26	T39
T13	T27	T40
T14		

51-R

R1	R15	R28
R2	R16	R29
R3	R17	R30
R4	R18	R31
R5	R19	R32
R6	R20	R33
R7	R21	R34
R8	R22	R35
R9	R23	R36
R10	R24	R37
R11	R25	R38
R12	R26	R39
R13	R27	R40
R14		

Used NiCads

Used C Nickel Cadmium Batteries
1.8 amp hour
Pack of ten $8.99 per pack

Carbide Circuit Board Drill Bits for PCB Boards
5 mix for $5.00

MURATA CERAMIC FILTERS

SFD 455D	455 KHz	2.00
SFB 455D	455 KHz	1.60
CFM455E	455 KHz	5.50
CFU455H	455 KHz	3.00
SFE 10.7MA	10.7 MHz	2.99

NEW 2" ROUND SPEAKERS
100 Ohm coil 2 for 99¢

LED'S

Jumbo Red	8/1.00
Jumbo Green	8/1.00
Jumbo Yellow	8/1.00

MEDIUM LED'S

Red	8/$1.00
Green	8/$1.00

NE555V TIMERS
.39 each or 10/$3.00

IC SOCKETS
Solder tail

8 pin	.13
14 pin	.15
16 pin	.17
18 pin	.20
20 pin	.29
22 pin	.30
24 pin	.30
28 pin	.40
40 pin	.49

IC SOCKETS
Wire wrap

14 pin	.69
16 pin	.69
40 pin	1.99

CERAMIC PLATE CAPS
$1.09 each
#1 type for 3/8 plate cap
#2 type for 5/8 plate cap

PLATE CHOKES

75 uH	3.00
.94 mH	3.99

NEW DUAL COLON LED
.69 each or 10/$5.00

TEKTRONIX PLUG-INS

CA	75.00
C	69.00

Soldering Kit

New Weller Soldering Iron Kit
#SP-23K............ 9.99 each
Kit includes:
- 1 - 25 Watt soldering iron, develops 750° of tip temperature
- 3 - tips (screwdriver, chisel, cone)
- 1 - soldering aid tool
- 1 - coil 60/40 rosin core solder

CIRCLE 142 ON READER SERVICE CARD

CRYSTALS

$3.00 each

5.120	10.010	11.855
7.3435	10.020	11.900
7.4585	10.030	11.905
7.4615	10.040	11.955
7.4625	10.0525	12.000
7.4665	10.130	12.050
7.4685	10.140	12.100
7.4715	10.150	16.965
7.4725	10.160	17.015
7.4765	10.170	17.065
7.4785	10.180	17.165
7.4815	10.240	17.215
7.4825	10.245	17.265
7.4865	10.595	17.315
7.4925	10.605	17.355
7.4985	10.615	17.365
7.5015	10.625	37.600
7.5025	10.635	37.650
7.5065	11.155	37.700
7.7985	11.275	37.750
7.8025	11.700	37.800
9.545	11.705	37.850
9.555	11.730	37.900
9.565	11.750	37.950
9.575	11.755	38.000
9.585	11.800	60.000
10.000	11.850	

MEMORY EPROMS C.P.U.'s ETC.

68B21 .... 9.99
2716 .... 4.99
2708/4708 .... 2.00
6820 .... 4.00
6845 .... 20.00
8202 .... 25.00
8212 .... 1.50
8214 .... 3.00
8257 .... 6.00
8279 .... 9.00
1793 .... 29.99
2114-2 & 3.................... 2.00
4044 .... 2.00
4027 .... 1.00
3232 .... 3.00
2732-6 .... 14.99
Z80 CPU 5.00
Z80 CTC 5.00
Z80A - PIO.................... 6.99
Z80A - SIO/O....................19.99
Z80A - SIO/I 19.99
Z80A-SIO/II 19.99
8251/2651 .... 4.50
3341 .... 3.00
8741 .... 25.00
8748 .... 39.00
MC1408L/6 .... 3.25
MC1408L/8 .... 4.25
8T28 .... 1.99
TMS1000NL 4.00
1702 .... 4.00
1488 .... .99
1489 .... .99
8085 .... 9.99
2102 .... .69
MC6800P 9.99
8080 .... 3.00
8080A 4.50

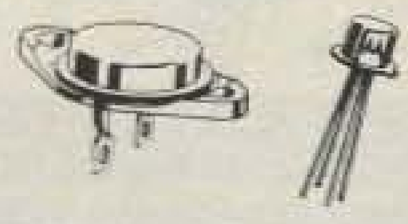
Floppy Disk Power Supply: Handles two units with the greatest of ease 89.99

NEW BCD SWITCHES

3 switch with end plates $8.99

8 switch with end plates
Model TSM 200-1011 (CDI) $16.8'

Transistors



		2N3959	3.85	2N5645	13.80
		2N3960JANTX	10.00	2N5842	8.00
		2N4072	1.80	2N5849	20.00
		2N4427	1.30	2N5942	40.00
		2N4429	7.00	2N5946	19.00
		2N4877	1.00	2N5862	57.50
		2N4959	2.30	2N6080	9.20
		2N4976	15.00	2N6081	10.35
2N2857	1.55	2N5070	18.40	2N6082	11.50
2N2857JAN	2.50	2N5071	20.70	2N6083	13.25
2N2949	3.60	2N5108	4.00	2N6084	15.00
2N2947	15.00	2N5109	1.70	2N6095	12.00
2N2950	4.60	2N5179	1.00	2N6096	15.50
2N3375	8.00	2N5583	4.00	2N6097	17.25
2N3553	1.57	2N5589	8.65	2N6166	40.25
2N3818	5.00	2N5590	10.35	2N6368	28.75
2N3866	1.30	2N5591	13.80	A210/MRF517	2.00
2N3866JAN	2.50	2N5635	10.35	BLY38	5.00
2N3866JANTX	4.00	2N5636	12.00	40280/2N4427	1.30
2N3925	10.00	2N5637	15.50	40281/2N3920	7.00
2N3948	2.00	2N5641	9.20	40282/2N3927	17.25
2N3950	25.00	2N5643	15.50	MMT74	1.04

CONNECTORS

PL-258
UHF female to UHF female 1.69
M-359
UHF 90° 2.50
UG363 UHF double female
Panel mount 2.99
UHF/M
PL-259 to RCA .90
F71-1115
4 pin plug .75
F71-1116
4 pin jack .75
F71-1120
6 pin plug .85
F71-1121
6 pin jack .85
Din plug & jack
5 pin male & female .49
BNC UG260
BNC male for RG 59U 1.25
BNC UG88U
BNC male for RG 58U
UG 273
BNC female to PL-259 2.50
UG 274
BNC T

2 female to 1 BNC male 3.75
UG 21
Type N male 3.60
UG 23
Type N female 3.75
PL-259 .69
SO-239 .69
F 61 female chassis mount connector with hex nut 10/1.99
UG 306
BNC male to female 90° 2.59
UG255
BNC male to female 90° 2.79
UG 491
BNC male to 80-239 female 3.00
UG 1094 BNC female chassis mount .80
UG 914
BNC female to BNC female
RS-232 Hoods 1.00
RS-232 Male PCB type 2.00
RS-232 Female PCB type 2.00
Centronics male 6.99
F-59 connector for UG 59U cable 100/13.95 or 10/2.00

New video monitor cases $49.99 ea.

EMI FILTERS

#NF 10870-8	10 Amps	6.99
#F 1845	5 Amps	3.99
# 3B1	3 Amps	2.99
# 2B2	2 Amps	2.69
# 3B4	3 Amps	2.99

TO-220 Heatsinks
Part # THM-6025 or THM-6030 4/1.00

TO-3 Heatsinks
For one TO-3 type transistors
Part # THM-6401B-2

LED Bar Graph Display
10 LED in bar.
835-11 3.99 each

3 1/2 Digit LCD
Part # LCD5654R15 5.00 each

TVT - 1 matching transformers
75 Ohms to 300 Ohms........ .55

78MO5
Same as 7805 but only 1/2 Amp
5 VDC .49 each or 10/$3.00

CONTINUOUS TONE BUZZER

#MB12 "Soma"
Freqz 450 Hz, size 5/8 x 5/8
12VDC............... $2.00 each

CORES

4/1.00

T20-12	T30-6	T37-6
T25-6	T30-12	T37-10
T30-2	T37-2	T44-6

T50-6.... 2 for 1.00

MAGNET WIRE

$22.50 per spool

#24	A.W.G.	9 lb.
#26	A.W.G.	9 lb.
#25	A.W.G.	9 lb.
#30	A.W.G.	8 3/4 lb.
#31	A.W.G.	6 lb.

TO-3 TRANSISTOR SOCKETS
Phenolic type............6/$1.00

110VAC MUFFIN FANS

New $11.95
Used $5.95

RELAYS

Meko #109P80060............ .99
5 VDC SPDT

Meko.................... .99
5 VDC SPST

AMF/P&B....................2.99
R10-E1-Y2-J1.0K - 8.5 MA
6 VDC DPDT

AMF/P&B....................2.69
R50-E2-Y1
12 VDC 210 ohms DPDT

AZ530-13-2....................2.69
12 VDC 45 ohms SPDT

Sigma #70RE62..............4.95
12 VDC 3P6T

Omron MHE202PG..........2.99
VA - DC12 DPDT

AMF/P&B 4.99
KUMP11D18
12 VDC DPDT

Sigma 65F1A................1.69
12 VDC SPDT

NAP Controls..............2.99
13 A 12D12 DPDT

Magnecraft 1.99
W104MX-2
250 ohms 12 VDC SPDT

P&B KH4695-1..............2.99
120 VAC 2P4T

P&B GA-2290..............3.09
110 VDC 2P4T

P&B PR5DY................3.99
25 A 12 VDC SPDT

P&B PR7AY................5.99
25 A 115 VAC DPST

AMF/P&B..................4.99
PRD11AY0
24 VAC 25 A DPDT

MS188-901/188-212081-102
70 ohms SPST.............1.69

CERAMIC COIL FORMS
$1.00 each

#1	3/16" x 4/8"
#2	3/16" x 1/4"
#3	1/4" x 3/4"
#4	3/8" x 7/8"
#5	3/8" x 5/8"

All of the above have powdered iron cores.

#6	1/2" x 2 3/4"

Miniature Ceramic Trimmers
.50 each or 10/$4.00

CV31D350	2 to 8 pF
HM00-4075-03	3.5 to 11 pF
300425	3.5 to 13 pF
E5-25A	5 to 25 pF
	5.1 to [illegible] pF
	3.5 to 15 pF
	5.2 to 40 pF
	2.5 to 6 pF

NEW CHERRY BCD SWITCH
New end plates
Type T-20............ 1.29 each

New Fairchild Prescaler Chip

95H90DCQM............ 6.50 each
350 MHz prescaler divide by 10/11

2822 North 32nd Street, #1 • Phoenix, Arizona 85008 • Phone 602-956-9423

SPECIALS-PRICES GOOD FOR 60 DAYS

IC SALE

400CJ	.88
2805HC/1405A	1.00
74LS27	.25
P3101/82525/ 74S289	1.00
SCL4013A/BE	.25
MC14001BCP	.25
MC14017BCP	.75
MC14012BCP	.19
MC14023BCP	.20
MC14027BCP	.39
MC14069BCP	.30
MC14093BCP	.60
MC3420P	1.00
MCM10152L	5.00
MC7408P	.19
74LS05PC	.20
AD580	1.00
8T01B	.60
CH164A	.25
CG388V	.25
74LS20F	.20
748SN	.39
DS0026CH	1.00
CD 4013BCN	.30
CD 4028AE	.49
CD 4040 BCN	.80
CD 4069CN/74C74	.30
MM74C74N	.40
CD 4015CN	.75
DS/DM 8839N	.60
DM 75L51N	.75
TLO-61CP	.30
SN7428N	.25
Z80CPU	4.99
2708-6	1.00
2516/2716	2.50
2732-6	10.00
2102	.50

2114-2 & 3	8/16.00
4104	8/16.00
D2116/4116	8/18.00
D8257	3.00
MC6845	10.00
Z80CTC	4.00
Z80SIO/O or /I	8.00
Z80PIO	4.00
74LS273	.80
74LS373	.80
74LS374	.80
74LS245	1.40
74LS367	.40
74LS14	.60
78M05	.39
78L05	.30
78L15	.30
78L08	.30
79L12	.49
LM317T	1.99
MC7808T/ LM340T-8	.49
7805/LM340T-5	.89
7812/LM340T-12	.89
7815/LM340T-15	.89
7824/LM340T-24	.89
D8202	20.00
D8212	1.00
D8214	2.00
8251	3.00
TMS1000NL	2.00
MC1306P	.75
MC1414L	.29
LM/SN1458V	.40
LM555V	.30
LM309K/7805CK	1.00
MC6852P	3.00
RC74LS51N	.15
SN74LS74N	.20
PT 1482B	2.00
EC 1422B	2.00
LA 4220 Sanyo	1.00
SN75427N	.30
N8T28N/MC6889	1.00
D3232/MC3232	1.00

CHOKES AND INDUCTORS

4/1.00

.3 uH	82 uH
.56 uH	91 uH
1.8 uH	180 uH
2 uH	220 uH
3.1 uH	270 uH
6.6 uH	410 uH
52 uH	450 uH
55 uH	

2/1.00

2.4 mH	68 mH
22 mH	

Miller 9055
50-120 uH 2.50

Summita 20K359
455 kc discrimination
Miller #8806/34H-650
2.50

RCA TRANSISTORS
80684
40235

AMPEREX/MOTOROLA
RF TRANSISTOR

BFR91	.75
MRF901	2.00

DIPPED SILVER MICA

5pF	$.40	120pF	$.25
10pF	.25	150pF	.25
12pF	.30	210pF	.40
15pF	.30	250pF	.40
20pF	.25	330pF	.40
22pF	.25	470pF	.40
24pF	.25	500pF	.40
33pF	.25	560pF	.40
50pF	.25	620pF	.40
75pF	.25	820pF	.50
82pF	.25	6800pF	1.00
100pF	.25		

Quantity pricing also.

JFD Piston Caps
VCJ 2819A 1.00 each

House numbered AY5-2376
Keyboard encoder chip - 88 (keys)
same as KR 2376 6.99 each

5 Way DC Voltage Adapter
Selective voltage: 6, 9, and 12VDC.
Input voltage - 115VAC $9.99

WALL TYPE TRANSFORMERS

115 VAC input
6 VAC @ 10 MA............ 2.99
12 V @ 700 MA............ 4.99
15 V @ 300 MA............ 3.99

115 VAC & 220 VAC input
15 V @ 300 MA............ 3.99

DL-1416
4-Digit 16 Segment Alphanumeric
Intelligent Display with Memory,
Recorder, Driver $14.95 each

Fuse Holders
HKP type for 3AG .89 each

UHF Varactor Tuners - Sony
$19.99 each

Teledyne Serendip
Solid State Dip Relay
Part #A641-1 $2.49 each

Capacitor, Resistors & Diodes
Assortment
(All New) (Not Junk)

100 pcs.	4.00
250 pcs.	7.00
500 pcs.	12.00
1000 pcs.	20.00

Hardware Assortment
1 pound mixed screws, standoffs,
washers, feet, insulator 5.00

IC Assortment
50 New IC's. Not Junk.
7400/S/LS Linear, DTL/RTL etc.
$10.00

New Miniature Toggle & Rocker
Switch - 25 mix. $6.99

TO-3 and TO-66 Used Power
Transistors
High voltage switching in CRT's.
30 pcs. Good/Bad? 2.00
100 pcs. 10.00

IC, TTL-LS/S/Linear/MOS etc.
Used - some good/some bad. 50%
we buy are good!
400 pcs. 4.00
1000 pcs. 8.00

Electrolytic Caps.
All types (new).
50 pcs. 6.99

New Assorted Toroid Cores
10 big & small 4.00

LED Display
FND 357 . 362 red
C.C. 2/1.00

TIL312 LED Display
Red 2/1.29

Assorted Heat Sinks - 3 each.
For TO-3, TO-220, TO-66 & TO-5.
12/1.99

Assorted Potentiometers
"All new" not junk. Some with
switch, some with 1/4" shaft.
#S.S. 283 30 for 4.00
#S.S. 284 100 for 10.00

2822 North 32nd Street, #1 • Phoenix, Arizona 85008 • Phone 602-956-9423

CIRCLE 146 ON READER SERVICE CARD

a monthly feature by
A. EDWARD HOPPER, W2GT

Awards

NEWS OF CERTIFICATE AND AWARD COLLECTING

The Story of The Month as told by "Rex" is:

Robert R. Woodford, W5VNW
All Counties #290, 7-5-80

"I received my Novice ticket in 1951 and my General in 1952. During the period BC (Before County hunting), I worked a reasonable share of DX, rag chewed, entered a contest now and then, and, somewhere along the line, was fortunate enough to acquire an A-1 Operator Certificate. In late 1966, I purchased my first s.s.b. rig, and, while I didn't realize it at the time, thereby committed myself to a tremendous change in operating practice. During the ensuing months, I kept hearing talk of 'County Hunting' on the air, and on April 19, 1967 I deliberately worked K7SLX, John, in Uintah County, Utah, and was hooked. From that time on, except for an occasional schedule with our son, W5TFR, all operating time was devoted to hunting counties, and, after I located the Independent County Hunters, the dial seldom strayed from the net frequency.

"I remember, in the beginning, noting in *CQ* that USA-CA All Counties #3 Award had been issued to K8CIR on October 10, 1966 and thinking it might take as long as six months, or even a year, to work them All. After all, even with the limited number of mobiles, it was easy to work 25 or 30 'new ones' in a single day. Little did I realize that 'getting them All' would require 13 years. As time passed, there was less talking and more listening, and the interval between 'new ones' became days or weeks.

"I am not certain that my XYL ever understood the importance of this project, but she was, in general, reasonably tolerant of the situation. I do know that during the early years of County Hunting when our travels permitted frequent mobile operation, she never quite learned to appreciate sitting on a county line in 100 degree weather while I waited my turn to put out the county. She did, however, prefer

Paul Schuett, WA6CPP, on Route 299 in California.

the sitting to my operating in motion in heavy traffic. Then when I retired and we acquired a 31-foot Airstream in 1976, real problems arose. It just isn't often that highway builders are considerate enough to equip county lines with nice, wide shoulders, and, since the XYL prohibited my operating in motion while towing the trailer, putting out counties became almost passe.

"Now that the goal has been achieved, I am suddenly overwhelmed by the realization of how much I owe to so many who gave of their time and energy to make it possible. So, to all of you, from K7SLX who started it to W5AWT, Mel, who spent four days and at least 1500 miles to give me my last three counties, I extend a grateful 'thank you.' It was with mixed emotions that I received #290, since it signified the end to a challenge. It did not, however, lessen my affection and respect for all the County Hunters, and I will continue to spend most of my operating time on the net."

Special Honor Roll
All Counties

#339 James Edward Bartlett, WD8AYN 9-11-81.
#340 Clifford J. McCoy, WB9ELH 9-14-81.
#341 James T. Painter, WB6SRK 9-26-81.
#342 Robert C. Garceau, K1YRP 9-29-81.
#343 Fred Zurbriggen, WB9YZE 9-30-81.
#344 Dennis F. Miller, WB5KEA 10-6-81.
#345 Edward Grogan, K1ZSI 10-6-81.
#346 William S. Coon, K9EHP 10-9-81.

Awards Issued

"Al" Pedneau, K5HKG, up-graded his All Counties #117 of 6-29-74 to be All Counties endorsed All S.S.B., All 20, All Mobiles.

Jim Bartlett, WD8AYN, waited until he had them All and got USA-CA-500 through All Counties, endorsed Mixed.

Cliff McCoy, WB9ELH, added to his fine collection All Counties endorsed All S.S.B.

Jim Painter, WB6SRK, also waited until he had them All and claimed USA-CA-500 through 3000 endorsed All S.S.B., All 20, All Mobiles, and All Counties endorsed All S.S.B.

Bob Garceau, K1YRP, added All Counties endorsed Mixed to his fine collection.

Fred Zurbriggen, WB9YZE, had his nice collection reach All Counties endorsed Mixed.

Dennis Miller, WB5KEA, moved around so much that he was happy that QSLs for USA-CA-500 through All Counties, endorsed All S.S.B., did find him.

Eddie Grogan, K1ZSI, added to his nice collection USA-CA-3000 endorsed All S.S.B., All 14, All Mobiles, and All Counties endorsed All S.S.B., All 14.

Bill Coon, K9EHP, waited until he had them All and requested USA-CA-500 through All Counties endorsed All S.S.B.

Bob Lamberton, WA3QNT, collected USA-CA-3000 endorsed Mixed.

Bruce Roberts, KC9DD (ex-WB9AAJ), won USA-CA-3000 endorsed All S.S.B.

Dick Peterson, W4KFA, qualified for USA-CA-3000 endorsed All S.S.B.

"Cal" Weyant, WA2PFF, picked up USA-CA-2500 endorsed Mixed.

Bill Hatcher, N5BDY, sent for USA-CA-1500 endorsed All 20 Fone.

Sadatoshi Shishido, JA8ZO, won USA-CA-1000 endorsed Mixed, #2 1000 to Japan.

John Woodham, G4IJW, claimed USA-CA-1000 endorsed Mixed.

USA-CA-500 Certificates endorsed Mixed went to:

Raphael Spitaels, ON6IT.
Barry Siegfried, K2MF.
John Noonan, KC4ZM (ex-KA4MFC, WA6SWL).
Naoki Akiyana, JH1VRQ.

Dieter Surmann, DL7MQ, received USA-CA-500 endorsed All C.W.

P.O. Box 73, Rochelle Park, NJ 07662

USA-CA Honor Roll

3000		**2000**		WB6SRK	672
WD8AYN	367	WD8AYN	488	WB5KEA	673
WA3QNT	368	WB6SRK	489	K9EHP	674
KC9DD	369	WB5KEA	490	G4IJW	675
WB6SRK	370	K9EHP	491		
W4FKA	371				
WB5KEA	372	**1500**		**500**	
K1ZSI	373	WD8AYN	547	ON6IT	1651
K9EHP	374	N5BDY	548	K2MF	1652
		WB6SRK	549	WD8AYN	1653
2500		WB5KEA	550	KC4ZM	1654
WD8AYN	431	K9EHP	551	WB6SRK	1655
WA2PFF	432			JH1VRQ	1656
WB6SRK	433	**1000**		DL7MQ	1657
WB5KEA	434	WD8AYN	670	WB5KEA	1658
K9EHP	435	JA8ZO	671	K9EHP	1659

Awards

Mexico DX Club—Diploma 100 X.

Diploma 100DX: Sponsored by the Mexico DX Club. Issued to amateurs and s.w.l.'s for confirmation of QSOs (or heard for s.w.l.'s) with stations that have in their calls one or more X letters (W4XYZ, LU3XYZ, G2XXX, XE1OX, etc.). To qualify a station must confirm a total of 100 points. Mexico DX Club members count as 3 points. Mexican stations count as 2 points. All other countries count as 1 point. QSOs with XE1MDX (club station) count for 10 points.

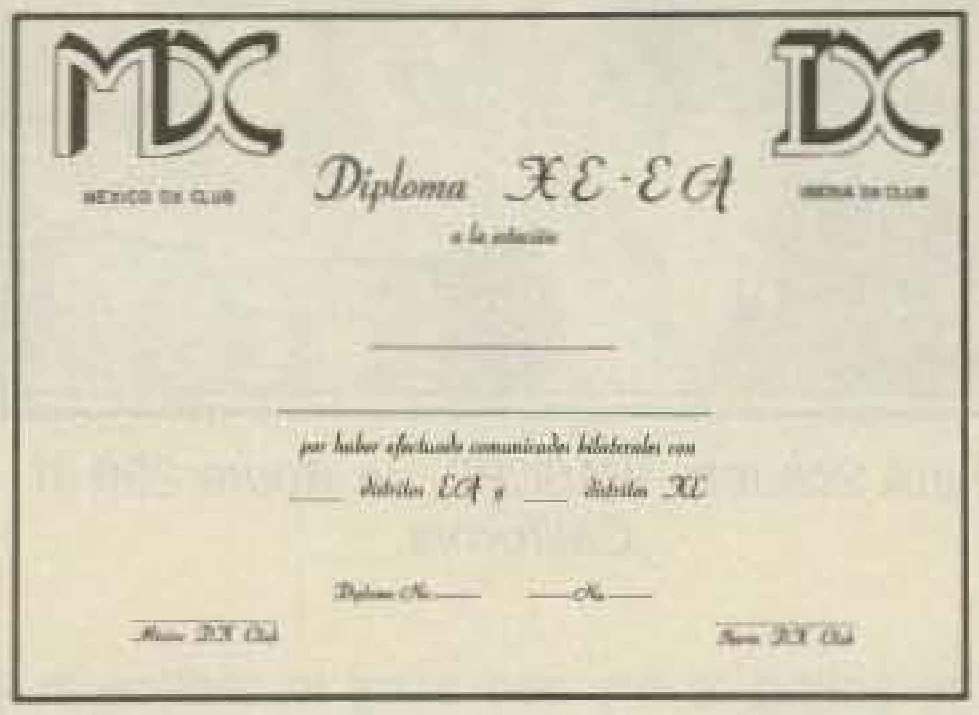
Only contacts after January 1, 1973 are valid. Award fee is 15 IRCs or $3.00 U.S. All standard award rules apply. Cards may be sent provided that the appropriate postage and instructions for their return are included with the application. Otherwise, the application should be verified by a local club official or two licensed amateurs. Apply to Scott R. Douglas, Jr., KB7SB, P.O. Box 46032, Los Angeles, California 90046. He is the official representative (check point) in the U.S.A.

Mexico DX Award.

Mexico DX Award: Also sponsored by the Mexico DX Club and available to amateurs and s.w.l.'s for confirmation of QSOs (or heard for s.w.l.'s) with Mexico DX Club member stations located in Mexico.

XE applicants need to confirm QSOs with 10 different club members. Zones 1 to 13 (except Zone 6) must confirm 5 different club members. All other applicants require only three different club members. Only contacts after January 1, 1973 are valid.

Award fee is 10 IRCs or $2.00 U.S. Apply to Scott R. Douglas, Jr., KB7SB, P.O. Box 46032, Los Angeles, California 90046. He is the official representative (check point) in the U.S.A. Mexico DX Club members include XE1AE, XE1FX, XE1GBM, XE1KS, XE1LCH, XE1LSS, XE1MDX, XE1MMD, XE1OD, XE1OK, XE1OH, XE1OW, XE1OX, XE1OZ, XE1RRP, XE1WIN, XE1UX, XE1VV, and XF4MDX.



XE-EA Award.

XE-EA Award: Sponsored by the Mexico DX Club and the Iberia DX Club. Issued to amateurs and s.w.l.'s for QSOs (confirmed—heard for s.w.l.'s) per these rules.

Class A: For confirmations with EA1, EA2, EA3, EA4, EA5, EA6, EA7, EA8, EA9, XE1, XE2, XE3.

Class O: All the above plus XF4 for Golden Seal.

Cost is 15 IRCs or $3.00 U.S. Apply to Scott R. Douglas, Jr., KB7SB, P.O. Box 46032, Los Angeles, California 90046. He is the official representative (check point) in the U.S.A.

The Mobile Amateur Radio Club of Colorado (MARCCO) is an organization of licensed amateur radio operators who engage in h.f. mobile operations. Meetings are held at noon on the first Friday of every month at Wyatt's Cafeteria, Cherry Creek Shopping Center, Denver. Visiting mobilers are invited to attend. MARCCO has established several Awards effective January 1, 1981:

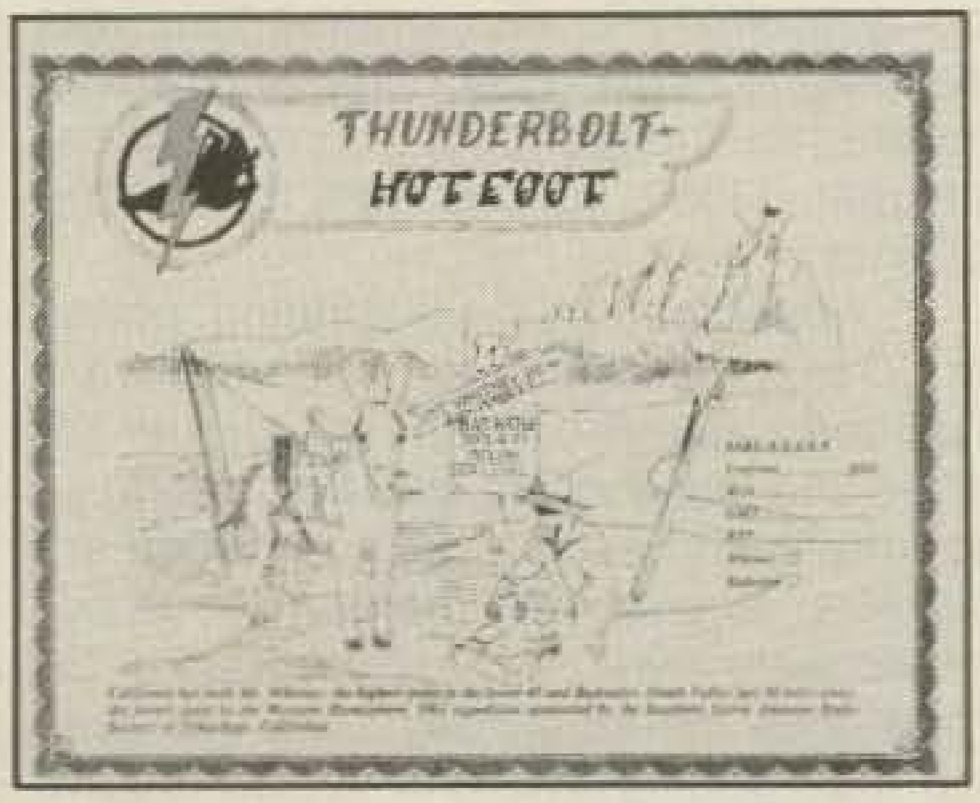
Worked Mobiles in All Colorado Counties.

Border-to-Border and **Coast-to-Coast Awards:** Work mobiles in an unbroken string of counties from Canada to Mexico or from the Atlantic Ocean to the Pacific Ocean. Any string must contain at least three Colorado counties.

WAMTZ Award: Worked mobiles in All Counties in the Mountain Time Zone.

Worked All Bingo Award: As a gesture of respect and affection for the late Bing Miller, WØGV (USA-CA-All Counties Award #140 dated 1-14-76) a charter member of MARCCO, the club will continue the Worked All Bingo Award which he established for working WØGV in All Colorado Counties. It will be called the WØGV Memorial Award and will be given for working the same mobile in each of the 63 Colorado Counties. Persons who already worked Bing in one or more Colorado Counties, regardless of date, may combine these contacts with those obtained from any other *single* mobile in the remaining counties to qualify for the Award. Log information is sufficient for all MARCCO Awards. For more information regarding awards, contact Rich High, WØHEP, MARCCO Awards Chairman, 451 East 58th Avenue, 239 B, Denver, Colorado 80216. Tel (303) 595-9286.


Naoki Akiyama, JH1VRQ, and his nice array of equipment.



The Thunderbolt-Hotfoot Award.

Thunderbolt-Hotfoot Award: The Southern Sierra Amateur Radio Society of Tehachapi, California conducted a simultaneous dual-site expedition under the call K6RL from Badwater, Death Valley, California, and the summit of Mount Whitney, California, during the Columbus Day Holiday weekend October 10–12, 1981. Death Valley is the lowest spot in the western hemisphere, 280 feet below sea level, and the summit of Mount Whitney is 14,496 feet above sea level, the highest point in the lower 48. To receive this beautiful certificate confirming your QSO, send your QSL and $1.00 to S.S.A.R.S., Rt. 2 Box 338, Tehachapi, California 93561.

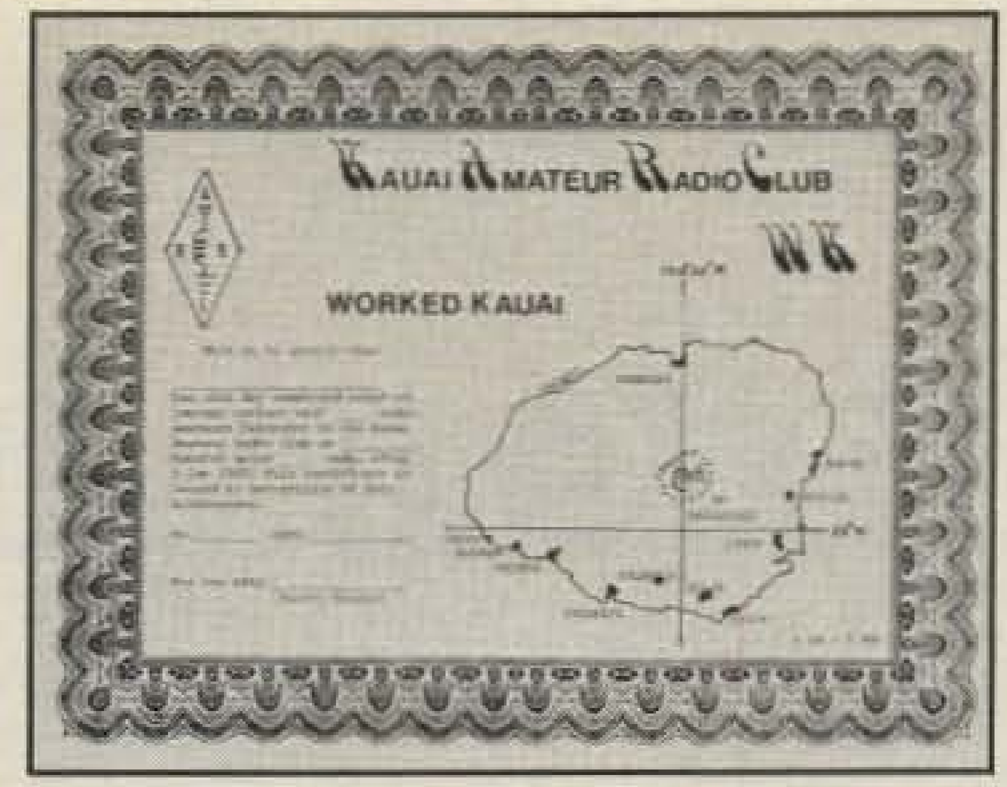
The WB2ZSC Award: Awarded (free) for interesting, spectacular, and friendly QSOs with stations that display patience, versatility, humor, good operating procedure, and mastery of the Morse code. Also awarded to Novices on their "first call," when they stay with him and "go the course."

The WB2ZSC Certificate.

Notes

A nice note from Paul Schuett, WA6CPP, told us he had fun mobiling and his son was very amused at some of the nicknames for signal reports: 22 Rifle shot; 33 Triplets; 44 Boxcars; 55 Nickels/Speed limit; 56 Hitchhiker; 57 Telephone pole; 58 Ice cream bar; and 59 Maximum.

Sad to report the loss of another friend/County Hunter, Mike Baustain, All Counties #149 of 6-15-76 and his story and



Worked Kauai Award sponsored by The Kauai ARC, P.O. Box 548, Kalaheo, Hawaii 96741 U.S.A. Rules on page 54, CQ, September 1981.

photo in the July 1978 issue of *CQ*. Mike was a charter member of MARAC #C-5.

Before I forget, The B & B Shop, 1348 Pinewood Drive, Woodbury, MN 55125, can help you with hosts of material for County Hunters, QSLs, *County Hunter Handbook, County Hunters Directory,* etc. Send an s.a.s.e. to them for details.

Here is some data on the *Awards Information Booklets* now available. There should be two new ones in the near future (data on them when I get it).

Booklet on *All Canadian Awards* (some 65)—cost $5.00 from Eric S. Walden, R.R. 1, Gowanstown, Ontario, Canada N0G 1Y0.

The *International Directory of Awards*—cost $8.00 from Vance LePierre, W5IJU, 2618 McGregor, Fernandina Beach, Florida 32034.

The Amateur Awards Directory of the World—cost $7.00 from Garry V. Hammond, VE3GCO, 5 McLaren Avenue, Listowel, Ontario, Canada N4W 3K1.

Amateur Radio Awards by the Radio Society of Great Britain via Ham Radio's Bookstore, Greenville, NH 03048—cost $6.95, but they do not keep them in stock, and it might take 6 months for you to get it.

DX Awards Guide by Charles J. Ellis, P.O. Box 1136 Welch Station, Ames, Iowa 50010. He has 3 different volumes to keep things up-to-date. Write to him for full data and prices.

Worldwide Awards Directory—Volume 1 costs $9.95, and Volume 2 costs $5.95, or both for $12.75. Write to Larry Kebel, 736-39th Street, West Des Moines, Iowa 50265. (Larry's call is KB0ZP.)

The *Directory of Certificates and Awards* by The International Amateur Radio Society, Inc. Available from Scott R. Douglas, Jr., KB7SB, P.O. Box 9990, Glendale, California 91206. Cost is $12.95 plus postage, which is $2.50 for U.S.A., Canada, and Mexico; all others $4.50. In California add 6% sales tax.

Hope you all have a wonderful and Happy New Year and that you will get All the things/QSLs you desire.

73 and DX, Ed, W2GT

a monthly feature by
KARL T. THURBER, JR., W8FX

Antennas

DESIGN, CONSTRUCTION, FACT, AND EVEN SOME FICTION

Another Time, Another Place: A Look at the Co-Inventor of the Yagi-Uda Antenna

In this month's antennas column, author W8FX departs from his regular format to trace the very early development of the Yagi antenna, going back to the mid-1920s for a look at the life and times of Japan's dai ichi *(number one) scientist and father of the parasitic array, Dr. Hidetsugu Yagi.*

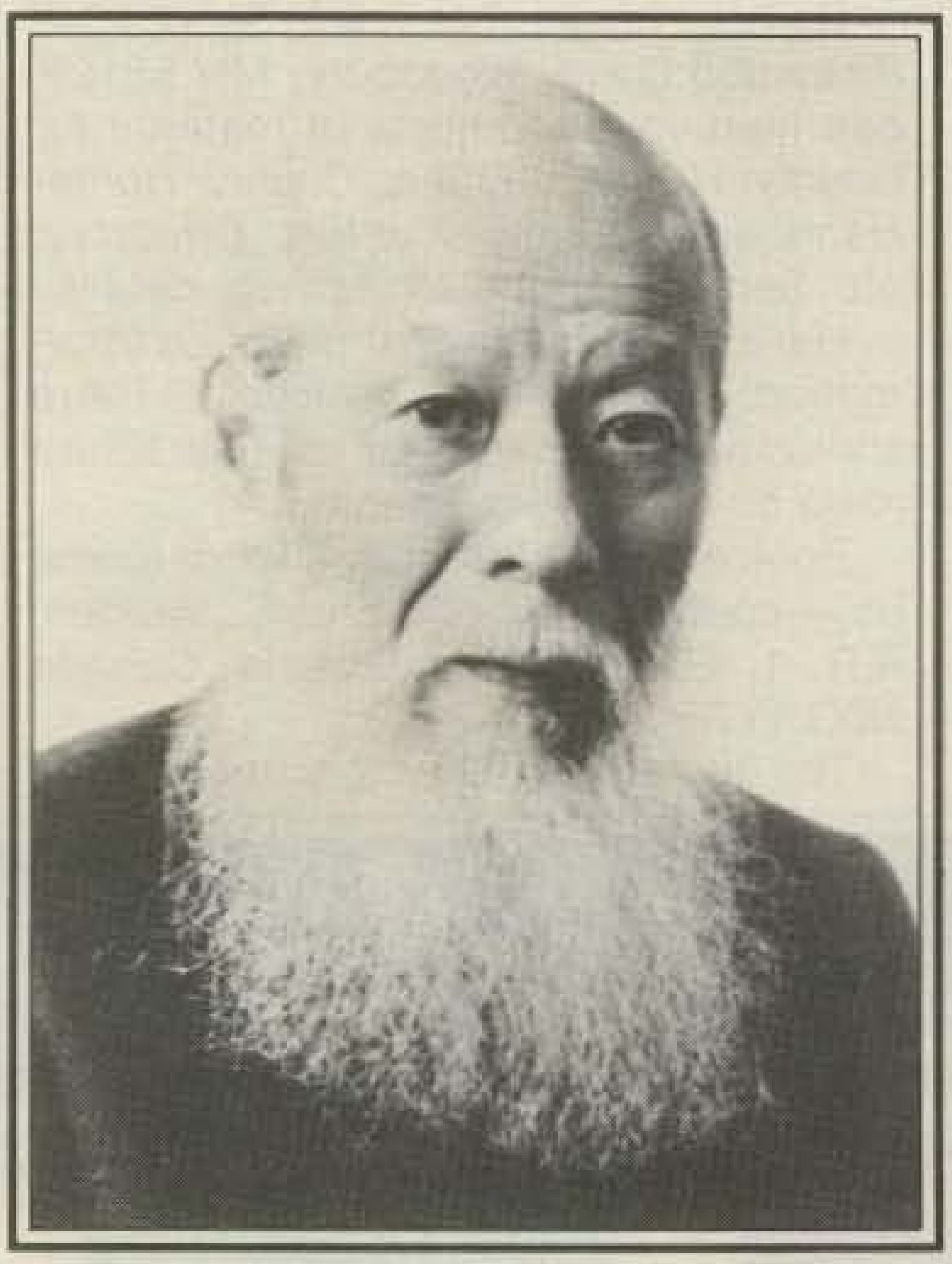
Choices for antennas are almost as varied as the amateurs who use them. They run from all-band, single-wire varieties, to the single-band dipole or folded dipole, to verticals, Windoms, Hertzes, loops, Marconis, Beverages, *ad infinitum*.

Beyond these types lies the potential "big blast" offered by a directional beam. With a modest 10 dB gain, a garden-variety beam can convert a 50-watt transmitter into the "r.f. equivalent" of a 500 watter. If you've even used a conventional beam, you have used an antenna that had its beginnings in a small laboratory in a university in pre-war Japan. The parasitic beam has been around for many years (since 1926, as we shall see) and owes much to the early pioneering work of Dr. Hidetsugu Yagi and his collaborator, Dr. Shintaro Uda.

First, a few words on just what the Yagi antenna *is*.

The Yagi: What Is It?

In plain terms, the Yagi consists of a driven (directly excited) dipole with closely-coupled parasitic elements—elements that have no direct electrical connection to the transmitter. The parasitic elements are electromagnetically coupled to the driven element, which is fed by the transmitter's output through a transmission line (fig. 1). The parasitic elements are cut to specific lengths and are known as the reflector and director; all of the elements are mounted in one plane on a boom support and spaced at given distances from each other.



Dr. Hidetsugu Yagi, whose landmark 1928 Proceedings of the IRE *manuscript made an indelible imprint on shortwave transmission and reception methods, is widely regarded as the father of the parasitic array. (Photo courtesy Tadao Kiga, JA1AR, Japan Amateur Radio League)*

Yagi, and later experimenters, found that little gain is added by adding more than one reflector, but considerable gain (to a point) results from adding additional directors. Although normally only one reflector is used, arrays using up to 12–16 directors are common. Larger arrays—those of 30, 40, or more elements—have been built, but these operate under conditions of diminishing returns for their size.

Although usually designed for operation on a specific h.f., v.h.f., or u.h.f. frequency or narrow range of frequencies, wideband characteristics can be obtained to some extent by using extra-thick elements, adding reactance, or adjusting the coupling to the transmission line. Typical gain over the half-wave "reference dipole" (dBd) is shown below:

Yagi-Uda Configuration	Gain (dBd)
2-element	5
3-element	8
4-element	10
7-element	11

This month's column is devoted to highlighting the life and work of Dr. Yagi, so we'll "cap" the technical discussion at this point. In subsequent issues, we will cover the practical Yagi-Uda at length, with emphasis on its use as an h.f. DX antenna.

Two Notable Japanese

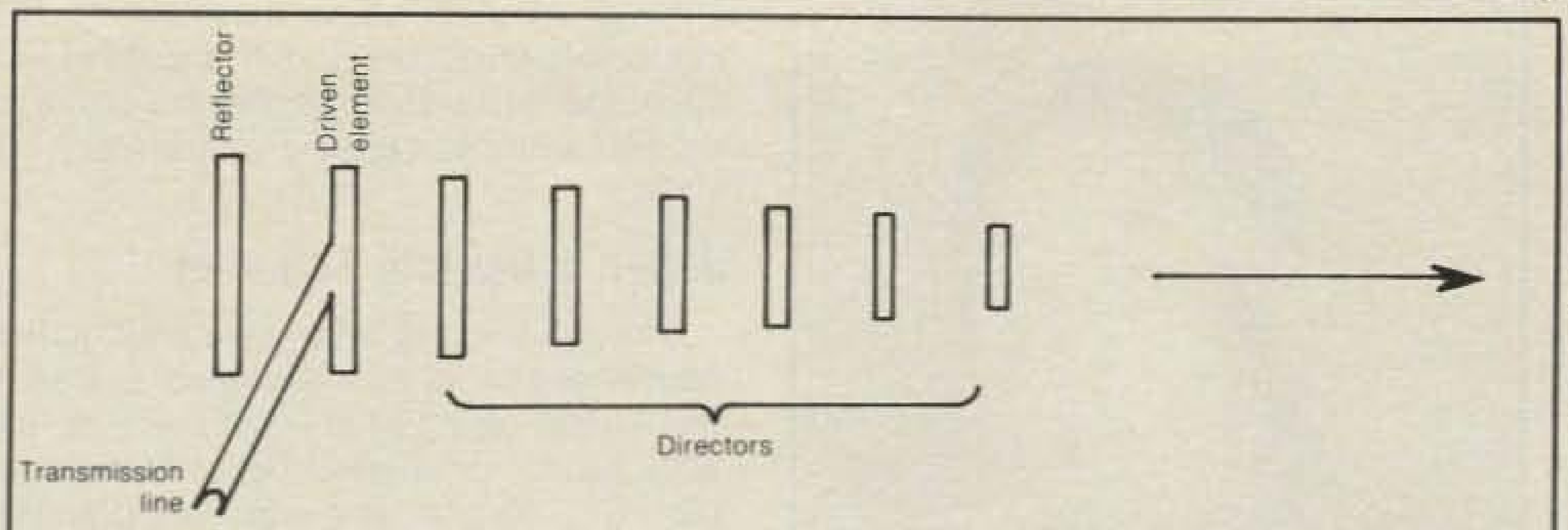
The Yagi array, as we know it today, evolved out of early v.h.f./u.h.f. experiments by Dr. Hidetsugu Yagi, Professor at Tohoku University, and a colleague, Dr. Shintaro Uda, an Assistant Professor at the same institution. This kind of antenna was first described in Japanese in 1926–27 by Dr. Uda, and was subsequently described in English by Dr. Yagi in the *Proceedings of the IRE* in 1928.[1]

It's particularly interesting to note that the name "Yagi" has stuck in the public mind, but in fact Prof. Uda's work was equally important. The fact that Uda's early work was published in Japanese, while Yagi's was published in English, resulted in the latter's name being indelibly fixed in the technical press. Nevertheless, through the years Dr. Yagi himself called the invention the "Yagi-Uda" antenna in recognition of his colleague's under-recognized part in its development.

Dr. Yagi submitted his landmark English manuscript, "Beam Transmission of Ultra Short Waves" (which he defined as having a wavelength of *10 meters* or shorter) to the Institute of Radio Engi-

*317 Poplar Drive, Millbrook, AL 36054

[1]*See sources 4 and 6 in the bibliography at the end of this article.*



Shown above is the schematic arrangement of what has come to be known as the Yagi-Uda parasitic array, better known simply as the "Yagi" in honor of its better known co-inventor. The Yagi is, essentially, a directional antenna system which consists usually of one driven half-wavelength dipole, one parasitically excited reflector, and a number of parasitically excited directors. The reflectors are somewhat longer than the driven element; the directors, shorter. The actual lengths of the parasitic elements, as well as their spacings, represent compromises with respect to bandwidth, input impedance, gain, front-to-back (F/B) ratio, minor lobe magnitude, and other factors. Future columns will dwell on practical, contemporary Yagi design and application.

Fig. 1– The Yagi-Uda array.

neers, where it was received on January 30, 1928. This paper was later presented before meetings of the Institute in New York, Washington, and Hartford, and published in the *IRE Proceedings* that same year. It appeared in the same volume containing papers by radio greats such as Edwin H. Armstrong, R.A. Heising, Guglielmo Marconi, and others equally as famous.

Yagi's IRE Paper not only described his beam experiments, but also went into magnetron tubes used for the production of "very short" wavelengths, known today as microwaves. In retrospect, perhaps equally important is the *commentary* at the conclusion of the 1928 Yagi paper, written by J.H. Dellinger, Chief of the Radio Division, Bureau of Standards, Washington, D.C. Mr. Dellinger's comments showed that the Yagi design would be well-received and widely respected. Some of his comments are prophetic:

"Professor Yagi's remarkable work stimulates some thought of a radical order. I venture to suggest that before many years radio operations will generally be considered as divided into two classes, broadcasting and directive radio. Radio communication is to a large extent done the wrong way today. And before 1920 radio was all wrong. The only use of radio was for communication between two points, and it was always done by broadcasting in every direction. It was not until 1920 that we had the advent of broadcasting as such, transmission intended for reception by large numbers of receivers. In the eight years since 1920 we have successfully developed broadcasting. At present, therefore, the job of straightening out radio is half done.

"It is interesting that 1920 marks not only the rise of broadcasting but also the beginning of directive radio. Ideally, radio transmission should be broadcast in every direction only when intended for reception in every direction, and should be sent as nearly as possible in one line when intended for reception by one receiver. Since 1920 we have had the gradual and partial evolution of beam systems and other means of confining a communications more or less to the path desired. One instance is the use of a string of relay stations. Now Professor Yagi has shown us that one of the ways to accomplish the directive function is to use a string of absolutely automatic relay stations, viz., the simple devices he calls 'directors.' Not only in this ingenious suggestion but throughout a wide field of basic possibilities in directive radio, Professor Yagi has done exceptional fundamental work and has set forth a series of principles which will unquestionably guide much of the further development. While Professor Yagi's conclusions are validated by experiment, he has, as he says, in many directions only made a beginning and much remains to be done. I am sure that many of those who have heard and those who will read this paper will join him in further pursuit of a number of these interesting possibilities. When they have been fully developed we shall be a long way on the road toward the possibility of carrying on point-to-point communications by directive radio processes.

". . . His work has included not only this development of wave projectors but also outstanding contributions to the technique of generating and using the shortest of radio waves, the development of the magnetron, and the amusing possibilities of radio power transmission. Whether the use of ultra-short radio waves will be important in long-distance communications, or whether Professor Yagi's ideas will have their principal application in methods of directing radio waves of more usual frequencies, time only can tell. In conclusion, *I would like to say that I have never listened to a paper that I felt* *so sure was destined to be a classic."* *(italics added)*

Surely an understatement by Mr. Dellinger, but perhaps speculative at the time, Dr. Yagi's antenna theory has become a classic for both commercial and amateur applications and has spawned a variety of parasitic array configurations for h.f., v.h.f., u.h.f., and even microwave applications.

How did the idea for the focusing of radio waves emerge? According to his colleague, Dr. Uda, the idea was born in 1926. Dr. Uda had built an oscillator for 4 meters which had, as a resonance circuit, a loop of wire at the plate and grid, each of the loops being closely spaced. He was surprised to find an unexpectedly strong directional effect associated with the loop, which prompted his (and Dr. Yagi's) investigation of directionality of radio waves, and how they could be focused. Refinements such as discrete reflectors and directors were developed, with the now-classic Yagi-Uda array the result.

Dr. Yagi's credentials are indeed formidable. Born on January 28, 1886, only 32 years after the "opening" of Japan to the West by Admiral Perry, he graduated as an electrical engineer from Tokyo Imperial University in 1908, and became a professor on the engineering faculty at Tohuku Imperial University in 1912. He was awarded a doctorate in engineering in 1919, following studies in Europe and in the United States from 1913–19. Subsequent to the co-development of the Yagi-Uda array in 1926–28, Dr. Yagi moved to Osaka Imperial University in late 1934. Among other accomplishments, he later become President of Tokyo Industrial College, and was name President of

Dr. Shintaro Uda, co-inventor and developer of the "Yagi-Uda" antenna array, described the work on the new-type antenna as early as 1926–27 in the Japanese language. First English-language article was prepared by Dr. Yagi and was published by the IRE in 1928. (Photo courtesy Tadao Kiga, JA1AR, Japan Amateur Radio League)

Osaka Imperial University. Dr. Yagi became President of the Japan Amateur Radio League (JARL) in August 1946, and established the Yagi Antenna Co., Ltd., in 1952. He also held a variety of government, industrial, and academic posts, including serving as a member of the House of Councilors and President of Musashi Industrial College. An era came to an end with his passing on January 19, 1976.

Japan's Dai Ichi Scientist

Though the Yagi name was not quite a household word in the United States in the 1930s and 1940s—we were at war with Japan for a good part of that period—Dr. Yagi's pre-war accomplishments were sufficiently well-known to be written about by Claire H. Ball, a public information officer in occupied Japan, for the October 1948 issue of *CQ* Magazine. Although the article is somewhat dated and terminology may now appear quaint, reprinting it almost in total affords an insight into Dr. Yagi's life that would be difficult to recapture today.

Writes author Ball, ". . . Of course, progress would have continued after Beverage had worked out the first directional antenna that offered a few dB gain, but the work which Dr. Hidej [Hidetsugu] Yagi started in 1924 is responsible in no small manner for the great impetus in directional arrays. Although a Japanese national, Dr. Yagi is indeed a world citizen.

"Dr. Yagi retired from the public eye in May of 1945 when he resigned as Director of the Bureau of Technology in the Tojo Cabinet, due to differences of opinion as to the outcome of the war. Before his appointment to the Tojo cabinet post he was president of the Tokyo University of Technology, which post he held from 1941 through 1944.

"After leaving the cabinet he returned to Osaka, where he had filled the post of Dean of the Faculty of Science at the Osaka Imperial University from 1933 to 1941, to find that B-29s had thoroughly incinerated his home, his laboratory and all of his precious notes and library. He did not stay long in Osaka to mourn his loss, but returned to Tokyo to build a modest home where he spends his spare time applying the Japanese magic of making things grow in his little garden among the cinders of a once densely populated area.

"The time he spends in his garden is limited indeed, since a man of Dr. Yagi's talents cannot remain hidden. The day after Americans entered Tokyo Dr. Karl Taylor Compton, President of M.I.T. was a Yagi visitor, and the procession of Americans has continued. Dr. Yagi is always the genial host and his fluent English is a most pleasant surprise to visiting Americans, many of whom have brought an interpreter with them.

"His time spent with American visitors might be charged to extracurricular activities, since it is his Japanese adherents who make the heavy demands on his time. He is consulting editor of *CQ* [the] leading Japanese amateur radio magazine and assists in its publication, as well as being president of JARL (Japanese Amateur Radio League). He is sort of 'The Old Man' of Japanese amateur radio, who no doubt kept a Samurai sword in place of the Wouff-Hong to deal with rotten fists and notes. He is also president of the Japanese Acoustical Society, and is constantly besieged by other scientific organizations for counsel and advice.

"Small wonder when you review Dr. Yagi's background that he should be a person so much sought after. After finishing his basic education in Japan, the outbreak of World War I found him with two years of work on his doctorate behind him at the Technical College in Dresden . . .

". . . Forced to flee Germany to prevent his internment as an enemy alien, he wandered over Europe for several months before deciding to go to England to continue his studies. There he applied himself to the study of electronics under Dr. J.A. Fleming at the University College of London. Security measures plagued Dr. Yagi's experiments, and after a short period of frustration he decided it was time to move to the United States . . .

". . . Late in 1916 the professorship of Electrical Power Engineering at Tohoku Imperial University at Sendai lured him back to his homeland. He later became head of the physics department and spent seventeen eventful years at the University.

"Continuing his penchant for probing the unknown while at Sendai, Dr. Yagi built a stable 50-mc oscillator. That was prior to 1924 and marks the beginning of parastic arrays. It was some time after that we had our first antenna handbook. We had our choice of 'T's' and inverted 'L's; flat tops and cages, the Harp and umbrellas. Paul Godley *et.al.*, were building a Beverage antenna miles long in England and successfully using its directive gain to first receive American hams. At the same time RCA and other commercial wireless moguls were pumping hundreds of kilowatts into marvelous hunks of skywire, flat-tops hundreds of feet high, through Alexanderson and Telefunken alternators in the region of 30 kc. to span the Atlantic.

"All this time Dr. Yagi was playing with his 6-meter beam in true ham fashion of methodical trial and error. First he used one parasite [parasitic element] as a director and noted its field pattern meticulously. Then another director and a repetition of plotting its power lobes in space. With his field strength meter first on the floor and then on the ceiling and all spaces in between, Dr. Yagi worked out the bugaboo of radiation angles. Different numbers of driven elements with variations of phasing and more reflectors and directors were employed until the law of diminishing returns set the number of parasitic elements to be efficiently employed as the ultimate 'Yagi Antenna.'

"His co-workers and students remember him at Sendai as being forever moving about the laboratory with field strength meter under one arm and a note pad under the other, taking readings, making notes. A new arrangement of his parasite elements and more readings and more notes, in sort of an enchanted aura.

"His work in wave propagation furnished an inspiration and a guide for the great installations of directional antennas ushered in by the commercial use of short waves. Chireix-Mesney, Telefunken and Walmsley antennas find a lot in common with the principles of Yagi's first beams. The fantastic arrays of the great Japanese Naval Station, JND, at Yosami bear the marks of the handiwork of Dr. Yagi, as well as the early warning radar antennas of his design located on top of Fujiyama that permitted a precious hour's notice of the arrival of the ever-increasing armadas of B-29s.

"Dr. Yagi made a worth-while contribution to the American war effort, too. Our first air-borne radar that the anti-sub groups used to great success in their patrol of the East and Gulf Coasts against the German marauders were equipped with two Yagi antennas, one on each wing. And it was called just that, a Yagi, with the usual variations of pronunciation, of course. It was not until the development of wave guides and parabolic reflectors that the Yagi was displaced [in some applications] . . .

"The time Dr. Yagi looks forward to with the greatest anticipation is the date the U.S. State Department raises its ban on the mailing of technical information to Japanese Nationals. That day, when at long last, arms full of current and back dated American technical publications arrive at Dr. Yagi's home, he will post a neat little sign on his door, 'Do not disturb' printed in at least three languages."

The Japanese have long since received their "technical information," to be sure. And so is told the story of Japan's *dai ichi* (number one) scientist, Dr. Hidetsugu Yagi, whose name is now a household word in the amateur fraternity—particularly among those whose interests lie with antennas. In preparing this article, I would like to extend a word of thanks to Tadao Kiga, JA1AR, of the JARL Technical Laboratory Preparation Dept.; Dr. Hiroshi Uda, the eldest son of co-inventory Dr. Shintaro Uda, who is engaged in Japanese space exploration programs; and Dr. Yasuto Mushiake of the Engineering Faculty of Tohuku University, who studied under both Dr. Yagi and Dr. Uda. Without their help, this article would not have been possible.

Next Month

This month, we have discussed the early origins of the Yagi, or Yagi-Uda as we now know the antenna should be described. In upcoming columns, we'll continue where we left off, concentrating on the Yagi-Uda design as it is today. See you then.

73, Karl, W8FX

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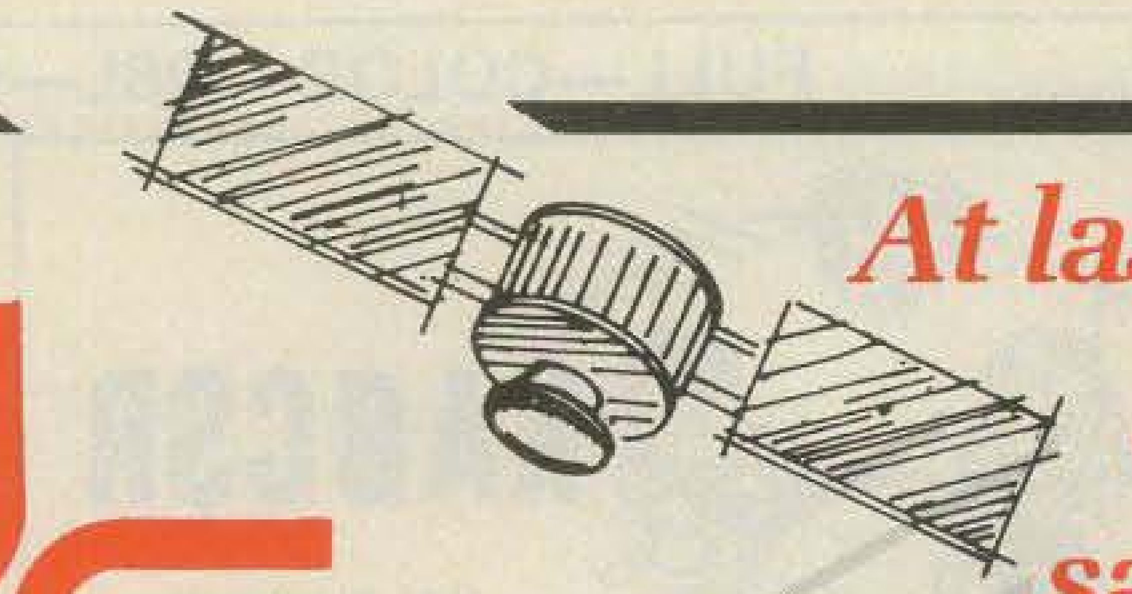

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THE INS AND OUTS OF THE WASHINGTON SCENE

On what many Washington observers called "Black Thursday," 1 October 1981, the 12% budget cuts proposed by the Reagan Administration hit with a vengence. For the Federal Communications Commission (FCC), the dollar amounts involved in the proposed fiscal-year (FY) 82 and 83 cuts translate into a possible reduction in staff of 470 people. Of these, it is anticipated that 350 persons would lose their jobs through "reduction in force" (RIF) actions, while the other 120 would leave as a result of natural attrition. No new people would be hired during an anticipated hiring freeze.

For the Commission—already hit hard by budget cuts which date to the end of the Carter Administration—the new cuts, if approved by the Congress, would have a devastating effect on bureaus connected with the amateur service. For example, if the cuts are applied evenly across the board, the Field Operations Bureau (FOB) would lose 130 positions. As a result, there is a good probability that additional field offices would have to be closed beyond those closed in FY80 and FY81. This, in turn, would require that the FOB examine its exam and licensing programs with an eye to eliminating some or all aspects of these programs. Enforcement activities, too, would have to be reduced, and it is highly likely that the Bureau's equipment budget would be "zeroed out." If the latter occurs, experimentation in the amateur service could be slowed by the Commission's inability to monitor on-the-air experiments using new communication techniques (e.g., spread-spectrum modulation, various digital codes, etc.).

The Private Radio Bureau (PRB) would also suffer heavy losses. According to Bureau Chief James McKinney, his staff would be cut from a projected level of 250 people in FY82 to an anticipated level of 193 people—a cut of 57 positions. McKinney will move to protect the operations in Gettysburg, PA, and so, the majority of the cuts will occur in Washington, D.C. Specifically, the PRB could experience a loss of 5 persons in Gettysburg, while 52 people would be dropped from the rolls in Washington. Another 17 PRB positions would be eliminated in FY83. To the extent possible, natural attrition will be used to reduce the PRB staff, although RIF actions will be used when necessary. McKinney and others noted that the President's proposals have had a significant impact on Commission morale and productivity.

The Commission's response to the President's proposed budget cuts was forwarded to the Congress in mid-October, just as this issue went to press. Thus, it is not possible to provide information on the actions taken by the Congress. Based on the assumption that Congress approved the cuts at the 10% to 12% level, however, readers can anticipate that substantial cutbacks will occur throughout the Commission. Whether these cuts will be applied evenly throughout the FCC is unknown. For example, it is possible that the Common Carrier Bureau (CCB) and the FOB will not be hit as hard, say, as the PRB and the Broadcast Bureau, since the CCB and the FOB have been much in the Congressional spotlight of late.

Additional information on the budget cuts and their impact on the FCC will be available in next month's column.

New Commission Holds First Agenda Meeting

On 30 September and 1 October 1981, the new Commission held its first agenda meeting. While the items before the commissioners were far ranging in their subject matter, several pertained to the amateur service:

1. Generalization of Digital Codes Above 50 MHz. This item, adopted by the Commission, will result in the release of a Notice of Proposed Rule Making (NPRM) which will propose to permit amateurs to use any digital code above 50 MHz. As always, the discussion of this matter centered around conflicting desires to encourage experimentation while, at the same time, to permit signal monitoring for enforcement purposes. One of the items the commissioners hoped amateurs would address is a method by which the service would self-police the use of digital codes.

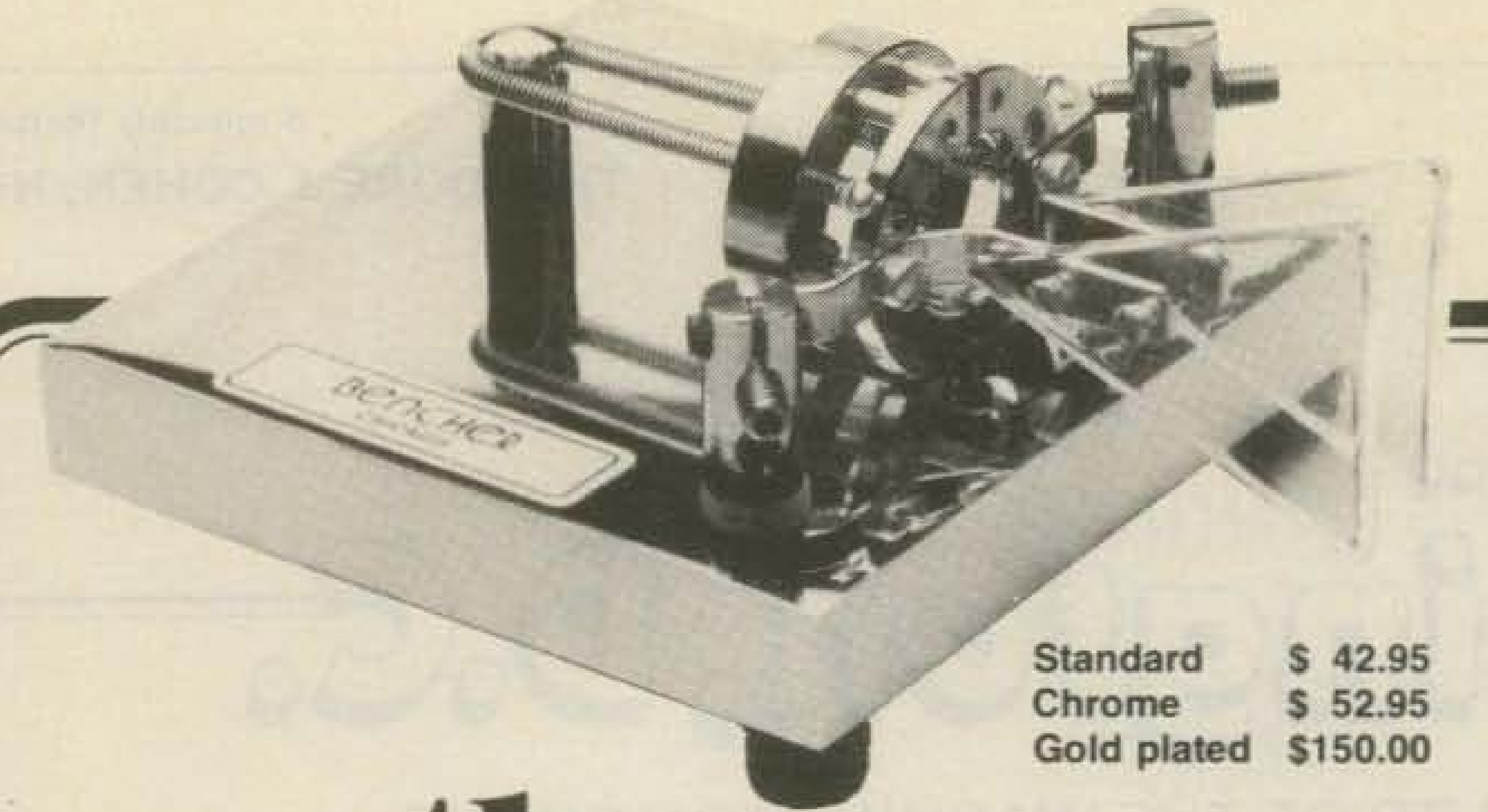
2. Bandwidth Docket (No. 20777). This docket, which would have eliminated emission designations from the amateur rules and which would have substituted a list of allowed emissions by their bandwidths, was closed.

3. Six and Ten Meter Repeater Operations. The commissioners voted to issue an NPRM which would investigate the desirability of raising the effective radiated power (ERP) for six meter repeaters. The Notice will also request views on whether a limit should be placed on the ERP of ten meter repeaters.

4. Station Identification. The commissioners adopted a Report and Order which changes the procedures used by amateurs to identify their stations. Under the new rules, an amateur need only identify himself, and he should do so every 10 minutes during an exchange of transmissions. Note that when international third-party traffic is being handled, traditional identification procedures must be followed. If the new rules are in effect during the 1981 *CQ* World Wide DX Contests, amateurs can thank James McKinney of the PRB, who pushed for their immediate implementation.

5. Request for Reconsideration of Radio Quiet Zones. While the Commission upheld its previous ruling concerning quiet zones around major radio observatories, it took great pains to recognize the contributions of the amateur service and to apologize for the poor wording of the Order under consideration (the Order, essentially, had stated that the issue was between the public's interest and the personal aspirations of a group of amateurs).

8603 Conover Place, Alexandria, VA 22308



Senate Adopts Goldwater Bill S929

The Senate, on a voice vote in late September 1981, adopted Goldwater's bill S929. This Bill, known by some as the "RFI Bill," is "to provide the Federal Communications Commission (FCC) with the authority to implement various programs which will result in improvements in the administration of the amateur radio service . . ." A search is now on for a floor manager to steer the bill through the House of Representatives, and it is likely that Dannemeyer (who introduced a similar bill, H.R. 2203) will be selected. The Senate bill, by the way, includes provisions to "unlicense" CB.

It is possible that the provisions contained in both Goldwater's and Dannemeyer's bills could be the "law of the Land" by the time this is read.

New R.F.I. Handbook Debuts

Not since the work of Philip S. Rand, W1DBM, and others in the late 1940s and early 1950s has there been a handbook on radio frequency interference (r.f.i.) that provides sufficient information to the amateur on all aspects of interference. Now, however, William R. Nelson, WA6FQG, a former r.f.i. investigator for Southern California Edison Company, has written an easy-to-read, comprehensive book on interference which should rapidly become *the* handbook on this vexing problem. Entitled the *Interference Handbook*, Nelson's work analyzes the causes and cures of myriad r.f.i. problems, most of which amateurs encounter in their day-to-day operations. Liberal use of pictures and diagrams, together with a readable text, takes much of the mystery out of diagnosing r.f.i. and makes curing such interference more a science than an art. If r.f.i. problems associated with television, stereo, radio, power lines, or a telephone are causing you problems, you would do well to pick up a copy of the *Interference Handbook* by Wm. R. Nelson (edited by Bill Orr, W6SAI). The book, which contains 13 chapters and 244 pages, is available from Radio Publications, Inc., Box 149, Wilton, CT 06897.

Manufacturers Of Digital Medical Equipment Yell "Foul"

The FCC's rules which require r.f.i. testing and certification of digital electronic equipment used in medical diagnosis—items ranging from blood pressure monitors to electrocardiographs, which can emit r.f.i. as a byproduct of their operation—recently raised the ire of medical equipment manufacturers. Contending that the FCC-required tests could cost from $5000 to $50,000, and that their equipment has never interfered with radio and television broadcast signals, the manufacturers asked that they be relieved of the testing and certification requirements. Furthermore, they insisted that the Food and Drug Administration (FDA) was the agency responsible for regulating their products. The manufacturers were somewhat relieved to learn that the FCC now proposes to exempt equipment used in hospitals from the testing and certification requirement, although the manufacturers still seek to have all diagnostic devices exempted, regardless of where they are used.

Space Invaders, Too, May Cause R.F.I.

As reported in *The Washington Post*, the FCC recently proposed to relax r.f.i. requirements covering coin-operated video games such as Space Invaders. While incidental radiation from these devices can produce interference to radios and TVs, the Commission noted that most games are located in commercial areas away from electronic home-entertainment equipment. As a result, game manufacturers will only be required to certify to the Commission that all required r.f.i. tests have been performed. Previously, manufacturers had to apply for FCC approval of each game.

CATV Leakage A Continuing R.F.I. Problem

Leakage from a cable TV (CATV) system in the Encinitas, CA, area has been observed on 145.25 MHz, with interference from horizontal sync sidebands extending a considerable distance from this frequency. The interference has already caused problems for a commercial frequency and spectral monitoring laboratory serving the broadcast industry, and concern is mounting that the interference will impair amateur radio weak-signal reception in the CATV system's service area. That signals transmitted by amateurs could enter this TV system through the leakage paths and cause television interference (TVI) is also of concern. Amateurs who observe or experience r.f.i. from CATV systems are urged to document such cases and to notify immediately the FCC and the ARRL.

ARRL Amateur Radio Computer Networking Conference A Success

The ARRL Amateur Radio Computer Networking Conference convened on 16 October 1981, at the National Bureau of Standards, Gaithersburg, MD. The purpose of the conference was three-fold:

1. To recognize the innovative work in networking done by Canadian, U.S., and other amateurs;

2. To explore the possibilities of developing an integrated amateur packet network;

3. To develop a framework within

which to provide for the orderly growth of an amateur network.

Following some opening comments on amateur packet radio networks by Paul Rinaldo, W4RI, President of the Amateur Radio Research and Development Corporation (AMRAD), attendees to the conference listened to presentations on a wide variety of subjects, including "Computer-Controlled Message Handling" (by Russell Ward, WA4ZZU) and "Network Structure, Protocal and Terminal Control" (by Douglas Lockhart, VE7APU).

Copies of the proceedings will be published in two volumes and are priced at $5 per set. For information on the conference papers, write to Mr. Paul Rinaldo, President, AMRAD, 1524 Springvale Avenue, McLean, VA 22101.

Amateurs Lauded In Hill Testimony

On 29 September 1981, Dr. Stephen J. Lukasik, Chief Scientist of the FCC, was invited to testify before the Subcommittee on Investigations and Oversight, Committee on Science and Technology, House of Representatives, to present the Commission's views on the use of new information handling technology in emergency situations. Speaking before the Subcommittee, and specifically addressing the contributions of the amateur service, Dr. Lukasik stated the following:

". . . The amateur radio service has historically been very active in assisting both the public and the government during local emergencies. Indeed, the value of the amateur service to the public, particularly with respect to providing emergency communications, is noted in the Commission's Rules and Regulations. Licensed radio amateurs may operate in the Radio Amateur Civil Emergency Service (RACES), if they are certified as registered in a civil defense organization. When telephone circuits are disabled or jammed, amateur radio operators may assist in providing either short or long range communications, including connecting calls into the telephone network by establishing a long distance contact with another amateur station outside of the affected area."

Dr. Lukasik, in concluding his testimony, noted that the Private Radio services (which include the amateur service), together with other services such as Common Carrier, ". . . constitute our national telecommunications resources—our information networks."

The editors of CQ join your Washington editor in extending their deepest sympathies to Mrs. Dorothy Morris, WB8LAI, on the death of her husband, Donald Morris, W8JM, and to Mrs. Rae McConaghy on the death of her husband, Harry McConaghy, W3SW. The contributions these men made to amateur radio were indeed significant, and we will miss them both.

a monthly feature by
IRWIN MATH, WA2NDM

Math's Notes

A LOOK AT THE TECHNICAL SIDE OF THINGS

Recently we came across a couple of novel but simple measurements that can be made with a common V.O.M. or V.T.V.M. type meter, and we thought it would be a good idea to pass these along.

The first of these is a method of measuring unknown inductances in the 10 to 2000 Henry range. Fig. 1 shows the hook-up.

To use this setup, turn the variac to zero and short the test jacks. Now increase the variac until the V.O.M. (on the 10 v.a.c. range) reads 10.0 volts. Remove the short and connect the unknown inductance. Note the new reading and plug it into the graph of fig. 2. You can now read the value of the unknown inductance on the chart. Keep in mind that the chart is calibrated for measurements at 60 Hz.

You can use the same setup to measure capacitance in the range of .005 microFarad to 1.0 microFarad. To do this, proceed as previously. Set the meter to 10 volts full scale with a jumper, then connect the unknown capacitor. Note the reading and refer to the chart in fig. 3.

To measure capacitance in the range of 100 pf to .005 microFarad requires a small circuit change. Refer to fig. 4. Here

*5 Melville Lane, Great Neck, NY 11023

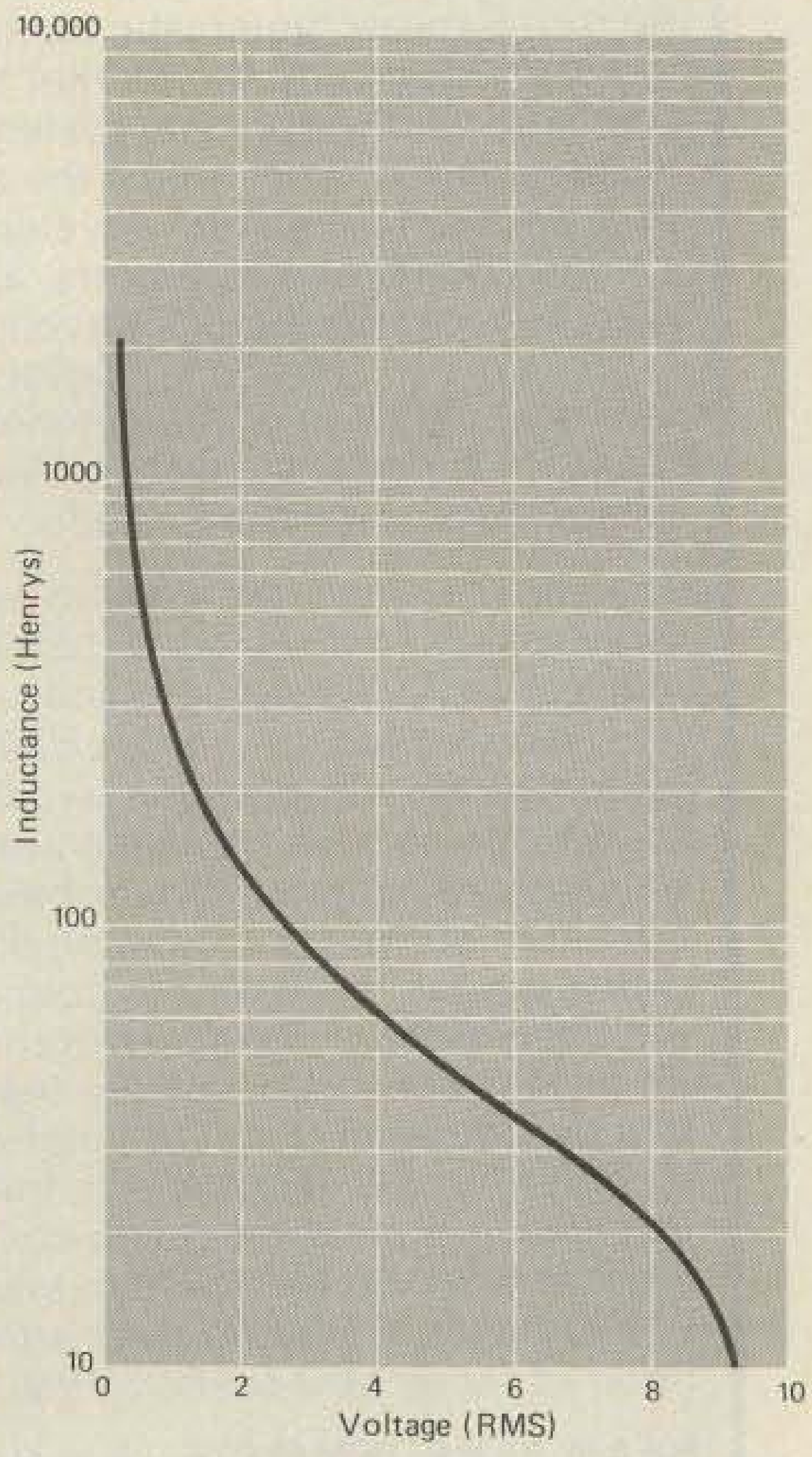


Fig. 2– Inductance conversion chart.

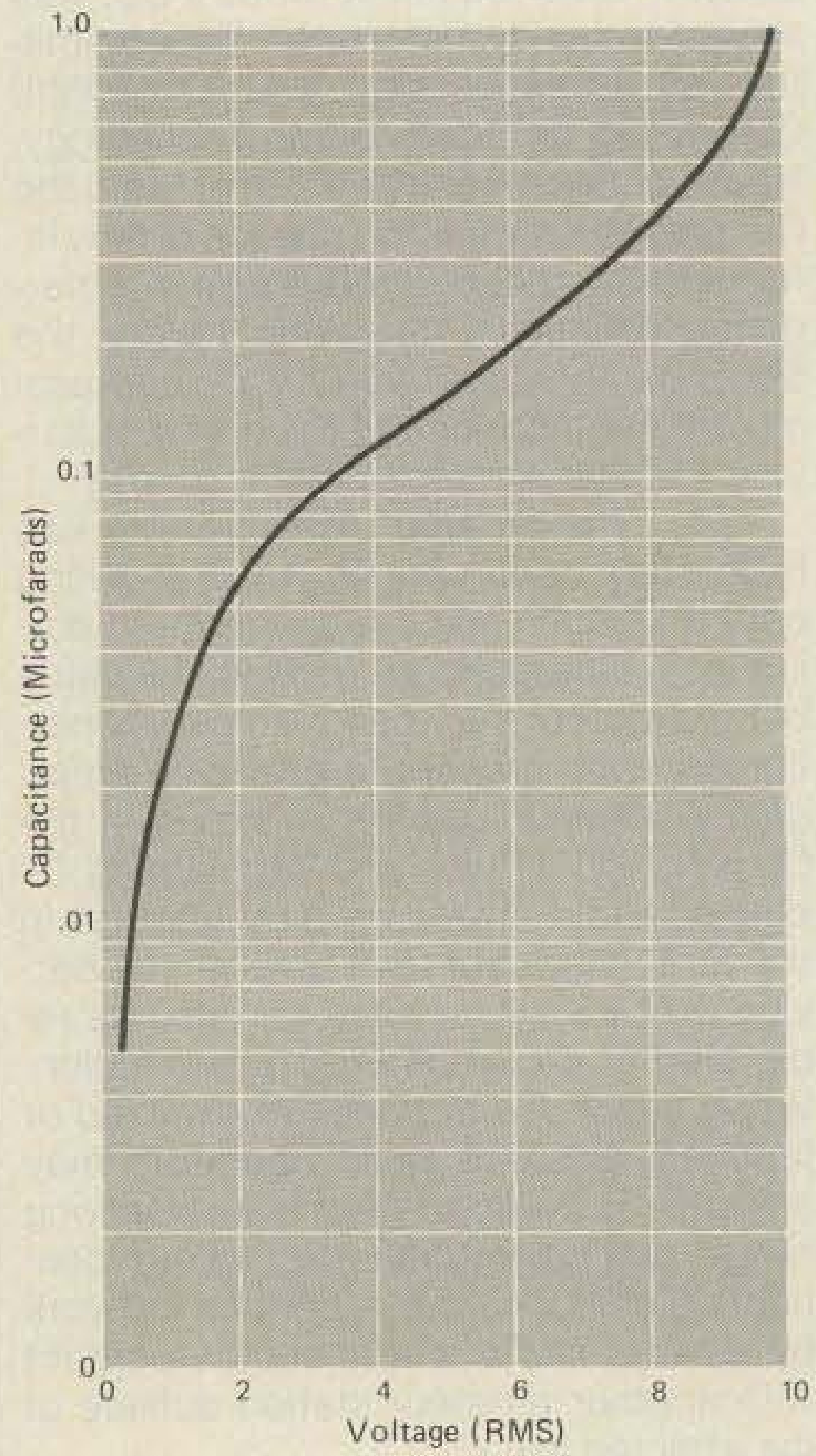


Fig. 3– High-capacitance conversion chart.

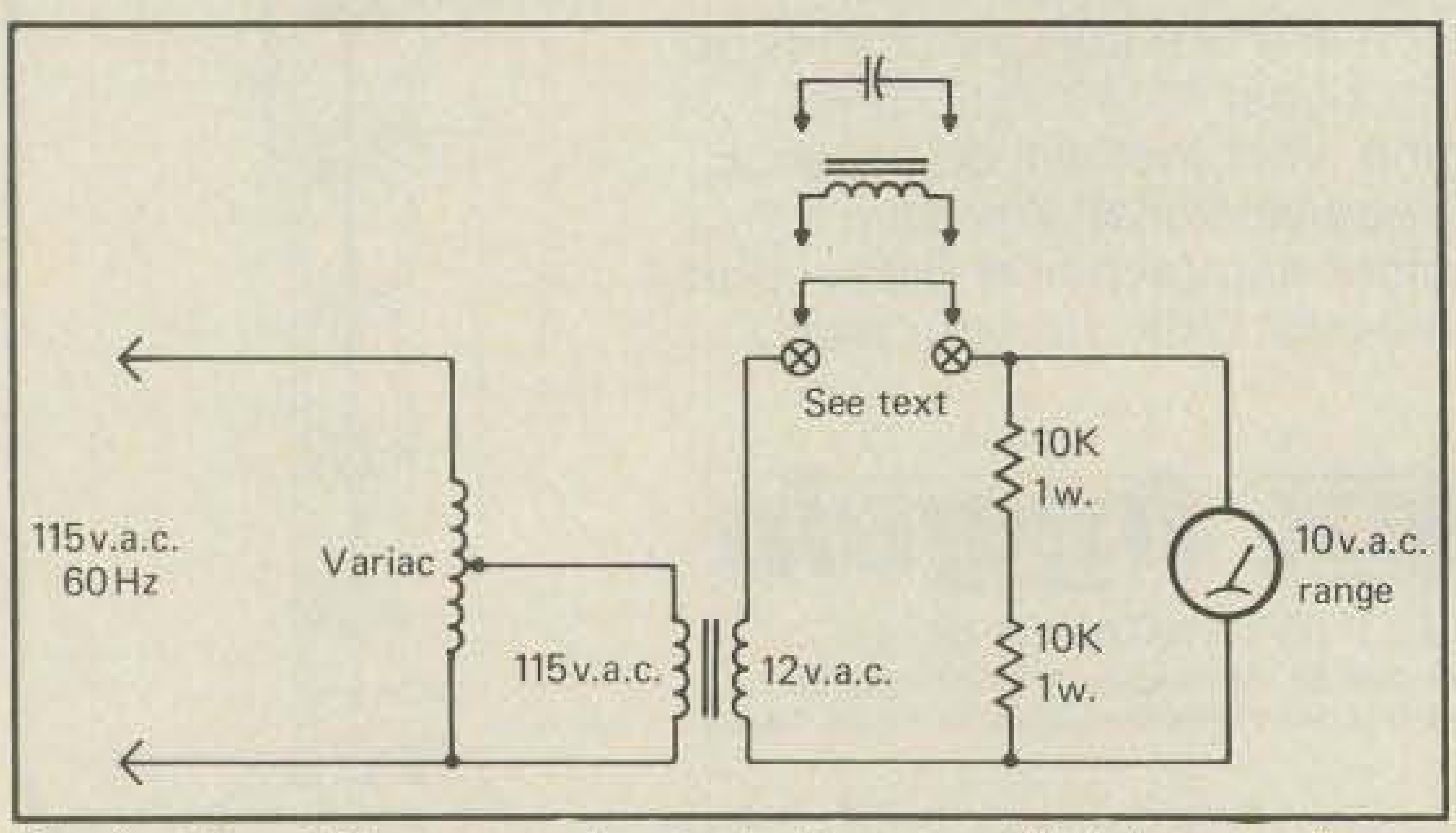


Fig. 1– Circuit for measuring inductance and high capacitance.

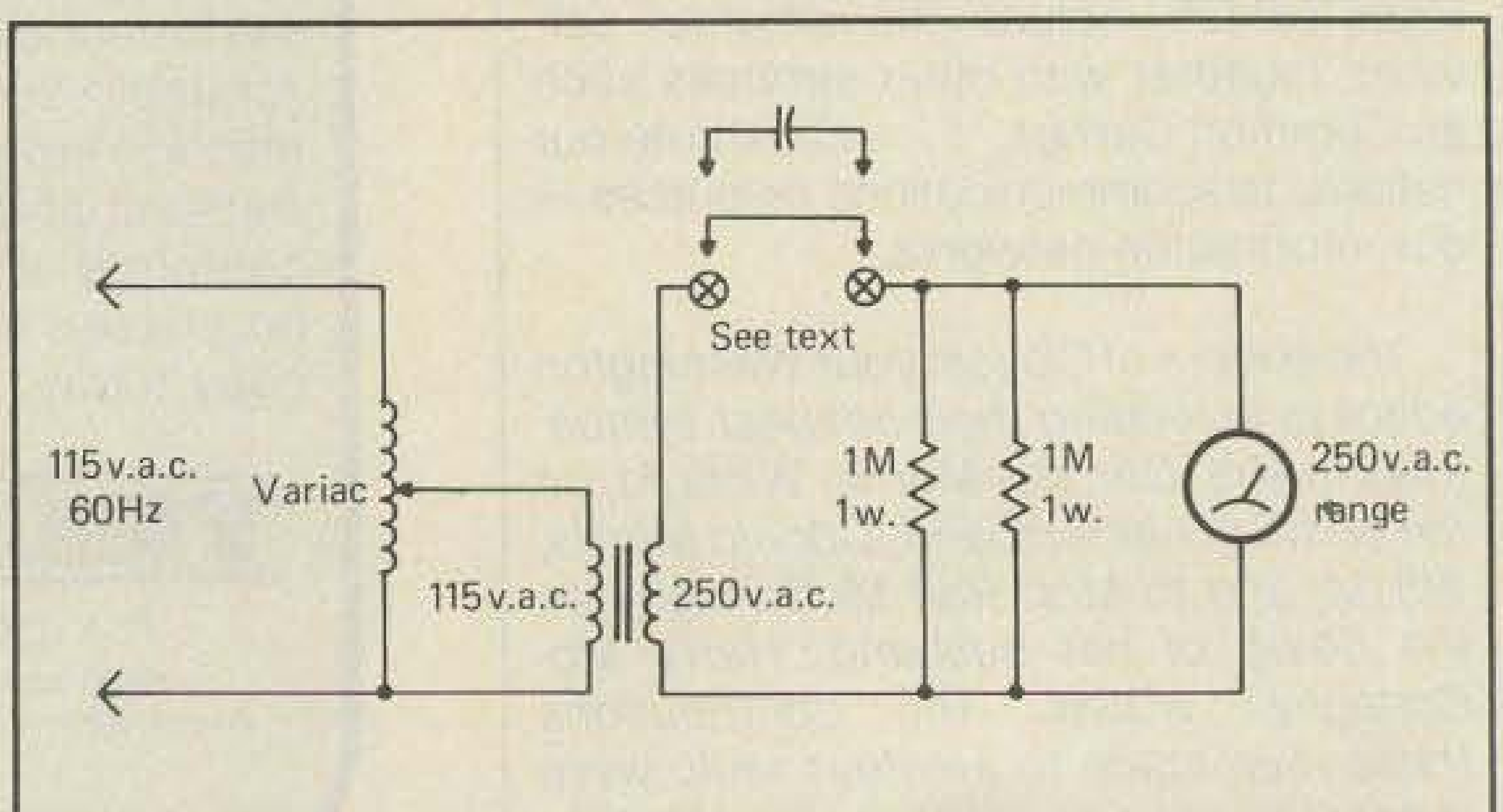


Fig. 4– A circuit for measuring low capacitance.

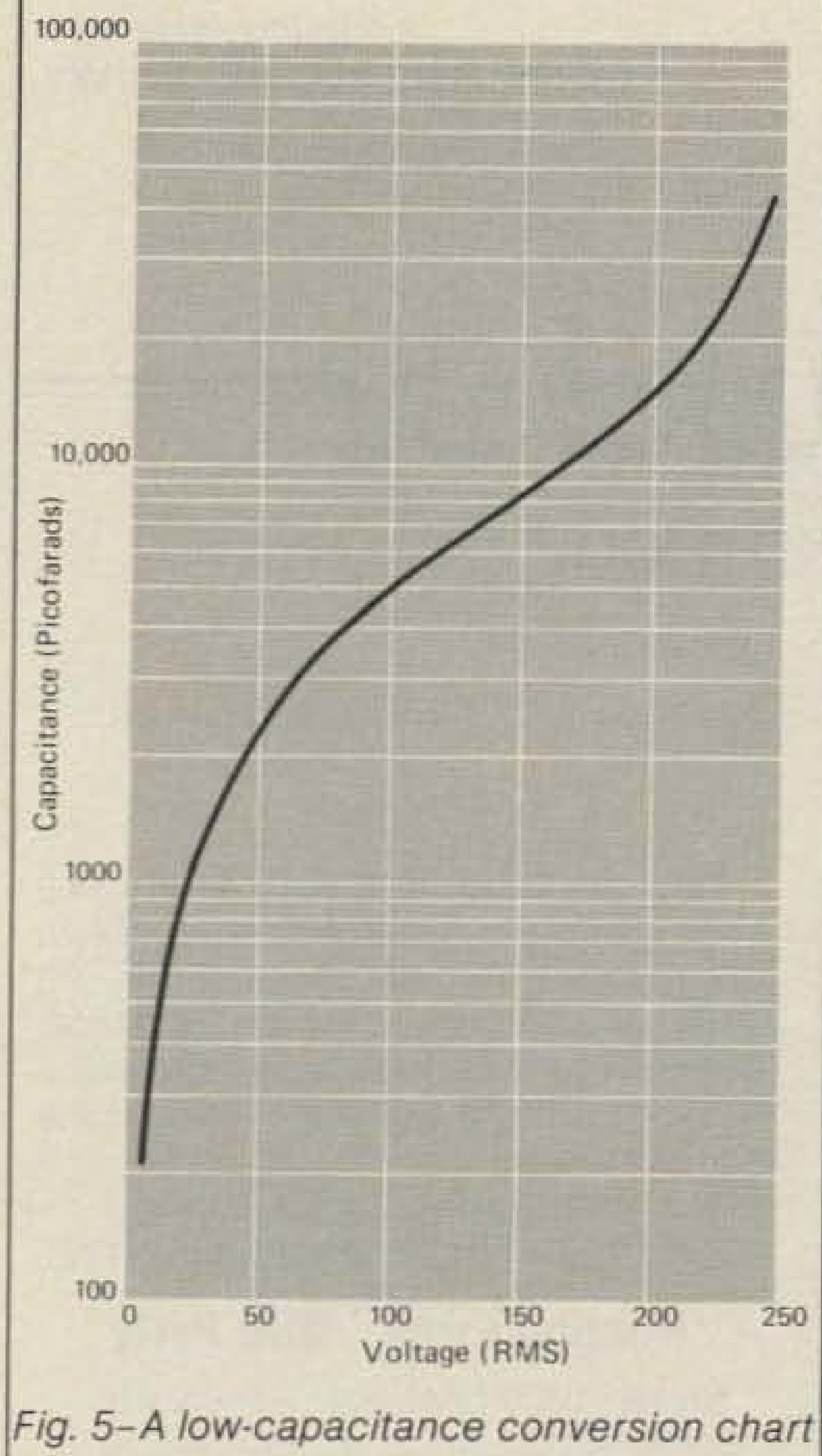


Fig. 5–A low-capacitance conversion chart

we have replaced the 12 V transformer with a 250 V unit, and the 10K resistors with 1 megohm values.

Operation is similar to the first scheme and consists of first shorting the test jacks and setting the variac so that the meter reads 250 V. Now, connect the unknown capacitor to the test jacks, and note the meter reading. The capacitance value can be read from the chart of fig. 5.

I hope the above information is of use to you. It certainly is simple to set up and will enable you to make reasonable measurements without expensive test equipment. Just realize that measurements are being made at 60 Hz, and be careful with the 250 volts.

73, Irwin, WA2NDM

a monthly feature by
FRANK ANZALONE, W1WY

Contest Calendar

NEWS/VIEWS OF ON-THE-AIR COMPETITION

CQ World Wide 160 Meter Contest

C.W.: Jan. 29–31 S.S.B.: Feb. 26–28
Starts: 2200 GMT Friday
Ends: 1600 GMT Sunday

Complete rules were given in last month's issue. Operating in this year's contest will require a different approach due to the expanded privileges recently granted by the FCC to the stateside amateurs.

With more 160 activity by overseas stations due to additional privileges also granted to some European countries, the DX picture on the Top Band is now somewhat different from previous years.

Of course, the usual European DX will still be found in the "DX Window," 1825–1830. DX stations will indicate where they will be listening, usually down in the lower portion of the band.

However, some Europeans are restricted to frequencies that will not permit them to operate in the "DX Window." OZ and OY are assigned to 1830–1850 and SP to 1830–1835. A suggestion by W1BB that the "DX Window" be extended to 1835 makes a lot of sense.

It has been suggested that we create another "Window" say between 1850–1855 for contest weekends, but I do not think that would be practical. The old "Window" is well established, and the fellows have been pretty cooperative, but another "Window"? I have mixed feelings as to how it would be received, especially by the phone boys.

The USSR stations will be found above 1850 and the JA's in a narrow band between 1907.5–1912.5, so don't know how you would handle that except for on-frequency operation. The DX can always indicate where they will be listening for split frequency operation.

Don't look for KH6's up at the high end of the band. They and other Oceania stations will now be found down in the lower portion, 1800–1810, which will make it rather rough going unless they use the "DX Window" and go split like the Europeans.

I would not be surprised to see additional overseas stations that have been given permission to operate 160 during the contest. The Top Band picture is rather nebulous at the present time, and I would suggest we play it by ear, especially for activity above 1830. Who knows, maybe the FCC will finally see the light and divide the band into c.w. and phone portions like all the other v.h.f. amateur bands.

My thanks to Stew, W1BB, and Don, N4IN, two knowledgeable Top Banders, for much of the above information. If there are any errors, blame them on me. If you have any suggestions, include them in your summary sheet when you send in your log.

Don't forget, mailing deadline for c.w. entries is February 28th, and March 31st for phone.

They can be sent directly to the 160 Contest Director, Don McClenon, N4IN, 3075 Florida Avenue, Melbourne, FL 32901, and of course to CQ 160 Meter Contest, 76 North Broadway, Hicksville, NY 11801. Please indicate c.w. or phone on the envelope.

Good luck. See you in the pile-up.

73 for now, Frank, W1WY

14 Sherwood Road, Stamford, CT 06905

Calendar of Events

*	Jan. 2-4	ZERO District QSO Party
	Jan. 9-10	Hunting Lions QSO Party
	Jan. 9&10	"73" 40 & 80 M. Phone
	Jan. 16-17	"73" 160 M. Phone
†	Jan. 16-17	AGCW DL QRP CW Contest
	Jan. 23-24	White Rose SWL Contest
	Jan. 23-24	North Dakota QSO Party
	Jan 23-24	Texas QSO Party
	Jan. 29-31	**CQ WW 160 M. CW Contest**
	Jan. 30-31	French C.W. Contest
	Feb. 6-7	RSGB 7 MHz Phone Contest
	Feb. 6-7	So. Carolina QSO Party
	Feb. 13-14	QCWA C.W. QSO Party
	Feb. 13-14	YL-OM Phone Contest
	Feb. 13-14	Dutch "PACC" Contest
	Feb. 13-15	TWO Land QSO Party
	Feb. 20-21	ARRL DX C.W. Contest
	Feb. 26-28	**CQ WW 160 M. Phone Contest**
	Feb. 27-28	YL-OM C.W. Contest
	Feb. 27-28	RSGB 7 MHz C.W. Contest
	Mar. 6-7	ARRL DX Phone Contest
	Mar. 13-14	QCWA Phone QSO Party
	Mar. 27-28	**CQ WW WPX SSB Contest**
	Apr. 7-8	DX YL to N.A. YL C.W.
	Apr. 14-15	DX YL to N.A. YL Phone

* Covered last month
† Not Official

"Hunting Lions" QSO Party

Starts: 1200 GMT Sat., January 9
Ends: 1200 GMT Sun., January 10

Sponsored by Lions International and coordinated by the Lion Club of Rio de Janeiro, Brazil, this activity is between Lions and non-members. The objective: "to create and foster a spirit of international understanding and cooperation" among Lions and amateur radio operators.

Exchange: Call, QSO no., and RS(T). Lions or Leos will also include their club name.

The same station may be contacted once on each band, 10 through 80 meters, both phone and c.w., but each mode is scored separately.

Scoring: One point for contacts between stations within the same continent, 3 points if between different continents. There is a bonus of 1 additional point if QSO is with a member of a Lion or Leo club, and 5 extra points if you contact a member of the Rio de Janeiro Arpoador Club.

Total QSO points is your score.

Awards: Will be made for both phone and c.w. A Trophy for 1st place, 2nd place, and 3rd place. There are also plaques for the 4th through 10th places. Each participant will receive a certificate.

It is suggested that you write to Lions International, Att: Robert Cywinski, 300 22nd Street, Oak Brook, IL 60570, or the Arpoador Club for additional information.

Logs must be submitted no later than 30 days after the end of the party to: Lion Club of Rio de Janeiro Arpoador, Rua Souza Lima 149, Apt. 402, Rio de Janeiro 22081, Brazil.

The multi-multi phone score of ABØI was inadvertently not included in the Kansas City DX Club's total. Correcting this omission puts their Club up from 32nd to 20th position with a score of 8.1 million points in the 1980 CQ World Wide DX Contest.

"73" 40 & 80 Meter Phone Contest

40 Meter: Sat., January 9
80 Meter: Sun., January 10
0000Z to 2400Z each day

This is a new one sponsored by *73* magazine. The same station may be worked once on each band. Single operator stations are limited to 16 hours of operation on each band; multi-operator stations can operate the full 24 hours on each band. Off periods must be no less than 30 minutes each and indicated on your log and summary sheet.

There are three entry options: 40 meters only, 80 meters only, and both 40 and 80 combined.

Exchange: RS and QTH. State, province, or territory for U.S. and Canada, country for DX (including KH6 and KL7).

Points: One point per contact on each band within the continental U.S. and Canada or within own country. Two points for all other contacts. (Contacts made between 1000–1400 local time are worth twice the normal points.)

Multiplier: One for each U.S. state (48), each Canadian prov./terr. (12), and each DX country worked on each band.

Final Score: Total QSO points × total multiplier points, single or dual bands.

Awards: In each category, U.S., Canada, and DX country. (A minimum of 5 hours or 50 QSO's required.)

Use a separate log for each band; include a dupe sheet and summary sheet and the usual signed declaration.

Duplicate contacts in excess of 2% of the final score and other infractions are considered grounds for disqualification.

Mailing deadline for logs is February 11th and they go to: Whidbey Island DX Club, 2665 North Busby Road, Oak Harbor, WA 98277.

"73" 160 Meter Phone Contest

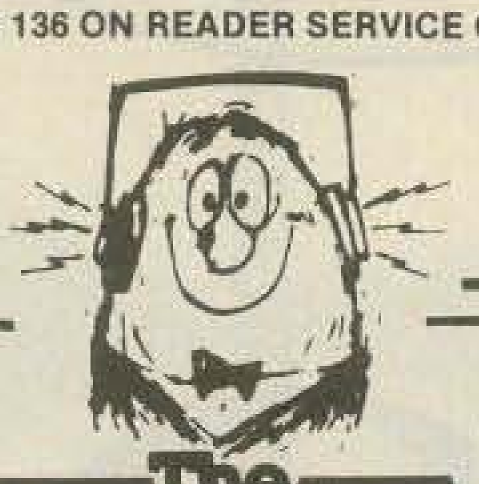
Starts: 0000Z Sat., January 16
Ends: 2400Z Sun., January 17

This is the 3rd time around for this Top Band activity sponsored by *73* magazine. This year there are a few modifications to the rules and to the scoring system.

There are two classes: single operator and multi-operator. Single operators are limited to 36 hours of operating time; multi-operators may operate the full 48-hour contest period.

Exchange: RS and QTH. State for the U.S., province for Canada, and country for DX stations.

Points: Five points for contacts within



the continental U.S. and Canada. DX contacts outside those boundaries are worth 10 points. An additional bonus of 5 points may be earned for each contact made during the hours of 1000–1400 *local time*.

Multiplier: One for each U.S. state (48), Canadian prov./terr. (12), and each DX country worked.

Final Score: Total QSO points times the sum of the multiplier points.

Awards: Awards will be issued in both classes in each state, province, and DX country. A minimum of 5 hours and 50 QSOs must be worked to be eligible.

U.S. and Canadian stations are expected to observe the "gentlemen's agreement" and not transmit in the 5 kHz segment between 1825–1830 kHz. (With the recent 160 FCC changes it would be advisable to also observe other recommended operating procedures.)

Disqualification may result for irregularities in logging and failing to omit duplicate contacts that would reduce your overall score by more than 2%.

Include a summary sheet, multiplier check list, and dupe sheet with logs with 100 or more contacts. Log forms are available; send s.a.s.e. to address below.

Mailing deadline for logs is February 18th to: 160 Meter Phone Contest, Att: Dan Murphy, WA2GZB, P.O. Box 195, Andover, NJ 07821.

AGCW-DL QRP Contest

Starts: 1500Z Sat., January 16
Ends: 1500Z Sun., January 17

This is the winter edition of this Contest organized by the AGCW-DL.

It's a c.w. only, all bands 10 through 160. The same station may be worked on each band for QSO credit.

There are 5 classes as follows:
A—Single Opr., 3.5 watts or less.
B—Single Opr., 10 watts or less.
C—Multi-Opr., 10 watts or less.
D—QRO stations, over 10 watts.
E—S.w.l.'s

Multi-opr. stations may operate the full 24 hours; all others must take a 9-hour break.

Exchange: RST, QSO no., and power input. Add X if transmitter is crystal controlled (559001/5X), (579001/QRO).

Points: QSO with own country, 1 point. Other countries own continent, 2 points. DX outside other continent, 3 points. Crystal-controlled stations double above. Crystal-controlled stations are limited to 3 crystals for each band.

Multiplier: One for each country and each DX contact.

Final Score: Total QSO points times the multiplier on that band. Add the sum of the scores from each band for final score.

For scoring purposes call areas in JA, PY, VE, VK, W/K, and ZS are counted as multipliers.

Awards: Certificates to the first three places in each class and each band.

Special log sheets are available from the Contest Manager (s.a.s.e. and 2 IRCs). Include one IRC with your entry for results.

Your log must be received no later than 6 weeks after the end of the contest by Contest Manager, Siegfried Hari, DK9FN, Spessartstrasse 80, D-6453 Seligenstadt, Fed. Republic of Germany.

Texas QSO Party

Starts: 0000Z Sat., January 23
Ends: 1800Z Sun., January 24

This one is again organized by the West Texas A.R.C. The same station may be worked on each band and each mode, and mobiles upon each county change.

Exchange: QSO no., and QTH County for Texas. State, VE province, or country for others.

Points: Texas stations score 1 point per phone contact, 2 points if on c.w.

Non-Texans same as above, however, Texan phone mobiles are worth 5 points, c.w. mobiles 7 points.

Multiplier: Texans use states, VE provinces, and DX countries worked for their multiplier. Non-Texans use Texas counties (maximum of 254).

Frequencies: C.W.—3565, 7065, 14065, 21065, 28065. Phone—3940, 7260, 14280, 21370, 28600. Novice—3710, 7110, 21110, 28110.

Awards: Certificates to the top scores in each state, VE province, and DX country, and top ten Texans. There are also plaques for the overall winners in 7 different categories: U.S., U.S. Novice, VE, DX, Texas fixed, mobile, and Novice.

All logs must be received by March 15th and go to: WTARC, P.O. Box 9944, Odessa, TX 79762-0041.

White Rose SWL LF Contest

1200 to 1200 GMT Sat./Sun., Jan. 23/24

We often receive requests from shortwave listeners for information as to what contests have an s.w.l. category. Here's one all your own sponsored by the White Rose Radio Society of England.

Use any 18 consecutive hours in the 24-hour contest period. There are two separate sections, phone and c.w., no mixed mode entries. You are limited to the three l.f. bands: 1.8, 3.5, and 7 MHz.

Points may only be claimed for stations heard in contact with another station. Both stations may be logged, but the practice of logging a series of QSO's made by one station is not allowed. Log entries must not include the same call in the "station worked" column more than 10 times on each band.

Scoring: One point for each station heard on each band from one's own continent. Five points on each band if the station is on another continent.

Multiply total points by the number of different countries heard on each band.

Add three band totals for final score.

Each call area of the U.S., Canada, Australia, and New Zealand will be considered a separate multiplier. The ARRL country list is the standard.

Certificates of Merit will be awarded at the discretion of the Society. Comments on the contest, details of the equipment used, etc., will be appreciated.

Entries should be received by March 16th and go to: Contest Manager, David McGregor, G4IDJ, c/o White Rose Radio Society, 8 Manor Court, Shadwell, Leeds LS17 8JE, England.

North Dakota QSO Party

0000–0800 & 1600–2400 Sat., Jan. 23
0800–1600 UTC Sun., Jan. 24

This new one sponsored by the Red River Radio Amateurs is entitled "The Great North Dakota QSO Binge."

Exchange: RS(T) and QTH. County for N.D. stations, state, province, or country for others. (Novices must include their I.D.'s in their exchanges.)

Scoring: Phone contacts are worth 10 points, c.w. 20 points, and RTTY 50 points. There is an additional bonus of 100 points for working 5 Novice stations.

Multiplier: States, provinces, and countries per band and mode for N.D. stations. N.D. counties worked per band and mode for others (maximum of 53 per band).

Frequencies: Phone—1815, 3905, 7280, 14280, 21380, 28580. C.W.—1810, 3540, 7035, 14035, 21035, 28035. Novice—3725, 7125, 21125, 28125.

Awards: Certificates to state and province winners (countries?). A plaque to the N.D. winner.

Mail logs with usual certification by February 28th to: Bill Snyder, WØLHS, P.O. Box 2784, Fargo, ND 58108-2784.

French DX Contest

C.W.: Jan. 30–31 Phone: Feb. 27–28
Starts: 0600 UTC Saturday
Ends: 1800 UTC Sunday

There has been a considerable change in the format of this contest. The exchange is still limited to contacts with French Europeans, Belgian, and French speaking countries and territories as per the following list: C3, CN, D6, DA1/2, F, FC, FB8, FG, FH, FK, FM, FO, FP, FR, FW, FY, HB, HH, J2, LX, OD, ON, TJ, TL, TN, TR, TT, TU, TY, TZ, VE2, XT, YJ, 3A, 3B, 3V, 4U (ITU), 5R, 5T, 5U, 5V, 6W, 7X, 9Q, 9U, 9X.

There are two classes, single and multi-operator. Single operator stations are limited to 26 hours of operation. The 10 off hours may be taken in 3 periods.

The same station may be worked on each band for QSO and multiplier credit.

Exchange: RS(T) plus a 3 figure QSO number starting with 001. French and Belgian stations will include 2 figures or letters to identify their QTH.

Points: One point per contact.

Multiplier: One point for each department and country/territory as follows: 96 French European departments, 29 French overseas departments and territories, 25 DUF countries, 9 Belgian provinces and DA2/FBA, and 14 DNF countries. (*Quite an assortment!*)

Final Score: Sum of QSO points multiplied by the sum of the multipliers from each of the five bands.

Awards: Certificates to the top scorers in each class in each country (minimum of 100 QSO's).

The usual disqualification rules will be in effect.

Official log and summary sheets are available from the REF headquarters. Include an IRC and s.a.e. with your request.

Send logs to this year's traffic manager, Bernard Francillon, F6BDN, REF Contest, square Trudaine 2 - 75009 Paris, France.

RSGB 7 MHz Contest

Phone: Feb. 6–7 CW: Feb. 27–28
Starts: 1200 GMT Saturday
Ends: 0900 GMT Sunday

The same rules used last year have been retained. Only single operator entries will be recognized.

The following rules are for stations other than the British Isles.

Bands: Phone—7.04 to 7.10 MHz (this will require split frequency operation for the U.S.). C.W.—7.00 to 7.04 MHz.

Exchange: RS(T) plus a progressive 3 digit QSO number starting with 001.

Scoring: Stations in Europe score 5 points for each QSO with a British Isle station. Those outside Europe score 15 points per contact.

Multiplier: One for each different British Isle country prefix worked (G2, GC3, GD4, GW4, etc.), a maximum of 42 possible. No credit for GB prefix.

Final Score: Total QSO points times the multiplier prefixes worked.

Awards: Certificates to the 1st, 2nd, and 3rd place scores in the British Isles, Europe, and non-Europe.

There is also an s.w.l. section with the scoring same as above. Overseas listeners log British Isles stations only. Record the call of the station as well as the serial number sent. Not more than 20 QSOs made by the same station may be logged.

Unmarked duplicate contacts will be penalized at 10 times the number of points claimed. Logs containing in excess of 5 unmarked duplicates will be automatically disqualified.

The phone entries must be received no later than April 3rd, the c.w. entries April 24th. They go to: The RSGB HF Contest Committee, P.O. Box 73, Lichfield, Staffs., WS13 6UJ England.

South Carolina QSO Party

Starts: 1800Z Saturday, February 6
Ends: 2359Z Sunday, February 7

This one is again being sponsored by the Colleton County Contesters.

The same station may be worked on each band and each mode, S.C. mobiles each county change.

Exchange: RS(T) and QTH. County for S.C. stations, state, province, or country for DX. (Novice and Techs. sign /N or /T.)

Scoring: Two points for s.s.b. contacts, three points for c.w. The multiplier for S.C. stations is the number of states (50), VE provinces, and DX countries worked. Out-of-state stations will use S.C. counties (maximum of 46).

Frequencies: C.W.—3560, 7060, 14060, 21060, 28060. S.S.B.—3895, 7230, 14280, 21365, 28560. Novice/Tech.—3725, 7125, 21125, 28125.

Awards: Certificates to the top scorers in each S.C. county, each state, VE province, and DX country. (Novice and Techs. compete with other N/T.)

Include a summary sheet showing the scoring, your log, and a large s.a.s.e. for a copy of the results.

Mailing deadline is March 5th to: Colleton County Contesters, Att: Elliot Farrell, Jr., WA4YUU, P.O. Box 994, Walterboro, SC 29488.

North America 1981 French Contest Results

C.W.

W1HHV	7,200
KA1CLV	6,144
WB1HIH	990
W1OPJ	318
K2QD	20,763
W2GKZ	8,451
W3ARK	128,654
W4KO	22,550
WB5YMS	73,568
N6JM	4,180
N7DF	43,218
W8UVZ	364,428
W8DSO	14,058
K8MN	5,670
W8EAO (QRP)	318
W9OA	254,670
W9RE	27,244
WA9MRU	420
VE3DAP	128,304
VE2WA	44,896
VE3KK	12,400
VE4MF	4,200
VE7IQ	9,720

Phone

F2YS/W2	213,962
WB3JRU	8,580
WA4VEK	132
WB9EEE	10,943
K9GTQ	10,540
WØOLL	7,680
WØCDC	6,670
VE2JV	263,444
VE1CCC	118,272
VE2AFC	72,520
HI3AMF	768

1981 PACC Contest Results North America

*WD4IHV	3,710
*AD8P	3,108
*W1END	2,144
W4VQ	1,740
*W9OA	1,534
WA4OML	1,425
*KN6O	1,056
N6ZX	1,050
N4MM	1,026
*W3DKT	805
*W2FGY	722
KA1B	600
W4KO	420
WB8IJN	403
WD9IIC	348
AE9X	338
*WB5YMS	320
WA4VEK	308
*N7DF	247
K1GZM	230
KA5BBL	220
NOAVT	216
W2KZE	200
WB4WHE	153
W7POC	140
W6MYP	112
W4IV	96
N6JM	91
K4GDV	30
WB1GLH	25
W9FSD	25
K3ZPG	20
KI8V	1
*VO1AW	3,686
VE3MFT	2,280
*VE1BNN	1,800
VE3GCO	1,650
VO1KO	1,540
VE3JPP	924
VE3FEA	220

*Certificate Winners

a monthly feature by
GEORGE JACOBS, W3ASK

Propagation

THE SCIENCE OF PREDICTING RADIO CONDITIONS

1982 Looks Like Another Good Year

The present sunspot cycle, officially Cycle 21, appears to have hit another plateau in its slow decent from a maximum level of 165 reached during December 1979.

The *Royal Observatory of Belgium*, the world's official keeper of sunspot data, reports a monthly mean sunspot number of 169.3 for September 1981. This results in a 12-month smoothed sunspot number of 143 centered on March 1981. The level of solar activity is measured by the smoothed number. March's level is slightly *higher* than the 140 and 141 recorded during January and February, respectively. Short periods of increasing solar activity during the descending phase of a solar cycle are not unusual, but they do extend periods of good propagation conditions.

As a result of this plateau, relatively high solar activity is expected to continue through 1982. The year should begin with a solar count of 120 or more for January, declining to approximately the upper 90's by the end of the year. While this level is lower than solar activity experienced during the past three years, the range is still expected to be high enough to produce a generally strong ionosphere with correspondingly good propagation on the h.f. amateur bands from *10* through *160* meters. Some unusual ionospheric openings should also be possible on *6* meters, although conditions are not likely to be as good as they were during the years 1979–81.

Table I contains a month-by-month listing of smoothed sunspot numbers reported since Cycle 21 began during June 1976, as well as a prediction for the level expected during 1982. The same data is shown graphically in fig. 1, including a prediction for the remainder of the cycle.

LAST MINUTE FORECAST

Day-to-Day Conditions Expected for January 1982

Propagation Index	*Expected Signal Quality* (4)	(3)	(2)	(1)
Above Normal: 2, 10, 19, 21, 29	**A**	**A**	**B**	**C**
High Normal: 1, 4-5, 8, 11, 18, 20, 22-23, 28	**A**	**B**	**C**	**C-D**
Low Normal: 3, 6-7, 9, 12-13, 17, 24, 27, 30-31	**A-B**	**B-C**	**C-D**	**D-E**
Below Normal: 14, 16, 25-26	**B-C**	**C-D**	**D-E**	**E**
Disturbed: 15	**C-E**	**D-E**	**E**	**E**

Where expected signal quality is: **A—Excellent opening, exceptionally strong, steady signals greater than S9 + 30 dB.**

B—Good opening, moderately strong signals varying between S9 and S9 + 30 dB, with little fading or noise.

C—Fair opening, signals between moderately strong and weak, varying between S3 and S9, with some fading and noise.

D—Poor opening, with weak signals varying between S1 and S3, and with considerable fading and noise.

E—No opening expected.

HOW TO USE THIS FORECAST

1. **Find *propagation index* associated with particular band opening from Propagation Charts appearing on the following pages.**
2. **With the *propagation index*, use the above table to find the expected signal quality associated with the band opening for any day of the month. For example, an opening shown in the charts with a *propagation index* of 3 will be good (B) on Jan. 1st, excellent (A) on the 2nd, good-to-fair (B-C) on the 3rd, good again (B) on the 4th and 5th, etc.**

For updated information, subscribe to bi-weekly MAIL-A-PROP, David D. Meisel, Editor, 54 Westview Crescent, Geneseo, NY 14454.

Federal Budget Cut Hits Propagation Forecasting Services

The "hotline" propagation forecast services provided by the government and reported in my column for October 1981 have been reduced drastically, apparently as a result of recent budget cuts by the Federal government.

The NOAA operation at NASA's Goddard Space Center no longer exists, and the NASA Solar Flux Hotline (301-344-8129) is no longer in operation.

The WWV Hotline (303-497-3235) has not answered since October 1st. The NOAA Space Environmental Sěrvice Center no longer provides telephonic forecasts to the general public.

Updated geomagnetic, solar, and ionospheric data continues, however, to be broadcast 18 minutes past each hour over WWV on 2.5, 5.0, 10.0, 15.0, and 20.0 MHz.

January Conditions

It should be a toss-up between *10* and *15* meters for daytime DX honors, with *20* meters not too far behind!

Ten meters should provide good-to-excellent DX conditions from daybreak through the early evening hours on most days during the month. Expect the strongest signals from Europe, Africa, and points east before Noon; signals from the southern hemisphere should peak after Noon; and from the Pacific and points west in the late afternoon and early evening. Also look for excellent short-skip openings between distances of approximately 1200 and 2300 miles during most of the daylight hours.

Fifteen meters should open at sunrise, with signals from Europe and points east peaking before Noon. The band should swing around towards the south and southwest during the afternoon hours, with signals from the west, northwest, and Pacific areas strongest in the late afternoon and early evening. On some days expect the band to remain open to Central and South America and to the Pacific area well into the hours of darkness. Excellent short-skip openings are also ex-

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1976						12	13	14	14	13	14	15
1977	17	18	20	22	24	26	29	33	39	46	52	57
1978	61	65	70	77	83	89	97	104	108	111	113	117
1979	124	131	137	141	147	153	155	155	156	158	162	165
1980	164	163	161	159	156	155	153	150*	150*	150*	148*	143*
1981	140*	141*	143*	**141**	**138**	**136**	**134**	**132**	**130**	**128**	**126**	**124**
1982	**122**	**120**	**118**	**116**	**114**	**112**	**109**	**107**	**104**	**102**	**99**	**97**

* *Provisional, subject to slight change*
(bold face) Predicted for remainder of 1981 and 1982

Table I– Progress of sunspot Cycle 21.

11307 Clara St., Silver Spring, MD 20902

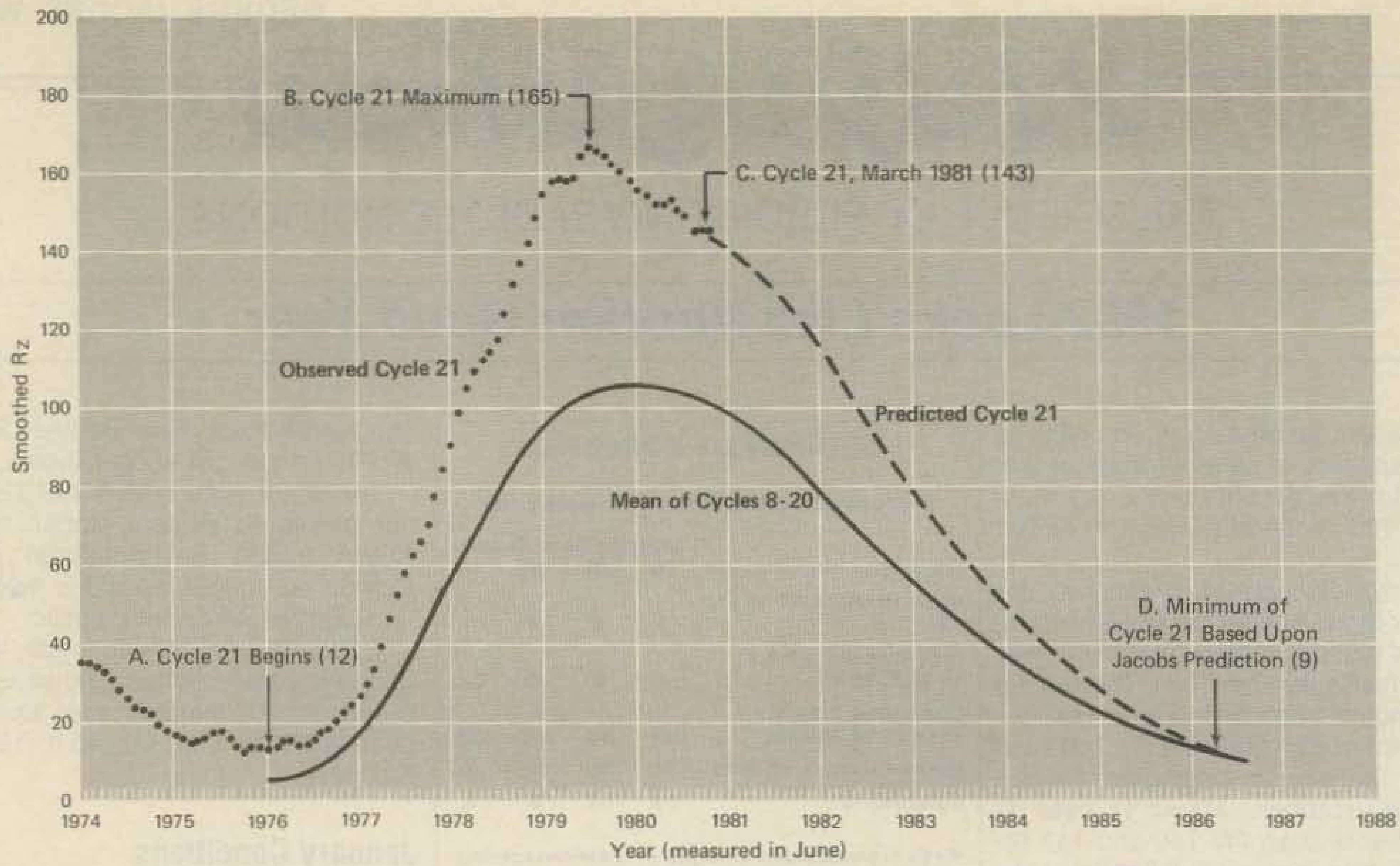


Fig. 1– Observed and predicted smoothed sunspot numbers for Cycle 21.

pected from shortly after sunrise through the early evening hours for distances ranging between 1000 and 2300 miles.

During January *20* meters should remain open to some area of the world or another almost around the clock. The best times for strongest signals should be for about an hour or two after sunrise, and again an hour to two before sunset, when openings to most areas of the world should be possible. On many days the band is likely to remain open well past Midnight, particularly towards South America and the Pacific. Excellent short-skip openings between distances of approximately 800 and 2300 miles should be possible from just after daybreak to as late as Midnight. Openings over much shorter distances are likely from mid-morning to mid-afternoon.

The optimum band for DX conditions during the hours of darkness should be *40* meters. Openings to most areas of the world should be possible at sometime between sundown and the post-sunrise period. Signal levels may often be exceptionally strong on this band due to a seasonal decrease in atmospheric noise or static. Look for signals from Europe and points east in the late afternoon, early evening, and until about Midnight. After Midnight the band should shift towards the west, northwest, and Pacific areas, peaking in these directions just before sunrise. Look for good openings towards the Carribean and Central and South America just about anytime between sundown and sunrise. During the daylight hours short-skip should be optimum between approximately 100 and 600 miles. The skip should lengthen during the late afternoon, and by nightfall conditions should be best for openings between 800 and 2300 miles.

Eighty meters should open for DX towards Europe, Africa, and points east between sunset and Midnight. Around Midnight signals should peak towards Central and South America (they should be in earlier) and begin to open towards the west, northwest, and Pacific areas. These will peak around daybreak. Daytime short-skip of between 50 and 250 miles should stretch to between 250 and 1500 miles during the late afternoon and early evening, and by nightfall openings up to and beyond 2300 miles should be possible.

Expect some relatively good DX openings on *160* meters during the hours of darkness. Openings towards Europe and the east should peak around Midnight. The band should shift towards the west and the Pacific area after Midnight, with signals expected to peak at daybreak. Openings towards the Caribbean area and Central America should be possible at just about any time between sundown and sunrise, with openings further south more difficult with increasing distance. Short-skip openings up to approximately 1300 miles should be common during the hours of darkness, and frequently the skip is expected to lengthen to 2300 miles or more. During the daylight hours, intense solar absorption will severely limit openings, although some may be possible at times up to 150 miles or so.

Short-Skip Charts

This month's column contains a *Short-Skip Chart* for use in the continental United States for distances between 50 and 2300 miles. Special prediction charts centered on Hawaii and Alaska are also included. The Charts are valid through February 1982. See last month's column for detailed *DX Propagation Charts* for use during January.

V.h.f. Ionospheric Openings

Some fairly good *6* meter DX openings should be possible during January. This may be the last year in this solar cycle that the count will be high enough to support F2-layer openings. Look for peak conditions towards Europe and Africa an hour or two before Noon, and towards the Caribbean area and Central and South America from an hour or two before, to about an hour or two after, Noon. Expect some *6* meter openings towards the Pacific area and possibly the Far East during the last afternoon hours. Trans-continental openings should be possible during the afternoon hours. Don't expect openings on *6* meters every day, but some should be possible during the month, particularly on days that are High or Above Normal. (See the "Last Minute Forecast" at the beginning of this column.)

The *Quadrantids* meteor shower should occur right at the start of the new year and continue through the first several days of January. This is a major shower, with a peak of approximately 40 mete-

HOW TO USE THE SHORT-SKIP CHARTS

1. In the Short-Skip Chart, the predicted times of openings can be found under the appropriate distance column of a particular Meter band (10 through 160 Meters) as shown in the left hand column of the Chart. For the Alaska and Hawaii Charts the predicted times of openings are found under the appropriate Meter band column (10 through 80 Meters) for a particular geographical region of the continental USA as shown in the left hand column of the Charts. An * indicates the best time to listen for 80 meter openings.

2. The *propagation index* is the number that appears in ( ) after the time of each predicted opening. On the Short-Skip Chart, where two numerals are shown within a single set of parenthesis, the first applies to the shorter distance for which the forecast is made, and the second to the greater distance. The index indicates the number of *days* during the month on which the opening is expected to take place, as follows:

(4) Opening should occur on more than 22 days
(3) " " " between 14 and 22 days
(2) " " " between 7 and 13 days
(1) " " " on less than 7 days

Refer to the "Last Minute Forecast" at the beginning of this column for the actual *dates* on which an opening with a specific *propagation index* is likely to occur, and the signal quality that can be expected.

3). Times shown in the Charts are in the 24-hour system, where 00 is midnight; 12 is noon; 01 is 1 A.M.; 13 is 1 P.M., etc. On the Short-Skip Chart appropriate *standard* time is used at the *path midpoint*. For example on a circuit between Maine and Florida, the time shown would be EST, on a circuit between N.Y. and Texas, the time at the midpoint would be CST, etc. Times shown in the Hawaii Chart are in HST. To convert to standard time in other USA time zones *add* 2 hours in the PST zone; 4 hours in the MST zone; 3 hours in the CST zone, and 5 hours in the EST zone. *Add* 10 hours to convert from HST to GMT. For example, when it is 12 noon in Honolulu, it is 14 or 2 P.M. in Los Angeles; 17 or 5 P.M. in Washington, D.C.; and 22 GMT. Time shown in the Alaska Chart is given in GMT. To convert to *standard* time in other areas of the USA *subtract* 8 hours in the PST zone; 7 hours in the MST zone; 6 hours in the CST zone and 5 hours in the EST zone. For example, at 20 GMT it is 15 or 3 P.M. in N.Y.C.

4. The Short-Skip Chart is based upon a transmitted power of 75 watts c.w. or 300 watts p.e.p. on sideband; the Alaska and Hawaii Charts are based upon a transmitter power of 250 watts c.w. or 1 kw p.e.p. on sideband. A dipole antenna a quater-wavelength above ground is assumed for 160 and 80 meters, a half-wave above ground on 40 and 20 meters, and a wave-length above ground on 15 and 10 meters. For each 10 db gain above these reference levels, the *propagation index* will increase by one level for each 10dB loss, it will lower by one level.

5. Propagation data contained in the Charts has been prepared from basic data published by the Institute for Telecommunication Sciences of the U.S. Dept. of Commerce, Boulder, Colorado, 80302.

ors an hour entering the earth's atmosphere on January 3rd. This shower should produce enough ionization at times to permit meteor-scatter openings on the v.h.f. bands.

Some auroral-scatter-type openings may be possible during January on the v.h.f. bands. These should occur when widespread auroral displays take place. Such displays are likely when h.f. conditions are either Below Normal or Disturbed. Check the "Last Minute Forecast" for appropriate dates.

January is seasonally a poor month for trans-equatorial (T.E.) propagation. Some infrequent openings may be possible, however, between southern tier states and countries well south of the equator in this hemisphere, and for corresponding locations in the eastern hemisphere. The best time to check for T.E. openings is between 7 and 10 p.m., local time, on 6 meters.

The New Year looks like another good year for h.f. propagation conditions, but it may be the last such year in the present solar cycle.

73, George, W3ASK

CQ Short-Skip Propagation Chart
January & February 1982
Local Standard Time at Path Mid-Point
(24-Hour Time System)

Band (Meters) — Distance From Transmitter (Miles)

	50-250	250-750	750-1300	1300-2300
10	*Nil*	*Nil*	07-08 (0-1) 08-09 (0-2) 09-10 (0-3) 10-12 (0-4) 12-15 (0-3) 15-17 (0-2) 17-18 (0-1)	07-08 (1) 08-09 (2-3) 09-10 (3-4) 10-12 (4) 12-15 (3-4) 15-16 (2-4) 16-17 (2-4) 17-18 (1-2) 18-19 (0-2) 19-20 (0-1)
15	*Nil*	07-08 (0-1) 08-10 (0-2) 10-15 (0-3) 15-17 (0-2) 17-18 (0-1)	06-07 (0-1) 07-08 (1-3) 08-10 (2-4) 10-15 (3-4) 15-17 (2-4) 17-18 (1-3) 18-19 (0-2) 19-21 (0-1)	06-07 (1) 07-08 (3-2) 08-18 (4) 18-19 (2-3) 19-20 (1-3) 20-21 (1-2) 21-22 (0-1)
20	09-11 (1-2) 11-14 (1-3) 14-15 (1-2) 15-17 (0-1)	06-07 (0-2) 07-09 (0-3) 09-11 (2-4) 11-14 (3-4) 14-15 (2-4) 15-17 (1-4) 17-19 (0-3) 19-20 (0-2) 20-06 (0-1)	06-07 (2-3) 07-08 (3) 08-09 (3-4) 09-17 (4) 17-19 (3-4) 19-20 (2-4) 20-21 (1-4) 21-23 (1-3) 23-01 (1-2) 01-06 (1)	06-07 (3-2) 07-08 (3) 08-12 (4) 12-14 (4-3) 14-21 (4) 21-23 (3-4) 23-01 (2) 01-04 (1-2) 04-06 (1)
40	07-08 (0-2) 08-09 (1-3) 09-10 (2-4) 10-19 (4) 19-21 (2-3) 21-00 (1-2) 00-07 (0-1)	07-08 (2-3) 08-09 (3) 09-11 (4-3) 11-15 (4-2) 15-19 (4) 19-21 (3-4) 21-00 (2-4) 00-02 (1-3) 02-06 (1-2) 06-07 (1-3)	07-08 (3) 08-09 (3-2) 09-11 (3-1) 11-15 (2-1) 15-17 (4-2) 17-18 (4-3) 18-00 (4) 00-02 (3-4) 02-06 (2-3) 06-07 (3-4)	07-08 (3-1) 08-15 (1-0) 15-17 (2-1) 17-19 (3) 19-02 (4) 02-06 (3-4) 06-07 (4-3)
80	07-08 (2-4) 08-10 (4) 10-15 (4-3) 15-00 (4) 00-04 (3-4) 04-07 (2-3)	07-08 (4-3) 08-09 (4-2) 09-10 (4-1) 10-15 (3-1) 15-16 (4-1) 16-18 (4-2) 18-04 (4) 04-07 (3-4)	07-08 (3-1) 08-09 (2-0) 09-16 (1-0) 16-18 (2-1) 18-20 (4-3) 20-06 (4) 06-07 (4-3)	07-08 (1-0) 08-16 (0) 16-18 (1-0) 18-20 (3-2) 20-04 (4) 04-06 (4-3) 06-07 (3-1)
160	09-17 (1-0) 17-19 (3-2) 19-06 (4) 06-08 (3) 08-09 (2-1)	17-18 (2-1) 18-19 (2) 19-21 (4-3) 21-05 (4) 05-06 (3) 06-07 (3-2) 07-08 (3-1) 08-09 (1-0)	17-18 (1-0) 18-19 (2-1) 19-21 (3-2) 21-03 (4-3) 03-05 (4) 05-06 (3-2) 06-07 (2-1) 07-08 (1-0)	18-19 (1-0) 19-21 (2-1) 21-03 (3) 03-05 (4-2) 05-06 (2-1) 06-07 (1-0)

HAWAII
January & February, 1982
Openings Given In Hawaiian Standard Time

TO:	10 Meters	15 Meters	20 Meters	40/80 Meters
Eastern USA	07-08 (1) 08-09 (2) 09-13 (4) 13-14 (3) 14-15 (2) 15-16 (1)	06-07 (1) 07-09 (4) 09-12 (3) 12-15 (4) 15-17 (3) 17-18 (2) 18-19 (1)	12-14 (2) 14-17 (4) 17-21 (3) 21-00 (2) 00-06 (1) 06-08 (3) 08-09 (2) 09-12 (1)	17-18 (1) 18-20 (2) 20-02 (3) 02-03 (2) 03-04 (1) 19-20 (1)* 20-01 (2)* 01-03 (1)*
Central USA	07-08 (1) 08-09 (2) 09-15 (4) 15-16 (3) 16-17 (2) 17-18 (1)	06-07 (1) 07-09 (4) 09-13 (3) 13-17 (4) 17-19 (3) 19-20 (2) 20-21 (1)	08-13 (2) 13-14 (3) 14-20 (4) 20-00 (3) 00-02 (2) 02-05 (1) 05-06 (2) 06-08 (3)	17-18 (1) 18-20 (2) 20-21 (3) 21-01 (4) 01-03 (3) 03-04 (2) 04-06 (1) 19-20 (1)* 20-22 (2)* 22-01 (3)* 01-03 (2)* 03-05 (1)*
Western USA	07-08 (1) 08-09 (2) 09-16 (4) 16-17 (3) 17-18 (2) 18-19 (1)	06-07 (1) 07-08 (2) 08-12 (3) 12-18 (4) 18-20 (3) 20-21 (2) 21-22 (1)	08-10 (4) 10-15 (3) 15-22 (4) 22-01 (3) 01-04 (2) 04-06 (1) 06-08 (3)	17-18 (1) 18-19 (2) 19-20 (3) 20-03 (4) 03-05 (3) 05-06 (2) 06-07 (1) 19-20 (1)* 20-21 (2)* 21-04 (3)* 04-05 (2)* 05-06 (1)*

ALASKA
January & February, 1982
Openings Given In GMT#

TO:	10 Meters	15 Meters	20 Meters	40/80 Meters
Eastern USA	17-18 (1) 18-20 (2) 20-22 (3) 22-00 (2) 00-01 (1)	15-16 (1) 16-17 (2) 17-21 (3) 21-23 (4) 23-00 (3) 00-01 (2) 01-02 (1)	12-16 (1) 16-18 (2) 18-21 (1) 21-23 (2) 23-02 (3) 02-03 (2) 03-05 (1)	06-12 (1) 07-11 (1)*
Central USA	17-18 (1) 18-20 (2) 20-00 (3) 00-01 (2) 01-02 (1)	15-16 (1) 16-17 (2) 17-20 (3) 20-23 (4) 23-01 (3) 01-02 (2) 02-03 (1)	12-16 (1) 16-18 (2) 18-20 (1) 20-22 (2) 22-00 (3) 00-02 (4) 02-03 (3) 03-04 (2) 04-06 (1)	06-08 (1) 08-13 (2) 13-14 (1) 07-12 (1)*
Western USA	18-19 (1) 19-20 (2) 20-21 (3) 21-23 (4) 23-00 (3) 00-01 (2) 01-02 (1)	16-17 (1) 17-18 (2) 18-20 (3) 20-01 (4) 01-02 (3) 02-03 (2) 03-04 (1)	12-16 (1) 16-18 (2) 18-22 (3) 22-02 (4) 02-04 (3) 04-05 (2) 05-07 (1)	04-05 (1) 05-06 (2) 06-14 (3) 14-15 (2) 15-16 (1) 05-10 (1)* 10,14 (2)* 14-15 (1)*

#See explanation in "How To Use Short-Skip Charts" in the box at the beginning of this column.

*Indicates best time to listen for 80 Meter openings. Openings on 160 Meters are also likely to occur during those times when 80 Meter openings are shown with a forecast rating of (2), or higher.

Note: The Alaska and Hawaii Propagation Charts are intended for distance *greater* than 1300 miles. For openings over shorter distances, use the preceding Short-Skip Propagation Chart.

Check for 6 Meter openings at times when the 10 Meter forecast rating is shown as (4).

CQ BOOK SHOP

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January – 1982

Announcing

• **Special Events Station in North Dakota** - A Special Events Station, sponsored by the Mandan-Bismarck ARC, will be held January 2–3. It is planned at the Lewis and Clark wintering site in North Dakota. Time of operation will be 1600–2100 UTC on both days. Frequencies will be as follows: s.s.b.—14295, 21395, 28595; c.w.—14065, 21065, 28065; Novice—21125, 28125, all frequencies QRM. To receive a special commemorative QSL, send an s.a.s.e. to Mandan-Bismarck ARC, P.O. Box 978, Bismarck, ND 58501.

• **Oak Park Radio Club** - On January 10 from 8 a.m. to 3 p.m. the Oak Park Radio Club will hold its annual Swap and Shop at the Oak Park High School in Oak Park, Michigan. Admission is $2. There will be a League table, door prizes, YL raffle and table, and refreshments. Talk-in on 146.04/64 and 146.52 simplex. For more information, contact Rob Numerick, WB8ZPN, 23737 Couzens, Hazel Park, MI 48030 (include an s.a.s.e.).

• **Worked All Morton Contest** - The Morton Amateur Radio Club will hold the Worked All Morton Contest from 0001Z January 9 to 2400Z January 10 and 0001Z January 16 to 2400Z January 17. The award will be issued to those amateurs who have QSOs with five or more members of the Morton Amateur Radio Club or residents of Morton, Illinois. To receive the award, applicants should send log information, listing at least five Morton contacts, along with a large s.a.s.e. to Morton Amateur Radio Club, 701 Columbus Ave., Morton, IL 61550.

• **Southfield High School ARC Annual Swap and Shop** - The Southfield High School ARC will sponsor their annual Swap and Shop on January 17 at the Southfield High School, 24675 Lahser, Southfield, Michigan. Doors open at 6 a.m. for exhibitors, 8 a.m. for the public. Admission is $2. Reserved tables are $8 per one 8-foot table (paid in advance). Tables will also be available at the door. Refreshments and door prizes available. For more information or reservations, write to Robert Younker, Southfield High School, 24675 Lahser, Southfield, MI 48034.

• **Beacon Experiment Authorized For 10, 18, and 24 MHz** - The FCC has authorized the establishment of an experimental radio beacon on the bands 10.100–10.150, 18.068–18.168, and 24.890–24.990 MHz, these being the bands allocated for amateur radio use by the World Administrative Radio Conference, Geneva, 1979. The experiment is intended to permit amateurs to become familiar with the characteristics of these bands, simplifying the scheduled future change-over to amateur use, to improve amateur use of these new parts of the spectrum, and to provide data on sharing between different services. Success of the experiment depends on participation by amateurs and s.w.l.'s, and on their reports. For more information, contact R.P. Haviland, 2100 South Nova Road, Box 45, Daytona Beach, FL 32019.

• **Martin County ARA Picnicfest Hamfest** - The Martin County ARA will hold its annual Picnicfest Hamfest on Saturday, January 30, from 8 a.m. to 3 p.m. at Langford Park, Jensen Beach, Florida. Admission will be free. For more information, contact Vern, WA4GQY, 305-334-6220 or Don, W4OST, 305-286-0500.

• **Dayton ARA Audiovisual Slide Show** - As a result of requests from radio clubs for program material on the Hamvention, the Dayton Amateur Radio Association has developed an audiovisual slide show that is timed at 12 minutes and is suitable for showing at club meetings. The show depicts one amateur's activities at the three-day affair. Use of the program is free; however, a security deposit is required to assure reasonable turnaround time. For additional information, contact Hamvention Slide Show, Box 44, Dayton, OH 45401.

a monthly feature by
HUGH CASSIDY, WA6AUD

DX

NEWS OF COMMUNICATIONS AROUND THE WORLD

And we meet,
With champagne and a chicken,
And a little DX,
At last . . .

We were sure that we'd heard someone calling. Perhaps as a DXer I should have realized that there are times when you'll hear a call that isn't there, although you hope it is. So we called this old timer over on the other ridge. He is a well-known DXer who calls everything.

"I always have," he said, "so why should I stop now!" Inasmuch as this is one who also works just about everything, who were we to offer dissent. No, he had not been calling us, only thinking of calling us. This was not a surprise, because most DXers eventually learn that if you are in there before they call, you will be among the first to work them. But that's the way it has always been. Call first, listen later!

"I was getting ready to call you," he told us. "I've been working on this idea of a new and higher tower all winter long, and it's about ready to fly. I was thinking of asking for a hand in putting it up."

We were available. Most DXers are when there is a new tower going up. One is always interested in the state of the art. But later we got to thinking. This old timer already has a 60 footer and an 85 footer up on his ridge a couple of thousand feet above sea level firmly anchored against the winds off the wide Pacific. But one learns by looking and listening, especially when it is in the lair of the big signal, so we hastened over the hills and far away.

January is usually the wettest month in these parts. However, you'll often have some difficulty in convincing the imbedded local DX types that with New Years behind, spring is not already upon us. "Look at the mimosa trees," they will tell you. "When they turn the hillsides yellow with bloom, you'll darn well know that spring is here. And they always bloom by the third week in January. Always!"

After a spring or two you will also learn that they are not particularly interested in yellow blooms, but are interested rather in the chance to bask in the still thin sunlight, to back off a bit from the long winter's search for DX, and to plan the coming year. Any DXer who is into January and not thinking of the beam and the tower and how things will go in the year ahead has not yet attained the needed hue of the true-blue. Never!

77 Coleman Dr., San Rafael, CA 94901

During the '81 Jacksonville Hamfest, the North Florida DX Assn. (13 of the 20 members shown above) held their annual election of officers meeting at the QTH of Ron Blake, N4KE. The new President is Bill Walker, WB4EYX; Dick Knox, AJ2E, VP; and Pres Walker, W4FDA, Secty/Treasurer. Dr. Ray Donovan, WØAX, spoke of upcoming DXpeditions to CEØX and FB8W. CQ WPX Contest Director Bernie Welch, W8IMZ, discussed CQ *Contests. The NFDXA bestowed their highest honor on Bernie, W8IMZ, by electing him a Lifetime Honorary Member, as a friend of the Club and for his many contributions to DX and WPX Contesting in his long-time position with* CQ *magazine.*

We found the old timer on the ridge, his yard filled with tower and antenna parts. "First I'll explain my plan," he told us, "and I don't want to explain things more than once. This year we're going to run up this new tower, hoist up the new antenna that I worked on during the winter, and when the whole thing jells, no one is going to beat me out—ever. No one, not even Frank Clement!"

There are some who may be intimidated by the tone of the old timer's voice, but we often stumble in where others fear to tread. Perhaps we even snorted at his words. "W6KPC's tower is 200 feet up with stacked arrays on top of stacked arrays," we argued. "How can you figure to even match that? How?"

If we had thought that this might be the first time such a thought had surfaced, we could have saved our breath. "Two hundred feet up, that's right," the old timer said, "and two hundred feet above sea level at its base. What's the elevation here?" Right then we knew he had us, for even if he stuck the antenna right on top of his roof, he would still start close to 2,000 feet above the clearly visible Pacific to the west. So all we could say was, "But is it possible?" He didn't even bother to answer us.

So we asked, "Why? Why, with two big towers already up, a superb location, and being just about always the first out of the gate, are you putting up a third tower and beam? Do you really need it?" Maybe we could have left out that last question.

The old timer was hardly irritated at our questioning, but he did lean close so we would not miss any of his words. "I doubt if I'll ever live to see the day when I have enough tall towers or big antennas," he rasped, "or even work enough DX. But one thing I know for sure. When I have that big array up on top of the new tower and everything is working right, I'll be happy and content just to know that it is there . . . all mine. And should I need it, I already have it!"

As usual, he was right, for no DXer is ever fully satisfied with his antenna or the height of his tower. He always wants just a bit more. But that's the way it has always been. For the DXer to need and not have is a disaster, but to have and scarcely need, that is an ongoing comfort.

Many of us may know of some younger types, around 45 or so, maybe even 50 but still young, who often dream of a small boat and a fair wind and the tropical islands below the wind. So never forget that DXers also dream of tall towers, long beams, and the DX that perhaps someday they'll work. And the dream comes anew and afresh every spring. Perhaps after a bit we will realize that the tower itself may be the dream of things we might do some day but often never do. But still the possibility is always that it might be realized. Perhaps even DX itself is the dream, fresh at every dawn, intriguing with promise at the close of every day, and always hauntingly close during the long watches of the night.

Take from no man his dream . . .

CW DXCC Award

There have been changes in this award. This subject was discussed a couple of months back, and the ARRL has moved to correct what many found were questionable practices. Cross-mode contacts for the CW DXCC Award, and for the other single-mode awards as well, are being wiped out.

There will be no credit given for mixed-mode contacts for the CW DXCC Award for contacts made October 1, 1981 or later. For contacts made before that date, credit will be given through December 31, 1981, and by the time you read this, that date most probably will be past.

From January 1, 1982 purity will prevail. Mixed-mode contacts will not be counted for the CW/SSB/RTTY DXCC Award. The ARRL has thus moved to end a practice which long bothered a good many DXers, although there were some who stoutly defended the practice, often because it was to their advantage.

ZS6QU/ZS3 QSLs

There are some who figured out a way to get a QSL for this operation back in 1976, although a good number still have a blank spot on the wall and a waiting hand. But, as it is with a lot of other things, if you wait long enough you will get it. Roy Larsen, ZS6QU/ZS3, now lives in Kimberley, Sout Africa and is signing ZS4T. His XYL, Isabel, advised N6EM that she had been working on the box of QSLs on hand when she married Roy a couple of years back, and by now they are all cleaned up. Roy had the incoming ones on hand and had carried them with him through ZS-Land, but as of the end of the year the back-log had been worked down to zero.

After the operation in November and December 1976, some of the incoming cards were inadvertently disposed of by an office worker in the agency where Roy was employed. Although it is a long way back, if you need a QSL, you can still get one. Isabel says that she is the QSL Manager and she will answer any query. So, if you want to try again, go to Mrs. Isabel Larsen, The Belfry, 9 Edgar Davis St., Monument Heights, 8301 Kimberley, Republic of South Africa.

K6LPL and Various Matters

Last spring there was again a tremor through the DX ranks when word began leaking out through a variety of routes of a possible scandal on manufactured QSL cards for non-existent contacts. By now the whole matter has settled except for the hints that lawsuits may be filed. Dave Gardner, K6LPL, has severed his association with the DXCC, ARRL, as a Southern California DX Club Director, and possibly a few others. He probably has also severed rather definitely his plans for DXpeditions.

If you are a newer DX type, this may be a hard thing to accept—the possibility that sometimes things are not on the straight and narrow. If you are a bit older, you have learned that as the amusement park carousel goes around and around, often so does DXing, and things do seem to repeat.

Sometimes in looking back one cannot help but wonder what motivates whom. The Don Miller happenings in the mid-sixties are vividly remembered by many DXers, known to others who have come on the scene since, but still a matter of regret to many that it ever happened.

In those days Don Miller was the Su-

The WAZ Program

10 Meter Phone

158	W9VA	160	JA1NLI
159	ZL1BIL	161	KM6K

15 Meter Phone

101	KL7D	104	K1MEM
102	WD8MGQ	105	W2IJB
103	WA4LOF	106	I1RJP

20 Meter Phone

373	UF6RD	377	IT9VQC
374	VK3RF	378	I0SYQ
375	WA6DTG	379	I2YBC
376	G2HJT	380	K1MEM

40 Meter Phone

11	JA1VKV

15 Meter C.W.

53	AA4AK	54	K5AQ

20 Meter C.W.

154	K1MEM

40 Meter C.W.

28	K1MEM

All Band WAZ

S.S.B.

2289	WB4FTU	2296	W8UVZ
2290	VK2DPN	2297	K4CKS
2291	WB6VSK	2298	W9VWV
2292	UF6RB	2299	KB8KD
2293	SM4CTT	2300	WA6LFF
2294	W3HRD	2301	AD7S
2295	WD9FOE	2302	G4GED

C.W. and Phone

5220	N2BI	5231	W6SWE
5221	OH1SM	5232	W1BWS
5222	AA4CM	5233	VE3VC
5223	W7QMU	5234	K5GOE
5224	KB8O	5235	JA6VNR
5225	AG6D	5236	I3ZKD
5226	KB7MO	5237	K2IKF
5227	AI3Q	5238	YU3DTN
5228	W5YB	5239	KJ6F
5229	W8NE	5240	WA2EYA
5230	SM7CQY		

ALL PHONE

574	K5GOE

Applications and reprints of the latest rules may be obtained by sending a self addressed stamped envelope (30 cents) size 4½ × 9½ to the W A Z Manager, Leo Haijsman, W4KA, 1044 S.E. 43 Street, Cape Coral, Florida 33904. Applicants forwarding QSL cards either direct to the W A Z manager or to a check point should include sufficient postage for safe return of their QSL cards. The processing fee for all C.Q. awards is $4.00 for subscribers and $10 for non-subscribers. In order to qualify for the subscriber rate, please enclose your latest *CQ* mailing label with your application.

The WPX Program

Mixed

945	KC4LP	949	KJ6F
946	WD9ACQ	950	DL3ME
947	W3KHQ	951	IV3PVD
948	NI4Y		

S.S.B.

1428	W1WLW	1433	ON6IT
1429	W2IBZ	1434	WA8KMK
1430	JI1LLD	1435	KE2C
1431	JE2HCL	1436	WDØFSJ
1432	N4CLT	1437	NP4CC

C. W.

2102	W6MUL	2105	WA7OBH
2103	VE1ACK	2106	DF1OF
2104	SM5AKT	2107	OK1ZP

WPNX

203	KA7GXO	204	VK7NWR

Endorsements

Mixed: 400 KC4LP, WD9ACQ, W3KHQ, DL3ME. 450 W3KHQ, JA4ESR, IV3PVD. 500 JA4ESR. 550 JA4ESR, KQ4M. 600 VE3FEA. 650 KO8T, VE3FEA. 700 YU1FD. 750 OE1KJW. 800 N4IB, WB4RUA. 900 DJ8WD. 950 VE7IG, KØDEQ. 1000 KØDEQ, N6JM. 1050 KØDEQ. 1100 KØDEQ. 1400 AA4A/8. 1900 W2NC.

S.S.B: 300 W1WLW, W2IBZ, JI1LLD, JE2HCJ, N4CLT, KE2C, NP4CC. 350 JE2HCJ, JA9DDM, ON6IT, KE2C, NP4CC. 400 JE2HCJ, K7CU, W5LBT, ON6IT, KE2C, WD9FOE, NP4CC. 450 JE2HCJ, WB4UBD, ON6IT, KE2C, HM1SX. 500 JE2HCJ, WB4UBD, KE2C, HM1SX. 550 JE2HCJ, WBØLXM, JH5FQQ, KE2C, WA2SRM. 600 JE2HCJ, N4IB, ISØMVE, KE2C. 650 WA7OBH, KE2C. 700 WA7OBH, KE2C. 850 W7KOI, VE7IG, I3ZKD. 900 W7KOI, I3ZKD. 1000 I6SF. 1150 XE1J. 1200 XE1J, AA4A/8. 1250 XE1J. 1300 IØMBX.

C.W.: 300 W6MUL, VE1ACK, WA7OBH, DF1OF, OK1ZP, N3KR. 350 W6MUL, VE1ACK, SM5AKT, N3KR. 400 W6MUL, K7CU, SM5AKT. 450 W6MUL, K9TI, N4IB, SM5AKT. 500 WDØAVG, W6MUL, SM5AKT. 550 SM6INC, SM5AKT. 600 SM5AKT. 650 SM5AKT. 700 SM5AKT, AA4A/8. 750 SM5AKT. 800 SM5AKT, JH1VRQ. 850 SM5AKT. 1250 W1WLW.

10 meters:	JE2HCL, SM5AKT.
15 meters:	JI1LLD, JE2HCL, KF2O, SM5AKT, WA2SRM, HM1SX.
20 meters:	AC2J, JA4ESR, SM5AKT, IV3PVD.
40 meters:	SM5AKT.
80 meters:	SM5AKT.
160 meters:	VE2FOU.

Asia:	WA7OBH, W2NC, SM5AKT.
Europe:	W6MUL, WDØAVG, SM5AKT, N3KR, VE2FOU, HM1SX.
No. America:	W6MUL, WDØAVG, JA4ESR, SM5AKT.

WPX Award Of Excellence holders to date: K6JG, W4WSF, W4CRW, WA5VDH, K6XP, WA2EAH, VE3GCO, DL1MD, DJ7CX, DL3RK, WB4SIJ, DL7AA, ON4QX, YU2DX, OK3EA, OK1MP, N4NO, ZL3GQ, W4BQY, IØJX, WA1JMP, KØJN, K4IEX, WA2AUB, W8CNL, W1JR, F9RM.

Complete rules and application forms may be obtained by sending a business-size, self-addressed, stamped envelope (foreign stations send extra postage if air-mail desired) to CQ WPX Awards, P.O. Box 1351, Torrance, CA 90505-0351 U.S.A.

perman of DXing. He did things no other DXer ever did. He found countries under the ARRL DXCC criteria when no one suspected such a country existed. He found ways to break through the bamboo curtain and operate from countries that had not been heard from for decades and have not been heard from since. The trust was implicit, and he was a superb operator; no one ever denied that. If you were not on the scene in those days, you may get the feeling if you tried to explain to a child that Superman was not quite what he seemed to be, that there were questions which needed answering about some of his activities. It was hard for some DXers to accept.

Last year at Visalia we talked with Dave Gardner. Young, well-educated, a doctor, a wealthy family, a Rolls Royce

Here's JA6-9304, an s.w.l.er who really works the DX bands. Masanobu Okumura was aiming for some better things when this photo was taken—his own amateur license, which he probably has by now. He was making sure that he did not stand short on equipment. But then again, what DXer ever does?

parked in the hotel lot, articulate, intelligent, and a DXer, we thought well of him and had hopes that his plans for the future would materialize. At that time he was aiming for San Felix last October, and he told us about the permits and his plans and hopes that he could keep finding rare spots from which to operate. But even as we talked things were coming apart.

Beyond this, and far back in what must be considered the distant, misty days of DXing, there are some almost-forgotten operations of which old-time DXers sometimes speak among themselves. Mostly their words are guarded, their speech cryptic. And most well realize that with the passage of the years, it would do little good to raise questions. They just remember.

Some have said that essentially DXing is an ego trip. That probably is no more true than generalities usually are. But it cannot be denied that there are those who desire to be considered as clever by other DXers. Often their goals are but to have the highest number of DXCC counters, to work a station first, to work it with the higher signal report, or just to be a subject of admiration among other DXers. In the end these are often but superficial gains.

In the end, and when one looks back over the years, the realization usually comes that all the cleverness used to evade or circumvent the rules makes the gains hardly more than hollow shells, and probably something that one is less and less proud of as the years pass.

In the long run our feeling is that the ARRL and the Awards Committee have done well in protecting the integrity of DXCC. Sometimes there are areas at which a finger can be pointed. Sometimes it must be asked, "Why?" And sometime again in the future you can be sure that situations will come about in which someone will seek, as it has been sought in the past, to not play by the rules,

Franz Langner, DJ9ZB, in a bit of hot DXing. Franz has shown in a number of hot spots, DX and otherwise, and will soon be heard from some more. "Sure I was operating barefoot," Franz said, "but when you are at one of the rare ones, no one is going to worry about your clothes, only the QSL!"

but rather to play by his own special ideas of what is right and what is wrong. Sometimes it is also evident that the only thing that can be thought to be wrong is to be detected.

Always some DXers are reported as throwing up their hands in horror when something happens to upset them, some even taking their towers and smashing them to pieces across their knees, or so they say. But all this passes. DXers get a bit more knowledgeable and a little less likely to admire some transient cleverness.

There are still some who believe that youth will die for love. There are still some who believe that those a little older will die for money, position, and recognition. And there are even some who believe that DXers will die, or do something even worse—gain DXCC status and be the object of admiration and envy by other less-fortunate DXers. Why, there are some who believe all of this and more.

Each DXer must be his own judge. Play it straight down the middle, and you'll always walk as a DXer should—tall! Think you are the cleverest DXer among the multitudes of clever DXers, and it will prove to be not so.

Franz Langner, DJ9ZB

A handful of notes came through recently from Franz, who must be numbered among the top DXers. Franz was on from Liechtenstein during the CQ WW DX Test, and if you worked HBØBOE during that big bit of DX action, you'll know where to get your QSL card.

Franz has been looking for a number of possible DX efforts, some of which are not jelling well. A query to the United Arab Emirates advised that the government there does not permit the use of amateur radio in the UAE at the present time. This information comes from the Minister of Communications.

A query to the Department of Communications in New Delhi brought the reply that a license could not be granted because Franz would not be in India for a full year. He was looking for something more than a routine VU operation.

Franz has been looking for some other possibilities, and something will undoubtedly jell before long. In another area, Franz has been named to the UNICEF International Committee for Radio Amateurs in Europe.

Hopefully!

There are still some working on a possible ZD9-Tristan operation. One has been going along in the planning stage for some months without actually ever looking like things were falling into place. Another effort may step up if the initial one did not jell by the end of the year. This is the season of good (!) weather there.

Jim Smith is still looking for a Heard Island operation, and the word a couple of months back was that there might be transportation available during this season for the visit. In this case "season" means the few months right after the solstice, when weather and ice conditions are at their best, and that is right around now. Jim acknowledges that he was disappointed last year when things did not work out, but he is optimistic for this year. The Heard Island DX Association (HIDXA) is currently based on Norfolk Island (Box 103, Norfolk Island, Australia 2899).

5 Band WAZ

Standings as of October 1, 1981

All 200 zones worked:

1. ON4UN, John Devoldere (Belgium)
2. K4MQG, Gary Dixon (U.S.A.)
3. SM4CAN, Kent Svensson (Sweden)
4. AA6AA, Steve Orland (U.S.A.)
5. W8AH, Albert Hix (U.S.A.)
6. W6KUT, E. A. Andress (U.S.A.)
7. EA8AK, Fernando Fernande (Spain)
8. LA7JO, Stig Lindblom (Norway)
9. EA3SF, Fernando Blenert (Spain)
10. OH1XX, Hannu Nieminen (Finland)
11. EA8OZ, Julio Rosello (Spain)
12. WØSD, Edward Gray (U.S.A.)
13. KØZZ, Gary Knutson (U.S.A.)
14. ON6OS, P. Michiels (Belgium)
15. OK3TCA, E. Melcer (Czech.)
16. K6SSS, Fred Capossela (U.S.A.)

The top 12 contenders for 5 Band WAZ:

1. K5UR, 199
2. ZL3GQ, 198
3. OZ3PZ, 198
4. LA5YJ, 197
5. DL3RK, 196
6. W8GT, 195
7. K1MEM, 194
8. G3MCS, 194
9. N4RR, 192
10. LA9GV, 191
11. N6DX, 191
12. F6DZU, 191

115 Stations have attained the 150 zone level

Referring back to the callsigns involved in the manufactured QSLs, here is the list taken from the *DX Bulletin:*

A51PN	SV1IW/A
BV2A/B	T3KC
C8MIZ	TY9ER
HKØAA-Baja	XU1DX
HKØAA-Serrana	3Y1VC
JT1KAA	4S7DA
K5CO/5A	5R8AL
SV1DC/A	9S4AX
SV1JG/A	

Possibly you may recognize one of these as being among your treasures. Anyhow, this may not be the total list of questionable calls, and it is possible that the ARRL has an even more extensive list. So make sure that you use good judgment.

Years back in a contest we worked our first 5N2 and happily sent off the QSL for DXCC credit. The happiness was dulled a bit when a stern note came from the DXCC Desk noting that the 5N2 QSL card had everything gone over twice with a pencil, that there were still penalties for submitting altered cards, and that if it happened again we would be banished from the DXCC halls forever. Positively!

Trying to stifle our fears, we sent the card back to the RAF type in Nigeria along with the ARRL letter and our plea for mercy and a fresh QSL card, this one not double-lined all around. We got back the fresh QSL, some new and choice British expletives, both vulgar and profane, and a few kind words of sympathy. We kept the sympathy, but sent the rest onto the ARRL. Such a letter can ruin your day for sure. We can laugh about it now, but back then it worried us.

Maybe it even made us a bit smarter. The next time we turned up with a QSL that we had to hold at arms length, this one for Tromelin. We sent the card by itself to the ARRL DXCC Desk and asked their opinion of it. Back came a note from Bob White noting that it was a "hell of a QSL card," but they would take it when submitted. We couldn't lose on that one.

So if you note any of your cards to be submitted in the above list, it might be well to check beforehand, and also to scan it most carefully yourself. Should you have need of any of the choice British expletives, we still have the list handy. Blimey! And that was not one of them.

Senator Goldwater's RFI bill, S.929, was passed by the Senate during the fall session, and should it have not cleared the House by now, it will have to be passed during the current second session of this congress, or it's back to square one. This Goldwater measure has been termed a "pro-amateur" bill and has a number of good things for amateurs within it. If you are not already familiar with the measure, you should get acquainted. If you have not already written your congressman, the time is right now. It presently should be in Congressman Timothy Wirth's Committee on Communications.

A Lot of DX Notes

The middle of this month of January is the deadline for getting your logs in for the CW CQ WW DX Test. Send your c.w. logs direct to Bob Cox, K3EST, 6548 Spring Valley Road, Alexandria, Virginia 22312 (or to *CQ* directly).

Almost a year back we wrote about the Sovereign Order of Malta and possible country status. Although we may have felt at the time that it was about 500 years late, starting the first of January you can submit your 1AØ card for DXCC credit. Back in early November San Hutson, K5YY, was rather sure that the Kermedec operation was going to come off. San thought that the callsign would be ZLØAEQ /K5/K. ZL1AMO was the other operator in on the operation, which was expected to be late in November.

DU1FEZ in Quezon City is the award manager for the new certificate being given out by the Oriental DX Club there in DU-land. Often active on RTTY, Ed is active in a good handful of other actions and holds DXCC and many other awards. Check W2GT's Awards Column for details on the new Oriental DX Club award.

You probably have the word by now, but from October 23rd you have had the identifying requirements loosened, unless you are involved in handling third-party international traffic.

No longer is it necessary to identify your station at the beginning of a transmission as long as you identify at the end of a transmission or series of transmissions and at least once every 10 minutes.

The FCC has also decided to ask for changes in the Communications Act, which would take them out of policing communications, specifically asking that they be relieved of "any power of censorship over the content of communications." This would remove them from any concern for obscene or other objectionable language, leaving it up to the Justice Department to get into the action.

Someone asked about the 5BWAZ Award recently, wanting to know just who has gained the award and a number of other things. Quicker than a speeding bullet, but two months later, we have the full list from W4KA (see the 5 Band WAZ box).

We also got curious about WAZ and what is the hardest major award to attain. We dusted off our own S.S.B. WAZ from 1968 and found it is #564. Thirteen years later the last number on the S.S.B. WAZ is 2302. The last number on the completed 5BWAZ (all 200 zones) is #16 to K6SSS. These numbers should tell something.

5BWAZ No. 14

A leading Belgium DXer, Pierre Michiels, ON6OS, did it with a station putting out a maximum of 100 watts and a couple of quad antennas. Maybe it wasn't easy, but it can be done. Pierre was first licensed in 1969, lives in Oostende, and is an engineer in the electronic field. Thirty-three years old, two children, primarily an s.s.b. operator, he will work c.w. if it means a new counter for DXCC.

Pierre says that working KH6 on 10 meters was the hard one. Generally Pierre works alone, not checking the action on the nets, lists, and other such areas. His father is ON4OS. It might also be noted that Pierre avoids the DX contests. The quad for 10, 15, and 20 meters is a two-element one, and for 40 and 80 Pierre designed his own 3/8 wavelength antenna. The accompanying photo of the 10/15/20 quad may give you some idea of the level of construction and engineering in his antennas.

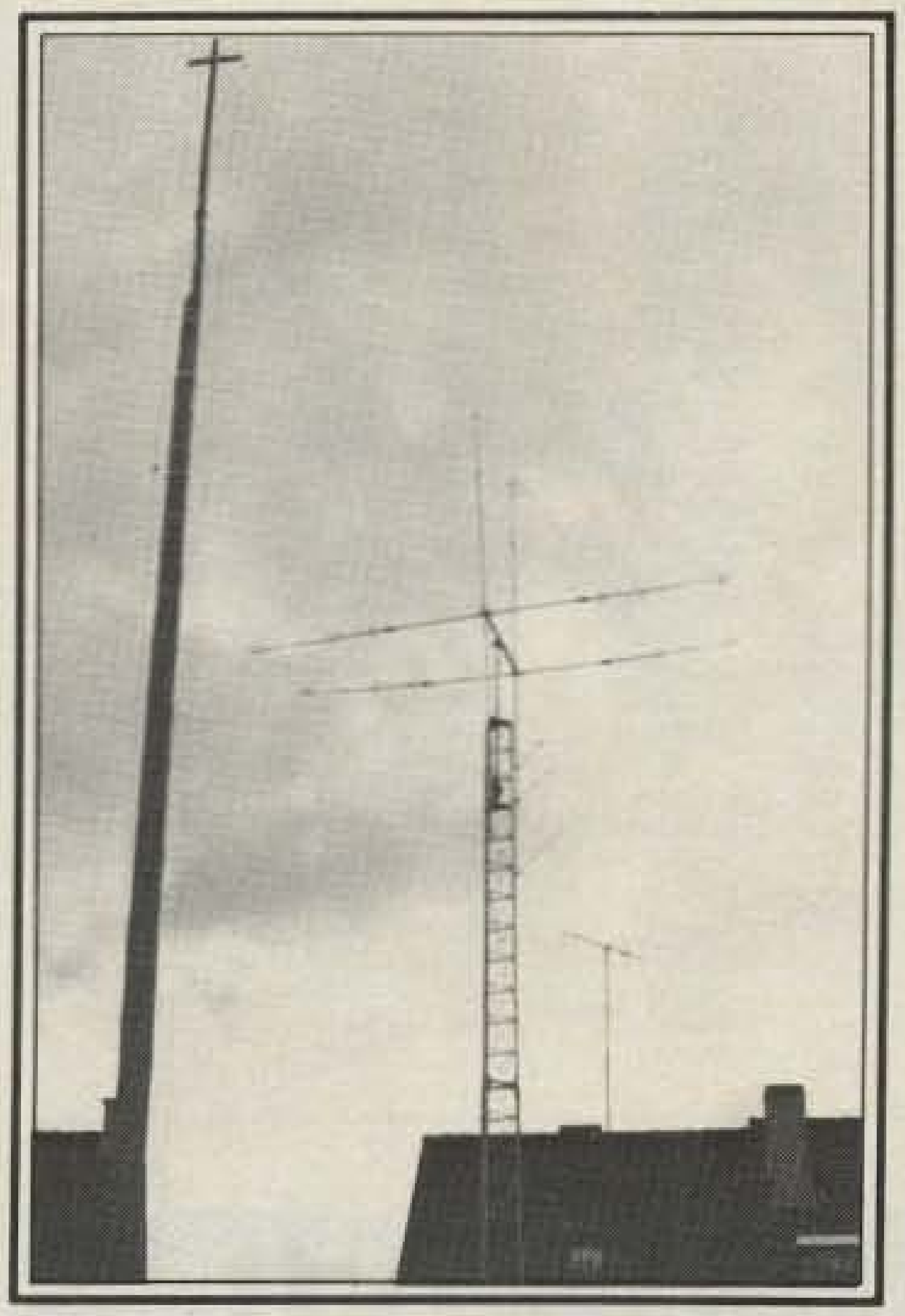
5BWAZ No. 12

Ed Gray, WØSD, an agricultural extension agent for the South Dakota State University, won the twelfth 5BWAZ to be awarded, and he says that the grayline path in the mornings was the most exciting portion as he scratched for 80 meter contacts to fill out his list.

First licensed in 1962, Ed is an Extra Class amateur, 38 years old, and covers the agricultural scene in McCook County. His XYL, Edith, is licensed as WAØUFS, and son Curt is licensed as NØAIT. There are two other sons, Jack and Tom, who undoubtedly will have their own calls before long.

Ed says that he got a lot of help from some of the locals, these being KØZZ, ACØM, and KJØM. Although he has made the DXCC Honor Roll, Ed says that he would still jump a bit to hear a BY or a VS9K, or maybe even another XZ5 about which there would be no hesitation accepting. But he also says that he still gets a thrill hearing an OH come through long-path on the grayline with a solid 5/9 signal.

Ed works 1.8 MHz to 432 MHz and also holds #11 on 144 MHz WAS. He is on both c.w. and s.s.b. with stacked four-element beams at 90 feet and 150 feet which can be fed separately or in phase. Forty me-



The antenna system of ON6OS, Pierre Michiels, with the tri-band, two-element quad flying against the winter sky. This system and 100 watts output earned him 5BWAZ #14.

Ed Gray, WØSD, #12 on the 5BWAZ list. Ed finds the morning grayline with some intriguing long paths on 80 and a look at his antennas might be something intriguing in itself.

CQ DX Awards Program

S.S.B.

1052	JT1BG	1056	WDØBNC
1053	WD5HEG	1057	VE3FEA
1054	W4PNY	1058	NO4J
1055	SM4CTT		

C.W.

509	K2BLA	511	VE3FEA
510	LZ1XL		

S.S.B. Endorsements

310	K5OVC/311	275	KB8O/280
300	K9BWQ/301	275	WB4UBD/279
275	WD8MGQ/293	275	KC8JH/277
275	SM4CTT/284	200	VE3FEA/200
275	WDØBNC/280	150	W9IGK/152
275	XE1NI/284	150	W4PNY/150
275	WD9IIX/282	28 MHz	WD5HEG

C.W. Endorsements

250	SM6CST/258	1.8 MHz	K1MEM
150	LZ1XL/164	3.5/7 MHz	LZ1XL
150	WB4FOT/160	28 MHz	LZ1XL

The total number of active countries is 318. The basic award fee for subscribers to CQ is $4. For non-subscribers, it is $10. In order to qualify for the reduced subscriber rate, please enclose your latest CQ mailing label with your application. Endorsement stickers are $1.00. Updates not involving the issuance of a sticker are made free when an s.a.s.e. is enclosed for confirmation of total. Rules and application forms for the CQ DX Awards Program may be obtained by sending a business size, No. 10 envelope, self-addressed and stamped, to CQ DX Awards Manager, Billy Williams, N4UF, Box 9673, Jacksonville, FL 32208 U.S.A. DX stations must include extra postage for air-mail reply.

CQ DX Honor Roll

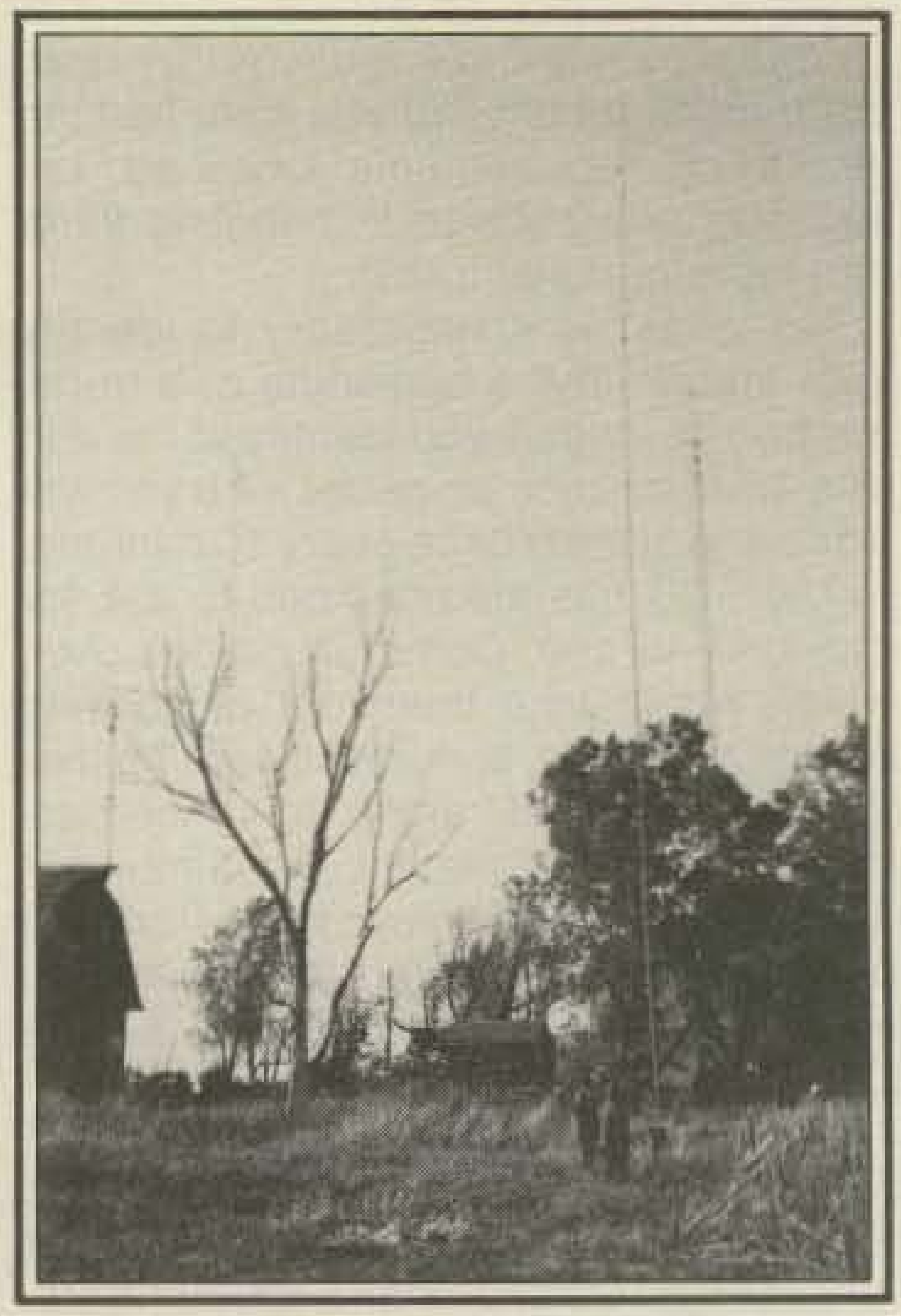
The CQ DX Honor Roll recognizes those DXers who have submitted proof of confirmation with 275 or more ACTIVE countries for the mode indicated. The ARRL DXCC Countries List is used as the country standard. Honor Roll listing is automatic when submitting application or endorsement for 275 or more countries. To remain on the CQ DX Honor Roll, annual updates are required. Honor Roll updates may be made at any time, in any number. Updates indicating "no change" will be accepted to meet the annual requirement. All updates must be accompanied by an SASE for confirmation. The fee for endorsements involving the issuance of a sticker is $1.00. The basic award fee is now $4 for *CQ* subscribers and $10.00 for non-subscribers. Please attach your latest *CQ* mailing label to qualify for the $4.00 rate.

C.W.

W6PT	318	W6ID	315	W1NG	305	N6FX	298	JH1VRQ	281
ON4QX	317	N6AV	314	W2GT	304	N4MM	298	K9QVB	281
DL7AA	316	K4CEB	311	DL3RK	303	WA8DXA	294	4Z4DX	280
W3GRS	316	K6JG	311	K3FN	301	K1MEM	289	WØIZ	278
K6EC	315	K9MM	310	W4OEL	300	JA1GTF	285	W1WLW	276
N4PN	315	W4BQY	310	DJ7CX	300	SM3EVR	284	W4BV	275
W9DWQ	315	N6CW	309						

S.S.B.

W6EUF	318	W4SSU	315	WØSFU	310	G4CHP	300	KA8T	282
W4UG	318	K6JG	315	K9RF	310	K5DUT	300	WB1DQC	282
W3NKM	317	K9LKA	315	I3LLD	310	JH1VRQ	298	WD9IIX	282
W9DWQ	317	DJ9ZB	315	K8LJG	310	W7OM	298	N3RL	281
DL9OH	317	ZL3NS	315	OE3WWB	309	AI8S	297	W2FGY	280
K8DYZ	317	VE3GMT	314	N4KE	309	W6DN	297	IV3YRN	280
W6REH	317	SM6CWK	314	N6AV	309	WA4JTI	296	VE3IUE	280
XE1AE	317	I8YRK	314	W9SS	309	LA7JO	296	WDØBNC	280
W4EEE	317	I4ZSQ	314	DL6KG	309	K8CMO	296	KB8O	280
W2TP	317	F2MO	314	YV5DFI	308	I6PLN	295	WD8MOV	279
IØAMU	317	OZ3SK	314	N6AW	307	WA4LOF	295	W7FP	279
K6WR	317	K4MQG	314	WØYDB	306	VE3FJE	293	XE1OX	279
K2FL	317	SM6CKS	313	XE1J	306	WD8MGQ	293	WB4UBD	279
W9JT	317	EA4LH	313	XE1KS	305	JA5PUL	292	K8HV	278
WA2EOQ	317	N4WF	313	LU1BAR/W3	305	ZL1BIL	291	K3MWV	277
W9QLD	317	YV1KZ	313	WA4WTG	305	IØMBX	289	KC8JH	277
ZS6LW	317	K9MM	313	W2SUA	304	YU2RTW	288	WA6TOO	276
W3GRS	317	W4DPS	313	W1NG	304	K9UAA	288	K1WJ	276
VE3MR	316	OE2EGL	313	OK1MP	304	VE3IPR	287	WA4TLI	276
TI2HP	316	DK2BL	313	N2SS	302	W4BQY	286	XE1CI	276
VE3MJ	316	WØSD	313	K8PYD	302	WB3HAZ	286	KB8KW	276
I8AA	316	W6YMV	312	VK2VC	302	AE5B	285	KB5FU	276
W9KRU	316	I5WT	312	W6FET	301	CT1UA	285	KKØC	276
I8KDB	316	W3GG	312	K9SM	301	WA4DAN	285	K9QVB	275
W3AZD	316	ZL1AGO	312	K9BWQ	301	N5FG	284	W8ILC/QRPp	275
W3CWG	316	YV5AIP	311	WØSR	300	K9HQM	284	WAØTKJ	275
K6EC	316	K5OVC	311	W2CC	300	XE1NI	284	I5BDE	275
VE2WY	316	W6RKP	310	HP1JC	300	SM4CTT	284	VE4AT	275
IØZV	315	K6XP	310	9H4G	300	I8LEL	283	KØGT	275
F9RM	315	W8ILC	310	K1UO	300	I3OBO	283	K8VFV	275
K6YRA	315	N4MM	310	DJ7CX	300	W8IMZ	282		



At WØSD's QTH you can realize the joys of country living, or at least the joys of tall towers, long beams, and far horizons. Ed, holder of 5BWAZ #12, admits that the antennas do help a bit, sometimes more so than others.

ters has a homebrew full-size two-element beam at 70 feet and a Bi-Square hanging from one of the 150 foot towers. Eighty has a quarter-wave vertical with some 80 radials. The station is a Kenwood TS-820 with a Drake L-4 amplifier.

With all of that, a good bit of DX knowhow, a lot of time spent at the rig, and a portion of encouragement from other amateurs, both close by and overseas, it can be done. Not easy, but the 5BWAZ Award was never intended to be.

73, Hugh, WA6AUD

QSL Information

AP2ZA to W6NLG
FØANY/FC to DL4FF
PAØLVB/3A to PAØLVB
PAØVDV/3A to PAØVDV
PAØWRS/3A to PAØWRS
KN5N/VP2A to K9MF
K9MK/VP2A to K9MK
SNØMSP to SP3AUZ
SO3CC to K1CC
YBØACP/4 to K6DLV
4N2DX to YU2DX
4N9PEP to YU2DX
4X4FY to WB2IXS
4Z4XK to WB3EGD (correction)
6Y5JW to VE3DAP
ZK2WW to North. Calif. DX Club
ZK2ZZ to North. Calif. DX Club
ZK2JK to North. Calif. DX Club
5W1DL to North. Calif. DX Club
5W1BT to North. Calif. DX Club
5W1DM to North. Calif. DX Club
Box 608
Menlo Park, Calif. 94025

Current address for K9MK is Michael Krzystyniak, 6061 Dunson Court, Watauga, Texas 76148.

WA4KIA advises that he is not the QSL route for EI9CB.

Phil Snider, N9AAR, is available for QSL Manager duties for DX Stations. Write to him at 125 412t Ave., Moline, Illinois 61244.

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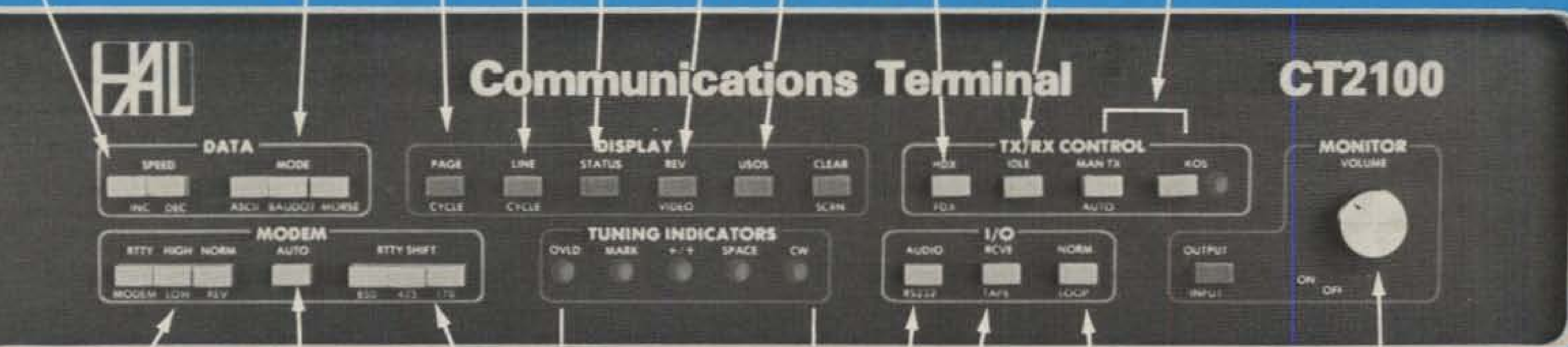

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PLAYBOY CLUB: Plan ahead now to attend the ARRL Hudson Division Convention October 30-31, 1982, at the Playboy Club, Great Gorge, McAfee, NJ. For info send SASE to HARC, Box 528, Englewood, NJ 07631.

FREE SAMPLE - Award winning ham insider newsletter - Best in the business! Judge for yourself! Send SASE w/2 stamps: THE W5YI REPORT; Box #10101-C; Dallas, Texas 75207.

WATER ISLAND DXPEDITIONS story October CQ, page 66. "SWEET" KV4 Virgin Island vacations. Club rates. Limestone Reservations, RD4, Princeton, NJ 08540, (201) 329-6309.

OLD TIME RADIO transcription discs wanted. Any size, speed, subject. W7FIZ, Box 724, Redmond, WA 98052.

NEED HELP for your Novice or General Ticket? Recorded Audio-visual Theory Instruction. No electronic background required. Free information. Amateur License, P.O. Box 6015, Norfolk, Virginia 23508.

INTERESTED IN QRP? Full information for s.a.s.e. QRP/ARCI, Box 12072, Capitol Station, Austin, Texas 78711.

WANTED: Used Tantalum Capacitors. Paying 31¢/oz. W6TWT, 10105 Stern Ave., Cupertino, CA 95014.

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QSL ECONOMY: 1000 for $12. S.A.S.E. for samples. W4TG, Drawer F, Gray, GA 31032.

WANTED: Gold plated connector pins, scrap. Paying $1.00 per ounce and up. Ron Guard, W6TWT, 10105 Stern, Cupertino, CA 95014, (408) 252-5067.

ATTENTION LOW INCOME HAMS: Heath HW-8 CW xcvr, $100. Heath SW-717 receiver, $80. Excellent buys. Billy Everett, KA5JQH, 1318 Winchester, Conroe, TX 77302, or call 713-273-4299.

NEW: 32S3, $1200; Astron PS-12-A, $50; 351D-2, $65. RECONDITIONED: KWM2-A, 516F2, $800; KWM-2, 516F2, $695; 75S3, $395; 312B4, $225; 32S3, 516F2, $450; Waters 374 D/L wattmeter, $75. J.W. Craig, W1FBG, 29 Sherburne Ave., Portsmouth, NH 03801.

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HAM WITH LIMITED FUNDS needs a good deal on purchase of RTTY demod. Have TT-7/FG machine (like model 19). N4EDX, Box 9684, Birmingham, AL 35215.

WANTED: Kenwood DG-5, MC-50. TenTec Century 21. WD0BVF, RR#1, Box 212C, Willard, MO 65781.

JOHNSON VIKING Kilowatt Amplifier wanted. Paul Kluwe, Box 84, Manchester, MI 48158.

KENWOOD TS-520S/VFO TS-520S. Excellent condition. Will ship UPS. $675.00. Joe, N5AMP, Rte 1 Box 239, West Columbia, TX 77486. Phone 713-345-3387.

WANTED: WA0RFF 160 mtr. coil and top section. WD4LLD, 7519 Pinebrook La., New Port Richey, FL 33553.

SELL: AUTEK QF-1 Audio Filter. Mint Condition, $30. W3AP, 215-678-4310.

SELL: Macro M80 Rtty/CW TRS-80 interface, steel case, cords, program, pwr and instr, $125. Bill Beckerley, K6RGY, 452 Manor Dr., Pacifica, CA 94044. Phone 415-355-0826.

FOR SALE: Hallicrafters FPM-300 5-band transceiver, all transistor except for 2 tubes, $275. Hammarlund HQ-215 all-transistor receiver, $175. Hy-Gain 2-band antenna, for 10 and 15 meters, model DB1015A, $40. N4TL, 305-733-1585. Tom Lewis, 4201 NW 37th Terr., Lauderdale Lakes, FL 33309.

WANTED: National HRO-60 receiver. Will pay top dollar for mint physical condition. K8AC, 7991 Lutz Ave. N.W., Massillon, OH 44646.

WANTED: Atlas PS-110H or 200PS, service manuals for 110 and 210. Jim Geras, 38-05 220 St., Bayside, NY 11361.

SWAN 250 6 meter SSB xcvr, 117XC P/S, VX-1 VOX unit and 500 kc xtal cal. Like new, $200 prepaid shipping. WA4AEB.

WANTED: Disabled OT needs small CW rig. Palmer, W2RD, 106 Greencrest Dr., Middletown, NY 10940.

FOR SALE: Kenwood 200SP, IC 230 with PS, TT, IC 230, IC 215, BC 250 scanner, 509 QRP rig. Send sase to ARS, P.O. Box 518, Whitehouse, FL 32220.

SELL: Sony 6700W and 2001, Allied SX190, Bearcat 210 Scanner, Johnson TR Switch, Kenwood R300, Hallicrafter HT40 xmtr and T-O Keyer. Send sase to Jim, W4BLX.

SELL: 3000 assorted receiving tubes @ $1.00 each from 1930 vintage to present. WANTED: Precision machinist tools from retired toolmakers or machinists, reasonable. W5QJT, 6020 Isabella, El Paso, TX 79912.

WANTED: Old CQ's with antenna articles, and any literature on amateur radio. W0LAA, 2913 Hickory St., Omaha, NE 68105.

WANTED: Kenwood TV-502, DG-5, DK-520. Joseph Schwartz, 43-34 Union Street, Flushing, NY 11355, phone (212) 461-5933.

REGULATED LAB POWER SUPPLY: ACDC Model OEM15-5; 13.5 to 18 VDC at 5 amps, with manual, mint, $27 includes shipping. J. Hoffer, W1DL, 24 Cherry Road, Framingham, MA 01701. Phone (617) 872-5084.

GOV'T SURPLUS Sig. Gen. AN/USM27B and other electronics, RTTY. Sale cheap. Details/List SASE to: DT RTTY, Box 9064-cq, Newark, NJ 07104.

WANTED: 42" to 50" equipment rack (19") and Hallicrafters HA-7 calibrator. C.T. Huth, 146 Schonhardt St., Tiffin, OH 44883.

NOVICE ALL-AMERICAN Certificate: Work a Novice in all 10 call areas. Send list and $1. K6ASI, 25 Rudnick, Novato, CA 94947.

CRYSTALS: S.A.S.E. for my list. K8LJQ, 355 Mower Rd., Pinckney, MI 48169.

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WANTED: Any National gear, working or not. SELL: Autek MK-1 keyer $85. 4KW gas generator 120-240V. Tim Colbert, WA8MLV, 9404 N. Church #316, Parma, OH 44130.

SELL: HW8 and matching Headset, factory aligned, shipped prepaid, $125. W4NLV, 2024 SE 27th Ter., Cape Coral, FL 33904. Phone 813-542-7306.

QRPers: Get details of the G-QRP-Club and free sample magazine from Rev. G.C. Dobbs, G3RJV, 17 Aspen Drive, Chelmsley Wood, Birmingham. B37. U.K.

WANTED: ARRL Handbooks and QST from the 1930's and older. State condition and price. H.F. Schnur, 115 Intercept Ave., North Charleston, SC 29405.

FOR SALE: Kenwood TS-830S Transceiver, including 230 External VFO, mint condition, only three months old, $1100. Please phone: 201-471-3798. Wm. Shevtchuk, 1 Lois Avenue, Clifton, NJ 07014.

SELL: 3 el Cushcraft 15 meter beam, 3 months old. Pickup. Sever, 424 Browning, North Canton, OH 44720.

TREASURE HUNTING HAMS interested in forming a net please contact Mike Russell, WA4FVI, 5100 North 25th Place, Arlington, VA 22207.

AMECO Model PT-2 Transceiver Preamp. Mint, $35, Postpaid. Bob Craig, K6XZ, 4950 Sunshine Ave., Santa Rosa, CA 95405.

SACRIFICE Sencore SC60 Wideband scope, 60 MHz, Dual Trace, Triggered, like new. Reason for selling: Buying Sencore's new SC61 Waveform Analyzer. Call Dave, 803-277-2863.

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DONATIONS OF PRINTED QSLS needed by DX station. Gary Mitchell, P.O. Box 1536, Hilo, Hawaii 96720.

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