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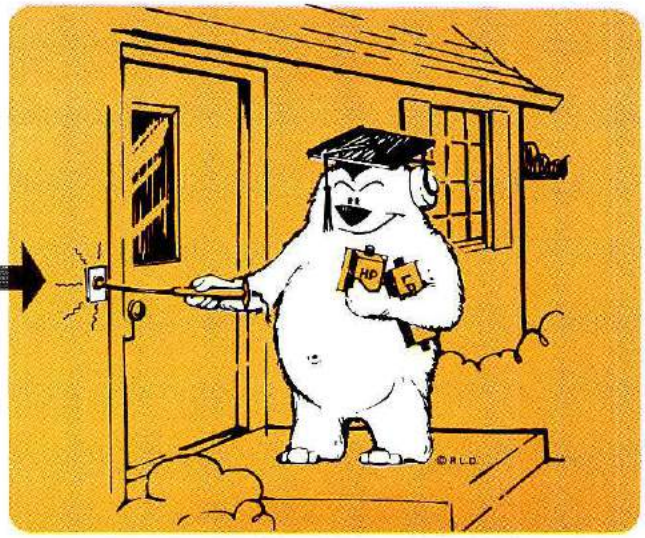
HAM RADIO HORIZONS

If you're having a TVI problem...

this fellow could be the "bearer" of the **SOLUTION...**



Don't let your several thousand dollar investment in a ham station sit idle for the want of a TVI filter

— let Drake solve the TVI problem.

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"Low Pass" Filters will reduce or eliminate TVI caused by harmonics from amateur transmitters. All transmitters generate some harmonics which might be just strong enough to cause TVI. We believe every station should be equipped with a Low Pass Filter, designed to cut off at 41 MHz, the TV i-f frequency. Drake filters are down 80 dB at 41 MHz to provide maximum protection.

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Drake TV-42-LP

For transmitters operating at 30 MHz and lower. Rated 100 watts input.

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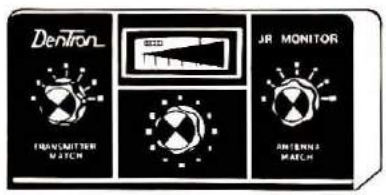

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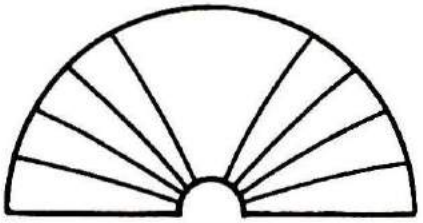

HORIZONS

Design Your Own QSL Cards

QSL cards have been an integral part of amateur radio for more than 50 years, but their importance is often overlooked. They are, after all, the only tangible proof of a pleasant or noteworthy radio contact. All too many of the QSLs used by hams lack impact — a snappy, attractive QSL demands attention, and more often than not the recipient will send you his QSL in return. In this article W1HR discusses some of the DOs and DON'Ts of QSL design, and tells you how to do the job yourself.

Collecting QSLs

Some amateurs send QSL cards immediately, but with others it is as hard to get the card as it was to work them in the first place — maybe harder. Then, too, many parts of the world do not have the convenient postal system that we enjoy. You can get around the obstacles and build up a good collection of impressive cards, and W2XQ is glad to pass along some tips that will help.

Foxhunting

Although there were plenty of hidden-transmitter hunts before the days of repeaters, the modern version, called foxhunting, had been discovered by thousands of fm and repeater buffs. It's a lively and interesting way to spend an afternoon, and it has some important side-effects too. N9YL, (who last appeared in these pages as WB9OJA), gives you enough hints to get started.

Other Countries Can Wait

It is hard to appreciate the mass of signals that pour toward a rare DX station until you have been there. Here's how one station tried to shovel sand against the tide. We're not sure where this one came from, because it just showed up in the mail one day without any signature or return address. You'll like it, thanks to the unknown contributor.

Bicentennial Competition

The saga of an amateur husband-and-wife team competing (and cooperating) to win the coveted Worked-All-States (WAS) award on the five high-frequency bands. Is there a message here? Teamwork really pays off in competitive events. In this instance a lot of love and mutual understanding helped pave the way to success.

Why CW?

Any new language has its awkward stage, where the difficulty and lack of speed make using it a chore. However, once you're past that hurdle, it becomes more of a pleasure to use, and eventually you'll really enjoy talking to someone in his own tongue. Experienced CW operators find the same is true of amateur radio's most efficient form of communication. WA1KWJ points out the tradition and joy of becoming a proficient brasspounder.

Contest Time

Listening to an ARRL DX Contest can be a traumatic experience for a beginner; but remember that each and every one of the big DX guns started out just the same way you will — slow, nervous fists, nibbling at the edges of the pileups, and they listened a lot more than they transmitted. There are two CW and two phone weekends to operate in, providing plenty of time to get over your initial apprehension. Follow W9KNI's lead and join the fun; you'll be the better for it!

Questions? And Answers!

This segment of the Novice Class license study material gets into some of the basic stuff that makes electronic equipment play. You'll see what current is, how an ohm got that way, and what some of the letters in electronic formulas stand for. You can also find out where the alternating current in your house wiring came from.

The Cover

QSL cards are as much a part of amateur radio as getting on the air. Some are unique and some are ordinary, but to accompany the feature story in this issue we rounded up a collection of goodies from the files of staffers W1HR, K1XX, and W1XU. Some samples from people who specialize in printing QSL cards are included as well. The story of designing your own special card begins on page 12. Color photograph by Ralph Wright, K1EGS.

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This NEW MFJ Versa Tuner II . . .

has SWR and dual range wattmeter, antenna switch, efficient airwound inductor, built in balun. Up to 300 watts RF output. Matches everything from 160 thru 10 Meters: dipoles, inverted vees, random wires, verticals, mobile whips, beams, balance lines, coax lines.

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Antenna matching capacitor. 208 pf. 1000 volt spacing.

Sets power range, 300 and 30 watts. Pull for SWR.

Meter reads SWR and RF watts in 2 ranges.

Efficient airwound inductor gives more watts out and less losses.

Transmitter matching capacitor. 208 pf. 1000 volt spacing.

Only MFJ gives you this MFJ-941 Versa Tuner II with all these features at this price:

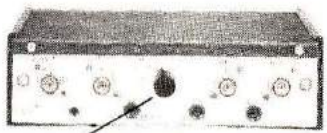
A SWR and dual range wattmeter (300 and 30 watts full scale) lets you measure RF power output for simplified tuning.

An antenna switch lets you select 2 coax fed antennas, random wire or balance line, and tuner bypass.

A new efficient airwound inductor (12 positions) gives you less losses than a tapped toroid for more watts out.

A 1:4 balun for balance lines. 1000 volt capacitor spacing. Mounting brackets for mobile installations (not shown).

With the NEW MFJ Versa Tuner II you can run your full transceiver power output — up to 300 watts RF power output — and match your transmitter to **any** feedline from 160 thru 10 Meters whether you have coax cable, balance line, or random wire.



ANTENNA SWITCH lets you select 2 coax fed antennas, random wire or balance line, and tuner bypass.

You can tune out the SWR on your dipole, inverted vee, random wire, vertical, mobile whip, beam, quad, or whatever you have.

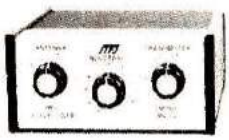
You can even operate all bands with just one existing antenna. No need to put up separate antennas for each band.

Increase the usable bandwidth of your mobile whip by tuning out the SWR **from inside your car.** Works great with all solid state rigs (like the Atlas) and with all tube type rigs.

It travels well, too. Its ultra compact size 5x2x6 inches fits easily in a small corner of your suitcase.

This beautiful little tuner is housed in a deluxe eggshell white Ten-Tec enclosure with walnut grain sides.

SO-239 coax connectors are provided for transmitter input and coax fed antennas. Quality five way binding posts are used for the balance line inputs (2), random wire input (1), and ground (1).



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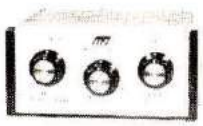

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Same as MFJ-901 Versa Tuner, but does not have built-in balun for balance lines. Tunes coax lines and random lines.

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Operate 160 thru 10 Meters. Up to 200 watts RF output. Matches high and low impedances. 12 position inductor. SO-239 connectors. 2x3x4 inches. Matches 25 to 200 ohms at 1.8 MHz.

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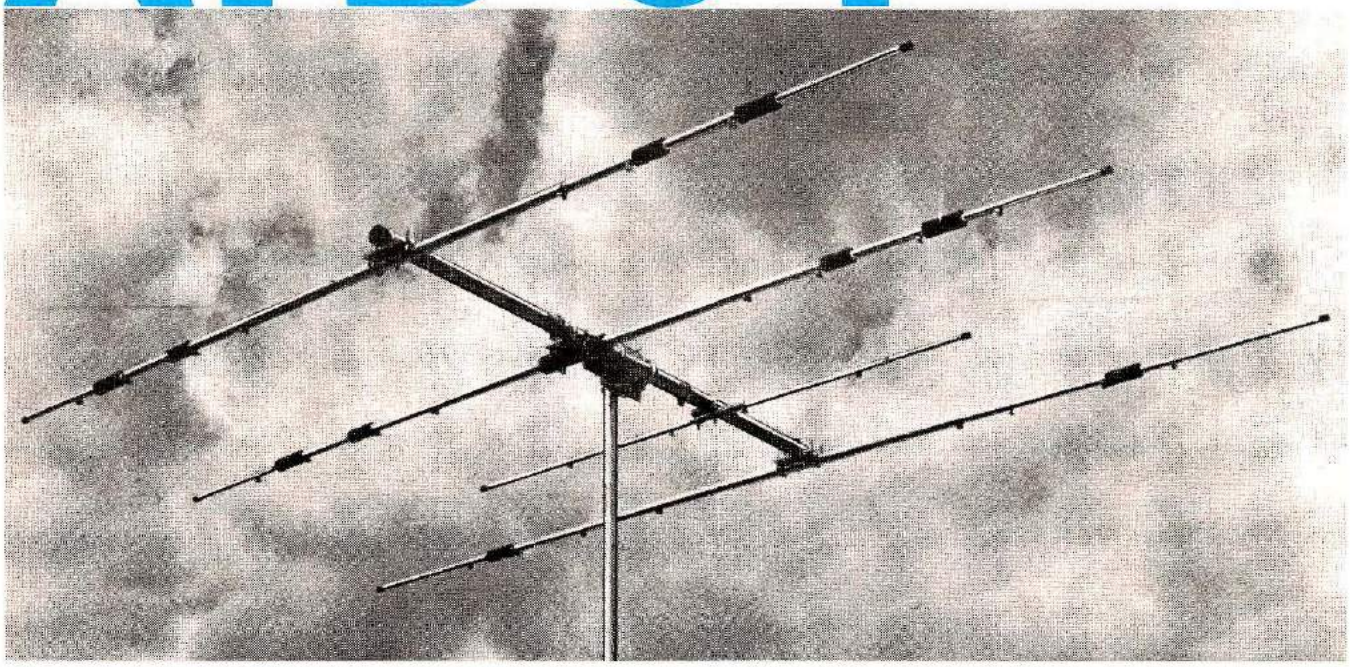

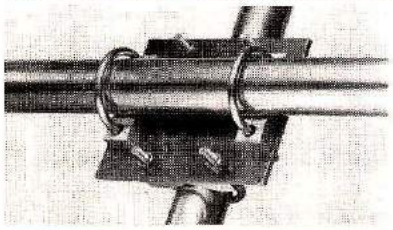

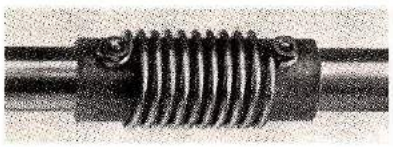

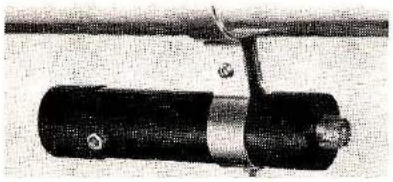

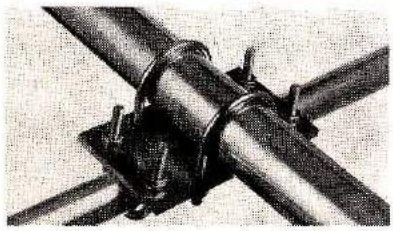

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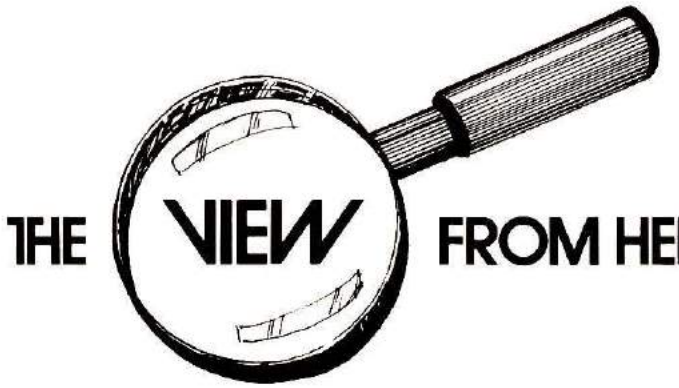

As this issue of *Horizons* goes to press, it appears that the launch of the next amateur communications satellite, AMSAT-OSCAR D is imminent (after it is in orbit this satellite will be known as OSCAR 8). Its famous predecessors, OSCARs 5, 6, and 7, this new "bird" has two transponders: a two-to-ten meter unit similar to that used in OSCAR 7 called *Mode A*, and a two-meter, 70-centimeter (435 MHz) transponder designated *Mode J*. The Mode J transponder was built by members of the Japan AMSAT Association in Tokyo; a similar combination of input/output frequencies was used in the short-lived OSCAR IV spacecraft back in 1966.

The new OSCAR will be launched from NASA's Western Test Range in California as a "piggyback" payload aboard the second stage of the two-stage Thor-Delta launch vehicle which will carry NASA's Landsat-C earth resources technology satellite into orbit. Because of scheduling at the Western Test Range, and the complex pre-launch checkout of Landsat-C, it's impossible to pinpoint the exact launch date, but late reports from AMSAT indicate it will be sometime in early March.

The new spacecraft is a 15-inch rectangular solid 13 inches high, weighs 60 pounds, and is solar powered. The solar cells, combined with the 12-cell rechargeable nickel-cadmium battery, should be adequate to power the satellite in Mode A for several years. The receiving antenna for both modes is a turnstile comprised of four 19-inch lengths of ½-inch carpenter's rule. Four permanent magnets located inside the spacecraft provide stabilization; this is the same technique used in OSCARs 6 and 7. The polarity of the magnets is such that the top of the satellite always points toward the earth's magnetic north pole. Permalloy dampling rods mounted behind the solar panels are designed to reduce the spin of the spacecraft; their operation is similar to a shorted transformer turn as it cuts the lines of flux of the earth's magnetic field. OSCAR 7 used the same system with good success.

The spacecraft will be automatically powered up upon ejection from the Thor-Delta launch vehicle over northern Greenland. It is designed to come on in Mode J; the Mode A transponder will not be turned on until the satellite is almost completely stabilized in orbit, which may take as long as a week. This is because the 10-meter dipole antenna cannot be deployed until the spacecraft's spin rate is less than 1 revolution per minute; otherwise the antenna may be severely damaged. The deployment process takes about 15 seconds and cannot be reversed — the elements can't be retracted once they are extended — so correct deployment is crucial.

OSCAR 8's orbit is planned to be sun-synchronous, with passes repeating at approximately the same time each day on a one-day cycle (as opposed to the two-day cycle of OSCARs 6 and 7). Since the altitude of OSCAR 8's orbit, at 560 statute miles, is just over half the altitude of OSCARs 6 and 7, the maximum communications range will be slightly shorter. The usable time on an overhead pass will be about 18 minutes instead of the 22 minutes provided by OSCAR 7, and the horizon range will be 2000 miles (down slightly from the 2450-mile horizon range of OSCAR 7). In practical terms this means that transatlantic communications will still be possible with OSCAR 8, but not as often as with OSCAR 7.

One of the big advantages of the 560-mile sun-synchronous orbit is that keeping track of OSCAR 8 is going to be much simpler than it was for earlier amateur satellites; it will come into range at nearly the same time every day — the overhead descending node pass is planned for 9:30 AM local time. The satellite's anticipated useful operating lifetime is three years.

Since the prime mission of the OSCAR 8 spacecraft is to use the Mode A transponder for the ARRL OSCAR educational program in schools, the spacecraft may be left in Mode A during weekdays and put into Mode J on weekends. Because of the relatively high current drain of the Mode J transponder, however, the power budget may not support the Mode J transponder for continuous full-time operation over an entire weekend. The spacecraft may also be switched to Mode J during the evening hours in the Western Hemisphere, depending on the burden to the command stations and the condition of the on-board batteries.

The new AMSAT will permit continuation of the educational program which began with OSCARs 5, 6, and 7. Since the first space launch 20 years ago, satellites have had a dramatic impact on education, and the OSCAR satellites have begun to play an important role in this new approach to science education. Used as remote laboratory tools, these satellites have pioneered in the use of an active space system in the classroom where students can gain first-hand experience with space science. This type of direct, active involvement is important to the study of communications, astronomy, engineering, physics, and meteorology. The inexpensive OSCAR ground terminal places an active satellite system at the disposal of the instructor and student.

If your local school is not yet making use of this important educational resource, bring it to the attention of your science teachers; complete details are available from AMSAT (Radio Amateur Satellite Corporation), Post Office Box 427, Washington, D.C. 20044.

Jim Fisk, W1HR
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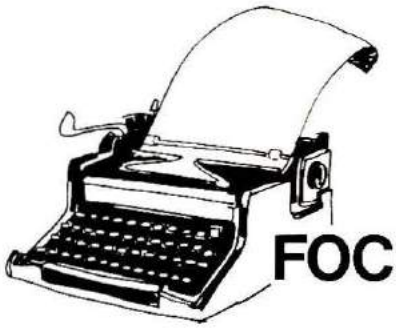

FOCUS & COMMENT

A friend once said to me, "There are users, and then there are builders. The bird who can be both is rare indeed." The object that brought forth this sage observation was a do-it-yourself microprocessor, which had kept him occupied for more evenings than he would admit to in front of his wife. I have recently begun to see that his wisdom applies to the field of amateur radio as well. Perhaps the ranks are not as sharply separated as he saw it, but the division is there to the discerning eye.

The division is not what I am concerned about — as long as it exists we know that builders are alive and well, just by reading about what they are doing in the technical content of amateur publications. I'm worried about the possibility that too many of the builders will decide to become users instead, and thus remove one of the assets that makes amateur radio unique and separate from other radio services.

At first, amateurs built things because the equipment they needed didn't exist. Then, as manufacturers began to meet the need, some things could be bought, but there was still plenty that had to be put together from "scratch," following a recipe from a handbook, a magazine, or from notes scribbled in a friend's hamshack. Slowly, more and more equipment became available at the marketplace, but still there were builders who wanted to beat the price, or they just had the urge to see what could be done. The price is seldom valid as an excuse nowadays; the cost of parts is often more than that of a completed unit. The urge to do better, to prove what you can design, is still driving many amateurs to their slide rules — oops, pocket calculators — and soldering irons.

However, if you have access to some electronic publications, especially amateur-radio types, that span the last decade you'll notice a trend: why build an i-f amplifier strip that calls for half-a-hundred parts when you can plug in a sixteen-legged IC that will do the same thing for you? Why fuss with a multi-section variable capacitor for a receiver front end when you can use a simple potentiometer and a variable-capacitance diode to tune in any signal you want? Audio amplifiers? What once took up half the chassis has been replaced by a dime-sized IC that can be hidden away in a corner.

Now , clearly, most of this trend is desirable because of the time saved, the (electrical) energy saved, and there is greater assurance that a given project will work if most of the tricky parts of the circuit are built and packaged and sealed by a reputable manufacturer. However, I must admit that I am a bit saddened by the phasing out of the old way of doing things, and thus the loss of some valuable learning experiences.

Yes, we learn by our mistakes, and if all of those little modules go together nicely and the gadget works when you turn it on, you have proved that you can read the instructions (or have extraordinary intuition). I'd hate to tell you how many times I tried before I got a "simple" regenerative receiver to work — but when it did work, I knew why it worked and what I had done wrong. Many other projects went the same way, and some never did work — but months later a stray sentence, or a different circuit, would trigger a flash of understanding about what earlier was a dead end. Sometimes, determination to "make it work or else" drove me to delve into the theory far deeper than I originally intended. Negative results can indeed be positive experiences.

Don't think that I am downgrading the importance of kit-built equipment, manufactured equipment, or suppliers of integrated components; they are doing a necessary job in reducing manpower-related costs and increasing reliability, both of which are vital in today's competitive world.

The one thing that an amateur has plenty of, especially a beginning amateur, is manpower to build with and time for learning. These are liabilities for a manufacturer, but valuable assets for you. Evaluate your goals and act accordingly. If your operating activities require a complex receiver or transmitter or whatever, then buy or kit-build it as the way to reach your goal. But, don't be afraid to explore, to try something that might not work the first time. Try some simple projects that use parts you can scrounge from a friend or pick up at a flea market or surplus house. If it doesn't work, crack the books and find out why. It's a type of training that is far superior to that offered in any classroom or assembly plant.

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Tom McMullen, W1SL
Managing Editor

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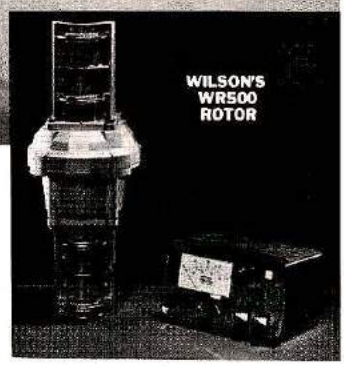

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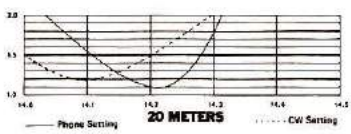
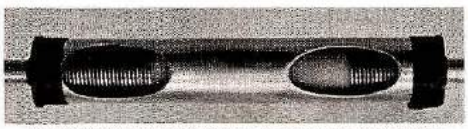
Maximum Power Input:	Legal Limit			Surface Area	7.3 sq. ft.
Gain	10 dB	No. of Elements	5	Windload Area	146 lbs.
VSWR (at Resonance)	1.5 to 1	Longest Element	26' 7"	Shipping Weight	50 lbs.
Impedance	50 ohms	Turning Radius	18' 6"		





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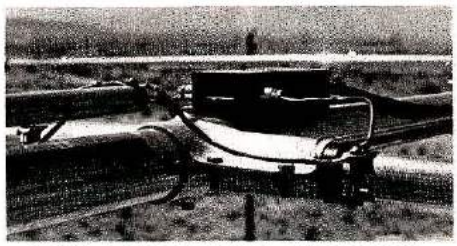

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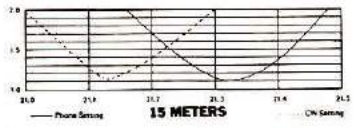

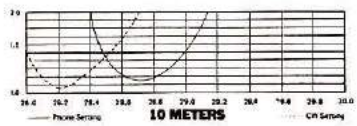

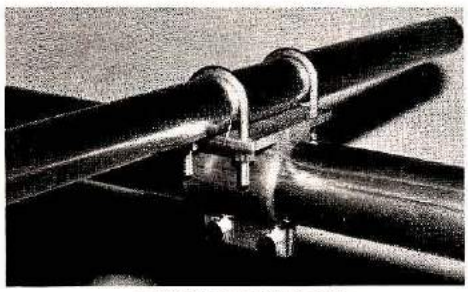

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NEWSLINE

"REPEATER DEREGULATION is being delayed," FCC Safety and Special Services Chief Charley Higginbotham reported recently. Enough serious questions about some provisions of the Docket 21033 Report and Order were raised by concerned Amateurs — and particularly the ARRL in its Petition for reconsideration — to justify staying its effective date pending further review. Charley expects the Commission to move quickly in its reconsideration.

Individual Secondary Station licenses will be on their way out when the Commission announces a decision on Docket 21135, but military recreation, club, and RACES station licenses will be continued. Charley also predicted that by sometime this year Amateurs will no longer need to change callsigns when moving from one call area to another. Call areas will continue, but having a prefix corresponding to your call area will become optional. He also predicted a "lifetime" Amateur operator's license will be adopted. In addition, he expects we'll soon be able to claim credit for "elements passed" in an Amateur license exam — take the whole test even if you fail the CW, then return for only the failed portion next time.

Autopatch Abuses, Charley warned, continued to jeopardize interconnects for the Amateur Service. "It's your decision!" he said, and if we don't clean up our act we'll end up with formal Commission proceedings that will severely curtail, if not eliminate, Amateur ability to tie into the phone system.

High Level FCC Changes are being widely discussed in various Washington trade circles. Several people are reported actively going after Ray Spence's job as FCC Chief Engineer, and the latest story is that Carlos Roberts (presently head of FCC's Office of Plans and Policy) may be in line to become Chief of the Safety and Special Services Bureau, replacing Charley Higginbotham. As both positions are filled by appointments, they are not protected by Civil Service.

K5NY RECEIVED AN 18-MONTH JAIL sentence and was fined $500 by U.S. District Court Judge Edward J. Boyle, Jr. last November as a result of his pleading guilty to three counts of transmitting obscene language and interfering with a New Orleans repeater this past summer. K5NY must serve 90 days of his sentence after which the remainder will be suspended; his co-defendent — WB5AWN — received a suspended sentence but must pay costs for the public defender. K5NY received a severe reprimand from the Judge, himself a CBer.

POINT-OF-SALE CONTROL for linear amplifiers has been instituted by Canada's Department of Communications. In a Canada Gazette announcement, the DOC stated that all linear buyers must sign a special form including their names, and addresses at the time of purchase. The form is then forwarded to the DOC and the buyer's name compared with lists of General Radio Service (CB) licensees to determine whether the purchaser is in violation of DOC rules barring linear possession by an operator in the General Radio Service.

No-Code Canadian Amateur License is expected by next fall as a result of the November 26 Department of Communications/Canadian Amateur Radio Federation National Amateur Radio Symposium in Ottawa. More than 100 Amateurs from across Canada, representing 27 Canadian Amateur organizations, attended the jointly sponsored session, during which the suggestion for a Canadian Novice-class license was firmly turned down while a no-code "experimenter's" license for 200 MHz and up was strongly supported. Expectations are that the new license will have a tough technical exam; other details are still to be worked out.

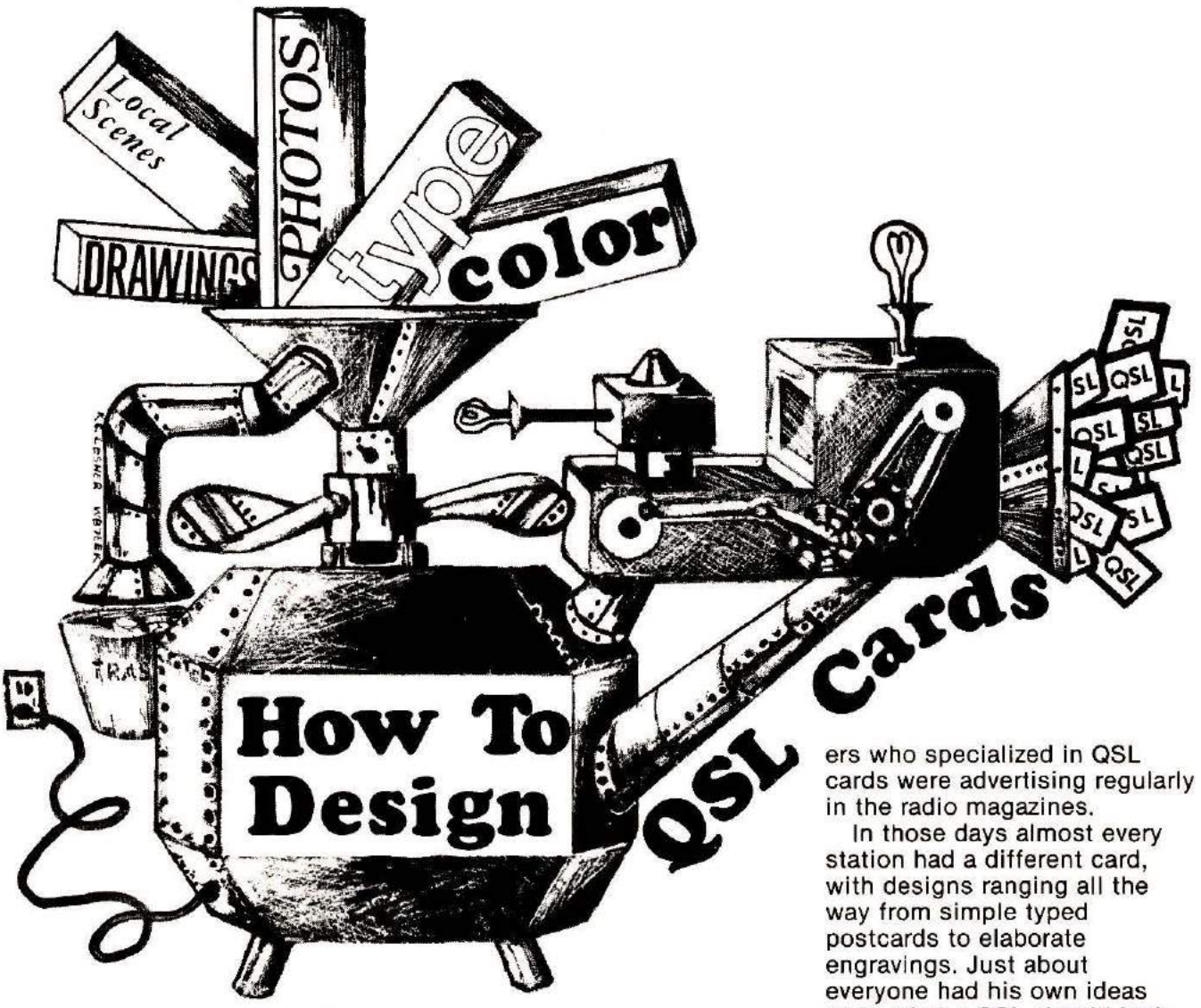
A New Permanent Canadian Prefix may be forthcoming as Ontario Amateurs have just about used all the VE3x3 callsigns. The DOC, with the assistance of the Radio Society of Ontario, will be looking into alternatives.

1978 Could See VC7 in use by Vancouver Island Amateurs. The Victoria Short Wave Club has asked the DOC to authorize the special prefix to mark the bicentennial of Captain Cook's exploration of Vancouver Island.

A Canadian Assault on 420-430 MHz is in the wind. A recent Department of Communications study of 406-960 MHz is expected to propose 420-430 MHz for mobile services, with 430-450 MHz shared between radiolocation and Amateurs as at present. On the positive side, the same study also will propose a new 902-928 MHz Amateur band to be shared with fixed services and radiolocation.

OSCAR 7'S THIRD BIRTHDAY was Tuesday, November 15, when the satellite reached its three year design lifetime. If OSCAR 6's performance can be extrapolated, however, expect OSCAR 7 to be serving us for a long time to come. Mode jumping problems are continuing, with the combination of low battery voltage (from seasonal sun angle on the solar panels) and excessive user signals (especially from Europe) the probable culprits.

The Russian RS Satellite is still not up as of late December, and one current report from Europe says it's been having technical problems, delaying the expected launch.



Snappy, good looking QSL cards attract attention and get response. Here are some ideas for designing a QSL card that demands more than a passing glance from amateurs you work.

BY JAMES R. FISK, W1HR

There's an old saying among amateurs that "The QSL card is the final courtesy of a QSO." So it is — and many amateurs pin their prize QSL cards up on the walls of their hamshacks as proof of their prowness in working other amateur stations across the nation and around the world. In one ham station I visited not too long ago the walls were covered from floor to ceiling with QSL cards from the four corners of the earth. What visitor could fail to be impressed by such a display?

On the list of international Q signals, QSL means "I acknowledge receipt," so it was only natural that when amateurs started exchanging verification cards they became known as "QSLs." The QSL card is nearly as old as amateur radio itself, and although it's not known who sent the first one, many radio historians believe it was W8UX, who had an amateur station in Youngstown, Ohio in the early 1920s. By the late 1920s QSL cards were in common use and printers who specialized in QSL cards were advertising regularly in the radio magazines.

In those days almost every station had a different card, with designs ranging all the way from simple typed postcards to elaborate engravings. Just about everyone had his own ideas as to what a QSL should look like — so originality was the keynote. Many amateurs wanted only to convey information confirming a QSO, with little technical data, while others sent out cards which read like engineering reports.

In some cases the QSL emphasized local attractions — it was a rare card from Wyoming that didn't feature a bronco buster, or one from Hawaii that didn't show a hula dancer and palm trees. Others showed an outline of their state or country. More often than not, however, the card simply displayed the station call letters in large block letters. Those cards showed up well on the wall of a foreign station, and in any photographs of that station which appeared in print.

QSL information

The average QSL card contains at least the callsign, operator's name, and station address as well as the time and date of the contact, frequency, signal report, and mode (CW or phone). Some cards also list a complete rundown of station equipment, and affiliations and certificates such as membership in the ARRL, DXCC (DX Century Club), or QCWA (Quarter Century Wireless Association).

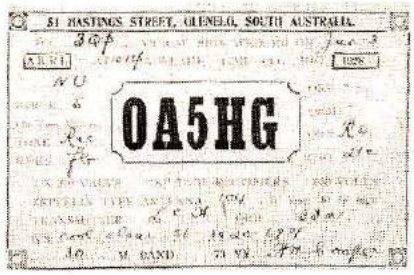
QSL cards used by amateurs in the United States are usually standard post-card size (3½ inches by 5½ inches) for easy filing and mounting on the wall (size is also restricted by postal regulations, which prohibit the 9-cent rate on cards which deviate from the standard dimensions — if you mail out a substantial number of QSL cards, postage is worth thinking about). On the other hand, QSL cards from overseas come in every conceivable size from miniature to gargantuan. The smallest card I have in my collection is the size of a business card (about 2 inches by 3½ inches); the largest is a double-foldout measuring nearly 12 inches across!

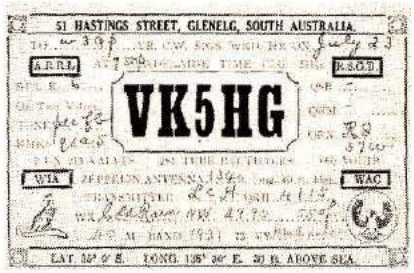
Basic QSL design

Even if you've only been on the air for a few months, you have probably already received a few QSL cards. Just take a minute to look through them. As you thumb through the stack you'll find a few that grab your attention — stop for a moment, read the card, and continue on through the stack. Now go back through the cards and separate those that captured your attention the first time through. Carefully look them over — what is it about those cards that compels interest? What is it that attracts your attention to those QSL cards and not to the others?

To answer these questions let's take a minute to talk about photography. How many times have you taken a series of snapshots on your vacation and showed them to friends while you told them about your trip? As you eagerly showed them the pictures you probably *explained* what they were and why you had taken those particular shots. Therein lies the secret: you had to *explain* the photographs. A good picture tells the story; it draws attention and the viewer wants to know more. As proof of the pudding, look at any of the modern picture magazines; all make the photographs tell the story — the captions are there to answer any further questions. This same technique is used in movie posters and on the front covers of newsstand magazines; they arouse interest and tempt the viewer to see the movie or to buy the magazine.

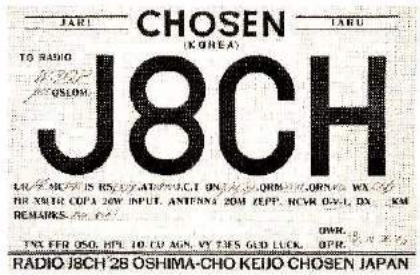
So it is with QSL card design. Those that do the job well are the ones chosen for display. They're also the cards most likely to get a rapid





Two versions of a QSL from the same station in Australia nearly 50 years ago. The OA5HG card is reminiscent of the times when there were no international prefixes — the O designates Oceania, the A indicates Australia. The VK5HG card was sent soon after VK became the Australian prefix. Note the improvement in station equipment during the three years between contacts (*cards courtesy K1RA*).

Old time QSL cards from the collection of *Horizons'* staffer K1RA who was first licensed as 3QP in 1923. The earliest card here is from Australian amateur 5DX in 1928; the card from Puerto Rican K4RJ recalls the time before distinctive KP4 calls were issued. FI8AC was operating in Hanoi when it was part of French Indochina, and J8CH was active from Korea in 1939 when it was a Japanese province. No amateurs have been active in China in several decades.



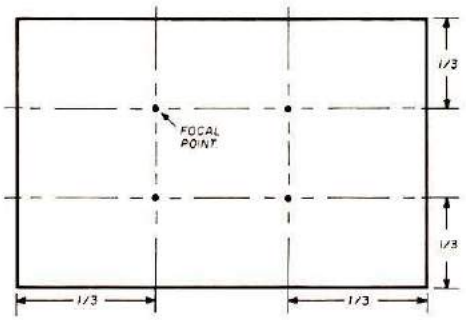


Fig. 1. Focal points are located about one-third of the way in from each of the margins. One simple way to give impact to a commonplace subject is to place it one of the points. As you look at magazine photographs, note how often this technique is used by professional photographers.

response from the other amateurs whom you work. For this reason many amateurs go to great lengths to send out attractive, snappy QSL cards that capture the recipient's attention. And you don't need formal art training to come up with a successful QSL design — most amateurs are capable of making their own QSL layout if they follow a few simple guidelines.

Make it attractive. Whether it's a movie poster or a QSL card, the rules are the same: make the general theme dominant, don't clutter it with extraneous material, and choose colors that support the design. In general, keep it simple — the less you put on the QSL, the more potent the design.

Choose a theme. This can be a photograph, a drawing, or the typography (lettering) itself. If you use an illustration, make sure it tells a story; there must be a reason for using it. It should also be tied in with your station, your town, or yourself. Do you live in the city, in a remote mining town, in a farming community, or on the sea coast? All offer dynamic possibilities as QSL themes.

You may have seen the skyline of your city so often it no longer commands your attention, but it may pique the curiosity of a ham in a distant state or a foreign country. Remember that a ham who lives in Tashkent, Timbuktu, or Tokyo probably thinks the same thing of his city! This is also true of old mine shafts, rolling fields of grain, and waves crashing against the shore.

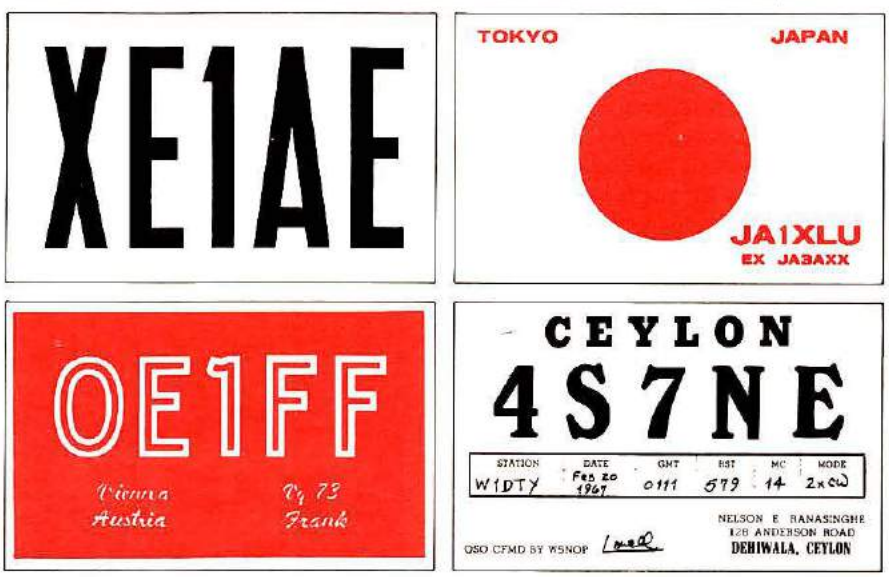
If you don't think your location has any particular interest, how about your profession or another of your hobbies? If you still draw a blank, probably a subject based on national or international interest would be best (such as space exploration or international peace, for example).

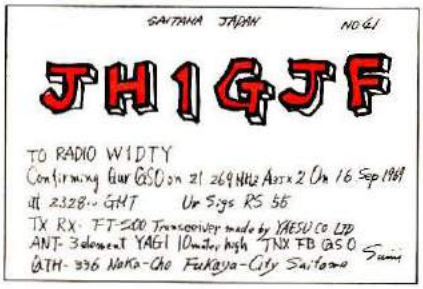
Highlight the important point. When you pick up a QSL card, your eye should be immediately drawn to the important part of the theme and carried smoothly through the rest of the design; it shouldn't jump around looking for something interesting. This, incidentally, is another secret of good photography and good art. It was recognized by the old masters, and well known by professional photographers and commercial artists, that one way to provide emphasis is to place the subject at one of the four focal points shown in **Fig. 1** (about one-third of the way from the top or bottom, and one-third in from the left or right margin). Color can also be used to highlight your theme, but remember that each color you add to the QSL design, the higher the cost.

Eliminate clutter. The most effective QSL designs are normally those where the theme stands alone with the call letters. If the theme is the highlight, keep the call letters small. If the call letters are the dominant feature of the design, make them large. To avoid clutter, place all the technical and report data on the reverse side of the card.

Carefully choose the colors. To a great extent the choice of colors is a matter of personal likes and dislikes, but in all cases choose combinations that give good contrast between the print and the card. If you use an illustration, try to use colors that are natural to the scene, don't pick colors that clash. Some colors are known to have certain psychological effects; reds, for example, are "exciting," yellows and oranges are "warm," blues are "cool," the earth colors of green and brown are considered to be neutral, gray is "sober," and

Good looking QSL cards from three continents. Note that, in QSL design, "simplest is often best." As a rule, the cards that are the least cluttered have the most impact.





Homemade QSL cards from the Far East; both are hand drawn in two colors on white cardboard. At the time he sent the card, HL1SK was a junior high student in Seoul.

purple suggests royalty.

Colors with different effects can often be combined to give very attractive results. Red on warm gray, and brown on medium yellow are good examples. Avoid combinations of similar colors such as dark green on a light green card, which lacks strength, or bright red on a yellow card which looks garish (unless, of course, you want a garish QSL).

Use an effective layout. A good QSL layout requires that some parts of the design must be subordinate to the highlighted subject. Allow plenty of space around the printed material. If you spend a few minutes thumbing through the advertising pages of any magazine, you'll see that the ads which are the most effective are those where large amounts of space have been left around the key words; the balance of the advertising message is grouped in such a way that it doesn't detract from the main point.

With these main points of QSL design in mind, let's talk about some of the things you can do to design a unique QSL card that has impact and commands the attention of the viewer. One of the most important of these is the choice of the type face used in printing your callsign and the other data on the QSL.

Choosing a type face

The type font, or style of lettering, has a subtle but noticeable influence in delivering the message. Ideally, the choice of type should complement the rest of the design. This is not always easy to discern, but if you watch the titles of television programs, you'll get an idea of what I'm talking about.

The solid, bold, block-face type used in the title of *Kojak* for example, imparts a feeling of masculinity and rock-solid stability that would be unsuitable for the hit comedy series, *Laverne and Shirley*. On the other hand, the feminine, free-form script used in the titles of that old favorite, *I Love Lucy*, doesn't have the feeling of accuracy and respectability required for television shows like *Nova* or *60 Minutes*.

There are hundreds of different type styles available, of which only a few are shown in **Fig. 2**. Basically, type is broken down into three main categories: serif, sans-serif, and decorative. The serif is the fine line setting off the main elements of a letter as at the top and bottom of the letter A below; it derives from the

chisel strokes which were used to finish off letters in the inscriptions on the ancient Roman buildings.

A type face without serifs is called sans-serif or "gothic" (the text on this page is set in a sans-serif type called *Helios*). Decorative or novelty types, of course, take all forms and depend only on the whimsy of the artists who designed them.

QSL card from a round-the-world DX-pedition is very cluttered but provides information about the operators and their previous DXpeditions. Since a DX-pedition card is highly prized because of the radio contact it confirms, clutter is probably of little importance. If the QSL is a rare one, it will be displayed regardless of the design!

In general, when choosing a type face for your QSL card, I think a bold sans-serif face is the best choice. Some of the serif type faces also stand out well and are easy to read, but they tend to be more old fashioned. Many of the decorative faces are also good, but you have to be careful to choose a face that's easy to read.

Of the type faces in **Fig. 2**, which is the easiest to read? *Old English* obviously wasn't meant to be set only in capital letters; *Crossfire* might be fine for a rifleman, but I find it hard to read; ditto for *Buxom* and *Orbit*. *Comstock* and *Cooper Black* are a bit old fashioned for my taste, and I find *Egyptian* too harsh. These are my own personal opinions, though, and you may feel completely differently — it is

Cartoon QSLs can be entertaining, but they can be very cluttered as the one below. This might be an interesting illustration for the wall of your ham shack, but it loses a lot when reduced to QSL size.

your QSL card, after all, so it should reflect some of your own personality.

Of the type styles below, I personally prefer *Futura*, although *Micro Outline* runs a close second. *Automation* would be great for an amateur who is also a computer buff, and *Hobo* imparts a bit of the free spirit that's in all of us.

Although it's probably not obvious to people who are not involved in the printing industry, type styles change from time to time just as clothing styles do. There are also faddish type faces which are born one year and forgotten the next. Before choosing a type face for your QSL card it's a good idea to check with a local printer to see if it's of fairly recent issue.

It should also be kept in mind that few printers have a large variety of type styles available. The equipment used to set type is expensive, so printers tend to stock only those faces which are the most popular. There are companies which specialize only in setting type, and they usually have a huge variety of styles. Their

Molded plastic QSLs which are available from Mac's Shack (see Appendix). These also make neat name badges for ham conventions.

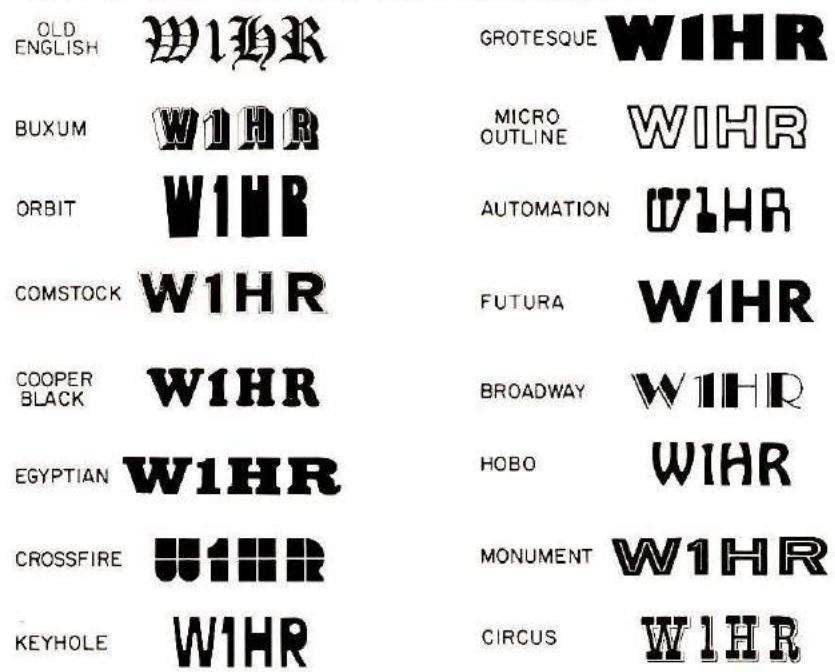
services are expensive, however, and it may cost $20 or more just to have only a few lines set!

A less expensive approach is to use the rub-on or transfer letters used by graphic artists. These consist of letters and numerals on a clear acetate sheet with an adhesive back which can be transferred to a sheet of paper. There are enough letters and numerals on a single sheet to do several QSL cards — the cost is only two or three dollars. These sheets are made by several firms and are available in most art stores (look in the *Yellow Pages* under Art or Drafting Supplies).

One final note about type faces: once you have chosen a type style for your call letters (which presumably will be the most dominant letters on the card), make sure any other type you use doesn't clash with it. Consider a QSL card with the call letters in *Cooper Black*, the name and address in *Comstock*, and the data block in *Hobo*. Every type element on the card is fighting for attention — the overall result is clutter with a capital C!

If you choose a decorative type face for the call letters, it's best to use a simple, non-imposing type face for the rest of the printed material; most of the popular sans-serif faces meet this requirement. They blend well with decorative type faces and don't distract from the impact of the card. It's also a good idea not to mix serif and sans-serif faces.

Fig. 2. Several of the many hundreds of different type faces which are available. Some of these are easier to read than others, but every one imparts a different "feeling," which is often reflected in the name the type designer has given it.



Choosing a QSL design

There are two basic design choices when selecting a QSL: to use only typography (lettering), or to incorporate the lettering with an illustration. There are a number of printers who specialize in printing QSL cards, and all will supply a copy of their catalog or samples of their cards for a nominal fee. A number of QSL printers who cater to radio amateurs are listed in the appendix (page 20) along with their charge for furnishing samples of their work.

The QSL samples are an excellent starting point — you may find a printer who has exactly what you're looking for. If you don't find a design that suits your needs, you can think about designing your own. Some QSL printers also offer custom-design services,

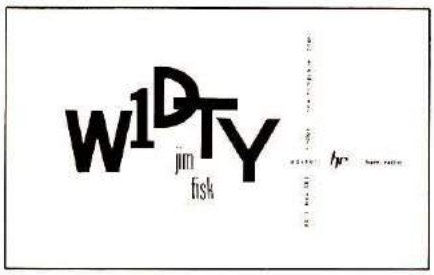


Fig. 4. Unusual arrangement of letters lends impact to this QSL design. Similar cards have been used by other members of the *Horizons* staff.

but the cost is higher than their stock designs. Nevertheless, this is an easy way to obtain your own individualized card if you don't want to do the layout yourself.

If you decide not to use one of the QSL printers' stock designs, the most economical approach is to design a card which uses only lettering. Several examples are shown in **Fig. 3**. All the printing can be one on side of the card as shown in **A**, or the callsign and address can be on one side, **B**, with the report data on the reverse side like a picture postcard, **C**. You can also use reverse printing for a dramatic effect, **D**, or reverse-print outline letters as in **E**. Nor does your callsign have to be right in the center of the card; the offset arrangement at **F** is also pleasing to the eye.

Note that printers will charge you more to print on both sides of the card, so if you're on a thin budget, design the card to print on one side. If you can afford the extra cost, I recommend the report data be placed on the reverse side to reduce clutter.

Part of the impact of the lettered QSL is its very simplicity; if you clutter it with extraneous material it loses impact. There's little you can do to make it stand out even more except to use color. Each color you add increases the cost, but you can gain a two-color effect quite simply by putting colored ink on colored card stock. One of the most beautiful QSLs I have in my collection came from the Far East and has gold printing on glossy black card stock. If that card had been printed in black ink on white card stock it wouldn't have earned a second look!

Another way to add impact to the lettered QSL is to use an unusual arrangement of letters.

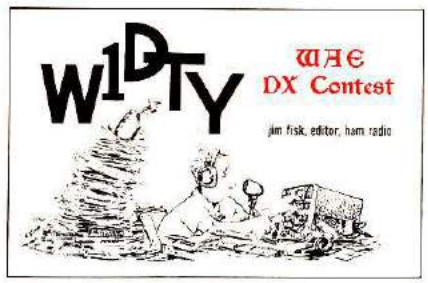


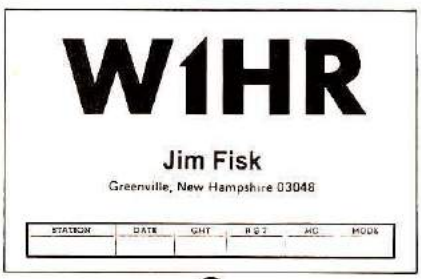
Fig. 5. A QSL card designed specifically for contest contacts. A large quantity of cards was printed without the red imprint. After each contest worked by W1DTY, an appropriate number of cards are imprinted with the name of the contest (the WAE Contest is the Worked All Europe Contest).

An example is shown in **Fig. 4**. This card was designed by a graphics artist and the same basic style has been used by other members of our magazine staff.

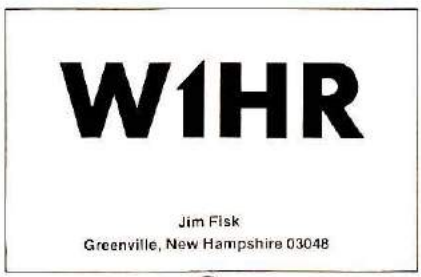
Using an illustration

If the simple lettered QSL doesn't achieve the effect you want, the next choice is to use an illustration. This can be as simple or as complex as you want, depending on your budget. The illustration can be based on an amateur radio theme, or some other topic that has impact (remember the city skyline, the rolling fields of

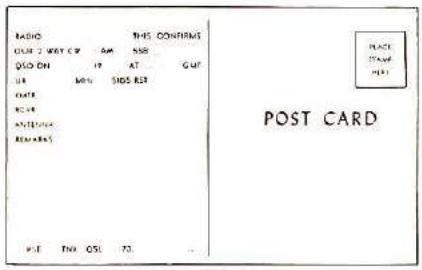
Fig. 3. Examples of QSL cards which use only typography. In a card at **A** all the data is printed on one side of the card to reduce cost. The card at **B** includes only the callsign and address on the front; the technical and report data is on the back, **C**. The card at **D** uses reverse printing as does the card at **E**. Shown at **F** is an offset arrangement; note that both the call sign and address are at the focal points shown in **Fig. 1**.



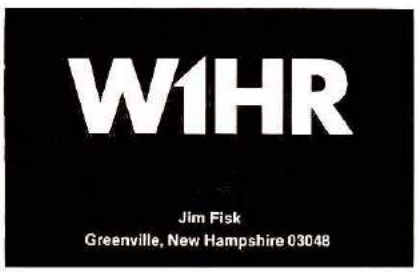
A



B

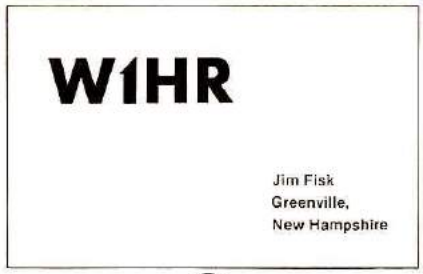


C



D

E



F

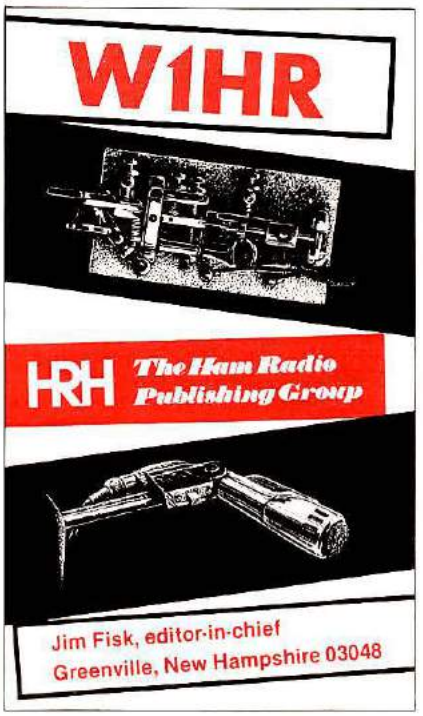


Fig. 6. QSL card presently being used by W1HR is based on an original design by K3SUK. Since this is a two-color QSL, two printing plates are required as shown in **Fig. 7**.

grain, waves against the seashore?). If you don't think you can do the illustration yourself perhaps you have a friend who is an artist. If not, talk to your local high-school art teacher. If all else fails, look for a commercial artist, but be prepared to pay a good fee for his or her services.

Before you talk to the artist, though, think about some possible subjects you might like to feature on your QSL. That will give the artist something to start with, and he's more likely to come up with a satisfactory design the first time around. Normally the artist will supply you with several sample sketches which are called "visuals." If one of these is acceptable, he will make up the final artwork which you can take directly to the printer.

Shown in **Fig. 5** is a QSL card I had designed specifically for contests. A number of years ago I had a large number of cards printed without the imprint in the upper right-hand corner; each time I worked a large number of amateurs during a contest, I had the printer run the card back through the press and put on the imprint (the card is printed in black on white card stock; the imprint is in red).

Fig. 6 shows the QSL card I am using at the present time. This card was designed by K3SUK, who also designs most of the front covers for our sister magazine, *ham radio*. Since this card is printed in two colors on white card stock, two separate printing plates are required — one for each color; these are shown in **Fig. 7**. The circled crosses in each of the four corners are called "register marks" and are used by the printer to align the two printing plates.

Try a photograph

If your budget prohibits the use of an artist, many dramatic QSL cards have been made with black-and-white photographs. You can use a photograph of your station as an inset, or use a photograph as a margin-to-margin background as in **Fig. 8**. When the edge of a photograph is beyond the edge of the card, it's called a "bleed."

When you take a photograph to be used as a background for type, be sure to leave a plain, uncluttered area for the letters. If the background is dark, it's probably best to reverse the letters; if the background is light colored, overprint it with black (or colored) letters. Also, you can print the photograph in some color other than black.

There are also a number of special effects possible with black-and-white photographs such as posterization or the use of a texture screen. One example is shown in **Fig. 9**. Some printers specialize in these effects, but if your printer doesn't, he can probably arrange to have the job done by another firm. Special effects cost more than a straight photograph, but if your budget isn't too skinny, the results may be worth it.

Fig. 7. Two plates are required for the two-color QSL shown in **Fig. 6**, one for black, left, the other for red, right.

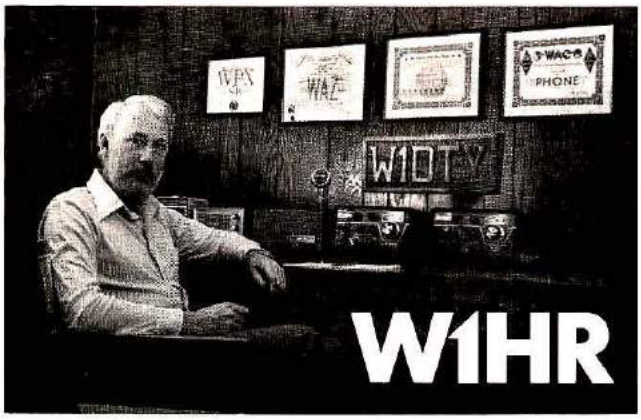


Fig. 8. Photographic QSL cards are always popular, but they don't always have a radio theme — what would be more appropriate for a ham from Indianapolis than an action photograph from the Indy 500? In the station photograph at the left note that both the operator's face and the callsign are at focal points (see **Fig. 1**). The photograph of the speeding race car, right, is exciting enough that it doesn't require the focal-point treatment.

Full-color QSLs

If you have a color slide which you think would make a super QSL card, be prepared to spend a lot of money! Before you can even think about printing costs you must have "separation" negatives made and this may cost $250 or more.* Then the card must be printed with a four-color press, which is also expensive.

A less costly alternative is to purchase a large quantity of picture postcards which show a local scene and have your callsign overprinted in a contrasting color. Most printers have the equipment to do this and the cost is not outrageous.

Samco, one of the firms listed in the Appendix, specializes in clear callsign strips with an adhesive backing which can be placed on postcards or photographs. Included with the package are gummed report forms which can be placed on the reverse side of the card. A package of 50 gummed report forms and 50 clear call strips is priced at $3.00. The cost of three- or four-line clear strip address labels is additional.

There are also several QSL printers who have a large selection of stock full-color QSL cards, including Alkan Print and Para-Graphics (see Appendix).

Cutting QSL costs

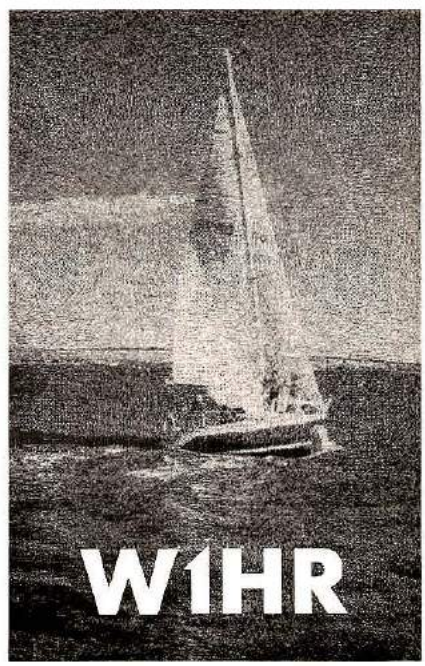
One of the best ways to cut QSL costs is to use a stock non-personalized QSL card which has a place to write in your call letters and address (or use a rubber stamp). Although this type of QSL is designed for the amateur who moves around a lot and doesn't have a permanent address, they're a good bet if you want to cut costs to the bone. Typical price is about $3.00 per 100 cards.

You can also cut QSL costs by ordering in large quantities, and by not using the most expensive card stock. That fancy, heavy-stock QSL card with the high-gloss finish (called *Kromecoat*) costs considerably more than standard card stock. Colored stock costs even more, as do cards with woodgrain or other special finishes. Your biggest cost saver, though, is to order in large quantities. The initial outlay will be higher, but in some cases you can cut your cost per card in half!

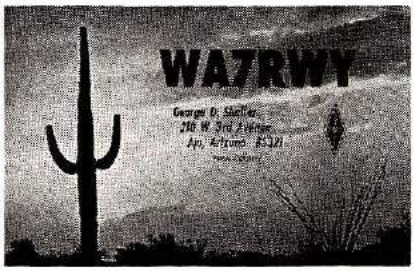
If you don't send out too many QSL cards you may want to consider drawing each one by hand. This takes a lot of time and gets to be a drudge, but the cost is low and a homemade QSL is effective. Who could fail to be impressed by the amateur who took the time to make his QSL by hand?

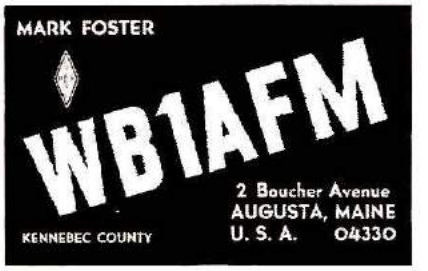
*Four separate negatives are required, one for each of the colors used in the four-color printing process: magenta, yellow, cyan, and black. Each of the negatives is made through a special filter and must be in perfect registration — hence the high cost.

Fig. 9. Use of a texture screen on a photograph to give the effect of a steel engraving. A variety of texture screens are available including wood grain, textile weave, mezzotint, and steel etch.



He'd get an immediate response from me, I can assure you, and probably from most other hams as well. The next step up from doing it by hand





is to use rubber stamps. Many of the Eastern European amateurs make their QSL cards this way, and Forwardco (see Appendix) sells rubber stamps which are especially designed for this task.

QSL cards are an important part of amateur radio, as they have been for nearly fifty years, but all too often their importance is overlooked. They are, after all, the only tangible proof of a pleasant or noteworthy radio contact. And if you're interested in applying for any operating certificates, you must have the QSL cards to show that you made the required contacts. Not every ham you work will send you a card, but if the QSL you send out is designed to attract his attention, the better your chances are of receiving a reply.

Appendix

List of firms which specialize in QSL materials for radio amateurs.

FIRM	Charge for Samples
Alkan Print Box 3494 Scottsdale, Arizona 85257	25¢
Brownie 3035 Lehigh Street Allentown, Pennsylvania 18103	50¢
Ebbert Graphics Box 70 Westerville, Ohio 43081	25¢
Egis Mailers Box 4846 Poughkeepsie, New York 12601	*25¢
Forwardco Box 76 Massillon, Ohio 44646	Free
K2RPZ Box 412 Rocky Point, New York 11778	Free
K7HLR Box 331 Clearfield, Utah 84015	50¢
Little Print Shop Box 9848 Austin, Texas 78766	Free
Mac's Shack Box 1171G Garland, Texas 75040	*1.00
N & S Print Shop Box 11184 Phoenix, Arizona 85061	35¢
Para-Graphics Box 268 Whitehall, Pennsylvania 18052	25¢
Petty, W2HAZ Box 5237 Trenton, New Jersey 08638	25¢
Printer's Devil Box 6301 Charlottesville, Virginia 22906	*75¢
QSLs Unlimited Box 27553 Atlanta, Georgia 30327	25¢
Ritz Print Shop 5810 Detroit Ave. Cleveland, Ohio 44102	50¢
Rusprint Box 7575 North Kansas City, Missouri 64116	25¢
Samcards 48 Monte Carlo Drive Pittsburgh, Pennsylvania 15239	Free
Samco Box 203 Wynantskill, New York 12198	25¢
WB9QOF 1313 Willow Chippewa Falls, Wisconsin 54729	35¢
Wilkins Creative Printing Box 787-1 Atascadero, California 93422	50¢

*Refundable with order

HRH

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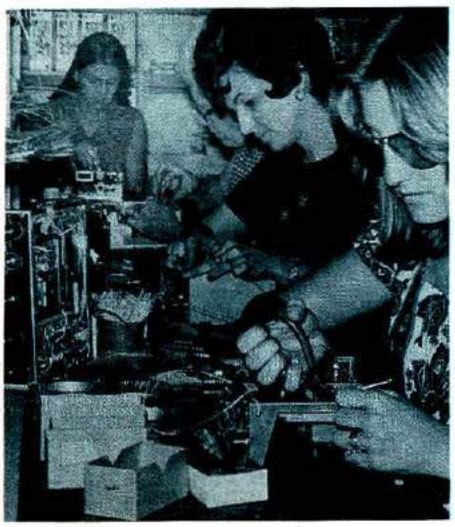
ATLAS 350-XL

The ultimate radio.

For SSB and CW...10, 15, 20, 40, 80, and 160 meters, full coverage...Plus WWV, 5, 10, 15 MHz...Up to 10 additional 500 kHz ranges by adding crystals...350 watts P.E.P. and CW input power...Broadband design, preselector tuning only...Digital frequency readout (optional), *and* standard analog dial...High receiver sensitivity...Super selectivity...Exceptional Dynamic Range...CW Filter...QSK Full Break-In CW...Sidetone...RIT...AF Notcher...Noise Blanker...ANL...VOX...Operates directly from a 12 to 14 volt DC supply, ideal for mobile and portable work...Optional mobile mount provides quick plug-in for going mobile.



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CUSTOMER SERVICE...SECOND TO NONE...That is our motto. When you buy an Atlas product...you inherit the best service policy there is. Ask the ham who owns one!

Model 350-XL (less options) . $995.
Model DD6-XL Digital Dial . . . $229.
Model 305 Auxiliary VFO . . . . $155.
Model 305PS AC Power Supply $229.

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COLLECTING QSLS
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F2VX
M1I
MALTA
GERMANY
AUSTRIA
TOKYO
SMSCTU
Maritime mobile
DL1EV
DL2WR
KENYA
YV5BTS
USSR
UK5UAN
Latvian amateur receiving station
UQ2-037-120
hong kong
VS6AD
W3TSP
8HR
B2SKA
LUSHFI
KUNGL UPPSALA SIGNALREGEMENTE

BY THOMAS SUNDSTROM, W2XQ

The QSL card is proof of contact between your station and another station, whether the other station is a block away or in another country.

After you make your contact on the amateur bands, obtaining a QSL card from the station requires some effort on your part. How do you get that address when the desired station doesn't provide it? How do you ensure that you'll stand a good chance of obtaining a reply from that DX station?

Here is some information you can use in collecting QSL cards. Many methods have been developed to distribute QSL cards to the intended recipients and to publicize your call sign. But first things first. The documentation to back up QSLs you send to other stations should be reflected in a *logbook*.

Logging stations

Logging requirements, that is, keeping records of contacts have been eased by the FCC, but a well-kept logbook is the sign of a good operator. A logbook also serves as backup if you're accused of causing television interference (TVI) when you were not operating. A by-product of QSL collecting is award hunting, and the logbook provides additional documentation for application purposes.

Although a number of firms have printed logbooks, probably the most popular and easiest-to-use version is the *ARRL Logbook*. The ARRL log is readily available through almost every amateur radio supply house or *Ham Radio's* Communications Bookstore.

If you're a newly licensed Novice or a Technician venturing into the high-frequency bands for the first time, make sure you read the suggested instructions on how to fill out the log.

When in a QSO, make all your notes of times, frequency, call, and signal reports on scratch paper (I use the reverse side of old computer printouts, which are otherwise tossed out in the trash), and after the QSO, extract the pertinent data and enter it into the logbook. It makes for a neater looking final log.

When recording the beginning and ending times of the QSO, use 24-hour Universal Time and don't forget to adjust the date forward when you go from 2359 (11:59 PM) UT to 0000 (midnight) UT. If you haven't learned how to convert local time to the 24-hour system, just add 12 hours to PM and delete the ":" mark. The time is expressed as a four-digit number. A conversion table is included in the first few pages of instructions of the *ARRL Logbook*.

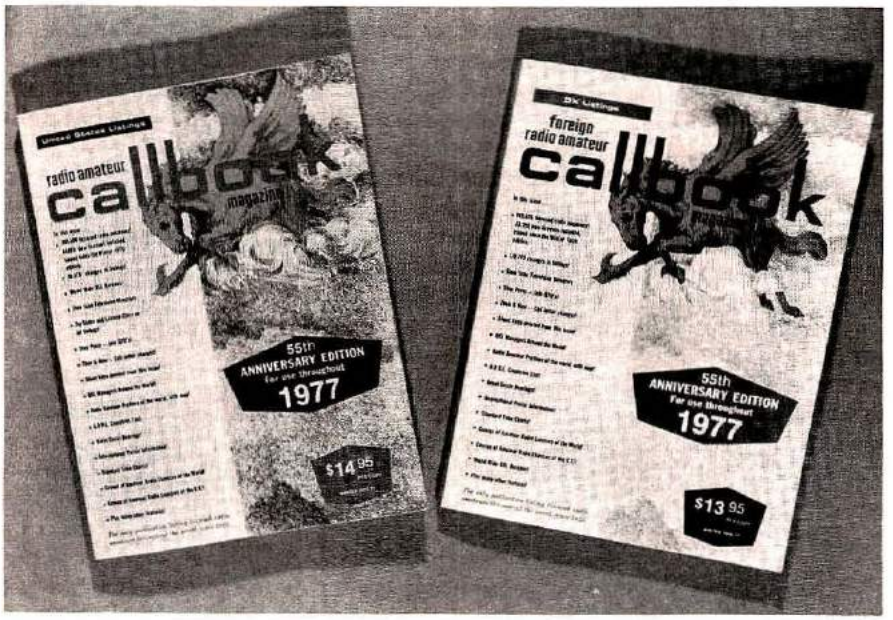
How do you calculate Universal Time? Listen to WWV, which announces the time each minute. WWV gives the time as Universal Time (UT) which is also known as Universal Coordinated Time. Greenwich Mean Time (GMT), UT, and UTC, for your purposes, are all the same. Why use UT? Because it avoids the hassle of converting dates, daylight to standard time, and calculating differences between time zones. Why not pick up one of those inexpensive 24-hour digital clocks, and set it to UT? Most of these clocks use the 60-Hz power line for regulation, and accuracy is good to within a few seconds a month.

One final comment on keeping a logbook. If you can read out your frequency with any degree of accuracy, I'd recommend you keep track of the *exact* frequency used for each QSO. Later on, an analysis of your logbook will show you what areas of each band have been most profitable for you. This also has a secondary benefit of providing documentation in case you are accused of interference or operating out of band.

QSO file

The now out-of-print *ARRL*

A QSO file is indispensable if you want to keep track of when and how often you work a particular station. A contact will get off to a friendly start when you greet the other operator by his name, or ask how the weather is in his town — information that you have just gleaned from his entry in a QSO file. You also know at a glance whether or not you have received a QSL from him.



How do you find out where the other station lives? The Radio Amateur Callbook makes it easy. It comes in two volumes, each 8-1/2 x 11 inches (22x28cm). One volume has listings for United States (and possessions) amateurs; the other is for foreign stations. Price for the United States listings book is $14.95; for the Foreign Listings is $13.95. Both are available from Ham Radio's Communications Bookstore, Greenville, New Hampshire 03048. Order CB-US (for United States), or CB-F (for Foreign).

Operating Manual suggests a simple method of cross-indexing your logbook, and it works quite well for me. Often it's nice to know if you worked a particular station before, and more than one ham has marveled at my ability to recall his name, location, and date of first QSO!

The manual suggests taking a set of 3 x 5 inch (75x125mm) cards with 26 dividers and set up the file by putting one letter of the alphabet on each divider. Behind each divider place 26 cards. Behind *A*, label each of the cards starting with *AA*, *AB*, *AC* . . . *AZ*. Behind *B*, label each of the cards starting with *BA*, *BB*, *BC* . . . *BZ*, and continue through the deck until you finish the task with *ZA*, *ZB*, *ZC* . . . *ZZ*. Only the first QSO is recorded. I insert, on one line, the call, location, first name, date, and band (in that order). The QSO is recorded on the card with the appropriate call letter *suffix*.

For example, my file card for *AU* shows, in order, QSOs with WN4AUW, F6AUK, and WB3AUE. I add an "*R*" in red to the end of each single-line entry if a QSL has been received. If that "*R*" is missing and we happen to QSO again, I'll ask him for a QSL card. Don't worry about the order on each card. At most there are only ten entries per card to look at. It will take a number of years before any one card is filled.

In the logbook I use markers of different colors to indicate when a card has been sent and when a card has been received. I happen to use green for *sent* and red for *received*, because these colors stand out in the pages when I'm checking to see what cards are outstanding. You could use the same scheme in the card file if you like.

QSLs

There's an old saying that "The final courtesy of a QSO is a QSL." I don't know where it came from, but I believe in it. If you've spent the time and effort to earn that Novice license, assemble a station, and subscribe to magazines such as *Ham Radio Horizons*, let's face it — you're interested in amateur radio.

Why not brag about your station through a good-looking QSL card?* The cost of verification cards and postage is minimal compared to what has already been invested, and many hams look forward to that confirmation of a QSO! Unfortunately many QSL-card printers send out free samples to newly licensed Novices based on data from the FCC computers. The unsuspecting beginner merely orders a QSL card that is duplicated thousands of times over — a real shame!

Originality is a key word here. If I want my card to stand out on the wall and get the attention of that DX station to elicit a reply, I want a QSL that's unusual, looks good, and hasn't been duplicated in wholesale numbers.

Get some sample cards from the various QSL printers advertising in the various ham magazines; most charge a nominal fee of up to 50 cents. If you can't find anything you like, look through the QSL card collection of a local amateur. You may find something appealing that you've not seen elsewhere. If you still can't find a card that strikes your fancy, combine some of the better features of some of the cards you have looked at, then talk to a local printer. Your cards will be quite costly initially as plates will have to be made, but re-orders will be cheap. Bulk purchases of cards, 1000 or more, are only marginally more costly than a 200- or 500-card order.

In designing your own card, make sure it shows absolute proof of a two-way contact. (Look at some of the cards you have on hand and you'll see what I mean!) Get the

*See item 1 in "Further Reading" at the end of this article.

needed data into your card: calls, date, time, RST, frequency or band, and mode should be a minimum.

One more comment in picking or designing a card: It's extremely helpful to the DX station or the special events station, who deals with masses of incoming cards, to get the QSO data on *one* side of the card. The time saved by not having to flip the card over when doing a log search adds up. A list of equipment and other comments can be put on the reverse side, but *get that basic log data* in plain view!

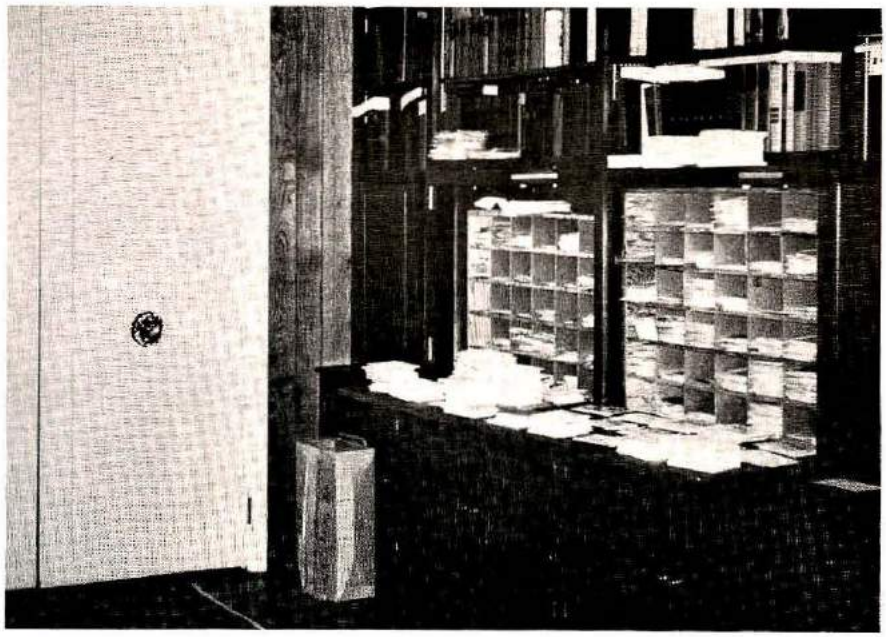
Don't forget to use 24-hour UT in filling out QSL cards. Most low-band hams and all DX amateurs maintain logs in UT. You stand a very poor-to-no chance of getting a return based on a QSL filled out with your local date and time!

The callbook

How do you know the addresses to which to send QSLs? There are two editions of the *Radio Amateur Callbook*. One lists all currently licensed amateurs in the United States, and the second lists everyone else. The two annual editions are released in December, and have quarterly updates. These supplements are available by mail subscription only. The *Callbook* is sold by virtually every outlet for amateur radio equipment, or through Ham Radio's Communications Bookstore. Despite its size and volume of listings, data in the *Callbook* is very accurate. However, new information is somewhat slow to appear. If you have just obtained a new license or have changed your address, you can expedite your station's appearance in the listings by sending the information directly to: *Radio Amateur Callbook*, 925 Sherwood Drive, Lake Bluff, Illinois 60044.

If a call change is involved, send along a *copy* of the new license (don't send the original!), and make sure the old call is included. The next annual edition will cross-reference any call changes that have occurred since the previous annual. The advantage of notifying the company directly is most important in the later portion of the year. Many purchasers of the *Callbook* don't buy the quarterly supplements so they won't see the new information for a year. It's to your advantage to get changes into the December issue.

In my case, for example, a license upgrade that came off the FCC computers in early October, 1976, didn't get into the 1977 annual. This wasn't important for me, but for someone moving across the country or getting a new call, it could mean a year or more of forwarding mail and cross-referencing calls in each QSO.



QSL bureaus speed up the flow of cards to and from most foreign countries, and are run by dedicated individuals or clubs. This is a view of the third-call-area bureau run by W3KT in Malvern, Pennsylvania; he handles both incoming and outgoing cards. Each call area has a QSL bureau to serve it, and you should write to the one for your area to find out how they do things; procedures for receiving or sending cards vary from club to club. You'll find their addresses in the *Callbook*, and in *QST*. Remember, when writing to any busy person or group, a self-addressed, stamped envelope will speed the reply (*photo courtesy W3KT*).

Sending QSLs

You should send QSLs *directly* to stations located in the United States and its possessions, Canada, and Mexico. Use the address in the *Callbook* unless you're given instructions to do otherwise.

Many Novices, because of the delay of having the license data appear in the listings, will give an address over the air.

When you send a card direct, put it in a number 6 regular-size envelope. Protect the card from the mangling machinery and the stray rubber stamps and stickers that adorn today's mail. The postage may be a few cents more, but what's more important, your precious cards or a few pennies?

Sending QSLs to DX stations is a slightly different matter. Many DX stations will say, "QSL via bureau." Briefly, there's a worldwide QSL clearing house mechanism set up to handle DX QSLs. Almost every country has its own QSL bureau to receive QSLs from other countries, and then distribute those cards to the individual hams who have

Some amateurs like to decorate their walls with QSLs, and others like to keep them in a neat file like this one. If you want to assemble cards for an award, it's easy to check to see what is in your file, or what is missing. Most cards are similar in size to a normal post card, but a few amateurs use extra-large QSLs, which can create a storage problem for you.

envelopes on file. If you send cards to DX stations using the bureau system, return postage does not have to be provided.

The disadvantage of the bureau system is that cards can take anywhere from six months to six years to clear through the system, although most are exchanged within two years. Typically, the Soviets are the slowest to transmit cards via the bureaus.

There are outgoing DX QSL bureaus also. Rather than get involved with International Reply Coupons and prohibitive air-mail rates, many amateurs take advantage of some of the excellent *outgoing* bureaus run by W3KT and others who advertise in the various publications. Cost of the private outgoing bureau runs between 5 and 7 cents per card.

If you're an ARRL member, you can take advantage of a recently installed outgoing mechanism for members' QSLs. There are some limitations to the ARRL service, so if you're a member, check it out for yourself.

An advantage of using an outgoing bureau is that the bureau keeps track of QSL managers and changes in bureaus. Many of the active DX stations use a QSL manager located either stateside, in Europe, or in Japan, to handle QSL requests. A card sent directly to the operator may not get answered, or it may be delayed in routing back to the QSL manager for answering.

Incidentally, if you have a QSO with a DX station who specifies a QSL manager in the United States, send along a self-addressed stamped envelope (SASE) along with your QSL directly to the QSL manager's address listed in a recent *Callbook*.

If you know a QSL manager, you'll get a reply more quickly than by sending the card through an *outgoing* bureau, which will route the card back to you through the bureau system.

Receiving QSLs

Any cards coming from U.S. or Canadian stations will probably come direct. To the best of my knowledge, all attempts to set up a stateside clearing house have failed. This includes a recent attempt in 1975 to set up a Novice-only QSL bureau based in Michigan. About the only thing you can do here is check your license carefully and make sure your name and address are complete and spelled properly. Whatever is listed on your license under "name and address" is what should appear in the *Callbook*. Check the *Callbook's* listing too. Any discrepancies on either the license or the *Callbook* listing should be attended to as quickly as possible.

To receive cards from DX stations, you should have envelopes on file at your local QSL bureau. In the United States and Canada, each call area has a QSL bureau that distributes incoming DX QSL cards that have come into the country through ARRL headquarters in Newington, Connecticut. You *do not* have to be a member of ARRL to use the QSL bureau system for receiving cards.

The bureaus are listed in any *Callbook* or periodically at the end of the "How's DX?" column by Rod Newkirk, W9BRD, in *QST* (the monthly journal of the ARRL).

If you've been chasing DX for a while and have some cards outstanding, contact your local bureau as soon as possible. Normally, the bureau will hold QSLs without envelopes for a year before discarding them.

Some bureaus prefer to supply both envelopes and

postage for a nominal sum, whereas others want you to provide self-addressed stamped envelopes (SASEs) of a certain size. Send a number-10 SASE to your bureau and find out how they run things.

By the way, if you have had a Novice license long enough ago to have had a WN call before the WA, WB, or WD prefix, make sure the bureau knows of both calls if you are expecting DX QSLs coming for the WN call.

Filing QSLs

Now that you have QSLs coming back to you, what do you do with them? Many amateurs like to hunt for different awards, some of which are quite well known and some a bit obscure. In virtually all cases, the QSL cards are needed to certify eligibility for a particular award.

To digress for a moment, most everyone is aware of the WAS (Worked All States), WAC (Worked All Continents), and DXCC (DX Century Club for 100 or more verified countries). One of the other more popular activities you'll encounter is that of county hunting. The county hunting award, sponsored by *CQ* magazine, marks two-way QSOs with 500 or more Unites States counties. The award has endorsements in increments of 500 up to the end — more than 3000 counties. Art Geyer, K8SWW, also once active as ZF1AG and known to many Novices, has over 1500 counties to his credit, and 1100 of those were earned in the Novice segments. The point of all this is that, if you're a Novice or a Technician on the high-frequency bands for the first time, your path of interests has not been fully developed. Pick up QSLs from your early contacts. At some point, later, you may decide to collect some of the awards and certificates that are available, and you'll have that head start.

When the QSL card arrives, mark your QSO card file and your logbook. If you haven't already sent a QSL, write one out in return. File the received card by state/province, and alphabetize municipalities within each. DX QSLs are filed by prefix. You don't need QSLs in the same order as your QSO card file, because the red *R* tells you whether or not a card has been received. You'll find this two-way index system, one for the QSO file and the other for QSL cards received, an easy way to see if you have the particular cards to qualify for an award at some later date. Both files can expand with a minimum of problems.

Closing remarks

The systems and procedures described above have worked for me. My philosophy is that I like to get on the air and not keep records. You'll note that there are no master lists to be written and rewritten. Everything is in a card-expandable arrangement that maintains order with a minimum of problems.

At any time, I can run a tabulation on states or counties verified. With an Atlas, the number of counties verified can also be determined easily. Perhaps one of these days I'll be entering your QSL into my records.

Further reading

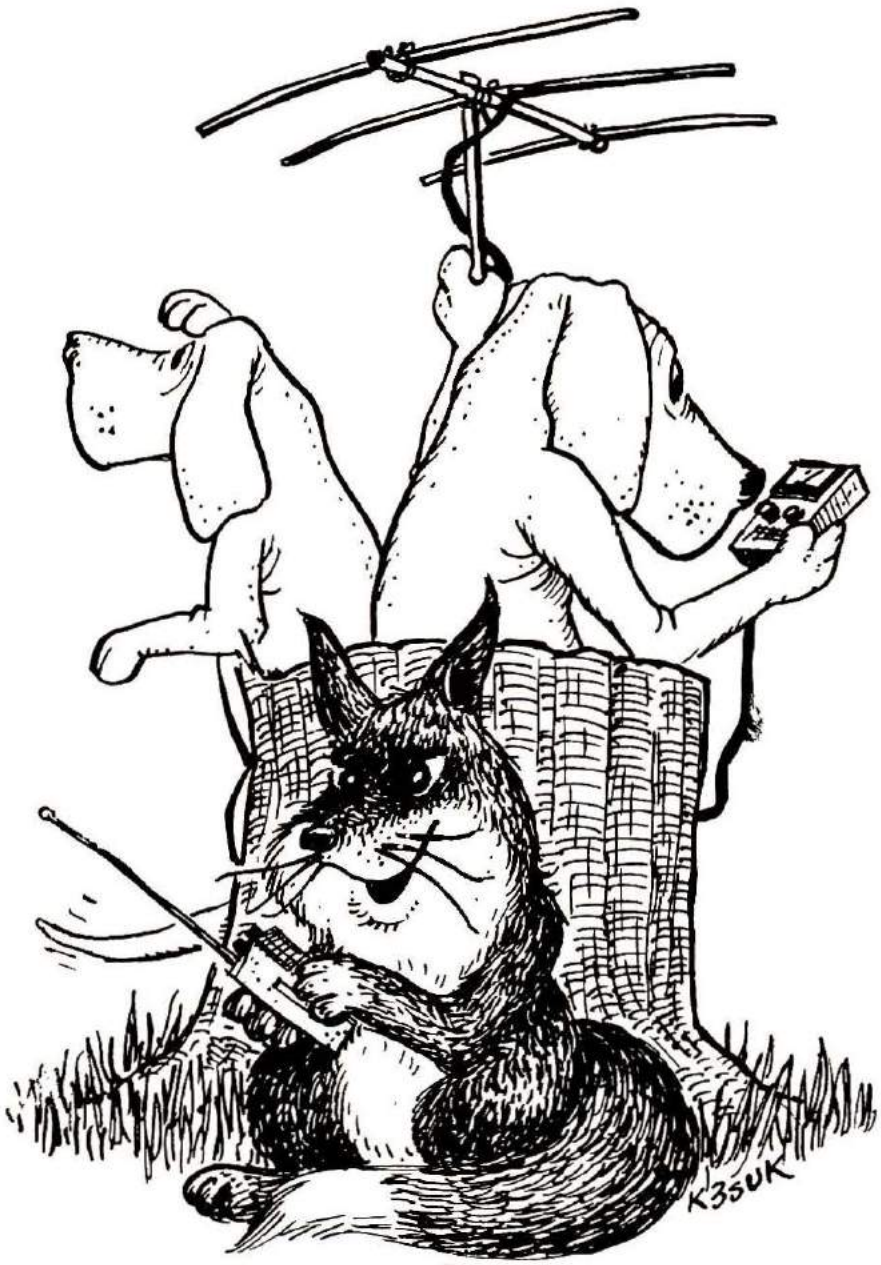
1. A. Wilson, W6NIF, "Personalized QSLs for Greater Returns," *73*, October, 1967, page 66.

2. Lee Vogel, WB6IUH, "Time-to-Reply Statistics for DX QSLs," *ham radio*, December 1968, page 50.

3. Ken Millar, ZE7JV, "A New Way to QSL," *73*, July 1969, page 24.

4. Lowell White, W2CNQ, "Simple DXCC Check List," *ham notebook*, *ham radio*, June 1973, page 55.

HRH



Hidden transmitters and determined hunters make the game lively and the competition fierce

BY JANICE SHILLINGTON, N9YL

some foxhunting fundamentals

My type of foxhunting is not the game revered by the British — well dressed riders, mounted on excellent horses, chasing over field and wood to the baying of many hounds. Nor is it the nightly journey by men and hounds in parts of Appalachia, in traditional pursuit of their wily adversary, that I'll tell you about.

Foxhunting by radio amateurs can be just as thrilling, the chase just as eager, and the satisfaction just as great, as in the more ancient sport. It has a multitude of social benefits too, such as helping to keep interest high among club members, and getting newcomers acquainted with the seasoned hunters.

There are some great technical side-effects that benefit all of us: foxhunting groups are ready to help in case of emergency — a car in trouble; a boat or plane in an unknown location — and they have had practice in using their techniques. And, (I hate to say it) there are sometimes repeater jammers who need to be found. A good foxhunting team in your club should be an excellent deterrent to intentional interference, and a source of quick relief from accidental jamming (a stuck microphone button in a parked car; a rig that is too easy for a toddler to reach).

But, we don't think of these things when we are out on the chase. It's fun, it's great competition, and it's a marvelous part of amateur radio.

The thrill of the chase, the magic of the hunt, and the cunning of the fox are part of the attraction of foxhunting. Sure, the fox is caught, but he is not cowering with fear; usually he is relieved to be found after hiding for several hours!

Amateur-radio foxhunting is a skill whereby the fox, a fellow amateur, tries to elude his fellow hams, the hunters or the hounds. From his hidden location, he periodically transmits signals on the same frequency to his fellow hams.

Meanwhile, the hunters try to locate "the den" through astute observation and skill (although I must admit Lady Luck can play a very definite role). The first hunter to find the fox is then the fox for the next hunt.

Getting started

First of all, contact your nearby radio clubs and find out the details of their foxhunts such as day, time, frequency, power requirements, border limits, etc. For example, the Wheaton Community Radio Amateur Club has no hard and fast rules, except that the fox must be within the county limits. The 2-meter foxhunts (they also have 10-meter hunts) are held twice a month on Sunday afternoons. There is no set starting place and the fox transmits frequently. You can pick out your own place to start, and try to "psych out" the fox. Some clubs have definite starting places and the fox transmits only once every 10 minutes. Although it is certainly not necessary, it will help if you go with another hunter on your first hunt and get the feel of the game.

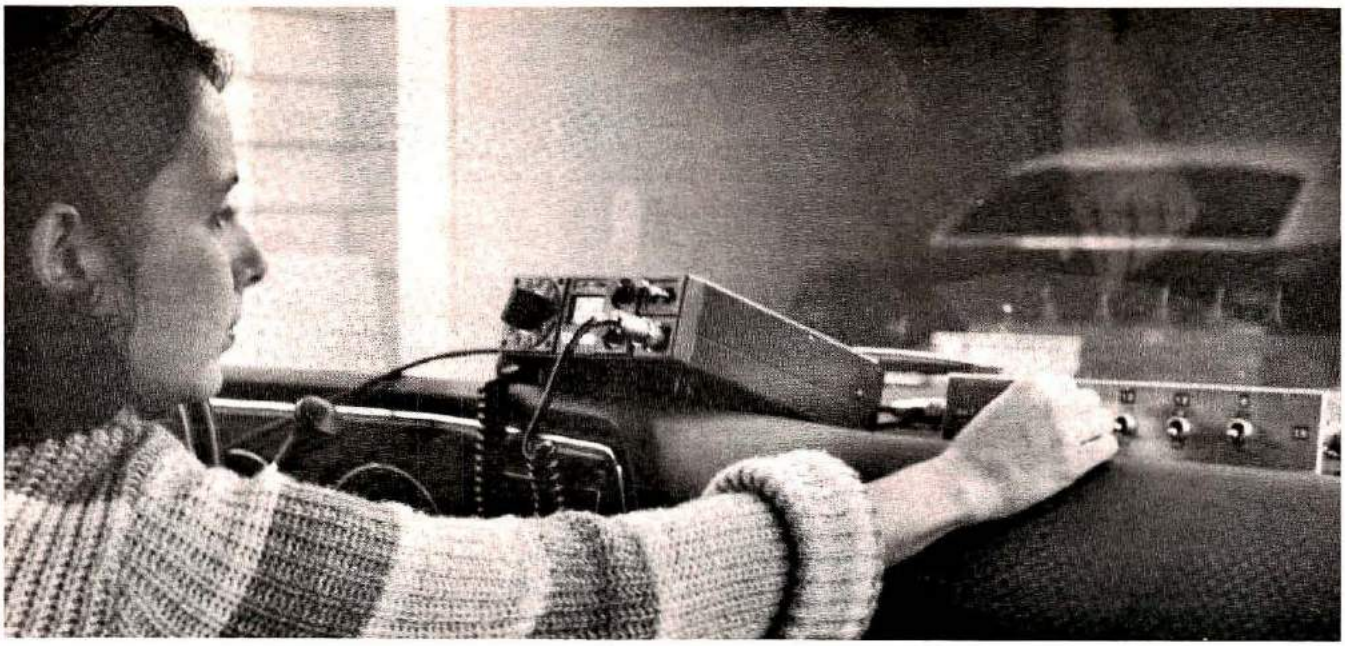
You do need several things to make life easier: a receiver with a signal-strength meter, an antenna, and probably an input attenuator. Remember, even if you are still a Novice and do not have 2-meter privileges, you can still join the hunt just by listening.

My family and I use a directional antenna. A four-element beam for 2 meters costs approximately $20. One ham I know built his own loop, another one used a coat hanger to find the fox, but 90 per cent seem to use some type of beam antenna. In one instance, a ham using a simple quarter-wave vertical antenna beat us all! So keep in mind that all my recommendations are purely suggestions and you might very well have better ideas. That's a big part of the fun in amateur radio — experimenting and implementing your own ideas.

The attenuator is placed between the antenna and the input of the receiver to lessen or attenuate the signal strength. It should be variable, allowing you to attenuate in small steps. The attenuator is necessary because when you get close to the radiating signal, the radio becomes fully saturated (overloaded) and the meter indicates full-scale, no matter which direction the antenna is pointed. In the *ARRL Radio Amateur's Handbook* there is a simple schematic for an effective attenuator.

Some hams have special "fox boxes." An example would be a crystal-controlled receiver (the less sensitive the better) with built in attenuators and

Getting ready to go foxhunting. The antenna mast fits into a bracket on the side of the door. It's easy to stop the car and turn the antenna to take a bearing on the signal.



The transceiver is temporarily placed on the dashboard, where I can see the meter reading at a glance.

metering. This receiver could be powered by a lantern battery, making it portable. A few radio stores even have fox-box kits.

Find the fox

Next is a matter of methodical search and astute observation. You know the fox is there somewhere — just find him. Also remember that the fox is cunning. I am almost embarrassed to admit how many "fox stories" I fell for, and was actually looking for a tunnel 500 feet (150 meters) underground! But, you have to be sharp, because many times the "fox stories" are true, with a little stretch of the imagination. That slight rise in the hill or the horizon could look like a "mountain." However, the longer he waits, the more accurate his clues become.

Now, for mounting your antenna, here are two suggestions about racks for your car (see **Figs. 1** and **2**). Foxhunting will be much easier if you are able to rotate your beam from your car while enroute. Be sure to bring a nice heavy glove for your hand if the weather is cool.

Another method is to simply have your antenna in the trunk and periodically stop and get out of the car and turn the beam. Make it a family affair and let your wife jump out while you interpret the meter. It might be wise to have a third party available to give messages from the meter man to the antenna woman; it saves a lot of yelling. But the system works; we have friends who frequently come in first using this "jump out" method.

The basic idea is that your meter will have its highest reading in the direction of the

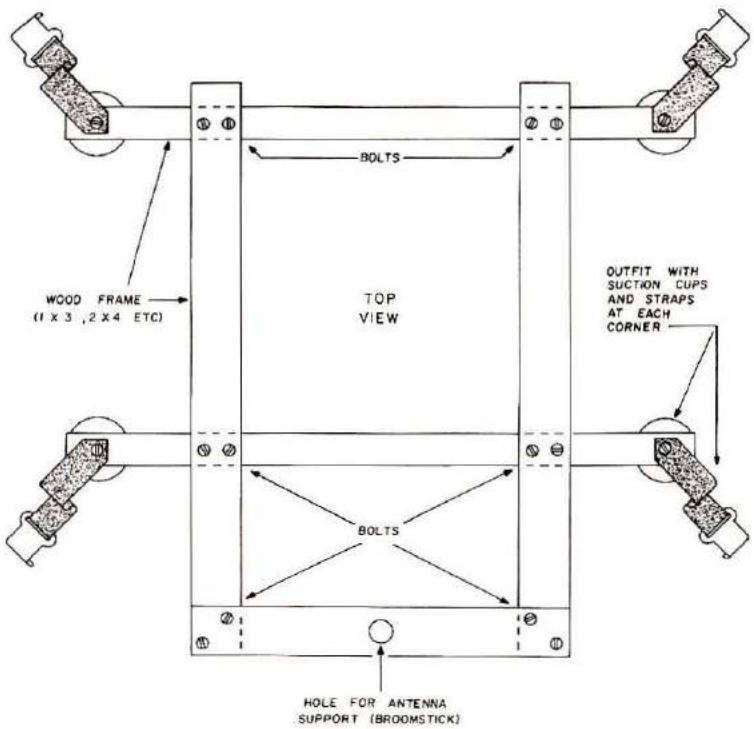


Fig. 1. A handy mount for holding a mobile direction-finding antenna can be made from strips of wood. The end piece, with the antenna support (broomstick or dowel) through it, hangs over the edge of the car roof so a passenger can rotate the antenna and watch a meter reading. The mount can be fitted with its own suction cups and fastening straps, or it can be adapted to a commercially made car-top luggage rack.

radiating signal. So you go — walk, run, or drive in the direction your antenna indicates. Simple, isn't it? Sometimes you can get false readings — reflections from buildings and perhaps water towers. (Hint: when in the city, take readings at intersections). As you get closer, all of a sudden the meter reading may take a dive. Don't be taken in by that one; the fox probably saw you and lowered his transmitter power. Surprise, surprise! Remember, the readings are relative. Learn to trust your meter. Accurate interpretation of your meter reading is one of the most important things you'll have going for you. You can practice at home and get a feel for relative distances and signal-strength readings. When the receiver is fully saturated, disconnect your antenna, and be ready to go portable, just in case the fox is up a tree. My brother-in-law, W9ZCL, went on a hunt where the fox was up a tree all right — the big Christmas tree in the middle of downtown Chicago!* That's Christmas spirit and ham radio ingenuity all in one.

Trust your own judgment; just because the last five guys came back from one direction, don't assume the fox wasn't there. It's just possible that nobody found him, or, maybe they all found him and are just acting as if they didn't! I must admit it is a reassuring feeling to see some other hams in the same general location.

I rate my successes, not by coming in first (it hasn't happened yet), but by my position in the lineup. One time, we came in third, but just by 30-60 seconds. The number 1 and number 2 hunters were some of the best hounds, so I thought we did pretty well. (By the way, as I was turning the beam by the side of the road, hunter number 2 passed us, turning his beam from the car. If I could have jumped out of the car a little faster, and not become tangled up in the coax, we would have been number 2. Wishful thinking, maybe, but it's fun and there is always next time).

Get a friend to help you practice. Have him transmit periodic signals and let you try to find him strictly through your antenna-direction interpretations. Also, you could get some good practice by trying to find a repeater location.

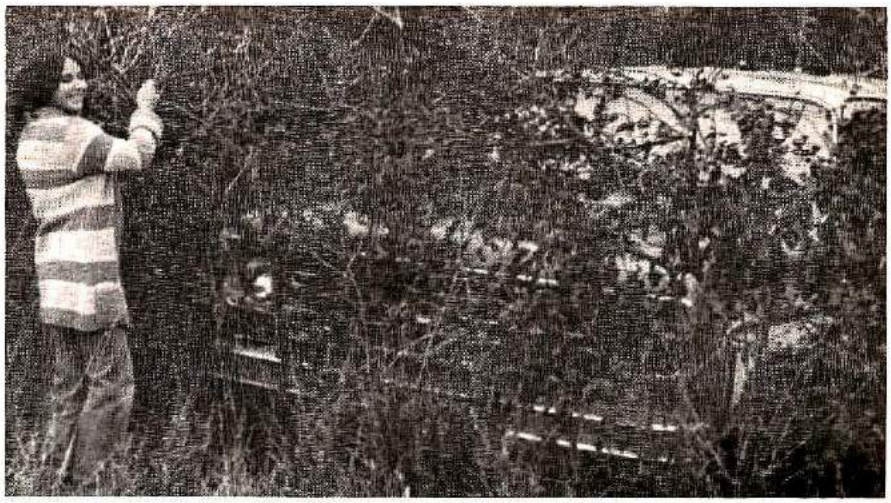
I have a feeling there are a few more tricks that I am not aware of. After all, a great chef will not give away his special recipes, so why should a great hunter tell you all the tricks of his trade? There is nothing like experience. (Hint: Bring binoculars and scan the horizon when you get close to the den).

Come on out and be a hunter! Foxhunting is limited only by your imagination, resourcefulness, and ingenuity. After all, with a little sugar and spice and a few puppy-dog tails thrown in, that's what amateur-radio operators are made of!

Late flash — it finally happened! We found the fox first! Now to find the most inaccessible, unlikely spot . . .

HRH

*The fox did get permission from the city officials.



It takes a lot of brush to hide a fox this large, but they used to camouflage tanks didn't they?

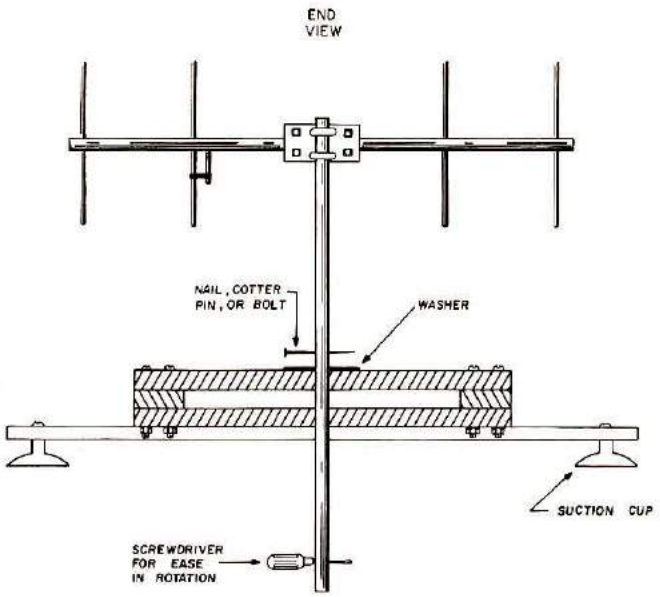


Fig. 2. An end view of the mount shows that the antenna support is given increased stability by passing through holes in both top and bottom pieces of wood. A large washer should be placed on the top piece to provide a bearing surface for the pin that holds the support in place. A convenient handle can be made by drilling a hole in the wooden support and forcing a small cross-point screwdriver through it. If the beam is aligned with the screwdriver shaft, then the screwdriver will point at the hidden station.

Other Countries Please Stand By

"QRZ Stateside from 7D9DX. Over."

AWDRGYjhLPOKUHTFEDSKXV DSFGHMUEWIRLYTVBNCMYB GHJKYIVNBNBRTYTEQMVNFI SLFKGJHPIYUFQHFBNCFgub

"This is 7D9DX. Sorry fellers, you're all bunched up. Spread out and I'll tune around the frequency. This is 7D9DX tuning two up and two down. Over."

bKJHYUKGNBOVDERBEDFGF BJHDYHTKHIJYbIFDGNMFHty YTYHNMKOODSEDHGJKLGB

"Ahh. . . . this is 7D9DX. I just can't copy any calls through the pile-up. Let's take the call areas numerically: that way everybody gets a fair deal. So QRZ W1 stations only. This is 7D9DX QRZ W1 and by."

GFDERTYUOOJKNVVMGHDh SDJKUIOMBVGRTEGHSDKG aDFGTYUHNMGUHKOEDCVBJKk FREDHJKYUYNVBCVGKEFGH

"Ahhh. . . . Yeah. . . . Guess there are more ones than I thought — aitch eye. Now let's see. . . Are there any Rhode Island, Delaware or Vermont stations on frequency? 7D9DX by."

(Silence)

"This is 7D9DX. I guess not OK. How about Connecticut? QRZ W1 Connecticut only. This is 7D9DX standing by."

ASWDRGYBNMIUKJHYGFVCdv BFGHKTXYIQBNGVBNXZGf GFRDVXXSWQAZVBNHTYUIMt bKJHYBGTURJHGRECWDSWH

"This is 7D9DX. Waal, I guess there's plenty of activity from Connecticut today — aitch eye. I couldn't copy any calls, so what say we take the North Connecticut stations first and then I'll go on around. That way everybody gets a fair chance. So, QRZ North Connecticut only from 7D9DX. Over."

AiSJHHLKOYIPVSMNVFREVBGHN SDEWDCGXZZARVBNBXUORJh JKLOPYTREWQZCBNMMFGH NMYUIKOLPGFDWGVBNFTYdESW

X-ray. Over."

"QRZ the station signing question mark X-ray. I can hear you in there old man, but just couldn't get the call. Let me have it once more, please. This is 7D9DX by for the something X-ray station."

GHJYKLJOZWNBVCSWEFHbtKPB NGFYEQZAQFDHJKLOPNMHB BMQAVBFRYUIOPKUHGFRTV JLOHLIQWYREQVBNMIQXZAD

"Ahhh. . . . this is 7D9DX. . . I guess there are more X-ray than I thought — aitch eye. Now let's see. . . suppose we take it alphabetically. That way everybody gets a fair chance. I'll take the As first. QRZ any North Connecticut station by the name of Andy with an X-ray in the call. 7D9DX by."

(Silence)

"OK. . . . well I guess Andy ain't at home — aitch eye. Okay, How about B? QRZ Connecticut, North Connecticut, that is, anyone with an X-ray in the call by the name of Bernard? 7D9DX by."

awkefpplekwa BREAK aawe 7 yy

"This is 7D9DX. Stand-by the breaker. If everyone gets out of turn we'll never get anywhere here. I'll get around to the Sevens in just a moment. OK, let's try Charlie. Should be plenty of Charlies around, I guess — aitch eye. By the way, the name here is Pete. So QRZ any North Connecticut

station named Charlie with an X-ray in the call. 7D9DX by."

[illegible]

"OK. . . . this is 7D9DX. Say, there sure are a lot of Charlies on today — aitch eye. I couldn't copy anything in that jumble. What say we try it alphabetically again. That way everybody gets an even break. So. . . ahhh. . . QRZ any North Connecticut station with an X-ray in the call named Charlie Abrahams. This is 7D9DX standing by. Over."

(Silence)

"This is 7D9DX. . . Okay, no As, how about Bs? Any Charlie Browns on frequency? Go ahead."

[illegible]

"Ahhh. . . this is 7D9DX. Okay. Sure was a pile of you Charlie Browns there — aitch eye — okay, tell ya what we'll do, I'll take the guys with the transceivers first and then the guys with separates later. That way everybody gets an even break. So QRZ any North Connecticut station named Charlie Brown using transceive with an X-ray in the call. Other stations please stand by. This is 7D9DX. Over."

Later (much later): "This is 7D9DX. QRZ any North Connecticut station by the name of Charlie Brown with an X-ray in the call, using transceive, aged 34, with two children and DXCC two hundred and fifty or better, of Scandinavian descent. What say, please? Over."

(Silence)

"Ahhh. . . this is 7D9DX. Well, I guess we are weeding 'em out now. Fellers, I think the band is going out on me here, but I'll be around tomorrow same time, same frequency."

HRH

TEN-TEC 540/544—the transceivers that almost seem like an extension of yourself. Following your every command, easily, simply — because we did our homework. They are designed with the same out-front thinking that characterizes all Ten-Tec equipment — super-sophisticated to make things simple for you.

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SIGNAL HANDLING OF ALL SIZES. IT'S SIMPLE! From the "down under" DX to the KW next door, the 540/544 series has excellent dynamic range that goes a long way in minimizing front-end overload. And that's important in today's growing amateur radio population. So is the 8-pole i-f filter. It gives you State-of-the-Art signal separation in those crowded bands — to make your operating simpler, more enjoyable.

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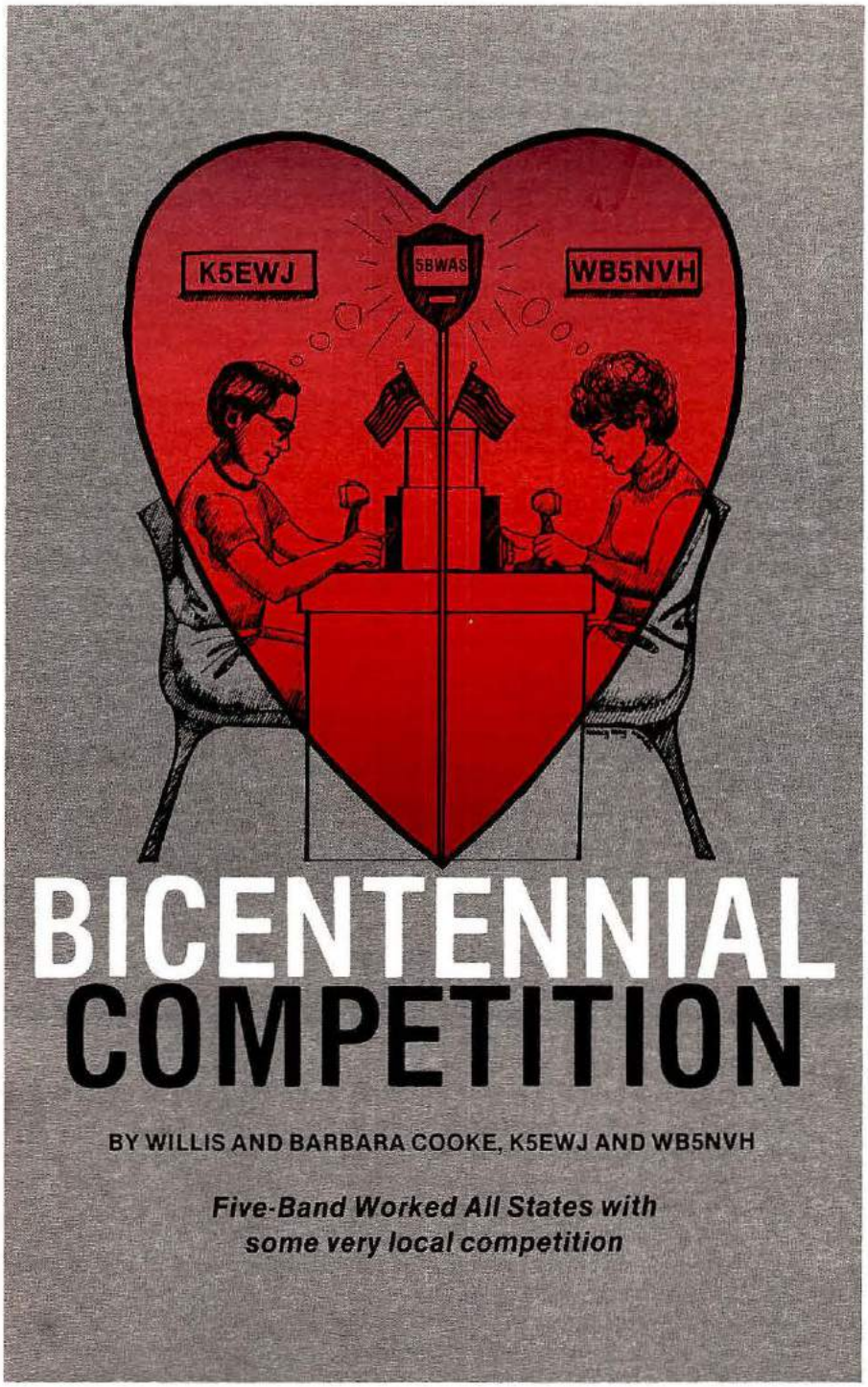


BICENTENNIAL COMPETITION

BY WILLIS AND BARBARA COOKE, K5EWJ AND WB5NVH

Five-Band Worked All States with some very local competition

Of the many awards offered by the ARRL, the 5-band WAS is one of the toughest to obtain. To qualify you must submit proof (QSL cards) from each station contacted, in each of the United States, on each of the high-frequency amateur bands (10-80 meters). The story illustrates that the job isn't an easy one. But winning this award lets you display your plaque with pride as an amateur who has really accomplished something in competition with his peers.

The beginning (by K5EWJ)

Our 5-band WAS story started when I became active in 1973 after a 4-year lull. I'd worked toward the WAS award at several locations, but despite more than 17 years of being licensed, frequent moves had kept me from my goal. This time I would get it or know the reason why! Four months of looking netted the single-band WAS award and spurred me on toward the 5-band award.

Another move left me frustrated. I'd worked 198 states toward the 5-band award and gathered 180 QSLs. I vowed I'd never again set the 5-band as a goal — just too much work and the QSL effort too expensive.

One of the brighter aspects was that my wife, Barb, had become interested in getting her license. I had been commuting long distances and became a 2-meter repeater user. She could follow my progress through a rig I set up for her, and before long the urge to talk back got to Barb. After a little work on code, and a lot of tears over theory, Barb was licensed as WB5NVH with a technician ticket in February, 1975.

The 5-band award was forgotten during 1975, and two meters was the mainstay. We both became active in organizing a repeater club. The high-frequency bands were almost forgotten. The Bicentennial year began with joint New Year's resolutions to upgrade our licenses. The air rang with Morse code day and night; a tape recorder became well worn, and the W1AW code practice was an important household event. Dinner conversation ran toward Hartley and Colpitts oscillators and FCC regs.

Barb and I decided we had a reasonable chance of passing the exam. We made the trek to the FCC on Thursday, February 12. A couple of cups of coffee later, the examiner arrived. When we asked for two form 610s, he replied, "Today isn't amateur day. Effective the first of the year, amateur day is Wednesday!" Another week to study and sweat!

The next Wednesday we went through the coffee routine

again, but this was the right day. Barb went in for the 13 wpm code test while I waited. When the examiner reappeared, he broke the bad news to one unfortunate soul, then announced the rest had passed. Barb made it! Now could I pass the 20 wpm code test? Yes, just barely. Somehow the examiner found a hundred letters correctly copied. We then took the theory tests. Both okay. We left to begin the 7-week wait for our General- and Extra-class licenses.

Co-author Barb, WB5NVH, at the operating position. Barb passed the examination for amateur Advanced Class in January, 1977. Look out, you big-gun DXers!

The Bicentennial WAS

With the tests behind us, we had time to read *QST*. The Bicentennial WAS competition caught my eye. I mentioned to Barb that we should try for it, and she replied, "I can't see why anyone would set such an arbitrary goal for himself." Undaunted, I proceeded to amass a total of three states confirmed.

A lazy Saturday morning, April 10th, was interrupted by the clatter of the mailbox. I checked for you-know-what, and sure enough there they were — two new licenses. The 7-week, 3-day wait was ended. Interest in the hf bands was renewed.

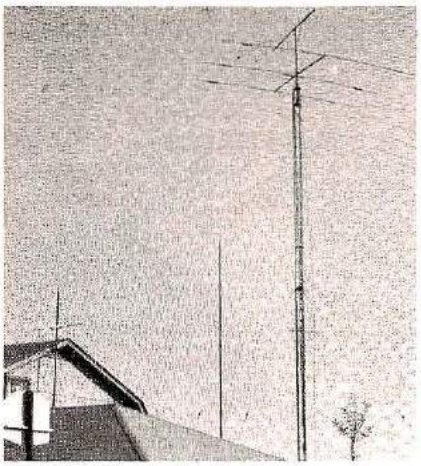
A call on 2-meters and a quick tuneup of the rig set Barb up for her first hf contact with WA5PQJ, which broke the ice. After a few unfruitful days on 40 meters while I was at work, Barb switched to 20 meters and discovered the YL ISSB system. When I came home, Barb had 9 more contacts with 8 new states and Canada. She had a gleam in her eye that could only mean she was hooked on the WAS game.

Willis "Cookie" Cooke, K5EWJ at the business end of his amateur radio station. Included are a Galaxy V transceiver, and a Kenwood TS-820. For tough going, a Hunter Bandit 2000A linear amplifier is used.

Competition

With two hams in the same house working toward the same award, what could result but a contest? Barb worked the rig during the day and I worked it at night. Barb stayed on 20 meters and I hopped from band to band as conditions dictated. We were roughly even until I had to leave the country on business during May. I returned three weeks later to find that Barb was almost finished with her Bicentennial WAS, all on 20 meters, and I had to concede defeat in the contest.

I'm not sure when it happened, but somewhere along the line, WA5PQJ suggested that we work 5-band Bicentennial WAS. Impossible! Not in 1976 with the bands in such bad shape! We could never work New England and Alaska on 10 meters. But we covered the door to the shack with ten maps in short order.



The antenna farm at K5EWJ/WB5NVH. The tower is 60 feet (18m) high and supports a Mosley tri-bander as well as a two-meter Yagi. Inverted-V antennas are used for 40 and 80 meters.

With 20 meters finished, Barb turned to 75 meters and the Bicentennial WAS Net, which met at midnight. I continued to hunt, catch-as-catch-can, and looked forward to the Bicentennial contest, hoping to catch up. All through June, I focused my attention on 10 meters, taking advantage of the frequent openings and looking for New England and Alaska. Connecticut and Massachusetts came through, as did Wyoming, Montana, and North Dakota; but the rare W1s and KL7 eluded me.

Barb was making steady progress on 75 meters and she also started working the 40-meter WAS net. As if getting waxed for the Bicentennial wasn't bad enough, I had to try to sleep to the tune of 75 and 40 meters and get up at 5:30 AM for work, while Barb forged ahead. About this same time, Barb began to work 10 meters in the daytime, snagging Delaware her first day on the band. I couldn't find Delaware anywhere.

New equipment

The new Kenwood TS-820 caught our eyes, and we decided we had to have one, so we ordered in early July. I told Barb that if I hadn't worked Delaware by the time the new Kenwood arrived, she couldn't use it until I *did* work Delaware. Even I don't know if I was serious or joking.

Barb must have taken me seriously, because a couple of nights later she woke me up at 2 AM with the news that she had found a Delaware station for me on 40 meters! I got out of bed, sat down at the operating position, and put on the headphones, then just sat there in a daze, too near asleep to call the station. A couple of nights later, the same thing happened, but this time I woke up enough to work W3DQZ in Wilmington. This contact had the combined benefits of finishing the Bicentennial WAS for me and stopping Barb from rousting me out in the middle of the night.

Barb's Bicentennial WAS number 789 now adorned our wall and was soon joined by her certificate from the 75-meter WAS net. I didn't feel too badly because I knew my Bicentennial would soon be here — also two contests were coming up to help me play catchup. Certificate number 1176 eventually arrived.

Now the 5-Band award

The County Hunters CW contest yielded 22 new states and whetted my appetite for the Bicentennial celebration. A good effort there brought 134 new states. For the next two weeks I didn't have time to get on the air, because I was spending all my operating time filling out and sending cards. With over 200 states worked, I had passed my 1974 mark, and Barb was doing about as well. She had 75, 40, and 20 meters completed, over 40 states on 10 meters and made a good start on 15 meters during the contest. I had 20 meters marked off and a good start toward the other four bands. Still, the 5-band award looked like an impossible goal for the Bicentennial year. Propagation to New England and Alaska on 10 meters looked hopeless.

The new transceiver remained on 10 meters, and every few minutes one of us tuned the band with the beam pointed northwest. We still weren't very optimistic, but you'll never know if you don't try. We called information (directory assistance) and got the phone number of KL7HKA, which we posted on the bulletin board. We thought that if ever we heard British Columbia well, there might be a chance to work southern Alaska, and KL7HKA lives in Ketchikan. Day after day we listened, but no sign of a KL7 or VE7; not even many W7s. The ARRL 10-meter contest was marked on our calendar.

The contest came, but dared we hope for a KL7? Saturday had a good opening to South America, but not much to the northwest. I worked a few W7 stations, but all were in Arizona. Maybe Sunday? The band opened Sunday morning toward the east, and I worked a hundred or so stations, but no W7s. About noon, the W6s and W7s started to come through. Then, there was a VE7 at twenty over nine. I said, "Barb, now is the time — call KL7HKA!" KL7HKA's son answered the phone and called his Dad, KL7IHK, to the phone: "Some lady in Houston wants to talk to you or Mom." KL7IHK said that their rig wouldn't work on 10 meters but that he had a friend, KL7HGA, who was working the contest. KL7IHK called KL7HGA on 2 meters and arranged for him to look for us at 28.590 MHz. We worked KL7HGA with difficulty despite the interference!

Barb still needed Montana on 10 meters so we kept working W7s, but Washington, Oregon, and an occasional Nevada station were all that came through. Barb arranged to phone her friend W7EOI whenever Barb heard anything close to Montana on 10 meters. W7EOI would get on the air and listen for her. They made the

contact the next Saturday, December 18th. All done, except for receiving a few cards and filling out the forms!

While we filled out the forms, we checked our cards carefully for errors and found several that had mistakes. Much to my chagrin, I found that I had *no complete* cards for Kansas, Minnesota, and Nebraska on 20 meters. Checking my log, I found plenty of contacts with Kansas and Minnesota, but I hadn't worked Nebraska on 20 meters. The next morning, December 22, I worked W0CDL to complete the 250 contacts.

Barb and I may be able to claim four records: the only husband-wife team to complete 5-band WAS within 4 days of each other; and the only husband-wife team to work 5-band WAS 100 per cent during the Bicentennial year. Also, Barb worked 5-band WAS in 8 months and 8 days after getting hf-band privileges, and I may be the first ever to need Nebraska on 20 as the last state to complete 5-band WAS. Barb was awarded 5-band WAS 277, and mine was 278.

And now, Barb's story (by WB5NVH)

As the typist for what Cookie has written, I can certify that it's now basically correct. I had some interesting adventures and met some great people during a very busy first year on the hf bands. I learned so much about propagation, operating practices, and use of our equipment!

I'd like to mention some of the high points, but first I want to address the subject of "arbitrary goals." In retrospect, I see several reasons why a person would set such a goal for himself. The thrill of competition is addictive and is probably reason enough for many of us. I've also found that, without a major goal for being on the air, I'm not nearly as active now as I was before I finished the 5-band WAS.

The authors proudly showing their 5-Band WAS plaques, which were earned for a job well done after many hours of trying.

With a growing interest in Public Service, I can see that you can't be of much help if you aren't on the air and aware of a problem when you're needed. Finally, I've discovered an *esprit de corps* with my peers that is there in whatever endeavor chosen within amateur radio. The achievement itself isn't nearly as important to me as are the memories of this fantastic year.

Chivalry may be dead in a lot of places, but not in Amateur Radio. I can't recall anyone's being rude to this newcomer, not even the net and system control operators, whose patience I'm sure I strained a few times. I tried to "do as Rome does," on whatever band I was working, and became a certificate hunter. There was the Bicentennial WAS net on 75 meters, and a certificate for WAS — all on 3.905 MHz. There was also a WAS net on 40 meters, and a bunch of new friends. (I tried my hand at Net Control a couple times — tricky and very enlightening.) The YL ISSB system, with its own awards program, is on a frequency I'll visit again and again; it's populated by some of the warmest, kindest people in the world.

I discovered some amazing things about the different bands. (Secrets previously known to everyone else, but not to me.) Who'd have guessed that 40 meters could act like 10 meters at 4 AM with sudden openings and rapid signal fade?

Seventy-five meters in June, with an old Galaxy V transceiver, was an agony of high static and bleeding ears. In November, with the new rig, 75 meters showed promise of being a really nice band.

People and their callsigns keep coming to my mind — W4GDY on two bands and AA4WCG — the most efficient net I've ever heard.

I remember four special people in Alaska. KL7HKA was my first Alaskan contact. Her husband, KL7IHK, and I had our conversation on the landline. KL7IHK helped set up my contact with KL7HGA for my WAS-5 number 249.

It's a credit to the ARRL for coming up with an incentive that inspired so many people to do so many wacky things, at such weird hours, to acquire a piece of paper reading, "BICENTENNIAL WAS AWARD, Worked All States. Presented to _____."

HRH

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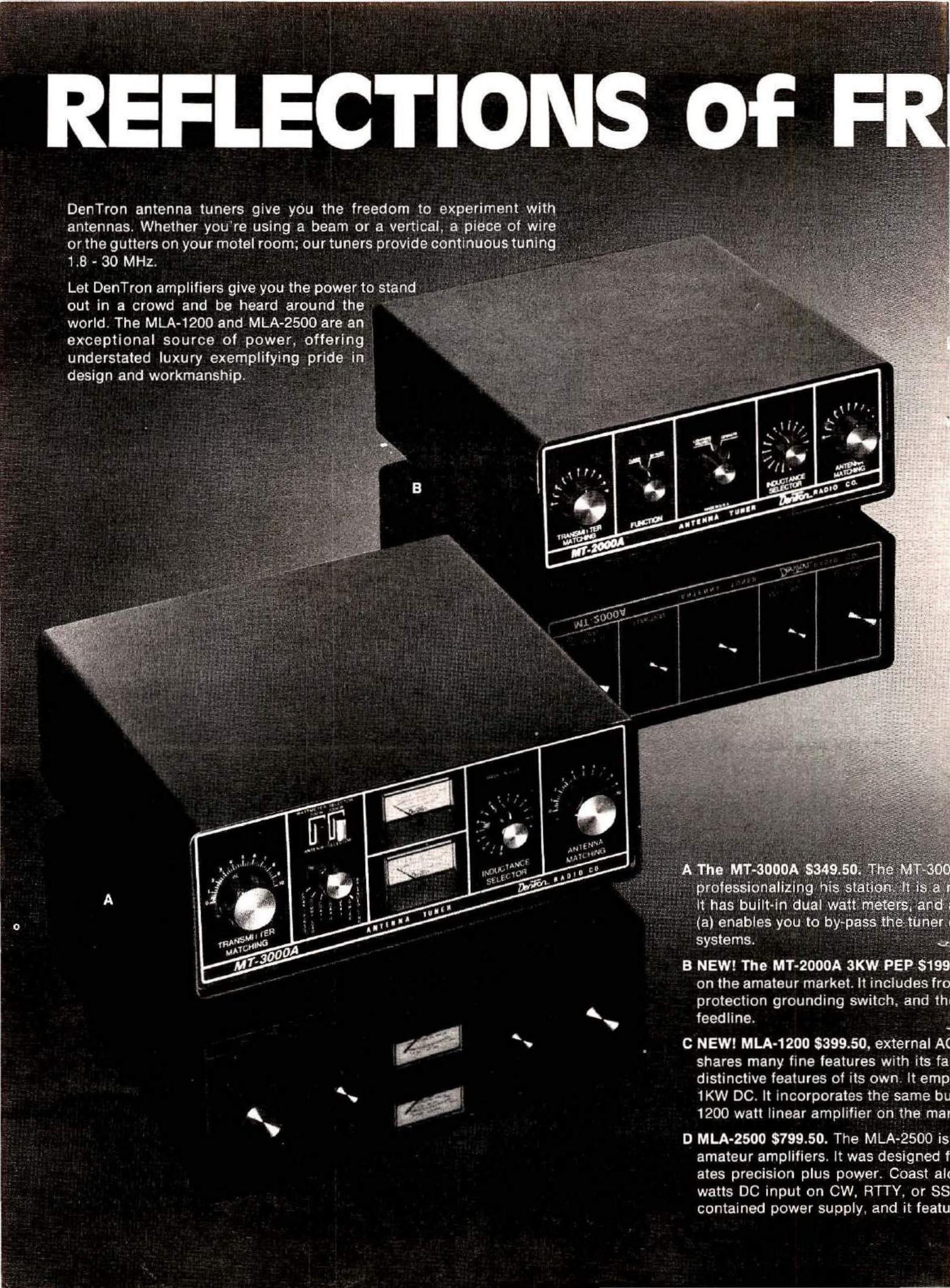

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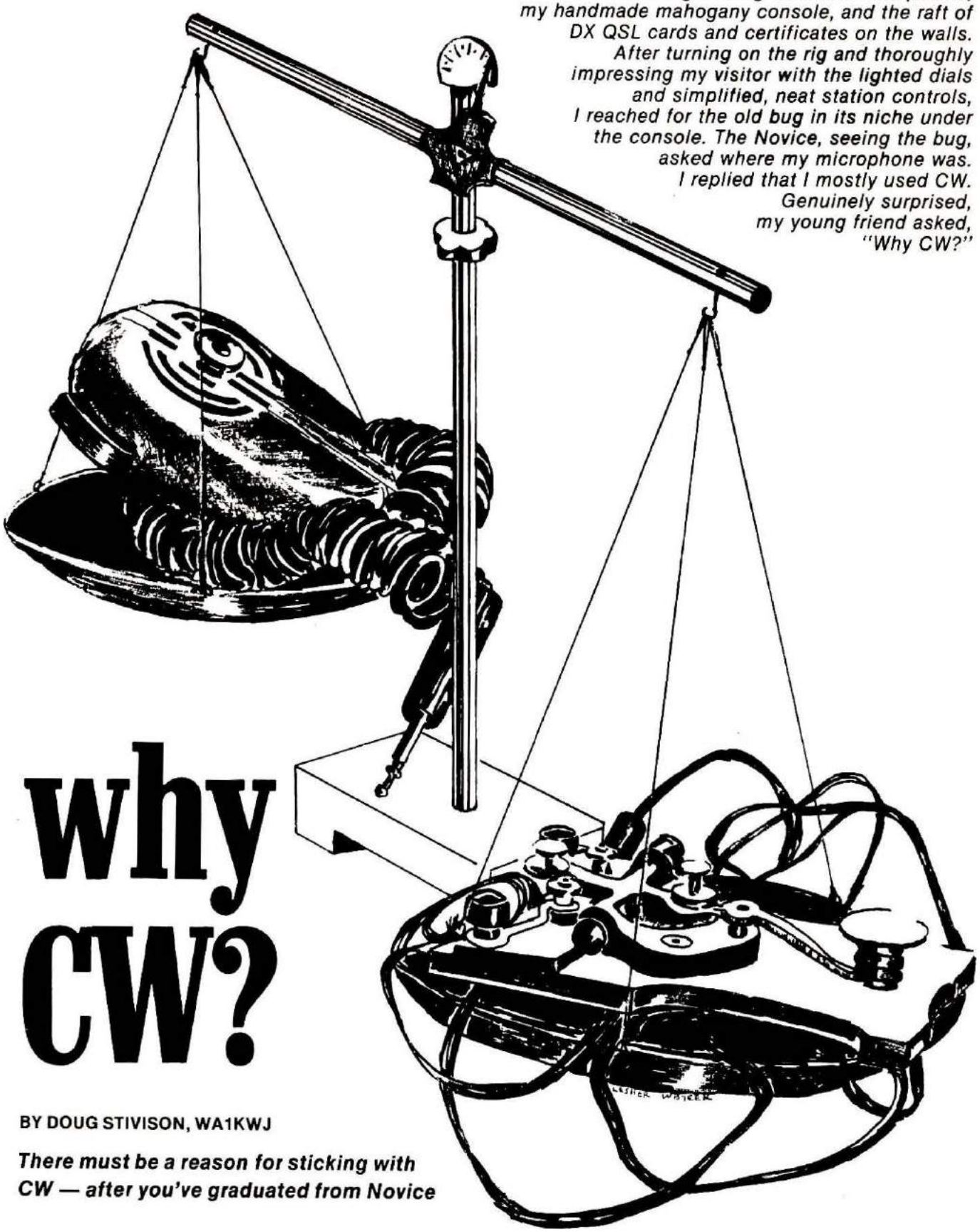
A young Novice entered my shack and admired the glittering Collins S-Line panels, my handmade mahogany console, and the raft of DX QSL cards and certificates on the walls. After turning on the rig and thoroughly impressing my visitor with the lighted dials and simplified, neat station controls, I reached for the old bug in its niche under the console. The Novice, seeing the bug, asked where my microphone was. I replied that I mostly used CW. Genuinely surprised, my young friend asked, "Why CW?"



why CW?

BY DOUG STIVISON, WA1KWJ

There must be a reason for sticking with CW — after you've graduated from Novice

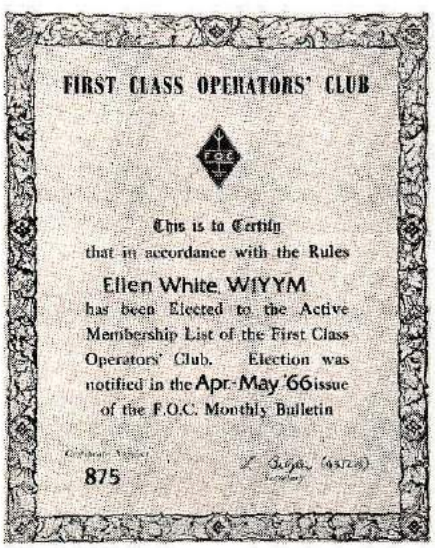
It seemed incomprehensible to him that once one was freed from the Novice-class restrictions and had fine-quality phone equipment that one would willingly prefer CW.

Perhaps this is puzzling to many amateurs — not just to Novices whose impression of CW is based on agonizingly slow speed, hundreds of nearly identical formula-like contacts, and hours of struggling through the din of Novice-band QRM. Yet for thousands of radio amateurs, CW is what amateur radio is, essentially, all about.

There is a sense of satisfaction in copying some well-sent, rapid CW that I have never experienced in any of the other facets of the hobby. For other amateurs, their greatest joy comes from triumphing in the heat of a DX pileup; some from getting a homebrewed circuit to perform perfectly; some from hearing the rattle of their RTTY machines. To me, there is a sense of proficiency and satisfaction in making sense out of a group of arbitrary sounds which, to 99.9 per cent of the people in this world, is utterly unintelligible noise.

CW lends itself to simple and efficient station layout. In the tradition of the old-timers, the author copies high-speed CW on a typewriter, or "mill." With practice, typewritten copy becomes both easy and automatic. The semi-automatic key, or "bug" is used most of the time, but a traditional straight key lurks in the console niche ready for a quick shift to slower speeds for excursions in the Novice bands.

Being able to copy Morse Code at high speed doesn't necessarily make you a good operator. Courtesy, correct procedure, versatility, and activity are some of the areas of qualification to become a member of the First Class CW Operator's Club (FOC). Membership is by nomination of five current members on at least two continents. You'll frequently hear FOC people near the low end of the bands calling "CQ FOC," where they enjoy the companionship of fellow amateurs who appreciate the thrill of good CW conversation.



FIRST CLASS OPERATORS' CLUB

This is to Certify
that in accordance with the Rules
Ellen White, W1YYM
has been Elected to the Active
Membership List of the First Class
Operators' Club. Election was
notified in the Apr.-May '66 issue
of the F.O.C. Monthly Bulletin

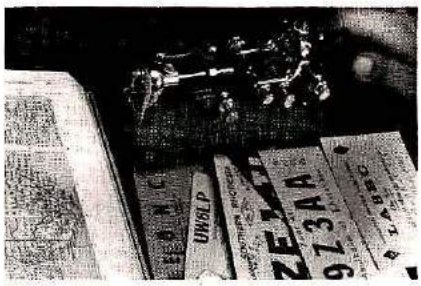
875

Traditions

There is a strong sense of being a part of an elite and proud tradition: the brotherhood of those true wireless pioneers who proved the commercial worth of radio to a skeptical business world and a bedazzled public. Our legacy from the press and marine operators is alive today in every page of clean copy; in every sentence wrenched from the demons of noise and interference; in every crisply-sent procedure sign.

My young visitor, intrigued by this tirade, asked me about these early operators. We are fortunate that there are still many of these unsung radio pioneers with us today, as active old-timers. Sadly, though, each year adds a few more of their names to the roll of silent keys. I guess the next generation of amateurs might not have that many two-letter calls in their log book; might not have that many QSL cards on their wall proudly bearing the emblems of the Society of Wireless Pioneers or the Antique Wireless Association or the other organizations of old brass-pounders. Perhaps those historic, lilting, romantic swings will no longer enliven the periodic Straight-Key Night celebrations. It is not too late, however, to look for the roots of our proud, amateur radio traditions.

Even before there was radio as we know it today or even before there was a telephone service, there was telegraphy transmitted over wires. Since 1844 there have been men whose job was to convey information by telegraphy. By the exact yet simple making and breaking of a circuit through a telegraph key, the



CW can be your simplest key to working DX and getting to know foreign amateurs.

world became united as it had never been before. Once a wire was strung between two points, no vital news could be delayed more than a fraction of a second. No longer could there be a tragedy like the Battle of New Orleans in which tens of thousands of soldiers died — days after peace had been declared — because the military leaders had not heard the news of the armistice.

Political and sports news, weather, economic information, and personal messages were all transmitted daily by telegraph. Every character and every word was sent through one man's skill at sending and another man's skill at transcribing a clicking, intermittent signal. As the bulk of traffic increased, the skills of the professional telegraphers became legendary. There is one story which has been retold by so many old telegraphers, in so many versions, that it must have its basis in fact. The story generally goes like this:

The old-timer

The storyteller always claims to have been an office boy in a telegraph office. On his first day of work he stares in awe at the telegrapher who sits quickly typing endless copy on an old office typewriter, easily chain-feeding page after page of fresh paper, and neatly piling up the typed copy. Eventually the next shift's operator would walk into the office. With the sounder still clattering with the endless stream of characters, the exhausted operator would finish the page he was working on and place it on the finished copy pile. After saying a few words to the new operator, he would walk out.

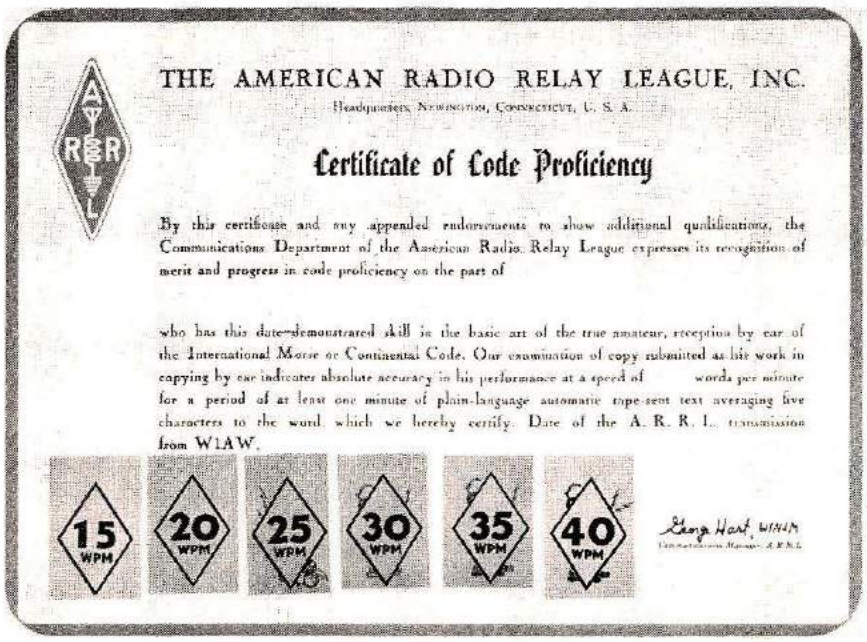
With the machine-gun like sounds still pouring from the sounder, the new op would slowly remove his hat and coat, hanging them up neatly. Ignoring the incessant clatter from the sounder box, he would greet the new office boy while filling his coffee mug. Finally he would saunter over to his chair and then begin to meticulously pack and light his pipe — generally using two or three matches for effect. Finally he would insert paper in his typewriter as if he just remembered that he had entered the office for some purpose. Within a few minutes of furious typing he would have recorded every word that had come through the sounder in the last ten minutes. Like all great telegraphers, he had been copying in his head every word sent.

This degree of skill appears to have been widespread. When wireless came along — and the first marine radios were truly primitive — these operators developed the additional skill of copying signals through the nightmarish din of atmospheric noise. To combat the high noise levels and tropical electrical storms which plagued the long wave bands, these operators developed unique code rhythms and spacings to increase readability through static crashes and fading. These "swings," or variations on the standard International Morse spacing, took on a host of colorful names — banana-boat swing, Lake-Erie swing, Phillipine swing, and even a rag-time swing. In spite of poor equipment and atmospherics, these early operators set quite a record for getting the messages through.

Sparks

Every ship radio operator was known as "Sparks" — a name they retain even today. They were a cocky and talented breed. Once shrewd insurance underwriters saw the overwhelming importance of

You can get a certificate to attest to your skill at copying Morse Code. Transmissions for the purpose of qualifying for a certificate or endorsement are given each month by W1AW in the east, and by W6OWP in the west. The dates are given in *QST*, or you can obtain a list of dates and times by writing to the Communications Department, ARRL, 225 Main Street, Newington, Connecticut 06111. Each time you submit correct copy at a higher speed, you receive an endorsement sticker, up to 40 words per minute.



THE AMERICAN RADIO RELAY LEAGUE, INC.

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Certificate of Code Proficiency

By this certificate and any appended endorsements to show additional qualifications, the Communications Department of the American Radio Relay League expresses its recognition of merit and progress in code proficiency on the part of

who has this date demonstrated skill in the basic art of the true amateur, reception by ear of the International Morse or Continental Code. Our examination of copy submitted as his work in copying by ear indicates absolute accuracy in his performance at a speed of words per minute for a period of at least one minute of plain-language automatic type-sent text averaging five characters to the word, which we hereby certify. Date of the A. R. R. L. transmission from W1AW.

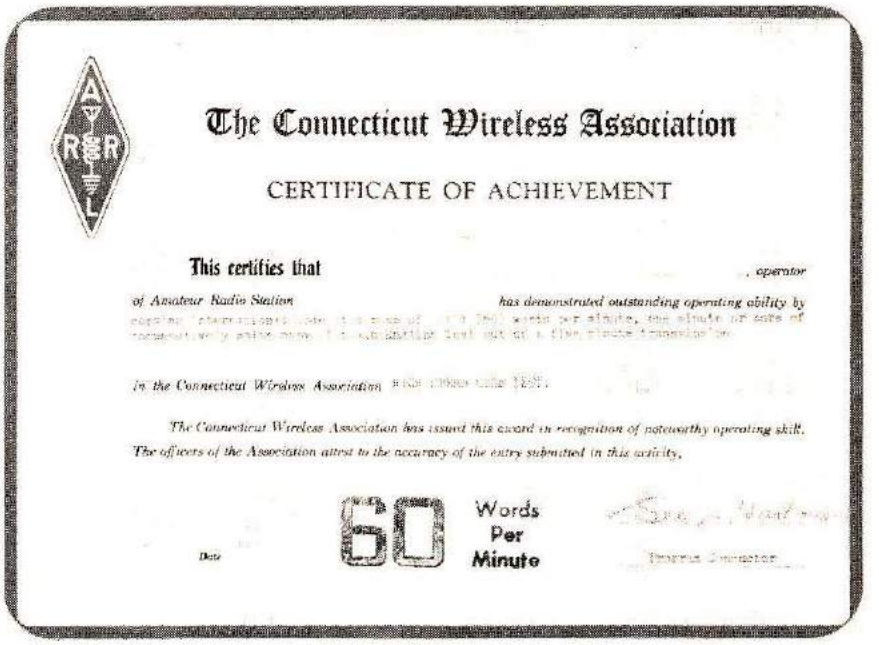
15 WPM 20 WPM 25 WPM 30 WPM 35 WPM 40 WPM

George Hart, W1HAR

shipboard radio, the sparks became not just a questionable convenience, but an economic and legal necessity. The cocky 19-year-old sparks knew the ship could not legally clear port without him — the master be damned!

What a record not only of skill, but also of valor, was carved by these ship sparks. The operators on board the *SS Republic* and the *RMS Titanic* became heroes instantly when they summoned help for their crippled vessels. Countless others also served selflessly, guiding rescuers to their sinking ships. Many sparks drowned because they would not leave their posts, remaining at their keys calling for more rescuers to save their shipmates. Theirs is a record too little recognized by the public today, but emblazoned in the heart, the soul, and the fist of every brass-pounder.

Although telegraphers and sparks were almost always men, the exigencies of war brought about a corps of exceptionally proficient women radio operators. Many a World-War-Two veteran sailor and pilot can attest to the exceptional proficiency and dedication of women military operators in every theater of the war.


The Connecticut Wireless Association

CERTIFICATE OF ACHIEVEMENT

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In the Connecticut Wireless Association

The Connecticut Wireless Association has issued this award in recognition of noteworthy operating skill. The officers of the Association attest to the accuracy of the entry submitted in this activity.

Date 60 Words Per Minute

When you feel that 40 words per minute is too slow for you, there's a chance to go higher. The Connecticut Wireless Association, 66 Highland Street, Newington, Connecticut 06111, offers high-speed qualifying runs several times a year. Although the club is affiliated with ARRL, and several of the members are employed at ARRL Headquarters, the high-speed program and award is not an official ARRL activity. It is offered by the Connecticut Wireless Association purely as a public service.

There are many amateurs today who follow proudly in the footsteps of these professional brass-pounders. Even with the advantages of modern equipment and big, efficient antennas, some of the best known radio amateurs today respond to the challenges of crack CW work. The perennial contest champ is Katashi Nose, KH6IJ. Besides his ability to work contests by maintaining a 60 word-per-minute pace for hours on end, he has toured the United States while operating CW mobile in his car. The famous DXer and DXpeditionaire Gus Browning, W4BPD, tells of developing his skills to send rapidly with one hand while writing up his log entries with the other hand in order to be able to work more stations per minute on his DXpeditions. Certainly both Gus and Katashi could have chosen the easier course of the push-to-talk switch.

Perhaps this all sounds like the mountain climber's concept of scaling a peak simply because it is there. There are

The author in his most characteristic pose — his back to household chores, his hand controlling his bug, and his mind involved in a DX contact.

strong arguments that facsimile and RTTY and ssb carry more information faster and with greater efficiency — CW's traditional claim over a-m. Yet today more than ever, in the face of ever-increasing sophistication of commercially-made amateur gear and the increased difficulties of securing build-it-yourself components, an amateur can build a CW rig far more easily and much more economically than any other type of equipment. Even receivers, traditionally the most challenging of construction projects, can be built more simply for CW-only reception because of simple, narrow-bandwidth filter technologies.

A real advantage

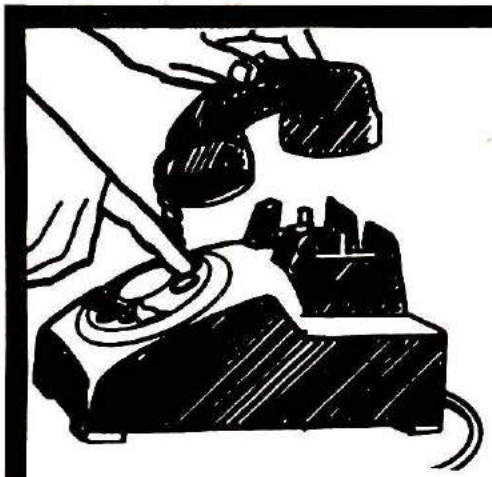
And there is still at least one practical advantage of CW even to the amateur with his chrome-plated does-everything commercial gear: in hundreds of countries around the globe there are thousands of DX operators who work only CW. Unlike the visiting foreign technician with his American gear (and American point of view) or the tiny, wealthy minority, the bulk of the indigenous, everyday, middle-class amateurs overseas run small, homebrew, or converted military-surplus CW gear. If you really want to work DX and to get to know the operators on the other end, you have to do it with the only mode open to them — CW. While searching for low-powered DX CW stations, I have worked dozens of foreign hams ecstatic to work into the United States. For them, unlike so many of their colleagues on ssb, I was not just their ten thousandth WA1 contact.

After listening to all this, my young Novice friend seemed quite eager to return to his own shack and start polishing up his own CW technique.

"Of course there is one more reason why I like CW," I said.

"What's that?"

"The fun of it." **HRH**



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THE FAR HORIZON

It's Contest Time

BY BOB LOCHER, W9KNI

For many radio amateurs who chase the Far Horizon, the months of February and March hold a special significance: it's Contest Time! And not just any contest — it's the ARRL DX contest — United States and Canadian hams against the world. It's one of the two big contests for the DX gang, the other being in the fall, and we'll take a look at that one when the time comes.

Contests in general, and DX contests in particular, are different things to different hams. It's a chance to add a lot of DX contacts to the pages of your log; it's a fine test of equipment, and a great opportunity to sharpen your operating skills.

You say you have only forty watts to a wet string? And you live in Radio Hole? And your hand key collapses in the middle of every fourth contact? And the only DX you ever worked was a KP4 in Puerto Rico? And he got your call wrong? Is that what's troubling you, OM?

Well, cheer up! The DX contest will give any ham an unparalleled shot at working a hatfull of DX. Let's take a look at why this is so, and how you can go about taking advantage of it.

Four weekends

The ARRL DX contest is run over four weekends — two for CW and two for phone. The CW weekends are February 18 and 19, and March 18 and 19, 1978. The phone weekends are February 4 and 5, and March 4 and 5, 1978. The contests start at 0000Z/0000 GMT on the dates indicated, and run for 48 hours. 0000Z is Greenwich Mean Time, often called Zulu time by hams and others, because Greenwich, England, is on the zero meridian. The situation can be further confused by the new terminology, UTC, which is the same as GMT but stands for Coordinated Universal Time. (The initials, UTC, are derived from the French *Universel Temps Cordonne*, but most English-speaking users of GMT and UTC refer to Coordinated Universal Time, even though the letters are not in the right sequence.) Anyway, 0000 is 7 PM EST, 6 PM CST, 5 PM MST, and 4 PM PST. Later, you'll have to adjust for

daylight savings time when it applies. (Now you understand why most hams and all DXers keep their logs in GMT!)

If you are new to DXing, don't bother to turn on the transmitter Friday night. Listen by all means and learn what it's all about; Friday night is when the big guns are out trying to run up an early lead, and there will be huge pileups on everything in sight. The situation will be reminiscent of the first day of the Battle of the Marne, or maybe the Indianapolis 500. But listen and learn, because your chance is coming soon.

Ground rules

The way the contest works is that United States stations (except Alaska and Hawaii) and Canadian stations try to work as many stations in other countries, and as many other countries as possible. Alaska and Hawaii count as foreign countries for this contest. Each foreign station may be contacted only once per band, but may be worked again on other bands. The hot-shot contest operators can really run up fantastic scores — 3000 contacts in over 150 countries is not unheard of — but this time around we'll talk in terms of getting your feet wet, seeing what it is all about, working some new countries, and having a good time in general.

When you work a foreign station in the contest, you send a signal report and your state or province. He counters with a signal report and the power input he is using. Contest contacts are brief, so that as many QSOs as possible can be made in the limited time that the contest runs.

Now, let's take a look at the game plan. First off, if you are new to chasing the Far Horizon of DX, your best chance of scoring will be on 20 and 15 meters. At 0000Z in mid-winter, these bands will be going out and nearly closed. Unless conditions are poor, some Central and South Americans, and possibly a few Pacific stations will be coming through on 15 meters. Twenty meters will provide Central and South America, some Pacific stations, and also some Japanese and Siberian stations. These conditions will be marginal for hams in the Eastern United States and Canada, better for the Midwest, and fine for the West Coast at that time.

So, fire up the receiver, and let's take a look around. Hmmm . . . It's 2350Z — that's ten minutes before the contest starts. A look across 15 shows nothing — the band must be dead already. Let's take a look at 20. Yes, there are some signals, but it seems like half of them are just carriers, tuning up. Huh? There's a real speed merchant — 569. What's his call? VKØZAA? That can't be right. There he goes again — CQ CQ VKØZAA? No, no, it's UKØZAA — a Siberian — and is he ever going to town with that keyer. Oh well, let's look on . . . there's another . . . he's going a little slower. It's JH1PKR. Let's see — back of the log book — there it is: It is Japan. That list of prefix allocations in the back of the logbook is sometimes a big help in figuring out where a station is.

2358Z: two minutes and counting. Oh boy! Listen to all those carriers; people checking their rigs. Most of them in the first 35 kHz.

2359Z: sudden quiet. No . . . there's that UKØ calling CQ TEST CQ TEST. He's early — his clock must be fast. Or is mine slow?

Zero hour — where did all those signals come from? They're everywhere. What a mess! Strong signals. Weak signals. Clean signals. Chirpy signals. Buzzy signals. It's staggering. So this is what a contest is? Wow! Start tuning around and let's see what they're up to.

There's another hot shot. Is he making contacts in a hurry! His speed is very high, but let's figure out who it is.

K6AAR DE KH6IJ 5NNKW K

Huh? It's KH6IJ. He's one of

The station is compact and businesslike, the logbook is ready, and the five-band DXCC plaque on the wall indicates that he knows how to get around in the DX world. Look for OK2BOB from Czechoslovakia in the thick of things.

This station in the French territory of Afars and Issas would be a great one to work whether or not you were in a contest. Here Hassan and son pause in their activities to let you take a look at their station.

the real old pros at contests. The 5NN is short for 599 — the KW is his power — the information required for the contest contact. Some people use TTT as an abbreviation for a KW — the T is an abbreviation for 0 during contests, so TTT equals 000 equals 1 KW. Or they might send 58N2TT, which of course is 589200, the 589 being the RST, (signal report) the 200 being the power of the transmitter.

Boy, there's a huge pileup. There must be hundreds of stations in there calling. But who? They're all stateside and Canadian stations. They're not going so fast here — the DX station must be sending a bit slower than KH6IJ. All of a sudden the noise tapers off . . . the DX station must have come back to someone. Where is he? There — maybe that's him

569100 569100 BK

Yes! There's someone coming back to him; it's a W7. Okay, but who's the DX station? The W7 started to send his call, but he got covered up by a lot of other stations tail-ending on him. There goes the pileup again. What a mess!

There he goes again. Wish I had a sharper filter. Wait . . . got part of it that time.

9AJ 569100 569100 BK

What can 9AJ be? Got to get the rest of it. Now . . .

W6ONV DE CR9AJ 589100 589100 BK

CR9AJ! That's Macau — the tiny Portugese colony near Hong Kong — right next door to China. Son of a gun! That would be a great entry in the log book. But with that pile of sharp shooters, my 200-watt peanut whistle doesn't have a chance, yet. But maybe tomorrow. And, after all, I *am* copying his 100 watts okay when the QRM lets go — he should be able to hear my 200 watts if the QRM doesn't wipe me out.

Well, time to tune around a bit more. I scribble the CR9's call and frequency in the margin of my logbook — maybe tomorrow I'll get a shot at him. The time is 0130Z; the contest is an hour and a half old.

The band does not seem as frantic now as it did earlier, and signal strengths are down; it's almost time for the band to close. Sure does pack it in early on these winter nights. There's an LU — Argentina — with only 20 or 30 fellows after him. And there . . . there's a PY — Brazil — with a fervent following. Heck . . . let's go have a look at 40.

Forty meters

The bottom 25 kHz of 40 meters is incredible! Solid, towering pileups — end to end of the Extra class portion. I look up above 7025. It's not so mad, but still a mess. What are they working? There's a KP4 — nice signals, too. And a DLØ — what a signal. I've never heard any European that strong on 40 meters. A lot of other fellows seem to be hearing him very well, too. Oh well!

My ears are ringing from the racket. I take off the headphones, turn down the gain, and retreat for a cup of coffee.

After an extended break, I return to the shack an hour later. I take another look at 20 . . . it's deader than a doornail. I go to 40 again — it's the same as before — a mess. A brief look at 80 shows more of the same — wall-to-wall pileups. I go back to 40 and tune a bit. I hear Caribbean stations, lots of Europeans, a few Africans, some South Americans — all with substantial followings. It's been a long day, and I'm tired. I turn it all off and go to bed. Tomorrow is another day . . .

My big chance

It's Saturday morning. The sun came up half an hour ago. I pull on my heavy bathrobe and slippers, stop off in the kitchen for a cup of coffee and head for the shack. I flip on the gear and take a look at 20 — it's in fine shape — jammed full of signals. There are as many signals — maybe more — as last night, but somehow it sounds different. Yes, things are spread out more. The

pileups are still there, but not as many big ones — and there seems to be a lot more DX stations coming through. Let's have a look around some more. There's a strong one going at a good clip . . . it's UK2BBB. He's over S-9! And G3FXB . . . he's S-9 too and going great guns. And there's a good pileup — lets see who they're after . . .

DE TA1ZB

Turkey! But what a mob. Let's go look at 15 . . . hey! It's open! Son of a gun! Almost sounds like 20 meters. Listen to those Europeans. Maybe I can do some good here. Let's get the rig tuned up . . .

I start tuning around again. There's GW3FSP calling CQ — quick — zero the VFO on him. There . . . he signed.

GW3FSP DE W9KNI W9KNI K

579150 579150 BK

Darn! Missed him. There he goes again.

R SK QRZ GW3FSP K

I call . . .

GW3FSP DE W9KNI W9KNI K

579150 579150 K

Phooie — missed again — and he's almost finished another contact. I must be calling too long. Let's listen for a round.

R SK QRZ GW3FSP K

Yes, there's a response —

DE W9VW K

W9VW DE GW3FSP 5NN150 5NN150 K

Huh? 9VW signed his call once, and only once, and he got him. I'll try that. There goes the GW again.

R SK QRZ GW3FSP K

DE W9KNI K

W9KNI DE GW3FSP 569150 569150 BK

Hot dog! It worked!

GW3FSP DE W9KNI 579ILL 579ILL BK

R SK QRZ GW3FSP

The Heath-equipped station of CT1OF in Portugal is the pride and joy of Jaime. He's relaxed and ready for either ragchewing or DXing.

I got him! Let's see . . . got to get it into the log. It's 1426Z. Well, that's Wales — a new one. Let's see what else we can do.
There's a CQ . . .

CQ TEST CQ DE OY2R OY2R

Hey! That's a rare one. Call him, quick!

DE W9KNI K

Ugh — there are four people calling him still, and he's coming back to someone already . . . it's a W2.

W2MUM 5791TT 5791TT DE OY2R K

OY2R 599NY 599NY DE W2MUM K

I call again . . .

DE W9KNI K

Darn. There must be ten people calling him now. This has all the earmarks of a lost cause. I listen to him work two more contacts, and by now the pileup has reached towering proportions. I haven't a prayer of a chance. I tune off.

I start tuning higher into the band. The QRM seems to thin out a bit as I go higher. There's a CQ . . .

CQ TEST DE DL9PF DL9PF K

I lay the VFO on him and give him a call . . .

DE W9KNI

He comes right back.

W9KNI 5NN5TT K

Wow! That was so fast I barely caught it all.

DL9PF DE W9KNI 589ILL 589ILL BK

R TU QRZ DL9PF

So, that's another one in the log — West Germany.

I keep tuning higher. Let's see . . . I'm at 21125 kHz and climbing. Okay, there's another CQ.

CQ TEST CQ TEST CQ DE 4X4FU 4X4FU

CQ TEST CQ TEST DE 4X4FU 4X4FU K

I pull the VFO on him fast.

DE W9KNI

I listen — I hear

DE WB5YKG/N WB5YKG/N K

WB5YKG/N DE 4X4FU 569200 569200 BK

The WB5 works him, then the 4X4 calls QRZ.

I call . . .

DE W9KNI W9KNI

That five signed his call twice, so I'll try it. Hah — I got him!

W9KNI DE 4X4FU 559200
559200 K

R 4X4FU DE W9KNI 569ILL
569ILL K

R TU QRZ 4X4FU

Oh boy! 4X4 — that's Israel — and that counts for Asia! A new country and a new continent. These contests are *all right*!

I go on up the band — I hear an I3 working a WB2/N. Say, some of these novices got their DX shoes on today. I wait, and call the I3 when he finishes — I nail him.

Getting better

I start to notice something that pleases me very much. As the speed merchants are ripping off high speed QSOs, I discover that I am having less trouble copying them. My code speed is beginning to show definite signs of improvement. Doubtless, the adrenalin flowing is partly responsible, but I'm sure I'll retain at least part of the increase.

Yes — there's another speed jockey letting fly — hah! — it's VP2G. Must be a special contest call. I zero him and call — I miss. He clears his contact. I call again. I miss. I call again. Nothing. Then he calls . . .

CQ TEST DE VP2G VP2G UP2
UP2 K

So. He wants calls up 2. I move my VFO up 2 kHz and call again. I miss. He clears. I call again.

W9KNI 5995TT K

My chest swells . . . I'm catching on.

And so it goes. By now you are getting a hint of the joys of DX contests. You must remember that conditions have a lot to do with success in a DX contest. If conditions are normal or better, that type of action is very possible for any operator. If you are a Novice-class operator, though you are restricted somewhat in frequencies, you will still have a fine opportunity to put away a lot of goodies — mostly on 15 meters — with possibilities on 10, 40, and even 80. It certainly can be done — a few years ago KN4RID worked well over 100 countries as a novice — and that was in the days when Novices were restricted to 75 watts, crystal control, and a non-renewable one-year license.

If conditions are bad, it will still be possible to work some DX — just not as much or as easily. Even under terrible conditions, it should be possible to pick up some Caribbean and South American stations.

In a contest, you must remember to keep your calls brief and your fist as neat as possible. If you use crystal control, call only those stations near your frequency. Keep the rf gain on your receiver as high as possible, and use the audio gain to control volume — that way you will hear the weak stations along with the strong.

The ARRL contest runs two weekends — if you hang in there you will work some good DX the first weekend — and you'll do even better on the second. Remember, contest rules allow only one contact per station per band, and on the second weekend some of the DX will be literally begging for calls. That will be your chance to log some goodies!

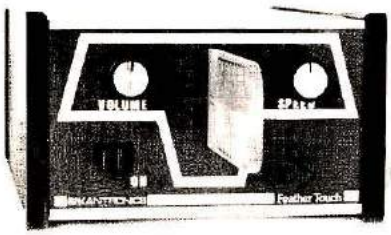
By next year, having gotten your feet wet this year, you may well go out to rack up a real score — maybe with an upgraded license, upgraded gear, and some better antennas. But, your skills will help you the most. You'll learn some of the other aspects of DX contests, like multi-operator efforts, check lists, high-band/low-band classes, staying up 44 hours out of 48, and so on.

But in the meantime — have fun, and Good DXing!

HRH

All in the family.

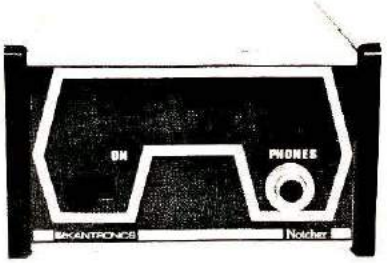
Feather Touch Keyer $69.95



No moving parts! The **Kantronics Feather Touch Keyer** responds to the lightest touch. No more slapping or sloshing! No moving parts also means the end of adjusting and readjusting before each QSO.

The **Feather Touch** sends self completing dots and dashes, adjustable from 7½ WPM, and gives you a great fist on the air. Attractive design and compact size make the **Feather Touch** a professional addition to the sharpest ham station. Design features keep the keyer from creeping away as you send.

This **battery powered** unit is great for portable use or home operation with the aid of any DC power supply from 5-15 volts. Pick up a motionless keyer today!



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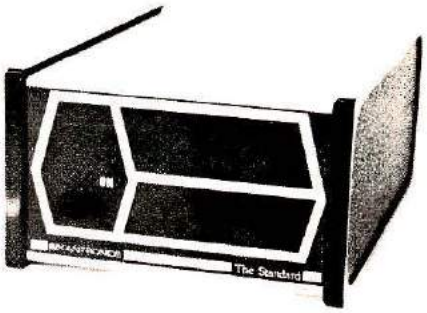
Make your CW receiver selectivity razor sharp with the **Kantronics Notcher Audio CW Filter.** This filter makes sense out of the biggest pileups! The **Notcher** funnels down to 150 Hz @ -3dB to separate signals that appeared to be on top of each other before.

Your **Notcher** will operate portable with a 9 volt internal battery, or from your 5-15 volt DC power supply.

Designed to look sharp too, the **Notcher** is one in a growing family of **Kantronics** quality products. Our quality is more than skin deep. One look inside will tell you the **Notcher** is built to perform!

The Standard Frequency Calibrator $39.95

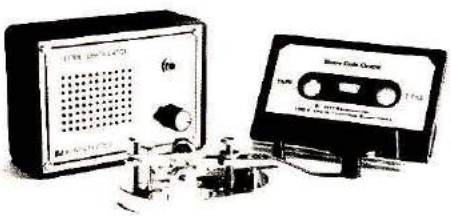


Kantronics frequency calibrator is **The Standard.** Advanced CMOS circuitry checks your frequency with crystal controlled accuracy. Zero-beat your transceiver to **The Standard** at 50 KHz intervals.

No direct connections are needed, the unit transmits to your receiver. Internal jumpers adjust **The Standard** for a choice of 25 KHz, 50 KHz or 100 KHz intervals.

Powered by battery for portable operation, or 5-15 volt DC power supply. **The Standard** is a handsome station accessory that looks sharp, inside and out.

Be confident of your frequency.



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QUESTIONS & ANSWERS

Electromotive force, atoms, and Ohm's law

BY THOMAS McMULLEN, W1SL

Previous installments of this series have covered Rules and Regulations, Operating Practices, Emission Characteristics, and Radio Phenomena — subjects that are important to a radio amateur in operating his station. Now, we can get down to what makes electricity behave the way it does. If you follow this section closely, you will gain insight into the workings of all the transmitters, receivers, amplifiers, antennas, power supplies, and almost anything else that requires electrical power to operate it. This section is called *Electrical Principles*.

Just as Amateur Radio had to have a firm basis and purpose to justify its existence, you need a firm understanding of electrical principles to be aware of what is going on inside your equipment. Even if you never intend to delve into it and do a repair or modification, it will be immensely satisfying to you to know what makes the whole thing go. For instance, it is fascinating to realize, when you press the key and send out a signal from your rig, that the whole chain of events started with a large volume of water flowing past the blades of a turbine at a power-generating plant many miles away — and ended with an electromagnetic wave being radiated from your antenna system. The whole network that brought the energy from that water pressure to your transmitter depends upon the laws of electricity to get the job done.

Electromotive force

The whole science of electricity, and therefore electronics, depends upon a thing called electromotive force, and a similar action called magnetomotive force (the two are tied together). You'll have to use your imagination quite a bit here, because most of the theory involves things that have not been photographed — as yet — but rather have been proved by careful experiments to back up reasoned conjecture.

The key to the whole thing is the word "electro," in various forms, which refers to the electron. The electron is very small, and doesn't weigh much, but it is the mechanism responsible for getting all that energy from the waterfall (or coal pile, or nuclear reactor) to your rig where you can use it. If you'll envision an atom as a very miniature solar system, with a mass called a nucleus at the center, and several electrons in orbit around this nucleus (just as planets orbit the sun), you have a start on grasping the situation. Some materials have a few electrons; others have many. Hydrogen, for example, has just one electron in orbit. Metals, some of which are used to conduct electricity, have a great number of electrons orbiting their nucleus. This is fortunate, because in order to use electricity, we need a lot of electrons, as we'll see later.

An element that has only one electron, such as hydrogen, is not of much use to us in electrical work, because the atom is going to be *very* reluctant to give up its one and only electron, and that is precisely what is required if electrons are going to move from place to place and do some work for us. Therefore, a useful atom would be one with so many electrons that you could pry one loose from one of the outer layers (or orbits) without too much trouble. Some metals will go along with this idea, especially if there is another electron nearby to immediately fill the gap. When you have several (billion) atoms packed close together, as in a copper wire, there is a plentiful supply of electrons that can be moved without spending a prohibitive amount of energy in the process.

Electrons can be persuaded to move by many circumstances, but there are two methods commonly used in electrical circuits: create a shortage of electrons at one end of the circuit and a surplus of electrons at the other end, or, push the atoms through a magnetic field.

Direct current

A common method of creating a surplus of electrons, and a shortage of electrons, is to use a chemical cell, just like

those in a flashlight (**Fig. 1**). This is called a carbon-zinc cell, because it consists of a zinc container (cup) with a carbon rod suspended in the center of it. Between the two is a chemical paste, called the electrolyte. The purpose of the electrolyte is to move, by chemical action, electrons from the vicinity of the carbon rod, and transfer them to the zinc container. This means that the zinc now has more electrons than it needs, so the excess electrons can be sent out into the external circuit to eventually find their way back to the carbon rod (which now has a shortage of electrons due to the chemical action). This transfer will continue as long as the circuit is complete, or until the electrolyte becomes so contaminated with byproducts that it will no longer do its job. On their way from the zinc terminal to the carbon terminal, the electrons go through a resistance (the flashlight bulb), and do some useful work for you — namely, providing light to see by.

Each cell of this type (called *Leclanche*, after its inventor) generates a potential difference (*electromotive force*) of 1.5 volts between the two terminals. Other cells, made of different materials, will produce other voltages. If you connect several of these cells together, so that the voltages add, you can create a *battery*, which can do other work for you, such as run a transistor radio, power a small motor, operate toys, or whatever can be operated by small amounts of direct current. Two things are important here: the terminal that has a surplus of electrons is called the negative (−) terminal, whereas the one with a shortage is called the positive (+), and the electron movement produced by a cell or battery is called *direct current*. It is called this because the flow is one direction only, from negative to positive. There is another type of flow called alternating current which I'll tell you about next.

Alternating current

The second method of creating a flow of electrons is by moving atoms through a magnetic field. Electrons, in orbit around their nucleus, have their own magnetic field (in addition to an electric charge), which is offset by the field of the nucleus so that the net result (to an outsider) is no discernible field. However, if you bring an outside force, such as the field between the two poles of a horse-shoe magnet, near an atom, this field interacts with the field of the electrons and the orbits will be disturbed. If you make the field strong enough, and provide a circuit that gives the electrons a place to go, they will leave their orbit and travel around the circuit. The common way of creating this interaction and electron movement is to force a conductor (copper wire) through a magnetic field, which has the same effect as moving the magnet past the wire. The wire is wound on a spindle or shaft, called an armature, shown in a much simplified form in **Fig. 2**.

If you apply force, or energy, to the shaft to cause it to rotate, the copper wire will be made to move through the magnetic field. This field disturbs the electrons, and creates a current flow along the copper wire, through the resistance (or other useful work-producing device).

If the point designated **A** in **Fig. 2** is moving through the lines of force near the North pole of the magnet, the electrons are forced to move in a given direction. At the same time, point **B** is moving through the lines of force near the South pole, which causes the electrons there to move in the same direction along the wire as those at point **A**.

This is fine for that part of the armature rotation when the conductor is moving *into* the lines of force, but once the wire has reached the closest point to the magnetic pole, something else starts to

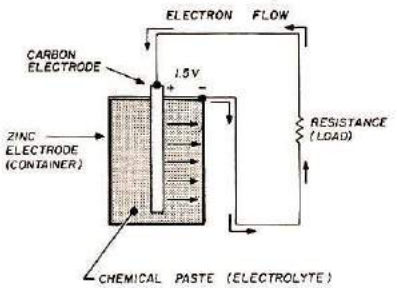


Fig. 1. A carbon-zinc (Leclanche) cell is one method of inducing electron movement, or current flow. The electrolyte, a paste containing a form of manganese and other chemicals, creates an imbalance of electrons between the two terminals of the cell. An excess of electrons, which have a negative charge, is present at the zinc cup. When a circuit is completed the electrons flow through the resistance (usually called the load) to get to the other terminal, which has a deficiency of electrons. On their way through the load, the electrons perform useful work, such as providing light from a flashlight bulb.

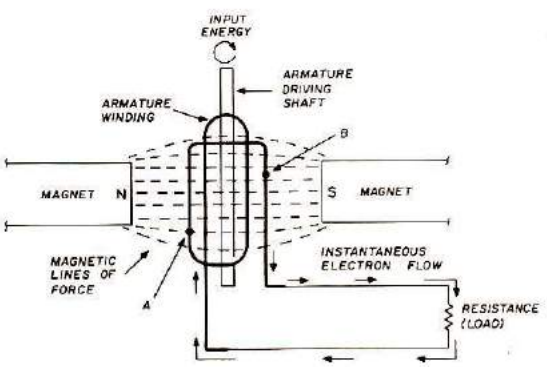


Fig. 2. The electrical circuits in your house, in most parts of the world, make use of a form of electricity called alternating current. It is created by forcing copper wire to move through a magnetic field. To illustrate this, points A and B will, during one complete rotation, move past first one magnetic pole and then the other, which causes electron movement (current flow) in one direction and then the other.

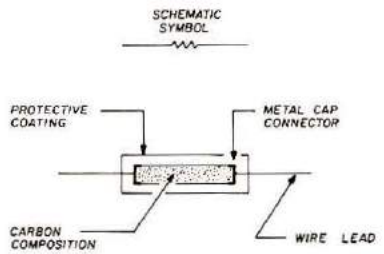


Fig. 3. The schematic symbol for resistance is the same, no matter what material is used for a resistor; carbon composition or wire. The cut-away drawing of a carbon type shown here is only one of many forms of resistor found in electronic circuits. The protective coating can be of plastic, bakelite, ceramic, glass, or other insulating material. Insulating material is nonconductive to electricity because the atoms in it will not give up any electrons under ordinary circumstances, therefore no current will flow through it.

happen: because it is now moving *away* from the pole, out of the lines of force, the electrons want to turn around and go the other way. This is just what happens — throughout one complete rotation (cycle) of the armature, the electrons flow first in one direction and then in the other. This back-and-forth movement of the electrons produces a current flow that is called *alternating current*. In your usual household wiring, the electrons are changing direction 60 times a second.

Alternating current is a most useful form of electricity because we can change the amount of electromotive force (voltage) by simply connecting a transformer in the circuit. A transformer is a device that steps the voltage up or down; I'll tell you more about transformers when I get to a later section, called *Circuit Components* in the FCC Study Guide.

It is precisely this alternating current principle, and the transformers along the way, that transfers that energy from the waterfall (or the steam pressure in a coal-fired or nuclear-reactor generator) through all the power lines and substations to your house. There you transform it again, into a value of voltage and current that your equipment can use, to eventually launch a radio wave from your antenna. It took some doing, didn't it?

At this point you have enough of the basics of this electron movement bit so that a few definitions will make sense to you. The difference in potential (difference in the number of electrons) between two points in a circuit is called electromotive force, which is like saying "the force of moving electrons." This electromotive force (emf) is measured in units called *volts* (abbreviated **V** in texts and on schematic diagrams, but in calculations the term **E** is used). When a circuit is completed so that electrons can flow between a terminal with a surplus and one with a shortage, this electron movement is called current flow, which is measured in units called *amperes* (abbreviated **A** in texts, but the term **I** is used in calculations).

Earlier, I said that a lot of electrons had to move through a circuit to do any useful work in electricity — it takes 6.25 x 10^{18} of them moving past a given point in one second to equal one ampere of current

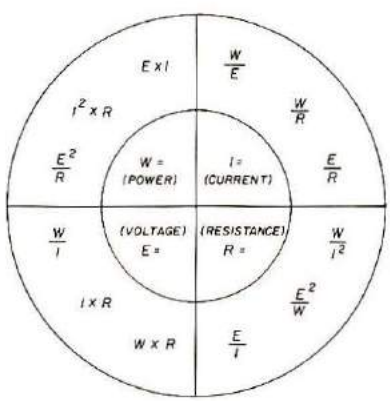


Fig. 4. A guide to the formulas needed for Ohm's law calculations involving direct current. It is sometimes referred to as a WIRE wheel. To use it, locate the unknown quantity in a quadrant, and use the adjacent formula that contains the two quantities that you do know.

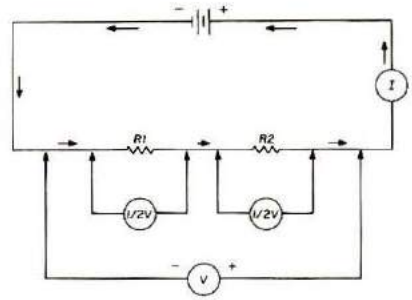


Fig. 5. When resistors are in series, the total current in the circuit must flow through all of them. In this simplified case, both resistors are assumed to be equal in value, therefore each will have just half of the total voltage across it. If the values were unequal, Ohm's law could be used to calculate the voltage or current or resistance, whichever was unknown.

flow! If you want to write that number out, put down 6.25 and place 16 zeros after it, then move the decimal point 18 places to the right. That's a *lot* of electrons!

So, there you have the unit of electromotive force, volt, and the unit of current flow, ampere, but, how about the resistance that the electrons had to go through? A resistor is only one of the devices used to turn the electron flow into useful work, of course. Other examples of electrons doing work on their way through a circuit would be when they cause a motor to run, make a loudspeaker or earphones create sound, or any of the thousands of industrial processes such as welding, electroplating, and the like. However, a resistor is useful in many ways, not just a device to create light when electrons flow through it. Resistors can be used to control the amount of electron (current) flow.

Resistance

As you might expect from the name, a resistor impedes or resists the flow of electrons. It does this because of the material from which it is made. Remember earlier that I said some metals have so many electrons in orbit that you

could pry one loose from an outer layer without too much trouble? Well, by choosing a different material, you can create a path where the electrons can get through, but with considerable difficulty. If the atoms either don't have a great number of electrons, or they want very strongly to hold on to them, then it takes more work to knock one loose to send it farther along the circuit. Usually, this work (energy) that is expended in moving the electrons is dissipated as heat. This is why you get light from the flashlight-bulb type of resistor; the tungsten-metal atom doesn't want to lose its electrons, and so much energy is used in forcing them to move that the metal gets white hot in the process.

Many other materials behave the same way. Most resistors used in electronic circuits are made of a carbon composition, enclosed in a protective layer of non-conducting material. Some of them are arranged with a tiny rod of carbon composition in the center, much like the lead in a pencil; other resistors have the material wrapped in a spiral form around a core of insulating material. If a resistor is meant to handle large amounts of current flow, which would cause it to get very hot, then it is made of wire, very similar to that in your flashlight bulb. The unit of resistance is the *ohm*, named after Georg Simon Ohm, who formulated Ohm's law. His law states that *current varies directly with the voltage, and inversely with the resistance* in a circuit. Although the resistance unit is the ohm, the letter **R** is used in calculations.

The schematic symbol for a resistor is shown in **Fig. 3A.** The same symbol is used for any type of resistor, no matter if it is made of carbon composition or of wire. **Fig. 3B** is a cut-away drawing of a carbon composition resistor. They are made in various physical sizes which roughly correspond to their ability to handle a given amount of power. Common sizes found in most radio equipment range from 1/2 watt up to 2 watts. Some miniaturized equipment, such as hand-held transceivers, might use resistors as small as 1/8 or 1/10 watt capability. The wattage rating of a resistor is the amount of energy it can handle before it becomes overheated to the point of destroying itself. If you force more electrons through it than it can safely withstand, it will burn out.

Power and calculations

Did you notice that new term (watt) that I used in the last few sentences? I thought you would — and here's what it is all about. The *watt* is the unit of electrical power, just as volt is the unit of electromotive force, and ampere is the unit of current flow, and together with the unit of resistance (ohm), the watt completes the set of terms for most of the calculations needed in electrical circuits where direct current is involved. The basic expression is: an electromotive force (emf) of 1 volt, applied across a resistance of 1 ohm, will cause 1 ampere of current to flow. Under these same conditions, the power involved is 1 watt.

Fig. 4 is a handy little helper when you need to do calculations involving Ohm's law. It is often referred to as the WIRE wheel. I would suggest that you cut it out and glue it to a small card that will fit in your pocket or wallet; you'll need it many times before you have all of the variations of Ohm's law committed to memory. To use it, simply locate the quantity you want to know in one of the quadrants of the wheel, and you'll find the applicable formula on the rim of the wheel adjacent to it.

For instance, suppose you want to find the current flowing in a circuit. You can measure the voltage across a resistor, and you know the value of the resistor. Remember that I said the term used for current, when doing calculations, is **I**. Locate the **I** term in the wheel, and note that there are three formulas adjacent to it. The one to use is the one that has the two *known* values in it — in your case resistance (**R**) and voltage (**E**). There it is: **I** = **E** divided by **R**. Let's check up on that Ohm's law statement I used before. If the voltage is 1, and the resistance is 1, then 1 divided by 1 equals 1, or 1 ampere. Right!

How about power? Okay, check it out. Look at the wheel and find power (**W**). Since you know all three quantities, you can pick any one of the formulas to test the law. How about power (**W**) equals electromotive force times current; **W** = **E**x**I**. Again 1 volt times 1 ampere equals 1 watt. It works every time!

Let me caution you about a trap that some beginners fall into when they first use Ohm's law — be sure that you use the same units throughout. Most radio circuits use fractions of units, such as milliampere (thousandths of an ampere) or milliwatts (thousandths of a watt) and kilohms (thousands of ohms). You have to keep track of the decimal places or your answer will not make sense.

Table 1 lists some of the common terms for multiple or fractional units of measure. For instance, 1 volt times 1 milliampere (0.001 ampere) equals 1 milliwatt (0.001 watt). Tenths and hundredths are not often used; 0.01 watt would be 10 milliwatts, and 0.1 watt would be 100 milliwatts.

Series and parallel

So far, the examples I have used have been with a single resistor in the circuit. However, life is seldom that simple in a radio circuit, so how do you deal with the case where there

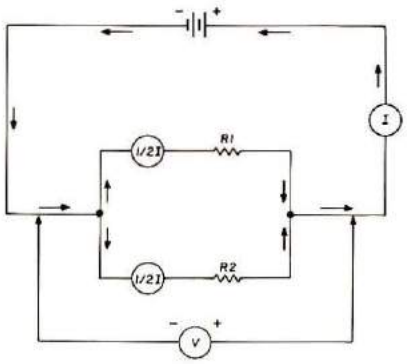


Fig. 6. In a parallel-resistance circuit, the current flowing in each branch must equal the total current in the circuit. In the case where each of two resistors is equal, each will conduct half of the current. If the resistors are of unequal value, the current and power in each can be calculated by using Ohm's law.

are several resistors? Well, here is something that you should really keep in mind: the current flow going into a circuit must be exactly the same as that coming out of it. Every electron must be accounted for; you cannot lose any along the way!

This leads to a second observation: the sum of the currents flowing in all the branches of a circuit must equal the current flowing into and out of the circuit. **Fig. 5** shows, in a simplified version that has only two resistors, how this works. In this series circuit, whatever goes through one resistor must go through the other one; therefore, the current in each resistor will be equal. Note, however, that the voltage across each resistor is half of the total voltage across the entire circuit. This assumes that the resistors are identical in resistance, of course.

Now, what happens when the resistors are not in series, but one is connected in parallel with the other? Well, if both resistors are equal, each one gets just half the current, but the voltage across it remains at the full supply voltage. However, if one resistor had a *lower* value than the other, then it would have the *most current* flowing through it. Because of this increased current, it would also be dissipating more power as heat.

To prove it out, let's apply Ohm's law to **Fig. 6** and assume the voltage is 2, R1 is 10 ohms, and R2 is 5 ohms. Let's work on R1 first; 2V divided by 10 ohms equals 0.2 ampere, or 200 milliamperes (I = E/R). Now, the same two volts are across R2, so, 2V divided by 5 ohms equals 0.4 amperes, or 400 milliamperes. To find out how much current the battery is furnishing, add the amounts flowing in each branch; 0.2 plus 0.4 equals 0.6 ampere, or 600 milliamperes.

No, wait, we're not through yet. Let's see how much power is being dissipated here. **W** (watts) = ExI, so, 2 volts x 0.6 ampere equals 1.2 watts, which is the amount being furnished by the battery. R1 is passing 0.2 ampere, so 2 volts x 0.2 ampere equals 0.4 watt being dissipated by R1. This leaves 0.8 watt unaccounted for, so it must be heating up

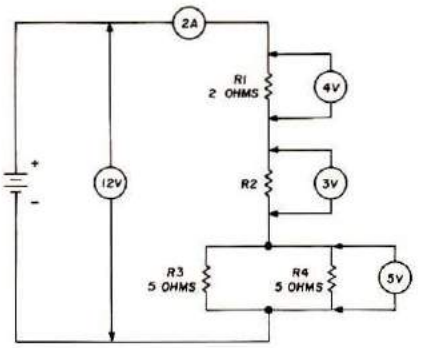


Fig. 7. This is a combination of a series circuit and a parallel circuit, which is called, naturally, a series-parallel circuit. Note that the total of all voltages across the resistors must add up to equal the supply voltage. See the text for some sample questions based on this circuit.

R2. Let's check it out. Again, 2 volts x 0.4 ampere equals 0.8 watt! Isn't this Ohm's law stuff great? Notice how all of the current was accounted for? None of the electrons got lost anywhere in the circuit and all arrived at the positive terminal of the battery just as they intended to in the first place.

Now for a couple of

Table 1. Metric prefixes most commonly used with electrical and electronic terms.

Prefix	Factor	Symbol		Example
tera	10^{12}	T	THz	(frequency)
giga	10^{9}	G	GHz	(frequency)
mega	10^{6}	M	MHz	(frequency)
kilo	10^{3}	k	kHz	(frequency)
deci	10^{-1}	d	dB	(sound level or relative power)
centi	10^{-2}	c	cm	(distance)
milli	10^{-3}	m	mm	(distance)
			mW	(0.001 watt)
			mA	(0.001 ampere)
micro	10^{-6}	μ	μA	(0.000001 ampere)
			μF	(capacitance) (0.000001 farad)
nano	10^{-9}	n	ns	(time)
			nF	(capacitance)
pico	10^{-12}	p	pF	(capacitance)

deka, 10^{1}; hecto, 10^{2}; femto, 10^{-15}; and atto, 10^{-18}; are not often used in electrical or electronic work.

questions about this part of the series. In **Fig. 7** I have combined a series circuit and a parallel circuit. If you will follow the electron path through it, you'll see that it is not nearly so complex as you would think at first glance.

The resistance of R2 is

(a) 2 ohms
(b) 2.5 ohms
(c) 3 ohms
(d) 1.5 ohms
(e) 6 ohms

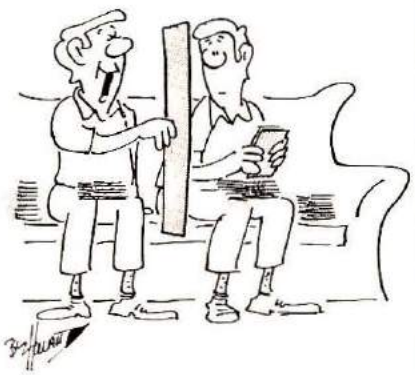
Use the WIRE wheel, and Ohm's law, to find the answer. Remember that in a series circuit all the current must go through both resistors. The correct answer is (d).

Second question: the current through R3 is

(a) 2 amperes
(b) 1 ampere
(c) 4 amperes
(d) 0 amperes
(e) 2.5 amperes

Here again, remember that the current path must divide, but that the sum of the current through the branches must equal the total current. The answer is (b).

That's enough for this time. The next subjects that I'll tell you about are *inductance* and *capacitance*, and what they can do for you in an electrical circuit. **HRH**



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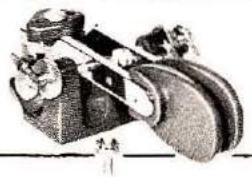

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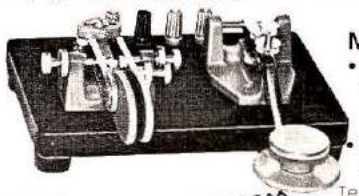

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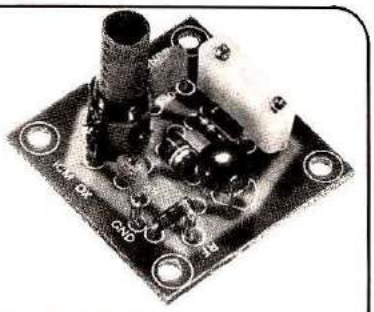

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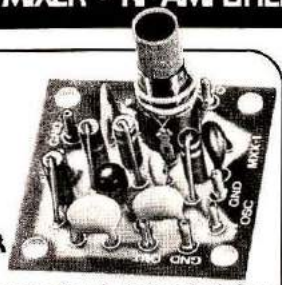

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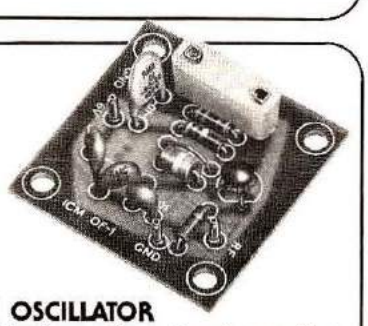

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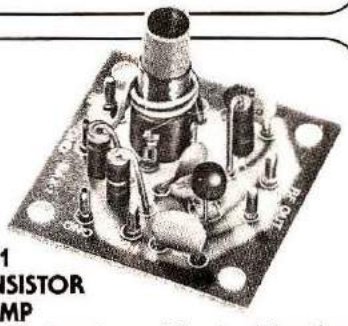

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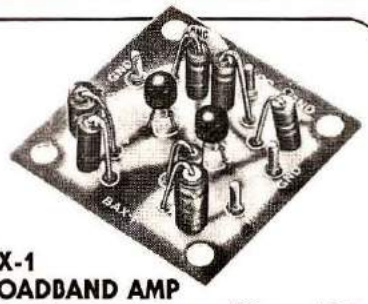

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The *Ham Radio Horizons* station of the month selection for February is that of Drew Pliszka, WB8YDP, of Newton Falls, Ohio. Things have changed a bit since the photograph was taken — for one thing the FCC's action in discontinuing the WN prefix for Novice calls has allowed Drew to sign WB8YDP. Additionally, not being one to stand still, Drew worked hard to obtain some new equipment for his station, which he will tell you about later. Here's Drew's story:

"I first became interested in radio when my father bought a crystal-radio kit for me when I was 6 years old. Later, my parents bought a general-coverage receiver for me as a Christmas present, and I began tuning the short-wave bands. My curiosity soon led me to the local library, where I obtained information on short-wave radio, including amateur radio.

I decided to start building amateur gear from kits, and the equipment included a Heath HW-16 transceiver, HG-10B VFO, and a science-fair Globe Patrol short-wave receiver. I still had my old general-coverage receiver and I converted an HG-10B VFO enclosure into a speaker cabinet. A large dipole-farm completed my station.

I learned the code by copying other amateurs on the Novice bands, and was lucky enough to earn a 10 word-per-minute code-proficiency certificate from the ARRL. There was a radio club in the area, the Warren Amateur Radio Association, which I soon found out about. I met Frank Moger at this club, and he later became my "Elmer." He gave me the Novice exam when I was 15 years old. The license arrived soon after, while I was in science class (my mother brought that official-looking paper directly to me at school).

My first QSO was with WN2DRT. I had some trouble copying him because my heart was pounding so loud with excitement that I could hardly hear the Morse! I still retain his cherished QSL card. Now I am in the eleventh grade at Newton Falls High School, and have been active in basketball and track.

My activities in amateur radio include working 46 states, with 33 of them confirmed. I have worked 18 countries on 15 meters. My code speed has been increased to 20 words per minute, with a sticker to confirm it. I have placed second two years in a row in the Canton Hamfest's Novice code contest.

During this past summer I painted houses and cut grass to earn enough money to purchase some new equipment. I now have a Kenwood TS-520S, SP-520, a home-brewed antenna switch, home-brewed antenna tuner for my random-length wire, a Heathkit wattmeter (HM-105), rotator control, and a microphone ready for the time when I get my General-class license. Through the help of several amateurs in the area, I now have a two-element quad up at 36 feet.

Several people who are interested in finding something better than CB have come to me for help, and while they are studying for their Novice exam, I am studying for my General ticket — the amateur tradition of helpfulness continues.

I enjoy almost every aspect of this, the world's most fascinating and rewarding hobby. I believe that we as amateurs should be strong and progressive at maintaining the respect and integrity that amateur radio has gained in the past.

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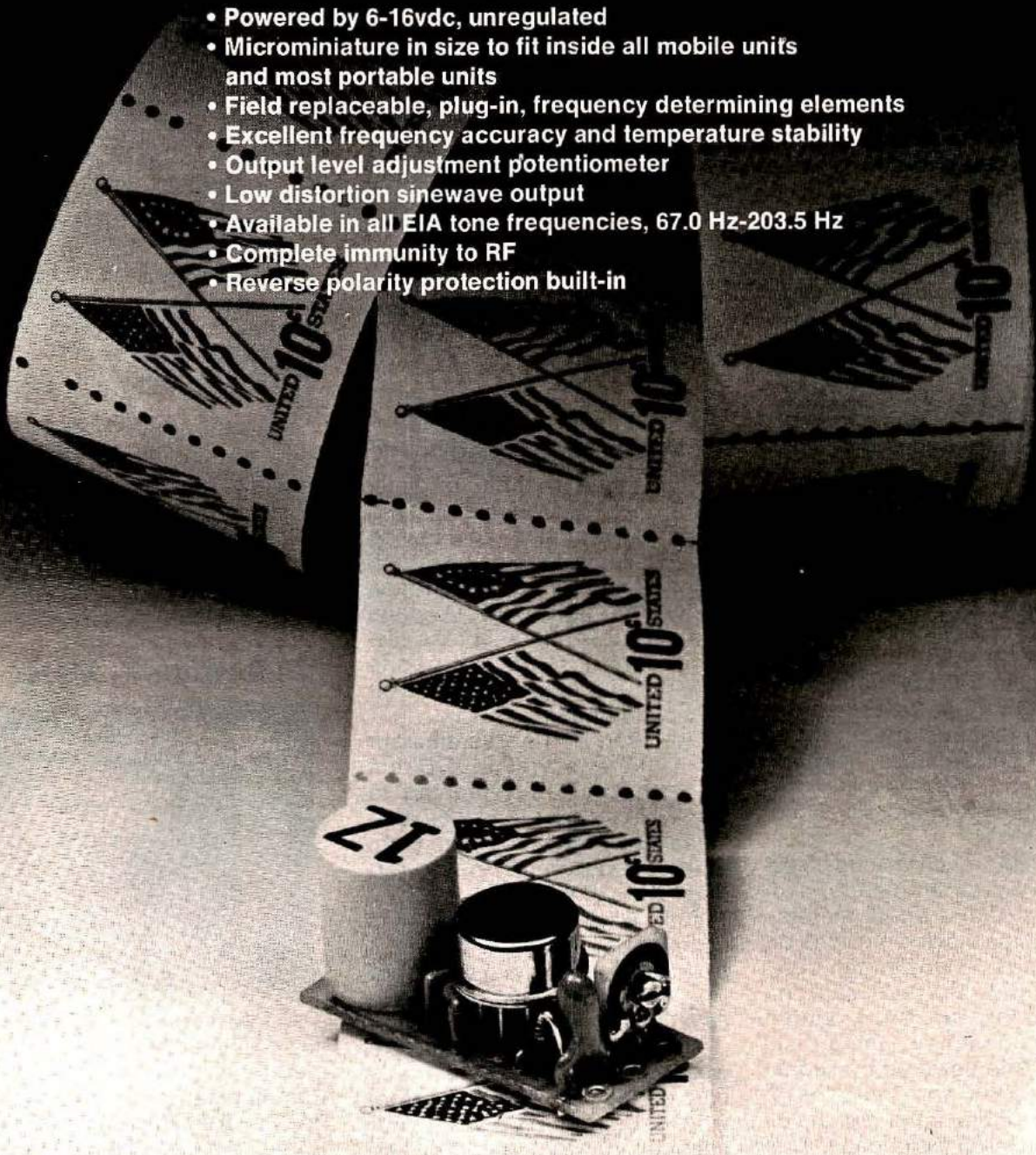

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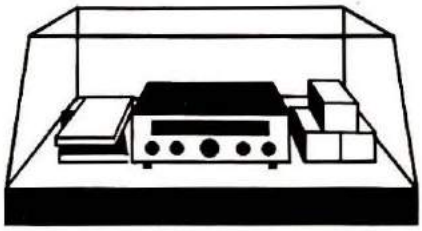


Kantronics 8040B Novice CW Receiver

Simplicity, sensitivity, and adequate selectivity are only some of the many features found in Kantronics' all-new, battery-powered receiver just introduced for Novice class radio amateurs. In addition to being small, neat, and functional, the 8040B receiver offers light weight, pleasing appearance, and good performance — which also makes it ideal as a standby receiver for the more advanced amateur.

The 8040B receiver tunes 3.65 to 3.75 MHz on 80 meters, and 7.05 to 7.15 MHz on 40 meters, including the Novice portions of both bands. Front-panel controls include ON-OFF switch, BANDSWITCH, RF GAIN, audio GAIN, and a vernier tuning dial. The 8040B is powered by two 9-volt batteries and includes a standard phono plug for an 8-ohm speaker or earphones. The size of this little gem is only 5.25 x 7.75 x 3.25 inches (13.3x19.7x 8.3cm), making it easy to carry for portable use and allowing it to fit neatly into almost any station, no matter how limited the available space.

On 80 meters, signals are directly converted to audio, while on 40 meters, signals are first converted to 80 meters and then to audio, which is filtered and amplified to drive a small speaker or earphones. Careful design and component selection minimizes frequency drift with temperature changes, and the audio response is shaped to provide optimum listening ease.

The receiver may be used with a random-length wire antenna, but a dipole — cut to frequency — is preferred for maximum performance. The price is a surprisingly low $79.95, with matching earphones available at only $10.95. For additional details on this and their other amateur radio products, write Kantronics, 1202 East 23rd Street, Lawrence, Kansas 66044, or use *ad check* on page 78.

80-Meter DX Handbook

To a large number of amateurs, the 80- or 75-meter band is most useful as a rag-chewing spot. Daytime coverage is strictly local, and longer paths open during the dark hours. Average contacts take place across distances that reach from one coast to the other during favorable conditions.

However, in the true amateur spirit, there is a core of DXers who are constantly probing to see what can be done on this "local" band to extend the communications range to the farthest parts of the globe.

John Devoldere, ON4UN, has compiled a handbook of things to do to squeeze the most out of this rag-chewer's haven; the *80-Meter DX Handbook*.

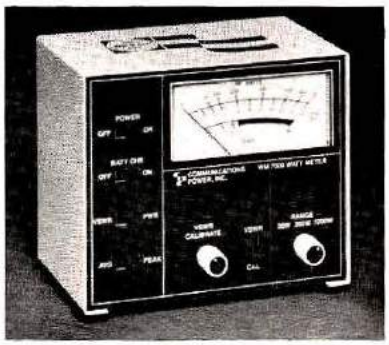
The handbook is a complete works on the art of DXing in this part of the HF spectrum, from why it happens (or does not happen), to what to build and how to use it. The book is arranged in four chapters: Propagation, Antennas, Stations, and Operating Practices. The propagation section covers magnetic disturbances, seasonal effects, twilight periods, paths, and more. As might be expected, the antenna section is the largest part of the book, with 15 distinct subjects — starting with the fundamentals and working through ZL-specials and Beverage antennas.

The section on stations contains a concise discussion of popular transmitters and receivers, and some hints as to their proper use. In Operating Practices, the author gives you information about what band segments are used in various countries, talks about procedures, types of operation, and points out some of the awards that have been won, and some that are much sought after.

The *80-Meter DX Handbook* ends up with a very good Bibliography for those who would like to explore some of the reference works in greater detail.

Published by Communications Technology, Inc., the *80-Meter DX Handbook*, by ON4UN, is available from Ham Radio's Communications Bookstore, Greenville, New Hampshire 03048. Order HR-80M, $4.50 postage paid.

CPI Power/swr Meter



A new meter with SWR accuracy 100 times better than typical meters is now available from Communications Power, according to the firm's president, Robert Artigo. The CPI Model WM-7000 uses a 30-dB directional coupler, which provides accurate SWR readings to 1.1:1. Most other SWR bridges use 10-dB directional couplers, reading accurately to only 2.0:1, and some of the more expensive meters use only 20-dB couplers, Artigo said.

The CPI WM-7000 reads peak or average power for accurate ssb measurements and to make it easier to adjust microphone and speech-compressor controls. The big 3½-inch (8.9cm) meter allows easy reading on three scales: 20, 200, and 1000 watts. The unit covers the 1.8 to 30 MHz frequency range (160-10 meters).

Further information on the CPI WM-7000, and the company's complete line of high technology American-made communications gear, is available from Robert Artigo, Communications Power, Inc., 2407 Charleston Road, Mountain View, California 94043, or use *ad check* on page 78.

The Low and Medium Frequency Radio Scrapbook

The frequencies below the 160-meter amateur band were the cradle of amateur radio until hams were exiled to the "useless" short waves. A number of experimenters are probing the world between 10 kHz and 1600 kHz. Here, through a little-known provision of FCC regulations, experimenters are permitted to operate unlicensed transmitters. Operation is generally limited to a power of only one watt and antennas smaller than ten feet (3 meters) but that is adequate for radio communications out to several hundred miles when conditions are good.

The transmitting restrictions only increase the challenge and fascination of these all but ignored frequencies. Low-frequency experimenters have rediscovered the thrill of the earliest days of our hobby when transoceanic DX was a pipe dream, and real-life DX records were well under 100 miles.

Ken Cornell, W2IMB, has put a time machine between two covers. His book describes loose couplers, honeycomb coils, absorption wavemeters, and classic loop designs — all of which were mainstays of the wireless pioneers and still serve effectively today. On the other hand, Cornell includes IC and modern filter technologies in the endless quest for transmitter efficiency and the conquest of the plague of all low-frequencies — man-made noise.

The book includes dozens of simple circuits and diagrams for electronic and mechanical station components — most using readily available parts. Indeed, some experimenters might label W2IMB's vacuum tube circuits as technological dinosaurs, but they are time-tested, flexible, forgiving, amateur favorites. An objective look also reveals that efficient low-frequency vacuum tubes are plentiful and inexpensive. In an

age of black boxes and IC chips, who can deny the nitty-gritty, hands-on learning opportunities of basic, discrete-component construction? Cornell does include many solid-state circuits, but the emphasis is clearly on proven tube techniques.

This is an informal experimenter's scrapbook with a unique format. It is pre-punched so you can conveniently keep it in a standard three-ring binder along with your own collection of notes, catalogs, and article clippings. The book has no fancy printing or polished professional prose; but it is a straightforward collection of one man's views, tips, experiences, and suggestions gleaned from years of actual on-the-air experimentation.

Of particular interest are the author's chapters on converting low-cost military surplus equipment; construction of receiver converters for the most popular 160- to 190-kHz band, excerpts from the relevant FCC regulations, and perhaps most useful of all, comprehensive details on the design and winding of low-frequency coils.

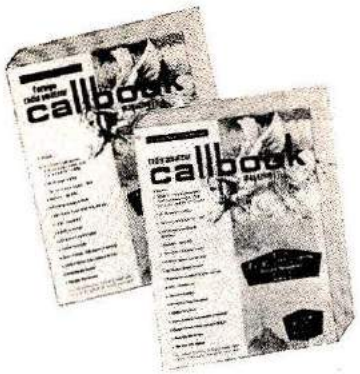
The soft cover *Scrapbook*, 110 pages, is $6.95. Also available is an Addendum of over 60 pages for $3.95. It contains much information that has come to light since the original work was printed. Both the *Scrapbook* and the Addendum are available from Ham Radio's Communications Bookstore, Greenville, New Hampshire 03048. Order HR-LF for the *Scrapbook* and HR-LFA for the Addendum.

Free Heathkit Catalog

The latest Heathkit catalog lists nearly 400 electronic products in kit form, plus a variety of Heath-recommended and assembled electronic products. Among the new kit products in the catalog are an entire line of personal computer systems, including software and peripherals; an active audio-signal processor to enhance the performance of most hi-fi systems; a digital electronic scale for the home; and new test equipment including an fet multimeter and an oscilloscope.

Assembled products include a microcomputer-based electronic chess game, a video-cassette recorder, telephone answerer/recorder, two new cassette recorders, and an electronic indoor greenhouse. The catalog also describes other kit form and assembled products such as automotive and marine accessories, amateur radio equipment, and a computerized, digital, programmable color TV.

The catalog is available free from Heath Company, Department 350-420, Benton Harbor, Michigan 49022, or use *ad check* on page 78.



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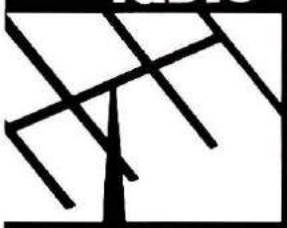

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MICHIGAN — 8th Annual Livonia Amateur Radio Club Swap 'n Shop; 8AM to 4PM Sunday, February 26th, at the Stevenson High School, Livonia, Michigan. Plenty of tables, door prizes, refreshments, free parking. Talk in on 146.52 Simplex. For details, write Neil Coffin, WA8GWL, Livonia Amateur Radio Club, Box 2111, Livonia, Michigan 48150

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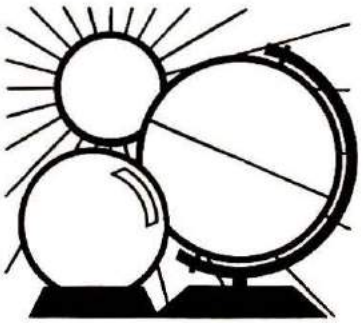

DX FORECASTER

February is expected to be a good month for DX propagation, with Solar Cycle 21 now well underway and sunspot numbers climbing rapidly. Future conditions are often best predicted by looking at past conditions, and the September, 1977, equinoctial period was one of the best months up to that time for solar and ionospheric activity favorable to DXers. Major flares, solar prominences, x-ray and proton events, and geomagnetic-field activity shared the limelight during the month. Perhaps the most encouraging phenomena of all were the unexpectedly high solar-flux levels accompanied by unusually low geomagnetic-field activity. These, coupled with monthly mean-sunspot-numbers that exceeded 30 for the third time during the year, showed all avid DXers that *Cycle 21 is improving much faster than most of us expected*!

Because equinoctial patterns are similar, Fall, 1977, conditions are likely to be repeated, with improvements, during Spring 1978, beginning in February! Add to this solar-terrestrial potboiler the great amount of operating activity that is expected, and you can plan to lose a lot of sleep during the month. For example, the annual ARRL DX Contest will begin on February 4th and 5th (phone section) and continue on February 18th and 19th (CW section). The Novice Roundup will probably begin on the 4th and continue for the next eight days. During the second weekend of February, the QCWA usually holds its annual QSO party; and the YLRL usually holds its YL-OM contest during the third weekend of the month. Add to these a number of state QSO parties, and your operating calendar will be chock full. Oh yes, don't forget the Ten-Ten Net Winter QSO Party that often takes place on the second weekend of February. Please consult the HAM CALENDAR in this issue for exact times and dates, because as we go to press some of these are tentative.

Band-by-band activity

Ten Meters will have occasional DX openings into Europe and Africa — perhaps even the Pacific — and frequent openings into South and Central America. Look at the chart for the most likely times and frequencies.

Fifteen meters will open up into most of the DX areas of the world on more than half of the days of the month, so it is best to pick your operating times and frequencies from the accompanying chart. Novices: don't forget that fifteen will be your best DX band, with many foreign stations (including *rare ones*) using Novice frequencies to help you with your countries-worked list.

Twenty meters will be the most consistent DX band but, as usual, will also provide the greatest QRM. Skillful operating will get you some choice tidbits from all areas of the world, even if you run low power, so be patient and persistent; the good stuff is there!

Forty, eighty, and one-sixty all exhibit excellent, and predictable, DX activity at this time of year — during the hours of darkness. Noise levels will be seasonably low for most of the United States and mid-latitude countries, while propagation conditions will benefit from generally high solar-flux levels and low geomagnetic-field activity, except on disturbed days. European forty-meter DX begins filtering into the East Coast at about 2000Z, moving west as the evening wears on. Eighty lags by about two hours, and one-sixty is often two or three hours behind eighty. If you really want to DX on the Top Band, plan to sleep during the daytime.

Last-minute forecast

Remember that solar storms severely affect the earth's magnetic field and ionosphere, sometimes resulting in a communications blackout. Minor disturbances often enhance the ionosphere and propagation. Expect slightly disturbed conditions during the first week of the month and again around the 23rd; and perhaps more severe ionospheric disturbances between February 15th and 20th. The remainder of the month should be reasonably normal for this time of year and solar cycle. As always, keep your listening fine-tuned to WWV at eighteen minutes past each hour for up-to-date solar-flux and geomagnetic-field information. Moon perigee will occur on February 5th at 2300Z. Historically, unusual weather conditions often accompany or shortly follow geomagnetic-field disturbances, so it might be well to watch for some atmospheric phenomena on the 19th or 20th.

WESTERN USA

GMT	PST	N	NE	E	SE	S	SW	W	NW
0000	4:00	—	—	20	15	15	15	15*	15
0100	5:00	15	—	20	15	20	15	15	15
0200	6:00	15	—	—	—	20	20	15	20
0300	7:00	20*	—	—	—	20	20	20	20
0400	8:00	20	80	—	40	—	20	—	—
0500	9:00	—	80*	—	80*	20	—	—	—
0600	10:00	—	80*	—	80*	20	—	40	—
0700	11:00	—	40	—	80*	20	—	40	—
0800	12:00	—	40	—	80*	40	—	40	40
0900	1:00	—	—	—	80*	40	—	40	40
1000	2:00	—	—	—	80*	40	—	40	80
1100	3:00	—	—	—	40	—	40	80	80
1200	4:00	—	—	—	40	—	40	80	80
1300	5:00	40	—	—	—	—	80	80	40
1400	6:00	80	—	—	—	—	80	40	40
1500	7:00	40	20	—	20	—	40	40	40
1600	8:00	—	15	—	20	20	20	20	40
1700	9:00	—	15	—	15	20	20	20	—
1800	10:00	—	15	15	15	—	20	20	—
1900	11:00	—	20	15	10	—	20	20	—
2000	12:00	—	—	20*	10	—	—	20	—
2100	1:00	—	—	20	10	—	15	15	—
2200	2:00	—	—	20	10	15	15	15*	20
2300	3:00	—	—	20	15	15	15	15*	15
	FEBRUARY	CENTRAL ASIA	EUROPE	S. AFRICA	S. AMERICA	ANTARTICA	NEW ZEALAND	W. AUSTRALIA OCEANIA	FAR EAST

MID USA

MST	N	NE	E	SE	S	SW	W	NW
5:00	—	40	20	15	—	15	15	15
6:00	40	40	20	20	20	20	20	15
7:00	80*	80	80	20	20	20	20	20
8:00	40*	80	40	40	20	20	20	20
9:00	20	80	40	40	20	—	—	—
10:00	—	80	40	40	20	—	—	—
11:00	—	80	—	80	40	—	—	—
12:00	—	80	—	80	40	—	—	—
1:00	—	80	—	80	40	—	—	—
2:00	—	80	—	80	40	40	40	—
3:00	—	80	—	80	40	40	40	40
4:00	—	40	—	80	—	40	40	80*
5:00	—	—	—	80	—	80*	80*	80*
6:00	80*	—	—	80	—	80*	80*	80*
7:00	40*	20	—	20	20	80*	40	20
8:00	20	20	—	20	20	20	20	20
9:00	20	10	15	15	—	20	20	20
10:00	20	10	10	10	—	20	20	—
11:00	—	15	10	10	—	—	—	—
12:00	—	20	15	10	—	—	—	—
1:00	—	20	15	10	—	10	—	—
2:00	—	20	15	10	—	10	10	—
3:00	—	20	20	10	—	10	10	—
4:00	—	40	20	15	—	15	15*	—
	CENTRAL ASIA	EUROPE	S. AFRICA	S. AMERICA	ANTARTICA	NEW ZEALAND	AUSTRALIA	FAR EAST

CST	EST	N	NE	E	SE	S	SW	W	NW
6:00	7:00	—	40	—	40	40*	20	20	20
7:00	8:00	—	80	40	80	40	20	20	20
8:00	9:00	—	80	40	80	40	—	—	20
9:00	10:00	—	80	40	40	80	—	—	—
10:00	11:00	—	80	80	40	80	—	—	—
11:00	12:00	—	80	80	40	80	—	—	—
12:00	1:00	—	80	80	—	80	—	—	—
1:00	2:00	—	80	40	—	80	40	40	—
2:00	3:00	—	40	40	—	80	40	40	—
3:00	4:00	—	40	—	—	80	40	40	—
4:00	5:00	40	—	—	—	80	80*	80*	40
5:00	6:00	40	—	—	—	80	80*	80	80*
6:00	7:00	40*	20	20	—	20	20	80	80*
7:00	8:00	20	20	20	—	20	20	20	40
8:00	9:00	20	15	15	15	20	20	20	20
9:00	10:00	20	15	10	10	10	20	20	20
10:00	11:00	—	15	10	10	10	—	—	—
11:00	12:00	—	20	10	10	10	—	—	—
12:00	1:00	—	20	15	15	10	10	—	—
1:00	2:00	—	20	15	15	10	10	15	10
2:00	3:00	—	20	20	20	10	15*	15	10
3:00	4:00	15	40	20	20	15	15	15	10
4:00	5:00	15	40	20	20	15	15	15	15
5:00	6:00	15	40	—	40	20	20	20	20*
		FAR EAST	EUROPE	CENTRAL AFRICA	S. AFRICA	S. AMERICA	OCEANIA	W. AUSTRALIA NEW ZEALAND	AUSTRALIA

EASTERN USA

HAM CALENDAR

February 1978

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
*All International events such as contests are shown on the GMT days on which they take place even though they may actually begin on the evening of the preceding day in North America.	TEN-TEN INTERNATIONAL NET WINTER QSO PARTY — 0000Z 2/11 - 2400Z 2/12* Open to all amateurs but only members eligible for awards. All contacts to be made on 10 meters, any mode. EXCHANGE: Name, QTH, 10-10 number. (Be sure to log date and time of each contact.) SCORING: 1 point for each contact, add 1 point if with a 10-10 member (maximum 2 points per contact). Give the name of your chapter for chapter credit. AWARDS: 1st and 2nd place certificates to each U.S. Dist., KH6, KL7, each VE Dist.; Central America and Caribbean; South America, Europe, Africa and South Atlantic; Asia and North Pacific; Australia, New Zealand and South Pacific. MEMBERS ONLY: Send log to Grace Dunlap, K5MRU, Box 445, La Feria, TX 78559, no later than March 31, 1978.		1	2	3	ARRL Novice Contest — 2/4 - 2/12 ARRL DX Contest — Phone — 2/4 - 2/5 4
Wheaton Community Radio Amateurs Swap & Shop — DuPage County Fairgrounds — Manchester Road — Wheaton, IL — WB9VFC Hamfest/Auction — Richland County Fairgrounds — Mansfield, OH — K8HF (K8JPF) 5	FLORIDA HAM NEWS — SWAP NET By the Broward ARC — Ft. Lauderdale, FL — 146.31-91 at 7:30PM WEST COAST BULLETIN Edited & Transmitted by W6ZF 8PM PST 3540 kHz, A-1, 22 WPM 6	AMSAT Eastcoast Net 3850 kHz 8PM EST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz 8PM CST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 7PM PST (0300Z Wednesday Morning) 7	8	9	QSO Party — By the Quarter Century Wireless Assoc., Inc. Starts Friday 2/10 at 2400Z and ends on Sunday 2/12 at 2400Z. Points will be based on the number of QCWA members contacted multiplied by the total number of Chapters contacted. Sponsored by the Northern New Jersey Chapter. 10	Cherryland Amateur Radio Club Swap 'N' Shop — Northwestern Michigan College — Traverse City, MI — WB8TRP Valentine Dinner Dance — By the New Jersey FM Repeater Assoc. of Woodbridge, NJ — Masonic Temple — Green Street — Woodbridge, NJ — Info: WA2FXB, WA2JDU, WB2JDU 11
Frequency Measuring Test 12	FLORIDA HAM NEWS — SWAP NET By the Broward ARC — Ft. Lauderdale, FL — 146.31-91 at 7:30PM 13	AMSAT Eastcoast Net 3850 kHz 8PM EST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz 8PM CST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 7PM PST (0300Z Wednesday Morning) 14	15	16	ARRL Florida State Convention Sheraton's Twin Towers Hotel & Convention Center Orlando, FL — 17-19 17	ARRL DX Contest — CW — 2/18 - 2/19 YL-OM Contest — Phone — 2/18 - 2/19 18
 See Feb. 4, 5, 10, 11, 18, 19 19	FLORIDA HAM NEWS — SWAP NET By the Broward ARC — Ft. Lauderdale, FL — 146.31-91 at 7:30PM WEST COAST BULLETIN Edited & Transmitted by W6ZF 8PM PST 3540 kHz, A-1, 22 WPM 20	AMSAT Eastcoast Net 3850 kHz 8PM EST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz 8PM CST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 7PM PST (0300Z Wednesday Morning) 21	22	23	24	French Contest — Phone — 2/25 - 2/26 25
26	FLORIDA HAM NEWS — SWAP NET By the Broward ARC — Ft. Lauderdale, FL — 146.31-91 at 7:30PM 27	AMSAT Eastcoast Net 3850 kHz 8PM EST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz 8PM CST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 7PM PST (0300Z Wednesday Morning) 28	COMPCON '78 Spring — San Francisco, CA — Info: Compcon, Box 630, Silver Spring, MD 20901 (301) 639-7007 — 2/28 - 3/2	NEW HAMPSHIRE QSO PARTY — By the Concord Brasspounders, Inc., W1OC, to promote Worked New Hampshire Award. Operating periods are 2000Z 2/10 to 0500Z 2/11 and 1400Z 2/11 to 0200Z 2/12.* Stations may be worked once per band per mode. New Hampshire stations may work each other. N.H. stations send RS(T) and county. Out-of-state stations send RS(T), ARRL section of country. N.H. stations score 1 point per QSO, times the no. of ARRL sections plus countries plus N.H. counties. Others score 5 points per N.H. QSO, times the no. of N.H. counties. Suggested freq. CW 1810, 3555, 7055, 14055, 21055, 28130 Phone 1820, 3935, 3975, 7235, 14280, 21380, 28575 Novice 3730, 7130, 21130, 28130 VHF 50.115, 145.015, FM Simplex (no repeaters)	Top-scorer in each N.H. county, and top scorer in each state, province, and country (50 points minimum). Additional certificate available for confirmation of all 10 N.H. counties. Send logs, summary and check sheets to: Concord Brasspounders, Inc., C. Halloway, 9 Via Tranquilla, Concord, N.H. 03301. Mailing deadline is March 15, 1978. Include business-size SASE for results and/or award.

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FEBRUARY, 1978

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LET'S FACE IT! We COULD just as easily offer liberal discounts or cash-and-carry incentives in order to attract more customers. BUT . . . if there's one lesson we've learned in our 40-PLUS YEARS of serving the nation's ham operators . . . it's that THERE IS NO SUBSTITUTE FOR "GOOD" S-E-R-V-I-C-E! Long after the price you pay has been forgotten, WHAT really sticks in your mind is the kind of S-E-R-V-I-C-E you got — both BEFORE and AFTER the sale.

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Furthermore, you'll find our ATTITUDE in serving you MORE than REFRESHING. We don't follow the "Hard-Sell" approach and, in fact, we will lean over backwards NOT to sell you a particular item when we feel it's not RIGHT FOR YOU! And, we're MORE than happy to offer whatever practical or technical advice you need in setting up or operating your station.

Finally, when you deal with us, you ALWAYS receive our PROMPT, PERSONAL ATTENTION and INDIVIDUAL CONCERN. Each and every letter or phone call puts you in INSTANT TOUCH with a licensed ham who is READY, WILLING and ABLE to give your order or inquiry their undivided attention — NOT put you on "HOLD!"

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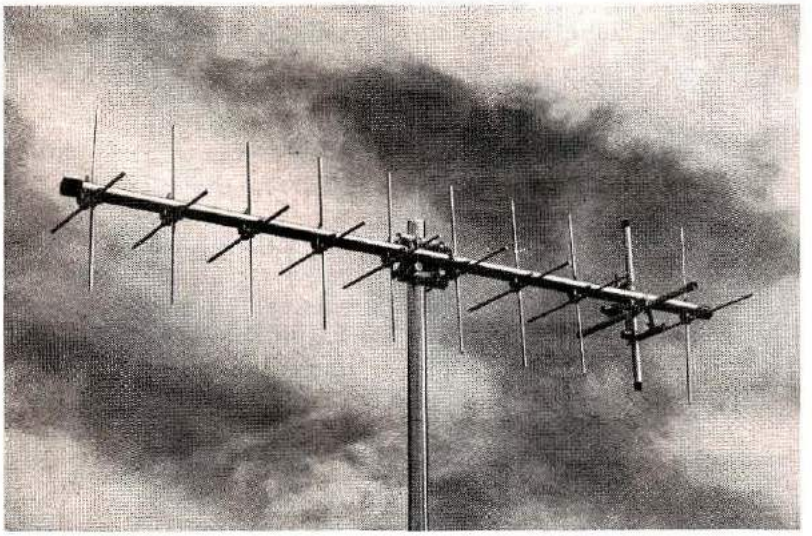

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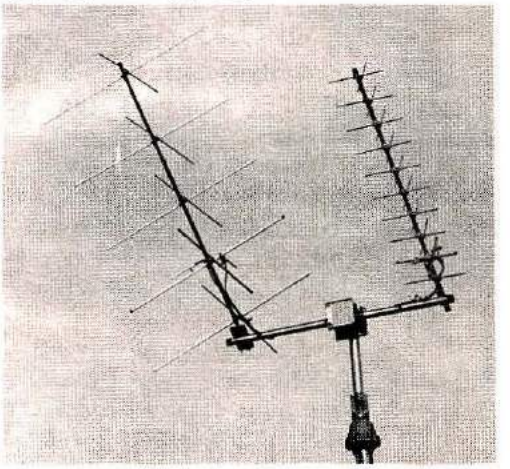
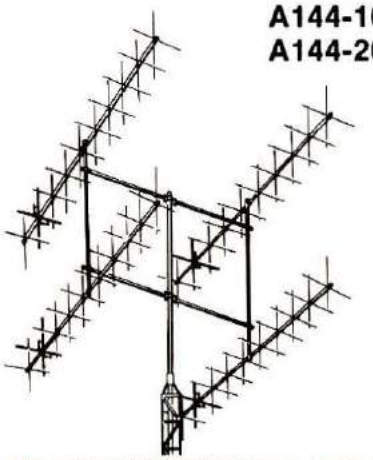


A144-10T $34.95 **A432-20T $49.95**
A144-20T $54.95 **A14T-MB $15.95**



PERFORMANCE ARRAYS . . .

Enjoy fade-free contacts on VHF/UHF with Twist Antennas and Arrays. Excellent for scatter and other long-haul techniques. Double your effective radiated power by stacking two Twists, or quadruple ERP by stacking four Twists. Arrays are easily assembled for your special communications requirement. Write for stacking and phasing harness details concerning amateur and commercial frequencies.

Dependable communications — *Now Yours!*

SPECIFICATIONS

Model	A147-20T	A144-10T	A144-20T	A432-20T
Center Freq. (MHz)	144.5/146.5	145.9	145.9	432
No. Elements	10/10	10	20	20
Weight (lbs.)	6	3.5	6	3.5
Wind Surf. Area (ft.²)	1.42	.74	1.42	.37
Mounting	Center	Rear	Center	Rear
Dimensions (Inches)	40x40x140	40x40x70	40x40x140	14x14x57

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THE ANTENNA COMPANY

P.O. BOX 4680, MANCHESTER, N.H. 03108

More details? Ad Check page 78.

KENWOOD

...pacesetter in amateur radio

The Kenwood family is growing!

The TL-922, a brand new linear amplifier, is now a reality. Give yourself the "big signal" that commands attention on today's crowded bands. The TL-922 runs the full legal limit on all the ham bands from 160-10 meters and is compatible with most amateur exciters. The TL-922 is a must in any Kenwood station. Make yourself heard like you've never been heard before, with the Kenwood TL-922 linear amplifier.

TL-922

What makes one linear amplifier different than all the rest? Check out these features:

Full amateur band coverage — Includes 160 meters.

Instant heating filaments — The 3-500Z tubes require no warm up period. Just turn it on and go!

Time delay fan circuit — Even after you turn the TL-922 off, the super quiet fan continues to work for approximately 2 minutes to greatly extend tube life.

Adjustable ALC output voltage — Lets you tailor the ALC voltage to your exciter.

Standby position — Provides amplifier bypassing without having to turn the AC power off.

Two independent safety interlocks — One disconnects AC line voltage and the second shorts B+ to ground when tripped.

Vernier plate control — For smooth, easy tune-up.

Diecast side panels — Includes functional carrying handles for easy transportation.

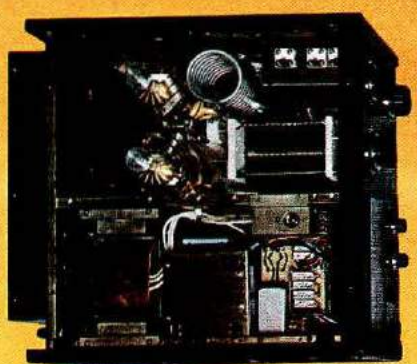
Thermal protection of power transformer — Amplifier automatically switches to standby if power transformer temperature exceeds 145°F.

Tuned Input Circuit — Means improved spurious characteristics.

Line voltage selector — Easily switched between 120 and 240 VAC.

Plate Current Meter — Separate meter allows continuous monitoring of plate current.

Limited quantities available in the Spring!



Shown with top panels removed

Frequency Range: Amateur bands, 160-10 meters
Drive Power Required: 80 W nom, 120 W max
Mode and Duty Cycle: SSB, cont for 30 min CW and RTTY, key-down cont for 10 min
RF Input Power: SSB: 2,000 watts PEP, CW, RTTY: 1,000 watts DC
Plate Voltage: (at idle) 3.1 KV SSB, 2.2 KV CW, RTTY
Circuit Type: Class AB_1 grounded grid linear amplifier
Input Impedance: 50 Ω, unbalanced at better than 1.5 SWR
Output Impedance: 50 to 75 Ω, unbalanced.
Harmonic Suppression: min 40 db, depending on exciter used.
Fan Motor Delay Time: 140±30 seconds. (at room temperature)

ALC: Neg going, adjustable threshold, −8V DC max output (typ).
Tubes: 2 x Eimac 3-500Z.
Semiconductors: 18 Diodes, 1 Zener diode.
Power Requirements: 120V, 28A; 220/240V, 14A; 50/60Hz; for maximum SSB input.
Dimensions: 390 mm (15⅜") x 190 mm (7½") x 407 mm (16")
Weight: Net 31 kg (68 lbs) Shipping 38kg (83 lbs)

The above specifications are subject to change without notice due to developments in technology.

TRIO-KENWOOD COMMUNICATIONS INC.
1111 WEST WALNUT/COMPTON, CA 90220

The HEATHKIT HW-101
it won't cost you an arm and a leg!

Chances are that getting on the air is pretty important to you. You may be a brand new Novice, a recent upgrade to General, or you're rejoining the Amateur ranks after years of inactivity. But the cost! $600, $700, in some cases $1000 and more. And that's just the price of a transceiver....no extras! Pretty staggering, isn't it? There's a choice though.

Did you know that you can equip your station with our performance proven HW-101, its optional crystal CW filter, and matching power supply, for a lot less than $450. Less than $430 in fact!

And for the price you'll have 0.35 μv receiver sensitivity, complete 80 through 10 meter coverage, selectable LSB, USB, CW, VOX and PTT operation, and 180 watts PEP in on phone and 170 in on CW....for less than $430!

Think about it. Ask the guy who's built a 101, then make your move to join the thousands of Amateurs who have turned to Heath for outstanding value, quality, and unparalleled performance. The HW-101 – it's a transceiver you can grow with and a pretty impressive answer to getting on the air....without it costing an arm and a leg!

AM-362

For complete details on our entire line of quality Amateur Radio Products use the postcard, found elsewhere in this issue to send for your Free Heathkit Catalog, or write: Heath Company, Dept. 348-381, Benton Harbor, Michigan 49022