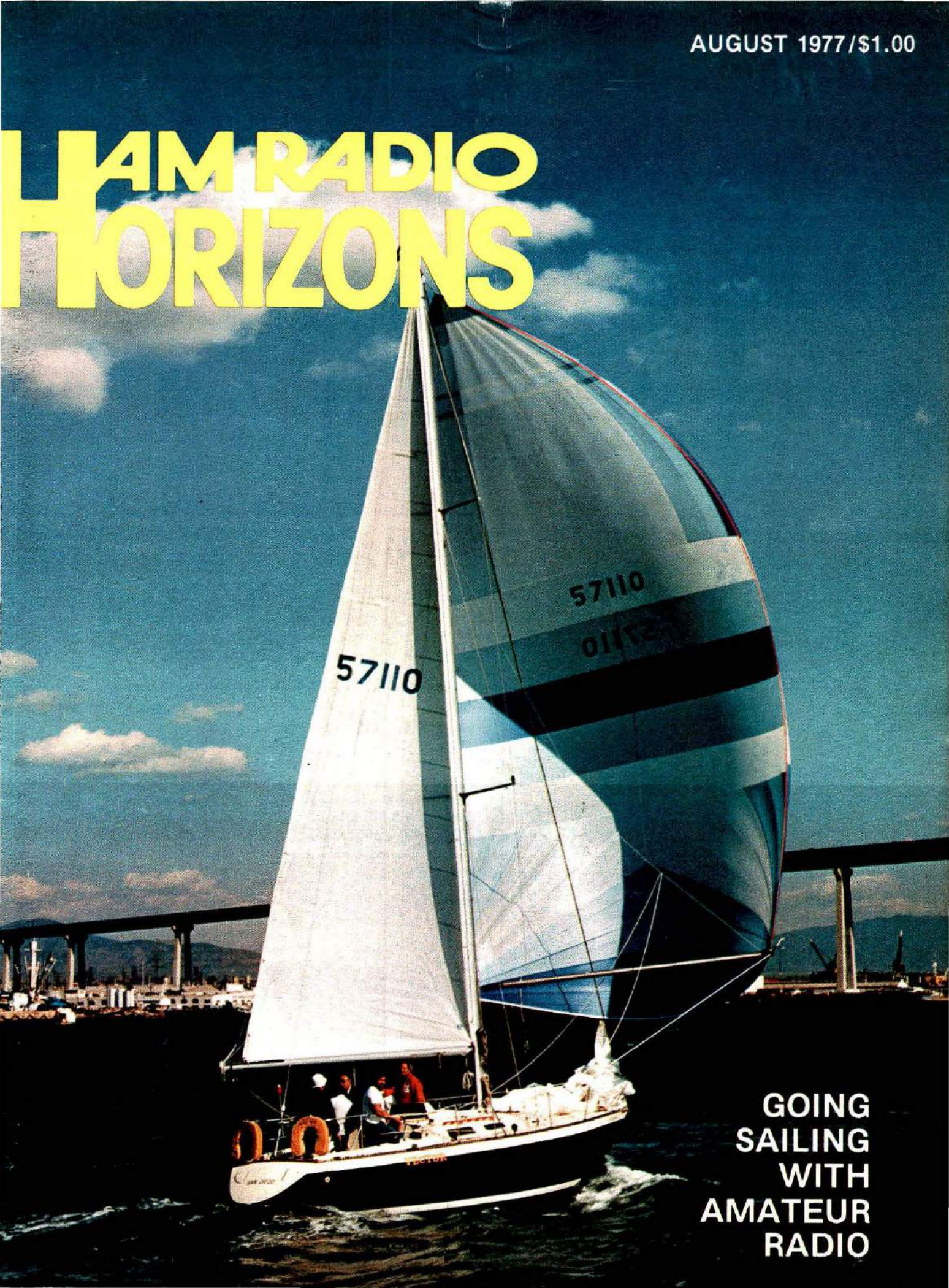
AUGUST 1977/$1.00

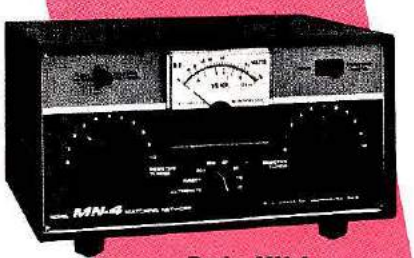
HAM RADIO HORIZONS



GOING SAILING WITH AMATEUR RADIO

the FCC, harmonics, spurious radiation, 40 dB, and you.

The First Report and Order, in docket 20777, requires that harmonic and spurious radiation from most hf amateur radio equipment must be attenuated by at least 40 dB. Can YOUR equipment meet this new regulation?



Drake MN-4

Drake MN-2000

It can...if it was made by R. L. Drake

R. L. Drake has been making equipment to meet these new regulations for the last 13 years. We didn't wait to be "forced" to produce quality equipment by FCC regulations.

It can...if you use a Drake Matching Network (tunable low-pass filter)

If you don't own Drake equipment, you can still use your present gear by adding a Drake MN-4 or MN-2000 Matching Network. Drake's Matching Networks, unlike most other networks, utilize the tunable low-pass filter type of matching (similar to a TVI filter) to provide 20 to 25 dB of harmonic attenuation in addition to producing a perfect impedance match. This, plus a direct reading SWR and forward rf power meter and built-in antenna selector provide the ultimate answer to the new FCC rules.

The Drake design philosophy has been meeting FCC radiation specifications before there were any! Think about it.

Drake TR-4Cw

Drake T-4XC

To receive a FREE Drake Full Line Catalog, please send name and date of this publication to:

R. L. DRAKE COMPANY

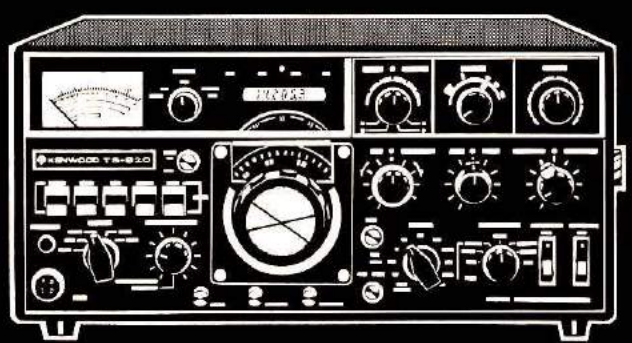
DRAKE®

540 Richard St., Miamisburg, Ohio 45342
Phone: (513) 866-2421 • Telex: 288-017

Western Sales and Service Center, 2020 Western Street, Las Vegas, Nevada 89102 • 702/382-9470

Call 1-800-633-3410 for Kenwood*

*YAESU, DRAKE, ICOM, CDE, HYGAIN, CUSHCRAFT, NPC, TPL, TRISTAO, NEWTRONICS, DENTRON, REGENCY, ROHN, WILSON, TEN-TEC, MCM & MFJ



KENWOOD TR-7400A 2m FM transceiver

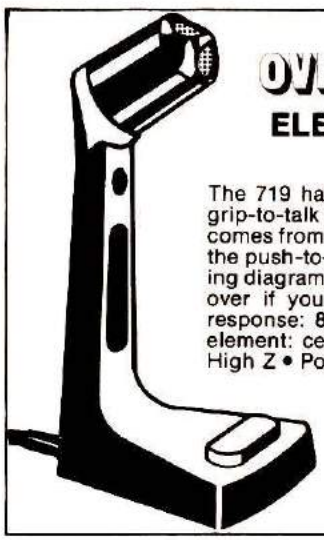
Features: • CTCS provisions, encode and decode • 25 watt RF output • Solid-state final stage • LED digital readout • PLL gives 800 discrete channels • Repeater offset circuit • PLL unlock protection circuit • Low power position, 5 watts • 2-pole, 10.7 MHz monolithic crystal filter • MOS FET

399.95 list price, Call for quote.

KENWOOD TS-820 transceiver

Features: • 10 thru 160 meters coverage • 200 watts PEP • Integral IF shift • Solid-state, except for drive and final stages • Noise blanker • VOX circuit • PLL circuitry • DRS dial • IF out, RTTY, XVTR capabilities • Phone patch IN and OUT terminals • RF speech processor • Ask about options.

869.00 list price. Call for quote.

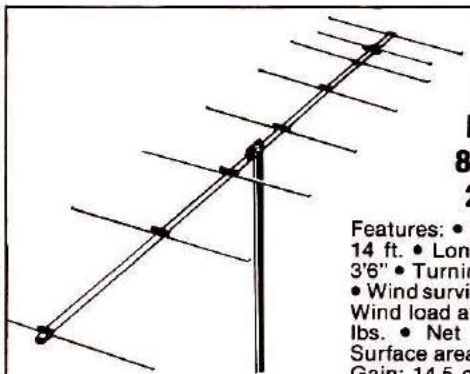


OVER 50% OFF!

ELECTRO-VOICE 719 push-to-talk mike

The 719 has two talk switch positions, grip-to-talk and push-to-talk. The mike comes from the factory with the switch in the push-to-talk position. Complete wiring diagrams are furnished for a change-over if you wish. Specs: • Frequency response: 80 to 7000 Hz • Generating element: ceramic • Output impedance: High Z • Polar pattern: omnidirectional.

19.95
List price 45.00



HYGAIN Model 28 8-element 2m beam

Features: • Boom length: 14 ft. • Longest element: 3'6" • Turning radius: 7'6" • Wind survival: 100 mph • Wind load at 80 mph: 20.7 lbs. • Net wt.: 7 lbs. • Surface area: 0.81 sq. ft. • Gain: 14.5 dB • Front-to-back ratio: 25-30 dB • Max. power output: 1KW • VSWR: 1.5:1 • Impedance: 52 ohms • Uni-directional pattern.

24.95
List price 37.50

Remember, you can call TOLL-FREE: **1-800-633-3410** nationwide or call **1-800-292-8668** in Alabama for Long's Electronics' low price on any Amateur radio or radio accessory item.

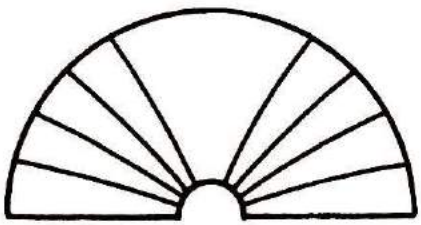
Your BANKAMERICARD welcome here

Long's Electronics

3521 10TH AVENUE NORTH, BIRMINGHAM, ALABAMA 35234

master charge

THIS MONTHS



HORIZONS

Amateur Radio Afloat

One of the greatest summer pastimes is boating — not just in the United States, but all across the world. Some people go for leisurely trips on a river or lake in a houseboat, others churn up the waves with power cruisers, and many seek the wind for locomotion. Some of them have discovered the delight of having Amateur Radio aboard for communications — both personal and emergency. Veteran racing sailor and long-time Amateur Radio enthusiast Herb Johnson, W6QKI, tells you the why and how of Amateur Radio afloat.

Ham Radio Sailors Are Never Out Of Touch

In emergencies, and for just plain relaxation aboard his yacht, K3RXK makes an excellent case for having his ham station on board. Life at sea quickly establishes priorities, and the sea-going Radio Amateur may find that his radio is close to the top of the list.

Low-Powered Transmitters

In a recent issue of *Horizons* you read about the Two-Band Superhet for the 80-and 40-meter bands, and will probably remember that we promised you a companion article about a QRP transmitter. Well, here it is. The original, written by the late Howard Pyle, W7OE, appeared in the December, 1968, issue of *ham radio*. This slightly updated version still carries all of the interest and enthusiasm that made Howard's contributions so much fun for a generation of hams. Read, build, and enjoy.

Ham Radio Antennas

Your Amateur Radio station is only as good as your antenna, and a well-known authority on the subject tells you how to build and install a proper "skywire."

Mechanics — Analogy To Electronics

For many years, students of electronics have been invited to compare hydraulic principles with events in the invisible world of the electron. Now, as an aid to better understanding, you are invited to see a new and better relationship between simple mechanical elements and their electronic counterparts.

Ten Easy Steps

If you've wondered why your wife (best girl, mom, sister, daughter) isn't interested in Amateur Radio, did you ever stop to think that part of the reason could be *you*? Here's a plan to change all that . . . in ten easy steps. Read and heed the words of a ham who knows whereof she speaks.

Power Paranoia

Frustrated in his DX attempts, and beset by a super-power loudmouth, the Amateur must sometimes resort to unusual measures to solve his problems. It's all a case of mind over matter.

The Far Horizon — Dawn Patrol

Many of us hate to get up in the morning, and can invent all sorts of excuses for lingering over another cup of coffee. But when the coffee is accompanied by the thrill of two new DX stations added to your log, it just has to make the day seem brighter. Listen in as W9KNI greets the sunrise.

DB Or Not DB

Different values of power and voltage may be compared with each other by using ratios, that is, decibels. In radio broadcasting, antenna work, sound recording, phone patching and many other applications, decibels have provided a convenient means of making critical comparisons where it is necessary to be able to measure and control levels of power and voltage with respect to reference values. Here's what decibels are, how they work, and how you can put them to use in your own station.

HAM RADIO HORIZONS August 1977, Volume 1, No. 6. Published monthly by Communications Technology, Inc., Greenville, New Hampshire 03048. One-year subscription rate, $10.00; three-year subscription rate, $24.00. Application to mail at second-class postage rates is pending at Greenville, New Hampshire 03048 and additional offices.

Take the next step: your own personal computer.

It's the Sol-20. It's the most sophisticated personal computer you can buy anywhere. It's a true breakthrough. It's a complete small computer system which includes all the essential elements as *standard* equipment — central processor, memory, keyboard, and display, software, power supply and proper package.

Your Processor Technology Sol-20 comes completely assembled and tested for just $1495 or in kit form for $995. It's about the size of a typewriter and has the look of the best IBM ever offered. And there's nothing like it on the market today. Not from IBM, Burroughs, DEC, HP or anybody else.

It fills a new role

Use it in the office as a full fledged business computer. Use it to compose and edit letters electronically, store and retrieve mailing and prospect lists, process orders, maintain journals and general ledgers, and produce statements and reports.

If you're a scientist or engineer, you can use Sol to analyze data statistically, control lab equipment, prepare graphics, and fit curves. Sol frees your time and expands your overall capability.

In schools and universities, use Sol to teach computer programming. Use it for computer-aided instruction. Use it for notes, records and sorting.

And after hours, use your Sol at home. Regulate your total home energy complex. Compute taxes with our special software tax package. Play TV games... tennis, hockey and the very complex Trek-80 where your starship takes on a whole fleet of klingons. Use Sol for the family finance plan, the diet and recipe plan, to inventory all the things in your house and their value.

Sol is so powerful, you'll wonder how you got by without it.

Sol-20 is a scaled down big computer system

Most small computers simply grew like "Topsy" — a memory here and expansion module there. In fact some small computers don't even have keyboards! Not Sol-20. It was designed from the ground-up as a complete system. There's the basic mainframe central processing unit (CPU), the peripherals designed to work with Sol, the software and the optional extras for even more power. Use Sol as a stand alone computer or as a "smart" terminal for distributed processing and the like.

And, unlike other small computers, Sol is already programmed to receive your commands the moment it's turned on, thanks to Sol plug-in Personality Modules.

Here's what you get in the basic Sol-20 as standard:

8080 microprocessor — 1024 character video display circuitry — control PROM memory — 1024 words of static low-power RAM — 1024 words of preprogrammed PROM — built-in cassette interface capable of controlling two recorders at 1200 bits per second — both parallel and serial standardized interface connectors — a complete power supply including ultra quiet fan — a beautiful case with solid walnut sides — software which includes a preprogrammed PROM personality module and a data cassette with BASIC-5 language plus two sophisticated computer video games — the ability to work with all S-100 bus products.

Add even more computer power

Extras include a module to help write, edit, assemble, debug and run your own programs. There's no better collection of add-on memories anywhere... up to 16,384 words per module. Solve additional interfacing problems with our I/O module. Get big system performance with our Helios II "floppy" disc system. Display results on our video monitor. Output on line or serial printer. Other peripherals include joysticks, paper tape readers, A/D and D/A converters, and PROM programmers.

The Small Computer Catalog awaits your request.

For all the details, fill in the coupon below or call us on our toll free hotline 1-800-528-6050 Ext. 765. Arizona residents only: 1-602-955-9710 Ext. 765. We'll send you without obligation a 22 page fully illustrated catalog, a price list, and dealer locator.

Processor Technology Corporation

Box E, 6200 Hollis Street
Emeryville, CA 94608

Send me The Small Computer Catalog

NAME _____

STREET _____

CITY ____ STATE ____ ZIP _____

Phone 1-800-528-6050 Ext. 765.
Arizona residents only:
1-602-955-9710 Ext. 765.

ATB-34

THE COMPLETE 3 BAND ANTENNA

BY

cushcraft

CORPORATION

IN STOCK WITH YOUR LOCAL DEALER

IN CANADA:
SCOTCOMM RADIO LTD. - 4643 Levesque Blvd. - Chomedey, Laval, Quebec
WORLDWIDE:
MAGNUS - 5715 North Lincoln Ave. - Chicago, Ill., U. S. A. 60659

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

August, 1977
Volume 1, Number 6

HAM RADIO HORIZONS

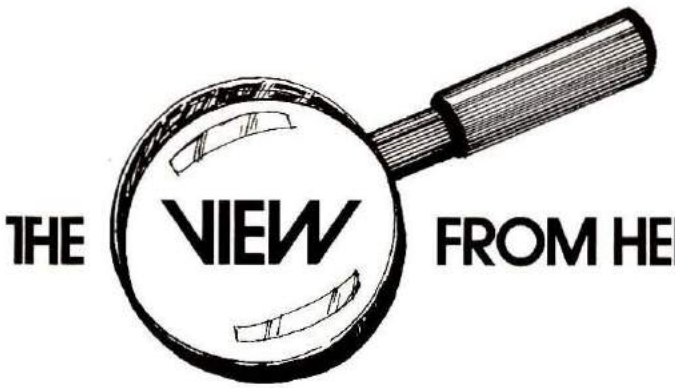
CONTENTS

Ham Radio Horizons
is published monthly by
Communications Technology, Inc
Greenville, New Hampshire 03048
Telephone 603-878-1441

Subscription rates are
$10.00 per year, worldwide

The Cover

W6QKI heads out for a day of sailing on his sloop *Vector*. Amateur radio goes along for many reasons. See page 12 for the story. Photograph by Jim Campbell



One of the most devastating experiences that could befall a ham is to lose an expensive tower and antenna during a storm. What's even worse is to be forced to dismantle an antenna installation because of some overlooked restriction pertaining to a local zoning law or building ordinance.

Hams often erect antennas and install electrical wiring at a new location in their eagerness to get on the air, only to receive a "cease and desist" order from the local authorities because of some oversight. If you plan to rent, lease, or buy a choice piece of real estate that promises to be the answer to a dream location, it's well to examine the fine print in all legal documents associated with the transaction *before* you sign anything.

In many parts of the country, local building codes contain restrictions against the installation of "radio transmitting apparatus and appurtenances thereto." Such restrictions are often included in lease agreements, title insurance policies, and grant deeds.

Housing developments are becoming a part of the more densely populated areas of the country. Property deeds in these developments often prohibit installation of "structures that conflict with the existing and planned decorative ensemble," or similar phraseology. The language of these documents is often made vague for a purpose: the development planners (and your neighbors) can then ban any structure they might consider to be at variance with local architectural and landscaping motifs. Such structures might include anything from chicken coops to your $500 antenna installation.

Before buying or leasing property, make certain a clause is added to the legal documents that will allow you to install a tower and antenna. It's a good idea to enlist the services of an attorney to help you word the clause, otherwise loopholes may exist that will cause all kinds of problems. The small fee for the attorney's help is well worth the peace of mind after you sign on the dotted line.

As a first approach, consult your local radio club. In most large cities, ham clubs are represented by people who are knowledgeable in this area, or have members who can steer you in the right direction. In California, for example, the Los Angeles Council of Radio Clubs has a service that provides answers to questions from any ham regarding the specific language in a clause to be added to a real estate document. Amateur radio clubs in many other cities have similar services.

Sometimes electrical and building codes aren't included in real estate documents; nevertheless they're still a part of local law. These ordinances should be thoroughly investigated before you add anything to your property. You might take a tip from the experience of one ham who installed a heavy-duty 220-volt circuit between the power company's service drop and his kilowatt transmitter. Not only did he neglect to obtain a construction permit, he also tied several guy wires from his tower to a power company utility pole. He was doing great in a DX contest one day when he was visited by a representative from the local sheriff's office. Sure enough, he was presented with a "cease and desist" order that required him to disassemble his tower and the 220-volt line to his rig. This chap finished the DX contest with an indoor dipole antenna and a healthy respect for local ordinances.

Jim Fisk, W1HR
editor-in-chief

ICOM wants you to

Begin with the Best

As you develop your skills, increase your participation in Ham Radio activities, and add hardware for ever-increasing flexibility of operations, you'll come to know ICOM. Just ask any old Ham. ICOM is the quality name in VHF/UHF Amateur Radio equipment because it is simply the best. ICOM is the line you'll want to move up to for unequaled quality and features.

But you needn't wait until you can trade in a truck load of equipment to reach up to ICOM. You can begin building your Amateur Radio operations with reasonably priced ICOM units that have flexible add-on features when you purchase your very first voice transceiver. And when you are installing ICOM's top-of-the-line fixed station unit, the ICOM equipment you began with will probably still be an important integral part of your active hardware.

Don't delay in moving up to ICOM: begin with the best.

Clockwise from lower left: **IC-211** 4MHz, 2 meter, All Mode Transceiver; **IC-245** Mobile 2 meter Transceiver; **IC-22S** Mobile VHF FM Transceiver; **IC-502** Portable 50 MHz SSB Transceiver; **IC-215** Portable 2 meter FM Tranceiver; **IC-30A** Mobile UHF FM Transceiver.

Ask your dealer for ICOM's complete product line catalog, or mail your request to an address below.

VHF/UHF AMATEUR AND MARINE COMMUNICATION EQUIPMENT

Distributed by:

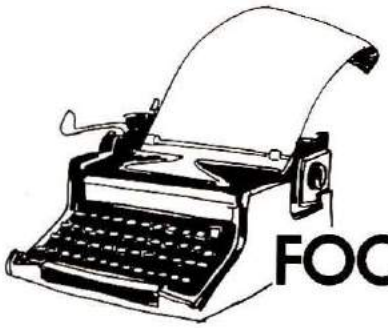
ICOM

ICOM WEST, INC.
Suite 3
13256 Northrup Way
Bellevue, Wash. 98005
(206) 747-9020

ICOM EAST, INC.
Suite 307
3331 Towerwood Drive
Dallas, Texas 75234
(214) 620-2780

ICOM CANADA
7087 Victoria Drive
Vancouver B.C. V5P 3Y9
Canada
(604) 321-1833

More details? Ad Check page 78.



FOCUS & COMMENT

Bring up the subject of antennas at any gathering of hams, or any group of radio enthusiasts for that matter, and you immediately start thoughts racing and voices agreeing and disagreeing about the merits of this or that type. The mystique of antennas seems to overshadow all other phases of amateur radio endeavor.

Further evidence of the hunger for antenna knowledge is given by the never-failing popularity of the "Antenna Issue" of the various publications, and the smashing attendance of hams at any forum or lecture on the subject. The recent Amateur Radio Antenna session at the IEEE conference in New York City was one of the best-attended of the entire week.

What is there about this facet of amateur radio that attracts everyone — newcomers and old timers alike?

There seem to be several avenues that lead people to be curious about antennas. I suspect that the primary one is that this field is still enveloped in mystery for the majority of us. In almost all other parts of an amateur station quantities can be measured, observed, predicted, and proved. You can probe with an oscilloscope or meter and know exactly what action and results are taking place. When it comes to the antenna, the usual measurement consists of checking the amount of energy that is being pushed up the feedline, and hope that what the books say should happen at the other end will indeed take place.

Oh, some of us can set up a crude system to check the field strength of the radiated energy at certain angles and distances, but we still don't know *exactly* what is going on up there.

Another reason for the popularity of written or spoken words about antennas is that each of us is looking for that elusive key that will help us defy what we see as the restrictive laws of electromagnetic radiation — there must be some way to make a small antenna perform as well as a full-sized one; what combination of size, height, spacing, or phasing can I use to lower my angle of radiation just a bit more?

Then there is always the ham who put together a real tangled mess in his backyard, and, because it was put up at a high point in the sunspot cycle, he worked the world with his low-powered rig and is forever convinced that his antenna is the answer to everything you need to know. His search is for some theory that fits the results, or some clue as to why it doesn't do so well a few years later.

And just to make things more interesting, at times even the experts disagree about what makes antennas play. Some of the most lively discussions or papers are the result of differences of opinion between two engineers or theoreticians. Each can put forth equally logical explanations of why his version works and the other should not. Who can help but be enthralled with dBs, standing wave ratios, reflection coefficients, conjugate matches, and isotropic sources being tossed about so effortlessly.

Then, too, we cannot forget the newcomer to amateur radio who just plain wants to know what to put up and how he should expect it to work; he needs to know about antennas so he can be sure the energy from his transmitter goes where it is supposed to; so he can communicate more effectively.

Whatever your reasons for being intrigued by antennas, it is a good sign, a healthy indicator of interest in amateur radio. We'll keep presenting antenna ideas for you — ideas that will perhaps explain some of the basics of why they work, or perhaps some that will help you to do some meaningful experiments with your own skywire. They'll be based on sound theory or positive experience, so as to lessen the confusion about why they should work. But the experiments and search for knowledge about antennas should continue; it's one of the fields that can still be explored by the amateur who does not have a laboratory full of equipment. Besides, building and testing antennas is fun, educational, and is a great topic for conversation at the next club meeting.

Tom McMullen, W1SL
Managing Editor

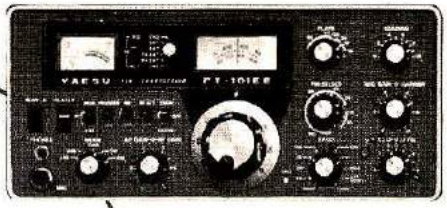
SERVING HAMS BETTER

NORTH, SOUTH . . . EAST, WEST.

ALL LEADING BRANDS . . . IN-DEPTH STOCKS . . . NEW/USED EQUIPMENT

DRAKE
TR-4C SSB transceiver

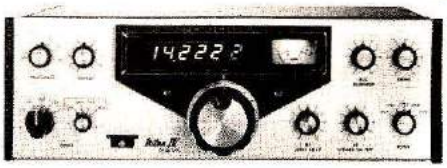
in stock
at
HAM RADIO OUTLET



YAESU
FT-101EE SSB transceiver

KENWOOD
TS-520 SSB transceiver

TEMPO
2020 SSB transceiver



TEN-TEC
Triton IV Digital SSB transceiver

TRI-EX W-51 TOWER

Our "package" deals can't be beat!
The "package" antenna, tower, rotator
Inquire

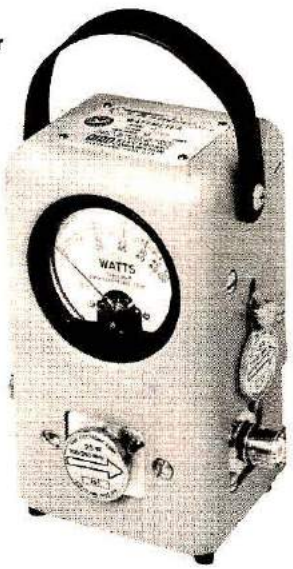
Every-day special
CDE HAM II rotator
129.95

HY-GAIN TH6DXX

De Luxe, 6 element Hy-Gain Thunderbird, covers 10, 15, 20 meters. Separate low loss traps for each band. Hy-Gain Beta match for low VSWR with 50 ohm line.

Longest element: 31.1 ft.
Boom: 24 ft.
Turning radius: 20 ft.
Wind load: (80 mph): 156 lbs.
Max. wind survival: 100 mph.
Surface area: 6.1 sq. ft.
Net weight: 57 lbs.

in stock at Ham Radio Outlet



BIRD 43

Model 43
THRULINE WATT METER

0.1 - 10,000 watts.
0.45 - 2300 MHz.

Standard of the industry!

OVER THE COUNTER (Mon. thru Sat. 10AM to 5:30PM). PHONE, WRITE. SAME DAY SHIPMENT MOST ITEMS.

HAM RADIO OUTLET

SOUTH
Anaheim, Calif. 92801
2620 W. La Palma, (714) 761-3033

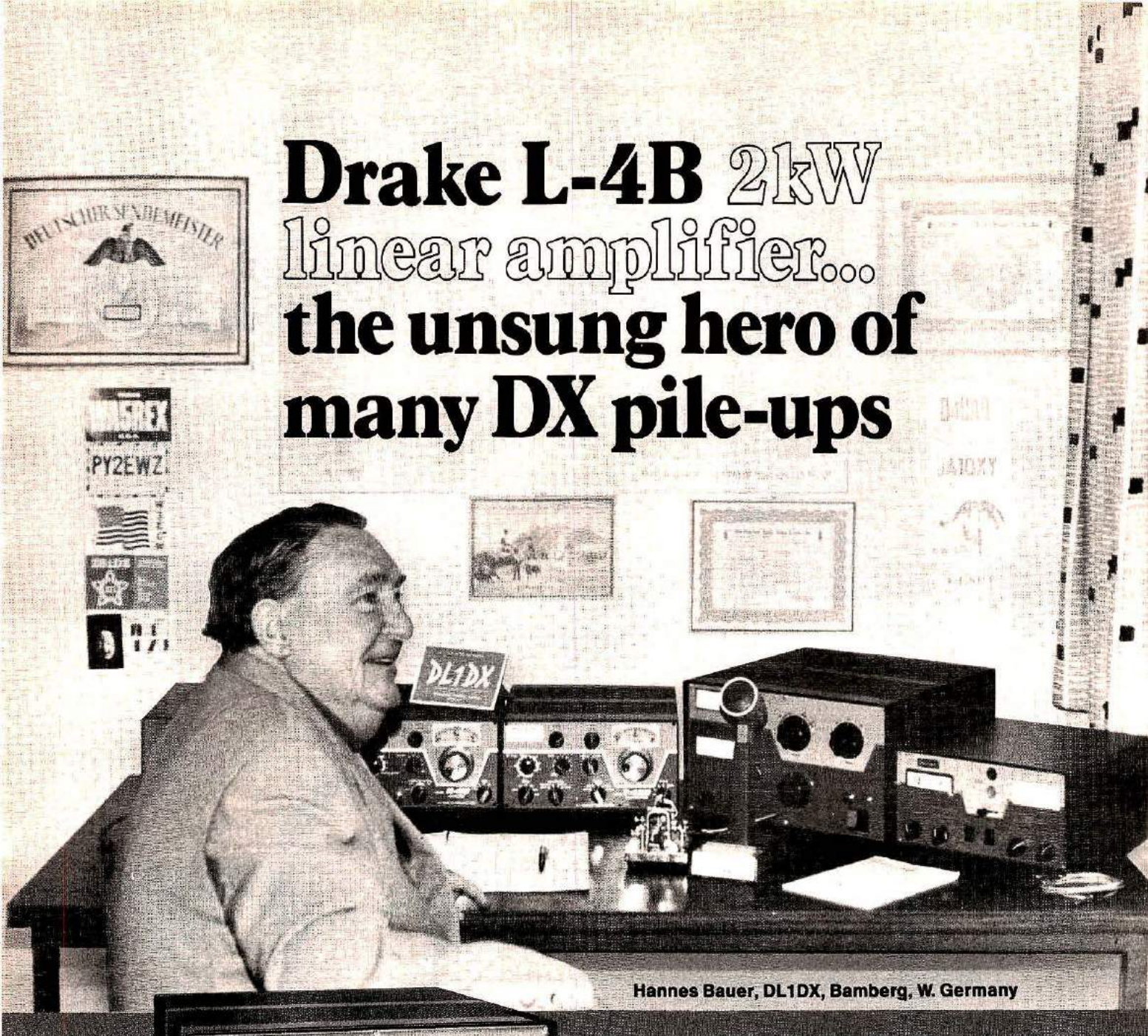
NORTH (Main Office)
Burlingame, Calif. 94010
999 Howard Ave., (415) 342-5757
5 miles south on 101 from S.F. Airport.

SOUTH
Van Nuys, Calif. 91401
13754 Victory Blvd., (213) 988-2212

Bob Ferrero, K6AHV/W6RJ.
Jim Rafferty, WA9UCE/K6AAR, other well known hams, give you courteous, personalized service.

• ATLAS • BIRD • CDE • COLLINS • CUSHCRAFT • CURTIS • DENTRON • DRAKE • EIMAC • HUSTLER
• HY-GAIN • ICOM • KENWOOD • KLM • MOSLEY • SWAN • TEMPO • TEN TEC • TRI-EX • YAESU • more.

Drake L-4B 2kW linear amplifier... the unsung hero of many DX pile-ups



Hannes Bauer, DL1DX, Bamberg, W. Germany

The L-4B puts the smoke in the antenna, not in the ham shack

The L-4B features smooth, quiet, continuous duty operation on ssb, cw, SSTV and RTTY with full operator convenience such as front panel by-pass switch and precision high-power wattmeter/VSWR bridge.

Write for our new free Drake brochure: "DX-ing; from the ground up!"

R. L. DRAKE COMPANY

DRAKE®

540 Richard St., Miamisburg, Ohio 45342
Phone: (513) 866-2421 • Telex: 288-017

Western Sales and Service Center, 2020 Western Street, Las Vegas, Nevada 89102 • 702/382-9470

NEWSLINE

16,290 WAS THE OFFICIAL ATTENDANCE at this year's Dayton Hamvention, surely an all-time record for hamfests! Perfect weather complimented the 26th DARA-run convention, which was a very smooth operation despite the incredible turnout (over 25% ahead of last year's record 13,000). Exhibitors reported business very brisk, and technical seminars all drew good crowds. Almost 2000 attended the Saturday-night banquet to see the 1977 Ham of the Year and Special Event Achievement Awards presented to WA4ZZG and Mt. Airy's EME DXpedition, respectively, and hear the keynote speaker, Roy Neal, K6DUE, of NBC News.

GETTYSBURG'S SPECIAL LICENSING CHIEF was indicted April 29th by a Harrisburg, Pennsylvania Federal Grand Jury on four counts of bribery. The indictment charged FCC official Richard C. Ziegler with the alleged solicitation of $100 each from four individuals in exchange for influencing the processing of their callsign applications last spring, according to the report in the April 29 Harrisburg Patriot. The indictment apparently was the result of an FBI investigation begun last fall.

220-MHZ CLASS-E CB still seems to be a live issue with the FCC, according to a report from the Commission's Office of Plans and Policy that was released April 25th. The document, "Spectrum Alternatives of Personal Radio Service," was prepared by the Personal Radio Planning Group, which considered 17 alternative spots between 25 and 1215 MHz for personal radio expansion.

Based On Such Factors as user loading, costs of relocation, and TVI potential, seven segments were selected: 26.95-26.96, 27.54-28.00, 29.80-29.89, 29.91-30.00, 222-224, 894-902 and 928-947 MHz. Since many of the problems of the present Class-D band seem to rule out any of the slots in the 26-30-MHz region, we're back to that same old basic conflict between 220 and 900 MHz. However, despite the Planning Group's determination that its selections were the only likely current candidates, their report did not preclude consideration of some totally different spot, and even suggested that the Commission could decide that further CB expansion was not in the public interest.

SIX 15-MINUTE RADIO PROGRAMS on Amateur-Radio-related subjects have been worked up by WA2DHF and WA2HYS of CBS. Subjects include women in radio, and theft protection for mobile installations (equally interesting to CBers). The programs are designed to entertain as well as educate; copies are available to those who have an "in" with an AM or FM BC station and at least a tentative commitment they'll be aired — contact Pete O'Dell, ARRL's Public Information Officer.

Bob Hope Has Recorded a set of Amateur Radio Public Service Announcements — they're also available from the League.

LINEAR AMPLIFIER SALES in Canada are likely to be restricted as the DOC proposes following the FCC's lead in limiting their use by CBers (General Radio Service in Canada). In addition, the DOC proposes limiting sale of Emergency Locator Transmitters which, though designed for locating downed aircraft, have been widely sold to hunters, snow-mobilers, and other non-flyers who operate in remote areas.

Most Comments on the proposed amplifier ban filed by Canadian Amateurs advocate limiting sales to qualified (licensed) buyers.

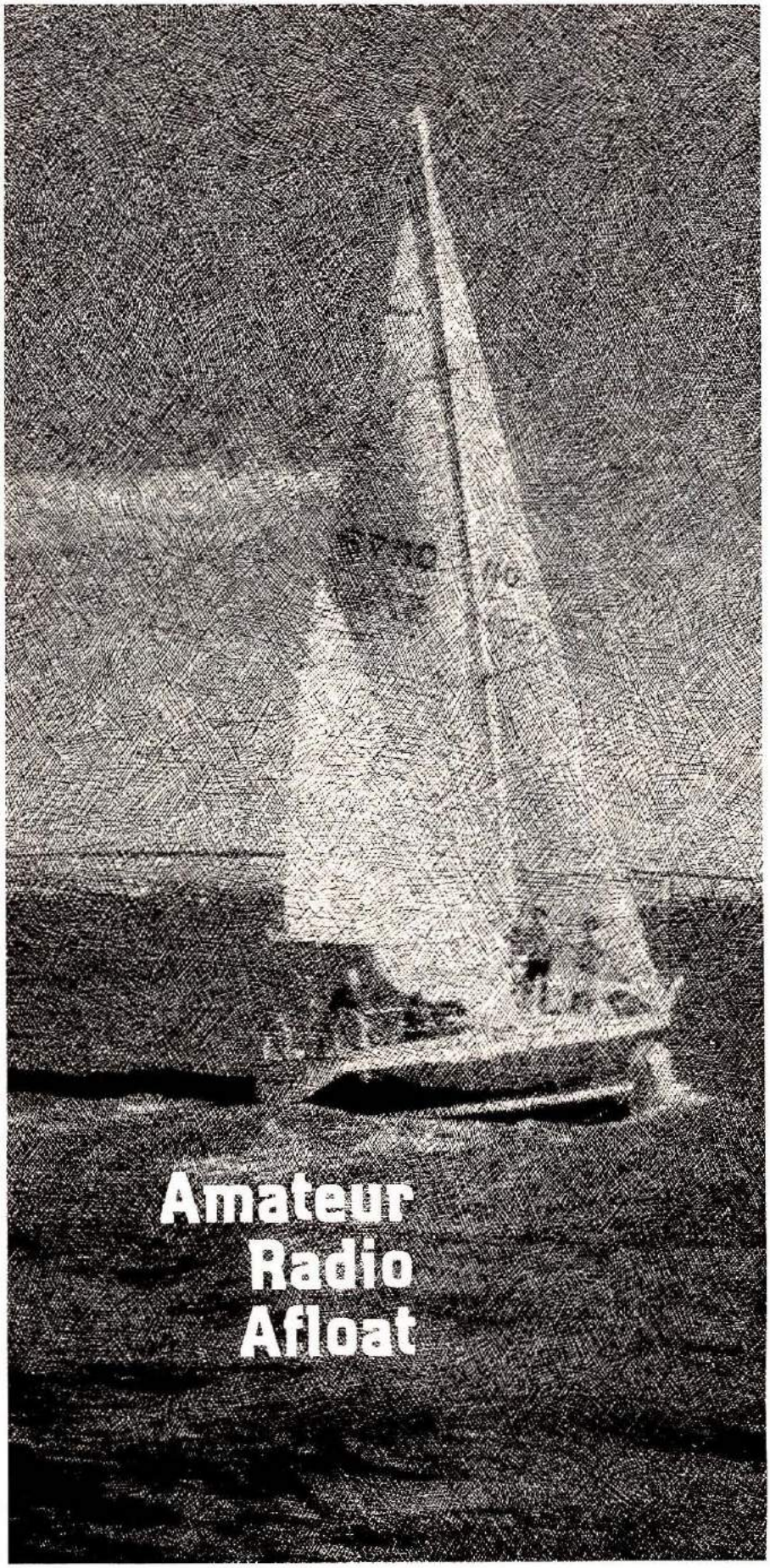
A FULL-TIME OSCAR COORDINATOR for ARRL headquarters is being sought by the League. For complete details and an application form contact Chod Harris, WB2CHO, at ARRL.

A Plaque Bearing the names and calls of major contributors to the spacecraft ($1000 or more) will be carried on OSCAR 8 when it's launched this fall. WA9AHZ, a recent life member of AMSAT, is the first to be listed. Potential contributors should call AMSAT at (202)488-8649 for further information.

ARMY RESERVIST AMATEURS can get their two-week summer duty teaching teenagers Amateur Radio in the FAA's Career Interest Program. For details call Col. Colby or Lt. D'Angelo at (202)325-8483 or write 118 South Royal, Alexandria, Virginia 22314.

CAL-COMM/EXPO '77 is called "the first total communications show anywhere" by its producers, who plan 100,000 square feet of exhibit area and plenty of entertainment for the September 24-26 Los Angeles show. Free tickets have been offered to HORIZONS readers — write 809 E. Victoria, Dominquez Hills, California 90745 or call (213) CAL-COMM.

ALIEN AMATEURS WHO become citizens are no longer eligible to hold reciprocal licenses, even if their non-U.S. licenses are still valid. The new citizen must take the U.S. Amateur examination and receive a U.S. license if he wishes to remain on the air, according to a recent FCC release.



Amateur Radio Afloat

BY HERB JOHNSON, W6QKI

The America's Cup races — you've heard of them, even watched parts of the big event on television. It's a beautiful and exciting scene, with acres of sail catching the wind, enough whitecaps and spray to make the crew step lively, and hordes of spectator craft being herded about by the Coast Guard and race officials. The onlookers seem to be having a great time, and those ashore are caught up in the enthusiasm of the day. Aboard the racing yachts the atmosphere is all business — they're enjoying the race too, from the viewpoint that all competitors enjoy a keen and well-fought race. This is the *World Series* of boat racing; the culmination of years of training and preparation. Trials and eliminations have narrowed the field to the best sailing boat and crew that each participating nation can offer. They're here to try to capture the prize Cup — one that was first won by the yacht *America* in a series of races that started in 1851.

Behind the scenes, Amateur Radio is doing it's part in the race, too. I am thinking particularly of the America's Cup race in 1974. Amateur Radio was useful not only at the time of the race, but also during the long trials to select the defender to represent the United States through the New York Yacht Club. There are a lot of people interested in keeping in touch with how things are going: people who provided backing for the boats, of course, and friends and relatives of the crew members and the news media. When you have a crew of, say 7 to 12 men on each boat, the involved audience can grow to sizable proportions. I had an Amateur transceiver — it weighed only seven pounds and was not much larger than an average CB set — set up on board a spectator boat that was keeping track of the progress

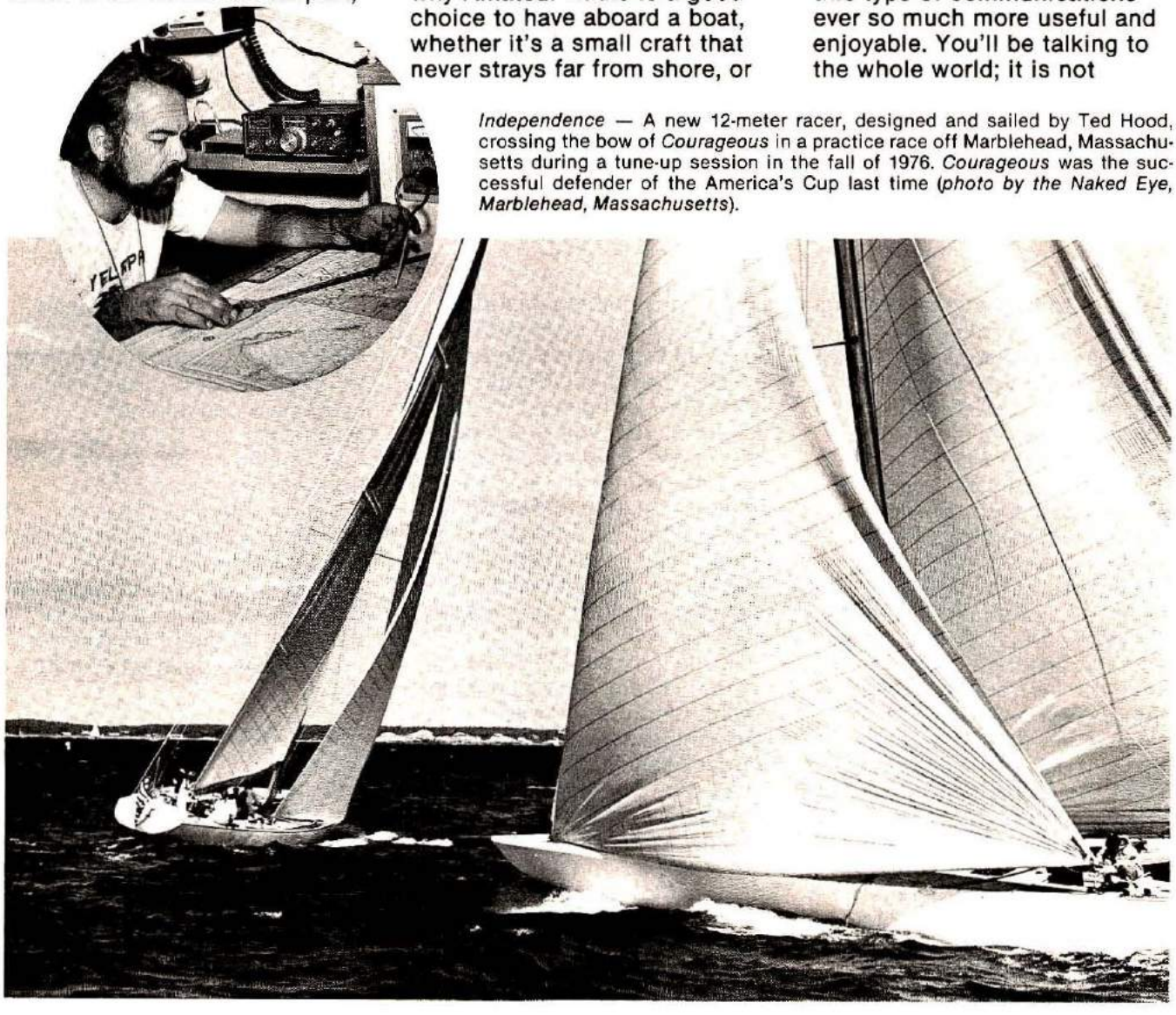
of the race between the *Intrepid* and the *Courageous* during the elimination trials. This *Intrepid* was backed by a West Coast syndicate, called Intrepid West, so there was a lot of distance to be covered to let the people know what was happening.

A regular schedule was set up with some Amateur stations on the West Coast, and that operation grew to a large network involving stations in San Francisco, Los Angeles, Newport Beach, San Diego, and Seattle. Eventually, some stations in Miami, Houston, and the Great Lakes area joined in. There is an amusing sidelight to this, too. The man in charge of public relations for Intrepid West had a little office down at the docks in Newport, Rhode Island, and as soon as the boats were out on the sound, he was out of touch with what was happening. One day, during a telephone call to the West Coast, someone there told him how things were going at the trials. He was astounded, and wondered how they knew so much more about it than he did. Later, he talked to me about it, and I gave him a spare receiver and set it up so he could listen in to our Amateur network. That was an exciting time, and an instance when Amateur Radio was providing one of its great services — keeping friends and relatives informed.

Why amateur radio?

There are scores of reasons why Amateur Radio is a good choice to have aboard a boat, whether it's a small craft that never strays far from shore, or a *blue-water* boat that is used for ocean sailing. But before I get into some of the reasons, let me clearly emphasize that having Amateur radio aboard in no way relieves you of the responsibility of having on board the communication facilities that are required by the Coast Guard; they require that you be able to communicate on channels that they use for safety and advisory messages, and those channels that they monitor for distress calls.

Amateur Radio can handle emergency messages, too, and I'll tell you more about that shortly. But the vast coverage of ham radio, in terms of distance, and in the numbers of people who are hams, makes this type of communications ever so much more useful and enjoyable. You'll be talking to the whole world; it is not



Independence — A new 12-meter racer, designed and sailed by Ted Hood, crossing the bow of *Courageous* in a practice race off Marblehead, Massachusetts during a tune-up session in the fall of 1976. *Courageous* was the successful defender of the America's Cup last time (*photo by the Naked Eye, Marblehead, Massachusetts*).

A neat shipboard Amateur radio installation using an older tube-type transceiver with a crystal-controlled fixed-frequency attachment. These rigs do their job well, but place a burden on the vessel's power source just to keep the tubes warm.

unusual to find several boating enthusiasts sharing the airwaves with you. How much more friendly and interesting your next port of call will be if you have been talking to someone there who can advise you about facilities, supplies, anchorages, and perhaps be part of a welcoming committee when you arrive.

Because of the great selection of frequencies that Amateurs are able to use, you could be talking to almost anyplace — from England to the Mediterranean to Africa; from Japan to the Philippines to Australia. You'll always find someone to chat with, and on almost any subject from chess to anthropology to sailing to scuba diving. None of this is permitted on the channels allocated to the Marine radio service.

Amateur Radio has more than paid its way in providing emergency communications, too. This phase of Amateur Radio is well covered in an article by Anthony Curtis, K3RXK, elsewhere in this issue, but let me tell you of a recent case where a combination of the right equipment and the technical skill acquired while studying for the Amateur license was instrumental in getting people out of a bad situation, and perhaps in saving lives as well.

In the summer of 1976 a 61-foot (18.6m) racing/cruising yacht, the *Sorcery*, was crossing the Pacific from Japan to San Francisco. They were more than one thousand miles from shore, in a storm, when a freak wave hit the ship and rolled it over. In addition to dismasting the boat, the wave had carried away the life rafts, and disabled the engines and the source of power for their regular communications equipment.

Many of the eleven people on board were injured — one seriously. A fuel drum fell on the leg of one girl, causing either multiple or compound fractures; a very serious condition anywhere, let alone on a disabled craft in the middle of the ocean.

One of the people aboard, a woman, was a radio amateur, and had a transceiver with her. Again, it was a little 7-pound (3.2kg) box, and it was the only piece of communications equipment that was working that morning. Thanks to the study required for the Amateur license, she knew what to do, and soon they had strung a 20-foot (6m) wire across the deck — there was no mast to hoist it up on — and put forth a "Mayday" call. The first answer was from a ham in Alaska; he got in touch with the woman's husband in Escondido, California. They were joined by hams in Hawaii and in Seattle, Washington. The Coast Guard soon came up on the frequency, and not long after that the captain of a Danish freighter overheard the conversation and determined from his location that he was the nearest one to the stricken *Sorcery*. About 24 hours later he came alongside her. Meanwhile, the Coast Guard had a plane on the way to drop life rafts and pumps if the freighter was unable to do anything. A Coast Guard cutter arrived later and took the *Sorcery* in tow, and brought the injured crew aboard. Without that little Amateur transceiver, it could have been a far more tragic story.

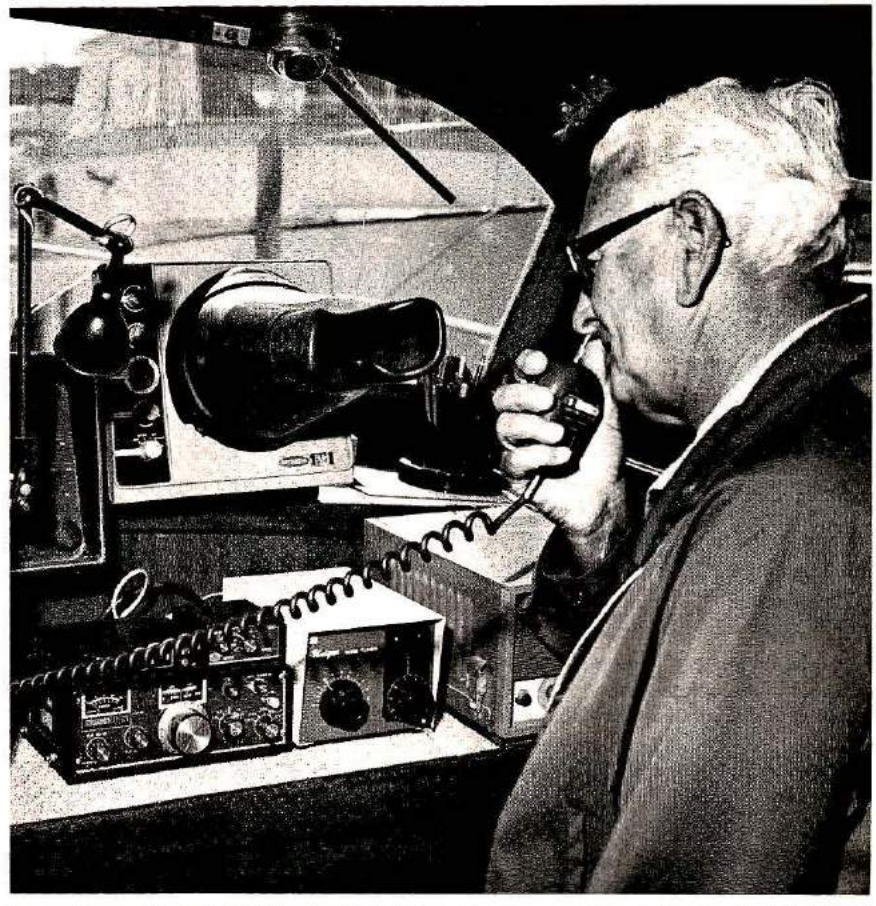
Amateur radio equipment

You need two things to take advantage of the usefulness of Amateur Radio: a transceiver (or transmitter and receiver) for the ham bands, and a license to use it. I'll tell you more about the license and how to get it a bit later, but for the moment let's talk about equipment.

First, don't expect the dealer who handles your Marine radio equipment to know much about Amateur equipment, or to have it available. It is usually outside his line of experience, in what it will do, how it is installed, and more important, what makes Amateur Radio a natural for the sailing enthusiast.

There are several ways to go about finding a dealer who has Amateur Radio equipment, and many of these same routes can be used to find people who will help you in getting the Amateur license that you will need. In the larger metropolitan areas, a search through the *Yellow Pages* will usually tip you off to the names of a distributor of electronic parts, equipment, and supplies. These are excellent places to start. Even if these distributors don't have Amateur equipment, they will usually be able to refer you to someone who does. If that search turns up a dead-end, then you can start looking for anything or anyone connected with electronics. This can be almost anything — the local a-m radio station, fm broadcast, TV station, or a shop that repairs and sells CB, TV, and Hi-Fi sets. It is not likely that many of them will be involved directly in Amateur Radio from the equipment standpoint, but they will usually have heard of one or several Amateurs, and can help you get in touch with them.

The Amateur, in turn, will almost always be happy to help in any way he can to make it possible for you to join his fraternity, and can steer you to a dealer who sells equipment. He can also help by letting you look through some of the Amateur magazines and journals, where all of the better manufacturers advertise their wares and list their dealers and distributors. If you live in a town so small that it has no local electronic facility of any kind — and it would have to be a small place indeed that had no nearby a-m or fm broadcast station — try the maintenance people at the local telephone company. Amateur Radio is not unknown to those who deal in communications-by-wire.



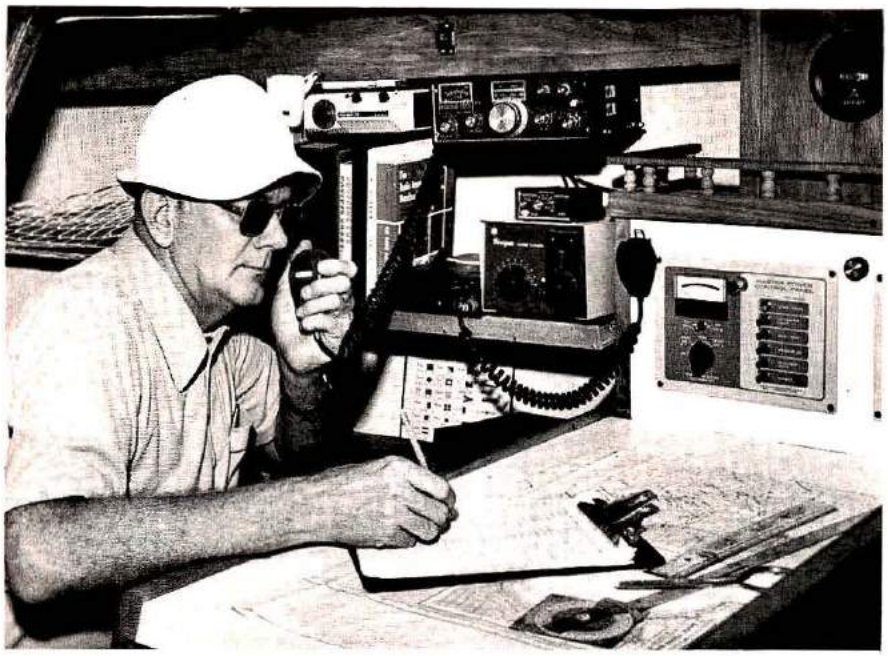
An amateur radio installation on the bridge of a power cruiser. The small white box to the right of the transceiver is an antenna tuner which permits the use of a random length of wire for all bands. The equipment is secured by brackets.

Oh, yes, I would like to point out that CB, while it certainly has its uses, falls far short of the capability of Amateur Radio. It has limited power (5 watts) and very short range. Further, the Coast Guard does not monitor CB, and usually does not have equipment capable of operating on CB frequencies.

Amateur Radio, on the other hand, allows the use of up to 1000 watts of power in the final stage, and can be operated over such a wide range of frequencies that it is not hard to find a frequency band that will cover the required distance. Further, most military (Coast Guard) equipment has tremendous frequency-changing capability, which will allow them to find you on a ham band, and, in case of emergency, communicate with you there.

What kind?

In terms of distance to be covered by Amateur Radio communications, there are two categories to consider. The globe-spanning type of operation that I have been talking about is done in what is termed the high-frequency part of the spectrum. This ranges from the segment just above the broadcast band (1.8 to 2.0 MHz) up to the 10-meter band (just above the CB channels). The most useful areas will be the 40, 20, and 15 meter bands (7.0, 14.0, and 21.0 MHz). Equipment that will cover these three bands will allow you to communicate with Amateurs at home stations or on other boats at distances varying from dozens to thousands of miles, depending upon the reflectivity



The author operating aboard his sloop *Vector*. This compact installation includes equipment for Amateur-band SSB, 2-meter fm, and vhf Marine Band operation. There is also room for an antenna tuner and a crystal-control adapter for the SSB transmitter.

or absorption of the ionosphere at the time. Maritime operation is not permitted in most areas on the two lower Amateur bands (160 and 80 meters).

An area of increasing importance, especially to those who do not venture far from shore, is vhf, (Very High-Frequency). The Amateur two-meter (144-MHz) band is the most popular, and is made more useful by the growth of repeaters on that band. A repeater is a station that receives a signal, amplifies it, and retransmits it with much greater power. They are usually located where they can take advantage of height — a mountain, hill, or tall tower — to increase their range. It is not unusual to be able to talk across distances up to 50 or 75 miles (80-120km) while using a low-powered unit connected to a 19-inch (48cm) antenna at the top of a mast.

There are several types and brands of equipment to choose from, as you will discover when you start talking to dealers or Amateurs about what to buy. You can make a reasonable choice by looking at the specifications and keeping a few simple requirements in mind. Two uppermost thoughts should be power consumption and frequency range. For best economy in power consumption, the unit should be all solid-state, that is, transistorized. Tubes require that the filament (heater) be kept warm all the time, thus placing a heavy drain on your power source even when you are just listening. A few of the modern transceivers have tubes in the high-powered output stage only, with the rest of the circuitry handled by transistors. Some of these have provisions to bypass the tube section, allowing an output of just a few watts instead of the hundreds available with the tubes. Among Amateur transceivers that provide output in the better-than-hundred-watt range are the Atlas 210X, 215X and 350-XL; Ten-Tec Triton IV; the Yaesu FT-101E, and the Heath SB104 and HW104. All of these can be operated directly from a 12-volt supply or battery, and cover the high-frequency Amateur bands.

Installation

There are three things to consider when installing Amateur equipment on a boat; transceiver placement, antenna location, and a ground system. When you install the transceiver, convenience in operating it and protection from salt spray or leaks should be kept in mind. This usually means that the equipment will be in a compartment or cabin, where it can be used by an operator in more or less comfortable surroundings. If you must hear what is being received from an exposed or remote location, an extension speaker is the answer. Most modern transceivers are set up so you can plug in an external speaker for just this purpose. Bear in mind that when you are protecting the transceiver from spray and leakage that the heatsink fins on the back of the unit require good free-air circulation for proper cooling.

If a plug-in or quick-disconnect type of mount is available for the equipment you choose, it might be a

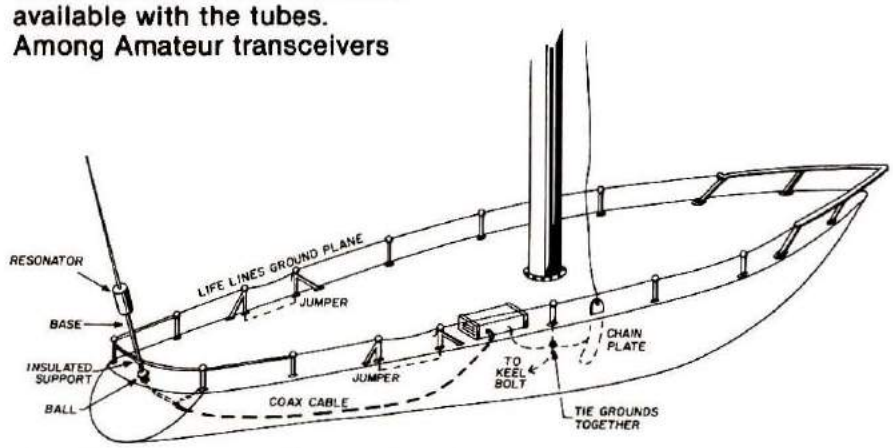


Fig. 1. The life lines on a sailboat can be used as a ground-plane system. Jumpers must be used to bridge the gap at the gates. Life lines, chain plates, and metal keel should all be tied together to obtain a good ground for the antenna to work against. A ball mount and insulated support fastens the antenna securely.

worthwhile investment. The easy-removal feature will allow you to store the equipment in safer or dryer surroundings during extended periods of inactivity (or you can take it home and use it between voyages).

The equipment is usually supplied with enough heavy cable to reach to the battery in an average automobile, but this may not be enough for some boats. The cable can be extended by using a heavy wire, 10 or 8 gauge (2.5-3.5mm) to splice on as needed. A fuse or circuit breaker should be installed at the battery end of the run.

Grounds

Ground connections can be as varied as there are types of boats. Sailing craft will require treatment different from power boats. Large bodies of water provide an essentially perfect *ground plane* for the launching of a radio signal into the ionosphere, but the problem appears when you try to connect to it.

Of course, a good ground connection at the transceiver itself is the first place to start, and this should not only be a ground for the power source but a ground for the radio-frequency energy as well. If your craft has a steel or aluminum hull, you are in luck; a good connection to the hull at the end of the coaxial cable from the transceiver, and at the transceiver, will do the job nicely.

Another type of ground can be made by using metal life lines, if the boat has that type running along the starboard and port sides (see **Fig. 1**). These lines can form a *counterpoise* system that is just as effective as a direct connection to the ocean or lake. You must watch for breaks in the life line, such as at the gate used to board the vessel, or at the bow or stern. Where such gaps occur, a jumper wire or cable must be used to bridge the open space to complete the ground. This can be done by running a stainless steel strap under the deck between the stanchions to connect the starboard and the port lines together. The jumper doesn't have to be very thick, but should be 3/8 to 1/2 inch, (10-13mm) wide. Braided copper or bronze strap will work, also, but stainless is preferable because of its anticorrosion properties. Be sure that any fittings in the life lines are clean, tight, and make good metallic contact.

A keel makes an excellent ground system, especially if it is of the solid-lead type. All that is necessary is to run a good ground strap from the equipment to the nearest keep bolt. Be sure, however, that you make a good clean electrical connection to this bolt. You can also drill and tap into the lead for a connection separate from a keel bolt if you like. One type of keel to avoid is the type that is made up of several pieces of metal; they may not all be making good contact with each other, and would serve as a poor ground. A solid-metal keel is a good ground even if it is encased in a wood

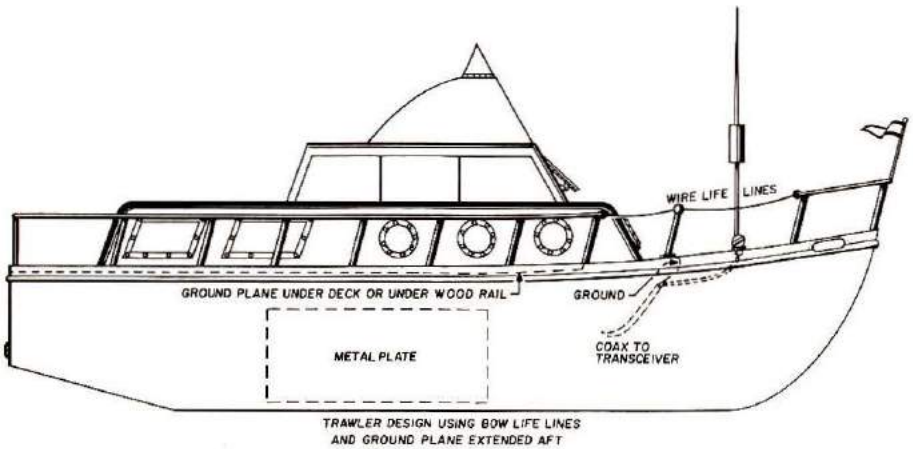


Fig. 2. Some power boats have wood rails, so you must place a ground plane under the deck, or under the rail itself. This can be a piece of stainless steel strap or copper braid. A metal plate, either inside or outside the hull, can be used by itself or in addition to the life lines or rail.

or fiberglass hull. The insulating material (wood or fiberglass) still allows efficient coupling between the metal keel and the water around it.

A boat which has neither life lines nor a metal keel, such as a power boat with a wooden or fiberglass hull, will likely require a metal plate for a ground (**Fig. 2**). It can be either inside or outside the hull. An internal plate should be at least 20 square feet (1.8m^2) in size, and laid up against the hull below the waterline. It can be made up of two or more sections, connected together and covered with fiberglass for protection. The metal can be quite thin, and stainless steel is best.

An external ground plate will be more difficult to install, but it can be smaller in area. An adequate size would be approximately 10 square feet (0.9m^2). It can be cemented in place below the waterline, and covered with fiberglass. Do not depend on the propeller shaft to provide an adequate ground for radio equipment and antenna systems.

You can tie several ground systems together for even greater efficiency. For example, you can connect the life line stanchions to the keel with stainless steel strapping. The mast should already be connected to the keel and/or life lines for lightning protection, but check to be sure. Don't forget to run a good strap to the engine and the battery ground (usually negative) terminal. You can't install too many ground systems, but you may easily have too few.

Antenna systems

I have found that the most useful antenna for Amateur Radio aboard boats is a vertical whip with the resonating coil located near the center. These are made for use in Amateur mobile installations and work well when installed on most boats; they consist of a base or bottom section, a coil or resonator that is designed to make the antenna work in a particular band of frequencies, and a top section that can be adjusted to fine tune the system to a particular frequency.

A number of manufacturers make these antennas, and they are sold by distributors and dealers in Amateur equipment. There is not a great difference in performance between the various brands. Those with the larger coils are somewhat more efficient, but because the ocean serves as a perfect platform to launch the signal, most brands work well. A very popular one, the *Hustler*, made by New-Tronics, works very well in most marine installations. You have to purchase one base, or mast section, one universal ball mount, and a resonator for each frequency range required. Each resonator comes with the

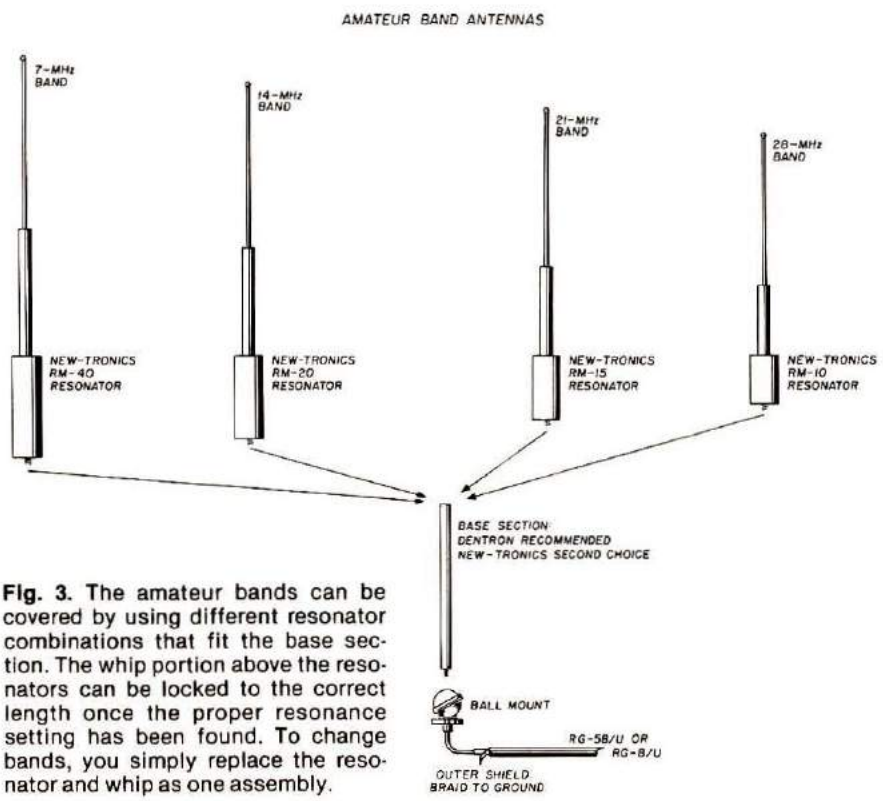


Fig. 3. The amateur bands can be covered by using different resonator combinations that fit the base section. The whip portion above the resonators can be locked to the correct length once the proper resonance setting has been found. To change bands, you simply replace the resonator and whip as one assembly.

necessary top, or whip, section. Once the whip has been adjusted and locked to the correct length, it can be left alone for that frequency. When you change bands, it is only necessary to change the resonator. Some antenna configurations for use on the Amateur bands are given in **Fig. 3**; **Fig. 4** shows how the Amateur antennas can be modified for use in the various Marine bands.

It is worth mentioning here that Amateur transceivers are not type-accepted for the Marine radio service and should not be used there. However, you can listen there as much as you like, and a modified Amateur antenna will perform very well when attached to your regular Marine transceiver. At any rate, it is worth knowing what must be done to make the maximum use of the antennas available on your boat.

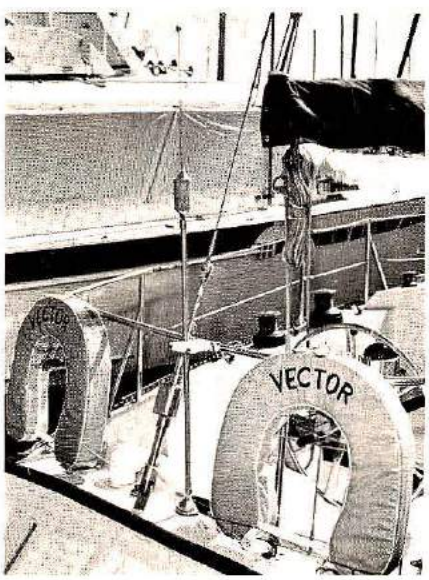
One problem with the New-Tronics antenna is that it is built with a hinged base section (to permit the top portion to be placed in a horizontal position to allow a car to be driven into a garage). In marine use this joint tends to loosen up. A possible solution is to buy a Dentron, or Swan, base section instead.

There are two models of the *Hustler* available: one is rated for transmitter power up to 400 watts; the other will handle 1000 watts. Either one is satisfactory for marine use.

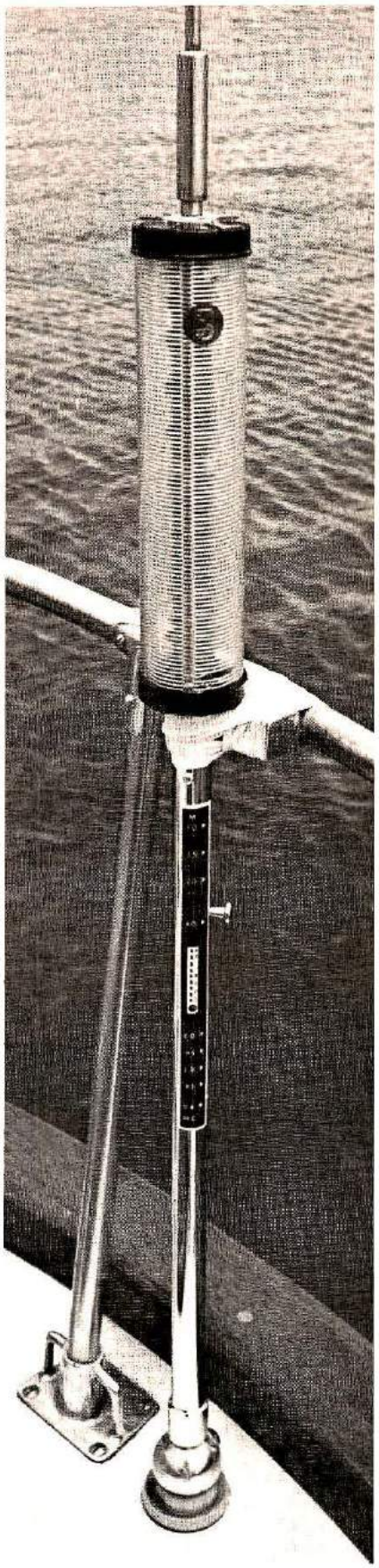
The vertical whip antenna has the advantage that you will still have an antenna even if the mast and all the rigging has been carried away. Changing bands does require a trip to the stern, but this doesn't have to be done too often, and is a small chore. A drawback of the whip is that it requires an exact adjustment for resonance at the operating frequency. A slight misadjustment will cause a severe loss of efficiency.

On most sail boats the best location is at the stern on the afterdeck. A ball mount such as is used on an automobile for cowl or deck mounting works well to get the antenna coax cable connections under the deck.

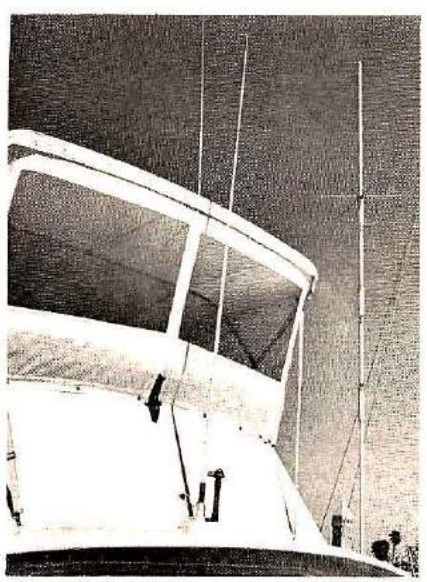
Further support for the antenna may be secured from the stern pulpit if there is one (**Fig. 5**). The ball mount at the very bottom of the whip antenna does not provide quite enough support, since in heavy seas the ship may be violently



A type of multiband whip antenna that requires that the coil and top section be changed to use a different band. A plastic block holds the whip for stability.



This multiband antenna permits operation on different frequencies by adjusting the loading coil. A block and tape secures the whip to the rail.



Considerable operating flexibility is provided by the vhf antenna (foreground), and the multiband vertical whip to its right.

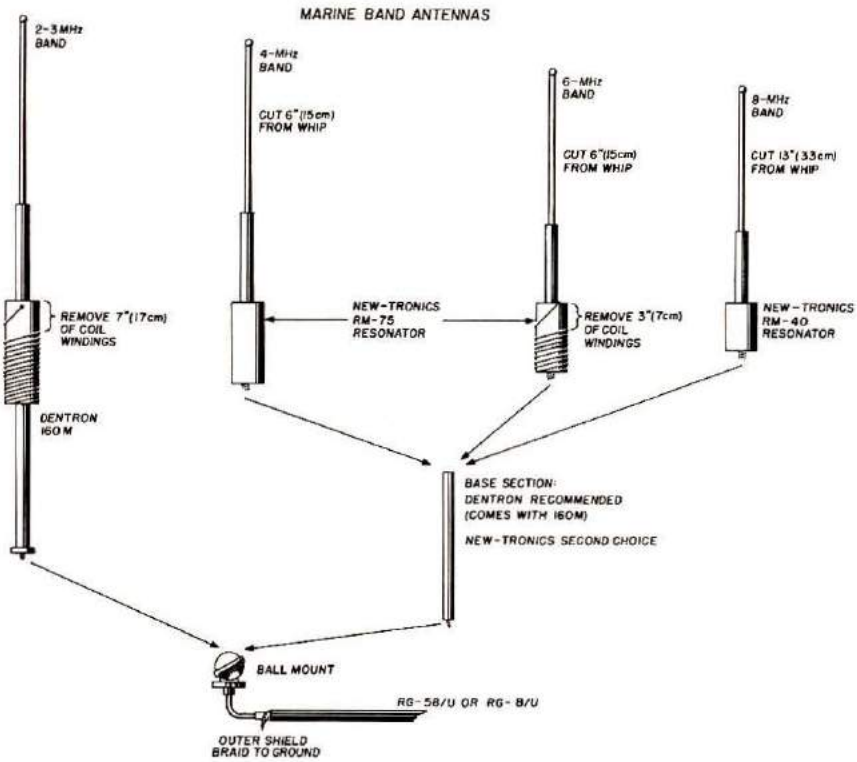


Fig. 4. To use the same antenna mounting system for the Marine radio frequencies, you can modify the resonators. Turns of wire can be removed from the coils, and a waterproof covering or spray applied after the modification. Color coding the resonators will help select the proper one for a particular band when you are in a hurry.

thrown back and forth. Also, people may grab the antenna for a hand hold. An insulated clamp arrangement where the whip goes near the stern pulpit will take care of this problem. Since there is only low rf voltage on the lower base section, insulation is not critical. A block of plastic with glass tape or metal clamp arrangement is adequate. You can probably find a suitable insulated support of the type designed for supporting the fiberglass-whip marine antennas.

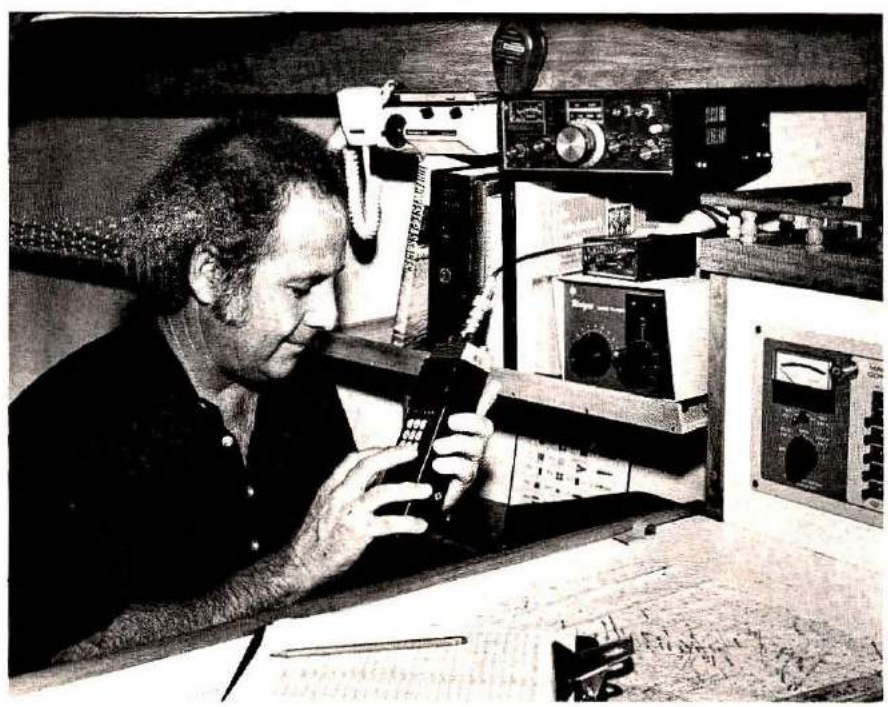
If the sailboat is a ketch or yawl rig, the mizzen boom may present a problem (**Fig. 5B**). The whip can be tilted back at 45 degrees or more if necessary without deteriorating performance to any great extent, and this will usually solve the clearance problem. This position may make it less convenient to change resonators, but is about the only solution.

The poorest location for the whip antenna is on top of a mast. Contrary to what you may think, it will not work any better on top of the mast since the radio signal is essentially launched from the surface of the ocean, so by all means, keep the whip down where you can easily reach it. Antennas for vhf present a different situation; because propagation is line-of-sight, with no benefit from an ionospheric reflector, vhf antenna height is very important.

It is sometimes difficult to find a good place to mount the antenna on a power boat. An important consideration is what type of ground system will be used. If the hull and superstructure is metal, the whip may be mounted almost anywhere since a ground connection will be available all over. If the hull is metal, but the superstructure is not, it's best to mount the whip down low, near deck level to have it close to the hull for the ground connection. If the hull is not metallic, a ground system must be established and this will determine the best antenna location.

Most offshore cruisers have a rail of some sort running along the deck on both sides. Often the portion up forward near the bow is metallic cable, the same as is used on sailboats. Most of the rail running aft is wood, but if the

A vhf Marine Band antenna can be used to increase the range of an amateur hand-held transceiver. Nearby repeaters extend the range even more.



underside can be lined with a narrow strip of stainless steel, ¼ inch (6.5mm) wide, or greater this will make an excellent ground plane. Remember that the ground straps must be jumpered at the gates. The whip can then be mounted anywhere near the rail, on the port or starboard side, or up forward near the bow. The coax cable outer shield should be connected directly to the life line/hand-rail ground system.

If a rail-level ground plane is not practical, it may be possible to install one under the deck. A strip of stainless steel can be run down both sides under the deck, or alongside the hull.

Insulated backstay antenna

This type of antenna requires an antenna tuner for adjusting its resonance to the desired frequency. The choice between the vertical whip and an insulated backstay depends on individual circumstances and requirements. The primary advantage of the insulated backstay is that it can be resonated to any frequency by adjustment of an antenna tuner which can be located near the transceiver. Thus, you can quite easily change bands without leaving the cabin.

Insulating the backstay is a relatively expensive operation, and has a disadvantage in that loss of the mast in a storm results also in loss of the antenna.

Another favorite among sailors is a doublet, or dipole, antenna that can be hoisted on a halyard. This is similar to many antennas that are quite successful at home stations, and can provide excellent results. The ends should be fitted with small *egg* insulators so that any moisture in the halyard will not effect the performance.

License requirements

Any person who operates a radio transmitter of any kind must have a license to do so, and the license required to operate Amateur equipment is, naturally enough, an Amateur license. There are several grades of Amateur license available, ranging from the Novice who is allowed to use only Morse code within well defined frequency segments, up to the Amateur Extra, which allows all privileges on all Amateur frequencies. The Novice examination consists of sending and receiving Morse code at 5 words per minute, and a written test on Amateur rules, operating procedure, and basic electronic theory.

The Amateur General class license exam encompasses more advanced theory and requires a code speed of 13 words per minute. This class of license carries both code and voice privileges throughout the Amateur bands but still within certain segments. The Advanced and Extra tests require even more theory and the Extra requires a higher code speed.

There is also a Technician class license, which is similar to the General in written content, but with the 5-word-per-minute code requirement. The Technician licensee has phone (voice) privileges on the vhf bands, and code privileges in the Novice segments on the high-frequency bands.

To take advantage of the frequencies that will provide the most useful and interesting communications, a General class license should be the minimum that an ocean-going sailor acquires. The Amateur 20-meter (14-MHz) band is very popular for talking from one continent to the other, and the 40-meter (7-MHz) band is more useful when closer to shore — although at times it becomes an intercontinental band too.

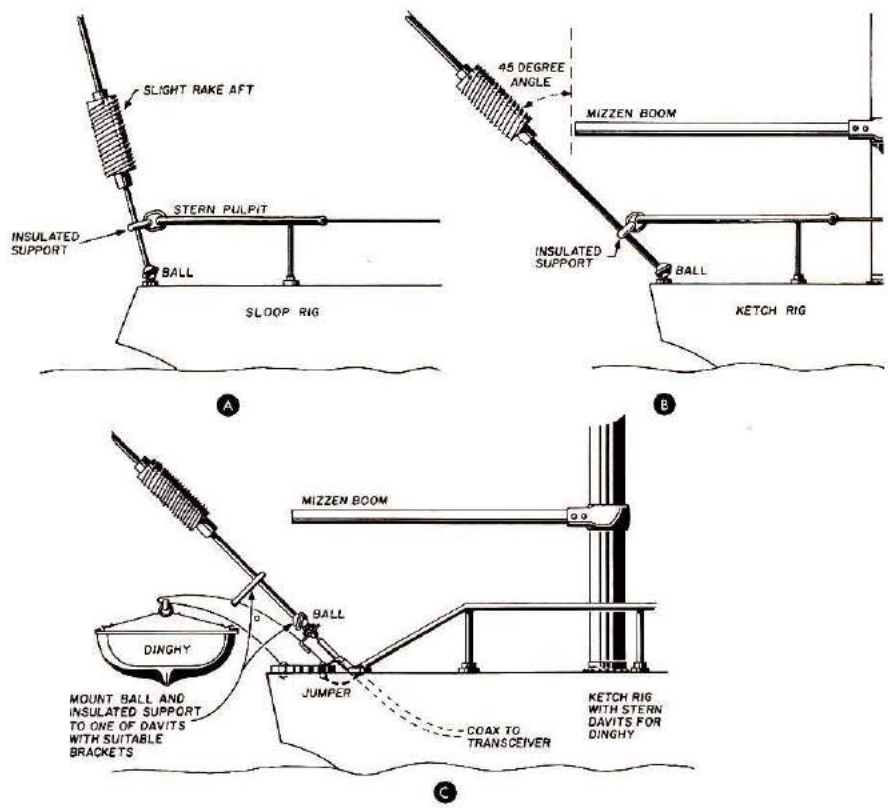


Fig. 5. The mizzen boom on some sailing craft may require some experimenting to find a way to mount the antenna so that it does not interfere. The antenna can be as much as 45 degrees from the vertical without seriously effecting performance. An insulated support bracket should be used to hold the antenna secure — the ball mount will work loose under the erratic motion of a boat. In all cases, the braid on the coaxial cable should connect to the nearest ground with a heavy wire or strap. Exposed ends should be treated or sealed to keep moisture out of the cable. The drawing is not to scale.

The phone (voice) segment of the 80-meter band, referred to as 75 meters, is very popular as a medium-distance band and is good when you are not too far offshore. However, maritime operation is not permitted on that band, by International treaty. Incidently, I should clarify something here about maritime operation. The only time you should identify your Amateur station as "maritime mobile" is when you are in international waters. When you are within the coastal boundary of any country, you are portable or mobile within that jurisdiction. This includes rivers and coastal waterways and lakes.

There are many countries that permit Amateurs from other countries to operate within their territories; some grant a reciprocal permit, others allow an alien to acquire an Amateur license. If you plan to visit a foreign country and want to operate Amateur Radio there, you can often find out about the requirements from someone whom you talk to on the air. The American Radio Relay League, 225 Main Street, Newington, Connecticut 06111, has current information on license requirements and reciprocal agreements throughout the world. They can also advise you as to what governmental department to write to and approximately how long it might take to process the licensing paperwork. Write to the Membership Services department at the above address, and send a self-addressed, stamped envelope to speed up the reply.

How to get started

As I mentioned earlier, some of the sources which helped you find out about Amateur equipment will also be able to help you get started toward acquiring an Amateur License. The ham who told you where to buy a rig, or what brand was okay, will probably be able to tell you where in the area there are radio clubs. Many clubs conduct Amateur licensing classes, and if you can spare a few hours a month you have a good chance to earn a license between boating seasons. If you are not near any group or club that is holding classes, there are many excellent study guides available that you can use at home and some cassette tapes that will help you learn the Morse code.*

There will also be a series of Questions and Answer articles right here in *Horizons*, to help people prepare for Amateur license exams.

Don't let that code business get to you; it is just like learning a foreign language, but much simpler. There are no dialects to learn, no accents to practice, and no tongue-twisting combinations of letters and sounds. Further, Amateurs all over the world know the language, and you'll have no trouble conversing with them in the international "Q" code that is the radio operator's shorthand. The French Amateur you are talking to may not speak a word of English, but when you send QTR? (what is the correct time?) he'll know exactly what you want, and will reply QTR 2150Z (the time is 9:50 PM, at Greenwich).

So, there you have some of the reasons for taking Amateur Radio along with you on your next cruise, and a bit of information about how it is done. I'll be looking forward to hearing some new voices and calls from out on the blue water. Excuse me, I thought I just heard a familiar voice signing maritime mobile on my receiver. Let me turn up the volume a bit . . . "G5ANV this is K3RXK — Good afternoon, Rutger. It's good to hear your voice again. How is the race going, and is the wind treating you well? . . ." **HRH**

**ham radio's* Communications Bookstore has an excellent selection of study guide material and code-practice tapes. Write for the "I Want to Become a Ham" package, *Ham Radio Horizons*, Greenville, New Hampshire, 03048.

About the author

When it comes to marine communications, Herb Johnson, W6QKI, of Oceanside, California, is eminently qualified to cover all parts of the field. He has been in the electronics industry for better than 30 years, starting in the Great Lakes area where he and a partner became known for getting improved performance from some almost useless 10-watt transmitters of the day.

He was the founder, in 1961, of Swan Electronics, a manufacturer of Amateur equipment, which he sold to the Cubic Corporation in 1967. Not one to sit idly on the sidelines, he then founded Atlas Radio Incorporated, of Oceanside, California, where he is still involved in the design of modern state-of-the-art equipment for Amateur use. More than 10,000 Atlas transceivers have been sold, and many of them have found their way aboard boats of all kinds.

Herb has been sailing for better than 15 years, and has been involved in long-distance racing for the past 10 years. He can often be found aboard his *Vector*, a customized, 38-foot (11.6m) CF-37 sloop shown on our cover this month. The Amateur transceiver aboard *Vector*? A 7-pound (3.2kg) 200-watt Atlas, of course.

STILL UNDER $500

DO YOU KNOW OF ANOTHER FULL POWER, FULLY ASSEMBLED, HF TRANSCEIVER STILL UNDER $500? WE DON'T!

BUT DON'T LET THE LOW PRICE FOOL YOU. THE TEMPO ONE'S QUALITY AND RELIABILITY HAVE BEEN PROVEN BY THE TENS OF THOUSANDS IN USE BY GENERAL AND ADVANCED CLASS AMATEURS.

AND NOW UNDER THE NEW FCC REGULATIONS THE TEMPO ONE BECOMES THE PERFECT RIG FOR THE NOVICE AND TECHNICIAN CLASS.

Ask any of the thousands of owners about its dependability, look at its features and specifications...and the reasons for its unparalled popularity will be obvious.

FREQUENCY RANGE: All amateur bands 80 through 10 meters,
MODES OF OPERATION: SSB upper and lower sideband, CW and AM.
SOLID STATE VFO: Very stable Colpitts circuit
RECEIVER OFFSET TUNING (CLARIFIER): Provides ±5 khz. variation of receiver tuning when switched ON.
FREQUENCY STABILITY: Less than 100 cycles after warm-up, and less than 100 cycles for plus or minus 10% line voltage change.
INPUT POWER: 300 watts PEP, 240 watts CW

AF BANDWIDTH: 300-2700 cps
RECEIVER SENSITIVITY: 1/2 μv input S/N 10 dB
AGC: Fast attack slow decay for SSB and CW.
SELECTIVITY: 2.3 khz. (-6 dB), 4 khz. (-60 dB)
IMAGE REJECTION: More than 50 dB.
AUDIO OUTPUT: 1 watt at 10% distortion.
AUDIO OUTPUT IMPEDANCE: 8 ohms and 600 ohms
TUBES AND SEMICONDUCTORS: 16 tubes, 15 diodes, 7 transistors
ANTENNA IMPEDANCE: 50-75 ohms
CARRIER SUPPRESSION: -40 dB or better
SIDEBAND SUPPRESSION: -50 dB at 1000 CPS
THIRD ORDER INTERMODULATION PRODUCTS: -30 dB (PEP)

TEMPO "ONE" TRANSCEIVER	$399.00
AC/ONE POWER SUPPLY	$99.00
DC/1-A POWER SUPPLY 12 volts DC	$120.00
TEMPO VF/ONE External VFO	$109.00

Tempo RBF-1 Wattmeter
An inexpensive, in-line Wattmeter and SWR bridge for use with any transceiver, transmitter, or amplifier from 1.9 to 150 MHz. Test and tune for maximum output or for monitoring on-the-air performance. Allows selection of wattmeter scales of 0-200 watts or 0-2000 watts. Insures consistent, efficient transmitter operation.

As with all Tempo equipment, the RBF-1 delivers performance value far beyond its price. Only $42.95

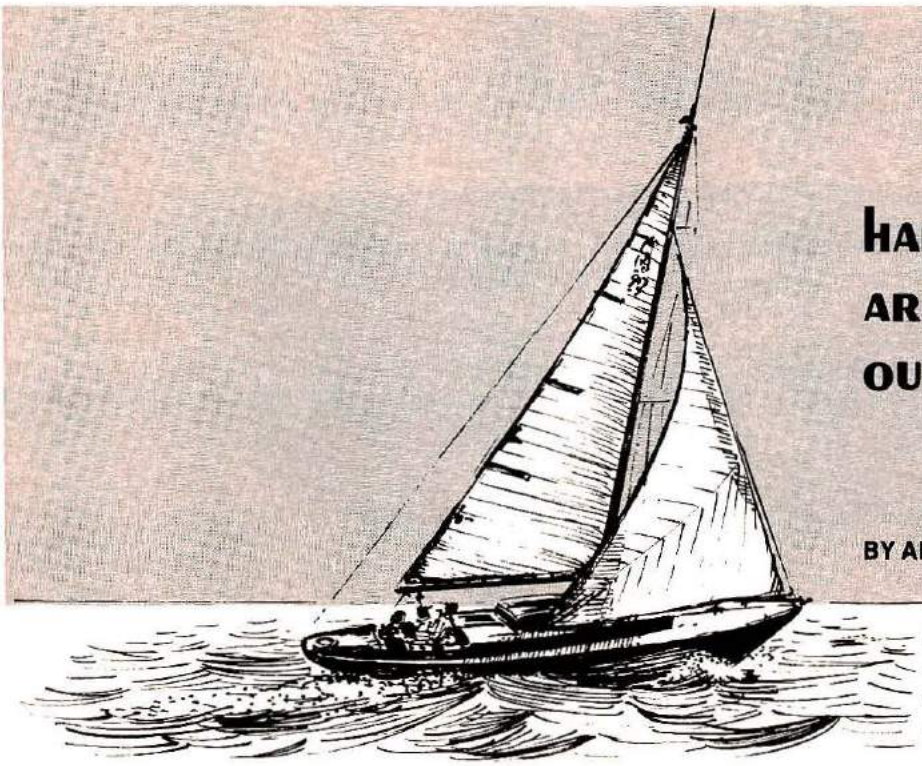
Prices subject to change without notice.

Tempo DM-20 Desk Mike
Features PTT and LOCK switches. Converts easily to high or low impedance (600 or 50k ohm). Only $39.00

Henry Radio

11240 W. Olympic Blvd., Los Angeles, Calif. 90064 213/477-6701
931 N. Euclid, Anaheim, Calif. 92801 714/772-9200
Butler, Missouri 64730 816/679-3127

More details? Ad Check page 78.



HAM RADIO SAILORS ARE NEVER OUT OF TOUCH

BY ANTHONY R. CURTIS, K3RXK

In fair weather, or foul, an Amateur Radio Station aboard your vessel is Bon Voyage

Ham radio operators in the southeastern corner of the United States were relaxing on a quiet Sunday afternoon last June, chatting with friends around the world and handling routine messages from hams aboard sailboats and ships thousands of miles away at sea in the Atlantic and Caribbean. Suddenly, an inexperienced-sounding voice on the air cried, "Mayday! Mayday!"

Quickly responding, hams learned that the yacht *Honeybee*, two days out of the Virgin Islands bound for the States, was in trouble. The captain had suffered a fatal heart attack, five landlubbers were aboard, and the vessel was rolling badly in heavy seas. Hams called the Coast Guard and activated Amateur Radio stations WB4SQJ at Miami and WB5KTY at New Orleans.

Following the terrified voices of *Honeybee* passengers on the 14-MHz ham band, direction-finding stations were able to pinpoint the exact location of the yacht. WB4SQJ and WB5KTY gave *Honeybee's* passengers careful step-by-step instructions, finally getting the boat turned around and headed for the nearest landfall on Grand Caicos Island.

A Canadian ham, listening in on the emergency from all the way out in British Columbia, switched to a different frequency in the 14-MHz ham band, made a call, raised George Thompson, operator of Amateur Radio station VP5GT on Grand Turk Island, and brought him over to the *Honeybee's* frequency. Familiar with both islands, VP5GT recommended bypassing the difficult anchorage at Grand Caicos and sailing on to Grand Turk where an easier landing could be made in the morning.

The drama continued through that Sunday night into Monday with a dozen Amateur Radio stations taking active part in the emergency communication. Hundreds of others stood by, monitoring the *Honeybee's* progress. The yacht's passengers, able only to use ham-radio gear, were connected (phone-patched) by hams into the United States telephone lines for calls to their families. They were also phone-patched to the sailboat's owner, the operator of ham station K2PSO, who had planned ahead for just such an emergency when he left a ham transmitter and receiver aboard *Honeybee*. He had left the rig tuned to 14.313 MHz where hams talk everyday with *maritime mobile* amateur radio stations at sea. The owner had instructed the novice crew to "turn it on and yell for help" if they got into any serious trouble. That made the rescue possible.

Fewer than 20 hours after the passengers sent the first *Mayday* call, VP5GT talked the *Honeybee* into Grand Turk harbor. Scores of hams in America breathed sighs of relief and tumbled into their racks for much-needed sleep.

As I bobbed along the Bay swells about 2300 GMT one evening last June and rested after a lengthy day-cruise, Rutger Webber, G5ANV, came back to my general call of

"CQ." Rutger, a member of the Hilbre, England, Yacht Club, was in the midst of a major Trans-Atlantic race to the Azores. He was on a rest break while under sail during the race.

Rutger and I talked for more than an hour and a quarter until 0017 GMT when he had to return to duty on deck. His signal from thousands of miles away across the Atlantic was loud and clear throughout. During our conversation, I learned that he grows strawberries near his Cornwall home, and that he works for the Commodore of the local yacht club.

The two greatest benefits of Amateur Radio afloat were wrapped up in that conversation with Rutger: Relaxation and safety. He was able to get away from stress to rest awhile. Clearly, if his crew had found trouble off France or Portugal, help could have been summoned easily through the ham gear aboard the racing yacht. If necessary, I could have used my radio equipment to span the miles back to Europe for help.

More drama on the high seas

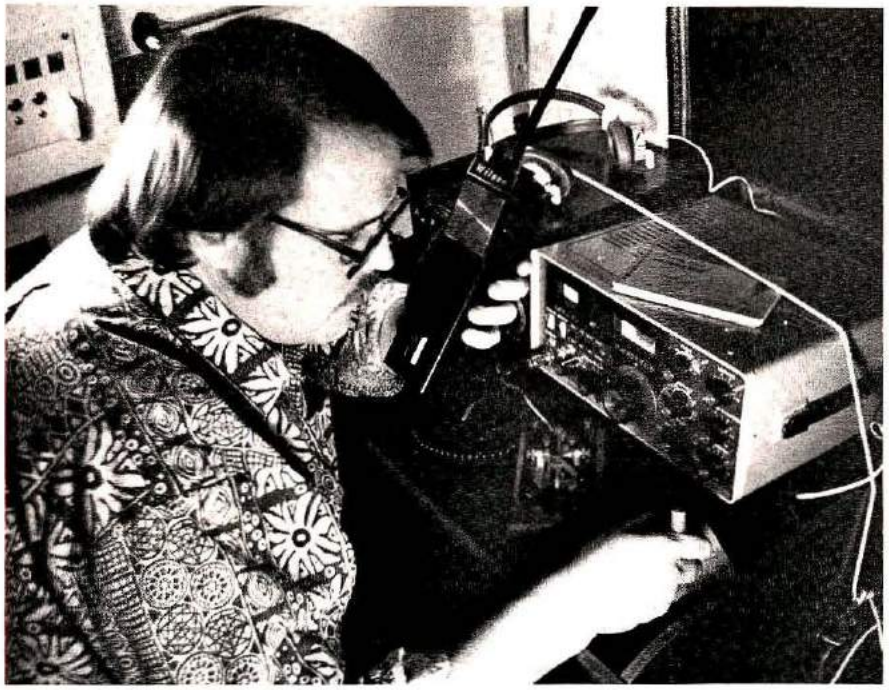
In another recent incident, the 36-foot sailboat *Aburab*, owned by the Costa Rican operator of Amateur Radio station TI8FAG, was 200 miles west of Ecuador in the Pacific Ocean when a passenger came down with what appeared to be appendicitis.

TI8FAG fired up his ham rig on the 14-MHz Amateur band and contacted a ham radio club station at Fort Clayton, Canal Zone. The Canal Zone rescue center was notified, and dispatched C-130E aircraft with a surgeon and two paramedics aboard. Alan Biddle, operator of WA4SCA, Jacksonville, Fla., flew as co-pilot and radio operator of the C-130. Using the ham frequencies, WA4SCA was able to locate the *Aburab*. The paramedics were dropped to successfully treat the patient.

Not long ago, the *Kluanne*, a 31-foot Canadian sloop, was in distress off South Carolina's Atlantic coast. The operator of ham station VEØMCM aboard the sloop broke into a Sunday morning on-the-air-chat on the 4.0-MHz ham band between Earle Taylor, WA4CFX, Spartanburg, S. C., and a Florida station. They were joined by retired Coast Guardsman John Price, WB4JNK, Southport, N. C., who coordinated rescue efforts with the Coast Guard and the Federal Communications Commission (FCC).

The FCC officially declared the *Kluanne's* frequency available for use only in that emergency, since Amateur gear was the communications equipment available on the *Kluanne*. Sixty hams helped out on the air. Some 14 hours after

They may be masts to most yachtmen, but to an amateur radio operator they are also antenna supports. If you'll look close you can see an "egg" insulator in the backstay, near the top of the mast on K3RXK's *Freelance* (center foreground). A vhf whip antenna is located at the top of the mast, out of the picture in this view.



K3RXK checks into one of the nearby vhf repeaters through a hand-held transceiver. Because of the excellent location of repeaters, they can be reached by low-powered units operating near the water level at a range of several miles. The larger equipment on the desk is for use on the amateur hf bands, either voice (ssb) or Morse code.

initial contact with WA4CFX, the Coast Guard cutter *Reliance* was alongside *Kluanne*, and rescued its crew by sunset.

Operating a ham station aboard a boat or ship is easy; many amateurs do it every day. Saving life, limb, and property are obvious uses. Less obvious may be the countless hours of pleasure and relaxation, sprawling in a cabin or sunning on a deck, talking with friends near and far.

I spent six weeks last summer aboard my sailboat *Freelance*, sailing out of Annapolis, Maryland, on the Chesapeake Bay. From late May to early July, my nights were punctuated by the excitement of contacts with Willy in Ghent, Belgium; Joe on Swan Island; Bob in British Columbia; Joe in France; Vic in Grenada, Spain; Art in Munich, Germany; Leo in the Ukraine, USSR; Odon in Brazil; Elvio in Rome; Pat in Helsinki; Sam in Pointe-a-Pitre, Guadeloupe; George in Australia, and many, many more Amateur operators.

These conversations ranged from 10-minute exchanges of signal and weather reports to two-hour chats about local culture, sight-seeing opportunities, politics and other thought-provoking topics. My contacts were spiced by having a fellow yachtsman on the other end.

Talking with other boatmen who are not in distress is a great pleasure. I chatted with HP9XCD who, with his wife and two daughters, was aboard the 32-foot sailboat *Teachers Pet III* which, by his reckoning, was 450 miles north of Venezuela and 900 miles east of the Panama Canal. We didn't talk long, however, as he was looking for a western United States ham station to telephone friends back home.

Amateur radio is there when needed

Hams help anybody they can, not just private yachts. The 990-foot container vessel *Delta Mar* recently collided with the Liberian tanker *Alkus* 90 miles out of Galveston. The *Delta Mar* took heavy hull damage; its regular communications gear was knocked out. Bill Pearce, *Delta Mar's* radio officer and operator of his own ham station W0MWO at Pueblo, Colorado, called for help on the 7.0-MHz ham band. John Carlson, WA7SAU, Tucson, Arizona, and Bob Warriner, W5TT, Arlington, Texas, responded immediately.

W5TT, himself a former seafarer, took over relay chores for messages to the Coast Guard and to the *Delta Mar's* owners, while dozens of other hams stood by. After finally docking the *Delta Mar*, her captain telephoned W5TT to say, "Thank God for hams."

You'll find hams everywhere

A ham radio station aboard a boat can provide contact with just about any spot in the world. I regularly talk from *Freelance* to nearby hams in Maryland, Delaware, and Virginia as easily as with the continents of Europe, Africa, Asia, or Australia. In fact, during my recent six-week vacation, I chatted with hams in all 50 of the United States and on five continents. Of special interest to wanderers on the waves, most of the Caribbean Islands, including most out-of-the-way places like Cayman Island, Swan Island and even Serrana Bank, sometimes have active hams on the air.

Helpful hams at U. S. military bases seem to be everywhere including Gamboa, Canal Zone; San Jose, Costa Rica; and

Distance Conversions

31 feet	9.5 meters
32 feet	9.75 meters
36 feet	11 meters
990 feet	302 meters
10-15 miles	16-24 kilometers
50 miles	80.5 kilometers
90 miles	145 kilometers
150 miles	241 kilometers
200 miles	322 kilometers
450 miles	724 kilometers
900 miles	1448 kilometers

many other locations. There are hundreds of thousands of amateur radio operators in all walks of life around the globe.

Which radio should you have aboard?

Three kinds of two-way radio systems are available to boatsmen: Ham radio, Marine radio, and Citizens' band (CB) radio. Each system is distinctly different, and each requires a separate FCC license. Ham radio has many features that complement marine radio, while holding great advantages over CB radio.

Amateur radio

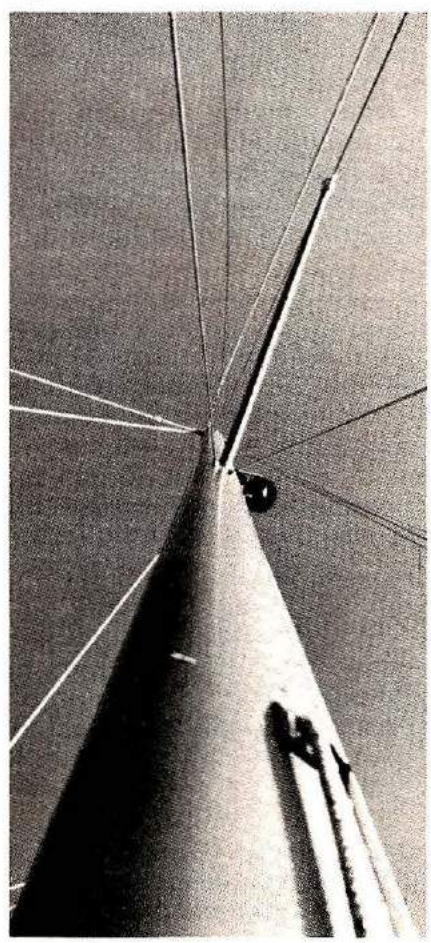
Hams use many different bands of frequencies in the radio spectrum, including short-wave, very-high-frequency (vhf), and ultra-high-frequency (uhf), bands that provide communications ranging from across a marina to across the world, any time of day or night. If they wish, Amateurs may operate transmitters with power up to 1000 watts into very elaborate signal-boosting antennas, and may indulge in chit-chat on any subject except money-making business matters. And, best of all for sailors, many Coast Guard stations have ham clubs monitoring for emergency calls on the Amateur frequencies.

Citizens' band radio

CB radios, on the other hand, are legally limited to only one short-wave band, and no vhf or uhf bands. A maximum permitted power input of 5 watts, somewhat restricted antennas, and a communication range limited to 150 miles, drastically curtails their usefulness. In practice, maximum communications range usually is not more than the equivalent of a few city blocks, and not more than about 10-15 miles in open countryside. The Coast Guard does not monitor or use CB radios.

Marine radios, of course, are monitored by the Coast Guard. The Marine Radio Service has two bands available for small boats: a 2-MHz short-wave band for use far offshore on the high seas, and a 156-MHz band for short-range contacts in and near harbors. Marine transmitter power on the 2-MHz band is limited to 150 watts: 30 times the power of CB sets. Meanwhile, the Amateur Radio power limit of 1000 watts is seven times greater than the marine radio power limit. The small ham short-wave radio I use aboard *Freelance* operates on six different short-wave bands and runs 140 watts. Marine radios on the vhf short-range band are limited to 25 watts, while hams enjoy a 1000-watt limit at vhf also.

The line going to the left from the top of the mast is really a backstay, insulated so that it can be used as an antenna for the high-frequency band amateur equipment aboard. The bottom end of the stay has another insulator, and is fastened near the transom area behind the steering wheel.



Marine radio

Boats outfitted for the 2-MHz marine band use antenna and ground systems similar to those used by hams operating in the six short-wave bands, and boats outfitted for the 156-MHz marine radio vhf band use antennas similar to vhf ham antennas.

Casual conversations are outlawed on the marine bands, so ham radio provides a back-up for vhf Marine Radio when a yachtsman is within line-of-sight-of shore, and for the 2-MHz Marine Radio when one is not too far offshore on "blue water." Ham radio also provides communication from points beyond the range of Coast Guard stations, and has the ability to reach directly to friends and relatives from thousands of miles away. The distance and reliability of Amateur Radio make CB radios seem mere toys.

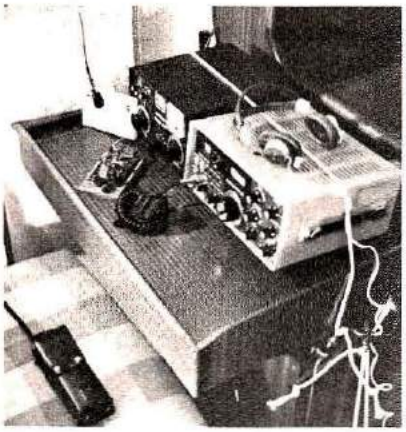
Ham radio is versatile

CB and Marine Radio Operators make only voice transmissions, whereas hams use voice plus International Morse code, television, facsimile, radioteletype and other, exotic, modes of communicating. Besides having great fun tapping out the dots and dashes of Morse code, hams know that code can be heard through static crashes which obliterate voice transmission.

Also much less power is required to get a code message through than is needed for a similar voice message, and a weak code signal can often be copied when a weak voice transmission is only an unintelligible whisper.

Licenses

It's not hard to get FCC licenses for any of these two-way radio services. Marine and CB licenses are yours when you complete an application form and plunk down the



The microphone and key are ready, the Amateur hf-band rigs are tied down in case of rough water, and the small vhf rig on the seat is ready to be clipped to a belt. Thus equipped, the *Freelance* is set for a weekend cruise with communications aboard for enjoyment or emergency.

required fee. Because it carries lots of extra advantages, the ham license requires passing a simple test of your knowledge of radio operating, FCC rules and the International Morse code.

The Federal Communications Commission makes licenses available to anyone passing the exam, regardless of age, sex, or nationality. U.S. citizenship is not required. Any person may take the exam and, if successful, receive Amateur Station and Operator licenses. Also, visitors from some other countries may operate Amateur stations here under reciprocal agreements between governments.

A good place to start

Paperback books giving questions and answers of the types asked on FCC exams are available from *Ham Radio Horizons* by calling toll-free (800) 258-5353 from 8 AM to 10 PM Eastern time Monday through Friday, and 8:30 AM to 4:30 PM on Saturdays. License manuals and study guides are available, along with code-practice tapes.

Learning the code is fun and not the stumbling block it might seem at first glance. Just last week, I talked on the air with a 12-year-old girl who had passed the ham-license exam and now is able to understand code sent at 15 words per minute. The beginning Novice-class license only requires sending and receiving five words per minute.

FM and repeaters

All CB and most marine radio communications are transmitted directly from one operator's set to another. Hams, on the other hand, have established a network of 2000 repeater stations across the United States, atop buildings, towers, and mountains, both inland and near seashores. Many other repeaters are in use in Canada and around the world.

Repeaters have very sensitive receivers and high-powered transmitters which pick up weak vhf voice signals and retransmit them over vast distances. Repeaters permit hams to talk far beyond the normal line-of-sight limitations on marine vhf radios.

Many Amateur operators have equipped their vhf radios with *Touch-Tone* telephone dials so they can make local telephone calls anytime to friends and authorities as if from an ordinary telephone. Police and other emergency services can be called from boat, car, or even deep in a forest. The telephoning ham need only be within range of a repeater.

I had an interesting conversation one evening last summer with Charlie, WA3RPU, as he was piloting the giant motorsteamer *Clipper* southbound in the large-ship channel of the Chesapeake Bay. Charlie had just left the port of Baltimore on his way down to Norfolk with a load of freight. We chatted for an hour before he passed out of range for direct boat-to-boat vhf communications. I was using only a small hand-held transceiver (transmitter and receiver in one box).

Freelance was rolling gently in her slip at Maryland Capital Yacht Club and I was relaxing on the port berth in the cabin with a cold *Diet Pepsi*. Saying goodbye to Charlie, I switched to a Baltimore repeater, and enjoyed a conversation with another sailor in his car 50 miles west of Baltimore on Interstate 70 heading for a weekend on the Bay. **HRH**

Glossary of Terms

Mayday is an International distress call, the voice equivalent of *SOS*; comes from French *M'aider* (help).

Landlubber is a person who is not used to sailing and ships.

Phone Patch is a device that can be connected between a radio and a telephone to permit telephone conversations to be sent and received by radio.

Paramedic is someone trained to give emergency medical treatment at the scene of a disaster or emergency.

Vhf is very high frequency, considered to be between 30 and 300 Megahertz.

Uhf is ultra-high frequency, considered to be between 300 Megahertz and 3 Gigahertz (3,000 Megahertz).

Blue water is an ocean or sea, as opposed to a lake or river; deep water.

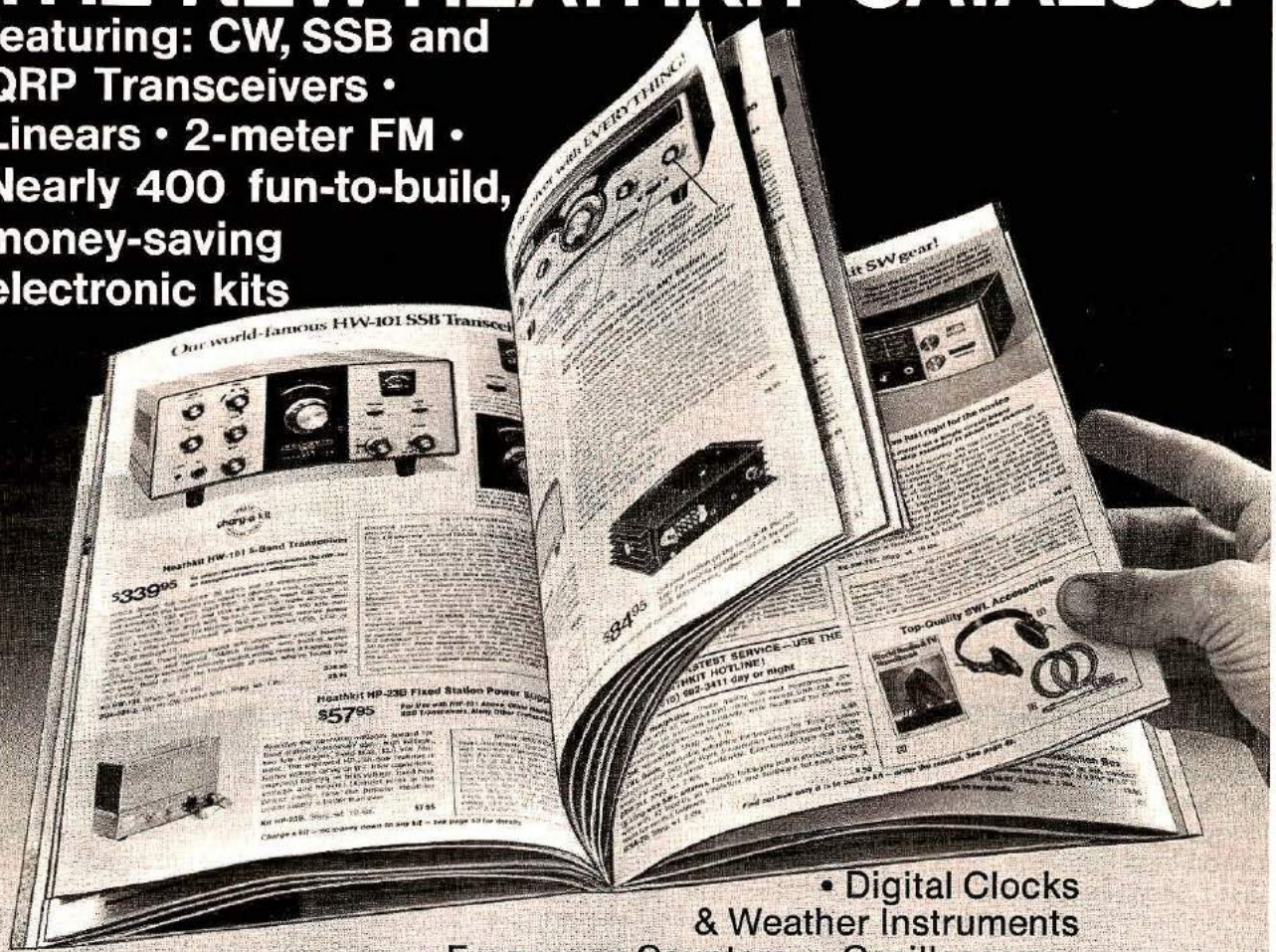
Repeater is a transmitter and receiver combination, usually set up in a high, remote location, that automatically receives a signal, amplifies it, and re-transmits (repeats) it over a greater distance than would otherwise be possible.

Touch-Tone is a trade name by Bell Telephone Company for a push-button dialing system that produces a characteristic tone when a button is touched.

FREE

THE NEW HEATHKIT CATALOG

featuring: CW, SSB and QRP Transceivers • Linears • 2-meter FM • Nearly 400 fun-to-build, money-saving electronic kits



• Digital Clocks & Weather Instruments
• Frequency Counters • Oscilloscopes
• Fishing, Marine and Aircraft Accessories
• Color & B&W TV's • Hi-Fi Components

PLUS SPECTACULAR CB VALUES!

Thousands of people have discovered the fun — and savings — of handcrafting a fine piece of electronic equipment. You can build it better — let us show you how.

Send for your FREE catalog today!

Heath Company, Dept. 348-32
Benton Harbor, Michigan 49022

HEATH
Schlumberger

Heath Company, Dept. 348-32
Benton Harbor, Michigan 49022

Please send me my FREE Heathkit Catalog.
I am not on your mailing list.

Name_____

Address_____

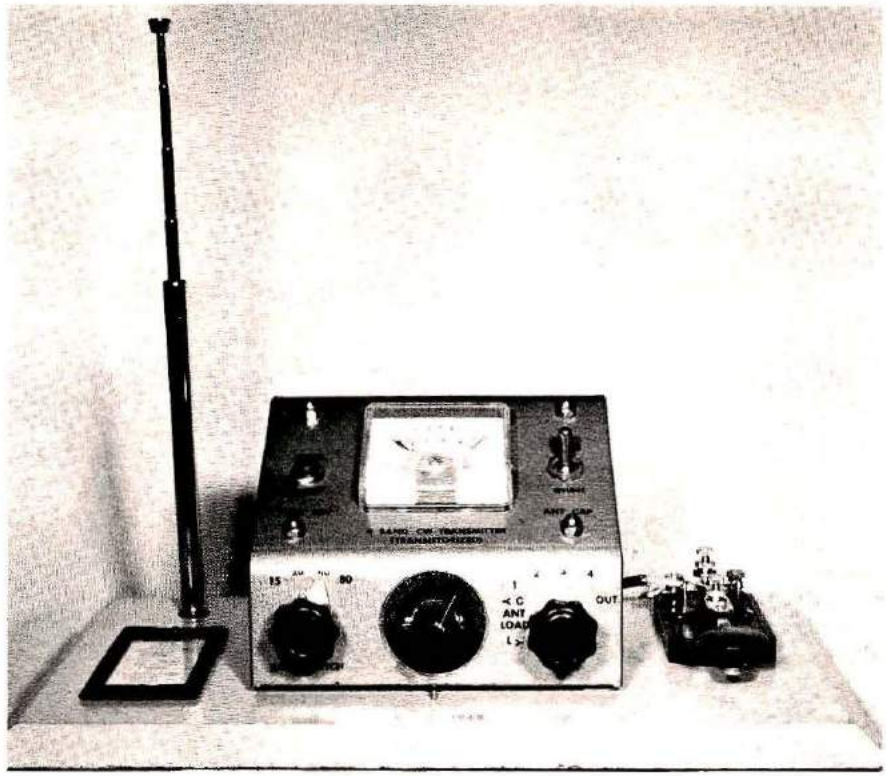
City_____ State_____

CL-608A Zip_____

Low-Powered Transmitters for the Beginner

BY HOWARD PYLE, W7OE

Some QRP$_p$ equipment you can build to set DX records



Are you aware of the interest in low-power operation on the ham bands? "CQ QRP" is heard on all the bands, as radio amateurs experience new thrills and exciting contacts through the operation of flea-power equipment.

What constitutes QRP? As one of the 'Q' signals established by the Radio Act of 1912, it is interpreted as, "Decrease power" or, if followed by a question mark, "Must I decrease power?" It was originally used to afford relief from inherently broad spark signals in the early maritime wireless service.

Loosely interpreted in amateur practice, QRP simply means that the station using it is in the low-power class as distinguished from the higher powered hams with their kilowatts. While no definite criterion has been formally established as a dividing line, hams generally consider 100 watts input as maximum power input in the low-power category. This is the figure used by the QRP Amateur Radio Club. Between 100 and 500 watts is generally classified as medium power and anything from 500 watts to the legal maximum automatically falls into the high-power group.

With the steady growth of amateur radio and the proportionate increase in high power stations a few years ago, the interference problem was becoming acute. A small proportion of hams were able to meet the high power competition by acquiring a kilowatt of their own; the little fellow found it increasingly difficult to fight through the powerful signals. As a result, a group of western hams, led by K6JSS, organized the QRP Amateur Radio Club in 1960. They were committed to a maximum power input of 100 watts. Their primary aim was to encourage more extensive use of low-power in an effort to reduce QRM (interference) and provide more equitable communication status for the modestly powered ham stations.

Careful impedance matching between transmitters and antennas, improved output

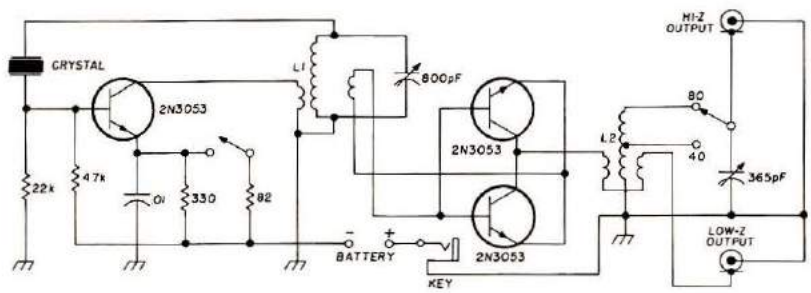
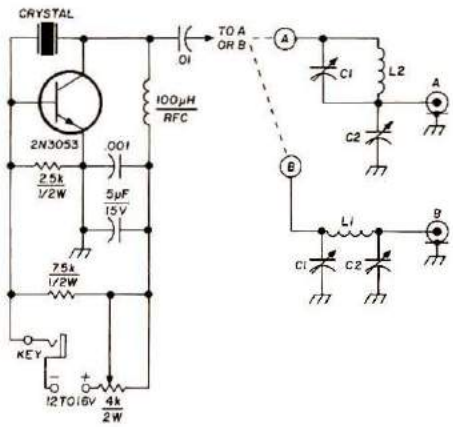


Fig. 1. QRP rig used at W7IGV. Power input depends on battery voltage and runs from 1 to 5 watts. L1 is number 30 enameled wire on a Micrometals T-50-2 toroid, wound to fully fill the circumference. L2 is 32 turns number 18 wire on a Micrometals T-80-2 toroid; 40-meter tap at 14 turns.



C1 970-pF trimmer (Arco L-314)
C2 2830-pF trimmer (Arco L-306)
L1 50 turns number 28 enameled, close wound on ¼" (6.5mm) form
L2 12 turns number 28 enameled, close wound on ¼" (6.5mm) form

Fig. 2. Rig used by W6TYP for his record-breaking 210,000-miles-per-watt contact with WB2GFQ. The 4k, 2W potentiometer permits input power adjustment from 1 to 500 milliwatts. Output circuit A is used with 50- or 75-ohm coaxial lines; B is used with 600- to 1000-ohm feedlines.

coupling and more effective antennas were all given careful attention. Operating proficiency was upgraded — not only in actual communication techniques but by choice of bands and time of day, frequency selection for the desired distance, and by finding holes that were relatively interference free.

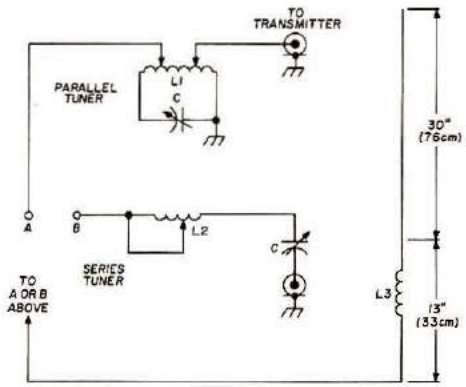
Equipment

Let's take a look at some of the gear being used to make 1000-mile-per-watt (1600km) contacts every day. These are just a few of the minirigs that have demonstrated exceptional performance.

Since the original article was written, many manufacturers have entered the field with QRP and QRP$_p$ equipment. Among them are Heath Company, of Benton Harbor, Michigan, with their HW-8, a CW transceiver that provides an input of about 3 watts on 80, 40, 20, and 15 meters. Ten Tec, of Sevierville, Tennessee, began a trend with their PM (Power Mite) series of QRP rigs having about 2 watts input power. More recently, Ten Tec introduced the *Argonaut*, a compact five-watt transceiver capable of CW or ssb operation on all amateur bands between 80 and 10 meters. The International Crystal Manufacturing Company of Oklahoma City, still provides their popular OX series of oscillator modules that can be used for building projects. In addition, they can furnish other receiver and transmitter components that will enable you to build a complete station, simply by assembling modules.

It's not my intent to give you complete construction details for any of these little rigs. However, with the schematics you can use your ingenuity and work up your own component layouts. I'll wager you'll find a whole new world opening before you!

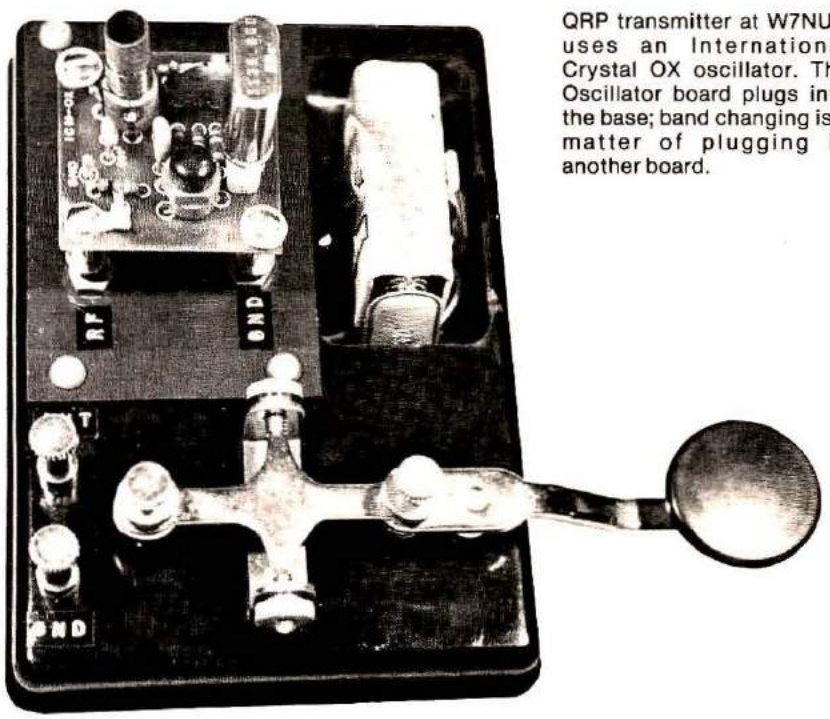
Naturally, you'll have some questions; I'll try to anticipate them and offer some answers.



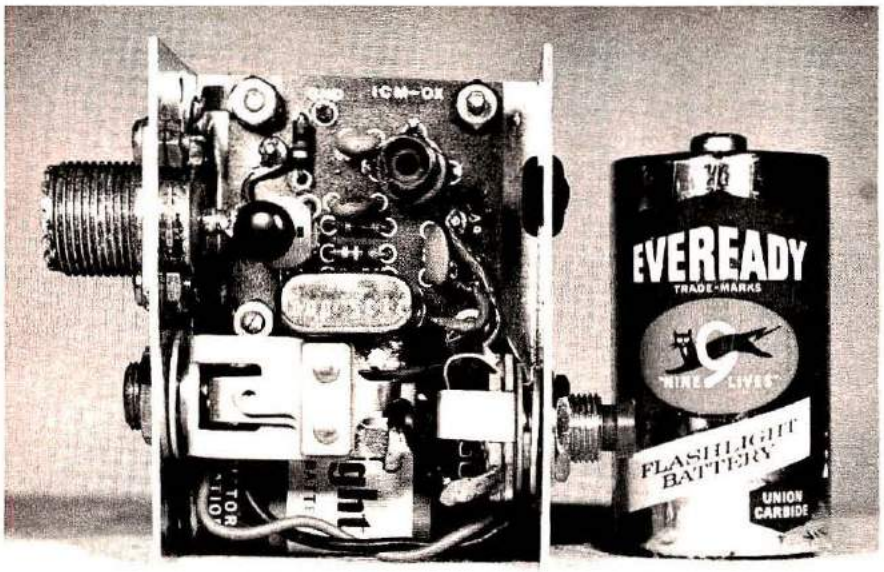
C 365 pF to cover 160 meters; 50 pF adequate for 40 meters
L1,L2 36 turns number 14 enameled, 2" (5cm) diameter
L3 195 turns number 14 closewound on 3/4" (2cm) wood dowel 48" (122cm) long

Fig. 3. Simple vertical antenna and tuners used by W6TYP with milliwatt transmitters.

First will undoubtedly be, "What about an antenna . . . what do I use?" That is an easy one; if you have a satisfactory antenna which produces results, use it! That's what 99 per cent of today's transistor



QRP transmitter at W7NUN uses an International Crystal OX oscillator. The Oscillator board plugs into the base; band changing is a matter of plugging in another board.



The International Crystal OX module can be put in a very small package. Placing the 9-volt transistor battery in the case makes the unit a complete pocket-sized transmitter. Compares the size to the standard D cell at right.

experimenters are using. If it performs well on higher power, you can be pretty sure it will deliver equally well with mini-power. But be sure it's a good antenna; well-matched, low swr, in the clear, and built to stay put.

I've been asked if putting the mini-powered rig directly at the base of the transmission line just below the antenna or, if vertical, right at the base insulator is desirable. Sure, if you can manage it; you'll lower your losses in the transmission line. However, from the experience many of the boys have had, what you gain isn't worth the mechanical complications.

W6TYP uses a random length of transmission line — 15 to 25 feet (5 to 7 meters). I use my 40-meter half-wave dipole with one hundred feet (30 meters) of RG-59/U and have worked over 900 miles (1450km) with .185 watts input! So, if you have an effective antenna now, you have no problem.

W6TYP is handicapped for space for a wire antenna, and practically all his work has been done with a loaded whip antenna extending from the fourth-floor window of his hotel room. He also uses a modified version of this antenna which is shown in **Fig. 3.** Art has tried dipoles and Windoms on the hotel roof, long wires from here to there, and variations of these, but he always comes back to a single, compact vertical for assurance of real success.

Bands

Next you'll ask, "What bands are being used?" For the most part, QRP operation has centered around 40 meters, but results are just as satisfying on any of the popular bands. For example, with four little OX oscillators from the International Crystal Company I have obtained excellent performance on 15, 20, 40 and 80; a four-band arrangement with a separate 2-inch by 2-inch (5x5cm) transmitter or each band! A few experimenters have had satisfactory reports up to several hundred miles (500km) on 160 meters with inputs of one watt or less!

And now, "Are all of the rigs crystal controlled?" Not by a long shot; W6EAC is getting

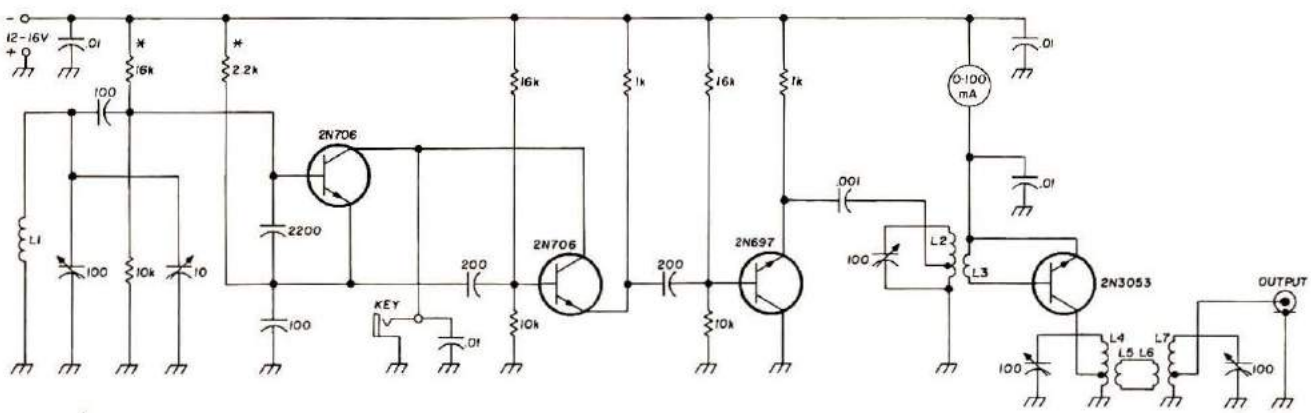


Fig. 5. This little rig developed by W6EAC runs one to five watts with vfo control. Resistors marked with an asterisk should be changed in value for best keying.

L1 18 turns number 20, airwound on 1" (2.5cm) diameter form

L2 30 turns number 20, airwound on 1" (2.5cm) diameter form

L3 3 turns around cold end of L2

L4,L7 30 turns number 20, airwound, 1" (2.5cm) diameter tapped at 6 turns

L5,L6 3 turns around cold end of L4 and L7 respectively

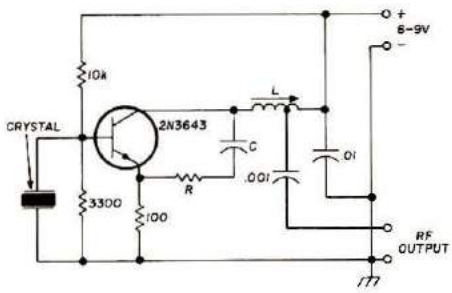


Fig. 4. International Crystal Company's OX oscillator circuit. The values of L, C, and R vary with frequency and are furnished with the kit. These kits are $3.95 postpaid from International Crystal Manufacturing Company, Inc., 10 North Lee, Oklahoma City, Oklahoma 73102. EX crystals for the OX oscillator are $4.95 each postpaid. Circuit may be keyed in either the plus or minus battery lead.

excellent results with his home-brew transistorized one-watt vfo! W7IGV in Idaho with his own vfo design equals W6EAC's results. Others have built their own vfos and encountered no problems. Crystal control is the logical first step; after you get your feet wet, see what you can do with a vfo.

Antenna tuning unit? No problem; make up a simple series or parallel arrangement such as W6TYP uses or use a conventional pi-network. The various Z-matches, transmatches and similar are just as effective with these little rigs as they are with their big brothers. Handle the output just as you would that from a more powerful tube transmitter.

What about modulation? Well, why not? The present trend is to concentrate on the rf angles; modulation is just around the corner. Of course, there is no reason why the little rigs can't be expanded to include modulation as well. Some efforts have been made along these lines; it's been reported that one W6 station has worked several hundred miles (500km) with voice on 160 meters with less than one watt input!

It's my guess that modulation experiments will be initially confined to a-m; there are too many hurdles to jump with ssb at this early stage. Take a lesson from the portable units and the increasing number of transistorized CB rigs; there are a lot of hidden tips if you want to pursue this angle.

I have only scratched the surface of this exciting new field. I have shown you a few examples of accomplishment by western hams because I am intimately familiar with their results. Undoubtedly you will find one or more hams in your own vicinity who are deeply engrossed in the art of QRP operation. Contact them and work with them; remember that many of the significant developments in the electronics field were ham conceived and ham developed.

Parts availability

For those who would like to duplicate the simplest of the little rigs shown, the following parts are available from G. R. Whitehouse, Newbury Drive, Amherst, New Hampshire 03031:

W6TYP transmitter, **Fig. 2.** 2N3053 transistor, 100-mHy rf choke (J300-100), Arco L306, Arco L314, crystal socket 33102, available as a package for $15, postpaid. The remainder of the items are standard parts, available from many electronic parts suppliers. Note that the 4k, 2W potentiometer may be omitted entirely or replaced by a fixed resistor for a predetermined power level, saving cost.

W6TYP antenna tuner, **Fig. 3.** 50-pF capacitor (APC 50B) and coil (B&W 3026), as a package, for $11.40, postpaid.

"It just loafs along at 2000 watts PEP . . . power supply is external of course . . ."

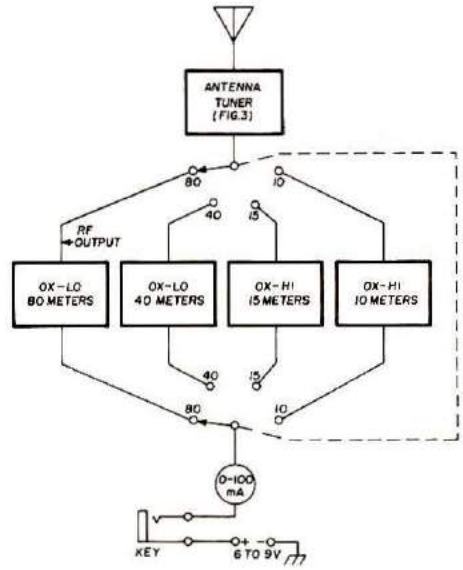


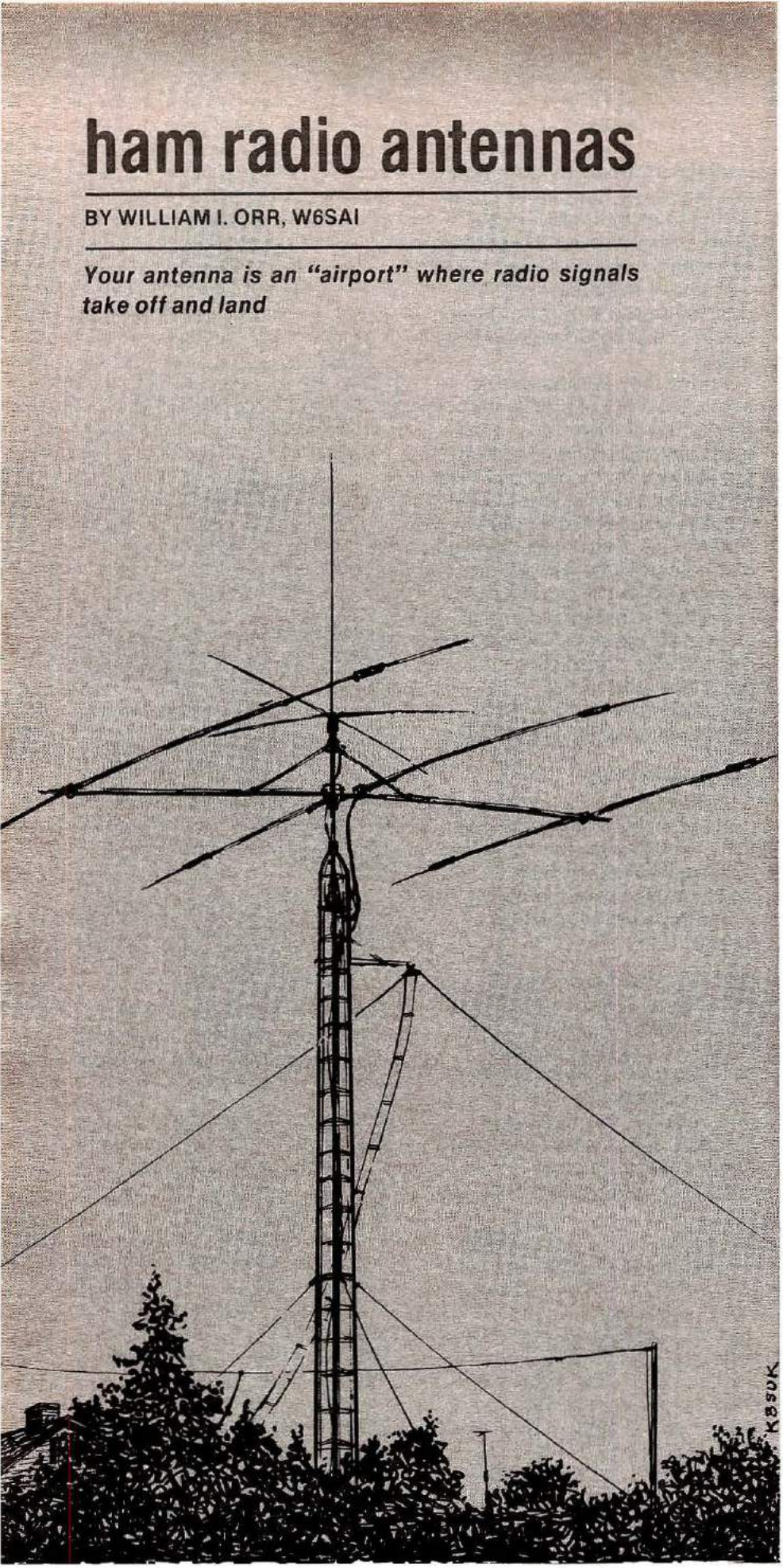
Fig. 6. The International Crystal OX-LO modules can be connected through a switch to select the one for the band in use, as shown in this functional block diagram. The beginner can purchase a module for one band as a start, and add the other bands at a later time. S-1 should be a two-section ceramic wafer switch, with at least 4 poles per section. If you use one with 6 poles, you will be able to add 160- and 20-meter coverage when you obtain the General Class License.

The other transmitters discussed in the article can be built from parts obtained through G. R. Whitehouse, Radio Shack, Lafayette Electronics, or almost any electronic parts supplier. Once you have built and operated the simplest of these little rigs, construction of the others becomes much easier. The small crystal oscillator modules, model OX-LO, supplied by the International Crystal Manufacturing Company, 10 North Lee, Oklahoma City, Oklahoma 73102, are suitable as basic building blocks or even tiny transmitters. **HRH**

ham radio antennas

BY WILLIAM I. ORR, W6SAI

Your antenna is an "airport" where radio signals take off and land



Welcome to the wonderful world of Amateur Radio! Each month, thousands of you are joining the ranks of those who enjoy the greatest hobby in the world. Many have come from the Citizen's Band, looking for a challenge, new experiences, and knowledge about the broader aspects of radio communication. This article is for you. Welcome aboard!

The greatest distinction between CB and Amateur Radio noticed by the newcomer is that Amateurs have operating privileges in several bands, and that a different antenna may be used for each band. Licensed Novices have frequency segments set aside for their use in the 80-, 40-, 15-, and 10-meter bands; and, unless special multi-band antennas are used, the beginner-Novice has to erect a separate antenna for each band. In the world of CB radio, the channels are so close to each other that a single antenna will work on all of them; not so in Amateur Radio, because the ham bands are scattered all over the radio spectrum.

Throw out your CB Antenna?

No! You'll probably want to continue talking to some of your friends on the Citizen's Band (perhaps inviting them into ham radio) and, besides, many CB antennas will function on the 10-meter ham band which is quite close in frequency to the CB channels.

If you are using a ground-plane antenna for your CB base station, you'll find that it will operate in the segment of 10 meters (28.1 - 28.2 MHz) assigned to Novice Class Amateurs. As is, the CB ground plane will work quite efficiently on *both* CB and 10 meters. The nit-picker who wants to tune his CB ground plane to the 10-

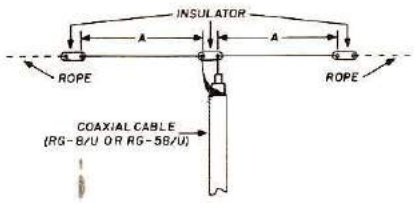


Fig. 1. The dipole antenna for 40 or 80-meter operation. For 40 meters, each section A is 33 feet long. For 80 meters, each section A is 62'8" long. The conductors of the coaxial line are connected to the dipole sections at the center insulator. Glass, ceramic or well-varnished wood may be used for insulators, which are about 3 inches long. Use waterproof rope, or the tension on the dipole will change with the weather! Bring the coaxial line away at right angles to the antenna wire.

meter Novice band can do so with a hacksaw; he'll cut 3 inches (7.6cm) off the top of the whip and the same amount off each radial. The antenna is now tuned to 10 meters, but will still work okay on the CB channels. The main difference is that whereas the swr was originally lower in the CB range, it will now be lower in the 10-meter band.

The CB ground-plane antenna can also be adapted to the Amateur 15-meter Novice Band (21.1 to 21.2 MHz) which is far-removed from the CB channels and lower in frequency. Therefore, the CB ground plane will be virtually useless for 15 meters unless the elements are lengthened. About 30 inches (76cm) must be added to the whip and to each radial of the CB ground plane and, once the extensions are added, the antenna will be useless for the CB channels.

Adding these extensions should be no big deal. The tips can be made from small-diameter aluminum tubing or copper-plated welding rod. The ground plane elements should be drilled and the new pieces connected with small nuts and bolts. It is a good idea to cover the joint with asphalt paint to prevent rust or corrosion from the weather. Needless to say, a good electrical connection must first be made between the extensions and the original elements, and it is this connection that you are trying to protect from the weather.

How About the 40- and 80-Meter Novice Bands?

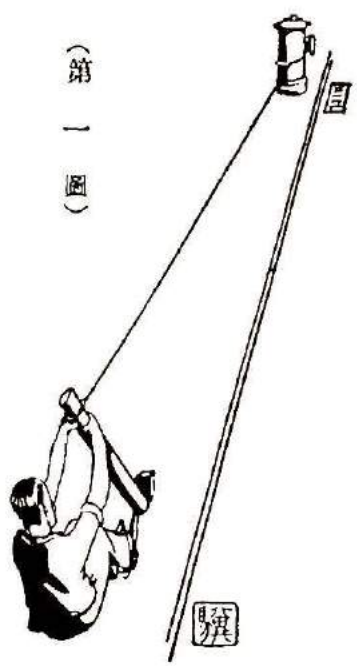
Well, these bands are quite low in frequency and the proper antennas for them are large enough so that it is impractical to rebuild a CB antenna to "hit" them. However, it is dead-easy to build a suitable antenna to work on either band, so let's take the 40-meter band first.

The 40-meter Novice band covers the frequency range of 7100 to 7150 kHz, and the best antenna for covering this range — in my opinion — is the *dipole*; an antenna virtually unknown in the 11-meter world of CB. The dipole can be thought of quite simply as two whip antennas placed back-to-back (**Fig. 1**), and no radials are required. In as much as the length of a single whip antenna (for any band) is one quarter-wave length, the length of a dipole is one-half wave length. For the Novice 40-meter band, this works out to an overall length of 66 feet (20 meters) "on the nose." Let me caution you at this point not to become confused between our metric dimensions accompanying the length, and the band that the antenna is being made for. When we speak of the 40-meter band the wavelength stated is *one full wavelength*. When we give the dimensions of the wire dipole, it is for a *half-wavelength*, which is 20 meters, or 66 feet.

The dipole, then, consists of two 33-foot (10-meter) conductors placed end-to-end and joined to each other with a coaxial line. As in the world of CB, extensive use is made of RG-58/U and RG-8/U coaxial cable. For medium power, up to the maximum Novice limitation of 250 watts input, there's no reason why you shouldn't use the lighter and less-expensive RG-58/U.

All you need for the dipole are two lengths of stranded or solid wire, three strain insulators, and some coaxial cable. The wire can be insulated or bare, but most hams use enamel-coated wire because insulated wire becomes pretty "scruffy" over a period of time when exposed to the effects of weather and abrasion. Solid copper wire, sometimes called magnet wire, is good stuff, and it comes with an enamel or *Formvar* coating.

Fig. 2. Orignially published in *China Radio* about 1934, this sketch was reprinted in the May, 1936 issue of *Radio* magazine. To stretch the wire, it is tied to a fire hydrant, and a hole is knocked in the concrete sidewalk! A "handle stick" is placed in the hole. The amateur then sits down and "pulls hard". Sage advice from the Orient!



不會再伸長。所以在裝置天線之前，可以使天線拉長後，裝在天空

Either type may be used successfully.

For a 40-meter dipole, no. 14 (1.6mm) wire may be used, although no. 12 (2.1mm) is preferred. The wire will stretch a bit under tension, so it is a good idea to pre-stretch it before use. Merely anchor (or tie) one end of the wire to a solid point and pull hard on the opposite end. Really jerk it several times! You'll be able to stretch it an inch or two (2.5-5cm). Don't worry, it won't break! See **Fig. 2** for an old sketch in a pre-war Chinese radio magazine showing how this was done in the Orient!

Once the wire has been stretched, remeasure it to length and wrap the wire ends around the insulators. At the end insulators, it is not necessary to clean the insulation off the wire, but it is necessary to scrape the wire bright and clean at the center insulator, because that's where you will attach the coaxial-cable feedline.

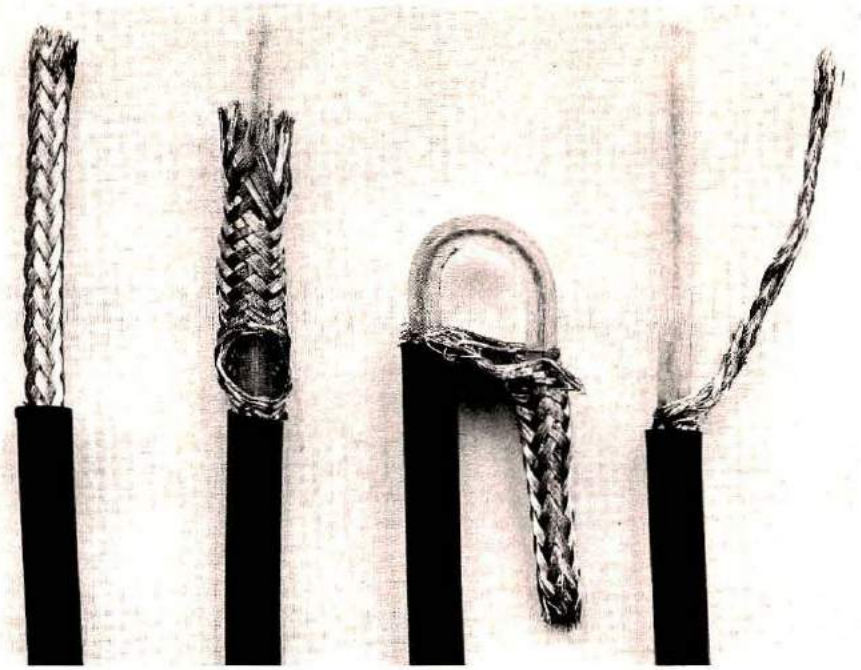


Fig. 3. Preparing the coaxial line. At left, the outer insulation of the line is removed with a sharp knife or razor blade. Next, the braid is pushed back to loosen it and a hole is carefully made by separating the fine wires of the braid with an awl, or other sharp instrument. Next, the inner conductor is fished through the hole in the braid. At right, the braid is flattened into a "pigtail" lead. The last step is to remove the insulation from the inner conductor of the line.

The coaxial-cable feedline

Energy is "fed" from your transmitter to the dipole by means of coaxial cable which is one form of feedline. The coaxial feedline is to be connected across the center insulator with the inner conductor of the cable going to one half of the dipole, and the braided outer shield going to the other half. Making this connection requires a bit of finesse because the joint must support the weight of the cable and must also resist the pull on the wire; you wouldn't want it to pull apart in a heavy windstorm! Many exotic center connectors and insulators for making this attachment have been shown in ham magazines over the years, and most of them are a waste of time and money. It is easy to do this job properly, and here's how.

First of all, you will have to remove the outer "jacket" insulation from the end of the cable for about a foot, to give yourself plenty of room to work. You can use a razor blade to do this (taking a chance on cutting yourself) or you can use a *Stanley 99A Shop Knife*, obtainable at most hardware stores for a small sum. Take this utility knife and circumscribe a cut in the outer jacket of the coaxial cable about a foot (30.5cm) from one end. Make the cut at right angles to the cable, and take care not to cut too deeply, so you won't damage the braided metallic shield underneath. Next, slit the jacket parallel to the cable all the way from the cut you just made to the end. If you do this carefully, the vinyl outer jacket may be stripped from the cable in one piece, leaving the braid intact.

The second task is to make the braid into a "pigtail." Push the braid back on itself to loosen the weave a bit. Then use a small pointed tool, such as an awl or a nail, and carefully open up a hole in one side of the braid about one-half inch (12.7mm) from the place where you made the first cut in the jacket. The hole is made quite easily by separating the strands of the braid, until a hole nearly equal in diameter to the diameter of the inner insulation has been made.

Go slowly and carefully, so as not to break any of the fine wires. Now, bend the cable sharply at the hole you just made and "fish" the insulated inner conductor through the hole, using the awl or nail as a sort of hook. Once you have pulled the inner conductor through the hole, the empty braid is squeezed and flattened into a pigtail lead.

Attaching the coaxial cable to the antenna

Now you are ready to attach the feedline you've just prepared to the antenna itself. Support the weight of the cable by the pigtail and not by the inner conductor — which is much weaker. Now, using the shop knife, make a circumferential cut in the insulation surrounding the

inner conductor, much in the same way you cut the outer jacket, but be careful not to nick the inner wire! Even a slight nick will cause it to break later on — usually when the antenna is at the top of your masts and in the dead of winter during a raging blizzard. Don't ask me how I know!

Now, grasp the cable in one hand and inner insulation in your other hand, and pull. If you allow the insulation to rotate slightly as you pull, it will "unscrew" itself from the wire. If it seems too tight, and you are afraid of breaking the wire, cut the insulation off in sections every 3 inches (8cm) or so as it leaves the wire.

Solder the end of the pigtail to one wire of the dipole and solder the inner conductor to the other wire of the dipole. Be sure to do the pigtail first so that it will take the weight of the cable and ease the strain on the inner conductor. After everything has been soldered and appears "shipshape," heavily coat the end of the coaxial cable you've been working on with bathtub caulk to make the joint waterproof. Rain water seeping down inside a coaxial cable can quickly corrode the shield and inner wire, as well as change the quality of the insulation. The best way to absolutely *ruin* an otherwise good antenna system is to leave an exposed end of the coaxial cable out in the weather. It will soak up water and moisture by capillary action, and corrode the wires, so be safe and seal the end of the line with great care.

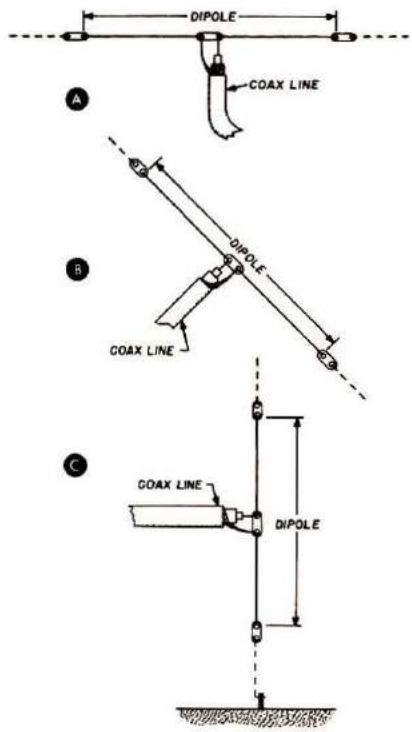


Fig. 4. A horizontal dipole, **B** sloper dipole, **C** vertical dipole. Note in each case the coaxial line is led away from the antenna at right angles to the wire.

Erecting your dipole

The golden moment is at hand! Ideally, the dipole should be erected horizontally, that is, parallel with the ground, with the coaxial feedline dropping down vertically beneath the antenna. Dipole heights of 40 to 80 feet (12 to 24 meters) are excellent! So this is impossible at your location? Well, the dipole is a forgiving antenna and really good results can be obtained at a height as low as 20 feet (6 meters).

The antenna doesn't *have* to be horizontal, either. It can be inclined, with one end higher than the other, and is called a *sloper*. When a sloper is used, best results seem to be achieved when the half of the dipole attached to the inner conductor of the coaxial cable is higher than the half con-

Glossary of Terms

Feedline is one or more electrical conductors that conduct, or "feed," radio frequency energy between the antenna and your radio. Also called transmission line. Coaxial cable is called feedline or, sometimes, just coax, pronounced *co-ax*.

Dipole is literally *two* poles, an antenna that has two poles or "legs", separated by a small space and connected to each other by a feedline. Sometimes called a doublet antenna.

Novice is a class of Amateur Radio license, requiring the ability to send and receive Morse Code at the rate of at least five words per minute, and the ability to pass a simple test in radio theory and practice.

Ground plane is an imaginary reflective surface that is sometimes represented by the earth and sometimes by metal elements in the form of screen, wire or tubular members. In a ground-plane antenna, the vertical "whip" radiates energy while the *radials* act as the reflective surface at the base of the whip.

SWR is standing wave ratio, which is the ratio of a voltage maxima to a voltage minima along the line. The usual term is VSWR, meaning *voltage* standing wave ratio. The ideal situation is to have a *flat* line, that is, a ratio of 1:1. The VSWR on a line can only be changed by changing the load at the end.

Insulator in the antenna sense, an insulator may be made from plastic, glass, or ceramic material. Antenna insulators are often egg-shaped or cylindrical and usually have holes at each end: One for attaching the antenna wire, and the other for attaching the supporting line or halyard. They are also mechanically strong to withstand stress and storm.

Bathtub Caulk is a gooey, waterproof material that smells like vinegar and hardens to a flexible, rubbery consistency upon contact with air. Usually silicone-based and available in clear, black, or white colors.

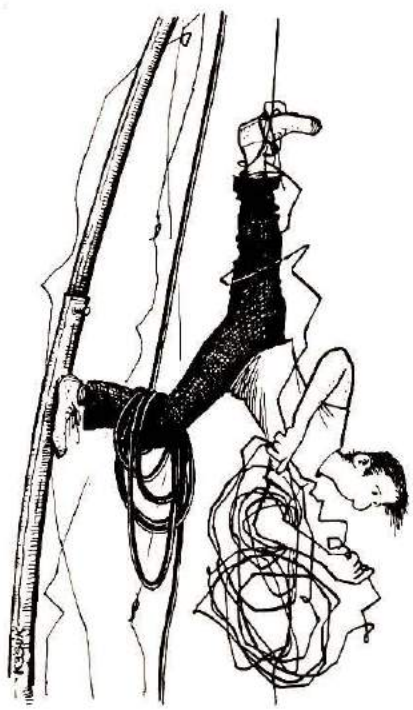
Formvar is the trade name of a tenacious insulating varnish developed by industry for coating wire that had to be stretched, bent, and wrapped, when winding motor armatures and coils. It is extremely thin and reddish-brown in color, and can be removed by scraping or with a special solvent. It is a good electrical insulator and completely protects wire against corrosion and oxidation.

nected to the pigtail (**Fig. 4**).

In fact, the dipole may be mounted in a vertical position, if that suits your location best. The bottom end should be well clear of the ground, say 8 to 10 feet (2.5 to 3 meters), and the feedline should be led away from the antenna at a right angle for at least 20 feet (6 meters). Most Amateurs prefer the dipole to be in a horizontal position, although the sloper is gaining in popularity, because a favored direction of maximum radiation (toward the low end) can be obtained. I suggest you try both positions, if you have time, to see which is best for you.

How about the 80-meter band?

The dipole is an excellent performer on the Novice 80-meter band (3.70 to 3.75 MHz), and assembly is the same as for the 40-meter band, except that each wire is 62'8" (19.1 meters) long, while the overall length is about 126 feet (38.4 meters), including the insulators. This length will take up quite a bit of room in your yard, but there's no reason why the wires couldn't be "bent" a bit to fit the antenna into a smaller space. Many hams fold the tips of the dipole back at right angles to the main wire to form a "U" or a "Z," and "shoehorn" the dipole into a smaller lot. However, this may require increasing the length of wire by one or two per cent so the antenna performs well.



As with the 40-meter antenna, the 80-meter dipole may be mounted horizontally or placed in a sloping position. Try to erect your dipole as high and in the clear as possible; any antenna surrounded by buildings and utility wires cannot be expected to do as good a job as one well up in the clear, away from metallic objects, house wiring, and other electrical conductors. Even nearby trees can have an effect on your antenna, so try for a clear spot to place it.

Trees at each end, however, can make good supports. Place a pulley high in each tree and run a nylon line through the pulley so that each end of the antenna can be hoisted, and the whole antenna pulled as flat as possible without placing too much strain on the wire or the connections. Nylon line will "give" slightly and tend to compensate for the swaying of the trees in a wind. Masts, of course, can be used in place of trees for supporting your antenna, and sometimes a high point of your house will serve as a good, solid support.

There's more to come!

There's a lot more information about ham antennas, and the writer — and other *Ham Radio Horizons* authors — will be bringing you helpful information in the months ahead. So stay tuned in!

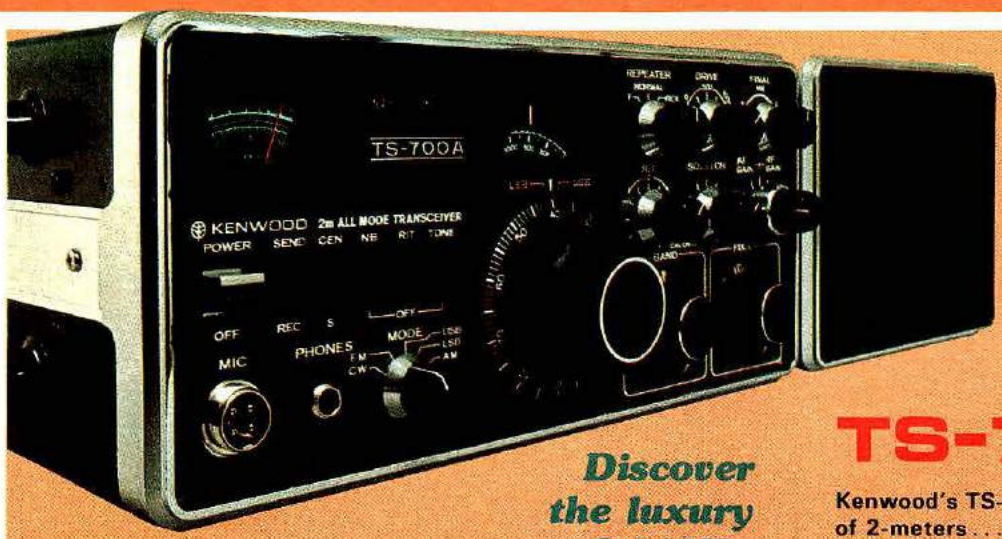
Reference

Simple, Low-Cost Wire Antennas, Radio Publications, Wilton, Connecticut. Available from *ham radio's* Communications Bookstore, Greenville, New Hampshire 03048. Order RP-WA, $4.95.

HRH

KENWOOD

...the Pacesetter in Amateur Radio

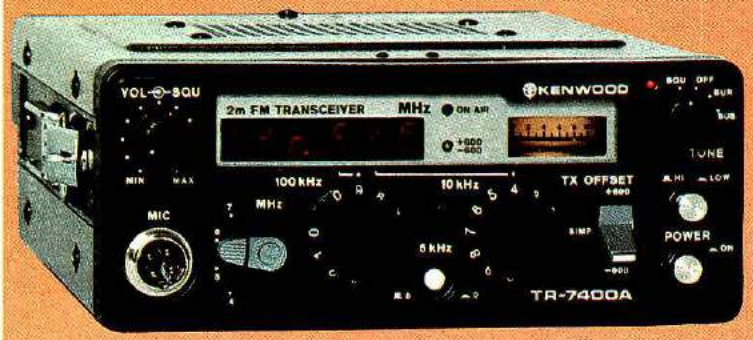


Discover the luxury of 4 MHz

TS-700A

Kenwood's TS-700A offers the ultimate promise of 2-meters . . . more channels, more versatility, tunable VFO, SSB-CW . . . and Kenwood quality.

Operates all modes: SSB (upper & lower), FM, AM and CW • Completely solid state circuitry provides stable, long lasting, trouble-free operation • AC and DC capability (operate from your car, boat, or as a base station through its built-in power supply) • 4 MHz band coverage (144 to 148 MHz) • Automatically switches transmit frequency 600 KHz for repeater operation. Simply dial in your receive frequency and the radio does the rest . . . simplex repeater reverse • Or accomplish the same by plugging a single crystal into one of the 11 crystal positions for your favorite channel • Transmit/Receive capability on 44 channels with 11 crystals.



TR-7400A

KENWOOD'S EXCITING NEW 2-METER MOBILE TRANSCEIVER • All solid state • Synthesized phase lock loop (PLL) • Power output: 25 or 10 watts (high or low selectable) • 6 digit LED frequency dislay • Full coverage 144-148 MHz, 800 channels in 5 KHz steps • 600 KHz repeater offset • Continuous tone-coded squelch (CTCS) for transmit and receive or transmit only with tone elements optional • Tone burst (tone elements optional) • Kenwood dependability and value built in.

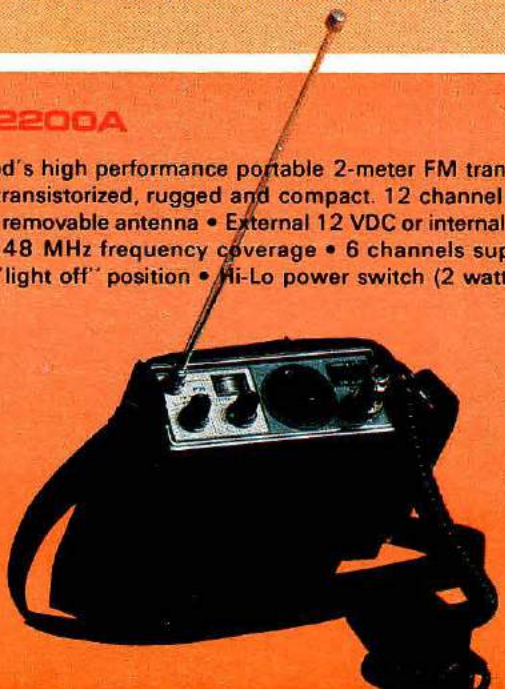
TR-7200A

Kenwood's superb 2-meter FM mobile transceiver. Designed to withstand the most severe punishment while providing consistently excellent performance. Packed with features like the PRIORITY function . . . Put your favorite crystals in channel 7, and the 7200A switches there with the push of a button . . . no matter what channel you are on. 146-148 MHz coverage, 22 channels, 6 supplied. Completely solid state.

The perfect companion to the TR-7200A is the PS-5 AC/DC power supply. Together they provide an efficient and handsome base station. Complete with a digital clock and automatic time control feature built in.

TR-2200A

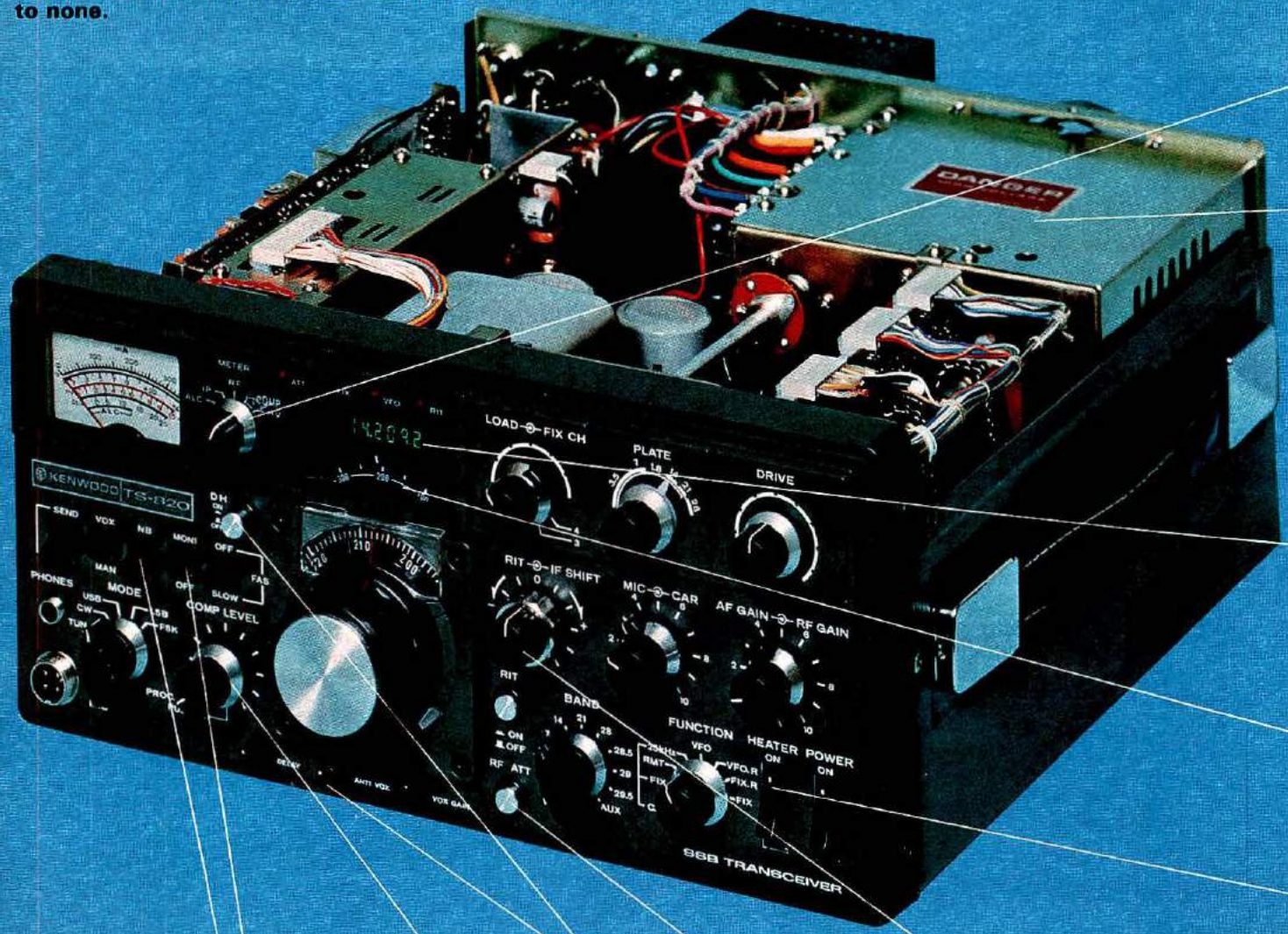
Kenwood's high performance portable 2-meter FM transceiver . . . completely transistorized, rugged and compact. 12 channel capacity • Telescoping removable antenna • External 12 VDC or internal ni-cad batteries • 146-148 MHz frequency coverage • 6 channels supplied • Battery saving "light off" position • Hi-Lo power switch (2 watts-400mW).



KENWOOD'S TS-820 *the Pacesetter*

Kenwood's well deserved reputation for fine craftsmanship and superb performance has never been more evident than in the TS-820. As a result of a host of innovative features being brought together, the 820 offers a degree of versatility, performance and pleasure second to none.

The Kenwood TS-820 is destined to be the world's new standard of excellence in amateur radio for years to come . . . a true "Pacesetter".



VFO-820

The VFO-820 is a solid state remote VFO designed exclusively for use with the Kenwood TS-820 *Pacesetter*. The VFO-820 has its own RIT circuit and control switch. It is fully compatible with the optional digital display in the TS-820. *The perfect extra to any Pacesetter station.*

RF MONITOR • Built-in monitor circuit allows you to hear your own voice by sampling the RF signal. Especially useful for adjusting the RF Processor.

NOISE BLANKER • The TS-820 uses an efficient noise blanker circuit, another Kenwood exclusive. A special crystal filter assures unsurpassed efficiency in eliminating unwanted pulse noises.

DIGITAL HOLD • A single pushbutton switch offers the operator unprecedented versatility. The digital hold circuit will lock the counter and display at any frequency, but will allow the VFO to tune normally. Ever wanted to return to a certain spot on the band and forgotten the frequency? That won't happen again with the new digital hold feature on the Kenwood TS-820.

SPEECH PROCESSOR • An HF circuit provides quick time constant compression using a true RF compressor as opposed to an IF clipper. Amount of compression is adjustable to the desired level by a convenient front panel control.

IF SHIFT • The IF SHIFT control varies the IF passband without changing the receive frequency. This "IF shift" control is located on the front panel and provides excellent unwanted signal reject control or "pass band tuning." The 820 moves the signal across the IF pass band not the pass band across the signal.

RF ATTENUATOR • Easy, one touch activation of the attenuator supplies 20 dB of padding on receive.

VOX • A voice-activated microphone circuit is built into the TS-820 with VOX GAIN, ANTIVOX, and VOX DELAY controls placed on the front panel for convenient adjustment any time.

Features

160 METERS • Full band coverage

PLL • The TS-820 employs the latest phase lock loop circuitry. The single conversion receiver section performance offers superb protection against unwanted cross-modulation. And now, PLL allows the frequency to remain the same when switching sidebands (USB, LSB, CW) and eliminates having to recalibrate each time.

RF NEGATIVE FEEDBACK • The linearity of the TS-820's final amplifier stage is now one of the best on the air. Third order intermodulation products are 35 db or greater below the output signal. RF Negative Feedback from the PA plate circuit to the driver cathode permits a high degree of linearity at the high power level of the final tubes.

FULL METERING • During receive, an easy to read meter functions as an S-meter. The same meter displays ALC level, plate current, RF output, and plate voltage during transmit. Includes COMP setting for adjusting the compression level of the built-in speech processor.

FINAL AMPLIFIER • The TS-820 is completely solid state except for the driver (12BY7A) and the final tubes. Rather than substitute TV sweep tubes as final amplifier tubes in a state of the art amateur transceiver, Kenwood has employed two husky S-2001A (equivalent to 6146B) tubes. These rugged, time-proven tubes are known for their long life and superb linearity. The input power of the TS-820 is conservatively rated at 160 W DC, 200 W PEP. Tubes run cool with the aid of a noiseless fan (standard) mounted on the rear panel. The above tube and power combination minimizes the possibilities of TVI and helps to maintain the Kenwood reputation for excellent audio quality.

DIGITAL READOUT DG-1 • (optional) A digital counter display can be employed as an integral part of the VFO readout system. Counter mixes the carrier, VFO, and first heterodyne frequencies to give *exact* frequency. Figures the frequency down to 10 Hz and digital display reads out to 100 Hz. Both receive and transmit frequencies are displayed in easy to read, Kenwood Blue digits.

DRS DIAL • Includes the same satin-smooth planetary drive found on other fine Kenwood models plus special, high-precision gears to add a new "monoscale" feature for easier frequency readout. LSB, USB, and CW operating frequencies can be accurately read from the same pointer.

HEATER SWITCH • The filaments of the three vacuum tubes may be turned off during periods of "receive only".

CW AUDIO CHARACTERISTICS • During CW reception, a special filter is used to alter the audio frequency response to provide a more comfortable, easy to copy tone.

HIGH STABILITY VFO • The VFO, heart of any SSB transceiver, is an exclusive Kenwood design using FET technology.

Other features include:
- **Built-in 25 kHz calibrator***
- **Built-in speaker***
- **CW Sidetone and semi-break in***
- **Rear panel terminals for linear amplifier, IF OUT, RTTY, and XVTR.**
- **Handy phone patch IN and OUT terminals**

the TS-520

Why wait any longer for a rig that offers top performance, dependability and versatility . . . the TS-520 has proven itself in the shacks of thousands of discriminating amateurs, in field day sites, in DX and contest stations, and in countless mobile installations.

Superb craftsmanship is evident throughout . . . in its engineering concepts as well as its construction and styling . . . craftsmanship that is a Kenwood hallmark.

Maybe the Kenwood TS-520 is the one you have been waiting for.

Fine accessories designed to increase the versatility of your TS-520

SP-520

The SP-520 is an external speaker designed for use with the Kenwood TS-520. The SP-520 can be used in place of the tranceiver's built-in speaker for better readability. The speaker's cabinet matches the TS-520 front panel to provide a clean looking integrated station.

VFO-520

The VFO-520 is a solid state remote VFO designed to match the TS-520 perfectly. It allows VFO controlled cross channel operation when connected to the transceiver. A built-in RIT circuit, with an LED indicator, permits receiver incremental tuning.

TV-502

The TV-502 transverter puts you on 2-meters the easy way. Simply plug it in and you're on the air. Operates in the 144.0-145.7 MHz frequency range with a 145.0-146.0 MHz option. The TV-502 is completely compatible with the TS-520 and the TS-820.

KENWOOD'S "Twins"

Kenwood developed the T-599D transmitter and R-599D receiver for the most discriminating amateur.

The R-599D is the most complete receiver ever offered. It is entirely solid-state, superbly reliable and compact. It covers the full amateur band, 10 through 160 meters, CW, LSB, USB, AM and FM.

The T-599D is solid-state with the exception of only three tubes, has built-in power supply and full metering. It operates CW, LSB, USB and AM and, of course, is a perfect match to the R-599D receiver.

If you have never considered the advantages of operating a receiver/transmitter combination . . . maybe you should. Because of the larger number of controls and dual VFOs the combination offers flexibility impossible to duplicate with a transceiver.

Compare the specs of the R-599D and the T-599D with any other brand. Remember, the R-599D is all solid state (and includes four filters). Your choice will obviously be the Kenwood.

The newest and best in world listening

KENWOOD'S R-300

Dependable operation, superior specifications and excellent features make the R-300 an unexcelled value for the shortwave listener. It offers full band coverage with a frequency range of 170 KHz to 30.0 MHz • Receives AM, SSB and CW • Features large, easy to read drum dials with fast smooth dial action • Band spread is calibrated for the 10 foreign broadcast bands, easily tuned with the use of a built in 500 KHz calibrator • Automatic noise limiter • 3-way power supply system (AC/Batteries/External DC) . . . take it anyplace • Automatically switches to battery power in the event of AC power failure.

HS-4

The Kenwood HS-4 headphone set adds versatility to any Kenwood station. For extended periods of wear, the HS-4 is comfortably padded and is completely adjustable. The frequency response of the HS-4 is tailored specifically for amateur communication use. (300 to 3000 Hz, 8 ohms).

MC-50

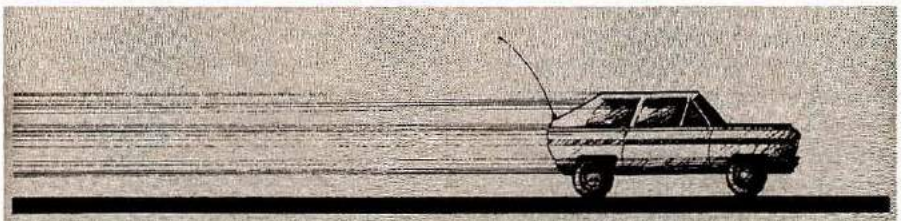
The MC-50 dynamic microphone has been designed expressly for amateur radio operation as a splendid addition to any Kenwood shack. Complete with PTT and LOCK switches, and a microphone plug for instant hook-up to any Kenwood rig. Easily converted to high or low impedance. (600 or 50k ohm).

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

KENWOOD
. . . pacesetter in amateur radio

MECHANICS

insight to electronics



BY NORMAN S. LAND, W4KOM

Sometimes a comparison with something you understand will explain something you don't know

First attempts to learn the fundamentals of electronics are often accompanied by frustration and a growing conviction that supposedly elementary concepts are unreal, vague, and elusive. There is a reason for this feeling: You cannot see, touch, hear, or directly observe an electron and its motion. Nor can your five senses perceive electrostatic and electromagnetic fields, or the behavior of a resistor, inductor, or capacitor; yet it's necessary for you to somehow acquire a "gut feeling" for these concepts because, lacking such an understanding, you can only hope to become a knob twister or appliance operator.

Although you can't directly observe electronic phenomena to help you learn, it is possible to achieve a feeling for them by substituting knowledge you already have. Almost everybody has grown up with an understanding of, and familiarity with, mechanical things — I will try to point out some likenesses between the behavior of mechanical elements and systems and electronic elements and circuits. These behavioral likenesses are called *analogies*. Similar, but not identical, things may be compared, and often better understood, by analogy.

Many of you have seen articles that tried to explain the fundamentals of electronics by using an old, worn out, hydraulics analogy which compared the flow of electrons in a circuit to the flow of fluid in a pipe. This particular comparison fell into disuse because any meaningful relationship between hydraulic principles and the more complicated concepts of inductance, capacitance, resonance, and the like is just not part of your everyday experience.

Mechanical analogues of electrical phenomena have not been used very often in non-professional literature, but are widely used by engineers. In some problems, the use of analogies is almost unavoidable; for example, the measurement of the mechanical impedance of a vibrating structure — often done experimentally. Mechanical analogies are also useful where electrical and mechanical phenomena overlap, such as in a loudspeaker.

Resistance — friction

You have been told or have read that a resistor opposes the flow of electrons in an electrical circuit, right? Now let's make a mechanical comparison, an analogy. Friction or mechanical resistance opposes the motion of a machine. The effect of resistance or friction is always to reduce another quantity — friction reduces the velocity of a machine and resistance reduces current in a circuit (**Fig. 1**). Friction and resistance convert energy into lost heat; the brakes of an automobile get hot and so does a resistor. If you build a fire under either one of them, you cannot restore either speed or voltage! That's why the energy is said to be lost. Sometimes, resistance is useful, as in stopping a car. At other times, resistance (or friction) is very undesirable, and great effort is made to reduce or eliminate it. In cryogenics, the field of low-temperature physics, supercooling is used to reduce electrical resistance in a circuit to an almost undetectable value. In such a circuit, current can be made to flow for long periods of time, without the addition of more current, because of the lack of resistance. Similarly, air or other fluid coolant is used to reduce mechanical friction, as in air bearings, for example.

The flow of electrons, negatively-charged particles of matter, in a circuit is called current. Velocity is distance per unit time, and current is charge per unit time. Therefore, charge and distance are somewhat analogous.

In this discussion, each element is considered to be

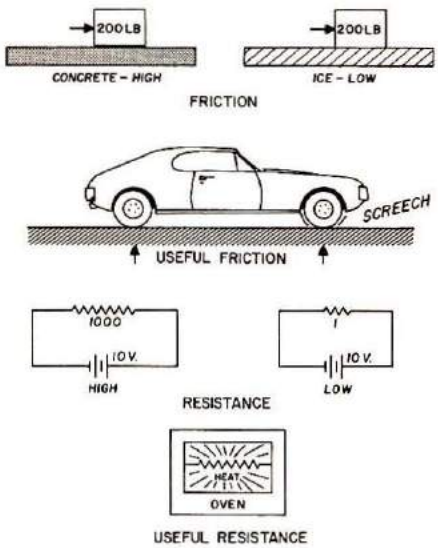


Fig. 1. Starting an object in motion against friction takes work and time. The greater the friction, the more time and effort. If the friction is reduced, as on ice, less effort is required. High resistance requires more voltage to move current through the circuit. If voltage is constant less current will flow. If resistance is reduced, greater current will flow for constant voltage. Friction and resistance can be useful as in brakes on an automobile, or an electrically heated oven. In both cases, the energy put into the system is dissipated as heat.

ideal, to exhibit only one form of behavior. That is an oversimplification of the real world and is not always true under all conditions, but may be justified to make learning easier for you.

Inductance — Inertia

The mechanical analogue of an inductor (coil) is mass. You have had the experience of pulling or pushing a heavy object to set it in motion, and you probably discovered that it takes more effort to get it up to a faster speed in a short time than it does to accelerate it slowly. Likewise, after you get it moving, it takes an effort to stop it again; the faster it moves, the more you have to push it to stop it quickly (**Fig. 2**). This effect is due to the mass of the object and the square of its velocity. The object, once moving, possesses something that you put into it — kinetic energy — the energy of motion, and its quantity depends on how hard you had to push to overcome the object's inertia. The kinetic energy possessed by the moving object is lost to friction as it slows down, or returned as it pushes back against you when you're trying to stop it. You probably noticed that you had to use almost as much energy to stop the motion as you did to start it.

An inductor opposes a changing current in much the same way that a mass opposes a changing velocity. The inductor also contains energy in its electromagnetic field, energy that is initially applied in the form of voltage to build the current to a steady value. You should remember that an ideal inductor does not dissipate, or use up, any energy when voltage is removed and the electromagnetic field collapses because the stored energy is returned to the circuit. You remember that the inductor is analogous to mass and probably have already jumped ahead to the correct conclusion that inductance is analogous to inertia. Mass opposes a changing velocity because of its inertia, and an inductor opposes a changing current because of its inductance. To go further, changing velocity is called acceleration and is analogous to a changing current.

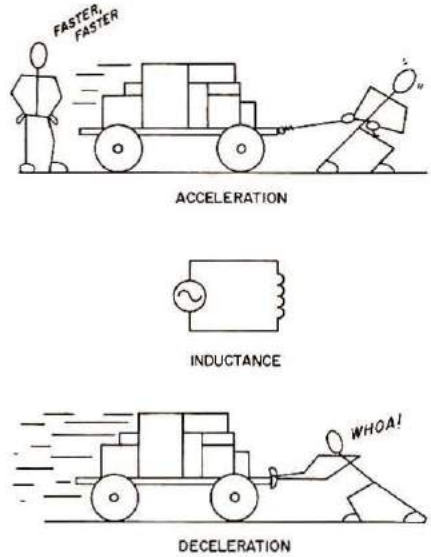


Fig. 2. Accelerating a moving object requires additional work and time, and once up to speed, stopping that object takes almost as much work and time as you put into it in the first place. In an electrical circuit containing an inductor, voltage is applied to the circuit to start the flow of current, but the energy is used to build up an electromagnetic field around the coil, and the flow of current takes time to reach its full value. When voltage is removed and the field collapses, energy initially put into the coil is returned to the circuit, again taking time. In an inductor, voltage *leads* current.

Capacitance — compliance

The mechanical analogue of a capacitor is a spring. A capacitor accepts a charge when voltage is applied to it, and the applied energy is stored by an electrostatic field established between the capacitor plates. A similar situation exists in the behavior of a spring: When a spring is deflected from its rest position, it stores potential energy as strain energy in the stressed material of the spring (**Fig. 3**). Potential energy is energy of position, that is, energy stored while the spring is in a compressed, or static, state. Capacitance may be thought of as the analogue of compliance, or softness (the inverse of stiffness). The main point to remember is that a capacitor and a spring store energy but do not dissipate energy, and that energy storage is brought about by applying voltage to a capacitor or by deflecting a spring. This provides another analogy: Electrical voltage and mechanical force.

These electrical-mechanical analogies give some insight to the invisible behavior of resistors, capacitors, and inductors by inviting comparison with the visible behavior of their mechanical counterparts. Familiarity with combinations of mechanical components leads to an understanding of the behavior of combined electrical components. Electrical tuned circuits may be compared, for example, to mechanical vibrators and isolators.

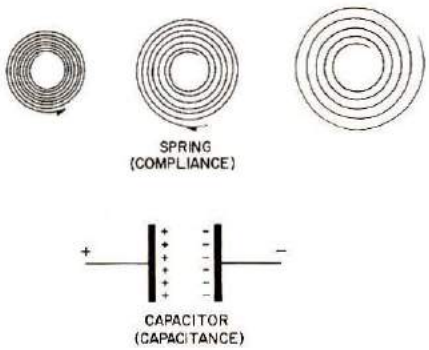


Fig. 3. A torsion spring stores energy as it is bent, which takes work, as in winding a clock. As the spring is released, the energy put into it is released and can do work, such as moving the balance wheel. A relaxed spring contains no energy. In a capacitor, when energy in the form of voltage and current is applied to the circuit, a charge is built up on the capacitor plates. A charged capacitor stores energy in the dielectric material between the plates, in the form of an electrostatic field. When the capacitor discharges, the stored energy is returned to the circuit. Building the charge takes work and time; current builds to full value immediately, but the buildup of charges — hence voltage — takes time. In a capacitor, current *leads* voltage.

Resonance — period

Two common mechanical vibrating systems are the combined balancce wheel and torsion spring of a timepiece, and a child's playground swing. If you have tried pushing a child in a swing at different frequencies, you will remember that there is one frequency that takes very little effort compared to the others. This is the natural frequency of oscillation, or period, of the swing itself. At the bottom of its arc, the swing is moving at maximum speed through its normal position of rest, and all of the energy that you originally put into it by pushing is in the form of kinetic energy — the energy of motion. At the top of the arc, farthest from its normal position of rest, the swing is momentarily stationary and all of the energy is potential energy -- the stored energy of position.

Therefore, during each complete cycle of the swing, its energy changes back and forth from kinetic to potential energy. You will also notice that the kinetic and potential energy reaches a peak twice during every complete cycle of the swing (**Fig. 4**). If left alone, without additional pushes, the swing will naturally move in shorter and shorter arcs (but at the same period or frequency) until it finally comes to rest. To keep the swing going to a constant height on each oscillation, you must give a tiny push at exactly the proper time in each cycle, most conveniently, when the swing is momentarily stopped at the top of its arc. The natural decay of the oscillation without additional pushing is due to friction (resistance) from air drag and bearing friction. Each little push you give the swing to keep it going exactly overcomes the losses due to drag and friction.

A resonant electrical circuit composed of an inductor and a capacitor behaves in an analogous manner. Electrical energy initially put into the circuit surges back and forth (oscillates) between electromagnetic field energy (kinetic energy) and electrostatic field energy (potential energy) at twice the resonant frequency. (Remember how the swing had *two* energy peaks for each full cycle)? The surges, or oscillations, can be observed as voltage or current changes, rising to a peak value and falling to a minimum value twice during each cycle of oscillation. As in the playground swing, energy is dissipated — not by the capacitor or the inductor — but by the resistance present in the system.

A mechanical engineer observes the period, or frequency, of the swing's oscillation and the rate at which it decays, and calls the decay rate a damping factor. An electrical engineer in an inverse manner describes the decay of oscillation in a resonant electrical circuit by

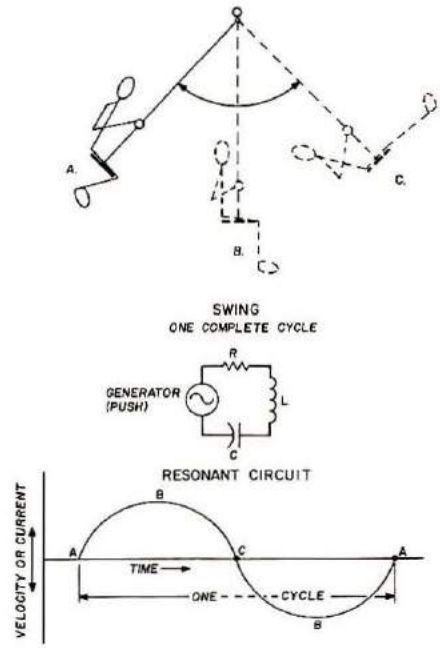
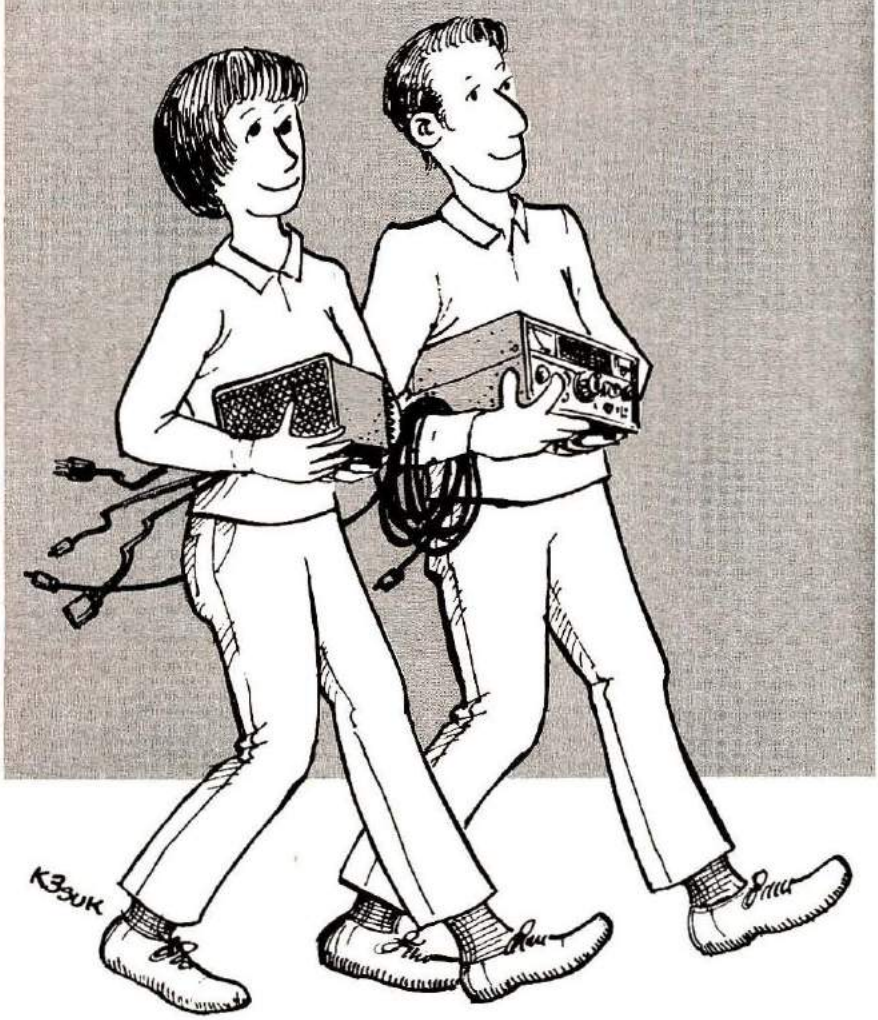


Fig. 4. A child's swing is like an electrical circuit oscillating at its resonant frequency. Energy is put into the system in the form of work required to raise the swing to its starting point at **A**; this is potential energy. At **B**, the swing has reached the bottom of its arc and is moving fastest, and its energy is kinetic — the energy of motion. At **C**, the swing has reached the opposite end of its arc and again is at momentary rest with the stored energy being potential once more. In an analogy, the resonant electrical circuit oscillates through a full cycle, with the contained energy flowing from inductor to capacitor (potential to kinetic) through the circuit, doing work. The resistor represents friction, and in order to keep the swing swinging, or the current flowing, additional work (small push on swing) or power applied to circuit to keep the oscillation going. The lower the friction-resistance, the higher the Q, and the longer the oscillation will keep going without help. The higher the friction-resistance the lower Q and the greater the damping factor; the oscillations stop sooner.

calling it the quality factor, or Q, of the circuit. If the rate of decay of oscillation due to high circuit resistance is high, the Q is low; if the rate of decay of oscillation is low, the Q is high.

At this point, you may want to take a little time to consider these mechanical and electrical devices, and work out some additional analogies for yourself. Soon, you should be able to read farther and with greater confidence into your favorite electronic text. **HRH**

TEN EASY STEPS...



Learning to share ham radio with your wife is more fun — and it's often a necessity

BY JUDITH L. GENEVICZ, WB3AIQ

Not so long ago I wasn't the least bit interested in electronics. I had refused to take high-school physics, and I didn't really care how my TV set made a picture — as long as there was a picture.

Now, I'm an active ham and I love Amateur Radio. I've worked Argentina on 40 meters, I'm active on 2 meters, I work as a public relations assistant for the American Radio Relay League, and I serve on the board of directors of my local Amateur Radio club. How did all this come about? What changed my mind?

My husband, Tony, and I often entertain hams and their wives and I've learned that the wives, for the most part, detest Amateur Radio. They aren't the least bit interested in talking across town — much less around the world — by radio. I've also discovered that these women weren't born with this attitude, and probably didn't learn it from their parents. They learned it from their husbands — the same men who say to me, "I wish *my* wife would become as involved in ham radio with me as you are with Tony."

These hams aren't aware that they are the ones who have turned their wives against the hobby, instead of exciting them into becoming enthusiastic participants. In selling a product or an idea, you put your best foot forward, and — as in life — you begin with the all-important sales pitch. Here are ten easy steps that you can follow to help turn around your wife's attitude toward Amateur Radio. Even if she never becomes a ham, at least she may not hassle you about going out on Field Day next year.

Watch that first step

One of the first, and easiest, steps is to explain to your wife in *simple terms* how your radio equipment works. She may have the same problem I had

and not realize, (as simple as it seems) that a television set is a receiver and needs an antenna to receive a signal being transmitted from a station many miles away. You might start by explaining to her that a television broadcast station transmits to the family TV set in much the same way that you work through a repeater. You could tell her that the family a-m radio is also a receiver, very much like your high-frequency rig. Perhaps you could introduce a little information about the radio frequency spectrum at this point, but don't get too technical at first. Keep ideas simple in the beginning, and use images of other appliances, like the radio and television, that your wife can relate to your ham equipment.

Make certain that you answer any and all questions she may ask . . . simply and directly, without sarcasm. You may not realize that you turned her against Amateur Radio last month when she asked you how *autopatch* works, and you answered that you didn't have time to explain it then, and besides, it was too complicated for her to understand. You might have demonstrated it by calling her on the autopatch system or, better yet, by letting her make a call to one of her friends.

Fred and his wife were going to visit some friends who were CBers. Fred wanted to demonstrate ham radio so he called his friends on the club's autopatch. It was a brilliant idea to let his wife talk to his friend's wife, reinforcing her thinking that the hobby had some real benefits that she could understand and use. When Fred's wife convinced her friend that they were driving down the road while talking on the telephone, the woman was ecstatic. She kept repeating, "Wow! Wow!" Fred took a giant stride that day toward getting his wife interested in ham radio.

Showing off your radio and its capability, which all hams love to do, leads right into step two: Explain the advantages of being an Amateur Radio operator, of being on the air. For me, the biggest attraction was the thought of being able to communicate with Tony, K3RXK, who always carries his hand-held transceiver to work. I have a rig in the kitchen and one in the car so, if I'm in the car, I have the option of calling him on the air — direct — or using the autopatch. We also have crystals for a *simplex* frequency that no one else in town uses, making our two-way radio conversations almost as private as the telephone — and much more convenient.

Another big selling point these days is the advantage of being linked — by repeater — to any location in the area. Suppose you're at work and your wife is driving down a winding road in the family car, taking a shortcut to a friend's house, and gets a flat tire. If she has a transceiver with her, she's not stuck. Chances are that she'll be able to raise someone through the local repeater who can quickly bring help. If not, there's always the autopatch. This type of communications brings a feeling of security, day or night, while you or your wife are driving alone in your car.

This is only one of the many reasons why the Amateur two-meter band has created such a boom in ham radio in recent years. For instance, I was more fired up about being able to talk on two meters than I was to contact Argentina or California (before I had done it, that is).

You may discover that your wife is attracted more than you are to some other aspects of ham radio. For example, I love to operate radio teleprinters (RTTY). Maybe you don't, but she might enjoy that particular aspect of hamming. The point is to let her expand her interests in the hobby in any direction she wants. Ultimately, her interests within Amateur Radio may not be the same as yours, but why should they be?

Variety is spice

For step three, don't insist that your wife love the same things about hamming that you do. Your job is to see that she gets on the air. If she has a fear of Morse code (many would-be hams have, you know), try teaching her the code in a new way. Help her look at it in a new, and different, light.

Many hams tend to say, "Well, yes it's tough, but you can't be a real ham without it." That may be true, and certainly the code has practical uses, but try a different tack. Think about presenting the code in terms of learning a new language. I always did well in languages in school, and as soon as I thought of learning the code as studying a new language, I got fired up about it.

I didn't learn the code through code classes and I don't think a code class is necessarily the easiest route. On the other hand, I don't recommend shoving a code tape at your wife and saying, "Here, learn this and come back when you do." The best way for your wife to learn the code, as well as anything else about the hobby, is from you.

Teach her the letters yourself, one by one. Ask her what a Morse code *R* is when you get home from work. Present the information in small pieces, and she'll be able to digest all the letters quickly. Once she's got the easy letters down pretty well, set up your

high-frequency receiver on W1AW. Then both of you sit down and copy it *together*. Don't make her feel as if it's her own problem, and a big obstacle that she must overcome alone.

The most sure-fire way I know to be certain your wife will copy code is to make some short tapes — not a page from QST, but a short personal message to her from you. You can be sure she'll play that tape one hundred times, letter by letter if she has to, to know what you said to her. Tell her it's a special tape with a special note just for her.

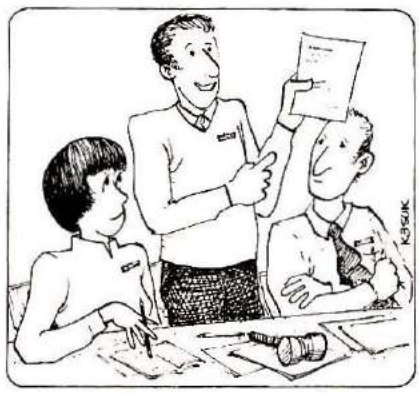
The most vocal opponent to ham radio I know is a woman who even tried to learn the code once. Before she and her ham husband were married, she carried around a slip of paper with the code on it, and sneaked glances at it during work. But it never went any further. I'll bet if her husband had sat down with her and had sent short, personal phrases in Morse Code she would have been more inspired. Try talking back and forth with your wife, for five minutes or so, using a pair of inexpensive code-practice oscillators.

Step four

Use the same approach with theory. For me, the theory was the harder obstacle to overcome. As I said, I never cared much for physics. The only way to plug through theory is to do it *together*. You understand it, so explain it to your wife so that she can understand it. The most important thing to remember at all times is to present it simply, and in terms she can relate to. Also, unless you have reason to know otherwise, don't take it for granted that your spouse even understands the difference between dc and ac current. If you explain things so she can understand the concept, and give it to her in small gulps of information, she'll come out ahead in the long run. Her interest will not be sustained if you hand her a question-and-answer book and say, "Here, learn the answer to these 25 questions."

The fifth step

Take your wife to hamfests with you. I had a blast in Dayton, Ohio, at the hamvention. That's where I got excited enough to move up from my Novice Class license. Every ham or would-be ham needs invigorating experiences



to keep pushing him along. I liked looking at the new gear which was available, wandering around the flea market by myself, and buying name tags with a *B* to replace the *N* in my call. Almost any hamfest has more than just ham gear. Many planners expect women and some have even set up displays that appeal directly to women.

At a big hamfest, like Dayton, there are demonstrations to watch and forums to attend. I like to keep up on what the FCC is doing, and I reported on that forum for my club's newsletter when I got home.

Maybe taking your wife along is one step too far for you, but try it out on the smaller local hamfests.

Step six

Take your wife along to a couple of club meetings. At first, pick out one where you know you're going to be having an interesting program that she might like. For one meeting our local club had a tour of the Pennsylvania State University's meteorology department. It didn't have a direct connection with ham radio, but the meeting was interesting and I enjoyed it. I was the only woman there, and I'll bet that many of the guy's wives would have found the tour interesting. You could persuade several members to bring their wives to a similar meeting. By the way, it takes time to overcome a feeling of self-consciousness when you're the only woman in the room.

You might interest your wife in certain aspects of running your local radio club. I recently was elected to a position on the nine-man board of directors of my club. It was very gratifying to realize that the men respect my opinions about ham radio enough to make me instrumental in running the organization.

I help publish the club's newsletter, and I'm sure that there are many similar services your wife could offer to your club besides being stuck with making the coffee and cooking the food on Field Day.

Step seven

This one is very important: Treat your wife as a ham, not as a woman who tagged along. Teach her the proper operating procedures on the air and, if she understands her radio theory, the rest of the guys will follow suit and treat her as a member of the ham fraternity. There's nothing wrong with being treated as a ham — I much prefer it. I consider myself "one of the guys" and expect to be treated as one.

Step eight

Mutually decide what equipment purchases you want to make. Even if your wife never becomes a ham, this step will make it easier for you to have the kind of shack you want.

Whenever Frank bought a new piece of gear, Cheryl

would retaliate and spend exactly the same amount of money on new things for herself. Often, she didn't even want what she bought, but felt cheated if she didn't get something for herself.

Show your wife the equipment you want for your shack, either in a magazine or — better yet, — if one of your buddies has the equipment, have him bring it over to the house so she can see it. If she sees that you're excited about having it, she'll want you to have it.

Let's say you buy an 11-element beam. In a few weeks, when you've made an exciting contact that you couldn't have made without the beam, rush in and show her how excited you are and thank her for buying you the beam. There are a hundred ways like that to make your wife have a good feeling about your hobby.

Cheryl has since become a ham. Now she and Frank together decide what equipment they want to purchase, and share the satisfaction of making a joint purchase — something for both of them to use. Cheryl no longer complains about the amount of money Frank spends on ham radio because she wants only the best equipment for her own operating.

Step nine

Don't pressure your wife too strongly into becoming a ham. Don't rush her. If you slowly, but surely, work to turn her negative attitude about Amateur Radio into a positive one, she may begin to ask you more and more questions about the hobby. Introduce it to her in small amounts, and don't press too hard, or your zeal may turn her off.

Last but not least

Step ten is to encourage your wife's own hobbies. I happen to enjoy sewing and making my own clothes as much as operating a radio station. It's something that I do alone, separate from Tony. If he's on the air and I don't have anything to do, then I'm going to feel left out and resent ham radio. But, if I spend an equal amount of time sewing a new outfit, then I don't resent his time on the air.

If your wife is the type of woman who needs your constant attention when you're home from work, then you ought to help her develop her own hobby. If you're lucky, maybe it will be ham radio. Either way, help her become involved in a hobby.

Every woman I've talked to who is against ham radio voices the same theme throughout her complaints: Her husband spends more time talking to strangers on the air than he does talking to her. If you try to involve your wife in your hobby, even a little bit, by explaining what you're doing and how your equipment works, then she'll feel a part of it and won't continue to resent it.

Finally, on the off chance that you really don't want to spend more time with your wife, and you use ham radio as an escape, you can use most of these same steps to get her off your back. If she sees a reason and a need for Amateur Radio as a public service, and for the promotion of international good will, it's going to be a lot easier for you to go to Dayton next year and stay at Field Day all weekend. **HRH**

Like to have some material to help your wife, girl friend, or relative start in ham radio? Our bookstore has a wealth of books, code-practice tapes and oscillators, and study guides for any class of license. To get the package, which includes *ham radio's* Communications Bookstore catalog, write "I want to become a ham," *Ham Radio Horizons*, Greenville, New Hampshire 03048.

Let Standard help you obtain your Technician Class Ham Ticket.

It's not as hard as you think. With Standard's exciting new package you can be ready before you know it. This is a program designed to assist CB'ers and other non-amateurs to get that all important first ticket. It has a retail value of $398.45 and sells for under $300.00.

Sound great? It is, and the Standard package has everything you need. The radio is a Horizon 2, a commercial quality 2 meter VHF-FM Transceiver, permitting you to listen while you learn, and configured for three popular channels, plus crystal coupons for an additional three sets of crystals of your choice. You'll also get with this package a wall mounted A.C. power supply and a back-of-set antenna suitable for listening only.

In addition you will receive a license training kit consisting of the following material: Code key/oscillator, ARRL Radio Amateur's License Manual AMECO Code Training Course, and a coupon for a 50% discount on the cost of a year's subscription to Ham Radio Horizons magazine.

Now you know what it takes to pass the FCC Technician Class amateur radio license examination: some time, some effort, and a little help from your friends . . . at Standard.

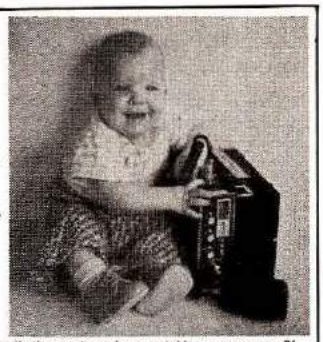
See your local Standard CB or Amateur Dealer for complete information or write:

Standard
Communications Corp.
P.O. Box 92151
Los Angeles, Ca. 90009

NOW!

OUR NEW UNIVERSAL PORTA-PAK

MAKES ALMOST ANY FM OR AM RADIO PORTABLE



This little guy thinks that the new Universal Porta-Pak is really the way to go for a portable power source. Of course he can't express himself in words, so you will just have to take my word for it. David is another of our more recent and great new products. He is probably one of our better efforts. David is just 13 weeks old and pre-occupied with the more important things like eating and sleeping...so, my interpretation of his thoughts may not be altogether correct.

The Universal Porta-Pak is designed to fit anything from a 5-watt CB to a 25-watt commercial 2-way radio. The Universal Porta-Pak comes in two versions, one is a 4.5 AMP HR unit that will recharge in 13 to 16 hours, and the other is a 9 AMP HR unit that recharges in 28 to 30 hours.

The Universal Porta-Pak comes complete with a heli-arc welded aluminum case, a gel-cell battery and a plug in charger. The Porta-Pak case is finished in a black wrinkle and baked to insure durability. Our new Universal Porta-Pak can be attached in several ways, depending upon the type of service to which it will be put. For intermittant or temporary portable service, elastic bands are provided. For more permanent duty as a portable, pop rivets or a slide mount may be used.

Our very popular custom models are still available for those of you who have the following radios: Regency BTH BTL, HR2, HR6, Microcom, Aquaphone, MT25 or MT15, Genave Business Amateur and Marine, ICOM 230, 22, 22S, 30A, Midland 13-500 and 13-509, Heathkit HW202 and HW2036, and Standard SR-C806, SR-C826MA.

Porta-Pak started out as a very versatile accessory for the amateur, but, now the word is out and as a result 85% of our sales are now to the business radio services. Among enthusiastic users of the Porta-Pak are the C.A.P., ambulance services, fire departments, Red Cross disaster teams, towing services and private surveilance organizations. The Porta-Pak and VHF Marine radio have provided small craft with reliable communications where it was impractical a short time ago.

Be sure to state the make and model of your transceiver when ordering, and a custom model will be provided if one is made for it. The regular mobile mount holes are used to attach the custom models. No modification of your radio is necessary.

4.5 AMP HR Deluxe Porta-Pak, Universal or Custom Case $67.50 plus $1.75 shipping

9 AMP HR Super Porta-Pak, Universal or Custom Case $88.00 plus $2.75 shipping

All Porta-Pak units include: Gel-Cell Battery, Charger and Case.

Rubber Duckie Type Antennas $7.00. L.E.D. Battery Condition Indicators $5.00.

PORTA-PAK, INC. P.O.BOX 67
SOMERS, WI. 53171

THE HAM-KEY

$16.95 delivered

Model HK-3

- Deluxe straight Key
- Velvet smooth action
- Heavy base with non-slip rubber feet.
- No need to attach to desk

FOR NEW & USED AMATEUR RADIO EQUIPMENT

CALL TOLL FREE

800-325-3636

HAM RADIO CENTER INC.
8342 Olive Blvd., P. O. Box 28271
St. Louis, MO 63132

More details? Ad Check page 78.

POWER paranoia

BY D. E. LOGAN, W1HEO

"Aaaaarrrrgggghhh!" A savage scream of frustration burst into the normally library-like calm of the psychiatrist's office, its fourth harmonic crashing into the glass door and leaving a jagged crack in its wake. A frazzled, twitching figure careened into the office, spun near the tropical-fish tank and miraculously landed safely in an overstuffed chair.

"Do you have an appointment, sir?" cooed the prim nurse at the reception desk, looking over her glasses at the quivering mass of jangled nerves. He was a pathetic picture: Flushed face, grinding teeth, and spinning eyeballs, with a pair of earphones swinging erratically around his neck.

"No, I don't," snapped the intruder, "but if I don't get to see the doctor super quick, I may become violent. I may cut coax, chop down a tower or . . . " His voice trailed off into a sob, his eyeballs spinning Las Vegas style.

"Dear me, we mustn't do that, must we?" The nurse pressed a hidden button to alert the doctor. "Fortunately Doctor Know has a cancellation. An FCC monitor who ran off with an illegal equipment seizure, I think it was. Certainly the doctor can break away from his research into stock market fluctuations as a function of the sunspot cycle."

The nurse rose behind the desk. "Before I take you in to the doctor, may I have your name and would you tell me if you've been here before?"

"Just tell him the amateur is here . . . and this is my first time."

"My goodness, sir, you don't have to call yourself an amateur simply because this is your first visit. Even Doctor Know has told me privately that even he feels like a beginner at times."

"Look nurse, I'm an amateur radio operator. Now will you let me see the Dooc?"

She quickly took his hand and led him down the hall and into the cool, quiet interior of the psychiatrist's office. Behind a desk stood a tall, bearded figure in a rumpled suit puffing busily on a meerschaum. The doctor was a dead ringer for Mel Brooks.

"I'm Doctor Know," he gushed warmly in a voice barely louder than S3." Please sit down, or if you wish to assume the classic reclining position, use the waterbed."

The amateur glanced around, spotting the waterbed covered in simulated leopard skin. He nervously took a seat. "Thanks," he sighed through clenched teeth.

The Doc leaned over and removed the earphones from the amateur's neck and pried loose a vfo knob still clutched tightly in the ham's fist.

"Now, suppose you tell me the nature of your problem," said the psychiatrist, relighting his pipe.

"*My* problem!" snapped the amateur, his eyes glazing and his body shaking violently. "Who said that *I've* got a problem?"

"An unfortunate choice of words, sir," said Dr. Know quickly. "Please calm yourself." He flipped a hidden tape recorder switch and disappeared behind a cloud of smoke. "Now then, please tell me in your own words the source of your frustration."

The ham paused to compose himself, took a deep breath, and began: "Well, Doc, I've been a licensed ham for about six months now. I like to ragchew — or chat leisurely — with stations around the world. Call it my person-to-person campaign or cultural exchange program if you will, but the point is I appreciate the chance to really *communicate* something besides a

description of the kind of radio equipment I'm using."

"A most noble undertaking and certainly the basis of a meaningful relationship," commented the Doc, listening intently.

"So anyway, I was on the air one evening talking with a nice guy in Katmandu, Nepal, about some really fascinating things. He was telling me about the evolution of 15th-century tempera painting and I was explaining about the linebacker blitz."

The psychiatrist's eyes lit up. "I've always been intrigued by the linebacker blitz!"

"So was he, Doc. Anyway, after about a half-hour of perfect copy a big signal jumps on frequency and this loudmouth starts shouting 'Break, Break' while my friend in Nepal is still talking."

"Certainly rude behavior."

"That was only the beginning. The Nepal station wasn't interested in having our conversation interrupted, so he asks the loudmouth to please stand by."

"And did he?"

"Not a chance. It was like he didn't own a receiver. The turkey keeps shouting and cranking up his power and makes our QSO a wipe-out. My friend in Nepal is losing his cool, but still asks this guy in a nice way if he will please wait until we've finished our chat. The breaker shouts something about Nepal being a new DX country and the band going out and refuses to move off our frequency."

"A compulsive interloper, it appears."

"It's also against FCC rules to cause malicious interference, Doc. He must've won his ham ticket in a raffle. By now his shouting has drawn a crowd of curious DXers and there must be a hundred stations all shouting at once. Most of them didn't know who they were calling."

"Certainly sufficient to strain the bonds on international understanding and Nepalese tranquility."

"Well, that was it, Doc. My friend in Nepal apologizes to me about not being able to hear too well and excuses himself. He pulls the switch and that's it. The crowd was hollering for at least a half-hour, with the loudmouth leading the cheering."

"Hmmmm." The pyschiatrist stroked his beard in thought. "Let me see if I have it straight? First, the interruption was the result of a strong ego drive manifested in extreme anti-social behavior. Second,

severe frustration resulted for the participants in an unusually rewarding experience in cross-cultural communication. Third, you became personally frustrated."

"If you mean was I burned up, you bet your autographed picture of Marcus Welby I was!"

"And is this a recurrent phenomenon?"

"Is it ever! I hooked up with Nepal again a few days later. This time, he told me about preparing roast yak and I describe zone defense."

"Ah, roast yak!" The psychiatrist smiled, rolling his eyes toward the ceiling. "A most delicate dish when garnished with bamboo shoots."

"It was a fine chat while it lasted, but before long this loudmouth breaks in again and he must be running several gallons."

"I beg your pardon. Gallons?"

"A gallon is 1000 watts of power. He was so strong his signal splattered all over the band. My friend in Nepal only runs 50 watts, so you know how his signal was covered up. He was buried alive!"

"Quite antisocial!"

"This has happened again and again, Doc." The amateur's face was red, his temples throbbing and his hands gripped the arms of his chair. "'Every time it's this birdbrain butting into my conversations with DX stations. His zillion watts must wipe out TV sets in three counties and look at the swell reputation our country gets with hams overseas from this jerk! I tell you, Doc, this guy's not playing with a full deck!"

"Now, now. We must be tolerant of those with behavioral disorders."

The ham jumped to his feet. "*We* must be tolerant? Come on! Who's operating legally? Who's minding his own business? Which of us is using amateur radio to enhance international understanding?" He paced back and forth and then regained his composure, slumping back into his chair.

"You mentioned DX and rare country status. The motivation behind this boor's interruption of your chat must have something to do with his standing in some kind of Amateur Radio ranking."

"Right. Loudmouth is a high-ranking member of the DX Pros Club. They collect contacts with new countries like dogs collect fleas."

"Ah, yes. His ego massage bruised others and therefore is disruptive behavior. He must be retrained to learn that his actions are not socially-acceptable."

The amateur groaned. "The local hams have tried to reason with him. They called on him and pleaded with his XYL — sorry, his wife — but she's powerless to do anything either. She told the guys that her husband has hidden his high-power linear in a stuffed moose in the attic and when he

keys his transmitter the street lights dim for two blocks!"

"Clearly he must be in violation of the law. Can the authorities . . ."

"Not a chance, Doc. He's not too bright, but on the other hand he's not dumb enough to get busted by the Friendly Candy Company, either."

"The Friendly Candy Company?"

"That's the FCC — Federal Communications Commission. They have staff and budget shortages like everybody else, so not much is going to happen there."

"The answer must be in some type of corrective therapy. Behavior modification?"

"Cutting his coax or chopping his linear to bits would work in my opinion!" The ham's eyes lit up. "How about a *real* shock treatment?"

"How barbaric!" The psychiatrist looked sternly at the amateur. "You must not lower yourself to his level. Soon, you'll all regress to the caves."

"The temptation's very great, Doc, and jungle warfare may be the only thing left."

The doctor rose, a slight twinkle appearing in his eyes, and paced the floor for several minutes. Trailing clouds of blue smoke and stopping only long enough to consult dark, musty volumes from his bookshelves, he appeared to grow more excited by the minute.

"Tell me," said Dr. Know after several more minutes had gone by, "do you know the name of this interfering operator?"

"I sure do."

"Then please write it down on this piece of paper and leave it on my desk."

The ham was puzzled. "Sure thing, Doc, but what does this have to do with the problem? If you try to talk with him, he's not going to be any more reasonable than before."

The psychiatrist smiled. "Let me simply say that while we won't descend to the jungle in the physical sense, we may well do so intellectually."

The ham remained perplexed. He took a piece of paper from the Doc and wrote the offending operator's name and call letters.

"Thank you. My time is up for now, but let me assure you that a solution is at hand. Leave your address with my nurse, and I'll bill you only if we achieve satisfactory results."

They shook hands and the amateur left the office. Somehow, talking it all out made him feel better, but he had no idea what the doctor planned to do to help him.

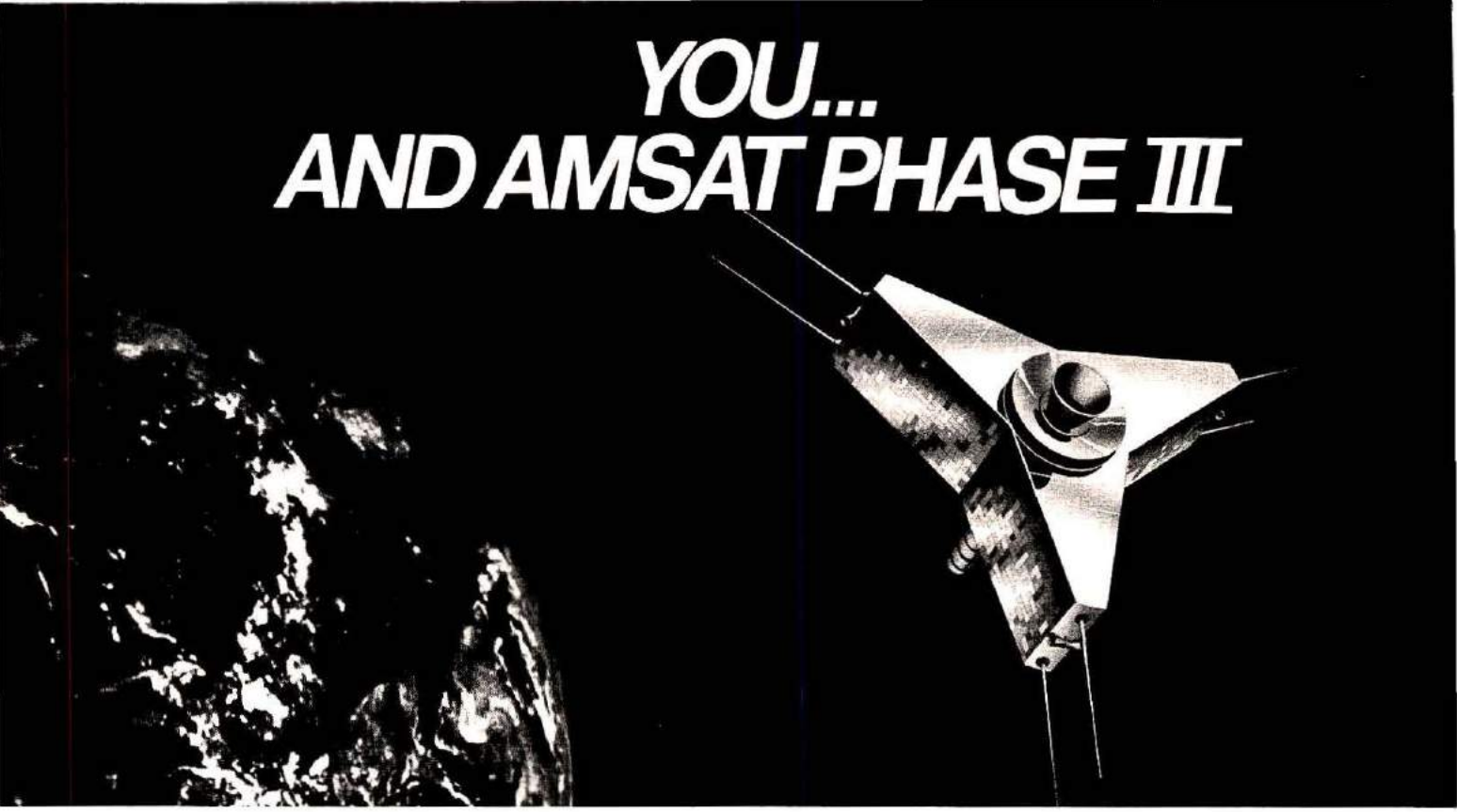
The next time the ham was on the air with Nepal discussing a recipe for Peking duck and the quarterback rollout option pass, he kept expecting to hear the superpower loudmouth breaking in, but nothing happened! It was a beautiful contact. After an hour, they signed 73 and ended their first perfect contact in months. There had been no breakers, no super-power stations yelling at them, nothing. The silence was wonderful — and eerie.

Over the next several weeks the amateur enjoyed many chats with DX stations. He discussed clarets with a French winemaker, Moog synthesizers with a rock music fan in Taiwan, and the lesser-known paintings of Monet with a fine operator in Micronesia. Never once was he bothered by a breaker. It was heavenly ham radio!

One afternoon the ham was driving by the loudmouth's address and glanced over as he went by. He was shocked to see a vacant, weed infested lot, and it looked like the lot had always been that way. He was puzzled, but decided not to mention it to anyone.

At last he heard from Dr. Know. In his mail was a postcard from a small Caribbean island. Scribbled on the back was this notation, "For professional Services, no charge; one voodoo doll, $9.75." **HRH**

YOU... AND AMSAT PHASE III



An exciting new era in amateur radio is about to begin... the era of AMSAT PHASE III OSCAR satellites.

Many of you are familiar with the benefits of the AMSAT OSCAR satellites, notably OSCAR 6 and 7. These satellites, with a combined total of over 8 years in orbit, have provided communications between amateurs throughout the world. They have also provided a capability for an educational program in space sciences and many interesting experiments.

AMSAT, with members and contributing groups worldwide, and headquarters in Washington, D.C., has been responsible for our current satellite program. Many people feel that perhaps the greatest value of the amateur satellite program is the dramatic demonstration of amateur resourcefulness and technical capability to radio spectrum policy makers around the world.

The value of this aspect of amateur radio as we prepare for the 1979 World Administrative Radio Conference (WARC) is enormous.

The AMSAT PHASE III satellite program promises a continuing demonstration that amateur radio is at the forefront of modern technology. PHASE III satellites will routinely provide reliable communications over paths of up to 11,000 miles (17,600 km) for 17 hours each day. You can think of them as a resource equivalent to a new band.

The cost of these PHASE III satellites is a projected $250,000. Commercial satellites of similar performance would cost nearly $10,000,000.

Your help is needed to put these PHASE III OSCAR satellites in orbit.

Your valued, tax-deductible contribution can be as small as one of the 5000+ solar cells needed. A handsome certificate will acknowledge the numbered cells you sponsor for $10 each. Larger components of the satellites may also be sponsored with contribution acknowledgements ranging to a plaque carrying your name aboard the satellites. Call or write us for the opportunities available.

Your membership in AMSAT is important to the satellite program, and will give AMSAT a stronger voice in regulatory matters concerned with satellites. At $10 per year or $100 for life, you will be making a most significant contribution to the satellite program and the future of amateur radio. You will also receive the quarterly AMSAT newsletter.

Clip the AMSAT PHASE III coupon below and send your support today, or call 202-488-8649 and charge your contribution to your BankAmericard (VISA) or Master Charge card.

HRH

AMSAT PHASE III
Radio Amateur Satellite Corporation
Box 27, Washington, D.C. 20044
202-488-8649

YES, I want to support AMSAT PHASE III OSCAR satellites. Enclosed is:

☐ $_____ *in sponsorship of* ____ *solar cells (@ $10 each)*
☐ *$10 Annual membership* ☐ *$100 Life membership*
☐ *Send information on sponsoring larger satellite components.*

Name *Call* *AMSAT Member?*

Street

City *State* *Zip*

The publisher has donated this space to AMSAT in support of AMSAT and the PHASE III program.

ME-3 microminiature tone encoder

Compatible with all sub-audible tone systems such as: Private Line, Channel Guard, Quiet Channel, etc.

- Powered by 6-16vdc, unregulated
- Microminiature in size to fit inside all mobile units and most portable units
- Field replaceable, plug-in, frequency determining elements
- Excellent frequency accuracy and temperature stability
- Output level adjustment potentiometer
- Low distortion sinewave output
- Available in all EIA tone frequencies, 67.0 Hz-203.5 Hz
- Complete immunity to RF
- Reverse polarity protection built-in

$29.95 each

Wired and tested, complete with K-1 element

communications specialists

P. O. BOX 153
BREA, CALIFORNIA 92621
(714) 998-3021

K-1 FIELD REPLACEABLE, PLUG-IN, FREQUENCY DETERMINING ELEMENTS
$3.00 each

THE FAR HORIZON

Dawn Patrol

BY BOB LOCHER, W9KNI

The alarm goes off at 5:55. I lie in bed for a few minutes, listening to the closing strains of Beethoven's First, then the Six o'clock news. As it finishes, my wife firmly plants her foot in the middle of my spine and shoves. I decide to get up.

After donning bathrobe and slippers, I go down to the kitchen, put the coffee on, and go down to the shack. I turn on the gear, turn the antenna into the northwest, and go back to the kitchen. The coffee is ready in a couple minutes, and I go back to the shack, with a large mug in hand.

I pull on the headphones, and begin tuning. The sky is slowly lighting up through the basement window, and with it signals start coming in on twenty meters. I begin searching.

The quarry this morning is Cocos-Keeling Islands, VK9Y. Last night, while casually tuning, I got a call from Darryl, WB8EUN over in Michigan.

"Bob, this is Darryl. Do you need Cocos-Keeling?"

"Yes, sure do."

"Okay, VK6KC portable 9 was on this morning. 14025. He's only going to be there two more days."

"Rog. VK6KC slash 9. What time?"

"He was S5 here at 1130 Zulu."

"Okay, I'll be there. Thanks."

"Good luck."

Those one-minute long-distance phone rates are great. Darryl and I are buddies from several Dayton hamfests, and last year we exchanged need lists. I helped him snag Geyser Reef about six months ago, and he has more than paid his share by helping me to a couple of goodies.

I tune the receiver to around 14025 kHz and have a look around. Nothing much yet. A couple of strong Japanese stations, one HM in Korea; no pileups. I begin to tune the band in earnest. The first half hour of a good band opening is always exciting. In a matter of a few minutes, the band can go from nearly dead to wide open, with the expected DX stations, and sometimes DX stations unexpected. The trouble is, you don't know whether the opening is going to be good or not. But that's a part of the fun.

I move the receiver up to the

phone band. A few stations are working Europeans on phone — the early morning opening to Northern Europe is very reliable this time of year, but brief. The Europeans are very weak in my receiver, because they are virtually in the null off the side of my antenna.

Ha! There's VK6RT, in Perth, Western Australia. Nice signals. So . . .? But it indicates the band is opening nicely — we'll have a shot at that Cocos-Keeling station if he shows. Sure hope so. Seems like it's been a while since I snagged a new one. A bit early for him according to Darryl's report, but it's always wise to be up a bit ahead of time — you get the cobwebs swept out, and at the same time get a feel for the band.

My conscience jogged, I zip the receiver back down to 14025, and start tuning again. A quick look around reveals no pressing developments. I flip the antenna switch to the dummy load, and key the exciter. The rf-meter shows that all is well, and I flip back to the quad — always good to be sure that the gun is loaded.

My coffee cup is drained — I rush upstairs and get a refill.

It's almost 1130 Zulu. I begin to watch very carefully. There are a number of JAs in evidence now, nice solid signals, with virtually no flutter or fading. There — there's a carrier that sounds different, somebody tuning up. Definitely some flutter on him, and a characteristic watery sound, caused by minute Doppler shifts of frequency, due to multi-path effects of a band just opening.

I quickly bring the VFO up and zero him — probably not the Cocos-Keeling station, but the time and frequency are right, and you never know. Then:

CQ CQ CQ DX DE VK6KC/9 VK6KC/9 VK6KC/9 CQ DX CQ DX CQ DX CQ DX CQ DX . . .

Oh no! There he is, but with that long call, he's going to attract callers in hundred lots.

CQ DX DE VK6KC/9 AR K

I pause a moment. A mob starts calling him, most of them not too strong. They must mostly be Japanese DXers — and they've got the propagation edge.

But, what the heck, nothing ventured, nothing gained. I pull the VFO down about 400 hertz to avoid the worst part of the pileup. It looks clearer there. About four seconds have passed since he signed. I call —

VK6KC/9 DE W9KNI W9KNI W9KNI AR

I listen.

JA1EMX DE VK6KC/9 . . .

Huh, Masa got him. Not surprising, Masa is one of the finest of a substantial crew of red hot Japanese DXers. "Hey, Butch. These guys are very very good."

I continue listening. Its pretty obvious that while those JA's have good propagation my chances of getting through are very slim. But in the meantime I have a great chance to study the VK6's operating habits. When my turn comes, I'll be ready. He's working stations fast — just a call and a signal report. That will help.

Now, He's working JA7SSB. He breaks — there's 7SSB. H'm. About one kHz up from the VK6, the JA7 is weak — I'm copying him off the back of his beam. As he sends his 73, JA1KSO drops in a perfect tail-end. I catch the VK6 again . . .

JA7SSB R 73 QRZ VK6KC/9 K

Hmm. KSO's tail-end didn't work. There he goes again:

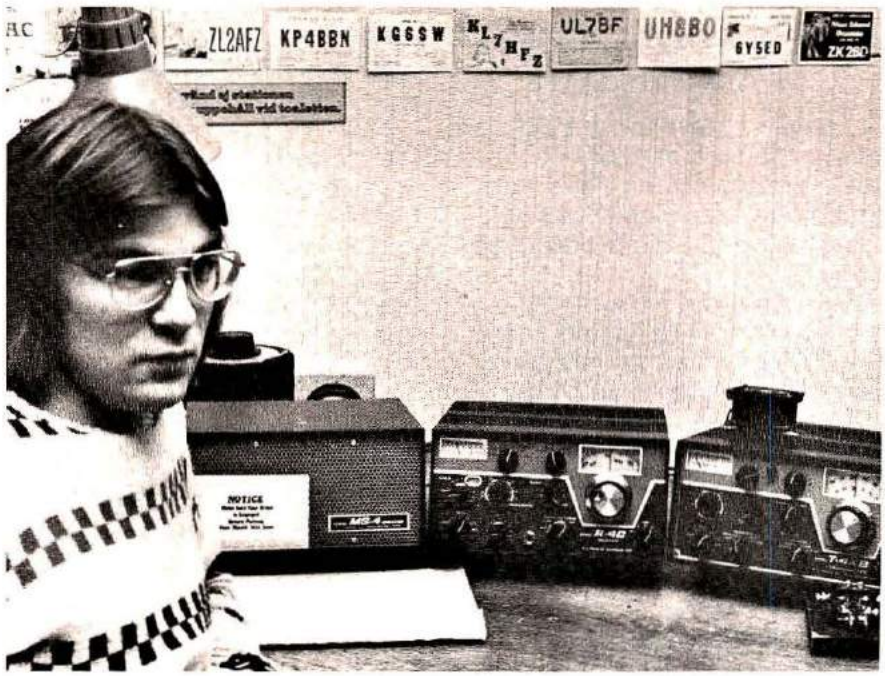
JA8AA DE VK6KC/9 589 589 BK

I find 8AA — he's half a kHz below the VK6, and one and a half below where 7SSB was. I listen . . . 1KSO drops another picture-perfect tail-end. The VK signs clear, then QRZ's again. Guess he ain't buying tail-ends today. Well, that's one trick I won't waste my time on when it's my turn. He comes back again,

KG6JAR DE . . .

Huh? Joe got him. Joe should have a better signal — he runs a KW to a 14AVQ ground plane. I look — yes, there he is, 589. No problem listening to the backside of a

Venkat, VU2KV, (standing) and Bob, K0HUD, enjoy a visit. In that array of Heath equipment you can find SB-401, SB-200, and enough monitor scopes to watch several modes at once (*photo courtesy K0HUD*).



SM2EKM and his neat Drake-equipped station. Cards from New Zealand, Puerto Rico, Guam, Alaska, Kazakh, Turkoman, Jamaica, and Niue Island make interesting wallpaper.

ground plane. Hmm. He's up about 2 kHz from 8AA's frequency. Is that VK6 playing roulette with his receiver? He clears with Joe, then picks up JH1KSB. I find KSB. He's *below* the VK's frequency!

Aha! Maybe there *is* a pattern to this after all. Could he be working the old high/low trick? Work a guy on the high side of the pile-up, then switch to the low edge of the pile-up. It's a good technique for a rare DX station. It keeps the pile-up in reasonable shape, makes copy easier, and gets the more proficient DXers through in fairly short order. Let's see if it holds water.

He clears with KSB. I listen . . .

JA1KSO DE VK6KC/9 . . .

Okay, Nob, KSO got him. Lemmeseehere. If I'm right, 1KSO will be about 1 kHz above the VK frequency. The VK turns it over — I look for KSO. Yup, there he is, a little more than 1 kHz, higher than the VK. Hey, I'm going to try to play this game. I spin my VFO down, about one kHz below the VK. He clears with 1KSO and I call . . .

He comes back to a VK!

VK4FC DE VK6KC/9 BT JOE HW GOES BT WX HR IS . . .

Oh no! He's found a crony. Sounds like he's setting up for a nice long ragchew. This may take a while. Hope the band holds open. After a nice long transmission, the VK6 turns it back to his friend. I look carefully. Yes, there he is, very weak, and almost dead on the frequency I made my call on. Well, at least I think I know what to do now, if I get another chance at him. Might as well move the VFO to the high side now, and be ready.

They chat about fifteen minutes, while I fidget. Will the path hold? Finally, they sign clear, and you can kind of sense a sigh of relief in shacks all over the Pacific basin. Then:

QRZ W QRZ W/K QRZ W?
DE VK6KC/9 AR

I call, but he comes back,

WA8ZDF DE . . .

Ach! Doc got him. I look for Doc — there he is — just a hair above my frequency. Okay, let's drop down below now. I set up about 2 kHz below Doc, and wait. Doc clears with him, as K4YFQ drops a beautiful tail-end.

Huh? That's Austin. Austin is a heck of a nice guy, and a fine operator. But my pride still hurts from the night not so long ago that he nailed VKØAC right over my back. Then the VKØ left the air. I still need VKØ. Maybe I can even up the score a bit here.

The VK6 clears with ZDF, and I call:

VK6KC DE W9KNI W9KNI W9KNI AR

W9KNI DE VK6KC/9 569 569 QSL
VK6KC OK? BK

Son of a gun! I got him.

VK6KC DE W9KNI R TNX NW ONE 569 569 QSL OK BK

R W9KNI 73 QRZ
DE VK6KC/9 K

I listen — I'm still excited, of course. I listen. It's a madhouse on my transmit frequency. Let's see. He should come back to some one about two kHz above my frequency this time. I tune the receiver up there. Oh Oh! There's K4YFQ calling. He signs. I go back to the VK's frequency.

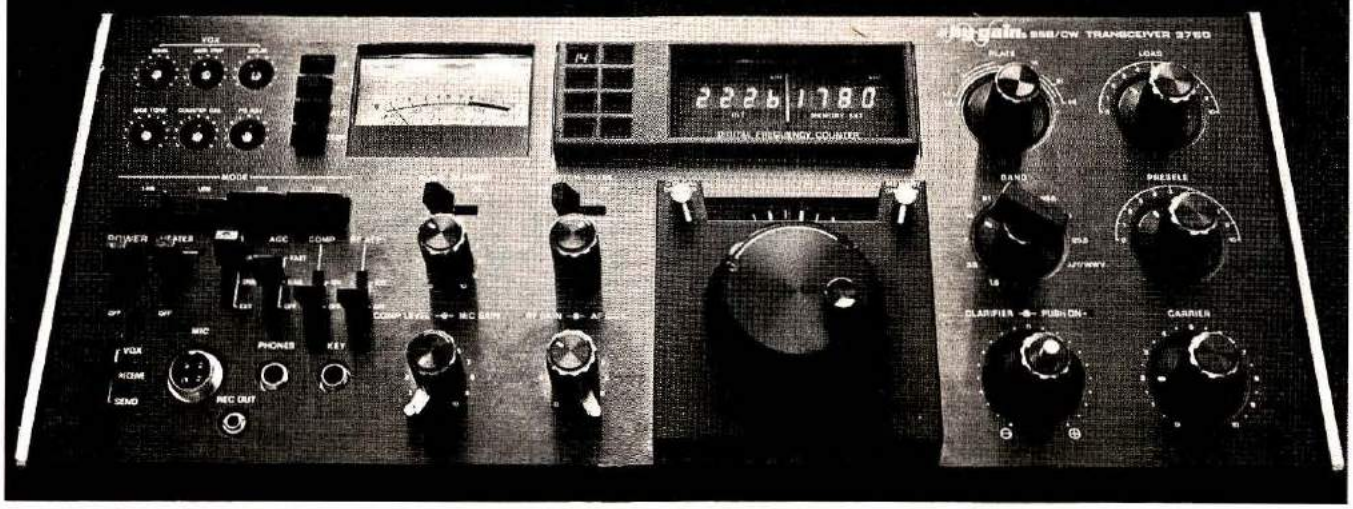
K4YFQ DE VK6KC/9 589 589 . . .

Yup, there's nothing wrong with Austin's operating. Oh well . . . at least I beat him out this time. I'll rib him about it next time I catch him on 75.

So I catch a good one. Careful listening determined the VK's operating pattern, so that when I got a decent shot at him I was ready. Almost any DX station you pursue, be he on ssb or CW, has some operating habits that will help you work him quicker once you understand tyem. Taking the trouble to understand the DX station's operating pattern is what will fatten your country total in a hurry, and separates the men from the boys in DXing.

Even if the band had faded before I could have gotten the QSO, I would have been ready for tomorrow, knowing his usual time, frequency, and operating pattern. I would have

HOW TO ENJOY GLOBAL COMMUNICATIONS WITHOUT A PHONE BILL



There is no other amateur transceiver available in the United States today that can match the quality. The reliability. Or the performance of the Hy-Gain 3750.

It covers all amateur band 1.8-30MHz (160-10 meters) with uncanny accuracy. It has advanced Phase-Lock-Loop circuitry. Dual gate MOS FET's at all critical RF amplifier and mixer stages. Electronic frequency counter with digital readout. Digital memory display. And stability that's truly remarkable by any standards.

The Hy-Gain is simply the finest amateur transceiver you can buy. There is nothing else like it.

Read our specs. Then see your amateur radio dealer or write for complete details on the features and performance of the incomparable 3750.

SPECIFICATIONS

FREQUENCY COVERAGE
1.8 MHz Band 1.8 - 2.0 MHz
3.5 MHz Band 3.5 - 4.0 MHz
7.0 MHz Band 7.0 - 7.5 MHz
14 MHz Band 14.0 - 14.5 MHz
21 MHz Band 21.0 - 21.5 MHz
28 MHz Band A 28.0 - 28.5 MHz
28 MHz Band B 28.5 - 29.0 MHz
28 MHz Band C 29.0 - 29.5 MHz
28 MHz Band D 29.5 - 30.0 MHz
WWV RX only 10.0 MHz
MIC, INPUT IMPEDANCE
50KΩ
AUDIO FREQUENCY CHARACTERISTICS
300 - 2700Hz (-6dB)
SENSITIVITY
SSB less than .25 μv for 10 dB S/N+N ratio
CW less than .15μv for 10 dB S/N+N ratio
MODES OF OPERATION
SSB (LSB or USB)
CW

INPUT POWER
200 W PEP
ANT, IMPEDANCE
50Ω - 75Ω Unbalanced
CARRIER SUPPRESSION
More than 50dB
SIDE BAND SUPPRESSION
More than 50dB
SPURIOUS AND HARMONIC SUPPRESSION
Greater than 40dB
3RD ORDER DISTORTION PRODUCTS SUPPRESSION
Greater than 30dB
IF FREQUENCIES
1st IF 9MHz
2nd IF 50kHz
SELECTIVITY
SSB 2.4kHz (-6dB)
4.0kHz (-66dB)
CW 400Hz (-6dB)
1.8kHz (-66dB)

AUDIO OUTPUT into 8Ω load
2.5W (10% distortion)
3.0W (MAX)
POWER SOURCE
AC 120V 50/60 Hz (can be re-wired for 240V)
POWER DRAIN
400VA TX
78VA RX
48VA RX (Power tube OFF)
SEMI-CONDUCTORS
Transistor 98
(including 23 FET)
IC 43
Diode 120
Tube 3
Digital Ind. 1
WEIGHT
44 lbs. 6 ozs. (23kg)
DIMENSIONS
16¾" x 7" x 13⅝"
(420 x 172 x 340mm)

Matching speaker unit (Hy-Gain 3854) and complete external VFO (Hy-Gain 3855) available at extra cost.

Hy-Gain Electronics Corporation
8601 Northeast Highway Six
Lincoln, NE 68505

Send me information on the incomparable Hy-Gain 3750 amateur transceiver.

NAME CALL

ADDRESS

CITY STATE ZIP

hy-gain®

WE KEEP PEOPLE TALKING.

SEE ALL THE QUALITY HY-GAIN AMATEUR PRODUCTS AT THE AMATEUR RADIO EXPO SEPTEMBER 17-18!

More details? Ad Check page 78.

certainly had a better chance of working him than some fellow who just happened to find his frequency.

One of the first things a DXer learns is that after you've worked a good one, you clear off and start hunting again. This is a lesson usually learned the hard way. Like, having beat upon your chest over a relatively common GD3 that you snatched from the jaws of the ravenous horde, and basking in your glory, listening to the poor stiffs tear each other apart, you then have the fellow six blocks away who runs thirty five watts to a dipole call on the landline and asks if you still need Monaco, 3A2, because he just worked one twenty kHz above the GD3, but the fellow said he was going to QRT. You yank your receiver to the new frequency, and sure enough, you hear the fellow sign clear and leave the air.

The VK6/9 is a good case in point. He has a huge pile-up on him, and propagation must be half way decent, because that's a long shot from here. So, let's go see what we can find.

A slow tune up the band meets with success.

FB8WD FB8WD DE W6PT W6PT AR

Crozet! One of the small French Sub-Antarctic islands, outposts of the South Indian Ocean; the rarest of the three. And, one I need badly. (Anything I need, I need badly. The rest are common!) I listen carefully on 6PT's frequency. Nothing. I tune around a bit. More of same. Must be coming through on a different path. I begin to swing the antenna around to the opposite path, SSE, tuning back and forth across 6PT's frequency as I go. Still nothing. Then:

FB8WD DE W6PT R CHER AMI ANDRE . . .

I quell the rising tide of panic, and think about this situation. Let's see. Short path bearing is about SSE for this fellow, but that path really isn't likely to be open at this time of day, and anyhow I certainly didn't hear anything when I looked in that direction. And the path would be even worse for 6PT than it would be for me. What about long path? Yes, that makes a lot more sense. That would be nearly the same path I worked the VK9 on a few minutes ago. But if that's so, assuming we have any propagation at all, then the FB8 must be well off 6PT's frequency. And you know, now that I think of it, 6PT wouldn't make a long call without a good reason, because that would only draw competitors — like me. The only likely purpose in making a long call is because for some reason he is calling well off the FB's frequency, and he wanted to be sure that the FB8 heard him.

HB9NL operating as HB0NL in Liechtenstein in October, 1976. Since 1969 he has worked more than 10,000 United States Amateur stations on CW from this rare spot.

I swing the antenna back on the long path, as 6PT turns it back over to the FB8. I begin searching quickly — 2, 3, 4, then 5 kHz, off 6PT's frequency. Hah!

8WD R MERCI CHER OTTO . . .

There he is! Let's see now . . . If he already tuned that far away from his transmitting frequency, he might well continue tuning away, and I should set up shop just past W6PT. But if I'm wrong, I'm dead. Still, probably the thing to do is move just above 6PT, a couple hundred hertz away. That way, the FB8 is sure to hear me. With a bit of luck, there won't be much of a pile-up; maybe none.

Yes, now the FB8 sends his 73, and turns it back to Otto. As I begin to tune the receiver back to 6PT's frequency, I hear a couple stations begin to call the FB8, pretty well dead on his frequency.

I get back to 6PT.

OK, ANDRE 73 ET BONNE CHANCE FB8WD DE . . .

As planned, I slip my VFO just above 6PT, and quickly tune the receiver back to the FB8's frequency. Two stations are calling him, desperately, unaware that the FB8 is listening much higher. As they continue calling, I hear the traditional "dit dit" from the FB8, closing the contact. I begin my call, a short one, because I know (I hope!) where the FB8 is listening, and I don't want to attract the wolves, at least not yet.

Duck soup.

W9KNI DE FB8WD . . .

Son of a Gun! (All good DXers say "Son of a Gun" when they are excited). A little thinking saved me from the fate of those still calling the FB8 madly while I'm logging him.

I eye the old gear fondly. It has held up well and long. The receiver was built in 1956, and the exciter in 1964, the linear I home-brewed about 4 years ago, mostly with used parts contemporary with the receiver. But I've maintained the gear carefully, keeping always an eye open for a tube getting past it's prime, annual alignment, and keeping the gear clean. It doesn't require the very latest of equipment to chase DX successfully. Sure, I'd like to have the latest, but I know how to get the most out of what I have, and I'll stick with it for a while.

I glance up at the clock. It's 1241 Zulu — 7:41 A.M. local time. I yawn and get up from the rig. I look out the basement window. It's going to be a *lovely* day. **HRH**

More details? Ad Check page 78.

NEW VISUAL CODE READER AND ELECTRONIC KEYER

Works with any keyer, including squeeze keyer in speeds from 7 WPM to 40 WPM. Both in a single unit.
Model CR101EK $249

from ATRONICS

- Display letters, numbers, and commonly used punctuation visually as Morse Code signal is received.
- Operating speed 5 to 50 WPM at selected speeds.
- All Solid State.
- Makes code learning faster and easier.
- A single connection to your receiver or transceiver speaker puts it into operation.
- Hard copy read-out of CW available with TU-102 TTY interface Module accessory.

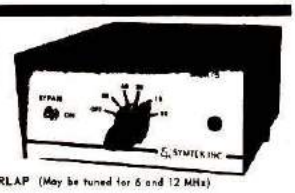
Our popular, lowest priced CODE READER KIT
Model KCR101 ..... $149
Ready made CODE READER...Model CR101 . . $225

BUY FACTORY DIRECT & SAVE! SEND FOR FREE LITERATURE.
USE YOUR BANKAMERICARD OR MASTER CHARGE

P.O. BOX 77 ESCONDIDO, CA 92025 (714) 745-1971

Atronics

SABA-5



THE SIGNAL INTENSIFIER .... IT REALLY WORKS ! NO TUNING, 10, 15, 20, 40 & 80 METER OPERATION FOR AMATEUR OR HAM ....

- BROAD BAND WITH ADEQUATE MARS OVERLAP (May be tuned for 6 and 12 MHz) 2 Meter Operation Available Also.
- VASTLY IMPROVED SIGNAL/NOISE RATIO (i.e. S-35 ratio from Europe to U.S.A.) Increased to S - 9 Over with SABA 5.
- T R RELAY OPERATION FOR INSTANTANEOUS SWITCHING IS AVAILABLE.
- SOLID STATE MOS - FET CIRCUITRY.
- SIMPLE INSTALLATION. NO MODIFICATION TO ANY MAKES/MODELS OF AMATEUR EQUIPMENT (Antenna Connection & Plug to Power).
- BATTERY OR EXTERNAL POWER MODELS ARE AVAILABLE.

ITEM	QTY.	DESCRIPTION	*HAM NET EA.	COLOR **	TOTAL$
1		SABA 5 - 1R Battery Operation - Receive Only	68.00		
2		SABA 5 - 2R 115VAC Operation - Receive Only	82.00		
3		SABA 5 - 1T Use DC Power Source. Has TR Switch (100MA @ 12 to 18 V) included.	76.00		
4		SABA 5 - 2T HAS T R Switch included. Externally Gated operation at 110VAC	90.00		
5		SABA 5 - 3T Has T R Switch included. Automatically Gated operation at 110VAC	96.00		
6		SABA 5 - 2MM Mobil - DC operation. T R Switch included. 2 Meter operation	69.95		
7		SABA 5 - 2MB Base unit. T R Switch included. 2 Meter operation.	74.00		
8		TORA - 6 Power Booster	59.95		
9		MINI - AMP, MA - (Specify Band) 2 to 160 Meter available.	15.00		
10		OTHER (Specify Below) Such as Antenna Matcher, Speech compressor, etc.	Request Information (Tell us about your appl		

* PRICES SHOWN ARE HAM NET, U.S.A., F.O.B. TAMPA, FLORIDA. CHARGE, CASH OR C.O.D. ORDERS ONLY.
** COLORS AVAILABLE: (B) Blue, (G) Grey, (BL) Black
Charge to: ___ BankAmericard ___ Master Charge +
Card No. _____ Exp. Date _____
+ Also Bank I.D. No. _____ For BankAmericard

TOTAL FOR MOSE	
SHIPPING & HANDLING	1.50
AIR MAIL, INSURANCE & HANDLING (If Applicable)	3.50
FLA. RES. ADD 4% S.T.	
TOTAL REMITTANCE	

FOR MORE INFORMATION PLEASE CONTACT:

SYMTEK INC.
4805 N. HESPERIDES, TAMPA, FLA., 33614, U.S.A.
FOR PLACING ORDERS OR REQUESTING SALES INFORMATION PLEASE CALL (813) 879-8730
FOR TECHNICAL INFORMATION PLEASE CALL (813) 879-8467

DON & BOB'S

SUPER STATION BUYS

VHF SPECIALS: Kenwood TS-700A List . . . $599 — **Call for quote.**
KLM In Stock on Antennas, Linears, Accessories.
JANEL PREAMPS In Stock
KLM KR400 Rotor **$85.00**
CDE Big Talk Rotor **$79.00**
CDE Ham-2 **$129.00**
Hy Gain handi talkie $189.95 - **Call for quote**
Midland 13-510 2m FM synthesized $399.00 - **Call for quote**
CABLE 5/32", 6-strand, soft-drawn guy cable. For mast or light tower, 3¢ **foot.**
RAYTHEON 811A $16.00/pr.
BELDEN COAX CABLE: 8237 RG8 19¢ **ft.**, 8214 RG8 foam 23¢ **ft.**, 8448 rotor cable 14¢ **ft.**, 8210 72 ohm kw twinlead **$19/100 ft.** 8235 300 ohm kw twinlead **$12/100 ft.** PL259 49¢; UG175 adapter 19¢; PL258 double female **$1.00.**
TELEX HEADSETS In Stock
NYLON CORD 5000 ft. + per roll **$15.00**

CALL US FOR QUOTES ON: ATLAS 350XL, KENWOOD TS520, TS700A, TR7400A, FT-101E, TEMPO 2020 & ETO. ALL IN SEALED CARTONS.

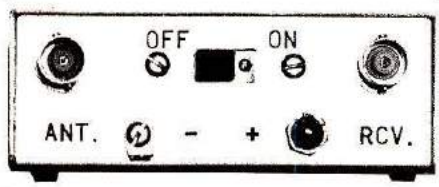
BIRD WATTMETERS IN STOCK.

CALL US FOR QUOTES & ITEMS NOT LISTED

TERMS: All prices FOB Houston. Quotes Good 30 Days. All Items Guaranteed. Some items subject to prior sale. Send letterhead for Amateur dealers price list. Texas residents add 5% tax. Please add postage estimate, excess refunded.

MADISON ELECTRONICS SUPPLY, INC.
1508 McKinney Houston, Texas 77002
713/658-0268 Nites 713/497-5683

Vanguard now has a HOT 2m converter - at a price you can afford

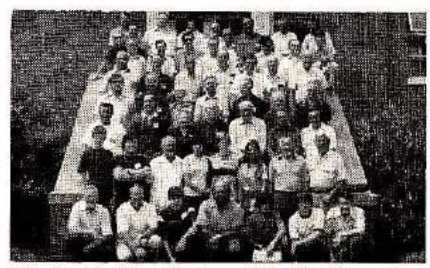


MODEL C-144-A ONLY $39.95
READ THE SPECIFICATIONS & SEE WHY IT'S THE BEST CONVERTER VALUE AVAILABLE ANYWHERE!!

- Dual-gate MOSFET r.f. stage with diode protected input.
- Dual-gate MOSFET mixer for minimum cross modulation. Every converter tested for noise figure (2.5 — 3.0 dB max.) with Hewlett Packard noise measuring equipment.
- 6 tuned circuits.
- More than 20 dB gain. .1 microvolt sensitivity guarantee when used with receivers having 1 microvolt or better sensitivity.
- Complete with one .005% plug-in crystal to cover 144-146 or 146-148 MHz (be sure to specify which, or get both for only $5.00 more). Standard output is for 28-30 MHz.
- 16 gauge aluminum case with BNC receptacles and antenna/power switch. Measures 3½" x 2¼" x 1¼"
- Operates 12 Vdc @ 15 ma.

IN STOCK NOW FOR IMMEDIATE C.O.D. SHIPMENT. Call Monday through Friday 9 AM to 4 PM (212) 468-2720.

VANGUARD LABS



Glade Valley School Radio Session

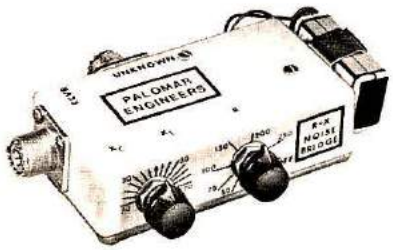
18th Year — July 30 thru August 12, 1977

Hams do it with more frequencies! Improve your slice of the spectrum by upgrading.
Glade Valley School in the Blue Ridge Mountains of North Carolina offers an intensive two week Radio Session in code and theory starting at your level.
Expert instructors and close association with fellow amateurs offer an opportunity for Saturation-Learning.
Novices upgrade to General, Techs become General and Advanced and Advanced become Extras.
FCC exam available at close of session.

C. L. PETERS, K4DNJ, Director
P. O. Box 458, Glade Valley, N. C. 28627
Please send me the Booklet and Application Blank for the 1977 Glade Valley School Radio Session.
Name_____ Call_____
Address_____
City/State/Zip_____

More details? Ad Check page 78.

R-X NOISE BRIDGE



√ Learn the truth about your antenna.
√ Find its resonant frequency.
√ Adjust it to your operating frequency quickly and easily.

If there is one place in your station where you cannot risk uncertain results it is in your antenna.

The Palomar Engineers R-X Noise Bridge tells you if your antenna is resonant or not and, if it is not, whether it is too long or too short. All this in one measurement reading. And it works just as well with ham-band-only receivers as with general coverage equipment because it gives perfect null readings even when the antenna is not resonant. It gives resistance and reactance readings on dipoles, inverted Vees, quads, beams, multiband trap dipoles and verticals. No station is complete without this up-to-date instrument.

Why work in the dark? Your SWR meter or your resistance noise bridge tells only half the story. Get the instrument that really works, the Palomar Engineers R-X Noise Bridge. Use it to check your antennas from 1 to 100 MHz. And use it in your shack to adjust resonant frequencies of both series and parallel tuned circuits. Works better than a dip meter and costs a lot less. Send for our free brochure.

The price is $49.95 and we deliver postpaid anywhere in U.S. and Canada. California residents add sales tax.

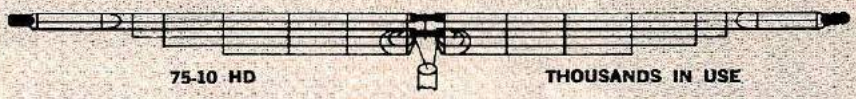
Italy write i2VTT, P.O. Box 37, 22063 Cantu. Elsewhere send $52.00 (U.S.) for air parcel post delivery worldwide.

Fully guaranteed by the originator of the R-X Noise Bridge. ORDER YOURS NOW!

PALOMAR ENGINEERS
BOX 455, ESCONDIDO, CA 92025
Phone: (714) 747-3343

HALF-SIZE FULL PERFORMANCE
Multi-Band HF Communications Antennas

ESPECIALLY SUITABLE FOR THE NEW AMATEUR



75-10 HD — **THOUSANDS IN USE**

MOR-GAIN HD DIPOLE SPECIFICATIONS

MODEL	BANDS (Meters)	LENGTH (feet)	PRICE
40-20 HD	40/20	36	$49.50
40-10 HD	40/20/15/10	36	59.50
80-40 HD	80/40 + 15	69	57.50
75-40 HD	75/40	66	55.00
75-40 HD (SP)	75/40	66	57.50
75-20 HD	75/40/20	66	66.50
75-20 HD (SP)	75/40/20	66	66.50
75-10 HD	75/40/20/15/10	66	74.50
75-10 HD (SP)	75/40/20/15/10	66	74.50
80-10 HD	80/40/20/15/10	69	76.50

NOTE: 75 meter models are factory tuned to resonate at 3950 KHz. (SP) models are factory tuned to resonate at 3800 KHz. 80 meter models are factory tuned to resonate at 3650 KHz.

WHY MOR-GAIN?

NOVICE LICENSE OPERATION. The MOR-GAIN HD Dipole is the ideal antenna for the new or Novice operator. As the Novice progresses to higher license classes, he can easily re-tune the HD Dipole to the new frequencies of his higher license frequency privileges. The HD Dipole is thus a one-time investment. HD Dipoles are available for all Novice frequencies.

LEAST COST. Dollar for dollar, the HD dipoles are the highest performance least cost multi-band antennas on the market today. For Example: the 5-band 75-10 HD dipole costs less than $15.00 per band - an unbeatable low cost.

MOR-GAIN HD Dipoles . . .

- One half the length of conventional half-wave dipoles.
- Multi-band, Multi-frequency.
- Maximum efficiency - no traps, loading coils, or stubs.
- Fully assembled and pre-tuned - no measuring, no cutting.
- Proven performance - more than 10,000 have been delivered.
- Permit use of the full capabilities of today's 5-band xcvrs.
- One feedline for operation on all bands.
- Lowest cost/highest performance antenna on the market today.
- Highest performance for the Novice as well as the Extra-Class Op.
- Guaranteed ONE YEAR.

LIMITED REAL ESTATE. Where real estate for antenna installation is limited, the HD dipole is the ideal solution. Operation on 80/75/40 meters is now possible since the HD dipole is only half the length of a conventional half-wave dipole. For all-around operation, the HD dipole will outperform any trap loaded horizontal or vertical dipole.

Contact your favorite dealer or order direct from MOR-GAIN today. Write for fully descriptive four page brochure.

MOR-GAIN

Manufactured & Guaranteed by
MOR-GAIN
2200N South 4th Street
Leavenworth, Kansas 66048
(913) 682-3142

This MFJ Antenna Tuner...

lets you operate all bands — 160 thru 10 Meters — with a simple random wire. Use virtually any transceiver — up to 200 watts RF power OUTPUT.

$39.95

Imagine being able to operate all bands — anywhere, with virtually any transceiver — using a simple random wire and an antenna tuner small enough to carry in your hip pocket. Size is only 2-3/16 x 3-1/4 x 4 inches.

Operate from your apartment with a makeshift wall to wall antenna. Tune a simple vertical for low angle, DX operation. Operate from your motel room with a wire dropped from a window. Tune out the SWR on your mobile whip. Enjoy ham radio on a camping or backpack trip with a wire thrown over a tree. Prepare for an emergency. Take it on a DX expedition or use it for Field Day.

Match both high and low impedances by interchanging input and output. SO-239 coaxial connectors are used.

The secret of this tiny, powerful tuner is a 12 position variable inductor made from two stacked toroid cores, and a quality capacitor manufactured especially for MFJ.

Try it — no obligation. If not delighted, return it within 30 days for a refund (less shipping). This tuner is unconditionally guaranteed for one year.

To order, simply call us toll free 800-647-8660 and charge it on your BankAmericard or Master Charge or mail us a check or money order for $39.95 plus $2.00 for shipping and handling.

Don't wait any longer to operate on all bands. Order today.

MFJ ENTERPRISES
P. O. Box 494 H
Mississippi State, MS 39762
Call Toll Free . . . 800-647-8660

dB? OR NOT dB?

BY MICHAEL JAMES

With apologies to William Shakespeare, that's the question; but what is the answer? Actually, there are several answers and I'd like to thank Roger Stagnol of Ballantine Laboratories and Harold Engelke, W2IBM, for their valuable help in finding them.

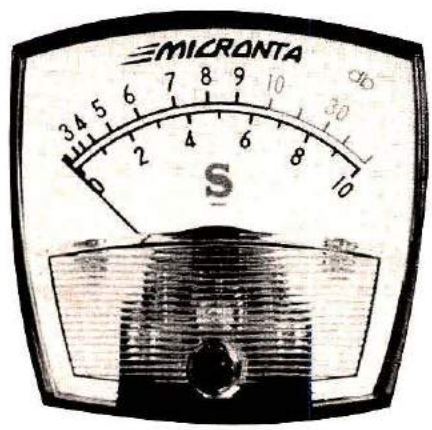
DB stands for decibel, one-tenth of a bel. Okay, so what's a bel? Well . . . the bel was named for Alexander Graham Bell, inventor of the telephone. It seems that the American Telephone and Telegraph Company had been using "a mile of standard cable" as their signal level reference device. The ratio between the volume of the signal put into one end of the cable, and that of the same signal taken out at the other end of the cable was called a "transmission unit." In other words, the cable served as an attenuator and provided a not-so-handy comparison device for determining signal strength ratios.

In 1924 an international advisory committee, including representatives of the Bell Telephone System, met to establish international standards for the transmission and reception of voice signals by "land line," that is, telephone wires. It was agreed that the representatives should recommend to their respective countries that AT&T's standard "transmission unit" be adopted, since it conveniently represented a logarithmic power ratio between input and output signal strengths. One of the delegates to the conference (perhaps a Bell System representative?) suggested honoring the inventor of the telephone sounder — Bell — by changing the name of the standard unit to "bel," when it was calculated with logarithms to the base ten, and "neper" when calculated with natural logarithms to the base *e*. It seems that neper is a contraction of Napier, the Scottish sheep farmer and mathematician credited with discovering the principle of natural logarithms. In any case, two famous persons were honored that day, and the names have stayed to the present.

One thing more: The bel was an inconveniently large value for use in those days of small amplification factors and limited power ratios, so the conferees decided to adopt a smaller and more commonly workable unit. Coincidentally (?) one standard "transmission unit" was exactly equal to one-tenth of a bel, so it was approved then and there to adopt the *deci*bel as the working unit of measurement.

Perhaps it isn't so coincidental after all, humans being what they are, for even today the same things are being called by different names while very different things are often called by the same name.

For those malcontents among us who are unwilling to let matters rest where they are, and who insist upon a more technical explanation, I must beg the pardon of the rest of you for that which is to follow. Stick around if you like, otherwise split; you're excused.



The S-meter of a typical amateur radio communications receiver has a scale that indicates signal strength in S-units up to S-9, and in decibels (dB) over S-9.

The $bel = log\ P1/P2$, and the $decibel = 10\ log\ P1/P2$, where $P1$ is the power level being considered and $P2$ is the standard or "reference" power level. Okay so far? Fine, let's use an example. Suppose your transmitter uses an input power of 100 watts, but you're planning for a kilowatt amplifier and want to know how many dB that will boost your signal. From the formula: (n is number of dB)

$$n = 10\ log\ \frac{1000}{100}$$

$$= 10\ log\ 10$$

and since "log 10" is equal to 1, then the power ratio, $n = 10\ dB = 1\ bel$. Simple, huh?

There's another ratio used in radio work, and that is a ratio between two *voltages*. Want to find out how that is figured in dB? Thought so! By a variation of Ohm's Law, power P is equal to the square of the voltage divided by resistance (or impedance, in ac circuits). If you want to compare two voltages at the same impedance it is simple to let the impedance equal an arbitrary 1; and the ratio is $(V1/V2)^2$. In logarithmic form, the ratio in decibels is therefore $n = 20\ log\ V1/V2$. In an example, suppose you wanted to know the voltage ratio between 2000 volts on the plates of your linear amplifier, and 200 volts on the plate of a driver tube in your exciter. Here we go . . .

$$n = 20\ log\ \frac{2000}{200}$$

$$= 20\ log\ 10$$

but you already know

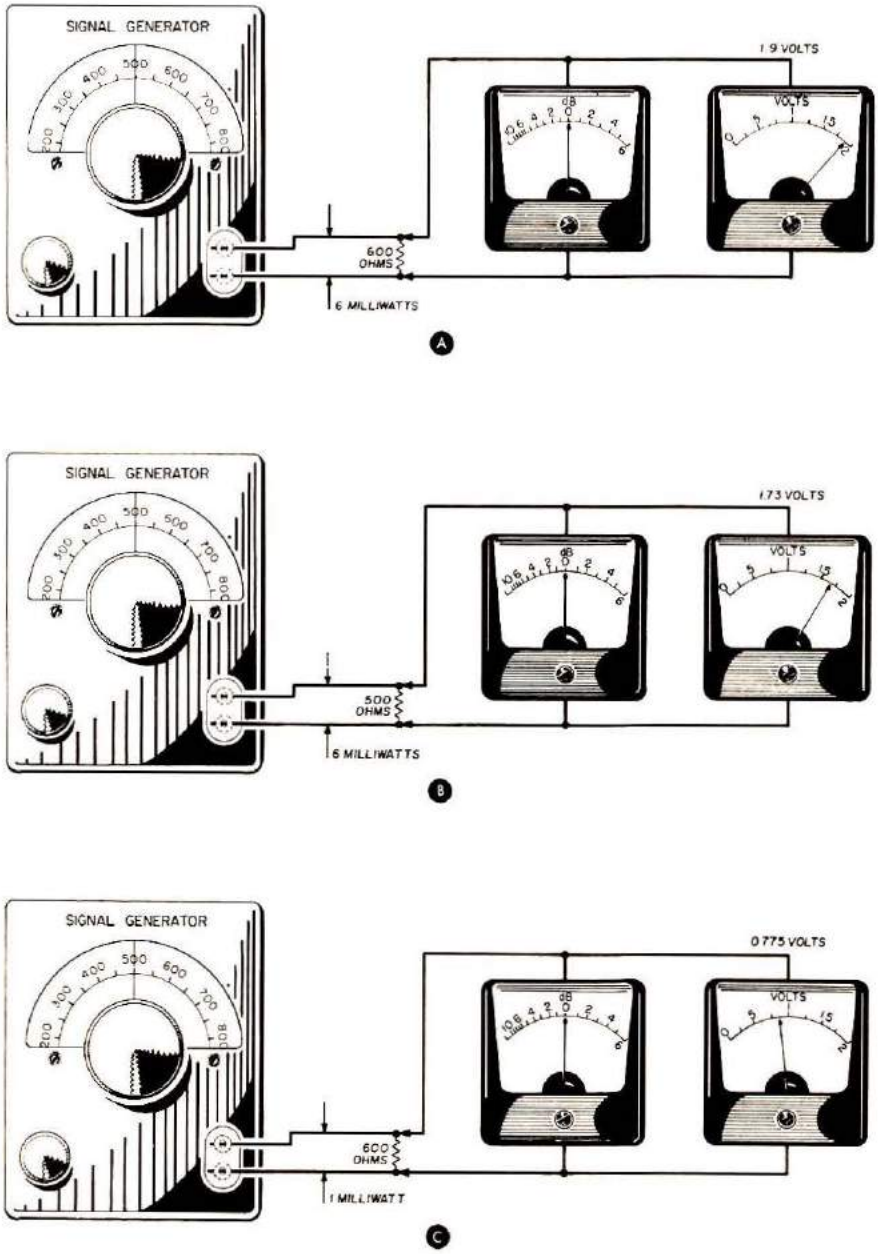


Fig. 1. Shows how different reference levels relate to power, voltage and dB. Present standard **A** uses 6 milliwatts across a 600-ohm load to read zero dB. Old standard **B** used 6 milliwatts across 500 ohms. Earliest standard **C** used 1 milliwatt across 600 ohms. Note that in all cases the dB meter reads the same, but that the voltmeter reads 1.9 volts, 1.73 volts and 0.775 volt, respectively.

(remember?) that log 10 is 1, so

n = 20 times 1
= 20 dB or 2 bels

That wasn't too bad was it?

To figure power or voltage ratios when the values are less than one volt or one watt, what do you do? Again, it's simple: the logs have negative values and the decibels are expressed in negative numbers. For example – 10 dB is one-tenth the power and – 20 dB is one-tenth the voltage.

Welcome back to those who left for awhile. Would you like to know what other, practical uses are made of these numbers? Well, for example, antenna *gain* is a power ratio between a reference antenna and an antenna that you're testing. Hopefully, the decibels will be positive integers in this case.

Or beam width — how "sharp" or "narrow" is the lobe radiated by your Yagi array or your cubical quad? A pattern plot is taken with a field strength meter every ten degrees or so around the antenna, and the results are drawn on a piece of paper. A line is drawn from the center of the paper through the "half-power" points of the pattern, that is, where the power is 3 dB less than it was directly in front of the array. The angle between these two lines is the beamwidth of your antenna. That's right, Bunky, half the power is – 3 dB and twice the power is + 3 dB.

Then there's the good ol' hearing aid — your receiver. Do those funny numbers on the S-meter confuse? If so, just bear in mind that we're talking about *reference* values again. When your receiver was calibrated at the factory, a signal of known strength was applied at the antenna terminals, and the S-meter was adjusted to read S-9. You will notice that the numbers to the left of S-9 on the meter are single integers. These are "S-units," and the meter scale is calibrated such that each S-unit represents about twice the voltage of the next lower value; that is, about 6 dB. To the right of the meter center, the values are given in double integers, such as 10, 20, 30, 40 . . . dB over S-9.

Be assured that meters are not linear, and at low signal strengths the meter jumps around quite lively with only modest changes in signal strength. Above S-9, the meter responds only sluggishly — at best — to very large changes of signal strength. This is done purposely for a couple of reasons: First, to give the meter a logarithmic scale (or close to it), and second, to prevent extraordinarily strong signals from breaking the meter movement or pointer. Besides, if a station is over S-9 on your meter, he's gosh-awful loud. It doesn't make much difference whether the signal is 30 or 40 dB over S-9, unless someone is on an ego trip!

A signal that registers S-9 + 40 dB is about 10,000 times stronger than a signal that shows S-9 on the meter.

Audio measurements

Decibels are also used in the measurement and evaluation of sound intensity and its electrical equivalent. The volume produced by a "rock" group, that of an air hammer, or the sound of the Anglo-French Concorde taking off from Dulles International can be measured and recorded in decibels. A far cry from ham radio, you say? Well — maybe not! Stay tuned-in for a few minutes and then decide.

Sooner or later, as a radio amateur, you're going to be dealing with sound and its measurement. It may be the sound coming out of the loudspeaker of your receiver, it may be the sound put into your transmitter by your microphone, or it could even be the sound put into your telephone line when you decide you need a "phone patch."

Let's kick that last item around a bit. Ma Bell is pretty strict about how much voltage you can put into the equipment she owns, and there's a good reason, too. Excessive sound power applied to the telephone lines produces interference — *crosstalk* — and the phone company talks cross to you if you crosstalk them!

Then there's the possibility that you may want to do a bit of voice or music recording, but you don't want the tape you make to sound distorted; after all, it's hi-fi, right? Okay, you're going to have to control audio *level*, the amount of sound you put on the tape. When sound is still audible, its quantity or intensity is referred to as volume or loudness, but when it is converted to electrical signals its quantity if referred to as amplitude or level. Therefore, audio level is the electrical analog of sound intensity, and it must be controlled for your radio equipment to function properly. Television and radio broadcast stations devote a great deal of time and money to the measurement and control of audio level.

When a radio signal is made to carry sound, it is said to be modulated. Speech and music — as well as other audible sounds — can modulate a radio signal. Some sounds have a constant frequency (pitch) and a constant amplitude (loudness). An example of such a sound would be the tone produced during one of the emergency radio alert broadcasts.

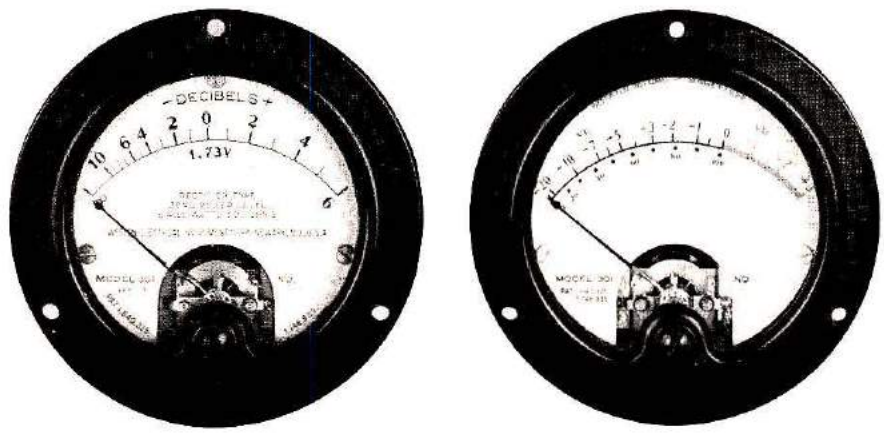
Other sounds have constantly changing pitch and amplitude. Music and speech are examples of constantly changing sounds. We know that radio and TV stations must be able to accommodate both kinds of sounds and reproduce them faithfully, so the place they must begin is the same place you and I must begin — the measurement of sound. Normally, it is necessary to measure only the loudness or level of the audio material, so let's start with that.

The measurement of sound

When sound is converted to electrical pulses or signals, these signals have all ohe characteristics of electricity: Current, voltage and power — things that can be measured by instruments called meters. Did you know that the word meter means measure? Fine, glad you did, because we're going to talk about meters and metering.

In working with sound and its electrical equivalent, engineers use two basic kinds of meters. One kind is called a decibel (dB) meter and the other kind is called a volume unit (VU) meter.[1,2] Both measure ac voltage, but in a slightly different way because of the way the meters are constructed. The dB meter measures audio level in decibels compared to a reference level, while the VU meter measures audio level in volume units compared to a reference level. The main difference between the dB meter and the VU meter is that the VU meter is built to follow the complex waveforms of speech and music that bounce up and down in level (intensity) and frequency (pitch or tone); whereas the poor dB meter can't follow the changes at all, but only reads some fixed value of intensity.

Now you may wonder why anyone would ever want to have a dB meter at all, and the answer is simple: It's great for accurately measuring audio signal levels of substantially constant frequency and amplitude and for comparing input and output levels of an



A typical broadcast-type dB meter is shown next to a typical VU meter. Both are commonly used by radio and TV stations for the purpose of measuring signal levels, and controlling them to predetermined values.

Bearcat® 210 $289.

The Bearcat® 210 is a sophisticated scanning instrument with the ease of operation and frequency versatility you've dreamed of. Imagine, selecting from any of the public service bands and from all local frequencies by simply pushing a few buttons. No longer are you limited by crystals to a given band and set of frequencies. It's all made possible by *Bearcat* spaceage solid state circuitry. You can forget crystals forever.

Pick the 10 frequencies you want to scan and punch them in on the keyboard. It's incredibly easy. The large decimal display reads out each frequency you've selected. When you want to change frequencies, just enter the new ones.

Automatic search lets you scan any given range of frequencies of your choice within a band. Push-button lockout permits you to selectively skip frequencies not of current interest. The decimal display with its exclusive "rolling zeros" tells you which channels you're monitoring. When the *Bearcat* 210 locks in on an active frequency the decimal display shows the channel and frequency being monitored.

With the patented track-tuning system, the Bearcat 210 automatically aligns itself so that circuits are always "peaked" for any broadcast. Most competitive models peak only at the center of each band, missing the frequencies at the extreme ends of the band.

The Bearcat 210's electronically switched antenna eliminates the need for the long low band antenna. And a quartz crystal filter rejects adjacent stations as well as noise interference.

Call toll-free 800-521-4414 now to place a BankAmericard or Mastercharge order. This is our 24 hour phone to our order department and only orders may be processed on this line. To order in Michigan or outside of the U.S. dial 313-994-4441.

Add $5.00 for U.S. shipping or $9.00 for air UPS to west coast. Charge cards or money orders only please. International orders invited. Michigan residents add tax. Please write for quantity pricing.

Bearcat® 210 Features

- **Crystal-less**—Without ever buying a crystal you can select from all local frequencies by simply pushing a few buttons.
- **Decimal Display**—See frequency and channel number—no guessing who's on the air.
- **5-Band Coverage**—Includes Low, High, UHF and UHF "T" public service bands, the 2-meter amateur (Ham) band, plus other UHF frequencies.
- **Deluxe Keyboard**—Makes frequency selection as easy as using a push-button phone. Lets you enter and change frequencies easily . . . try everything there is to hear.
- **Patented Track Tuning**—Receive frequencies across the full band without adjustment. Circuitry is automatically aligned to each frequency monitored.
- **Automatic Search**—Seek and find new, exciting frequencies.
- **Selective Scan Delay**—Adds a two second delay to prevent missing transmissions when "calls" and "answers" are on the same frequency.
- **Automatic Lock-Out**—Locks out channels and "skips" frequencies not of current interest.
- **Simple Programming**—Simply punch in on the keyboard the frequency you wish to monitor.
- **Space Age Circuitry**—Custom integrated circuits . . . a *Bearcat* tradition.
- **UL Listed/FCC Certified**—Assures quality design and manufacture.
- **Rolling Zeros**—This *Bearcat* exclusive tells you which channels your scanner is monitoring.
- **Tone By-Pass**—Scanning is not interrupted by mobile telephone tone signal.
- **Manual Scan Control**—Scan all 10 channels at your own pace.
- **3-Inch Speaker**—Front mounted speaker for more sound with less distortion.
- **Squelch**—Allows user to effectively block out unwanted noise.
- **AC/DC**—Operates at home or in the car.

Bearcat® 210 Specifications

Frequency Reception Range

Low Band	32—50 MHz
"Ham" Band	146—148 MHz
High Band	148—174 MHz
UHF Band	450—470 MHz
"T" Band	470—512 MHz

*Also receives UHF from 416—450 MHz

Size
10⅝" W x 3" H x 7⅝" D

Weight
4 lbs. 8 oz.

Power Requirements
117V ac, 11W; 13.8 Vdc, 6W

Audio Output
2W rms

Antenna
Telescoping (supplied)

Sensitivity
0.6μv for 12 dB SINAD on L & H bands
U bands slightly less

Selectivity
Better than −60 dB @ ± 25 KHz

Scan Rate
20 channels per second

Connectors
External antenna and speaker; AC & DC power

Accessories
Mounting bracket and hardware
DC cord

COMMUNICATIONS ELECTRONICS™
Box 1002
Ann Arbor, Michigan 48106 USA

master charge THE INTERBANK CARD

your BANKAMERICARD welcome here

audio amplifier. A pure sine-wave output from an audio signal generator is an example of such a signal; the tone put out by WWV is another; and the radio emergency alert signal is still another. Of course, these do change slightly in amplitude — but so gradually that the dB meter can easily follow.

By now, you've probably figured that the VU meter can serve as a dB meter, but the dB meter cannot be used as a VU meter, and that's true. That's why most broadcast stations monitor program level with VU meters — they're versatile and can follow the constantly changing tones and amplitudes of music and speech.

Some meters have a little switch on them whereby they can be changed from reading dB to reading VU, and vice versa, but they are very expensive.

I mentioned reference levels, because if you want to know where you are, or where you're going, you must know where you've been — just like on a map. Your starting point is a reference, and so it is with audio-level measurement.

Although many different references have been used as standards over the years, the one commonly accepted as the *zero dB standard* is the meter deflection produced by a power of one milliwatt (0.001 watt) applied across a 600-ohm impedance. If someone wants to set some point other than zero on a meter scale as a reference point, that is their business, but the industry uses the zero-dB point as standard. This point on the scale is usually *not* at the left-hand edge, however, for reasons we'll mention later.

Other standards have been used, and among the most common are 6 milliwatts across 600 ohms, followed — as a close runner-up — by 6 milliwatts across 500 ohms. It is easy to see that a meter calibrated to one standard will not accurately represent a level adjusted to another standard. It is therefore necessary to know by which standard your meter has been calibrated. It is also necessary to know the impedance of the circuit which your meter is measuring the level of a signal, just in case the meter you have was calibrated for the zero dB reference point with another impedance.

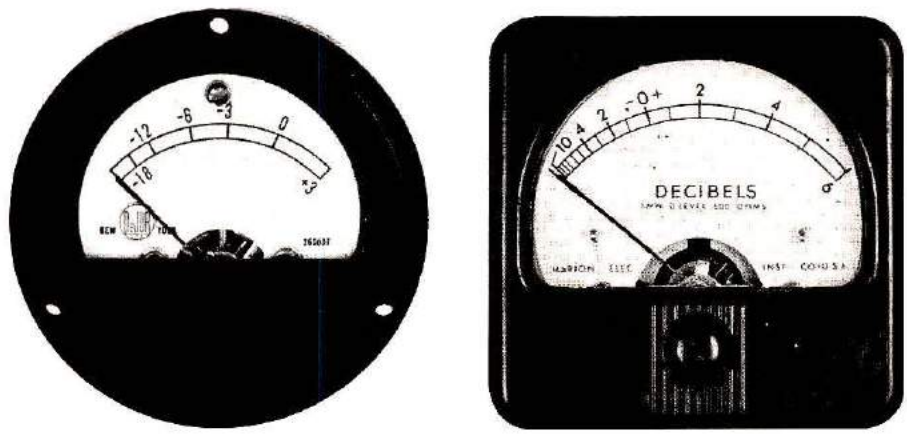
Power, rather than voltage, was selected as a basis for meter calibration to minimize the problems caused by measurements taken across lines having different impedances.

Let's pause just a moment to take a look at the term *impedance*. It comes from the word impede, meaning to hinder. Therefore, impedance is a hindrance to the flow of electrical current. Ordinarily, resistance is the word used by electronics people to describe such a hindrance, but the poor engineers had to deal with two kinds of current — direct and alternating. So, by a gentleman's agreement, it was decided long ago to use the word *impedance* to describe hindrance to the flow of *alternating* current, and *resistance* to describe hindrance to the flow of *direct* current. Thus an impedance of 600 ohms, for example, describes the hindrance a particular circuit offers to the flow of alternating current. By using Ohm's Law and substituting the value of impedance for resistance, voltage, power, and current calculations for ac circuits can be made.

So far, so good. Now let's just try to determine the voltage present at the meter terminals when the different standards are used. By a permutation of Ohm's Law, the voltage is the square root of the product of power and impedance:

$$E = \sqrt{P \times Z}$$

If we substitute the known values mentioned above for the different standards, we find that the 1-milliwatt and 600-ohm standard represents 0.7746 volt; the 6-milliwatt and 600-ohm standard represents 1.987 volts; and the 6-milliwatt and 500-ohm standard represents 1.732 volts. These were rounded off to 1.9 and 1.73 volts for meter use.[4]



An example of the variations in scales found in dB meters is shown on these instruments. The scale on the left meter has considerable range below the 0-dB reference mark, while that on the right has more scale to the right of the reference.

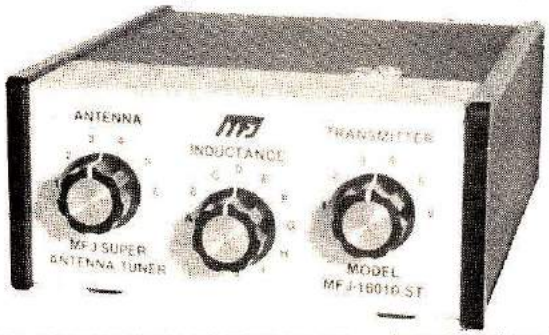
Checking dB meters

If you happen to have some dB meters lying around, and they don't have the reference voltage or standard to which they were calibrated marked on them, you can still find out, and very simply, too!

All that you need is an adjustable source of ac voltage

This NEW MFJ Super Antenna Tuner . . .

matches <u>everything</u> from 160 thru 10 Meters: dipoles, inverted vees, random wires, verticals, mobile whips, beams, balance lines, coax lines. Up to 200 watts RF <u>OUTPUT</u>. Built-in balun, too!



$69.95

With the NEW MFJ Super Antenna Tuner you can run your full transceiver power output — up to 200 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.

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.

The secret of this tiny, powerful tuner is a wide range 12 position variable inductor made from two stacked toroid cores and high quality capacitors manufactured especially for MFJ. For balanced lines a 1:4 (unbalanced to balanced) balun is built-in. Made in U.S.A. by MFJ Enterprises.

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).

Try it — no obligation. If not delighted, return it within 30 days for a refund (less shipping). This tuner is unconditionally guaranteed for one year.

To order, simply call us **toll-free 800-647-8660** and charge it on your BankAmericard or Master Charge or mail us an order with a check or money order for $69.95 plus $2.00 shipping/handling for the MFJ-16010ST Super Antenna Tuner.

Don't wait any longer to tune out that SWR and enjoy solid QSO's. Order today.

MFJ ENTERPRISES
P. O. BOX 494 H
MISSISSIPPI STATE, MS. 39762
CALL TOLL FREE . . 800-647-8660

**** Please mention HORIZONS when you call ****

This NEW MFJ Deluxe Keyer at $69.95 . . .

gives you more features per dollar than any other keyer available.

Based on the Curtis 8043 IC keyer-on-a-chip, the new MFJ Deluxe Keyer gives you more features per dollar than any other keyer available.

Sends iambic, automatic, semi-automatic, manual. Use squeeze, single lever or straight key.

Iambic squeeze key operation with dot and dash insertion lets you form characters with minimal wrist movement for comfortable, fatique-free sending.

Semi-automatic "bug" operation provides automatic dots and manual dashes. Use a manual straight key to safely key your transmitter or to improve your fist.

Dot memory, self-completing dots and dashes, jam-proof spacing and instant start for accurate and precise CW.

Totally RF proof. No problems, whatever.

Ultra-reliable solid-state keying. Keys virtually any transmitter: grid block, —300V max., 10 ma, max.; cathode and solid state transmitters + 300V max., 200 ma, max.

All controls are on the front panel: speed, weight, tone, volume, function switch. Smooth linear speed control, 8 to 50 WPM.

Weight control lets you adjust dot dash space ratio; makes your signal distinctive to penetrate thru heavy QRM for solid DX contacts.

Tone control. Room filling volume. Built-in speaker. Ideal for classroom teaching.

Function switch selects off, on, semi-automatic/manual, tune. Tune keys xmtr for tuning.

Completely portable. Take it anywhere. Operates up to a year on 4 C-cells. Miniature phone jack for external power (3 to 15 VDC).

Beautiful Ten Tec enclosure. Eggshell white, walnut sides. Compact 6x6x2 inches.

Three conductor quarter-inch phone jack for key, phono jacks for keying outputs.

Optional squeeze key. Dot and dash paddles have fully adjustable tension and spacing for the exact "feel" you like. Heavy base with non-slip rubber feet eliminates "walking". $29.95 plus $2.00 for shipping and handling.

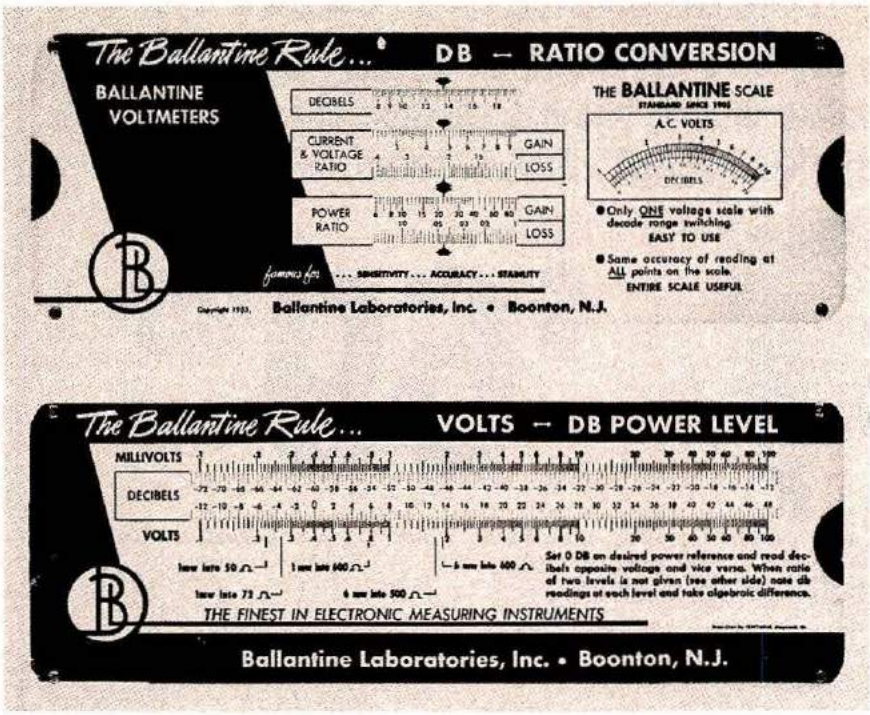
Try it—no obligation. If not delighted, return it within 30 days for a refund (less shipping). This keyer is unconditionally guaranteed for one year.

To order, simply call us **toll-free 800-647-8660** and charge it on your BankAmericard or Master Charge or mail us an order with a check or money order for $69.95 plus $2.00 shipping/handling for the MFJ-8043 keyer and/or $29.95 plus $2.00 shipping/handling for the squeeze key.

Don't wait any longer to enjoy the pleasures of the new MFJ Deluxe Keyer. Order today.

MFJ ENTERPRISES
P. O. BOX 494 H
MISSISSIPPI STATE, MS. 39762
CALL TOLL FREE . . 800-647-8660

More details? Ad Check page 78.



A Ballantine slide rule can be used for making voltage and power calculations in terms of decibels.

capable of being set to the voltage values mentioned above. Apply each of the voltages, in turn, across the meter terminals and see which one makes the meter pointer indicate the zero dB reference mark. In most cases, unless you have a very old — or perhaps foreign — meter, the zero reference will be achieved with 0.7746 volt, ac.

Of what practical value is all of this, you ask? How do you apply it to your own needs? Fair questions. Obviously, if the zero reference value is somewhere upscale on the meter and the needle indicates some other values than zero, you either have too much audio or not enough. First, notice that the values marked to the left of zero are negative values and those to the right are positive. Based upon the current standard, Ma Bell permits audio signals of +4 dB *maximum* to be applied to her telephone circuits. Inasmuch as most commercial radio stations are connected to telephone lines for transmitting program material from a remote studio to a transmitter, means for setting the audio equipment to the +4 dB level are required.[3] Such means are located at the control console of the station and are under the supervision of the engineer who "runs the board."

Sometimes it is desirable to make the setting automatic and foolproof. To do this, the engineer places a test signal of +4 dB on the circuit and mechanically adjusts the meter pointer to read zero dB reference. Now, when a program is being sent over the line and the man who handles the equipment "rides the gain" to maintain the zero reference, actually the audio level is held to −4 dB, and well within acceptable limits. This is merely a safety factor and insures that the telephone lines are not overdriven. If this amount of audio is not enough at the transmitter, it is easy for the engineer to turn up the audio gain at the transmitter to compensate, while leaving the level on the telephone lines alone.

Another way you can use the information about meter calibration is to build your own dB meter from an ac voltmeter. It is suggested that you use a meter having a full-scale deflection of about 1.5 volts. The zero-reference level would therefore be about half scale with an input of 0.7746 volt, representing 1 milliwatt across 600 ohms.

As an aid to troubleshooting or converting from one standard to another, **Tables 1** and **2** were prepared from a slide rule provided by Ballantine Laboratories. The slide rule will provide data for almost any dB calculation in

Table 1. Comparison of ac voltages with corresponding dB values referenced to the three commonly-used "standards" for calibrating dB meters.

volts	1mW/600 ohms	6mW/600 ohms	6mW/500 ohms
0.1	−17.75	−25.5	−24.75
0.15	−14.25	−22.0	−21.25
0.2	−11.75	−19.5	−18.75
0.3	−8.25	−16.0	−15.25
0.4	−5.75	−13.5	−12.75
0.5	−3.75	−11.5	−10.75
0.6	−2.25	−10.0	−9.25
0.8	+0.25	−7.5	−6.75
1.0	2.25	−5.5	−4.75
1.5	5.75	−2.0	−1.25
2.0	8.25	+0.5	+1.25
3.0	11.75	4.0	4.75
4.0	14.25	6.5	7.25
5.0	16.25	8.5	9.25
6.0	17.75	10.0	10.75
8.0	20.25	12.5	13.25
10.0	22.25	14.5	15.25

use, but only limited information is provided by the charts.

There was a slightly different formula provided for use with the slide rule

$$V = 0.0316\sqrt{P \times R}$$

Where

V = zero dB voltage
P = power in milliwatts at zero dB,
R = load resistance in ohms

It is unclear whether this is just for the one slide rule or provides a more accurately calculated value for other applications.

The charts are not the last word in accuracy because they have been rounded off to the nearest readable unit, but they should be accurate enough for most troubleshooting and equipment checks. If you have to set an exact standard, you'll probably want an accurately calibrated meter anyway.

Table 2. Decibel (dB) values with corresponding ac voltages referenced to the three commonly-used "standards" for calibrating dB meters.

dB	1mW/600 ohms	6mW/600 ohms	6mW/500 ohms
−20	0.078	0.19	0.172
−18	0.098	0.24	0.218
−16	0.123	0.30	0.275
−14	0.155	0.38	0.342
−12	0.19	0.48	0.438
−10	0.245	0.60	0.55
−8	0.31	0.75	0.69
−6	0.39	0.95	0.86
−4	0.49	1.20	1.10
−2	0.62	1.50	1.38
0	0.78	1.90	1.72
+2	0.98	2.40	2.18
4	1.23	3.0	2.75
6	1.55	3.8	3.42
8	1.90	4.80	4.38
10	2.45	6.0	5.50
12	3.10	7.50	6.90
14	3.90	9.50	8.60
16	4.90	12.0	11.0
18	6.20	15.0	13.80
20	7.80	19.0	17.20

The volume unit

As mentioned before, the VU or volume unit is not an exact measurement because its value at any given moment is undergoing a change due to the presence of many different amplitudes and frequencies in the speech or music waveforms. Although there is no exact correlation between VU and dB, the two can be compared in a very practical manner with sufficient accuracy for most equipment checks and for level setting.

As we said before, dB measurements are made with a sine-wave signal (usually about 1000 Hertz, for convenience). The general rule-of-thumb is that the volume-unit indicator reaches a value of approximately 8 to 14 dB below that indicated by the dB meter under these conditions. For test purposes and to set the zero reference level, select a sine-wave voltage at least 10 dBm above the normal audio (program) level to insure that audio peaks do not exceed allowable line levels.

In a practical example, consider that you are going to set up a phone patch and want to keep the audio level in the line below the allowable limits of +4 dB.

You can beg or borrow an audio frequency generator, and may even have a dB meter. Adjust the generator output to 1000 hertz and feed it into the patch. To allow for an adequate safety margin, you might want to use 10 dB. Therefore, the maximum audio signal level should be +4 dB −10 dB, or a net −6 dB. You can now manually adjust the meter to read 0 dB at that level, or you can install a 6-dB attenuator pad in the line and feed the true 0-dB signal to the attenuator pad and then to the telephone lines.

Once the meter is set up with a suitable reference zero level for safe use, the signal generator can be disconnected and the circuit attached directly to the audio source you intend to use, whether it be output from your speaker terminals, a tape recorder, or some other device. By watching the signal level on your now-calibrated meter, you can adjust the audio gain controls on the equipment to keep the signal level hovering around zero — the preset, "safe" level. For most purposes, a good vacuum-tube voltmeter or a vom (volt-ohm-milliammeter) may be used in the low-voltage ac scale position as a satisfactory dB meter.

Modest equipment backed up with the knowledge of how to use it will produce professional results. Good luck and happy VUing.

References

1. H.A. Chinn, "The Measurement of Audio Volume," part I, *Audio Engineering*, September, 1951, page 26.
2. H.A. Chinn, "The Measurement of Audio Volume," part II, *Audio Engineering*, October, 1951, page 24.
3. Edward M. Noll, *First-Class Radio Telephone License Manual*, 2nd edition, page 72.
4. *Latest Instruments For Servicing Radio-Television*, Coyne Electrical School, Inc., 1960, page 148.
5. *Ballantine Slide Rule*, Ballantine Laboratories, Inc., Boonton, New Jersey 07005. **HRH**

More details? Ad Check page 78.

DX forecaster

August, 1977

There is little to be said about mid-summer propagation conditions, except that DX is where you find it. This month, the propagation chart is a guide only. In general, it will be to your advantage to monitor WWV propagation information at 18 minutes after each hour. When the solar flux is above 80, and the *A* and *K* indexes are below about 7 and 3, respectively, you can expect reasonable DX conditions along the predicted paths. However, when the *A* and *K* indexes rise above 10, and the solar flux index falls below 80, conditions will be poor for DX. You may be able to make good use of the chart in June *Horizons* to find out for any given day whether conditions are normal to high normal. When they are, keep your ears fine tuned for DX. When conditions are below normal, give up gracefully and turn to another hobby.

As usual at this time of year, 20 meters will be the best all-round DX band, with one area or another coming in and fading out as the day progresses. Start listening after sunrise in the morning for the band to open. It should remain open all day and up to about midnight on most days when conditions are normal or better.

Ten meters will be open occasionally on the north-south trans-equatorial path, and sometimes on east-west paths to Europe and the Pacific, but don't count on it as an everyday fare.

Fifteen meters will show more of the properties of 20 than of 10, and you can expect some excellent DX on this band. Fifteen meters is somewhat more erratic than 20, but when it is open, low power and a modest antenna will bring lots of good DX to your operating location and, hopefully, to your log. In general, 15 opens later and closes earlier than 20.

Forty meters will have some fine DX for those of you who are willing or able to burn the midnight oil. Much of the rare DX on 40 will occur during the hours after midnight and will continue until sunrise and beyond — let's say up to 7 or 8 AM, local time. As usual, QRN is the big problem on 40 and 80.

Eighty meters will also bring some good DX in the wee hours of the morning. Be especially careful to look for twilight-path DX at sunrise and sunset, plus or minus a half hour or so.

The 160-meter band is about gone for the summer due to static levels and high absorption. Some local evening contacts will be possible, however.

There will be frequent *sporadic-E* openings for DX enthusiasts among the six and two-meter crowd. Six could open up to as much as 2500 miles (4000km), and two meters could open up to distances of about 1200 miles (2000km) or so.

The *Perseid* meteor shower is expected to peak on August 12th, but look for activity from the 11th through the 13th. Meteor-burst propagation will be popular with vhfers at this time, also with star-gazers. The moon will be at perigee on the 24th for you moon-bouncers.

Special Notice. The period from August 9th to 16th is likely to be very disturbed, with unusual geomagnetic conditions and weather-making news. A minor disturbance is predicted for the 29th.

WESTERN USA

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

MID USA

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

EASTERN USA

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

HAM CALENDAR

August 1977

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	1	AMSAT Eastcoast Net 3850 kHz 9PM EDST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz 9PM CDST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 8PM PDST (0300Z Wednesday Morning) 2	West Coast Qualifying Run 3	4	W1MU Hamfest — South of West Yellowstone about 25 miles — Macs Inn, ID Info: W1MU Hamfest, P.O. Box 30756, Billings, MT 59107 — 5-7 Texas VHF/FM Society's Convention — By San Antonio Repeater Organization — El Tropicano Hotel — San Antonio, TX — 5-7 5	Bold City Hamfest — By the Jacksonville Range Assoc. — Jacksonville Beach Auditorium — Jacksonville, FL — 6-7 Oklahoma Ham-Holiday — Southgate Inn Best Western, 5245 S. Interstate 35 — Oklahoma City, OK — 6-7 6
FM Hamfest — By Fort Wayne Repeater Assoc. — Allen County Police Dept. Reserve Center — 3022 Easterday Rd. — Ft. Wayne, IN Hall of Fame Hamfest — By the Tusco RC & Canton ARC Stark County Fairgrounds — Canton, OH South Hills Brass Pounders & Modulators Hamfest St. Clair Beach — Upper St. Clair Township Western PA — WB3AAC Steuben County RA FM Picnic/Swapfest — Steuben County 4-H Park approximately 2 miles west & 2 miles north of Angola, IN Zero-Beaters ARC Hamfest — Washington, Missouri City Park — Dutzow, MO — W9IVPF 7	8	AMSAST Eastcoast Net 3850 kHz 9PM EDST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz 9PM CDST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 8PM PDST (0300Z Wednesday Morning) 9	10	11	Golden Spread Hamfest/Fleamarket — By Panhandle ARC — Holiday Inn — West Amarillo, TX — 12-14 12	Bristol Hamfest — By the Bristol ARC — Beacon Drive-In Theatre on Blountville Hwy — Bristol, VA — WA4KAS — 13-14 European CW Contest — 13-14 Mini-Hamfest — By the Western Montana Amateurs — Flathead Lake near Polson, MT Straits Area RC Swap/Shop — Emmet County Fairgrounds — Petoskey, MI — W8WF The Wisconsin Rapids ARC will operate station W9DQA to celebrate "Wonderful Wisconsin Rapids Week" 75/80M — 1400-1800Z — 20M — 1800-2200Z — 2M — 146.94 — Novices listen on 7.125 (1800-2200Z) 3.725 (1400-1800Z). 13
Cedar Lakes Hamfest — By the Jackson County — ARC Arts & Crafts Fair site — 3 miles off 177 Ripley, W.VA — WB8TJA Central Kentucky Hamfest — By the Bluegrass ARC — Lexington National Guard Armory — Lexington, KY "Hamfest 77" — By the Union County ARC — Plain City Fairgrounds — Plain City, OH Hamfesters RC Inc. Hamfest/Picnic — Santa Fe Park 91st & Wolf Rd. — Willow Springs, IL Mt. Airy VHF RC (the Packrats) Family Picnic Flourtown area of the Ft. Washington State Park — Ft. Washington, PA — Rain date 8/21 Saint Cloud RC Hamfest — Sauk Rapids Municipal Park — St. Cloud, MN — WA9DTO 14	15	AMSAT Eastcoast Net 3850 kHz 9PM EDST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz 9PM CDST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 8PM PDST (0300Z Wednesday Morning) 16	17	W1AW Qualifying Run 18	Central States VHF Conference The Breckenridge Inn Kansas City, MO — W0OHU 19-21 19	Canadians/USA Contest — 20-21 1977 Hawkeye Ham & Computerfest — By the Des Moines ARA — Camp Dodge (in the suburb of Johnston on Des Moines' north border, IA) — 20-21 New Jersey QSO Party — By Englewood ARA see below† Worldwide SARTG RTTY Contest — 20-21 20
Lafayette, Indiana Hamfest — By the Tippecanoe ARA — Tippecanoe County Fairgrounds at 18th Street and Teal Rd. — Lafayette, IN — WA9ZDI North Alabama Hamfest — Calhoun Community College Decatur AL — Info: North Alabama Hamfest Assoc., P.O. Box 9, Decatur, AL 35602 Warren Hamfest — Trumbull Branch of Kent State University — Warren, OH 21	22	AMSAT Eastcoast Net 3850 kHz 9PM EDST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz 9PM CDST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 8PM PDST (0300Z Wednesday Morning) 23	24	25	26	All Asian DX Contest — CW — 1000Z 8/27 — 1600Z 8/28 Ohio Interstate Contest — By the Ohio Council of Amateur Radio Clubs — operation shall consist of two ten hour periods — noon to 10:00PM EDT each day. Dupe sheets & summary sheets must be received by September 15 to be eligible for award. Send to: Joe Subich, WB8HWE, RD 5, Box 7825, Circleville, OH 43113 27
LaPorte ARC Electronic Swapfest — County Fairgrounds LaPorte, IN St. Charles ARC Hamfest — Diermanns Lake — 4 miles south of O'Fallon, MO on Highway K 28	29	AMSAT Eastcoast Net 3850 kHz 9PM EDST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz 9PM CDST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 8PM PDST (0300Z Wednesday Morning) 30	31			†New Jersey QSO Party — 2000Z 8/20 — 0700Z 8/21 — 1300Z 8/21 — 0200Z 8/22* Phone & CW. Suggest phone activity on even hours — 15 meters on odd hours (1500-2100Z) — 160 meters at 0500Z. Certificates will be awarded to the first place station in each N.J. county, ARRL section, and county. In addition, a second place certificate will be awarded when four or more logs are received. Novice & Technician certificates will also be awarded. Logs and comments should be sent to Englewood Amateur Radio Assoc. Inc., 303 Tenafly Road, Englewood, N.J. 07631. Portable and mobile operation is encouraged.

RATES Regular classified is available at 50¢ per word. Display classified (1 inch deep x 2¼ inches wide) is $50, or at the 12x rate is $35. All Ad Scan payable in advance. No cash discounts or agency commissions allowed.

HAMFESTS Sponsored by non-profit organizations receive one free regular classified ad (subject to our editing). Repeat insertions of hamfest ads pay the standard rate.

COPY No special layout or arrangements available. Material should be typewritten or clearly printed (not all capitals) and must include full name and address. We reserve the right to reject unsuitable copy. **Ham Radio** cannot check each advertiser and thus cannot be held responsible for claims made. Liability for correctness of material limited to corrected ad in next available issue.

DEADLINE 15th of fourth preceding month.

SEND MATERIAL TO: Ad Scan, Horizons, Greenville, N. H. 03048.

CUSTOM EMBROIDERED EMBLEMS, your design, low minimum. Informational booklet, Emblems Dept. 65, Littleton, New Hampshire 03561.

FREE LICENSING CLASSES in Flushing, NY area. Send inquiries to FRATS (Flushing Radio Amateur Technical Society), 62026 Boelsen Crescent, Rego Park, NY 11374.

WYOMING

Ranch land. Antelope, deer, elk, wild horses — Your "Antenna Ranch." 10 Acres $35 down, $35 month. FREE info — maps — photos. Owner.

Dr. Michael Gauthier, K6ICS
9550HH Gallatin Rd., Downey, CA 90240

W.I.M.U. HAMFEAST (Wyoming, Idaho, Montana and Utah), August. The 45th annual WIMU Hamfeast is scheduled to be held at Macs Inn, Idaho. Just south of west Yellowstone about 25 miles. The dates to be August 5, 6 and 7th . This is one of the Rocky Mountain Northwest's largest hamfeast and we would like to invite you to attend, and at the same time enjoy a tour through Yellowstone National Park. Advance registration is $6.00 before July 1st. Registration will be $7.00 at the hamfeast. Please send all pre-registrations to WIMU Hamfeast, P.O. Box 30756, Billings, Montana 59107, c/o Ronald Conley General Chairman, WIMU, Hamfeast.

ATTENTION MICHIGAN HAMS! See us for Collins, Drake and Ten-Tec gear. W8RP, WB8UXO, WB8VGR. Purchase Radio Supply, 327 E. Hoover Ave., Ann Arbor, MI 48104. Ph. 313-668-8696.

PEORIA HAMFEST. Sunday, September 18 at the Exposition Gardens, same place as last year, Northmoor Road just west of North University Ave. For hamfest tickets write Bruce Funston, K9PWQ, 304 Indian Circle, East Peoria, IL 61611. Advance tickets $1.50, door tickets $2.00.

MOBILE IGNITION SHIELDING provides more range with no noise. Bonding strap sale less than 50¢ each. Literature. Estes Engineering, 930 Marine Drive, Port Angeles, Wash. 98362.

AWARDS — 2nd Annual Ham Hollerin. Beautiful certificate for contacts with NC4NHC, located at Spivey's Corner, NC, "The Ham Hollerin Capital of the World." June 18, 1977 (9AM to 9PM EST). Make contact with NC4NHC and send $1.00 (for postage/handling) to Cape Fear Amateur Radio Society, Box M-618, Fayetteville, NC 28301 for your cerfificate.

QSL's with class! Unbeatable quality — reasonable price. Samples. QSL's Unlimited, Box 27553, Atlanta, GA 30327.

TRIPOLE MULTI-BAND

All-band antenna. Guaranteed. 80 to 6 Meters plus 160! 5 SWL Bands. Built-in balun . . . 2 KW PEP rating. No retuning, tap or trap changes. 80 to 120 ft inverted-V or horizontal. Available in kit form or assembled.
Kit T80-K . . . . . $54.95 cash PPD in USA.

Universal Radio Co. Dept. H3
Box 25041 El Paso, TX 79925
Telephone (915) 592-1910

Texas residents add 5% sales tax
Send postal card for information on TRIPOLE antenna and feedline kits

---

TECHNICAL MANUALS

Ameco	Hayden-Rider	Sams
ARRL	RCA	Tab
Cowan	Radio Callbook	T. I.
Gilfer	Radio Pub.	

Postage 35¢ per book. PPD 5 or more books.
MADISON ELECTRONICS SUPPLY, INC.
1508 McKinney, Houston, TX 77002
713-658-0268

MULTI-BAND ANTENNAS. How about 5 Bands (80-10) in 105'? How about 4 Bands (40-10) in 60'? Pace-Traps are the way to do it! See Lew McCoy's April '77 QST Antenna article. 5-Band or 4-Band FG(KW) $17.95 pr. ppd. NG(300w) $14.95 pr. ppd. Copperweld Antenna Wire 7-strand #22-Handles like soft-drawn. 5-Bander 110' $3.75; 4-Bander 60' $2.60. Wire shipped UPS, add $1.00 in USA, Conn. residents add 7% tax. Pace-Traps, Box 234, Middlebury, CT 06762.

SEPTEMBER 10-11: The Queen Welhelmina Hamfest will be held at the Inn, on top of Rich Mt. near Mena AR. Exhibits, fabulous prizes, fun for XYL's YL's Harmonics. More Info. contact Steven Myers, WB5MFI, RFD 1 Box 204, Hatfield, AR 71945.

DISCOVER RADIO ASTRONOMY, the newest branch of amateur radio! Learn how in The Radio Observer, the only magazine devoted entirely to the hobby. Sample copy $1.00 from The Peterson Press, 657HR Circle Drive, Santa BBarbara, CA 93108.

FREE Catalog, Solar Cells, Nicads, Kits, Calculators, Digital Watch Modules, Ultrasonics, Strobes, LEDS, Transistors, IC's, Unique Components. Chaney's, Box 27038, Denver, COLO 80227.

NEED HELP For your novice or general ticket? Complete audio-visual theory instruction. Easy, no electronic background necessary. Write for free information: Amateur license instruction, P.O. Box 6015, Norfolk, Virginia 23508.

WESTERN PENNSYLVANIA — The 40th annual Hamfest af the South Hills Brass Pounders and Modulators will be held on August 7. 1977, from noon till 6:00 P.M. at St. Clair Beach, Upper St. Clair Township, 5 miles south of Mt. Lebanon, on Rte 19. Swap and shop, picnic space and swimming for the family. Mobile check-in on 29.0 and 146.52. Information and pre-registration at $1.50 per ticket ($2.00 at door) from Rick Eckenrode, WB3AAC, 1410 Bellaire Pl., Pittsburg, Pa. 15226. Vendors must register.

The "Cadillac" of QSL's! — New! Samples: $1.00 (Refundable) — MAC'S SHACK; Box #1171-G, Garland, Texas 75040.

VACATION AT OUR HAMFEST, "Florida's Friendliest". The Bold City Hamfest sponsored by Jacksonville Range Association, Jacksonville Beach Auditorium August 6-7. Special Solar and QRPp forums. Request for information & tables to HAMFEST Coordinator, Jacksonville Range Association, P.O. Box 10623, Jacksonville, FL 32207. Motel reservations. Call RAMADA INN, Toll Free 1-800-228-2828.

SST T-1 RANDOM WIRE ANTENNA TUNER

All band operation (160-10 meters) with most any random length wire. 200 watt output power capability. Ideal for portable or home operation. Toroid inductor for small size. 3 x 4-1/4 x 2-3/8. Built-in neon tune-up indicator. SO-239 coax connector. Guaranteed for 1 yr., 10 day trial. Compact – easy to use. . .only $29.95 postpaid. (Add Sales Tax in Calif.) (213) 376-5887

SST ELECTRONICS, P.O. BOX 1, LAWNDALE, CA. 90260

AD CHECK

. . . for literature, in a hurry — we'll rush your name to the companies whose names you **check**.

Place your check mark in the space between name and number. **Example: HRH ✓ 150.**

Amsat ___ 220
Atlas ___ 198
Atronics ___ 382
Audio Amateur ___ 564
Brevettata ___ 594
Byte ___ 487
CFP ___ 022
CIR ___ 548
Cleveland Inst. Elect. ___ 566
Cohoon ___ 559
Comm. Center ___ 534
Comm. Elect. ___ 489
Comm. Spec. ___ 330
Cushcraft ___ 035
Dentron ___ 259
Drake ___ 039
E. T. O. *
Elect. Dist. ___ 044
Erickson ___ 047
Glade Valley ___ 213
Ham Center ___ 491
Ham Outlet ___ 595
Heath ___ 060
Henry ___ 062
Herrman ___ 568
Hy-Gain ___ 064
Icom ___ 065
Kengore ___ 073
Kenwood *
Long's ___ 468
MFJ ___ 082
Madison *
Mor-Gain ___ 089
NW ARRL Conv.*
Palomar ___ 093
Porta Pak ___ 274
Processor Tech. ___ 540
RF Power ___ 542
Shavney ___ 570
Standard Comm. ___ 109
Symtek ___ 203
Telrex ___ 377
Vanguard*
Whitehouse ___ 378

*Please contact this advertiser directly.

Limit 15 inquiries per request.

AUGUST, 1977

Please use before September 30, 1977

Tear off and mail to
HAM RADIO HORIZONS — "Ad Check"
Greenville, N. H. 03048

NAME _____

CALL _____

STREET _____

CITY _____

STATE _____ ZIP _____

AD INDEX

Foreign Subscription Agents for Ham Radio HORIZONS

Ham Radio Canada
Box 114, Goderich
Ontario, Canada, N7A 3Y5

Ham Radio Europe
Box 444
194 04 Upplands Vasby, Sweden

Ham Radio France
20 bis, Avenue des Clarions
89000 Auxerre, France

Ham Radio Holland
Postbus 3051
Delft 2200, Holland

Ham Radio Italy
STE, Via Maniago 15
1-20134 Milano, Italy

Ham Radio UK
Post Office Box 63, Harrow
Middlesex HA3 6HS, England

Holland Radio, 143 Greenway
Greenside, Johannesburg
Republic of South Africa

DRAKE

TR4-CW 80-10m hf trans. with CW filter reg. $649.00 Now $589.00
34PNB Noise blanker for TR-4C reg. $100.00 Now $90.00
RV-4C Remote VFO/speaker reg. $120.00 Now $109.00
AC-4 AC power supply for TR-4C & T-4XC reg. $120.00 Now $109.00
DC-4 DC power supply reg. $135.00 Now $124.00
L4B Linear amplifier reg. $895.00 Now $789.00
SSR-1 Gen. coverage rcvr. .5-30 MHz reg. $350.00 Now $279.00
R-4C 80-10m receiver reg. $599.95 Now $539.95
4-NB Noise blanker for R-4C reg. $70.00 Now $64.00
T-4XC 80-10m transmitter reg. $599.95 Now $539.95
TV-3300LP Low pass filter reg. $26.60 Now $19.95

HY-GAIN

TH3-MK3 3 element tri-band reg. $199.95 Now $169.95
204BA 4 element 20m beam reg. $179.95 Now $149.95
TH6DXX 6 element super Thunderbird reg. $239.95 Now $199.95
402BA 2 element, 40m reg. $199.95 Now $169.95
14AVQ 10-40m vertical reg. $67.00 Now $57.00
18AVT 10-80m vertical reg. $97.00 Now $87.00
18HT Hy-Tower, reg. $279.95 Now $239.95
3806 2m Handheld reg. $189.00 Now $169.00
3750 Transceiver reg. $1895.00 Now $1695.00
3854 Speaker for 3750 reg. $59.95 Now $49.95
3855 Remote VFO reg. $495.00 Now $449.00

YAESU

FT-101E, 160-10m trans. w/processor $729.00
FT-101EE, 160-10m trans. wo/processor $649.00
FT-101EX, Transceiver AC only $589.00
FTV-650B, 6 meter transverter $199.00
FTV-250, 2 meter transverter $199.00
FV-101B, external VFO $109.00
SP-101B, speaker $22.00
SP-101BP, speaker/patch $59.00
FA-9, cooling fan $15.00
XF30C, 600 Hz CW filter $40.00
XF30B, AM filter $40.00
YO-100 Monitor scope $199.00
MMB-1 Mobile mount for 101 $19.00
YC-601 Digital readout (101&401) $169.00
YD-844 Base mike $29.00
YP-150 Dummy load wattmeter $69.00
FT-301S Trans. 40W PEP dial $559.00
FT-301SD Trans. 40W PEP digital $765.00
FT-301 240W PEP dial $769.00
FT-301 240W digital $935.00
FP301 AC supply for FT301 $125.00
FP-301D AC supply with clock and IDer $209.00
YO-301 Monitor scope $219.00
FV-301 Remote VFO $109.00
FR-101S 160-2m Receiver $489.00
FR-101D 160-10m Digital Receiver $599.00
FL-101 160-10m Transmitter $525.00
FT-221R All mode 2m transceiver $595.00
FT-620 6m transceiver $365.00
FRG-7 General coverage receiver $299.00
QTR-24 24-hour clock $30.00
FL-2100B Linear amp, 1200 PEP $399.00

TEMPO

Tempo 1 80-10m transceiver $399.00
AC-1 AC supply $99.00
DC-1A DC supply $120.00
VF/1 Remote VFO $109.00
Tempo 2020 80-10m transceiver $759.00
8120 External speaker $29.95
8010 External VFO $139.00

SWAN METERS

WM-3000 — 79.95 Peak/RMS Wattmeter
WM-2000 — 59.95 In Line Wattmeter
WM-1500 — 74.95 10% Accuracy
SWR-1A — 25.95 3.5-150 MHz
WM-6200 — 59.95 50-150 MHz
FC-76 — 169.95 Frequency Counter

CALL FOR DAILY SPECIALS
OPEN 7 DAYS A WEEK

Talk to Bob, WBØRQZ, Joe, WAØWRI, Don, WBØYEZ, Roy, WBØWWA, or Bob, WBØVXF.
2% discount for certified check or money order.

402-466-3733

Communications Center
2226 North 48th Street
Lincoln, NE 68504

STEP UP TO TELREX

WITH A

TELREX "BALUN" FED—"INVERTED-VEE" KIT

THE IDEAL HI-PERFORMANCE

INEXPENSIVE AND PRACTICAL TO INSTALL LOW-FREQUENCY

MONO OR MULTIPLE BAND, 52 OHM ANTENNA SYSTEM

Telrex "Monarch" (Trapped) I.V. Kit
Duo-Band / 4 KWP I.V. Kit $63.50
Post Paid Continental U.S.

Optimum, full-size doublet performance, independent of ground conditions! "Balanced-Pattern", low radiation angle, high signal to noise, and signal to performance ratio! Minimal support costs, (existing tower, house, tree). A technician can resonate a Telrex "Inverted-Vee" to frequency within the hour! Minimal S/W/R is possible if installed and resonated to frequency as directed! Pattern primarily low-angle, Omni-directional, approx. 6 DB null at ends! Costly, lossy, antenna tuners not required! Complete simplified installation and resonating to frequency instructions supplied with each kit.

For technical data and prices on complete Telrex line, write for Catalog PL 7 (HRH)

COMMUNICATION SYSTEMS SINCE 1921 **Telrex Laboratories**
ASBURY PARK, NEW JERSEY 07712 U.S.A.

BYTE

The Small Systems Journal

Isn't it time you had your own personal computer?

Read BYTE, the leading consumer publication covering the fantastic new field of personal computer applications. Today, large scale integration has made it possible for the individual to enjoy the unique benefits of a general purpose computing system. Now, an entire micro industry markets microcomputer related items, products that range from computer system kits to peripherals, software and literature on the subject. But where should you go for all the details about your personal involvement in computer technology?

Read BYTE, the Small Systems Journal devoted exclusively to microcomputer systems. Every issue a monthly compendium of lively articles by professionals, computer scientists, and serious amateurs.

Fill in subscription coupon today, or phone your request directly — call 617/646-4329 and ask for your subscription. Read your first copy of BYTE, if it's everything you expected, honor our invoice. If it isn't, write 'CANCEL' across invoice and mail it back. You won't be billed and the first issue is yours.

Allow 6 to 8 weeks for processing.

BYTE Subscriptions Dept. 34B
P.O. Box 361
Arlington, Mass. 02174 *Please enter my subscription to BYTE...*

☐ $12 One Year ☐ $22 Two Years ☐ $32 Three Years
☐ Bill me ☐ Check Enclosed
☐ Bill BankAmericard ☐ Bill Master Charge
Credit Card Number ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐
Credit Card Expiration Date _____
Name (Please Print) _____
Address _____
City _____ State _____ Zip _____

More details? Ad Check page 78.

The world's first digitally tuned 80M-10M SSB transceiver

with over 40,000 frequency synthesized channels.

• Ultra-stable frequency synthesizer • Large LED readout • 200 Watts PEP input • *All* solid state including electronic tuning • Front end filtering • Built-in TVI filtering • Modular construction • WWV Receiver, Squelch, Noise blanker, VOX, Speech processing are standard • Full metering.

Discover a whole new world of communications with the CIR ASTRO 200 . . . the Ham SSB Transceiver that has established a new plateau of sophistication for the serious enthusiast.

The built-in digital synthesizer with LED readout gives you over 40,000 crystal controlled channels in the 80 through 10 meter bands with 100Hz resolution. Just press a momentary switch and tune your frequency with no moving parts.

Calibrate it with WWV at the turn of a switch for absolute accuracy. No more crystal calibration.

And, as for frequency drift, the ASTRO 200 is ten times better than VFO types. Total filtering sets the ASTRO 200 above all others for TVI and harmonic suppression. Selectable USB or LSB allows you complete flexibility.

CW operation features include semi break-in CW with adjustable delay and side tone . . . no key click or CW chirp.

CIR offers a complete range of accessories including fixed station console and external frequency synthesizer for crossband DX work.

This extremely compact transceiver is only 2.8″ high by 9.5″ wide by 12.3″ deep including heat sink. With all of these features incorporating rugged militarized type construction, it has no equal for SSB and CW operation.

Be the first to learn more about the exciting new CIR ASTRO 200 . . . ham radio's next generation transceiver. List price, $995. Write or phone for complete details.

CIR
TRANSCEIVERS

CIR Industries, Inc., 1648 N. Magnolia Avenue, El Cajon, California 92020 U.S.A., Phone (714) 449-7633, Telex 69-7989

DenTron amateur radio products have always been strikingly individual. This is the result, not of compulsion to be different, but of a dedication to excellence in American craftsmanship. This dedication now extends to one of the worlds finest high performance Military amateur amplifiers.

Luxury styling, however, would not be fully appreciated without an exceptional power source. The heart of the MLA-2500 is a heavy duty, self-contained power supply.

Compare the MLA-2500. It has the lowest profile of any high performance amplifier in the world. It's modular construction makes it unique, and at $799.50 it is an unprecedented value.

Very few things in life are absolutely uncompromising. We are proud to count the DenTron MLA-2500 among them. And so will you.

MLA-2500 FEATURES

- 160 thru 10 meters
- 2000+ watts PEP input on SSB
- 1000 watts DC input on CW, RTTY, or SSTV
- Variable forced air cooling system
- Self contained continuous duty power supply
- Two EIMAC 8875 external-anode ceramic/metal triodes operating in grounded grid.
- Covers MARS frequencies without modifications
- 50 ohm input and output impedance
- Built in RF watt meter
- 117 V or 234 V AC 50-60 hz
- Size: 5½" H x 14" W x 14" D.

All DenTron products are made in the U.S.A.

Introducing the new MLA-2500

The linear amplifier beyond compromise.

Amplifier in actual operation.

DenTron Radio Co., Inc.

2100 Enterprise Parkway
Twinsburg, Ohio 44087
(216) 425-3173

THE ATLAS 210x / 215x SSB AMATEUR RADIO

The Atlas transceiver is by far the most popular single sideband amateur transceiver for marine service because of its light weight and low power consumption. And despite its small size, 3½" x 9½" x 9½", it is a giant in performance.

Hundreds of Atlas transceivers are now in regular marine mobile use throughout the world, providing inexpensive phone patch communications for your boat, as well as emergency communications when necessary.

In a recent mishap at sea, the sailing yacht "Sorcery" was severely damaged in a storm, to the point of almost sinking. All communications equipment was knocked out except for an Atlas amateur radio transceiver. Using the Atlas, they were able to contact several ham operators who relayed their messages to the Coast Guard. Had it not been for the little Atlas transceiver, "Sorcery" with all aboard, would almost surely have been lost.

In the 1976 single handed Transatlantic Yacht Race, Bob Lengyel used the Atlas 215x transceiver to maintain communications with the mainland during the entire voyage. Crossing the Atlantic Ocean solo in a small boat demands reliable communications, and Bob Lengyel selected the Atlas transceiver.

With an accessory crystal oscillator other frequencies such as WWV may also be tuned in. The Atlas 215x provides a powerful, reliable, yet light-weight back-up communications system that should be on every offshore boat.

Atlas 210x or 215x **$679**
Model 210x covers 3.5, 7, 14, 21 and 28 MHz ham bands. Model 215x covers 1.8, 3.5, 7, 14 and 21 MHz ham bands.

Atlas transceivers are available at most amateur radio stores. For complete information see your Atlas dealer, or drop us a card and we'll mail you a brochure with dealer list.

ATLAS RADIO INC.

417 Via Del Monte, Oceanside, CA 92054
Phone (714) 433-1983
Special Customer Service Direct Line
(714) 433-9591