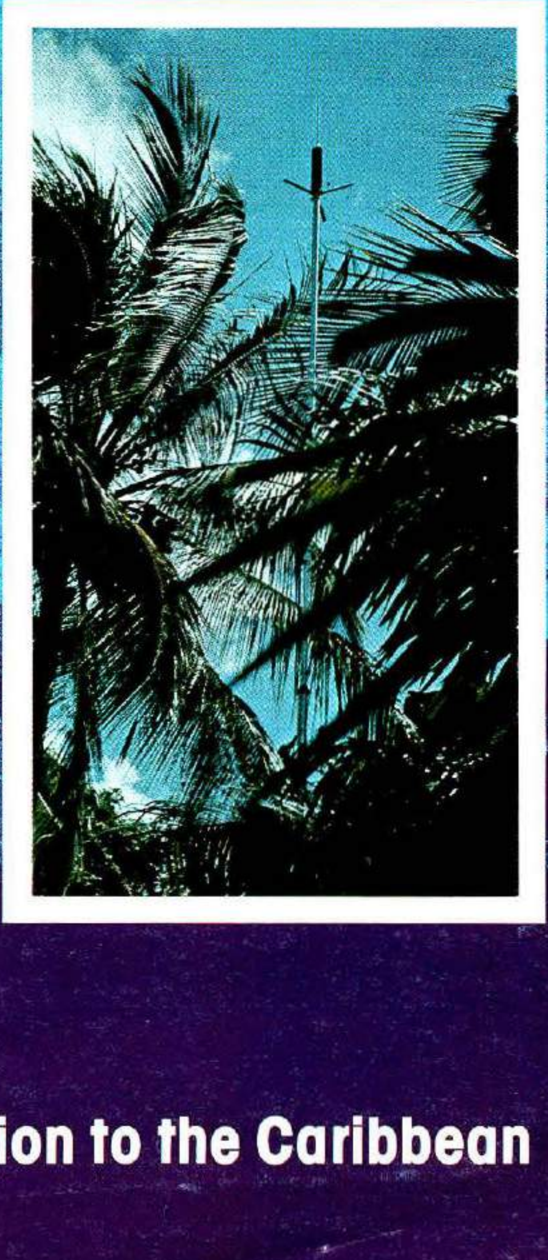
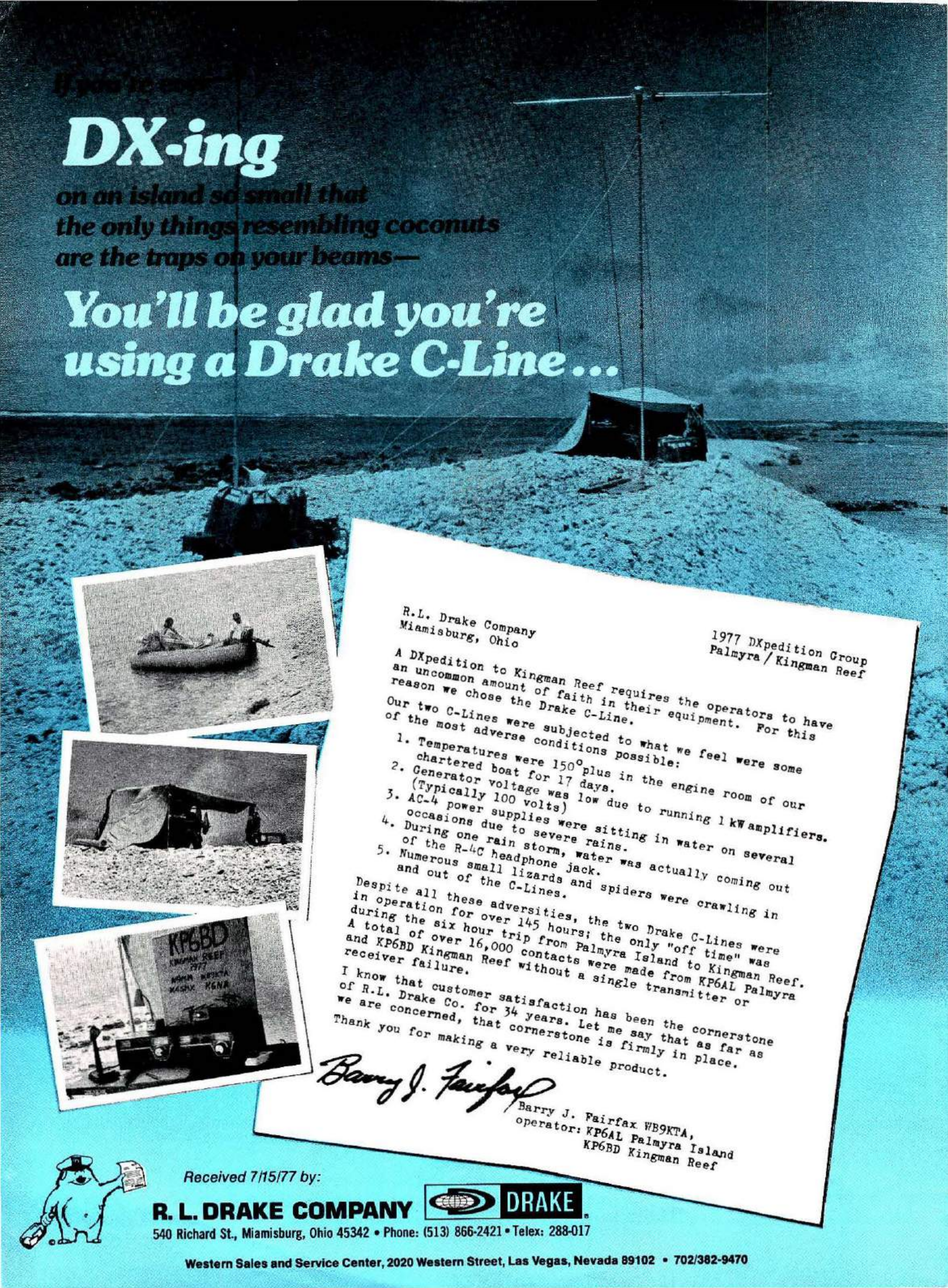
JANUARY 1978 / $1.25

HAM RADIO HORIZONS



DXpedition to the Caribbean



R.L. Drake Company
Miamisburg, Ohio

1977 DXpedition Group
Palmyra / Kingman Reef

A DXpedition to Kingman Reef requires the operators to have an uncommon amount of faith in their equipment. For this reason we chose the Drake C-Line.

Our two C-Lines were subjected to what we feel were some of the most adverse conditions possible:

1. Temperatures were 150°plus in the engine room of our chartered boat for 17 days.
2. Generator voltage was low due to running 1 kW amplifiers. (Typically 100 volts)
3. AC-4 power supplies were sitting in water on several occasions due to severe rains.
4. During one rain storm, water was actually coming out of the R-4C headphone jack.
5. Numerous small lizards and spiders were crawling in and out of the C-Lines.

Despite all these adversities, the two Drake C-Lines were in operation for over 145 hours; the only "off time" was during the six hour trip from Palmyra Island to Kingman Reef. A total of over 16,000 contacts were made from KP6AL Palmyra and KP6BD Kingman Reef without a single transmitter or receiver failure.

I know that customer satisfaction has been the cornerstone of R.L. Drake Co. for 34 years. Let me say that as far as we are concerned, that cornerstone is firmly in place. Thank you for making a very reliable product.

Barry J. Fairfax

Barry J. Fairfax WB9KTA,
operator: KP6AL Palmyra Island
KP6BD Kingman Reef

CALL TOLL FREE!
1-800-633-3410
and save big on Drake!

In some cases save up to $100.00! Offer is good while supplies last.

DRAKE
TR-4CW transceiver

TR-4CW covers 80 thru 10 meters • Modes: SSB, AM, CW • 300 watts PEP input: SSB, 260 watts AM & CW • Has RIT • Transceive or separate PTO • Wide range receiving AGC • Solid-state VFO • CW semi-break-in • VOX or PTT • Shifted-carrier CW • Constant calibration mode to mode.

699.00 List price: 799.00

DRAKE
T-4XC transmitter

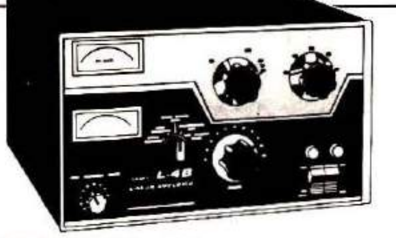
T-4XC features: 80 thru 10 meter coverage with crystals furnished • Covers 160 meters with accessory crystal (optional) • 200 watts PEP input on SSB and CW • Controlled carrier modulation for AM • VOX or PTT on SSB or AM is built-in • USB/LSB/AM/CW on all bands • Built-in CW sidetone.

599.00 List price: 699.00

DRAKE
R-4C receiver

The R-4C features: • 80 thru 10 meter coverage with crystals furnished • Covers 160 with accessory crystal (optional) • Linear permeability-tuned VFO • Modes of operation: SSB/CW/AM/RTTY/SSTB • 3 AGC release times • Crystal lattice filter • Dial calibration: 0 to 500 KHz in 1 KHz increments.

599.00 List price: 699.00



DRAKE L-4B
linear amplifier

The L-4B features: • 2000 watts PEP on SSB, 1000 watts DC on CW, AM, & RTTY • High efficiency Class B grounded grid circuit • Transmitting AGC • Broadband tuned input • Directional watt meter • RF neg. feedback • 2 taut-band suspension meters • Solid-state power supply.

895.00 List price: 995.00

DRAKE
MS-4 matching speaker

The Drake MS-4 matching speaker is designed for use with the Drake R-4C, R-4B, R-4A, and R-4 receivers. It has space inside to house the Drake AC-4 power supply or the AC-3 power supply. The 8-ohm speaker will always come through loud and clear.

30.00 Long's price. Call today.

DRAKE
AC-4 power supply

The AC-4 power supply works with all Drake 4-line transceivers and transmitters. Fits inside the MS-4 speaker cabinet. • Input: 120 or 240 VAC • Output: 650 VDC at 300 mA average, 500 mA peak, also: 12.6 VAC at 5.5 amps. Just what you need to complete your Drake station.

120.00 List price: 150.00

Remember, you can call TOLL-FREE: **1-800-633-3410** in U.S.A. or call **1-800-292-8668** in Alabama for our low price quote. Store hours: 9:00 AM til 5:30 PM, Monday thru Friday.

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THIS MONTHS HORIZONS

West Indies Adventure

Did you ever dream of being on the receiving end of a pileup throughout a contest? How about being able to change from one sought-after country to another with a minimum of travel and bother? Then add exotic sights, friendly people, helpful local amateurs, and you have the makings of a most memorable vacation. K1DG tells you how he and his friends worked out the plan and then carried it through. The line for tickets forms on the right.

Simple Dipole Antennas

Of the many antenna designs which are available to amateurs, the half-wavelength dipole or doublet is hard to beat. It has much to offer: simplicity, low cost, easy installation, and good performance; all contribute to its great popularity. In this article W1HR shows you how to build dipole antennas, discusses what you can expect in way of performance, and tells you how you can extend coverage up to five bands with one simple antenna.

CB Happiness

If you are a Citizens-Band operator and are thinking of something better in radio communications, here's real food for thought. WB2HJD interviewed many CBers who were disenchanted with what's happening on CB and who wanted something better. Most didn't want to abandon CB entirely in favor of ham radio. The testimonials included here indicate that many CBers would like the best of both worlds.

In true reporting style, WB2HJD obtained written permission to use their pictures from all persons whose photos appear in this article.

Looks like more converts every day to amateur radio! So be it.

Learning Morse Code

It's an inescapable fact. You must be able to receive and send Morse at various speeds to pass examinations for amateur operator licenses. There's really no easy way to get over this hurdle. Many ads in the amateur magazines offer all kinds of methods for learning the code. Some are okay; some are questionable. It all boils down to one basic fact: To be proficient, you *must practice*. There's no other way.

In this article, editor W6NIF has provided some ideas for learning the code; once learned, these ideas can be used for increasing proficiency in receiving and sending.

Earthquake

Certainly you remember the devastating quake that struck Guatemala in early 1976. Some of the pictures accompanying this article aren't very pretty — but, as the story shows, man is ever ready to help man. We at *Ham Radio Horizons* are proud to present this account of how amateur radio operators reached out to help others in distress.

How To Speak "Ham"

Abbreviations and *Q signals* are used to save time without losing essential information in the transmission and reception of radio messages. To be an efficient operator, you'll need to know what abbreviations mean, as well as how and when to use them correctly. Correct use of these time-honored signals helps you lose your Novice "dialect."

Your Power Supply

Power supplies probably cause more problems in electronic equipment than any other circuit. To be sure, you may find a piece of equipment in which some other circuit is more often the cause of problems, but that's the exception rather than the rule. Here we'll explore the operation of a simple power supply and examine the voltage waveforms produced on an oscilloscope.

Questions? And Answers!

This part of the series gets to the end of Operating Procedures, talks about the why and how of amateur operation during emergencies, and then finishes up the section on Emission Characteristics. You'll find out what the A and F designations mean, as in AØ, A1, or F3. Parasitic oscillations and harmonic output are undesirable emissions, but they are not alone in that category.

The Cover

What ham can resist the dream of antennas in the midst of a tropical vacation scene? The dream became reality for K1DG on more than one island in the West Indies. Just to compound the thrill, he combined the antenna location with a good DX spot, and checked it out during a DX contest.

HAM RADIO HORIZONS January, 1978, Volume 2, No. 1. Published monthly by Communications Technology, Inc., Greenville, New Hampshire 03048. One-year subscription rate, $10.00; three-year subscription rate, $24.00. Second-class postage paid at Greenville, New Hampshire 03048 and additional offices.

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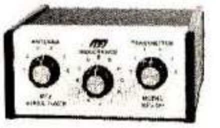

$59.95

BRAND NEW

MFJ-901 Versa Tuner

This NEW MFJ Versa Tuner matches everything from 160 thru 10 Meters: dipoles, inverted vees, long wires, verticals, mobile whips, beams, balance lines, coax lines. Up to 200 watts RF OUTPUT. Built-in balun, too! New efficient air wound coil for more watts out!

Only MFJ uses an efficient air wound inductor in this class of tuners for **more watts out** and far less losses than a high permeability toroid core!

$39.95

MFJ-16010 Antenna Tuner

Now you can operate all bands — 160 thru 10 Meters — with a single random wire and run your full transceiver power output — up to 200 watts RF power OUTPUT.

• Small enough to carry in your hip pocket, 2-3/16 x 3-1/4 x 4 inches • Matches low and high impedance by interchanging input and output • SO-239 coaxial connectors • 12 position tapped inductor. Stacked toroid cores • At 1.8 MHz tuner matches 25 to 200 ohms.

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CWF-2BX Super CW Filter

This MFJ Super CW Filter gives you 80 Hz bandwidth, and extremely steep skirts with no ringing for razor sharp selectivity that lets you pull signals out of heavy QRM. Plugs between receiver and phones or connect between audio stage for speaker operation.

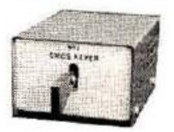
• Selectable BW: 80, 110, 180 Hz • 60 dB down one octave from center frequency of 750 Hz for 80 Hz BW • Reduces noises 15 dB • 9 V battery • 2-3/16 x 3-1/4 x 4 inches • CWF-2PC, wired PC board, $19.95.

$69.95

MFJ-8043 IC Deluxe Electronic Keyer

This NEW MFJ Deluxe Keyer gives you more features per dollar than any other keyer available.

• Uses Curtis-8043 keyer chip • Sends iambic, automatic, semi-automatic, manual • Use squeeze, single lever, or straight key • Dot memory, self-completing dots and dashes, jam proof spacing, instant start • RF proof • Solid state keying ±300 V max • Weight, tone, volume, speed controls • Uses 4 C-cells; external power jack • 6 x 6 x 2 inches • Sidetone and speaker • Optional squeeze key: $29.95

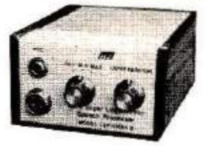


$54.95

CMOS-8043 Electronic Keyer

State of the art design uses CURTIS-8043 Keyer-on-a-chip.

• Built-in Key • Dot memory • Iambic operation with external squeeze key • 8 to 50 WPM • Sidetone and speaker • Speed, volume, tone, weight controls • Ultra reliable solid state keying ±300 volts max. • 4 position switch for TUNE, OFF, ON, SIDETONE OFF • Uses 4 penlight cells • 2-3/16 x 3-1/4 x 4 inches

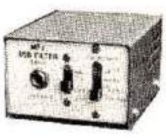


$59.95

LSP-520BX II Log Speech Processor

Up to 400% more RF power. Plugs between your microphone and transmitter.

• Gives your audio punch power to slice through QRM • 30 dB IC log amp and 3 active filters • RF protected • 9 V battery • Two Mic jacks: ¼" phone jacks, uncommitted 4 pin jack • Output cable • 2-1/8 x 3-5/8 x 5-9/16 inches • LSP-520BX, in standard MFJ enclosure, electronically identical, $49.95.

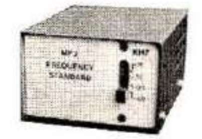


$29.95

SBF-2BX SSB Filter

Dramatically improves readability.

• Optimizes your audio to reduce sideband splatter, remove low and high pitched QRM, hiss, static crashes, background noise, 60 and 120 Hz hum • Reduces fatique during contest, DX, and ragchewing • Plugs between phones and receiver or connect between audio stage for speaker operation • Selectable bandwidth IC active audio filter • Uses 9 volt battery • 2-3/16 x 3-1/4 x 4 inches



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MFJ-200BX Frequency Standard

Provides strong, precise markers every 100, 50, or 25 KHz well into VHF region.

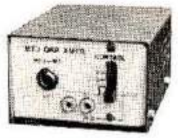
• Exclusive circuitry suppresses all unwanted markers • Markers are **gated** for positive identification. CMOS IC's with transistor output. • No direct connection necessary • Uses 9 volt battery • Adjustable trimmer for zero beating to WWV • Switch selects 100, 50, 25 KHz or OFF • 2-3/16 x 3-1/4 x 4 inches

$49.95

MFJ-1030BX Receiver Preselector

Clearly copy weak unreadable signals (increases signal 3 to 5 "S" units).

• More than 20 dB low noise gain • Separate input and output tuning controls give maximum gain and RF selectivity to significantly reject out-of-band signals and reduce image responses • Dual gate MOS FET for low noise, strong signal handling abilities • Completely stable • Optimized for 10 thru 30 MHz • 9 V battery • 2-1/8 x 3-5/8 x 5-9/16 inches



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MFJ-40T QRP Transmitter

Work the world with 5 watts on 40 Meter CW.

• No tuning • Matches 50 ohm load • Clean output with low harmonic content • Power amplifier transistor protected against burnout • Switch selects 3 crystals or VFO input • 12 VDC • 2-3/16 x 3-1/4 x 4 inches

MFJ-40V, Companion VFO $29.95
MFJ-12DC, IC Regulated Power Supply, 1 amp, 12 VDC $29.95

$49.95

BRAND NEW

MFJ-202 RF Noise Bridge

This MFJ RF Noise Bridge lets you adjust your antenna quickly for maximum performance. Measure resonant frequency, radiation resistance and reactance. Exclusive range extender and expanded capacitance range gives you much extended measuring range.

• Tells whether to shorten or lengthen antenna for min. SWR • Range extender and expanded cap. range (±150 pf) for wide imp. measurements • 1 to 100 MHz

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C-500 Digital Alarm Clock

This digital alarm clock is also an ID Timer. Assembled, too!

• Gives ID buzz every 9 minutes automatically, or after tapping ID/doze button • Pressing ID/doze button displays seconds • Large .63 inch digits • Easily zeros to WWV • AM and PM LED indicators • Power out indicator • Fast set, slow set buttons • 110 VAC, 60 Hz • 3-1/8 x 3-3/4 x 3-3/8 inches • One year warranty by Fairchild

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Order today. Money back if not delighted. One year unconditional guarantee. Add $2.00 shipping/handling.

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HAM RADIO HORIZONS

January, 1978
Volume 2, Number 1

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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

Microfilm copies
are available from
University Microfilms, International
Ann Arbor, Michigan 48103

Cassette tapes of selected articles
from *Ham Radio Horizons* are available to
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919 Walnut Street, 8th Floor
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CONTENTS

The Second Year of *Ham Radio Horizons*! It seems hard to believe that nearly twelve months have passed since we put the final touches on that all-important first issue and then waited to see just how our reception would go.

It's all history now, and exciting history at that. *Horizons* has been very well accepted, and both our magazine and amateur radio have continued to grow at a very brisk pace; we like to feel that these two events go hand in hand. *Ham Radio Horizons* continues to introduce amateur radio to many potential newcomers, while the tens of thousands who have been licensed in recent months have provided us with an ever-growing, eager, group of new subscribers.

We would particularly like to extend a welcome to several thousand subscribers who have joined us in the past month or so from sources outside the ranks of amateur radio. Your new readership is both an honor and a responsibility to all of us here at *Ham Radio Horizons*, and we promise to do our very best to show you just what ham radio is all about, and how to start getting in on all the fun the rest of us are having with this fascinating hobby.

We have some good plans for *Ham Radio Horizons* in 1978, and you should find each issue even more useful and exciting than ever before. You'll find a new column, "Benchmarks," which will focus on those small ideas and gadgets which can make the maintenance and operation of an amateur station so much more enjoyable. For many, these pages may well become one of the most valuable aspects of their electronics library.

Many excellent, new, feature articles are in the works, including both a new Novice transmitter and receiver that have been designed specifically with the newcomer in mind. They'll be easy to build, and perhaps of even more significance, all of the required components will be easy to find. You can look for the first of them by mid-year, with the other not too far behind. There will be some excellent articles on the important part that clubs play in amateur radio. You'll learn about the good features (and some bad features) of many clubs, and also what your organization can do to stress the positive side of things.

We'll be growing in 1978: as more and more advertisers learn of the unique advertising opportunities that *Ham Radio Horizons* offers we will be able to bring you larger issues with even more good ideas and projects. We'll also be doing a lot of hard work to line up a lot more new readers (we hope to at least double our circulation this year), and, hopefully, reach out to many real good candidates for the amateur ranks.

As you can see, we are all planning for a busy and exciting year at *Ham Radio Horizons*. Stay tuned along with us and join in on all the fun.

Skip Tenney, W1NLB
Publisher

More details? Ad Check page 78.

FOCUS & COMMENT

In the first issue of *Horizons*, March, 1977, we had a letter from a reader asking how to get started in putting a ham station together. Some of the articles we have printed since then have been aimed at providing this information, notably "Your Station From the Ground Up," in April, "Be Proud of Your Hamshack," in September, and "Amateur Station Accessories," in November. Then, too, there was "Get On the Air On A Budget," in the same first issue that saw the letter published in the *Postbox* section.

An idea was put forth in the Editor's answer to that letter — how about some readers sending in photographs and descriptions of their stations so we could show the uninitiated what amateur stations look like.

I'm glad to say that response to the idea has been good, and that we are starting 1978 in the proper manner by presenting a *Station of the Month* in this, the January issue.

There are several important areas to consider when the *Station of the Month* is being selected, and the two that are foremost in our minds are that the station depicted must be meaningful to a beginner, and the accompanying photograph must be of sufficient quality to withstand the rigors of magazine reproduction; the greatest station layout in the world will be meaningless if the photograph is fuzzy, dark, pale, streaked, or if the composition is poor.

There are no restrictions as to cost, amount of equipment, shack size, mode(s) of operation, or whatever. Photographs that have the operator visible are fine, of course, as long as the perspective doesn't cause him (or her) to hide a major portion of the equipment from view. After all, we are interested in showing other hams some ideas about setting up their own stations.

We are also trying to show people that a good, working, hamshack is an achievable goal — therefore a photograph that shows a roomfull of equipment costing kilobucks does not guarantee that it will be selected; but, neither does it automatically get ruled out because of cost. I guess the word I am looking for is "relevant."

Each station that is selected and published will receive a suitable gift from our Ham Radio's Communications Bookstore. We'll start out with Alice Clink Schumacher's excellent book, *Hiram Percy Maxim*. It's an enthralling story of the man acclaimed "father of amateur radio," who had the vision and perseverance to take steps to secure the existence of our great hobby — a book that should be read by every amateur and would-be amateur.

At year's end, we will look over all of the stations selected, and see if there is any way to choose the best of the lot (without getting our ears roasted in the process). The one selected will receive a three-year subscription to *Ham Radio Horizons*.

You'll find suggestions about photographs and written material on page 64, where we present our first selection as *Station of the Month*. Dust off your camera, put a new ribbon in the typewriter, and let us know about your station if you feel that it has something to offer a beginner who wants to know, "but what will my station look like?"

Tom McMullen, W1SL
Managing Editor

SPECIAL TRIPLE BONUS DEAL on KENWOOD TS-820S

SERVING HAMS *BETTER!*

North ... south ... east ... west

All leading brands ... in-depth stocks ... new/used gear.

The deal:

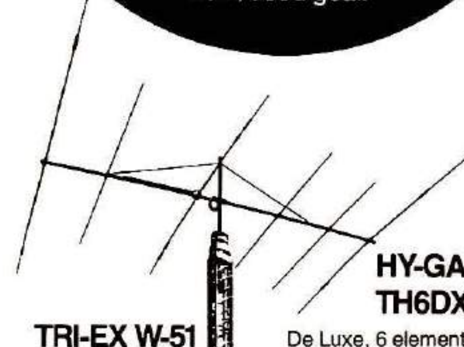
1)—**Send us 1048.00*** (in the form of check, M/O, BankAmericard, VISA, Master Charge)

2)—**We'll ship you immediately, a beautiful brand-spanking-new, peerless performing KENWOOD TS-820S TRANSCEIVER!**

3)—**PLUS a BIRD Model 43 wattmeter** (a 120.00 retail value). **or . . . De luxe Remote VFO** (for TS-820S)

4)—**PLUS prepaid shipment of both items** (UPS Brown)

*(Calif. residents add 6% sales tax)



TRI-EX W-51 TOWER

Our "package" deals can't be beat!

The "package" antenna, tower, rotator

Inquire

Every-day special

CDE HAM III rotator

129.95

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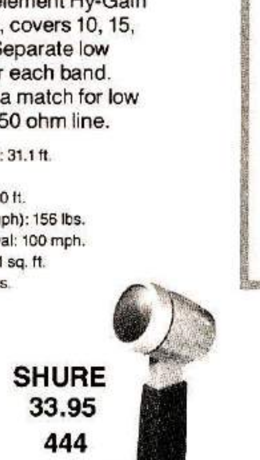
HY-GAIN TH6DXX

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.

ICOM IC-22S VHF transceiver **249.00**

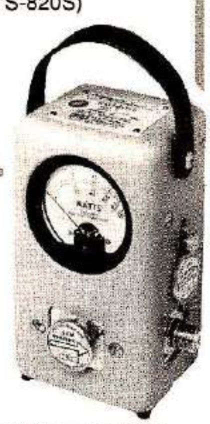


SHURE 33.95 444

RFE-100 DIGITAL READOUT (for Drake R-4C receiver) **169.95**

DRAKE R-4C RECEIVER

A limited number at old price of **599.00**



BIRD ELEMENTS

(Not supplied with BIRD wattmeter)

2-30MHz ... **42.00**

25-1000MHz ... **36.00**

← shipped prepaid (UPS Brown) →

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

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Bob Ferrero, K6AHV/W6RJ, Jim Rafferty, N6RJ, other well known hams, give you courteous, personalized service.

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1 mile east Knott's Berry Farm *(213) 860-2040*	5 miles south on 101 from S.F. Airport.	Dealer inquiries invited.

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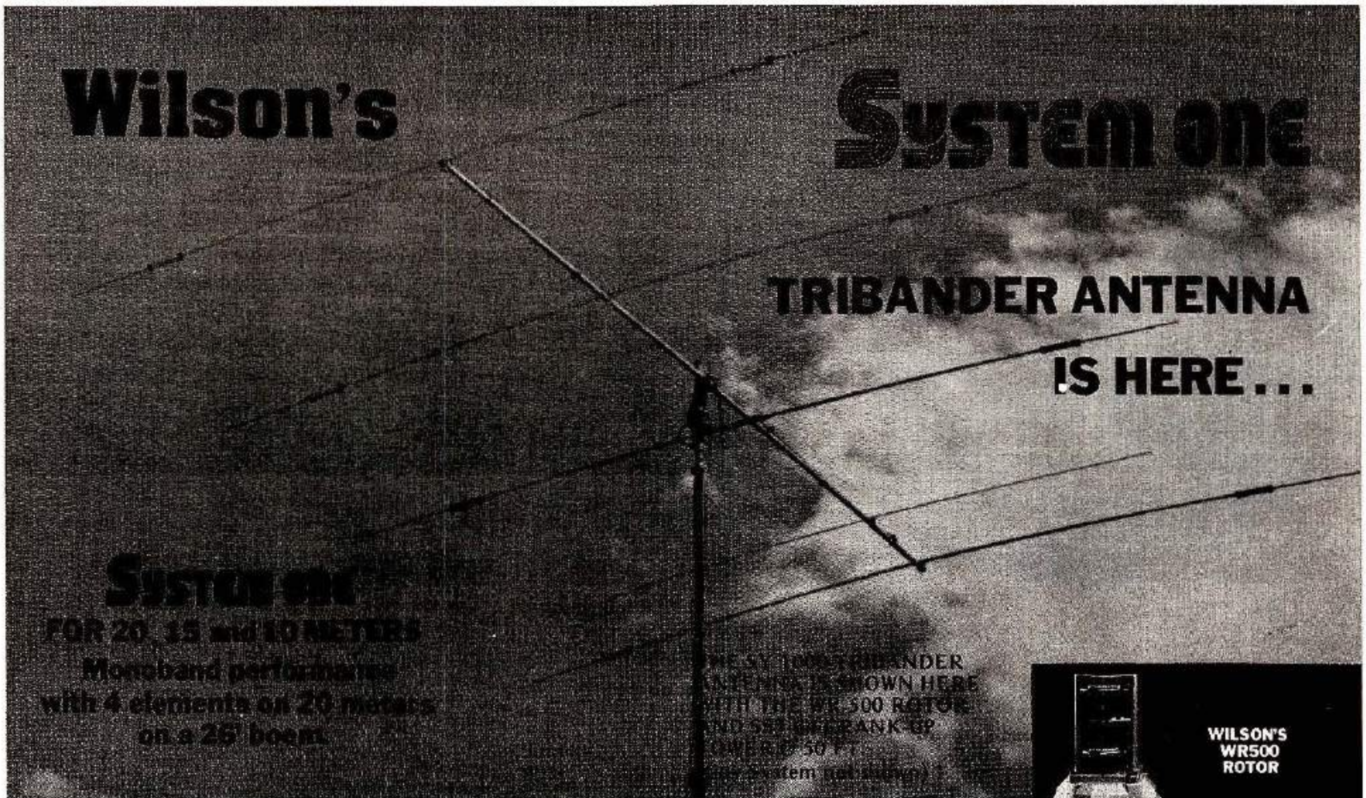
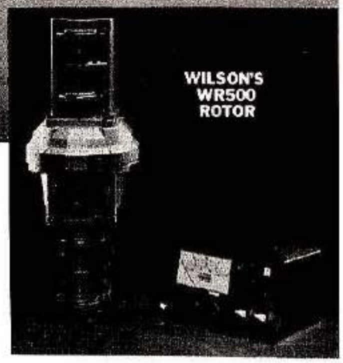
More details? Ad Check page 78.

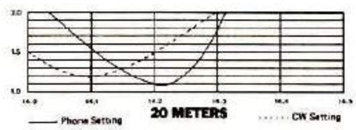


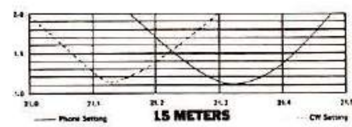


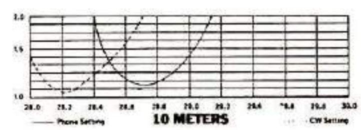
The new standard of performance for Tribanders is the Wilson System One!!! A DX'ers delight operating 20 meters on a full 26' boom with 4 elements, 4 operational elements on 20-15-10, plus separate reflector element on 10 meters for correct monoband spacing. Featured are the large diameter High-Q Traps, Beta matching system, heavy duty Taper Swaged Elements, rugged Boom to Element mounting . . . and value priced at $259.95. Additional features: • 10 dB Gain • 20-25 dB Front-to-Back Ratio • SWR less than 1.5 to 1 on all bands.

MODEL SY-1 SPECIFICATIONS:

Matching Method:	Beta	F/B Ratio	20-25 dB	Mast Diameter	2" O.D.
Band MHz:	14-21-28	Boom Length	26' (2" O.D.)	Boom Diameter	2" O.D.
Maximum Power Input:	Legal Limit			Surface Area	7.3 sq. ft.
Gain	10 dB	No. of Elements	5	Windload Area	146 lbs.
VSWR (at Resonance)	1.5 to 1	Longest Element	26' 7"	Shipping Weight	50 lbs.
Impedance	50 ohms	Turning Radius	18' 6"		







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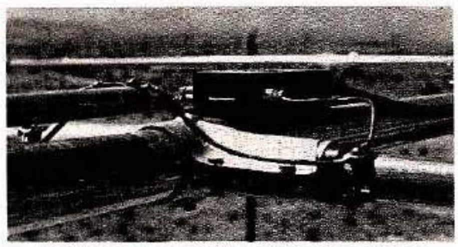

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NEWSLINE

FCC'S DROPPING OF DOCKET 19759, the proposal that the 220-MHz Amateur band provide a home for a new CB service, doesn't mean that the band won't still become the new CB home. It does remove the immediate threat to the band, however, and many opinions have it that the longer the decision on where CB should go is delayed, the less likely 220 becomes as a choice.

In Announcing Its Termination of Docket 19759 the Commission pointed out that so many changes in related circumstances have occurred since several thousand comments were filed on it back in 1973, those comments are now obsolete. However, the question of new CB frequencies is still very much alive, and 220 will undoubtedly be one of the options when the Commission considers the issue again in a future rulemaking.

THE LARGEST NON-EMERGENCY AMATEUR RADIO net operation ever organized provided total communications for the October, 1977, New York City Marathon, in which over 5000 runners from all 50 states and 38 foreign countries participated. 221 New York and New Jersey Amateurs, coordinated by the Tri-State Amateur Radio Council, provided communications for the 26-mile, 385-yard race through all five New York City boroughs. Long Island Mobile Amateur Radio Club alone provided 65 operators for the event, which used repeaters WR2 ACD, ACH, and AFE plus simplex.

Fine Amateur Radio PR resulted, with over a million and a half spectators seeing and hearing Amateur Radio at work during the 12-hour event. Congratulations to Coordinator WA2DHF.

AMATEUR LICENSING IRREGULARITIES will receive a full-fledged investigation run by an FCC Administrative Law Judge. The decision to go all-out on such a probe was reached at a closed meeting of the Commission last October, when information was presented that some of the same abuses may have occurred without payment; and that some amateur callsigns have been issued inconsistent with normal FCC procedures.

Such An Inquiry is a very formal proceeding including subpoena powers and the ability to require witnesses to testify. Though it will undoubtedly be Washington based, it's entirely possible that sessions will also be held in other cities. It has been considered likely for some time that a full-bore probe would be forthcoming, with as many as several hundred amateurs involved. When the story broke back in August, 1976, one of the investigators was quoted as saying they had uncovered "just the tip of the iceberg."

A PIRATE 220-MHZ REPEATER operating in Chicago as a "commercial telephone service" was shut down in early November by the FCC's Chicago Field Office after a two-week-long investigation. No Amateur Callsigns were ever heard and it's probable that most of the "subscribers" (including a tire wholesaler and a medical clinic) thought they were perfectly legal.

NEW MANAGER OF AMSAT QSL BUREAU is Ross Forbes, WB6GFJ, P.O. Box 1, Los Altos, California 94022. Former manager, WAIEHF, is stepping down after 4½ years at the helm. Ross is well qualified, having spent 1969-1972 as manager of the ARRL W6 QSL Bureau, which handles over 90,000 cards per month!

Donations From Clubs and Individuals to the solar cell and battery funds have brought in nearly $18,000, proving the effectiveness of AMSAT's recent-heavy publicity campaign.

Several Donations of $1000 Each have resulted in the names and callsigns of the donors being inscribed on a plaque to be carried into space aboard the first Phase Three satellite.

A New Satellite Bandplan is going into effect January 1, which will place CW only on the bottom third of the satellite downlink, mixed CW and sideband in the center third, and ssb only on the top third — just the reverse of current practice.

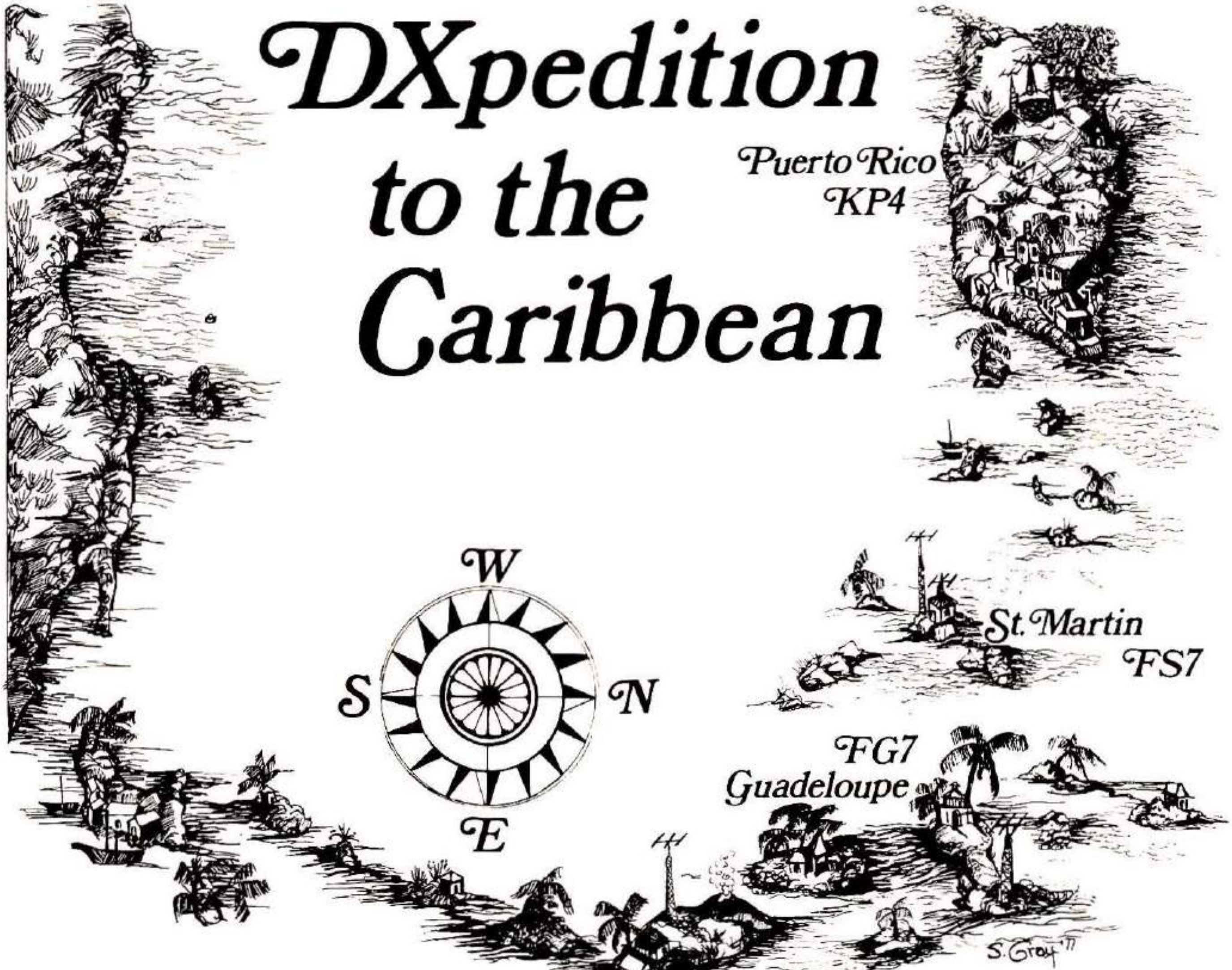
Arthur C. Clark, The noted science-fiction writer, has been made an honorary AMSAT member in ceremonies attended by most of the AMSAT brass — Clark's honor came in recognition of his predictions of communications satellites and synchronous satellites in a 1945 Wireless World article.

FCC'S NEW CHAIRMAN, Charles D. Ferris, was sworn in October 17 by Vice President Mondale at White House ceremonies. Chairman Ferris has a B.S. in Physics and a law degree, and until his appointment to the Commission was general counsel to House of Representatives Speaker Thomas O'Neill.

FCC Safety and Special Services Chief Charley Higginbotham, in a banquet speech at the November SAROC Hawaii hamfest, warned that autopatch abuses continue to jeopardize interconnect abilities for the Amateur Service. "It's your decision!" he said, and if we don't clean up our act we'll end up with formal Commission proceedings that will severely curtail, if not eliminate, amateur freedom to tie into the telephone system.

CB AND TV ANTENNAS will both require warning labels, and detailed safety instructions for proper installation must be included with each antenna, under the terms of a proposal just issued by the Consumer Product Safety Commission. In its brief announcement of the new proposal, no mention of Amateur Radio antennas was made.

DXpedition to the Caribbean



BY DOUG GRANT, K1DG

It all began while we were still in high school. Bill, WA1JKJ, and I planned a dream vacation to almost every island in the West Indies. Air fares and hotel rates were computed and every minute accounted for. We decided that we'd need one or two other people with us, and the plans were shelved until an appropriate college semester break rolled around. Unfortunately, finding two other people proved as difficult as finding enough money, and our trip didn't happen — then.

Most people consider the Caribbean to be a playground for the jet set — a land of perfect tans in the winter and a place to unwind and relax. There's an added perspective for the radio amateur: many of the islands in the West Indies are considered separate countries for DXCC award purposes. Additionally, very few active ham operators are on these islands. Thus, when a visitor brings a radio along on his vacation, strings up a few antennas, and begins to operate, it isn't long before he's deluged with stations calling him. It's every ham's dream to be on the other end of a pileup for once. Add that to the everyday charm of the area, and it becomes a true dream vacation!

Bill graduated from college a year ahead of me and took a trip to the French island of St. Pierre in March 1975. St. Pierre is, unfortunately, not in the West Indies; rather it is in the North Atlantic, not far from the Canadian Maritime provinces. The weather was terribly cold, but Bill had a chance to experience operating from a semi-rare country and was hooked. Two months later, I finished school and started to work. With a cash flow, it appeared that our trip south might actually take place. After a few false starts, we obtained licenses to operate on the French island of Guadeloupe and were on our way.

First stop: San Juan, Puerto Rico

It was a typical October morning in Boston —

temperature about 45F (7C) and overcast. We were both unprepared for the 90F (32C) heat and high humidity in San Juan, Puerto Rico, that afternoon. Since we had several hours before our next flight, we shed our sweaters, stored our luggage in a locker at the airport, and took a taxi downtown.

The taxi driver turned out to be a Boston Red Sox fan. When he learned we were from Boston, he agreed to show us around San Juan for a while. We then decided to explore Fort Morro on foot, then went down to the "old city." After all the walking around, we started looking for someplace to eat. We found a cab and asked the driver to take us to McDonald's. He didn't speak any English. Bill explained in Spanish that we wanted hamburgers from a restaurant with golden arches; the driver took us to Burger King. Close enough.

When we got back to the airport, the first order of business was to check in at the Air France counter for our flight to Guadeloupe. We had no problems and went to the gate area to wait. As we approached, one of the other waiting passengers spotted the radio in Bill's hand and introduced himself as Austin Regal, K4YFQ. Austin was on his way to Sint Maarten, a Dutch possession in the Caribbean, which was an intermediate stop on our flight. We compared plans, swapped stories, and marveled at the coincidence of meeting. We arrived in Guadeloupe at 10:30 PM, found a hotel, checked in, and fell asleep.

Adventure in Guadeloupe — a contest

The next morning we took stock of our situation. We had a license, a rig, several spools of wire, and several hanks of rope. Our hotel was surrounded by other buildings and wasn't in a good radio location. We clearly needed some place more suited to our particular needs. We then consulted our *Callbook* and set out to visit some of the local amateurs.

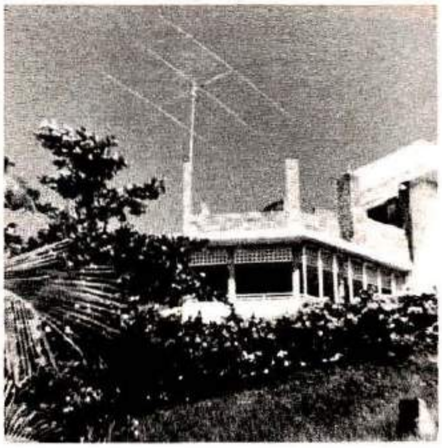
Hams are pretty easy to find. We climbed to the top of a tall building and looked for a house with antennas on it. After we spotted one, we walked toward it, and rang the bell. And, as luck would have it, Jean Wegimont, FG7XT, answered the door. We introduced ourselves as American hams on vacation, and he received us with open arms. Jean is in the import/export business and was at one time an underwater photographer. He's a long-time friend of Jacques Cousteau and a most interesting fellow to talk with. His radio station is very impressive, equipped for all bands, including OSCAR, and all modes including slow-scan television and radio-teletype. Jean is probably the most active ham on the island and is nearing completion of 5BWAS — all on teletype!

Yvon, FG7AK, and Jack, FG7TD, get together for a visit in Gosier.

After several Cognacs we asked Jean if he could recommend a hotel where we could operate. He said that there was a hotel nearby, which was on a hill near the water (and managed by a ham, no less). A few phone calls later, we were on our way there.

Au Grande Corsaire is a restaurant located in the resort village of Gosier. Nearby are six bungalows under the same management and available for a modest charge. As we pulled up in front of the restaurant, we noticed first the triband antenna on the roof, and second, a fellow rushing out to greet us, who turned out to be


Bill, K1MM, and Don, W1MIW/FP0DB, aboard FP8AP's boat *Atta Boy* for the March, 1975 FP0MM operation. If the operators look cold, it's because it is; about −20°F (−28°C). That's enough to drive you to a warmer climate, and it did.



Au Grand Corsaire in 1975. The first FG0MM operation took place from the room at right, atop the building.

the manager, Yvon Kerguen, FG7AK. Yvon welcomed us, brought us drinks, and then excused himself, explaining that he was needed in the kitchen. As we found out, Yvon is also the master Chef of the restaurant. After dinner, we were shown to our bungalow, where we collapsed, exhausted but encouraged by our good fortune thus far.

Next morning we explained to Yvon that we would like to operate his station during a contest weekend. He cooperated with us to the point of letting us take over his room at the restaurant while he moved into a vacant bungalow. Thus, we were able to use his antennas rather than our own. Yvon didn't have an 80-meter antenna, however, so we strung up a wire between two palm trees as a temporary solution. During the day, Jack Deckmyn, FG7TD, came over to visit. Jack is a priest in Gosier and we had a chance to visit his station several days later. He noticed we didn't have either a wattmeter or an antenna switch and returned later with one of each to loan us. They were quite useful for adjusting antennas and made operation in the contest much more effective.

Our main objective in going to Guadeloupe was to operate in a contest. Contests are sponsored by several organizations with the intent of developing operating skills in a competitive atmosphere. Scores are calculated on the basis of number of stations contacted as well as the number of different states, countries, or geographical zones contacted, depending on the contest. Obviously, the fellow in a rare country becomes popular, because he's everybody's only chance to talk to that country. A little research showed that there hadn't been any contest activity from Guadeloupe in several years, and that's why we went there. We had obtained the call sign FG0MM, and when the contest began at 7 PM Friday we were ready.

The next 48 hours were a chaotic mixture of operating, sleeping, eating, and taking some breaks to go swimming or sunbathing. When the contest was over we'd amassed over 4700 contacts and sufficient countries for a score of over 3 million points — good enough for fifth place worldwide! After a bottle of champagne to celebrate our success, we began planning the next trip, and Yvon assured us we'd be welcome.

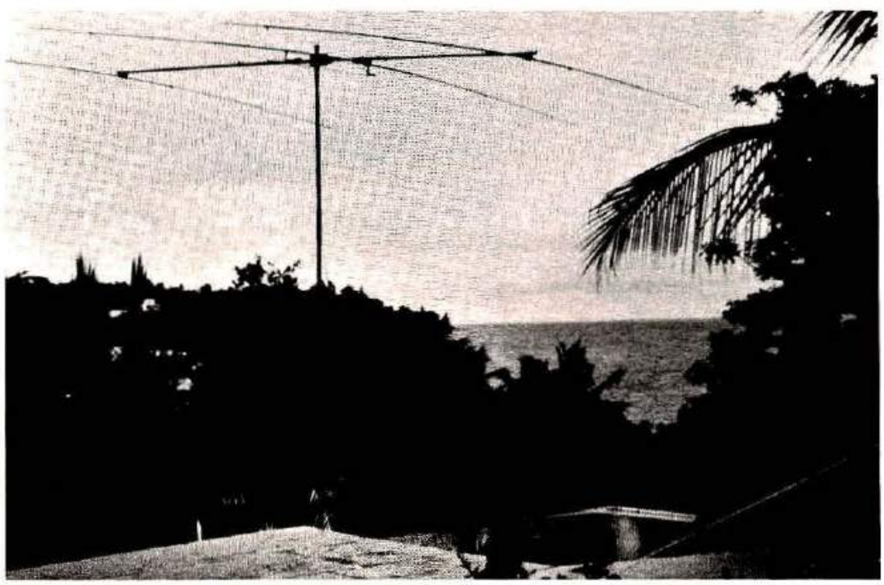
We spent the next few days touring Guadeloupe and on our last night there, we dined at Yvon's restaurant with a National Geographic Society officer, who was vacationing in the islands. Yvon prepared a special dinner for us, which was a culinary triumph. After dinner, he asked us to sign his guest book, which included signatures from visiting royalty, most of the *National Geographic* staff, and about a dozen other hams from several countries. We signed it and promised to return.

Further adventures — St. Martin and Martinique

Mark Pride, WA1ABV, offered his assistance by designing and building a full-size, 3-element 15-meter beam antenna that was lightweight and would easily knock down to fit a 4-foot-long (1.2m) case. Also, we brought along several telescoping sections of tubing for use as a vertical antenna as well as pre-cut wire dipoles for each band and plenty of rope. We were much better prepared this time than on our first trip.

Our first stop was French St. Martin. French St. Martin occupies the northern part of an island in the Netherlands Antilles, which is about 50 miles (80km) east of Puerto Rico. The southern part of St. Martin is administered by the

Au Grand Corsaire, 1976 — the view to the east includes the portable 15-meter Yagi on top of our bungalow.



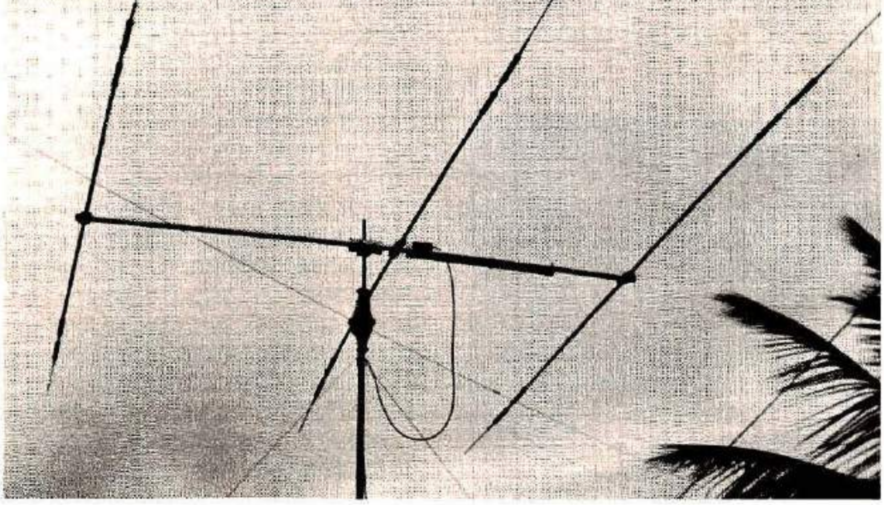
Netherlands and is known as Sint Maarten. We'd been informed beforehand that the management of Le Pirate, a small hotel in Marigot, had no objection to visiting amateurs stringing antennas on the grounds. Clearly, this was the place to stay. Upon our arrival, the desk clerk assigned us to room 6, where, he said, "all the hams stay." When we got to the room we took stock of our situation. We knew that all our checked baggage had missed the connection in San Juan and wouldn't arrive until the following day. Our clothes and personal items were in Puerto Rico, but we had the important things on hand (the transceiver, microphone, keyer, and the wire antennas), so we immediately put up a 40-meter dipole and began to operate.


Room 6 at Le Pirate — K1DG operating FGØMM/FS7 on 40 meter CW as a warm-up exercise for the contest.

When we took a break for dinner, we decided to give Alain Rochemont, FG7AR/FS7, a call on the telephone. Alain informed us that we weren't the only American hams on the island, since Terry, W4GSM, was also visiting. Terry and Alain dropped by Le Pirate that evening, and the four of us sat around talking until nearly midnight. Alain, the only active ham on the French half of the island, works at the power company. He came over several times to visit and answered our questions about the island. Terry was preparing for the contest the following weekend. He's a veteran island-hopping ham and had some good advice to offer on the subject.

During the next few days, we managed to recover our lost suitcases, put up a few antennas, see some of the sights on the island, and make about 2000 contacts in all 50 states and 65 countries. Several of the hams we contacted asked us if we were at Le Pirate in room 6 — where they had stayed! The desk clerk wasn't kidding after all!

Some of the antennas used at FGØMM in October, 1976, are visible here — including a tribander and various wire antennas.



We visited Terry again just before we left. He'd been joined by Jim, W4PRO, and Don, WA4DUS, at Le Grand St. Martin, a hotel on the north side of Marigot. Terry had brought a 60-foot (18m) aluminum tower with him as well as several antennas more elaborate than our wires. They used Jim's call sign, FGØCXV/FS7, for about three weeks including the contest weekend. Between their operation and ours, French Saint Martin became a little less rare.

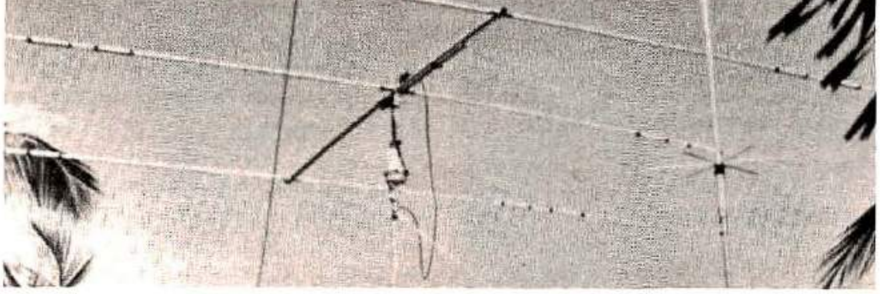
Back to Guadeloupe

Our next stop was familiar Guadeloupe. Yvon was no longer manager of the restaurant on the hill, having taken over a smaller place on the beach. His triband antenna was still on the roof of the building on the hill, and our makeshift 80-meter wire was still in the air. We never expected it to last that long! Since Yvon's new location was not suitable for the contest, we opted to set up the station in a bungalow about half way up the hill.

We removed his tribander and installed it at the bungalow, strung up some wires, and were on the air. We borrowed some pipe from a neighbor and put up the 15-meter antenna. Mark's design worked fine — it took only about a half hour to install, starting with the antenna in pieces on the ground, and finishing with the whole thing in the air and in use.

A few vertical antennas were also erected for standby use and we were ready to go. Unfortunately, the air conditioner in the bungalow failed the day before the contest, and the torrential downpours of the week before created oppressive humidity, which sapped our strength during the contest. We did manage slightly under 4000 contacts and enough multipliers to top our previous score by ten per cent or so. Our biggest problem was the triband beam — the traps were full of water and the antenna wouldn't work on 20 meters. But considering the 2000 stations we contacted on 15 meters, we were satisfied. In fact, we were able to sustain rates of 200-250 contacts per hour for several hours each day. It really is a switch, operating from the DX end. During the contest, we ran across FG7AS on the air, a relative newcomer to Guadeloupe. Sam and his brother Jude, FG7XA, are both very active and came over several times to visit during the contest and afterwards to dine with us at Yvon's restaurant. We've talked to both Sam and Jude (who prefers CW) several times since returning to the United States, and expect to see Sam again when he visits the Boston area next winter. We visited Jean Wegimont, FG7XT, once again and borrowed some of his equipment for use in the contest. It's amazing how helpful the local amateurs have been every place we have operated. We've been welcomed with open arms and have always been offered equipment, antennas, advice, and assistance in finding places to stay and putting a station together. Ham radio truly is an international brotherhood.

Verticals, beams, and wires at FG0MM in 1976.



On to Martinique

After our stay of a week or so on Guadeloupe, we bade our friends good-bye and headed further south. Our destination this time was Martinique and the call sign FM0MM. Martinique was the first of the islands to actively promote tourism as an industry in contrast to Guadeloupe, which is still not fully geared to tourists. In Trois-Ilets, across the bay from Fort-de-France, luxury tourist hotels abound. There isn't a similar area on St. Martin (although the Dutch side is tourist oriented), and the resort hotels on Guadeloupe aren't all in the same area. Upon arriving at Trois-Ilets, we looked at a few hotels and finally settled on the Frantel, since it had a high roofline, a large lawn, and was right on the water.

We strung up a few wires, erected the vertical, and handed out 500 or so contacts in our two-day stay. Much of our time was devoted to sunbathing, since we had been too busy beforehand to really get tanned. We also had an opportunity to visit a small fishing village on the east coast of the island which, except for the cars, looked much the same as it must have for a hundred years. We found Fort-de-France to be an interesting city, which seemed to have been transplanted intact from Europe with all the stores and shops typical of a small city in France. We spent more time playing tourist on Martinique than we did playing ham radio, but enjoyed ourselves just as much.

In retrospect

All in all, our trip netted over 6000 contacts from the three countries in which we operated. We worked several stations from all three countries, including Austin, K4YFQ. You'll recall he was the ham we met in San Juan on our first trip to Guadeloupe in 1975. He had originally planned to come with us in 1976, but was unable to arrange the trip. However, he was with us on the air everyplace we went, keeping tabs on us. In fact, we run into each other often on the air and have become good friends. I'm amazed at how much has happened, and how many new friends Bill and I have made as a result of our afternoon musings about a vacation in the Caribbean — and bringing some ham gear along. It's been a truly unforgettable experience. **HRH**

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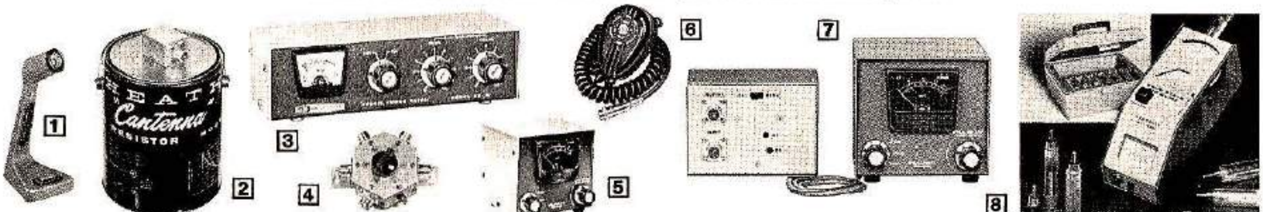

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simple dipole antennas

BY JIM FISK, W1HR

One band, two bands, three bands, more . . .

Of the many types of antennas which are described in the amateur magazines, the most popular single-band antenna for 80 and 40 meters is the half-wavelength dipole, fed in the center with low-loss coaxial transmission line. The same type of antenna also provides excellent performance on 20, 15, and 10 meters. The dipole's popularity is not without reason — among its many advantages are low cost, easy installation, and simplicity. Unless you make a poor solder connection, or use old, deteriorated coaxial cable, it's pretty hard to build a dipole that doesn't work right the first time you connect your transmitter to it and call CQ.

The length of the basic half-wavelength dipole antenna shown in **Fig. 1** is given by the simple formula

$$\text{Dipole length (feet)} = \frac{468}{f_{MHz}}$$

$$\text{Dipole length (meters)} = \frac{142.5}{f_{MHz}}$$

where f_{MHz} is the chosen operating frequency in MHz. Calculated half-wave dipole lengths for various frequencies on 80 through 10 meters are given in **Table 1**. Although the method of fastening the insulators, and the antenna's closeness to other objects, will have some effect on the dipole's resonant frequency, it's surprising how close a carefully measured and built antenna will resonate to the design frequency.

Antenna height

For daylight operation on 40 and 80 meters, and for close-in work on the higher amateur bands, antennas that are only 20 to 25 feet (6-8 meters) high work nearly as well as dipoles installed at greater heights. Over longer distances, however, the performance improves almost linearly with heights up to about 50 feet (15 meters), and more slowly for greater heights. If you don't have a couple of 60-foot (18-meter) trees in your backyard to support your dipole, don't worry about it; a low antenna outperforms a high one often enough to make it interesting, especially over distances up to 100 miles (160 km) or so.

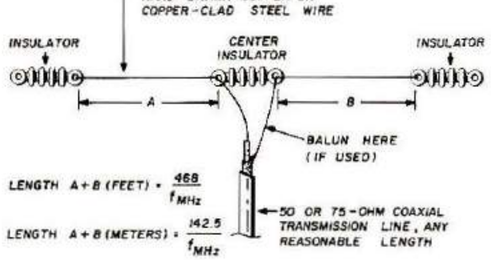


Fig. 1. Construction of the basic-half wavelength dipole antenna. Lengths for various frequencies on the high-frequency amateur bands are listed in **Table 1**.

Dipole radiation resistance

Theoretically, in *free space*, the radiation resistance or antenna feedpoint impedance of a half-wavelength dipole of small diameter wire is close to 72 ohms. When the half-wave dipole is installed over perfectly conducting ground, however, the radiation resistance varies with height, as shown in **Fig. 2**. Unfortunately, you're not going to come anywhere close to a perfect ground unless you have your hamshack on a houseboat anchored in saltwater. Since the ground under your antenna isn't perfect, the radiation resistance won't be exactly that shown in **Fig. 2**, but this graph should give you an idea of the range of values to expect. In practical terms, half-wavelength dipoles which are installed at reasonable heights over average ground provide an excellent match to 50- or 75-ohm coaxial cable, and that's what is important!

Antenna resonance

Every antenna, including the simple half-wavelength dipole, is really a complex electronic circuit consisting of resistance, capacitance, and inductance. At a certain frequency the effects of capacitance and inductance cancel out, and at this point the antenna is said to be resonant.

Below resonance the

antenna looks capacitive, and above resonance it looks inductive. This is important because it means the antenna is resonant at only *one* frequency; since amateurs don't limit their activities to a single, spot frequency, their antennas are seldom used at resonance. This has practically no effect on how well the antenna radiates, but it does affect the feedpoint impedance, the standing-wave ratio (swr), and ultimately, transmitter output power.

Swr itself is usually not a problem, but the output matching networks in most modern amateur transmitters (and transceivers) are designed for a maximum swr of 2:1. If the swr is greater than 2:1, the matching network in the transmitter simply can't compensate for the impedance mismatch, so the transmitter can't be loaded to full power input. In some solid-state transmitters the manufacturers even build in a circuit that shuts down the transmitter if the swr exceeds 2:1.

Amateur radio is unique among the radio services in that amateur operators can move at will from one frequency to another. There are exceptions, of course, but professional antenna engineers are accustomed to designing antenna systems for operation on a single frequency. Therefore, there is very little published experimental data on the performance of a half-wavelength dipole over a whole band of frequencies; the information which is available is difficult to translate into practical terms unless you have a degree in advanced

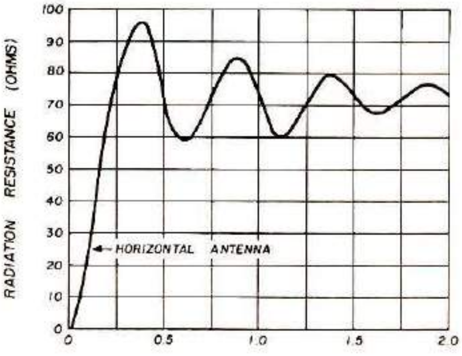


Fig. 2. Radiation resistance or feedpoint impedance of a horizontal half-wavelength dipole varies with height above a perfectly conducting ground. The earth under your antenna is not a perfect conductor, but this graph will give you an idea of the range of values to expect. A half-wave dipole, installed at a reasonable height over average ground, provides an excellent match to 50- or 75-ohm coax.

Glossary of Terms

Antenna tuner or antenna matching unit is a device which uses a combination of variable capacitors and inductors to provide a means of matching the low output impedance of your transmitter to the unequal (usually much higher) impedance of the transmission line to the antenna. Also called a Transmatch.

Balun is a device that will provide a transition between an unbalanced (to ground) feedline such as coaxial cable, and a balanced line or antenna such as twin-lead or a dipole. The term is derived from *Bal*anced-to-*un*balanced.

Dipole is literally *two* poles, an antenna that has two poles or "arms" which are separated by an insulator and connected to each other through the transmission line. The dipole is sometimes called a doublet antenna.

Dummy load is a device which accepts rf power and dissipates it as heat. A dummy load should always be used when tuning up a transmitter to eliminate unnecessary transmissions and interference.

Feedline or transmission line is one or more electrical conductors that conduct radio-frequency energy from your radio to the antenna. The most popular feedline used by amateurs is coaxial cable, often called *co-ax*.

Impedance is the apparent resistance of a load in an ac or rf circuit that opposes current into that load. It consists of the ohmic resistance plus the effects of inductance or capacitance in the circuit.

Insulators for antennas are often egg-shaped or cylindrical, are made from ceramic, glass, or plastic, and have small holes at each end: one for attaching the antenna wire, and the other for the supporting line or *halyard*.

Mismatch is short for impedance mismatch, for example, when the impedance of the feedline doesn't match the feedpoint impedance of the antenna. For best efficiency the impedances should be closely matched. The amount of impedance mismatch is defined by the SWR or standing wave ratio (for a perfect match the SWR = 1:1).

SWR is an acronym for standing-wave ratio which is the ratio of a voltage maxima to the voltage minima along a feedline. VSWR or *voltage* standing wave ratio is the more proper term for the same thing. The ideal situation is to have a *flat* feedline — a VSWR of 1:1. The VSWR on the feedline can be changed *only* by changing the impedance at the load (antenna) end of the line.

SWR Bridge is more correctly an SWR Meter because few instruments of this type are true bridge-type units. The SWR Meter samples both the rf energy going toward the antenna (load) and the energy reflected back because of an impedance mismatch. The indicator may be calibrated so either a direct comparison of power levels or their ratio is possible.

Transmatch is a popular type of antenna tuner first described by W1ICP in *QST* and later sold commercially by the James Millen Company. The term is now commonly used to describe all types of antenna tuners and antenna matching units.

Table 1. Length of half-wavelength dipole antennas for various frequencies in the high-frequency amateur bands.

Band	Frequency (MHz)	Use	Half Wavelength (feet, inches)	(meters)
160	1.825	General	256′ 5¼″	78.2
160	1.875	General	249′ 7¼″	76.1
80	3.600	CW	130′ 0″	39.6
80	3.725	Novice	125′ 7½″	38.3
80	3.750	General	124′ 9½″	38.0
75	3.800	Phone	123′ 2″	37.5
40	7.100	CW	65′ 11″	20.1
40	7.150	General	65′ 5½″	19.9
40	7.175	Novice	65′ 3″	19.8
40	7.250	Phone	64′ 6½″	19.7
20	14.050	CW	33′ 3 ¾″	10.15
20	14.150	General	33′ 1″	10.08
20	14.200	Phone	32′ 11½″	10.05
20	14.275	Phone	32′ 9½″	10.00
15	21.100	CW	22′ 2″	6.76
15	21.175	Novice	22′ 1¼″	6.72
15	21.225	General	22′ ½″	6.72
15	21.350	Phone	21′ 11″	6.68
10	28.050	CW	16′ 8¼″	5.09
10	28.150	Novice	16′ 7½″	5.07
10	28.510	Phone	16′ 5″	5.00
10	29.475	Oscar	15′ 10½″	4.84

mathematics — and time to correlate the theory with measured results.*

There's another problem with the published information: it is based on an antenna in free space. When a dipole is installed near ground — even several wavelengths above ground — the antenna behaves differently than it would out in free space. This is further complicated by the fact that the earth under your antenna has different electrical characteristics from every other antenna site, even one at a different spot in your own backyard! Nevertheless, it's possible to come up with some reasonable *guesstimates* of what to expect from real-life, small diameter, half-wavelength dipole antennas.†

The graph in **Fig. 3** shows the swr, with a 50-ohm transmission line, of a half-wavelength dipole in free space, compared to one installed near ground. The swr you can expect from a half-wave dipole installed in your own backyard will probably fall somewhere between the limits of these two curves. The horizontal axis is marked off in per cent deviation from the center resonant frequency, f_c, so the chart may be used for any of the high-frequency amateur bands. Note that this graph is only for 50-ohm transmission lines. If you use 75-ohm coaxial cable the shape of the curves will change somewhat, but will not be drastically different from those shown.

If you study this graph for a minute, you'll see that to maintain an swr of 2:1 or less, you have to limit your operation to within about 2 per cent above or below the center frequency. Except on 80 meters this is not as serious as it looks because the 40-, 20-, 15-, and 10-meter bands all fall between the 2 per cent limits as shown in **Fig. 4** (the entire 10-meter band, 28.0 to 29.7 MHz, is nearly ± 3 per cent of the center frequency, but most amateur operation takes place between 28.0 and 29.0 MHz, which is well within

*Formulas and graphs for the evaluation of dipole antennas operated off resonance are given by R. W. P. King in *Theory of Linear Antennas* (Harvard University Press, Cambridge, Massachusetts, 1956), but this book is not recommended unless you have a solid engineering background. A somewhat simplified discussion of the same material is presented in *Transmission Lines, Antennas, and Waveguides* (Dover Books, New York, 1965), but even here you must be prepared to deal with complex mathematical concepts. ***Editor***

†*Small diameter* in terms of wavelength. On 80 meters this includes wire or tubing up to about ½ inch (12 mm); at 28 MHz a wire size of no. 14 AWG (1.6 mm) or smaller is considered a small diameter for the purposes of this discussion.

The DenTron Jr. Monitor antenna tuner is designed for use with antennas fed with coaxial cable, balanced feedline, or a random length of wire. Power capability is 300 watts (*photo courtesy DenTron*).

the 2 per cent limits).

The 80-meter band presents some problems, however, because each of the band edges is nearly 7 per cent from the center frequency; to maintain a 2:1 swr on 80 meters, you must limit your operation to about 150 kHz of the band. If a half-wavelength dipole resonates at 3.75 MHz, the swr at 3.5 MHz will fall in the range between about 5:1 and 8:1; at 4 MHz the swr will be between 4:1 and 7:1. In both cases the swr is well outside the 2:1 swr limits recommended for amateur transmitters. One solution on 80 meters is to use an antenna tuner or *Transmatch* at the transmitter end of the line as shown in **Fig. 5**. With an antenna tuner in the line, it can be adjusted so the swr seen by the transmitter will be less than 2:1 from one end of 80 meters to the other.

Dipole length vs frequency

If you use the formula to calculate the length of a dipole for your chosen operating frequency, and carefully cut your antenna to the correct length, it should resonate very close to the desired frequency. However, nearby objects (including ground) may slightly move the resonant frequency away from the desired point.

If you want to resonate your dipole on a precise frequency, cut it slightly longer than the calculated length and put it up. Then install an *accurate* swr bridge in the transmission line and measure the swr at different frequencies near the desired center frequency. If you plot the swr values on graph paper, you should end up with a graph similar to that shown in **Fig. 3**; the point of minimum swr is the resonant frequency.

Since the dipole was cut slightly longer than the calculated length, the point of minimum swr should be *below* the desired operating frequency. To move the minimum swr point up to the desired spot, you simply have to shorten the antenna by a small amount. On the 80-meter band, the resonant frequency of a half-wave horizontal dipole changes appromixately 2.5 kHz per inch (1 kHz per cm) — slightly less near 3.5 MHz, and slightly more near 4.0 MHz. On the other high-frequency amateur bands the variation with length is greater, as detailed below:

40 meters	9 kHz/inch	4 kHz/cm
20 meters	36 kHz/inch	14 kHz/cm
15 meters	80 kHz/inch	31 kHz/cm
10 meters	142 kHz/inch	56 kHz/cm

Suppose you want your dipole to resonate at 3.725 MHz, the center of the 80-meter Novice band. The calculated length for a half wavelength dipole at 3.725 MHz is 125 feet, 7½ inches (38.29 meters). If you cut the antenna about 12 inches (30 cm) longer than the calculated length and put it up, the point of minimum swr will be lower in the band, say at 3705 kHz, 20 kHz below the desired frequency. Since the resonant frequency changes by about 2.5 kHz per inch (1 kHz per cm), if you shorten the antenna by about 8 inches (20 cm), the antenna should resonate very close to 3.725 MHz. (Be sure to shorten the antenna equally at both ends — in this case, 4 inches or 10 cm from each end of the dipole).

Simple multiband antennas

There's no doubt that the most efficient (and simplest) multiband antenna is a half-wavelength dipole, cut to

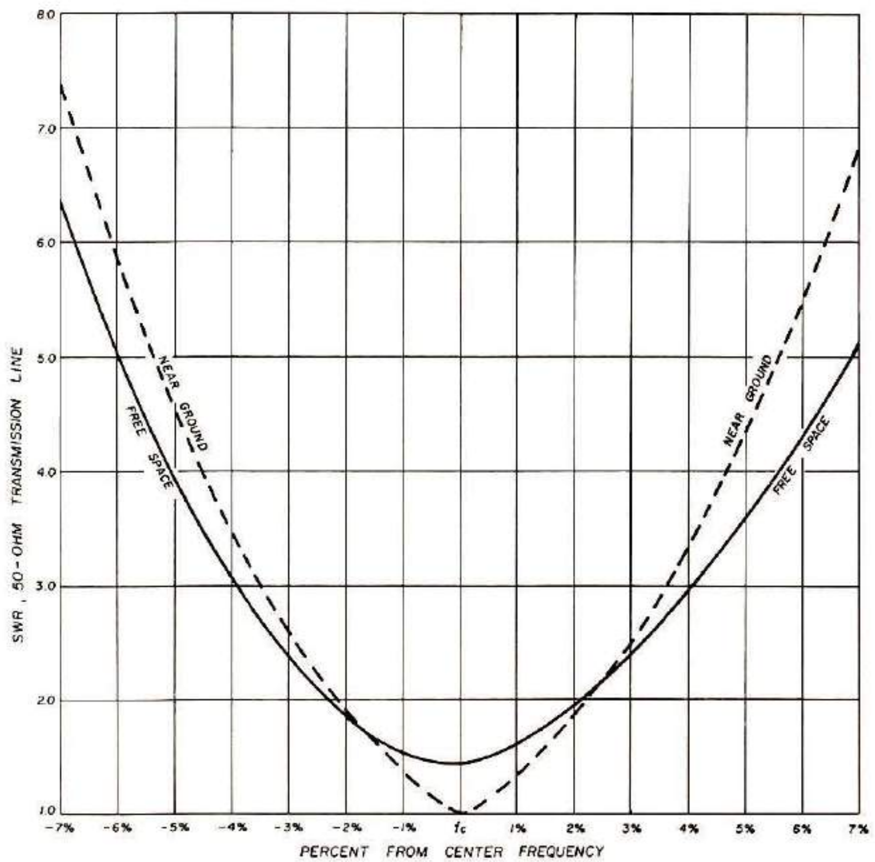


Fig. 3. Swr performance of a horizontal half-wavelength dipole fed with 50-ohm coaxial transmission line in terms of per cent deviation from the design center frequency, F_c. The swr curves of dipoles in free space and near ground are plotted — practical amateur antennas should fall between the limits of these two curves. Operation must be limited to within about 2 per cent of the center frequency for an swr of less than 2:1. Note that the swr increases more rapidly on the low side of resonance than it does on the high side.

Typical antenna tuner construction. This is the popular Transmatch circuit described by W1ICP in *QST*. Many manufacturers build similar units around the same basic design, and many amateurs have built their own (*photo courtesy the James Millen Company*).

resonate at the lowest operating frequency, center fed with open-wire transmission line through an antenna tuner. The only real problem with this arrangement is that the open-wire feedline should be installed well away from any metal objects, with no sharp bends. The transmission line may be either transmitting type twinlead, TV ladder line, or a pair of no. 12 or 14 AWG (1.6 to 2.1 mm) wires spaced 2 to 4 inches (5 to 10 cm) apart.

Many amateurs shy away from antennas fed with open-wire feeders because they don't like antenna tuners, but if you want efficient, all-band operation with a single antenna, this is the only way to go. Every other multiband antenna is a compromise.

Multi-dipole antennas

Another simple multiband antenna is the multiple-dipole shown in **Fig. 6**. On the lower frequency band the longer pair of wires acts as a conventional half-wavelength dipole, and the shorter wires have negligible effect on operation. On the higher band the short dipole radiates and the long one goes along for the ride.

If the two dipoles are on harmonically related frequencies — say 3.525 MHz and 7.050 MHz — this arrangement works quite well, but if the resonant frequencies are not harmonically related, the swr on the higher band may be greater than expected. For example, assume the low frequency dipole is resonant at 3.725 MHz, and the high-frequency dipole is tuned to 7.125 MHz. At 3.725 MHz the antenna will perform as advertised, but at 7.125 the swr will be higher than expected.

If you run a curve of swr vs frequency, you'll find that minimum swr will occur near 7.450 MHz, the second harmonic of the frequency to which the longer dipole is cut. This happens because at 7.450 MHz, the 3.725 MHz dipole appears as a simple high resistance of several thousand ohms across the transmission line. Below 7.450 MHz, however, it looks like an inductor and the resulting inductive reactance drives up the swr.

The solution to the problem is both simple and effective: just increase the length of the higher frequency dipole (lowering the resonant frequency) so it looks slightly capacitive. This will cancel

The Collins 637T multiband dipole is used primarily in military applications, and consists of two spring-loaded reels of wire. To use the antenna you simply unreel the wire to the proper length (indicated by the calibrated dial on the end plate). This dipole can be used on any frequency between 3.3 and 30 MHz, but you have to re-adjust the length for each band (*photo courtesy Collins Radio Company*).

out the inductance presented by the lower frequency antenna.

Assuming the minimum swr occurs at 7.450 MHz and you want minimum swr at 7.125 MHz — a difference of 325 kHz — then the higher frequency dipole should be lengthened approximately 3 feet (90 cm) for minimum swr on 7.125 MHz. This is based on the fact that the resonant frequency of a 40-meter dipole changes approximately 9 kHz per inch (4 kHz per cm).

When installing multiple-dipole antennas be sure to space the ends of the two dipoles several feet (1 meter) apart. If the antennas are spaced closer than this, slight changes in spacing between the two dipoles when the wind blows will cause large variations in the swr.

This same type of multiple-dipole arrangement can be used on more than two amateur bands, but the secret to success is to cut each dipole somewhat longer than the calculated length. Then, starting at the lowest operating frequency, trim each one for minimum swr. This may require raising and lowering the antenna several times, but the final results will be worth it.

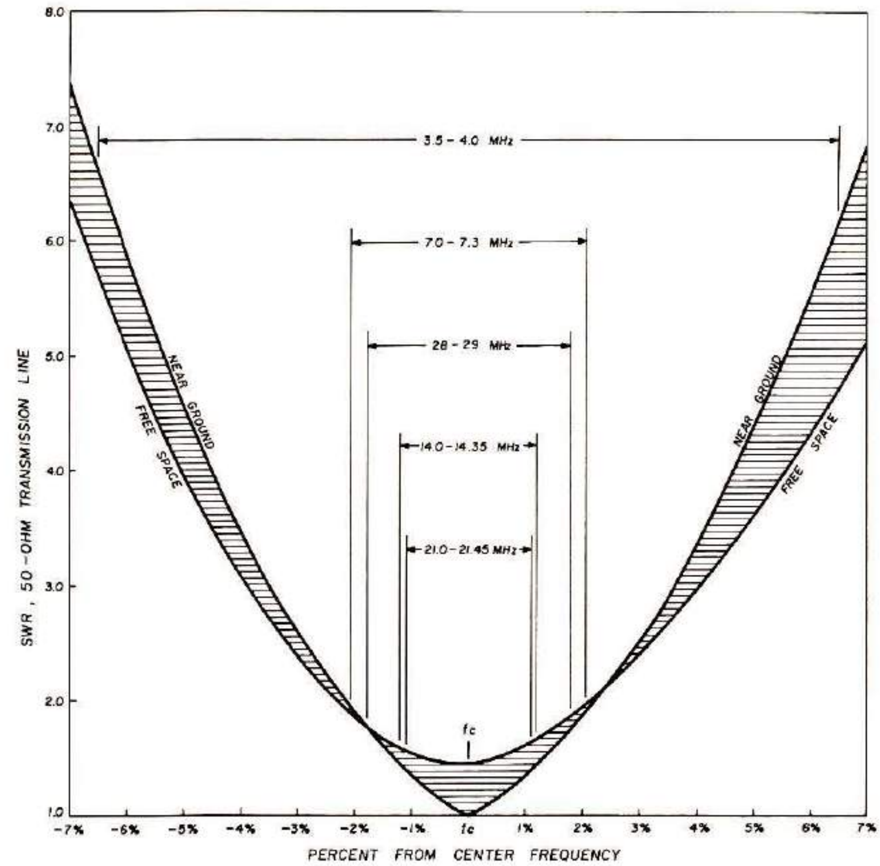


Fig. 4. Percentage bandwidth of the high-frequency amateur bands and how they compare with the swr curves of **Fig. 3**. Dipoles cut at the center of 40, 20, 15, and 10 meters are within the 2% bandwidth required for a 2:1 swr; on 80 meters the 2:1 swr bandwidth is about 150 kHz. One solution for operation to the 80-meter band edges with a single dipole is to use an antenna tuner, as discussed in the text.

Trap dipoles

One popular multiband antenna that has found widespread use on the high-frequency amateur bands is the *trap* dipole shown in **Fig. 7A**. The traps are tuned circuits which are used to electrically connect or disconnect the outer sections of the dipole as you change bands. At the lowest operating frequency the traps look like small inductors in series with the antenna wire so the dipole appears essentially as a continuous piece of wire (**Fig. 7B**). On the higher frequency bands where the tuned circuits are resonant, the traps exhibit a very high resistance and look like insulators (**Fig. 7C**); this effectively divorces the ends of the antenna from the center section.

Fig. 5. Using an antenna tuner to provide a good match to your transmitter when using a half-wavelength dipole on 80 meters. If line loss is low, the swr on the line between the tuner and the antenna is of little importance. The lowpass filter behaves as it should only when it's terminated in a matched load, so it should be placed between the transmitter and the antenna tuner.

Purists often point out that the efficiency of the trap dipole is lower than individual dipoles for each of the bands because traps are not perfect insulators. Theoretically this is true, but in practice an accurately tuned multiband dipole with high-*Q* traps compares favorably with separate full-size dipoles so far as bandwidth and operating efficiency are concerned.

Shown in **Fig. 8A** is a trap dipole for the 15- and 20-meter amateur bands. Since these two bands aren't harmonically related, it isn't practical to use the parallel dipoles of **Fig. 6**. The trap dipole, however, provides excellent performance. As shown in **Fig. 8A**, the center section of the antenna is resonant at about 21.15 MHz; this length is very close to that given in **Table 1**. The overall antenna is resonant at about 14.15 MHz. If you compare this length with that given in **Table 1** for the same frequency, you'll see that the trap dipole is about 3½ feet (1 meter) shorter. This shortening is due to the small loading inductance contributed by the traps. Note that each of the traps is about 4 inches (10 cm) long; this dimension must be included in the overall length. A similar arrangement for 10 and 15 meters is shown in **Fig. 8B**.

If you want to operate on three amateur bands, an additional set of traps can be installed in the dipole as shown in **Fig. 9**; this trap dipole is designed for the 10-, 15-, and 20-meter bands. In this antenna the center, 10-meter, section is the normal length while the 15- and 20-meter lengths are shortened slightly by the loading of the traps. The use of two traps decreases the bandwidth over which you can operate with an swr less than 2:1, but this three-band dipole can be used from 28.0 to 28.6 MHz, and over the entire 15- and 20-meter bands with swr less than 2:1. (Remember that height above ground affects swr, so in some cases you may have to prune the antenna length slightly to obtain best performance.)

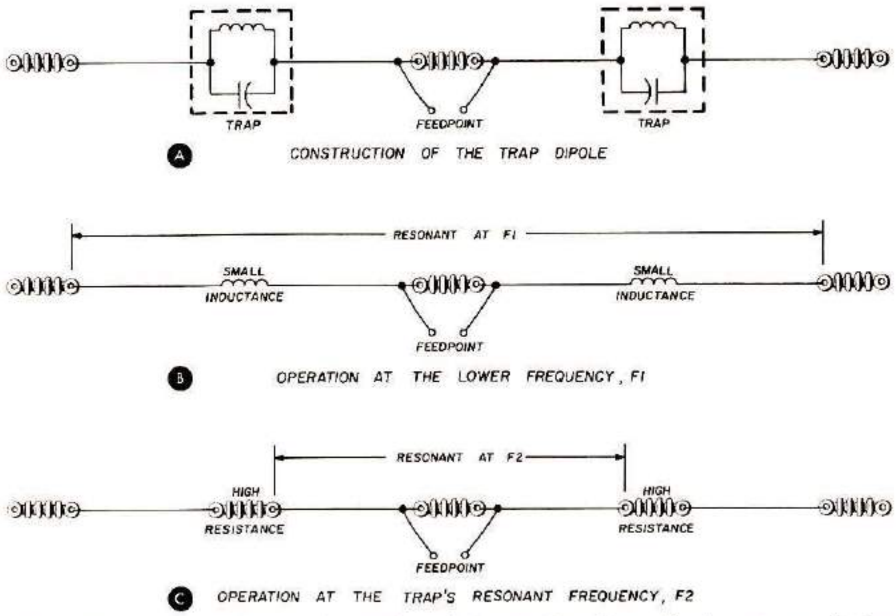
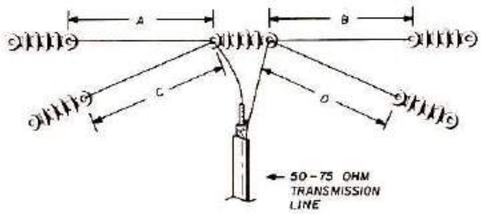


Fig. 7. Basic construction and operation of the two-band trap dipole antenna. At the lower frequency, *F1*, the traps appear as small inductors in series with the antenna, **B**. At the higher frequency, *F2*, the traps exhibit very high resistance and the traps look essentially like insulators, **C**.



$$A + B \text{ (LOWER FREQUENCY)} = \frac{468}{f_{MHz}} \text{ (FEET)} = \frac{143}{f_{MHz}} \text{ (METERS)}$$

$$C + D \text{ (HIGHER FREQUENCY)} = \frac{468}{f_{MHz}} + \text{CORRECTION FACTOR (FEET)}$$

$$= \frac{143}{f_{MHz}} + \text{CORRECTION FACTOR (METERS)}$$

Fig. 6. Multiple dipole antennas can be used for operation on two amateur bands, but if the center frequencies are not harmonically related, the higher frequency antenna must be lengthened slightly for low swr as discussed in the text. Multiple dipoles are usually built with no. 12 or 14 AWG (1.6-2.1mm) hard-drawn copper or copper-clad steel wire.

Trap construction

In most cases the traps are built around antenna strain insulators as shown in **Fig. 10**. The inductor is a short section of air-wound coil stock such as that manufactured by B&W.* The capacitor is a high-voltage ceramic capacitor such as the Centralab 850S series; these capacitors will handle up to 2000 watts PEP in this application. For power levels below 500 watts the Centralab 850A series of capacitors, rated at 3000 volts, is satisfactory. One of the best ways to connect the trap to the antenna wire is to use small electrical service connectors like the Burndy KS90 *Servits* which are available from electrical supply stores.

After the traps have been built, they have to be adjusted to the correct frequency. This is most easily done with a grid-dip oscillator (use your receiver to make sure the dipper is

*B&W coil stock, Centralab ceramic capacitors, and antenna insulators are available from G. R. Whitehouse, 15 Newbury Drive, Amherst, New Hampshire 03031.

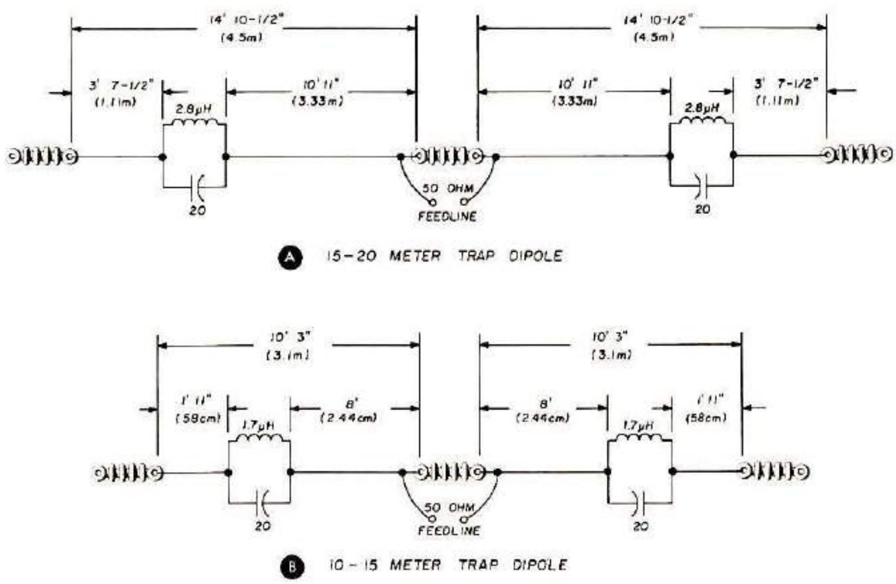


Fig. 8. Two-band trap dipoles for 15 and 20 meters, **A**; and 10 and 15 meters, **B**. The capacitors should be high-voltage ceramic units such as the Centralab 853A series. The inductors are made from sections of B&W coil stock. For the 15-20 dipole use 8 turns of B&W 3025 coil stock; for the 10-15 dipole use 6 turns of B&W 3025 coil stock.

tuned to the right frequency).

Place the assembled trap in a clear space away from any metal objects and loosely couple it to the dipper. For best results the traps should be tuned slightly *below* the operating frequency — this gives maximum bandwidth. The traps will also work if they are tuned to the center of the operating band, but the 2:1 swr bandwidth won't be as great. Adjusting the traps so they dip about 50 to 100 kHz below the band edge seems to give the best results. For coarse frequency tuning adjustments slightly prune off turns from the coil about one-quarter turn at a time; for fine adjustments simply expand or compress the outer turns.

5-band trap antenna

If you build a trap dipole for 40 and 80 meters and analyze its operation on the higher amateur bands, you'll find that the traps appear as small capacitors in series with the antenna wire at the higher frequencies. These capacitors have the effect of increasing the resonant frequency as compared to a simple dipole of the same overall length. By carefully choosing the inductance-capacitance ratio in the traps, it's possible to design a trap dipole that will provide a good match to 75-ohm transmission line on 80 through 10 meters.

Just such an antenna is shown in **Fig. 11**. This five-band antenna was designed by engineers at Cape Kennedy and is known as the "5-Band Cape Antenna." Each of the traps consists of a 50 pF ceramic capacitor (Centralab 850S-50Z) in parallel with a 10 µH inductor built from 15 to 17 turns of B&W 3905-1 coil stock. The traps are tuned to 7.1 MHz.

If you don't have enough room in your backyard to put up the 106-foot (32.3 meter) "5-Band Cape Antenna," shown in **Fig. 12** is a four-band trap dipole that covers 40 through 10 meters; the overall length of this antenna is only about 55 feet (16.8 meters). Each of the traps consists of a 25 pF capacitor in parallel with a 5.1 µH inductor built from commercial coil stock. For best results the traps should be tuned to 14.1 MHz with a grid dipper.

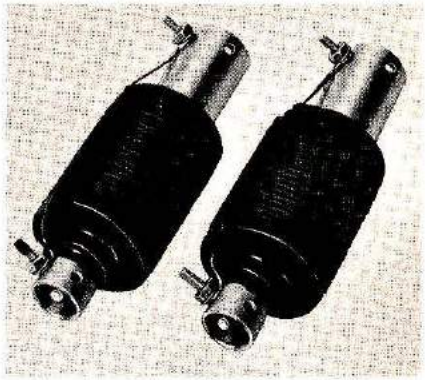
Waterproofing the traps

There are several methods for protecting the traps from the ravages of rain and snow. One of the neatest is to use short sections of 4-inch (10 cm) PVC drain pipe available at plumbing supply houses.* The trap is placed inside a section of plastic pipe and end caps are cemented on with PVC solvent (do this outdoors or in a well-ventilated area). Holes are drilled in the end caps for the antenna wire to pass through; after the antenna wire is installed, seal the hole with RTV or bathtub caulking to keep the moisture out.

Another method of waterproofing the traps is to use a short section of large-diameter Lucite tubing with large corks that are meant for Thermos bottles.

If you're really budget minded, you might consider using the round, flexible, plastic "squeeze" bottles that contain various household products. Cut the bottom off the bottle, insert the trap and antenna wire, and cement the bottom back on with bathtub caulking or RTV.

*PVC drain pipe is also available from Sears. The catalog number for the 4-inch (10 cm) pipe is 42G23131N; the matching end caps are catalog number 42G23119.



Commercial multi-band antenna coils manufactured by the Microwave Filter Company, 6743 Kinne Street, East Syracuse, New York 13057. Several models are available including the KW-40 trap for 40 meters, and the KW-10, KW-15, and KW-20 for 10, 15, and 20 meters. The KW-40 can be used by itself to build a five-band dipole, but operation is a compromise on 20 through 10. For lower swr performance on the higher bands, the other traps should be used as well. Total length of a five-band dipole using all eight traps is about 100 feet (30 meters). The traps are completely waterproof and will handle up to 1000 watts.

Baluns

Simple, center-fed dipoles first became popular with the development of efficient, flexible, low-impedance twin-lead transmission lines which matched the dipole's nominal 72-ohm center impedance. Even after amateur transmitters with unbalanced pi-network output circuits became standard, many amateurs continued to use twin-lead to feed their

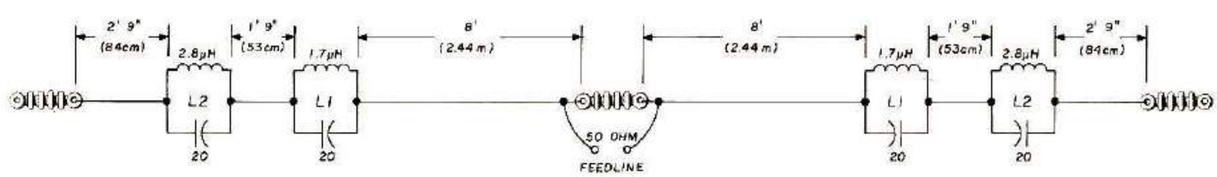


Fig. 9. Three band trap dipole for 10, 15, and 20 meters. The capacitors are high-voltage transmitting ceramics such as the Centralab 853A series. The inductor in the 10-meter trap (L1) is 6 turns of B&W 3025 coil stock; inductor L2 in the 15-meter trap is 8 turns of B&W 3025 coil stock. For best performance and greatest bandwidth the 10-meter trap should be tuned to 27.8 MHz; the 15-meter trap is resonated at 21.85 MHz.

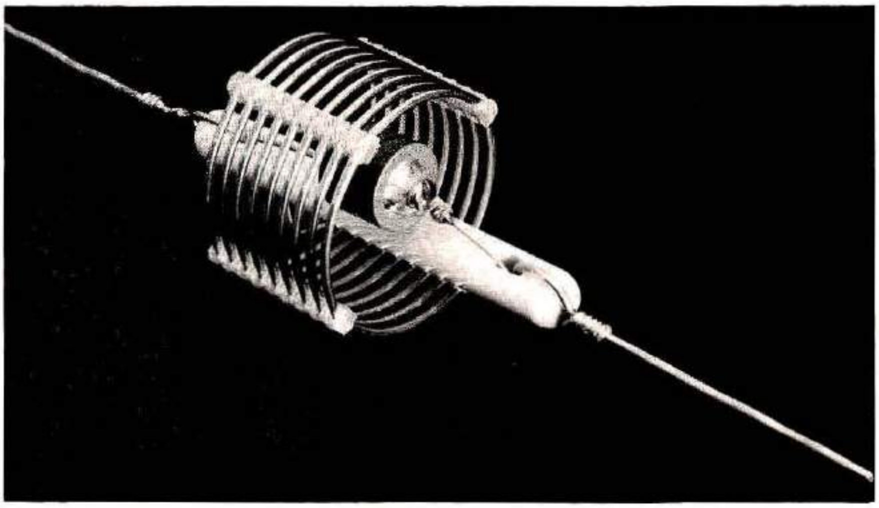


Fig. 10. Method of building the traps for multiband dipole antennas. The coil stock is air wound with no. 12 AWG (2.1mm) on a 2-inch (50mm) diameter form, 6 turns per inch (B&W 3025 or equivalent). The capacitor is a 7500-volt ceramic transmitting type (Centralab 850S series or similar). This design will handle the amateur power limits of 2000 watts PEP. For power levels up to 500 watts, the coil may be built from smaller diameter coil stock, and the capacitor may be the smaller 5000-volt Centralab 853A series.

dipoles by grounding one conductor of the twin-lead and connecting the other lead to the center pin of the transmitter's coaxial output connector.

This arrangement seemed to work just fine, but the word gradually got around that you couldn't feed a balanced transmission line with the unbalanced pi network.* Most amateurs dutifully switched from twin-lead to coaxial cable — and the antennas worked fine, just as they apparently did with the twin-lead. Then the purists came up with the edict that you couldn't feed a balanced antenna like the dipole with unbalanced coaxial feedline unless you put a balancing device such as a balun between the feedline and the antenna. Many amateurs quickly installed the required baluns, but noticed very little difference in antenna operation.

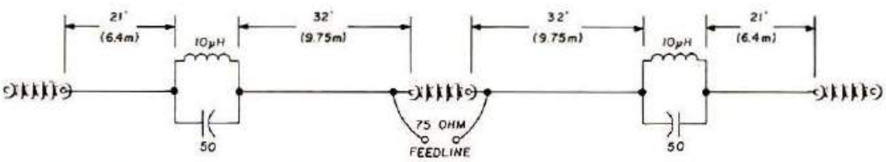


Fig. 11. Five-Band Cape Antenna for 80 through 10 meters which was designed by engineers at Cape Kennedy. The inductor is 15 to 17 turns of B&W 3905-1 coil stock (2½" 6.4cm diameter, no. 12 AWG 2.1mm wire, wound 6 turns per inch). The capacitor is a ceramic Centralab 850S-50Z. The traps should be tuned to 7.1 MHz by carefully pruning one end of the coil a little at a time.

Admittedly, there is some skewing of the dipole's radiation pattern when it's fed directly with coaxial cable, but for the average installation, where the antenna is less than 50 feet (15 meters) above the ground, the pattern is so distorted by nearby objects that the skewing goes unnoticed. With a balun installed, however, you'll notice poorer reception of local vertically polarized signals. This is important because most man-made noise is vertically polarized, so a dipole with a balun *may* be somewhat quieter than a dipole without one.

If you are using a high-gain beam which is designed for balanced feedline, the use of a balun is much more important because pattern skewing can be very noticeable without the balun. Amateurs who use simple balanced antennas such as dipoles, however, are about equally split on their use of baluns. If you want to install one on your dipole, it certainly won't do any harm, and it will probably reduce the amount of man-made noise your receiver hears.

Harmonic radiation

Some amateurs avoid multiband antennas because they're afraid of excessive harmonic radiation. Fortunately this is not a problem with modern transmitters and transceivers because they have sufficient harmonic suppression built into the design. If you carefully tune your transmitter into a dummy load before you go on the air, and operate with a swr of 2:1 or less, you should have no problems with unwanted harmonics. **HRH**

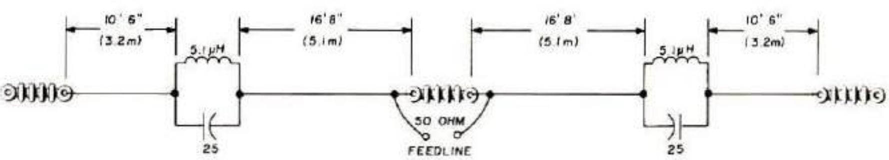


Fig. 12. Four-band trap antenna for 40, 20, 15, and 10 meters. The overall length is only 55 feet (16.8 meters), 10 feet (3 meters) shorter than a normal single-band dipole for 40 meters. The inductors are 9 turns of B&W 3905-1 coil stock (2½" 6.4cm diameter, no. 12 AWG 2.1mm wire, wound 6 turns per inch). The capacitor is a high-voltage transmitting type. The traps should be carefully tuned to 14.1 MHz.

*Unbalanced to ground; the output of the pi network is "hot" with respect to ground. A balanced line such as twin-lead must have equal magnitude, opposite polarity rf currents flowing on each of the two conductors to prevent rf radiation. When twin-lead is connected to a pi network, the currents in the conductors are not balanced, so the line acts like a radiator; this may lead to problems with television and hi-fi interference.

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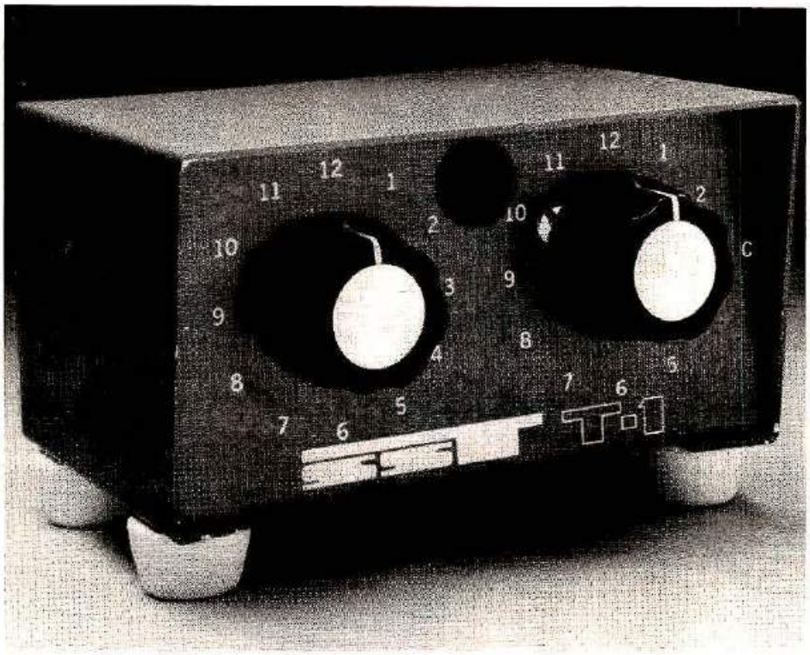

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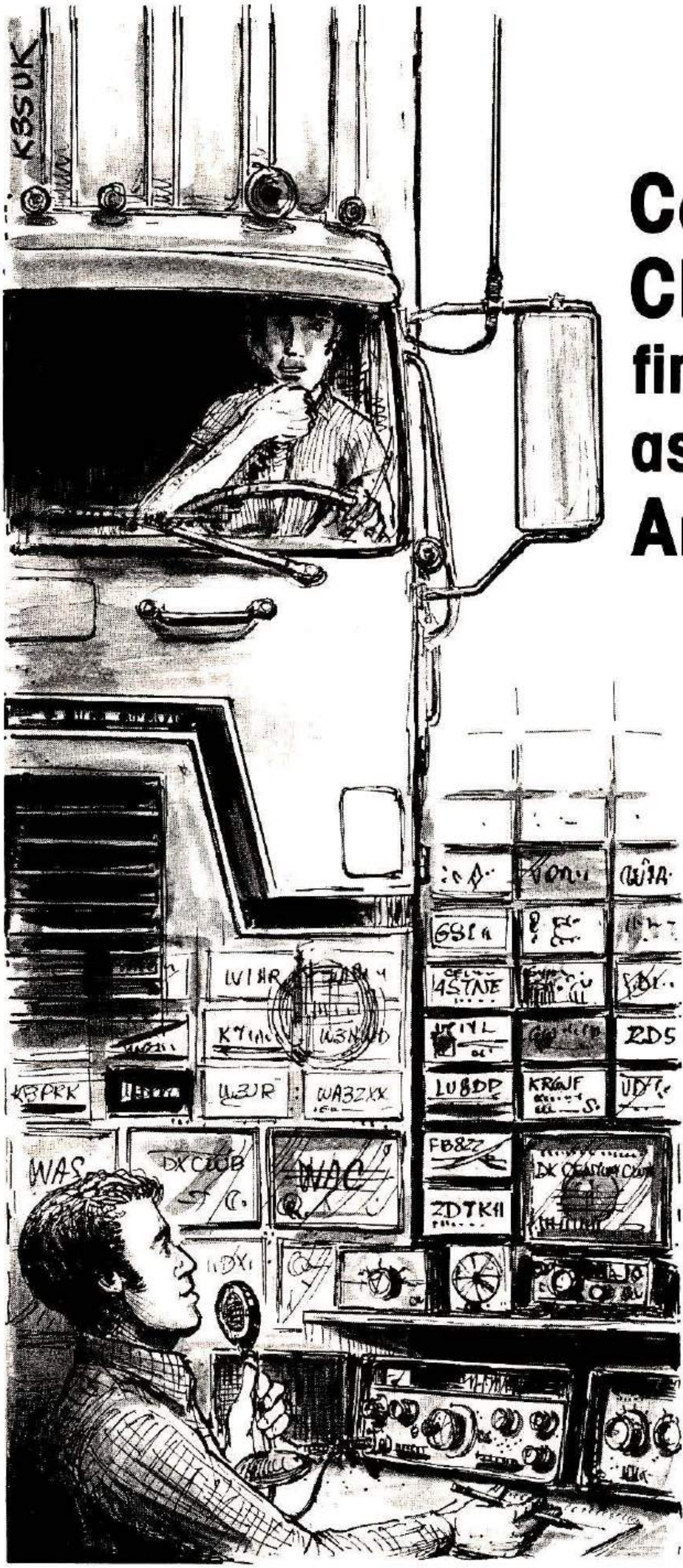
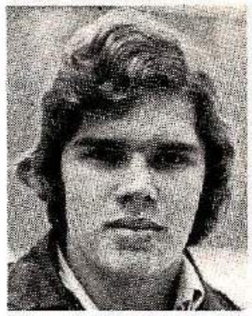


Can a CBer find happiness as an Amateur?


Kevin Fitzpatrick
"CB's too crowded . . ."


John Rosso
"I met most of my school friends (through CB)"


Ralph Flint
"Now seems like the time . . ."


Cynthia Donato
"I don't want to be left out of anything new . . ."


Constantine (Dino) Pahoulis
"Hams are more helpful"


Above: Ted Trostle
"CB keeps everyone together"


Left: Matthew D'Azzo
"Two meters is like super CB"

BY CHARLENE KNADLE, WB2HJD

Constantine (Dino) Pahoulis says, "CB just isn't enough of a challenge." Both Dino and Ted Trostle have a desire to get into the "nuts and bolts" of their rigs, partly by learning from fellow hobbyists. "But CBers know zilch about their rigs," says Dino. "Hams, on the other hand, are more helpful. They're interested in what you're doing and are capable and willing to give help if you need it."

Is DX your bag?

John Rosso and Franklin Donato cite greater distance as their strongest motivation for getting into amateur radio. Matthew D'Azzo agrees. "Back in 1960, when I first became a CBer," Matthew says, "CB was new and uncrowded. Once I even got 35 miles on a 5-watt a-m transmitter. CB was a ham station to me, then. But now the noise, the crowding, and the shorter possible distances discourage me. Now it's terrible — unless you leave the New York area."

Crowded conditions on CB bothered almost everyone. "I've seen this problem even at 4 AM." says Dino. "You can't have a conversation — just, 'Where are you?' 'Meet you at such-and-such a place.' Then you go *there* to talk."

Ragchewing

Ability to have reasonably long, uninterrupted conversations on the air was a popular reason for getting into amateur radio. Cynthia Donato wants mainly to be able to talk to her husband, Franklin, when she's in the house and he's in the car. Matthew D'Azzo, also, hopes to be able to communicate with his wife at home. Ralph Flint, however, does not have a problem between house and car: "I'm on sideband (single sideband) on CB," he says. "It's less crowded."

But on a-m, where most CBers operate, crowding remains a problem. For Kevin Fitzpatrick, it's enough to leave him undecided about continuing with CB after he gets his amateur-radio license. "I'm discouraged," he says. "CB's too crowded. People even curse each other."

The case for CB

Most others, on the other hand, planned to remain CBers even after becoming hams. Franklin Donato values CB for traffic and weather reports. "I will use both (CB and amateur radio)," he says. "I can listen to two rigs at once." Ted Trostle plans to use CB, as he has before, for Boy-Scout trips. "We usually have a 7-car convoy," he says. "CB keeps everyone together." And Dino Pahoulis will use it for help on the road "in case I get stuck." Not all CBers are entirely happy with CB radio, even though they still derive some satisfaction from it. But their frustration with CB in no way diminishes their interest in radio communications. What are they doing about this dilemma? Some of them are planning to become radio amateurs.

I recently visited a class for prospective radio amateurs at Stony Brook University. The class, taught by Arnold Benton, a physicist and radio amateur (WA2AHB), is designed to prepare one to pass the FCC exam for an amateur radio Novice-class license (a follow-up class will lead to preparation for the General-class license). The class is sponsored by the Suffolk County Radio Club, some of whose members volunteer their time to assist Arnold with the class. Of the 50 or so people who had signed up for the class, the majority were CBers. I wondered why, and decided to find out.

Testimonials

After talking with some of the CBers, I could see that their main goal was to get more of what CB radio had promised but had not fully delivered. Listen to Franklin Donato, who had once seen what radio communications could be:

"For about six years I was employed as a deputy sheriff at a county sheriff's office," says Franklin. "Our cars were equipped with Motorola sets, which operated in the 39-MHz band. The combination of that frequency, high power, and a clear channel, always gave us a powerful radio clout. I got involved with CB communications in 1964 in an effort to have a personal two-way communications system in my own car that might resemble the capability of the police radio. I found the CB set to be a poor substitute. Amateur radio now affords additional capabilities. It allows more range, a broader frequency spectrum, and the capability for phone-patch communications. It's a tremendous additional aid for community service and travel."

But almost everyone when asked why they would remain with CB included one word in their answer; friends. "I met most of my school friends that way," says John Rosso. Dino Pahoulis has had lots of delightful experiences with the friendliness of CBers. He says, for example, "When my wife and I were expecting a baby, I mentioned it over the air, and when the baby was born, I naturally told everyone. A bunch of CBers showed up with gifts. I hadn't expected that." And when he moved into his new house, Dino was delighted to find that the other new house, across the street, had been bought by a CBer he knew.

The transition to amateur radio

How do people, including CBers, learn about amateur radio? Mostly by word of mouth. John Rosso, Dino Pahoulis, and Matthew D'Azzo all had neighbors who were hams. In addition, John's father is a former ham, who still occasionally turns on his receiver and listens. (It's illegal to transmit without a license, but perfectly legal to listen.) Kevin Fitzpatrick's first exposure to radio also came from his father, whose hobby was listening to international shortwave broadcasts. Franklin Donato says, "After I got my CB rig, an old friend who is a ham talked with me about (amateur) radio."

Ralph Flint says he's been interested in radio ever since World War II, when he was denied training as a radio operator because the class was filled. "Now seems like the time to go ahead and do it," he says. "I made that decision after I gave up my airplane and needed a new interest. One thing at a time!" Ted Trostle, too, has had a long-standing interest in radio. He says, "I've been putting it off since 25 years ago, when a high-school friend who was a ham got me interested. But an easy opportunity was never presented until now. An associate of my wife's, who is a ham, knew about this class. So I called Arnold (the teacher)."

Goals

Now that they're close to getting their amateur-radio licenses, what do these CBers expect from amateur radio? "Fun," says Ted Trostle, "I want to operate long distances — maybe around the world." Matthew D'Azzo agrees. "It's exciting to think of contacting Alaska, Europe, Australia, Africa." Franklin Donato adds, "I'd like to make new friends, and maybe even promote international good will through amateur radio."

In this country, Ralph Flint and Kevin Fitzpatrick both have relatives "everywhere," whom they would like to be able to contact, either directly or through phone patch.

Ted Trostle looks forward to being able to use Morse code, as does Cynthia Donato. "I don't want to be left out of anything new that's going on," Cynthia says, "but I don't feel comfortable talking to strangers over a microphone. I think I could do it with code."

Some CBers hope amateur radio can fulfill their technical interests. "I'm an antenna nut," says Ted Trostle. "I've just been trying a new 5/8 wavelength CB mobile antenna. Maybe I'll experiment like that with mobile amateur radio." And Ralph Flint plans eventually to add computers to his amateur-radio setup.

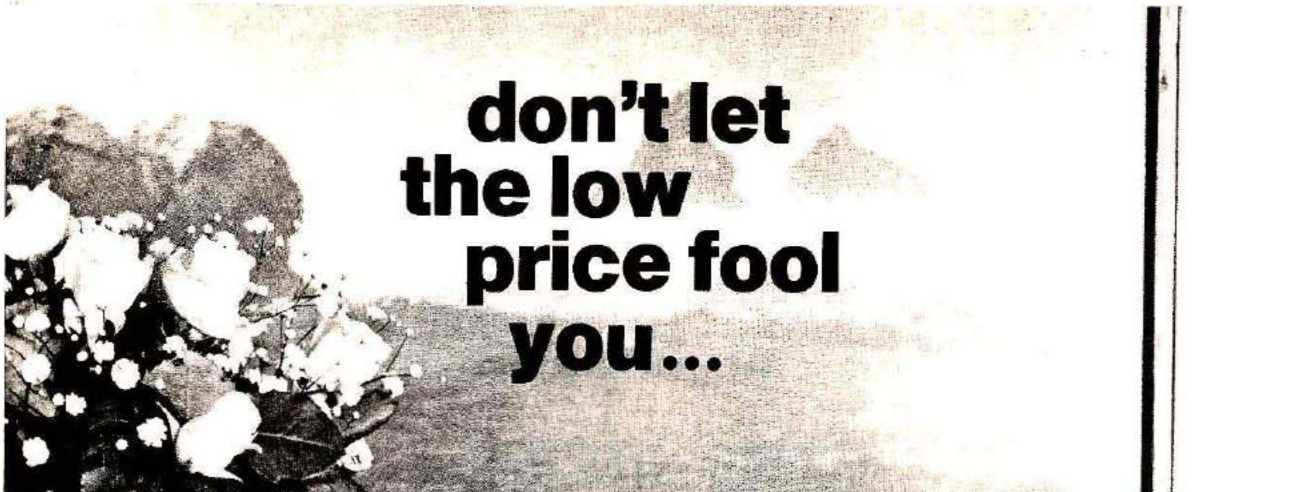
Franklin Donato wants to put an autopatch in his motor home so he can make regular phone calls while on the road.* But he's not interested in the technical aspects. "I don't plan to service my own rig," he says. "I won't get into the electronics. The parts would be all over the house."

Mostly, CBers expect better mobile operation from amateur radio. Franklin Donato looks forward to greater distance through the use of amateur-radio repeaters. And he wants to use fm, which is mostly static-free. "I want to be able to hold a long conversation in an intelligible way," he says. "Two-meters is like super CB," Matthew D'Azzo says. "Crystal clear. You get 100-200 mile range."

"I expect more courtesy," says Dino Pahoulis. "Hams are more law-abiding, and more helpful with radio."

But Matthew D'Azzo summed up what seemed to be everybody's feelings: "What do you expect from amateur radio?" I asked. His answer: "A whole new world." **HRH**

*Amateur-radio autopatch works this way: A touch-tone equipped transceiver in the car contacts a repeater station hooked to telephone-company lines (an autopatched repeater). Hams making calls from their cars still pay for the calls.



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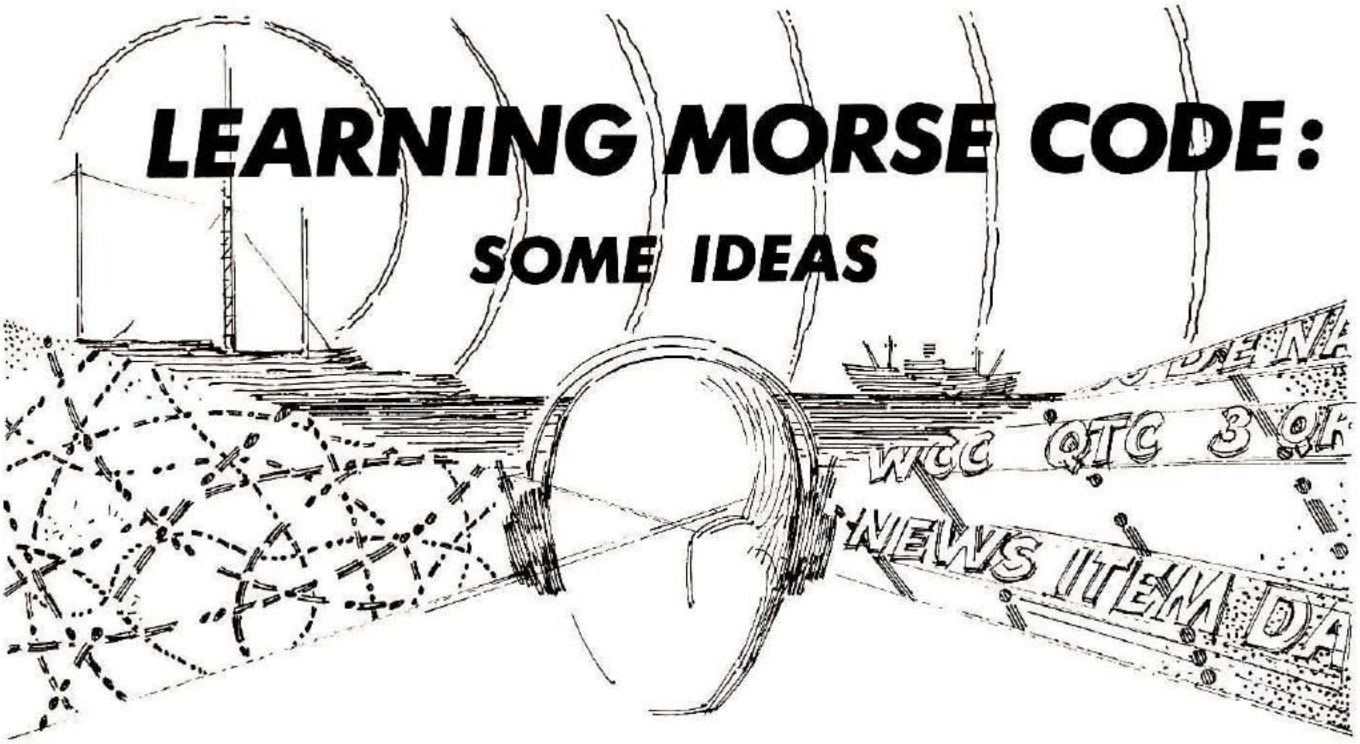
SOME IDEAS



BY ALFRED WILSON, W6NIF

Receiving and sending Morse code seems to be the major hangup in passing amateur radio license exams. Here's one approach to the problem — it worked for me

Learning to copy and send Morse is much like learning to touch type. When you first start a class in touch typing, the instructor usually gives you a copy of the typewriter keyboard with a diagram that shows what fingers are to be used to type each character. The row of keys on the machine starting with the letter *A* and ending with @ is called the "home row." You are then instructed to learn the typewriter keyboard by first typing *ASD* with your left hand and *JKL* with your right hand. You do this over and over and over again until you instinctively type these letters *without looking at the keyboard*. The remaining portion of the typewriter keyboard is learned similarly. Eventually, after hours of practice, you can sit down at any standard typewriter keyboard and type copy without looking at the keyboard.

This article, of course, isn't a lesson in learning to touch type, but rather a way to learn Morse code based on the repetitive principles used to learn how to handle the typewriter keyboard. The key (no pun intended) is *practice*. Many, many hours are required for some; for others, perhaps just a few hours.

Preliminary steps

You've heard that Morse is learned by sound rather than sight. You don't learn the Morse alphabet by memorizing "dot dash" for the letter *A* or "dash dot dot dot" for *B*, and so on. You must translate the Morse characters for each letter, number, and punctuation mark into sounds: "dit-dah" for *A*, "dah dit dit dit" for *B*, and so on through the alphabet.

In keeping with the repetitive principles of learning to touch type, start by learning the first three letters of the alphabet. Mentally sound out these three letters over and over again until you can irrevocably recognize each letter, however slowly. After sufficient practice you'll be able to have someone sound out these first three letters and you'll be able to write them down in any combination, without error, and without hesitation.

The next step, again in keeping with touch-typing principles of repetitive learning, is to get acquainted with the next three letters of the alphabet. (You've learned how to recognize *ABC* in all three combinations by now, and you'll never forget them —

providing you've practiced sufficiently.)

Work with *D, E,* and *F* in the same way. Try copying various combinations, over and over again, until you can recognize each Morse character for these letters *without having to think about it*. Your brain and motor nerves will then be conditioned to operate as a system. Once learned, you'll never forget.

Table 1. Where to find commercial ship and coastal radiotelegraph stations in the medium- and high-frequency shortwave spectrum.

Ship stations (frequency, MHz)	Coastal stations (frequency, MHz)
4.160 - 4.177	
4.187 - 4.238	4.238 - 4.368
6.240 - 6.265	
6.281 - 6.357	6.357 - 6.525
8.320 - 8.354	
8.374 - 8.476	8.476 - 8.745
12.471 - 12.531	
12.561 - 12.714	12.714 - 13.130
16.622 - 16.706	
16.748 - 16.952	16.952 - 17.290
22.148 - 22.220	
22.270 - 22.400	22.400 - 22.650

How to practice

One method I used to gain code proficiency proved quite helpful. It was many years ago when I was a youngster going to high school. I'd learned all the letters, numbers, and punctuation using the repetitive learning approach mentioned above. But my code speed was slow, slow, slow! Perhaps 5 words per minute.

On the trolley car to school, I read all the billboard ads and mentally sent the words to myself in Morse. I'd look at a billboard, send the message to myself mentally, and wait for the next billboard. After about two weeks of this I was able to mentally recognize words, numbers, and punctuation without hesitation. With this new-found ability, the next step was to increase speed.

I didn't have any buddies to send Morse to me so I could increase my code speed. I did, however, have a general-coverage shortwave receiver. In those early days there were no code-practice transmissions by ARRL station W1AW. So I tried to build up my code speed by copying fellows on the 40-meter band. Sounds like a reasonable approach, but it didn't work — at least not for me. Too many guys with lead (I mean lead as in lead pipe) fists, too much interference (the band is even worse today), and unpredictable propagation conditions.

Then, one evening, I tuned my receiver upward in frequency past the 40-meter band and started listening to marine radio-telegraph stations, which operate between about 8.0 and 8.8 MHz. What a difference! I started copying ship stations sending messages to each other and to stations on the coastal shores of the U.S. No real problems with fading or interference!

The marine coastal stations are in business to make money, of course, so they operate on clear channels with substantial power and are manned by operators who are real pros. These fellows don't horse around, believe me. They send Morse code, perfectly and impeccably, and gear their sending to prevailing conditions.

All in all, I recommend using coastal and ship stations, operating in the CW commercial bands, as sources for code practice. You can hear all sorts of stuff from the coastal stations that should provide code practice for whatever level your code speed is. You'll find newspress items (generally sent at speeds around 20-25 wpm); weather transmissions (between 15 and 25 wpm); messages to ships at speeds ranging from 5 to 35 wpm, depending on conditions. Some of the coastal stations ops use electronic keyers, some use the dash side of a bug, some sound as if they're using a heavy foot pushing a trapdoor. But in every case, the Morse is generally perfect. Characters are formed so that there's no doubt as to the letter or number being sent. If propagation conditions are not good, the coastal station operators repeat words or sentences.

After you gain a little proficiency in handling code, listening to the stations on the marine radio telegraph short-wave bands can be a lot of fun.

Table 2. Selected list of coastal marine radiotelegraph stations operating in the 8-MHz band. These stations will be found just above the 40-meter Novice amateur band on a general-coverage shortwave receiver.

Station	Frequency (kHz)	Power (kW)	Location
WMH	8502	0.75	Baltimore
WSL	8514	2.5	New York
WAX	8526	3.0	Ojus, Florida
WPA	8550	3.0	Port Arthur, Texas
KFS	8558	10.0	San Francisco
WNU	8570	2.0	New Orleans
KLB	8582	2.5	Seattle
WCC	8586		Chatham, Massachusetts
KOK	8690	10.0	Los Angeles
WSC	8610	20.0	Tuckerton, New Jersey
KPH	8618	10.0	San Francisco
WCC	8630		Chatham, Massachusetts
KPH	8642		San Francisco
WSL	8658	10.0	New York
KBL	8658	2.5	Seattle
KLC	8666	2.0	Bremerton, Washington
WSC	8686	2.0	Tuckerton, New Jersey
WMH	8686	0.75	Baltimore

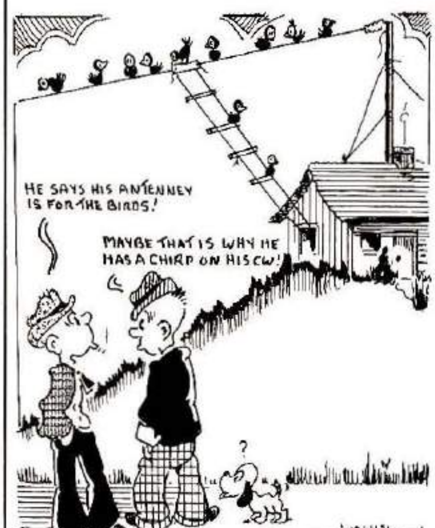
For example, the other day I was listening to a west-coast coastal station trying to work a foreign-ship station. Seems that the ship's operator was having problems receiving the coastal station. After about ten minutes the foreign-ship operator said, "Mucho QRM, OM. Tomorrow is another day, OK?"

Where to find them

The accompanying tables will help you find the marine stations on your general-coverage receiver. **Table 1** lists frequencies of ship and coastal stations in the shortwave marine bands. In **Table 2** you'll find information on commercial coastal stations and their locations. Most of the latter stations run a lot of power, so you should be able to find them without any trouble, even if you use a wet noodle for an antenna.

Closing remarks

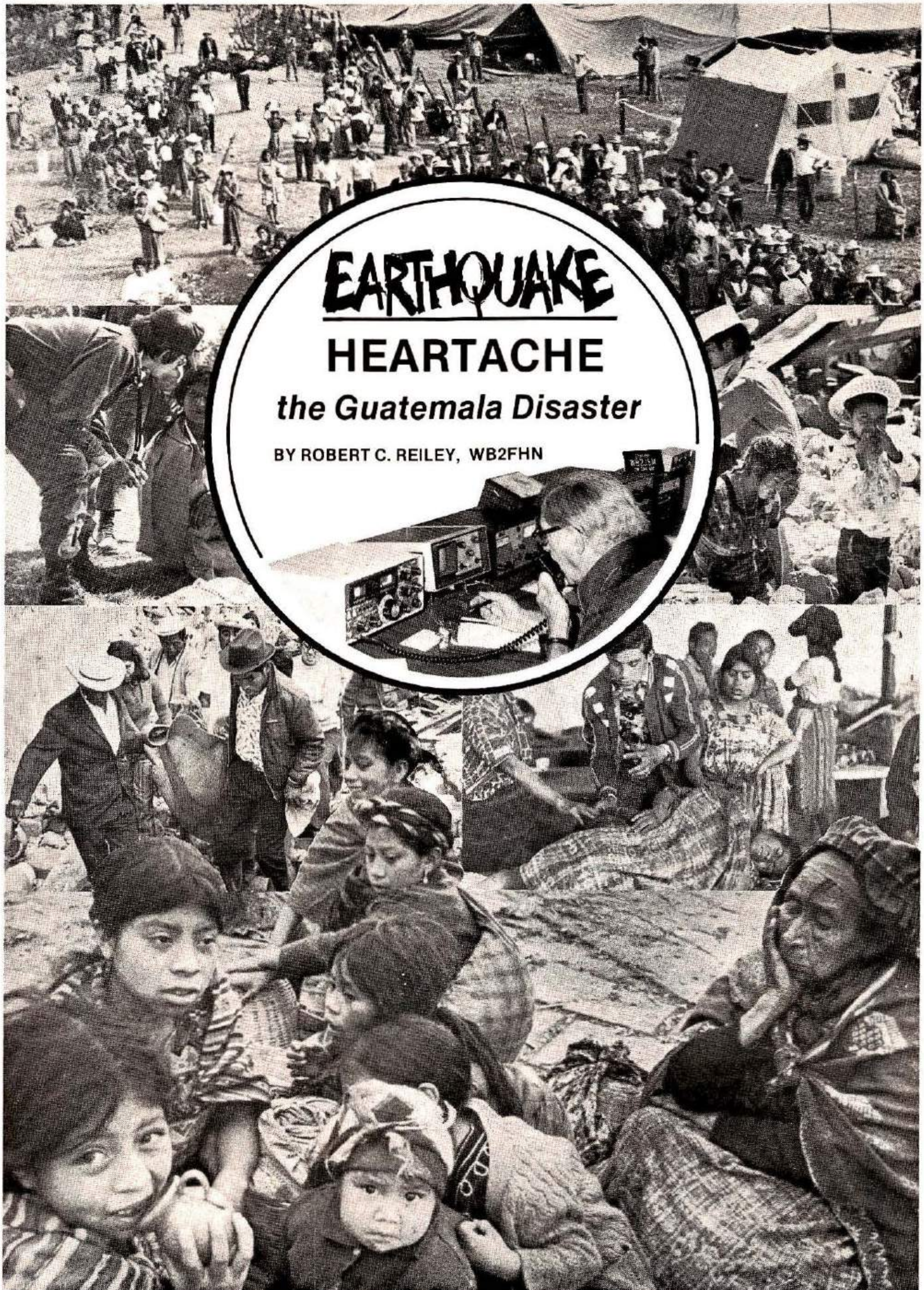
Learning to achieve proficiency in receiving and sending code is a matter of perseverance and much practice. This means listening and copying what you can, bit by bit, until you achieve your goal. It may take weeks, months, or years. Eventually you'll make it. If I made it, so can you. **HRH**



EARTHQUAKE HEARTACHE

the Guatemala Disaster

BY ROBERT C. REILEY, WB2FHN



It was early in the morning; the sun wouldn't be coming up for several hours. People were asleep in their small mud-walled houses. It was February 4th, 1976, and each day now the sun moved farther north bringing warmer days. The dogs in the village lay outside the doors of the houses as always; but this night they were restless, skittish — something just wasn't right.

Then it happened — like the crack of a whip, only deafening, no warning, instantaneous. The earth shook, rumbled, and groaned. Earthquake! The small country of Guatemala was ripped from one end to the other by disaster. In the next few days more rumblings were to come. Walls cracked, roofs fell in, buildings twisted, roads buckled, lights went out. Then silence — but not for long.

Now the people ran into the streets, bewildered, some injured, screaming. Calmer heads quickly gathered in small groups, who feverishly clawed at the collapsed homes to help trapped people to safety.

Maria was only seven years old. She was dead under the fallen roof of her home when they reached her.

Frederico had spent his life developing his small factory. Now it was only rubble. All his workers' homes were gone, but Frederico was thankful because none of his workers had been killed.

Word of the disaster flashed around the world as relief teams went into action. Disaster crews were inside the collapsed buildings removing the injured; first aid stations went up. The missionaries, the Maryknolls, the Red Cross, the police, the army — all quickly went to the aid of the victims. Supplies were needed. Power and telephone lines were out. The few emergency radio communications sets with the disaster units were overwhelmed and could only be used for local communications.

But Guatemala is one of the countries that has encouraged its citizens to become amateur radio operators. These amateur operators own and operate their radio stations from their homes, and many have emergency gasoline-engine-driven generator sets to provide power when the local power source is inoperative. The Guatemalan amateurs quickly put their stations on the air and established a communications network throughout the country.

Overseas help

As thousands of amateur operators in many other countries received the disaster news, they too went on the air, checking into emergency nets and offering their services. The airwaves were full of emergency traffic, and soon amateur-radio operators had some urgently needed medical supplies on the way from Cleveland, Ohio; building-repair materials from Texas; and many other supplies from all parts of the country.

In New York City thousands of people have families or friends in Guatemala. As the New Yorkers learned of the quake, they tried to place telephone calls to the stricken area — but without success. They overwhelmed the telephones at the New York Red Cross headquarters, the Guatemalan consulate, the Guatemalan desk at the State Department, and even at the United Nations headquarters. All to no avail.

Emergency radio networks

It is well known that in times of disaster, amateur radio operators traditionally establish nets quickly between the

The montage on the facing page was assembled from photographs supplied by Associated Press of their news coverage of the Guatemalan disaster. Inset photograph by WA2VOS.

John Gorman, WA2ROF, of the Hall of Science Radio Club, New York City, talks on amateur radio with an operator in Guatemala City during an emergency traffic call to the earthquake-stricken city. Standing by is the Carlos Jiminez family, formerly of Guatemala City, and now living in New York. They contacted relatives in Guatemala City to find out how they were. They discovered, through amateur radio, that the family sustained no injuries but that the family home had been destroyed in the quake. The radio-amateur emergency station was set up and operated in Flushing, New York, in the Meadow Park Hall of Science.

Darkened section of map shows extent of area affected by a massive earthquake, which rolled through three Central American countries and Mexico. The quake epicenter was estimated to be southwest of Guatemala City, Guatemala, which was severely damaged (*AP*).

stricken community and the outside world. More than 300,000 licensed amateurs are in the United States.

In New York City, the Hall of Science, (a science and technology museum) operates amteur radio station WB2JSM as an exhibit, demonstrating to the public and permitting many visitors to talk to people in foreign countries as well as in the fifty contiguous United States. Millions of people have visited the Hall of Science and have seen WB2JSM on the air.

On receiving news of the disaster, WB2JSM checked into the emergency traffic nets and offered its services in the New York area. Guatemalan Nationals and people with family and friends in Guatemala came to the station, seeking information on their loved ones. Hundreds of others called the Hall of Science, asking for the help of the radio station.

Newspapers and television stations learned of the dramatic developments at the Hall of Science and ran stories and programs, bringing more inquiries. The Hall of Science placed three telephone operators at its switchboard just to handle these calls and take information. Station WB2JSM was placed on a 24-hour-per-day schedule. It was manned by volunteers from the Hall of Science Radio Club. The story of tragedy and joy of people learning bad and good news from Guatemala was seen by hundreds of thousands of Americans on nationwide television.

WB2JSM contains equipment capable of the maximum power permitted by the Federal Communications Commission to amateurs and could easily contact Guatemalan stations directly on a sustained basis. The station made contact with several missionary amateur radio stations and with members of the Radio Amateur Club of Guatemala City. In the ten days following the quake, WB2JSM handled over three-thousand messages to Guatemala.

Ron Greene, WA2PCY, of the Hall of Science Radio Club, operates station WB2JSM during the Guatemala earthquake emergency, while Leon Weiner, WA2PFY, accepts traffic from Guatemalan Nationals and explains communications progress with the stricken country (*WA2VOS photo*).

Sidelights

A woman in the Bronx called the Hall of Science pleading for information on her family; seven-year-old Maria was her niece. A man in Brooklyn called about his brother; his brother, Frederico, was safe. The Guatemalan amateurs furnished information about hundreds of families when there was no other way to learn of their fate. Dozens of other stations, such as WB2JSM, operated from all over the United States with similar results. Emergency traffic handled by amateur radio operators resulted in expediting shipment of tons of urgently needed supplies, aiding in saving the lives of hundreds and alleviating the suffering of thousands.

In 1979 there will be a meeting of communications officials from many countries, (WARC), who will review the uses of the various frequencies in the radio spectrum. Many National organizations from police departments, armies and navies, commercial communications services, and radio hobbyists will be seeking to gain more radio-spectrum space, or at least to protect what they presently have.

Some countries don't approve of their citizens having radio stations in their homes with which they can communicate with others in foreign countries. The few radio bands now available to amateur radio operators worldwide will be under attack at the 1979 conference.

Much of the technology that has made modern radio, television, and home entertainment devices possible has been developed by amateurs. Their role in times of disaster has been well established.

There's a cooperative understanding between the American Red Cross and the American Radio Relay League, the National organization of amateur radio operators, which states: "The American Red Cross recognizes that the amateur radio service, because of its excellent geographical station coverage, can render valuable aid in maintaining continuity of communications during disasters and emergencies when normal communications are disrupted or overloaded."

Every day, somewhere in the United States, this cooperative understanding becomes a living reality when disaster strikes, as amateur radio operators play their volunteer role as part of the Red Cross Disaster Service. Communications officials representing their countries at the 1979 World Administrative Radio Conference (WARC) would be well advised to ensure that these important services to their citizens will be available in times of disaster, as this example shows. **HRH**

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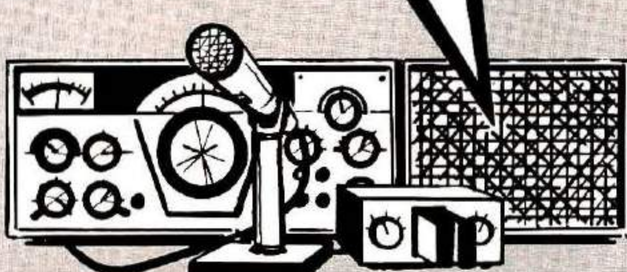
How to Speak "Ham"



Hams use a somewhat different language for their contacts on the air — a combination of abbreviations and Q signals — that sound like gibberish if you don't understand them; and you need a key to break the code

BY JIM GRAY, W1XU

The lamp sheds a soft glow on the polished surface of your operating desk, illuminating a clean sheet of tablet paper and sharpened pencil that seems to be waiting for your hand. The station clock indicates 0000 GMT — 7 PM Eastern Standard Time — and the mute faces of the silent radio equipment lined up along the back of the desk invite you to reach over and bring it to life. You sit down, lean forward, and begin the now-familiar routine of switching things on. Antenna: *Ungrounded*; Receiver: *On*; and — for the first time, "for real" — Transmitter: *On*. Your faithful hand key is positioned a comfortable forearm's length in front of you at the operating position and slightly in from the right-hand edge of the desk. It beckons irresistably.

This all began about six weeks ago when you passed the Novice code test and your buddy, a "General", gave you the written exam. You worried about passing in spite of all the studying. Looking back, you remembered some questions you might have answered differently. Then, when you came home this afternoon, an envelope marked *FCC* was waiting in your mail. Instant butterflies! License or invitation to re-take the test? Your hands shook a bit trying to tear open the envelope and you thought, "Did I or didn't I?" Hot dog, you did, you really did!

Now, a couple of hours later, things look good on 80 meters as you spin the dial of your receiver to the Novice part of the band. It had been set on W1AW's frequency where you still practice the ten wpm "runs," hoping to reach the magic "13." Wow! On 3730 kHz you hear a CQ. You've already checked the transmitter tune-up procedure for the tenth time on the dummy load. All is well and the meters point where they should. You "zero beat" the caller's frequency with the transmitter vfo and check the tuning for a brief second on the antenna. All okay. Switching to receive again, you find that the CQer is just signing. Your palms are a bit sweaty and your hand trembles slightly on the key. The "moment of truth" is at hand, and a thousand things run through your mind. "Will he hear me? How many times should I call him? Can I understand him if he returns my call? What signal report should I give him? What abbreviations should I use? How about Q signals — can I remember the right ones?"

The second milestone of your amateur radio career is about to take place (the first was getting your license), and you're naturally a bit tense because you want everything to be right the first time.

Have you been in this situation? Does it sound familiar? If not, either you haven't received your license yet, or you are Mr. Cool in person!

There is one way to help yourself prepare for this milestone — first QSO — in addition to the obvious one of being able to copy the code. You already know you can hack plain text, but what about not-so-plain text? Aha! Thought so. You did have trouble understanding what you put on paper, and thought you had copied wrong, when you listened to that Novice contact the other night. That wasn't the first time, either, was it? You copied only a few words "solid" with lots of missing letters, and you found letter combinations that didn't make any sense at all, right? Okay, read on.

The CW dialect

Way back in the early days of radio, commercial messages were sent by CW only. Time was money; the faster you "passed traffic" (handled messages), the more money you made for the company. High speed operators developed short cuts; they abbreviated common words that were ordinarily lengthy, they cut sentences down to only a few words, they adopted number codes for the most frequently sent messages, and they used *Q signals* — internationally accepted by shipboard operators — to replace frequently asked questions and corresponding answers. All of these traffic procedures reduced transmission time considerably and speeded up the flow of traffic. Just like yesterday's news, there was — and still is — nothing staler than undelivered messages. In addition, there are times when message-handling is literally a life-or-death proposition, and speed is of the essence.

As a ham, you are not expected to be a commercial operator, and in most cases an easy and leisurely flow of send and receive will be most enjoyable. But, as your operating skills improve, you'll find yourself becoming impatient with dragging conversation. After all, the idea is to communicate, not spend time with punctuation and laborious spelling of entire words.

Ham abbreviations were borrowed from commercial traffic handlers, from shipboard operators and — a surprising number — from other hams who manned the greatest message-handling network of all time: The American Radio Relay League. Just as you use slang expressions to add flavor, interest, and speed to conversation, the radio operator adopts his own ham slang for the same reasons. It becomes a dialect or accent, and is instantly recognizable to experienced operators. They all use it, and so will you.

Abbreviations are time savers

Perhaps the first thing that ought to be said is that you don't *have* to use abbreviations at all, but you'll find that most Amateurs *do* use them and — sooner or later — you'll probably use them too. The following list is not complete, but it does give you the most popular abbreviations and the original word from which they were taken. Notice another thing as you read them; sometimes just one letter is replaced, usually by a letter having a shorter Morse Code Character. For example, in the word *any* — or *ani* in abbreviated form — i replaces y; two *dits* instead of a *dit* and three *dahs*.

On land and ships traffic-handling shortcuts were developed.

ABT	about
AGN	again
ANI	any
ANT	antenna
$\overline{\text{AR}}$	end of message
$\overline{\text{AS}}$	wait a moment
B4	before
BALUN	balanced-to-unbalanced
BC	broadcast
BCNU	be seeing you
BFO	beat frequency oscillator
BGN	begin
$\overline{\text{BK}}$, BKG	break, breaking
BK, BKG	back, backing
BKR	breaker
BN	been, between
BT	dash, long break
C	yes (correct)
CUD	could
CUDNT	could not
CFM	confirm
CK	check
CKT	circuit
CL	close (closing station)
CLG	calling
CLIX	clicks
CLR	clear
CNDX	conditions
COZ, CUZ	because
CPI	copy
CQ	general call to any station
CUAGN	see you again
CUL	see you later
CUM	come
CUPLA	couple of
CW	continuous wave (telegraphy)
DBL	double
DA	day
DE	from
DIF	difference
DLR	deliver, dealer
DN	down
DNT	don't
DR	dear, doctor
DSNT	does not
DUNNO	don't know
DX	distance or rare station
ER	?
EL	element
EM	them
ENI	any
ERE	here
ES	and (from Morse &)
ETA	estimated time of arrival
FB	fine business
FD	field day
FER	for
FLD	field, filed
FLR	floor
FM	from, frequency modulation
FND	friend, find, found
FNI	funny
FREQ, FQ	frequency
FWD	forward
GA	go ahead, good afternoon
GB	good bye
GD	good, good day
GESS	guess
GG	going
GL	good luck
GLD	glad
GN	gone, good night
GNG	going
GND	ground
GOTTA	must
GP	group, ground plane
GUD	good

GV	give
GVG	giving
HD	had
HRD	hard, heard
HDG	heading
HI	high, laughter
HPE	hope
HPG	hoping
HPI	happy
HPN	happen
HQ	headquarters
HR	here
HRD	heard
HRG	hearing
HV	have
HVNT	have not
HVG	having
HVI	heavy
HW	how
INFO	information
K	go ahead (please answer)
$\overline{\textbf{KA}}$	attention
KLIX	clicks
$\overline{\textbf{KN}}$	go ahead, but only the station called
KNW	know
LK	look, like
LKG	looking
LL	land line (telephone)
LNG	long
LOTSA	lots of, many
LP	long path
LSN	listen
LTR	letter
LUV	love
LV	leaving
LW	long wire, low
MAG	magazine
MGR	manager
MI	my
MIL	milliampere
MILL	typewriter
MIN	minute, minimum
MK	make, mark
MIC, MIKE	microphone
MNG	morning, meaning
MNI	many
MSG	message
N	no, nine
NIL	nothing
ND	nothing doing
NG	no good
NR	near, number
NW	now
NVR	never
OB	old boy
OC	old chap
OM	old man
OT	old timer
OP	operator
OPTR	operator
PA	power amplifier
PD	period, paid
PKG	package
PSE	please
PSD	pleased
PLS	please
PSN	position
PT	part, point, plate
PWR	power
R	received, roger, ok, yes
RCD	received
RCVR, RX	receiver
RDI	ready
RDO	radio
RE	concerning
REG(S)	regulation(s)
RM	room
RNG	running
RIG	equipment, station
ROCK	crystal
RPT	repeat, report
RST	Readability, Strength, Tone
SA	say
SAE	self-addressed envelope
SASE	self-addressed stamped envelope
SB, SSB	single sideband
SG	sign, signature
SGD	signed
SHUD	should
SIG(S)	signal(s)
SKED	schedule
SN	soon
SRI	sorry
SEZ	says
$\overline{\textbf{SK}}$	signing off (see VA)
SS	sweepstakes
STN	station
SU	(I'll) see you
SUM	some
SVC	service
SW	switch, short wave
SX	$ (dollar sign)
T	zero
TRBL	trouble
TBL	trouble
TFC	traffic, messages
THR	there
TMW	tomorrow
TNG	thing, tuning
TNK	think
TNKS, TNX	thanks
TT	that
TU	thank you
TV, TVI	television, television interference
TX	transmitter
TWR	tower
U	you
UR, URS	your, yours
UT, UTC	universal time, GMT, (See "zulu" or "zebra" time)
$\overline{\textbf{VA}}$	signing off (same as $\overline{\text{SK}}$)
VERT	vertical
VFB	very fine business
VFO	var. freq. osc.
VOX	voice operated switch
VY	very
W, WT	watt
WAT	what
WATSA	what say
WD	word
WID	with
WK, WKG	weak, work, working
WX	weather
XTAL	crystal
XMTR	transmitter
XYL	ex-young lady (wife)
YL	young lady
YF	wife
YR	your
Z	"zebra" or "zulu" time UT, GMT
ZILCH, ZIP	nothing

You will occasionally see two letters with a bar over them, such as $\overline{\text{AS}}$, $\overline{\text{SK}}$, and the like. The bar means that the two letters are sent as one letter; that is, the Morse characters are run together. These symbols have special meanings of their own, as indicated in the list.

It is obvious that abbreviations are used almost exclusively for CW communication and are seldom used in voice transmission. It is ridiculous to hear someone *say* $\overline{\text{SK}}$ when he means "I'm leaving the air."

Q signals — CW only.

These have meanings of their own, and usually stand for an entire sentence in the form of a question (when followed by a question mark) or a statement. You will need to know some basic ones for everyday use, and some others for occasional use. When you begin operating on the voice (phone) bands, the habit of using *Q* signals is very hard to break, but please try. Use equivalent words — not the *Q signal* spoken aloud. Note: each may be followed by a question mark to indicate a question.

QRG	your (my) frequency is
QRK	readability of your (my) signals
QRL	busy
QRM	interference
QRN	static
QRO	increase power
QRP	decrease power
QRQ	send faster
QRS	send more slowly
QRT	stop sending

QRV	ready (to copy traffic)
QRX	delay, wait
QRZ	who is calling
QSA	signal strength
QSB	fading
QSK	full break-in capability
QSL	acknowledgement
QSO	contact, communication
QSV	send series of Vs
QSY	change frequency
QSZ	send each word twice
QTH	position, location
QTR	correct time

Some 'silly' *Q* signals have come into commonplace use in a kidding manner. Here are some, together with their usual meanings:

QLF	send with your left foot
QLZ	lazy operator
QMT	mail your traffic
QQQ	clean your antenna

Still others have been adopted by certain groups or organizations as special signals, for example:

QST	calling all Amateurs; adopted by the ARRL (also magazine)
QN —	used by traffic nets. The blank is replaced by appropriate letter. Example: QNZ — zero beat net control.

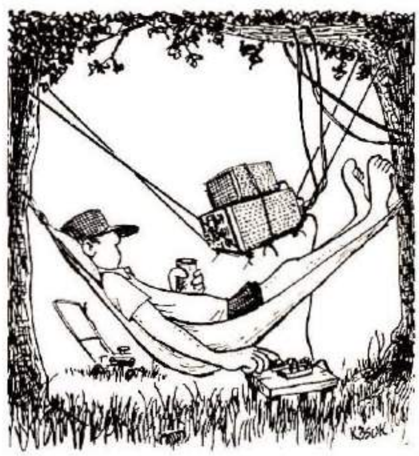
Abbreviations and Q signals in Practice

Now, let's take a look at a typical message and see how it might be deciphered. First, the code version:

W2EUQ DE WB1AEA R TNX FR
CLG ES GA —
UR SIGS FB HR — RST 579
QTH PETERBOROUGH, NH —
MI NM JIM —

WX HR CLR ES SUNI BUT CLD — HPE
UR WX GUD —
RIG HR TX 150W — WID LW ANT —
RX DRAKE 2B — HW CPI OM? AR
W2EUQ DE WB1AEA K

You will notice that very little punctuation is used. Questions, sentences, comments, and thoughts are spaced apart by long-break dashes; *i.e.* BT. If the message were formal, another style would be used, and proper punctuation supplied. Now for the plain text translation: "W2EUQ from WB1AEA. Roger, thank you for calling and good afternoon. Your signals are fine business here: readability 5, strength 7, and tone 9. My location is Peterborough, New Hampshire and my name is Jim. The weather here is clear and sunny but cold. I hope your weather is good. Equipment here is a 150-watt transmitter connected to a long wire antenna, and the receiver is a Drake 2B. How do you copy old man? End of message. W2EUQ from WB1AEA. Invitation to answer."



"QLZ"

It is obvious, of course, that a lot of time and space has been saved. You will also find right away that this kind of abbreviation is easier to take down on paper without getting writer's cramp. Eventually, you will use it only to make notes while you copy most conversations "in your head", that is, without putting them down on paper.

Although you probably can't believe it now, the day will come when you hear words and whole sentences, and won't even be conscious of hearing letters. The translation in your brain becomes automatic, and CW becomes almost like conversation.

Ham Jargon

Unfortunately, there is also a lot of jargon in common use on the Amateur bands. Some of it is acceptable — barely — and a lot is pure nonsense, adopted to give the talker a kind of *mystique*. You won't find much of it on CW, but you probably have heard a great deal on the Amateur phone bands and on CB.

It is using a lot of words that don't really mean anything — a kind of "ratchetjawing" just to hear yourself talk. Examples? There are plenty. Here's one: "By golly, OM, that ol' rig of yours is sure knockin' the top off my receiver and bendin' the meter against the peg, an' its been a wunderful cue-so, but the XYL is beatin' the gong for chow, an' if I don't QSY to the ol' kitchen, she'll be a-throwin' it to the hawgs, hi, hi, hi, hi. So by golly, OM, it's shore been a great cue-so an' that signal of yours has been real great. May see you on later if I don't QSY to the mahogany knot hole, you know the ol' modulated milk bottle, the ol' boob toob. So best seventy-threes and eighty-eights, yessir by golly. Sure has been real great hearin' that big signal of yours . . . blah . . . blah . . . " and so on for another ten minutes. This, of course is an exaggeration, but it is intended to show that very little real information has been passed. The "meat" of the conversation could have been transmitted in one sentence. Remember that the other Amateur probably won't hate you if you are brief and to the point. In fact, he may even want to talk to you again!

There's another type of abbreviation that should be routine, but seldom is: economy of words. You don't have to repeat everything twice or three times. Have you heard another Amateur send everything two or three times, even when the signals are loud and there is no interference? Sure, we have all heard that unnecessary redundancy, and it's not necessary; not even desirable, *unless* the other station *asks* for a repeat! Send each bit of information clearly and slowly — *once*. That's usually enough, and if it isn't, you'll be told.

Don't show off your Novice

"accent" by sending K twice when you invite the other station to answer, and — for goodness' sake — don't send KN when you mean K. If you send KN following a CQ, it's meaningless at worst; at best, it means you don't want anyone to answer!

A lot of jargon is pure nonsense.

Another mistake is sending your call two or three times after you have established contact with another station. If the other Amateur didn't get it right, then of course you should repeat it, but otherwise not.

If he got it right the first time, then he *knows* your call, and it's a waste of time to send it more than once on each transmission. Certainly he knows *his* call, so you don't have to send it twice or three times, either.

These common, but unfortunate and inefficient, practices betray your inexperience and lack of confidence. Sure, it takes time to build confidence, but don't do it by improper operating procedure. Your "fist" is your signature — and you'll be recognized by your "accent" so do it right.

Another common mistake is *too frequent* identification of your station by sending your call sign more often than necessary. FCC regulations state that you must identify your station once every ten minutes. Typically, you send the *other station's* call sign followed by your own at the beginning and at the end of the contact. In between, you send your call sign once every ten minutes, and the other station sends his every ten minutes. For example, all that's necessary is to send

". . . DE WB1AEA,"

or whatever your call may be, each time you identify. You don't have to send *both* calls each time. Almost everyone does, but it's *not* necessary.

Oh, yes, another much misused abbreviation that appears at the end of a closing transmission or message — 73. These numbers mean "best regards" just by themselves, but you often hear *73s*, both on CW and voice (and sometimes in print). The translation of this would come out as "best regardses," which is silly at best. Remember, when you send 73 you are sending "best regards;" when you send *73s*, you are sending the other guy a collection of magazines!

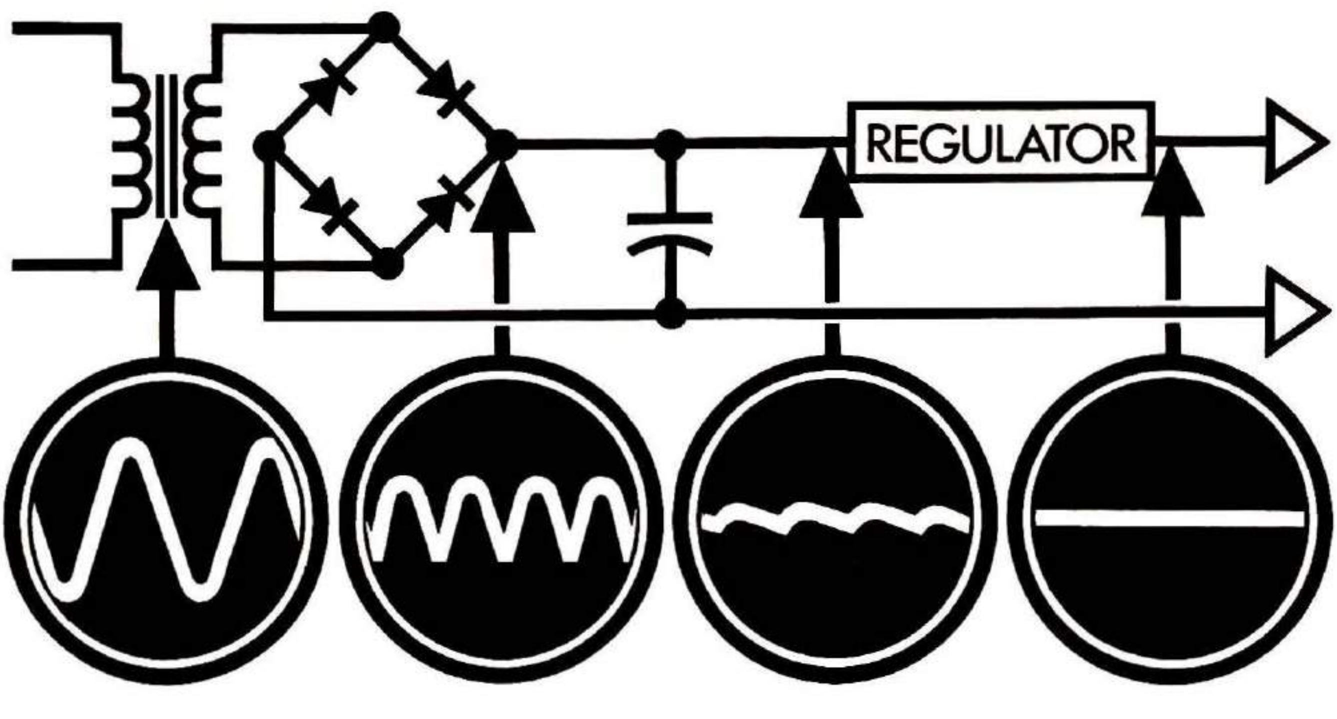
If you enjoy conversational CW, make it easy for yourself and the other Amateur. Most stations today have *break-in*, or modified break-in capability. Basically, this means that you hear the signals from your receiver as soon as you release the key; your station's transmit-receive function is automatic. This is a beautiful and smooth way to operate, especially if you use the right procedure. BK means *break*. When you send it, pause a few seconds and the other station should immediately respond by sending BK and then continue with his answer to your question, or with a comment about something you've just said. Notice that no call is required, no identification, as long as the ten minutes are not up. This easy and pleasant procedure makes CW communication as enjoyable as any two-way conversation, whether it be by telephone or radio. Use it, be brief, employ abbreviations and Q signals properly, and have the time of your life.

HRH

More details? Ad Check page 78.

More details? Ad Check page 78.

More details? Ad Check page 78.



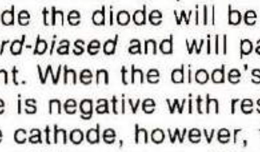
Your POWER SUPPLY--
What the 'Scope will show

BY JOSEPH CARR, K4IPV

A power supply can be said to provide the fuel that your electronic circuits run on. Most power supplies are so basic in design that it is surprising that they cause much trouble, and even more surprising that so many people have trouble understanding what the problem is. A few minutes spent with some elementary theory and following the current flow through some typical power-supply circuits will save much more time when trouble strikes. I'll start right at the beginning of a typical supply and tell you how it all fits together. So you'll be able to look for any problems, or build your own supply.

Some basics

The dc power supply converts the alternating current from the wall outlet to the direct current required by most electronic circuits. The heart of the supply is a rectifier, which may be either a vacuum tube or solid-state device. In recent equipment, of course, the latter is used. The rectifier has an important property: it allows current to pass in only *one* direction. The symbol for a diode rectifier is shown in **Fig. 1**. When the rectifier anode is positive with respect to the cathode the diode will be *forward-biased* and will pass current. When the diode's anode is negative with respect to the cathode, however, the diode will be *reverse-biased*, and won't pass current.



ANODE POLARITY WITH RESPECT TO CATHODE	CURRENT FLOW ?
NEGATIVE	NO
POSITIVE	YES

Fig. 1. The basic diode rectifier symbol.

An ac waveform is shown in **Fig. 2**. This waveform is called a sine wave. Positive-going peaks in this waveform represent current flow in one direction, while negative-going peaks represent current flow in the opposite direction. When this waveform is applied to a diode, only the positive half can forward-bias the diode and thus will appear at the cathode.

Figs. 3 and **4** show two common power supplies. **Fig. 3** is a full wave supply, while **Fig. 4** shows a full wave bridge circuit. Let's first consider the operation of these circuits as if the filter capacitor (C1 in both cases) were not there.

The power supply of **Fig. 3** uses a center-tapped transformer and two rectifier diodes (typically of the 1N4000 series). On the positive half of the ac input alternation, the top of the transformer will be negative with respect to the

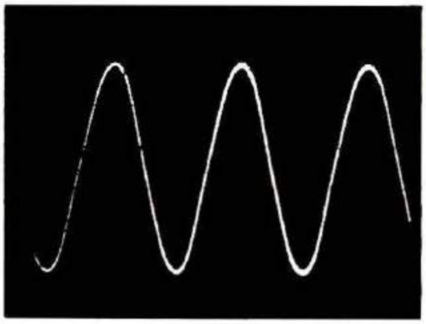


Fig. 2. Ac input waveform applied to the rectifier.

bottom. Of course, because of the operation of an inductor, we know that each turn will be slightly more positive than the turn immediately above it if we measure the potential on a turn-for-turn basis starting at the top. This means that the centertap will be positive with respect to the top end but negative with respect to the bottom end of the transformer secondary. Since it is a *center*-tap, the voltages appearing across the top and bottom halves will be equal. When the bottom half is positive, diode CR2 will be forward biased and diode CR1 will be reverse biased. This means that current will flow from the center tap through load resistor R1 then through CR2 back to the transformer. On the second alternation of the ac cycle the polarities will reverse, making the top of the transformer secondary winding positive with respect to the bottom. In this case, current flows *out* of the center tap, through R1 in the *same direction as before*, and back to the transformer secondary winding through diode CR1. The key to the success of the full wave supply is that *current in the resistor flows in the same direction on both halves of the ac input cycle.*

The bridge rectifier circuit of **Fig. 4** doesn't require a center-tapped secondary on the transformer. If the same transformer used in **Fig. 3** were used in **Fig. 4**, you'd obtain twice the output voltage but at one-half the current rating. When the top of the secondary of T1 is negative with respect to the bottom, diodes CR1 and CR3 will be forward-biased and CR2/CR4 reverse biased. Current will flow from the top of the transformer secondary through CR1, and load resistor R1, through CR3, then back to the opposite end of the transformer secondary. On the second half of the input ac waveform the situation will reverse, making the top of the secondary positive with respect to the bottom and forward-biasing diodes CR2 and CR4. Of course, CR1/CR3 will then be reverse-biased. Current will flow from the bottom of the transformer secondary through CR4 and load resistor R1 in the *same direction as before*, through CR2, and then to the top of the transformer secondary.

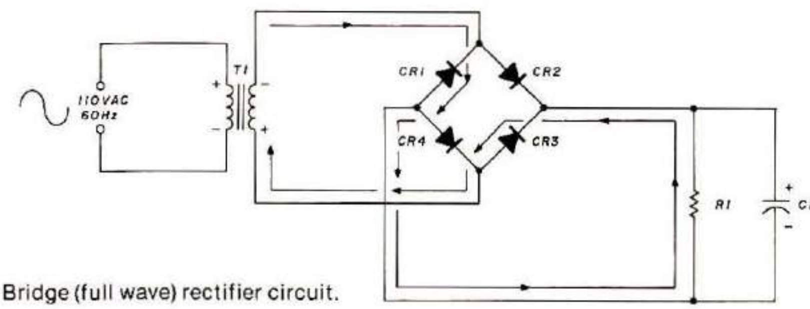


Fig. 4. Bridge (full wave) rectifier circuit.

Since both **Figs. 3** and **4** are *full wave* supplies, the current flowing through R1 will be the same on both halves of the ac input waveform. This action produces a waveform across R1 (assuming C1 is out of the circuit!) as in **Fig. 5**.

This waveform is still not pure enough for most electronic circuits. If it were a receiver power supply a loud hum would be heard in the output.

If the supply were for a transmitter you'd receive hum reports from other amateur stations, ARRL *Official Observers*, and maybe the FCC if you're unlucky. Adding C1 (**Figs. 3** and **4**) to the circuit will help reduce the bumpiness, or "ripple component" and make the dc output more like pure dc, as obtained from batteries.

Fig. 6 shows the waveforms associated with a full wave supply with a single filter capacitor to smooth the direct current. This is typical of most modern solid-state equipment, especially if critical stages such as the *VFO, crystal oscillator,* or *local oscillator* are fed from a regulated power-supply circuit. The waveform in **Fig. 6A** is the ac sine wave delivered by the transformer. If you placed the input of your oscilloscope across the secondary of T1 in either power-supply circuit you'd see this shape. The waveform in **Fig. 6B** is the full wave rectified voltage applied across the resistor (R1).

But since capacitor C1 is in both circuits, we find a slightly different situation, as represented in **Fig. 6C**. During

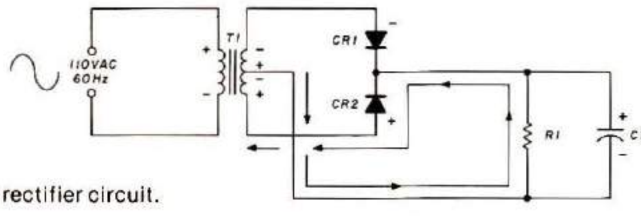


Fig. 3. Simple full wave rectifier circuit.

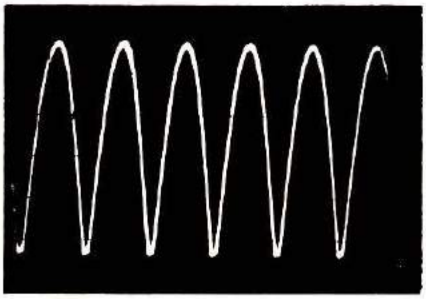


Fig. 5. Waveform across R1 if C1 is disconnected.

each hump or peak in the **Fig. 6B** waveform, capacitor C1 will charge on the upward excursion but discharges during the downward excursions. So when the rectifier voltage is increasing in amplitude, a charge will be stored in C1; but as the rectified voltage passes its peak and begins to fall, the charge from the capacitor is dumped back into the circuit. This action tends to fill in the spaces between peaks, as shown in the waveform of **Fig. 6C**. Of course, if an oscilloscope were placed across the power supply output, we'd not see the rectifier peaks but rather a ripple component riding on a dc level, as in **Fig. 6D**.

Some faults

Fig. 7A shows the waveform photographed on a scope. The waveform was at the output of a bridge-rectified power supply such as shown in **Fig. 4**. The oscilloscope horizontal sweep was set so that two cycles of the 120-Hz output saw-tooth were visible. But when either diode CR1 and CR4 opens up, you'd see the waveform in **Fig. 7B**. Because only one diode is operating, the ripple frequency will be half that normally expected.
(In any operating full wave supply, the ripple frequency is twice that of the ac mains frequency; in the 60-Hz systems used in the U.S. it will be 120 Hz.) In this case, the ripple component is only 60 Hz, indicating that one or more (of the same pair!) of diodes is open-circuited.

Although it may seem unlikely that a diode rectifier would *open*, it's fairly common in bridge circuits. With molded bridge-rectifier stacks, especially the low cost "bargain" variety, an internal connection may be broken. But in all bridges — and that includes those with four discrete rectifier diodes handwired — very often one of the diodes to the negative output line (CR1/CR4) will open if one of the other diodes becomes shorted.

Unfortunately this becomes an occult problem, because the shorted diode will cause all kinds of pyrotechnics including blown fuses. It seems that all of the initial and most obvious symptoms will occur from that shorted diode. No loud whistles will occur when CR1 or CR4 opens, but you'll find minor things like improper tuning; a loud hum (the filters were designed to work with 120 Hz, so are less effective); or off-calibration. In one case, I used the "bridge with a known good one" test to check the capacitor. When the extra capacitance was added to the circuit, the hum level decreased, so I erroneously labeled the existing filter as "bad" and replaced it . . . guess what — the hum was still there! The problem was caused by an open bridge rectifier and not by an open filter capacitor.

Replacement of solid-state rectifier diodes is one area where many amateurs go wrong. Most fail to appreciate the voltage at which the diode must operate. Let's take, for example, the common + 750-1000-volt power supply used with transmitters and transceivers in the 100-200-watt class. The diode-voltage rating is the *peak reverse voltage* (PRV) or *peak inverse voltage*

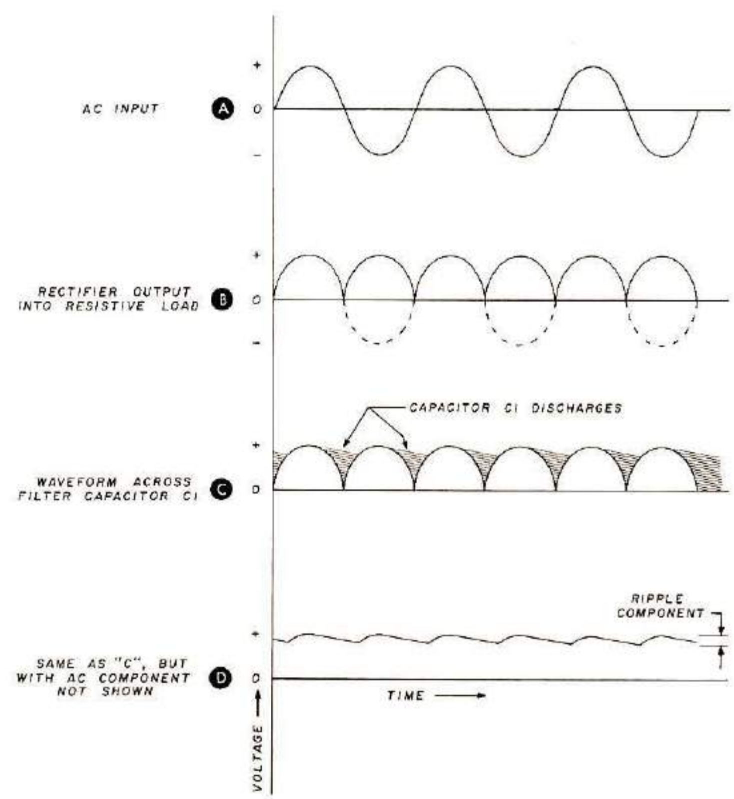


Fig. 6. Waveforms associated with either **Fig. 3** or **4** showing action of filter capacitor C1.

More details? Ad Check page 78.

(PIV) (both the same). This voltage is the maximum reverse bias the diode can handle without being destroyed. If the 750-1000-volt supply is built as in **Fig. 3** the transformer will have a 750-0-750-volt secondary. This means that the voltage applied to the diode will be *1.41 x 750 = 1060 volts*. The factor 1.41 is needed because the 750-volt rating is root-mean-square (*rms*) and we want *peak volts*.

A commonly available TV replacement rectifier is rated at 1000-volts PIV, so two in series can be used, right? Wrong! To be sure, the PIV rating of the combination will be 2000 volts, which is greater than 1060 volts — so what's the problem? If capacitor C1 (**Fig. 3**) were not used, then the PIV and forward voltages would be the same — but recall that capacitor C1 charges also to the peak voltage. The actual PIV presented to the diode will be *2 x 1060 = 2120 volts*. Clearly, 2000 volts of PIV rating is not good enough, because there will be 120 volts *more* on one half of each cycle! **Fig. 8** shows the full wave supply of **Fig. 3**, which has been redrawn and simplified to illustrate this problem. In this case, the reverse voltage applied to the diode is 2 x 1.41 x the transformer rms. The correct PIV rating of the replacement diode is *not less than* E_{rms} x 2.82. Most professional servicers, who back their work, prefer to use a factor of 3 for safety and so will select a diode that is 3 x E_{rms}.

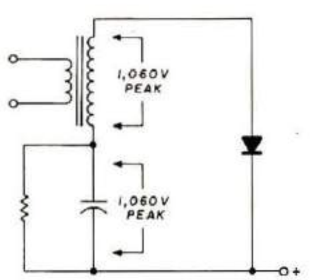


Fig. 8. Redrawn and simplified version of **Fig. 3** showing how the diode PIV is actually $2.82 \times E_{rms}$.

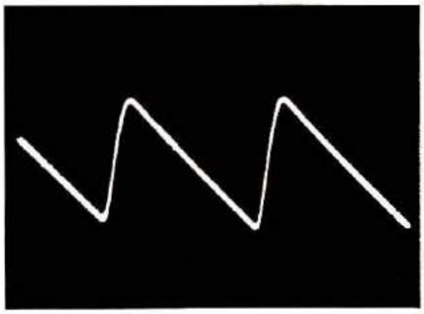
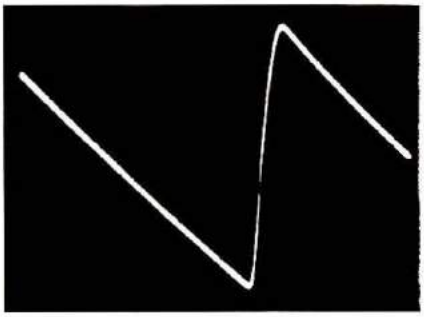


Fig. 7. Above, normal 120-Hz sawtooth from **Figs. 3** and **4**. Below, 60-Hz sawtooth if CR1 or CR4 is open.



Of course, we may still use those low-cost TV-replacement diodes, but we must adapt them as in **Fig. 9**. Each diode is a 1000-volt PIV TV replacement type. These diodes are available in the 1N4007 series at 1-ampere forward-current rating and up to 2.5 amperes in certain "house brand" types. Be a little wary of certain types apparently rated at 1 ampere, especially those of the imported variety, or when found in certain blister-pack offerings. Many of these diodes are substandard and will only withstand their rated current if the leads remain at full length to act as heat sinks.

You think I'm kidding? Ask a number of TV servicers about that! A lot of those diodes were sold to the service industry awhile back, and the sets that received them wouldn't make it through the 90-day warranty on the repair! There are no bargains, in general, so be prepared to pay a little bit for the diodes. Good 1N4007 diodes from reputable sources (see some of the advertisements in this magazine) cost only a little more than the off brands but will most likely behave themselves. It's an extreme case of penny wise and pound foolish to use less than top-grade replacement parts on that transceiver, which probably cost you almost a thousand bucks!

The resistors in **Fig. 9** balance the voltage drops across the respective diodes. It's usually satisfactory to use a value for R that is 100-ohms/volt peak applied to the stack. For full rating of the diodes, 1000 volts x 100 ohms/volt results in a value of 100 kilohms or more. Less resistance would make the circuit think that there is no diode and little in the way of rectification would occur. some sources also recommend that a 0.001 μF capacitor be placed across each diode.

Fig. 10 shows the waveform to expect in another kind of problem. **Fig. 10A** was from a bridge rectifier circuit such as **Fig. 4**. In both cases, the problem was the same: a B+ fuse placed at the rectifier output failed. Note that the waveform in each case is the rectifier output as if no filtering were present. The fuse in each case was used to protect the rectifiers in case a filter capacitor, final output tube, or other circuit element shorted to ground. The fuse was located right at the rectifier, between the load and the filters.

The waveform photos were taken at the (+) terminal of the rectifiers. An initial voltmeter check would lead you astray if made across the filters, at the

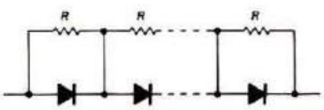
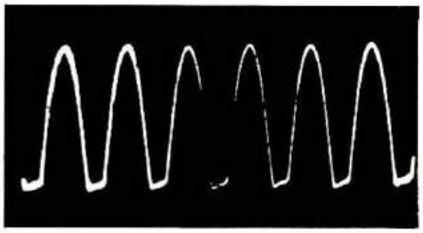


Fig. 9. TV-replacement rectifiers can be stacked to gain a higher PIV rating that might be needed in a transmitter.

transmitter final amplifier (rf choke), or other point beyond the fuse. One might say "Aha! A bad power supply!" and spend a great deal of time trying to figure out why the supply is no good. The real culprit, however, might be external to the power supply.



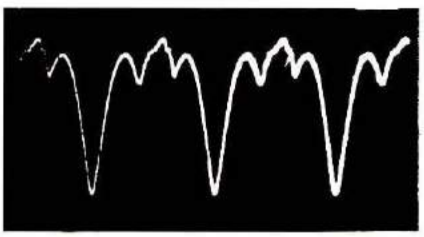
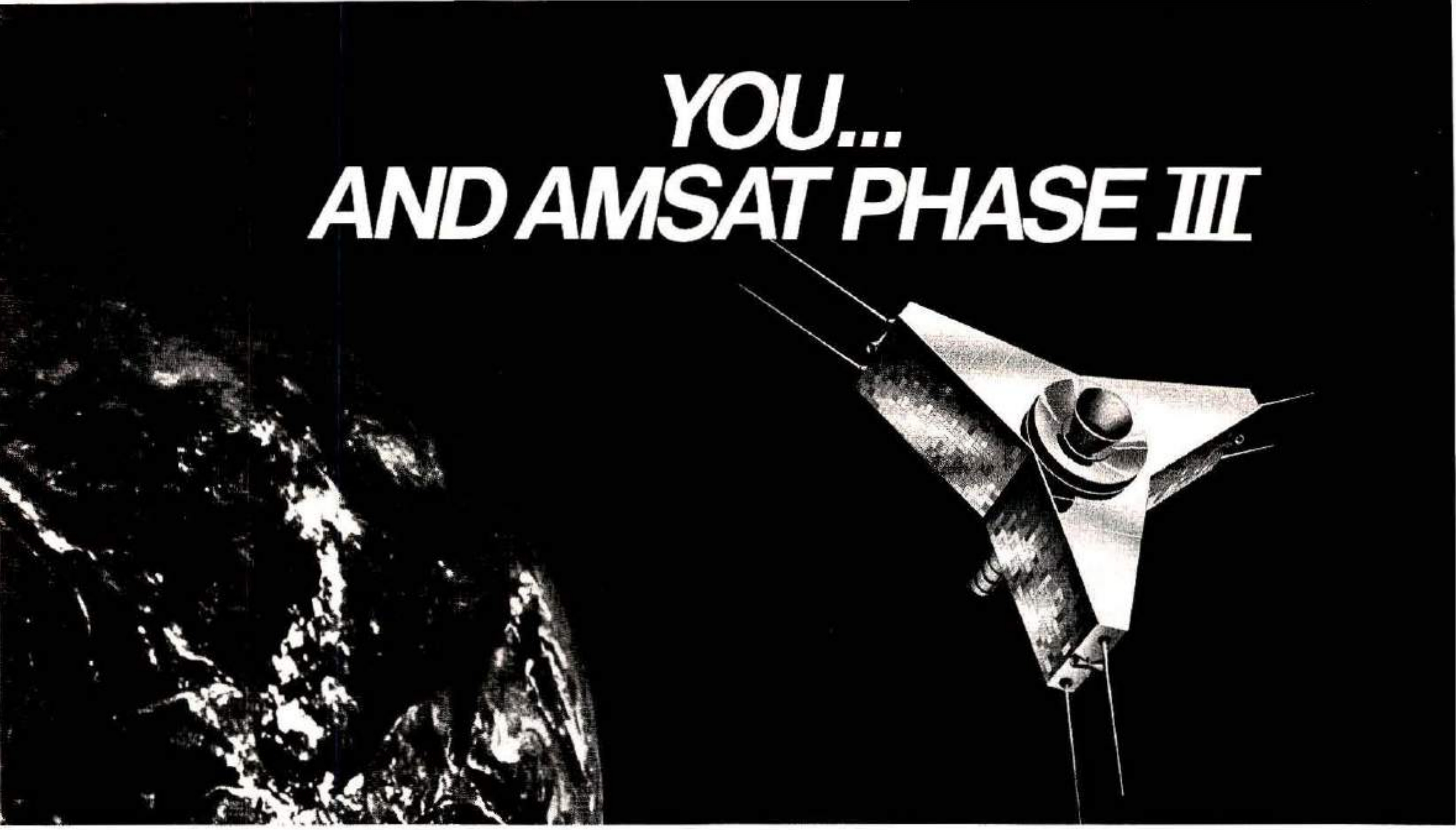


Fig. 10. Waveforms at the output of full-wave rectifier, above, and bridge rectifier, below, if a rectifier fuse is blown (see text).

For example, in many transmitters, if the oscillator or a buffer stage fails the final amplifier tubes will be unbiased and will run red hot. This means that an overload current is being dragged out of the power supply, so a fuse might blow — if you're lucky.

B+ fuses often seem to be located on the chassis rather than be accessible from the outside; I don't know why but it's a fact. So look for a fuse either in a chassis (open) fuse holder, or a pigtail fuse wired into the circuit. At the risk of repeating myself from earlier articles, let me point out once more that a fuse doesn't cause trouble, it *indicates* trouble! If a serviceman charges you beaucoup bucks for repairs that could have been simple, except that you installed an oversized fuse to stop the "blowing" problem, then you're up for *fair game*! **HRH**



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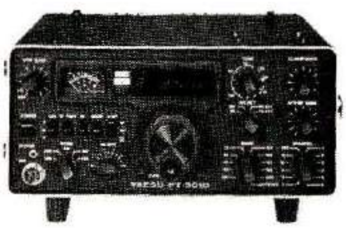

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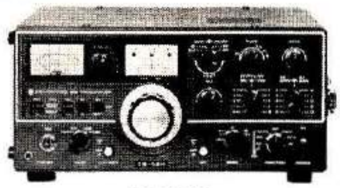

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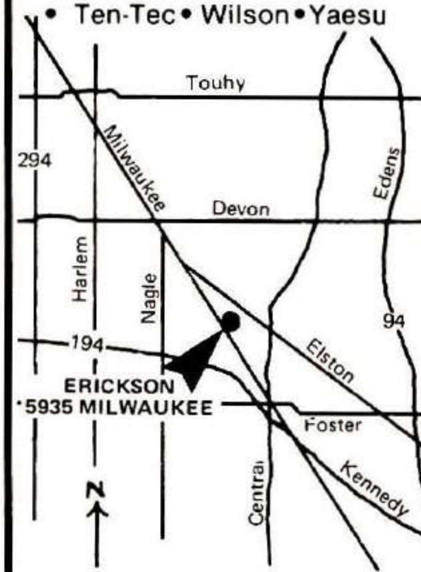

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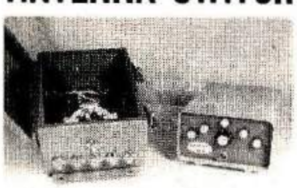

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QUESTIONS & ANSWERS

Public Service, Networks, Emergencies; Key Clicks and Spurious Emissions

BY THOMAS McMULLEN, W1SL

We're almost through with the Operating Procedures portion of the Question and Answer series; there's one more category to talk about — Public Service Operation. After that, I'll talk about the signals that are sent out by your transmitter, which is a subject that comes under the heading of Emission Characteristics.

Public service operation

If there is any part of amateur radio that you can be proud to show off to the general public, this is it. The usual man-on-the-street will not be overly enthused about your prowess at putting up antennas, at building an eleven-transistor widget, or in scoring 9-million points in a contest, but when you call him up to deliver a message from his son in Antarctica, or to assure him that his brother survived an earthquake in Nicaragua, then he is impressed.

There is no rule that says you have to "serve time" in traffic nets, learning to send messages in their proper form. Or, you are not required to earn points toward advancement by serving during an emergency situation; however, the requirement that amateurs *should be ready* to provide emergency communications is right there, in black and white, in the Basis and Purpose part of the Rules and Regulations. Just in case you missed the issue of *Ham Radio Horizons* that it was in, I'll give it to you again:

97.1 Basis and Purpose

The rules and regulations in this part are designed to provide an amateur radio service having a fundamental purpose as expressed in the following principles:
(a) Recognition and enhancement of the value of the amateur service to the public as a voluntary noncommercial communication service, particularly with respect to providing emergency communications.

By and large, amateurs have fulfilled this obligation very well. They have done a commendable job in large disasters, such as floods, fires, or earthquakes, on the high-frequency bands. Since the use of vhf repeaters has become widespread, the chances for an individual to lend a helping hand in more localized trouble have increased many fold.

As a beginner, restricted to CW operation in portions of the amateur bands, you can participate in some good training for the time when you need to be an efficient emergency operator. There are many slow-speed nets that tailor their activities to the beginner's abilities. You can eavesdrop on them until you know their style and procedure, and, when your courage is up to it, join in. Don't worry if you goof — they're patient types or they wouldn't be there.

You don't have to feel tied down to a lifetime of handling messages if you don't want to (although many amateurs enjoy great pleasure in doing just that), but you should definitely get enough practice to feel at ease in any network that you join.

Network operation

Amateur traffic (message-handling) networks spend a lot of time sending messages back and forth, and many of these messages are of no great consequence. Most are friendly greetings from one person to another, just to demonstrate a method of communication. However, all of these nets have one important function — they are keeping the operators' skills sharpened in readiness for troubled times. Their procedures were developed from long practice and experience in what works and what is most efficient in passing information.

Here are a few simple ground rules to remember when you join a traffic net:

1. The Net Control Station (NCS) is the boss. Follow his instructions at all times.
2. Don't break into the net except at the times when the NCS asks for more stations to check in (QNI).
3. Learn the Q-signals that apply to network operation, and use them properly. (Most QN-signals apply to network situations).
4. Wherever possible, put all of the information in formal message form, complete with addresses, telephone numbers, word count, time, and name of sender. This makes it easier for operators to assure that all the information gets through.

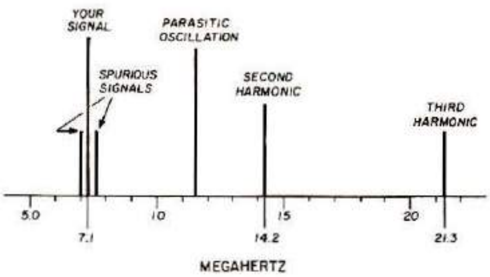


Fig. 1. Your transmitter could send out a spectrum of signals such as that represented here. Eliminating the harmonics and the two spurious signals near your main signal is a matter of good transmitter design and, perhaps, a filter in the output line. The parasitic oscillation is usually an indication of something gone wrong, especially in a transmitter that was once working well. Any signal other than the main one is a spurious signal which will usually cause trouble.

5. Do not send a message faster than the other guy can write it down. (Once, slow and accurate, is better than twice as fast with errors).

These rules are designed to apply to messages sent by Morse Code, but the same principles work just as well with voice. When you advance to a higher class of license, and can use voice for passing along messages, you'll find that some networks adhere to this more formal style of operation, and some do not. Also, if you are using the local repeater to talk to a Police or Fire dispatcher about some emergency, he will be completely unfamiliar with formal messages of this type, so you should not use formal message procedures. However, the general idea remains the same — be brief, be thorough, and stay calm; your early training in an 80-meter traffic net will give you a good deal of self-confidence and skill at making yourself understood.

Disaster operation

In the event that you become involved in handling communications during any widespread emergency or disaster such as flood, hurricane, or earthquake, there are some things to remember so that you will be helping, rather than causing more problems. An important procedure is to listen on and near the frequency where the emergency network is handling messages. You'll find that they usually keep several spots clear for calling frequencies, so a station in the disaster area can quickly reach the net control station. Other stations are shunted to nearby channels to pass the messages along. One or more stations may make announcements from time to time in an effort to prevent unsuspecting operators from interfering with the network. If the emergency is severe enough, the FCC may declare some frequencies as reserved for emergency work only. Listen carefully for bulletin stations in time of disaster — they may be transmitting important information about the frequencies that you should avoid unless you are needed.

Only the stations involved in the immediate area of a disaster need to be in constant touch with the net control station. If you are not one of those, spend most of your time listening and taking notes. If the net control station needs help, he'll ask for it, stating specifically what the nature of the problem is, for example: "This is Net Control, WD7XXX, with traffic for the Fire Department in Highvillage. Can anyone relay?" If you are in a position to help with his request, then go to it. Identify yourself and state how you can help him out. Again, this is where your previous exposure to message handling techniques in a network can save time and make you feel more at ease when the real thing comes along.

Emission characteristics

This section concerns the energy that is transmitted by your rig — its emissions. The term covers any type of energy that your transmitter sends forth, and it can include both desired and undesired emissions. Obviously, the Morse Code (or voice, or Teletype, or whatever) is the desired emission, but some transmitters will emit other energy too. Sometimes this is caused by poor design, sometimes by operator error, and occasionally something will go wrong in the rig to cause it to transmit signals other than what you intended. These unwanted signals are called *spurious emissions*.

A very common type of spurious emission is a harmonic. All non-linear electronic circuits produce harmonic energy, but a transmitter of good design will have circuitry that tends to suppress these harmonics. A harmonic is simply a multiple of the fundamental frequency — second, third, fourth, and so on. If you were operating at 7105 kHz, your second harmonic would be at 14210, third at 21315, fourth at 28420; see **Fig. 1**. Circuit losses at higher frequencies become so great that the harmonic energy cannot be developed, but it is possible to have troublesome harmonics as high as the 10th, 12th, or 15th.

Other types of spurious emissions include parasitic oscillation, which is sometimes caused by a defective component or poor design. This can cause your transmitter to send out a signal at a frequency near the desired one, but not necessarily within the confines of the amateur band. If these signals interfere with commercial or military stations, it can be very serious. Another type of spurious signal could be the product of a mixing action somewhere within the transmitter. In short, any type of signal that your transmitter puts out, other than the one you intend to use for communications, is a spurious one.

A key-click is another undesirable characteristic of a

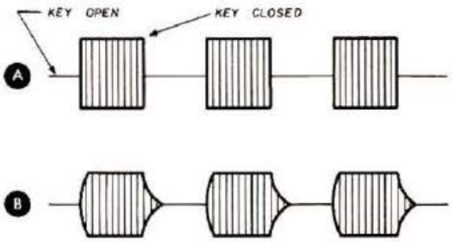


Fig. 2. A quick rise-time when you close your key looks nice on paper, **A**, but the sudden transition from rising to the steady "on" condition is similar to a square wave, which is full of harmonic energy and causes key clicks near your signal. A small amount of delay in the turn-on and turn-off, **B**, will soften the transition, and eliminate the clicks. If you go too far in softening the waveform, the code will run together and be impossible to copy.

transmitted signal. A click is caused by turning a signal (or other form of energy) on or off too rapidly. A Morse code element (dot or dash) should not be a nicely squared segment of rf energy, but rather should have the corners slightly rounded. The leading edge (start) should rise quickly, but with just enough time lag to prevent a sharp transition from one state to another (see **Fig. 2**). The end of the character (trailing edge) should have a similar soft decay. Some transmitters have built-in circuits that will provide this desirable characteristic; others require that you add the circuit at your key. A key-click suppressor is usually a capacitor and resistor in series, hooked across the key or the circuit to be keyed.

A chirp is a different matter — it almost always must be cured in the transmitter. If your transmitted frequency moves when you close the key, your signal has a chirp. It is caused by an unstable oscillator, poor power supply regulation, or by too much energy being drawn from the oscillator (heavy loading by the next stage). This is not the same thing as frequency drift. Although a chirp is noticeable as a slight change in frequency each time you close the key, the basic frequency remains the same throughout your transmission. If your frequency changes gradually while you are sending, so that the receiving station must keep retuning to hear you, then you have a frequency *drift*. This is often caused by too much heat in or near the oscillator circuit.

Types of emission

As a Novice licensee, you will be concerned with just one type of emission — A1. Generally speaking, emissions can be classed as amplitude modulated (AØ, A1, A2, A3), or frequency modulated (F1, F2, F3). don't let the modulation part of the term mislead you. To modulate means to modify, to impress one form of information upon another. When you turn a carrier on or off by means of a key, you are changing its amplitude from zero to maximum, thereby *modulating* it with information in the form of Morse code. AØ is a steady carrier, without any form of modulation such as tone, code, or voice. It is applied most often in amateur radio as a means of controlling model planes, boats, or cars. This type of emission cannot be used by amateurs below 51 MHz. **Table 1** gives the emission designations for the most common modes used by amateurs. Don't worry too much about any of them except A1, which is what you use when you send code (CW).

Now, there's another term that you may wonder about — CW. The letters stand for *continuous wave*. The natural (and often asked) question is: "How can it be continuous when you are turning it on and off with a key?" In order to answer that question, I'll have to take you back a few years to the beginning of radio communications.

Early transmitters were of the spark variety — that is, they sent information by making and breaking a circuit that caused a spark to jump across a gap. The energy that flowed through this circuit and spark-gap was coupled to an antenna, to be radiated and eventually received as a keyed buzz or tone. Energy that discharges through a spark in this fashion has a characteristic called a damped wave — each succeeding repetition of the waveform is smaller in amplitude until it dies out completely; **Fig. 3A.** Several of these characteristic wave-trains could occur during a single "dit" while the key was closed, depending upon how frequently the spark was made to jump.

The reason the waves were damped — decreasing in amplitude — was that no more energy could be supplied during the time that the spark was jumping. You had to wait for the spark to stop before the capacitors and inductors could have their energy restored, ready for the next spark to discharge them.

Well, along came vacuum tubes, invented as a means of controlling current flow, and used mainly to amplify audio

Table 1. Emission types and designations for the Amateur Radio Service are as follows:

AØ	steady, unmodulated pure carrier.
A1	telegraphy on pure continuous waves.
A2	amplitude tone-modulated telegraphy.
A3	a-m telephony including single and double sideband, with full, reduced or suppressed carrier.
A4	facsimile.
A5	television.
FØ	steady, unmodulated pure carrier.
F1	carrier-shift telegraphy.
F2	audio frequency-shift telegraphy.
F3	frequency- or phase-modulated telephony.
F4	fm facsimile.
F5	fm television.
P	pulse emissions.

More details? Ad Check page 78.

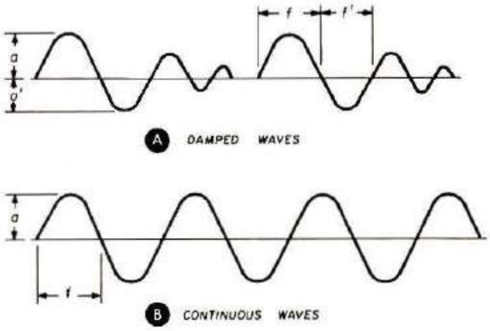


Fig. 3. Spark transmitters put forth a damped wave, as in **A**. Note that the amplitude, **a**, **a'**, changes, as does the frequency, **f**, **f'**, when the energy in the circuit dissipates. In modern oscillator circuits that use tubes or transistors, the energy is replenished so that the amplitude and frequency remain constant — or continuous, **B**. Therefore, it is called a *continuous wave*, even though you are keying the transmitter in a dot or dash sequence.

signals. Then circuits were developed for radio-frequency amplifiers or oscillators. Because a tube allows energy to flow through it in one direction, it could supply energy to a tuned circuit — thus sustaining oscillation — but it would not discharge the energy in that circuit as would a resistor or capacitor or transformer. This meant that each succeeding cycle of oscillation would be sustained at the same amplitude as the one before it — a continuous wave; **Fig. 3B**. (Yes, it was sometimes referred to as an "undamped wave" in the early days). So, CW is a continuous wave, even though you are breaking it up into dits and dahs with your key.

Keying, stability, and monitoring

The spot in your transmitter circuit to which the key is connected can have a lot to do with the quality of your signal. It generally is not a good idea to key the oscillator in simple transmitters, because many of them are not designed to accept the change from off to on without creating a chirp, which is undesirable. A buffer stage (medium-powered amplifier) is a good place to key a transmitter, if it has one; a frequency multiplier will also work well as a keyed stage, and many transmitters are arranged to key the final amplifier. Some transmitters have two or three stages keyed at once.

Sometimes, you might hear a weak signal from a station when his key is open, between characters or words; this is called a *back wave*. A back wave is caused by the signal from the oscillator (which is on continuously) leaking through the following stages even though they are not keyed. Transmitting a back wave is unnecessary and often annoying. It is usually caused by poor design or a malfunction in the multiplier or amplifier stages; the bias may not be sufficient to make the amplifier "turn off" when the key is up, or one or more of the stages may need neutralizing or shielding.

Amplifiers that use tubes are generally keyed by one of two methods: cathode keyed or grid-block keyed. A cathode-keyed transmitter has the key in series with one or more of the cathodes, and when you close the key you complete the circuit to ground, turning it on. Grid-bias keying involves applying a high negative voltage to a grid of a tube, through a resistor of several thousand ohms. When you close the key, you short out the bias, allowing the tube to conduct. Because of the series resistor, only a small amount of current will flow through your key contacts, which prevents overheating the bias supply.

Transistorized equipment can be keyed in much the same manner, but of course the names of the elements are different. You can place a key in series with the emitter circuit, which will have the same function as cathode keying. You can also place a bias on the base circuit, and then short it out with your key to make the stage work. Additionally, a stage can be self-biased so that it is not conducting, and you can apply a small forward bias through your key to make the transistor turn on. It gets a bit tricky here because of the different device and voltage polarities (NPN or PNP transistors), but the principle involved is the same.

Direct keying of the voltage applied to a transmitter is seldom done — in fact, it is usually downright dangerous. Tube transmitters normally require hundreds of volts for operation, which means that you would have high voltage on your key, waiting to zap you if your finger slipped. The low voltage required for transistorized equipment is not safe either; a short circuit could allow a high current to flow through some relatively small wires, which might get hot enough to start a fire, in addition to damaging the power supply or transmitter.

I've already pointed out that chirp can be caused by too much loading of the oscillator by the next stage, or by keying the oscillator. The obvious cure is to decrease the coupling to the next stage, or to key a buffer or multiplier or amplifier.

Frequency drift is usually a matter of too much heat somewhere in the oscillator circuit. Better ventilation might be the cure, or reduce the voltage to the oscillator to the minimum value that will allow it to operate properly. Less power consumed in that stage means less of it will be dissipated in heat, therefore less chance of frequency drift.

Good power-supply regulation is also a means of achieving frequency stability, for both chirp and drift problems. Another, often unsuspected, cause of poor frequency stability is rf from the output stage getting back into the oscillator of the transmitter. A severe mismatch at the antenna can allow reflected rf energy to get back into the oscillator or power supply, perhaps through the 117-volt ac wiring; a poor ground system could cause the same type of problem. This effect is especially noticeable with some solid-state rigs; even a fraction of a volt of rf can change the operating characteristics of some transistors.

Monitoring the quality of your transmitted signal can be done in many ways, but you'll have to choose one that fits your particular transmitting and receiving arrangement. If you are using a transceiver, it is impossible to hear your transmitted signal because the receiver portion of the unit is turned off when the key is closed. You may hear a tone, but it is usually just a keyed audio tone that is not related to the *quality* of your signal at all. To check on the quality of a transceiver's output, you must use a separate receiver that is tuned to your frequency. Some of the surplus frequency meters will do the job, too, by providing a heterodyne between the signal from the frequency generator and the one from your transmitter. You should check your transmitter quality periodically (several times a year) and after any changes have been made to your transceiver. If you do not own a separate receiver or a frequency meter, borrow one from a local ham or club, or ask someone for a critical on-the-air check.

Separate transmitter and receiver arrangements allow you to hear your own transmitter, but to be sure that you are not overloading the receiver, it should be isolated as much as possible from the transmitter. If too much rf gets into the front end of a receiver, it can overload the high-gain circuits, causing them to make your signal sound strange. In extreme cases of receiver overload, you may have to hook your transmitter to a dummy load, turn the rf gain control of the receiver all the way down, and perhaps even place a low-value resistor (simulating the load of the feedline and antenna) across the receiver input terminals.

Here's a sample question about emissions, taken right from the FCC study guide:

The symbol A1 designates
(a) the purity of an emission
(b) the readability of a signal
(c) the power level of an emission
(d) the stability of an emission
(e) the type of emission

The correct answer is (e), of course. Remember, A = Amplitude, 1 = Morse code (telegraphy, or CW).

That's the end of this section from the Study Guide. In the next part of this series the subject is Electrical Principles. Now, things are going to get very interesting. You'll find out what goes on inside all those circuits, and what some of those funny sounding names (Hertz, Ohm, Farad, Henry) are all about. Stick with me, and you can unravel the mysteries of electronics. **HRH**

"Some people get *very* indignant when you tell them that the letters 'SOS' don't stand for anything . . ."

HAM RADIO HORIZONS' FIRST PRIZE STATION OF THE MONTH

WB3DNA

Our Station of the Month feature is intended to show newcomers to amateur radio what some of the stations at the other end of the QSO are like. Some are simple and inexpensive, some are very complex with a large assortment of gear, but others are modest installations for only a single amateur band. Whatever their style, their purpose is to communicate with fellow amateurs. Perhaps some of you will recognize a station you have worked, or maybe these station layouts will suggest a way to start your own hamshack.

Our first selection as Station of the Month is from Timothy Fanus, WB3DNA. Tim is 17, and resides on Chambers Hill Road, Harrisburg, Pennsylvania. Tim says . . . "I got interested in ham radio while I was in 10th grade at Central Dauphin High School in Harrisburg, where I am now a Senior. My chemistry teacher, Ronald Funk, K3ZYT, started a radio club which kept my interest and led me to my ticket. I received my novice license in August, 1976.

On my first QSO, using the school rig, I worked WA4REE in Tennessee. The pleasure and excitement of this contact convinced me it was well worth investing my savings to buy a good rig. My first piece of equipment was an Allied AX190 receiver with which I practiced copying code along with a Heath-kit oscillator and key I built.

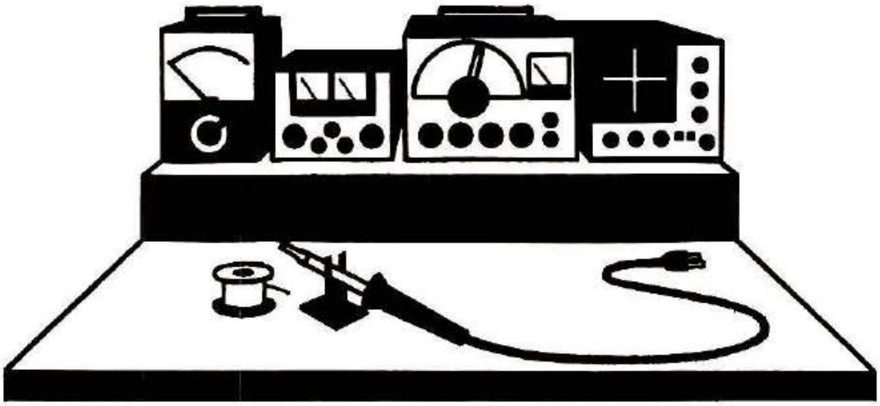
In December, 1976, I purchased a Kenwood TS520, and went on the air the same day. It was very exciting to make contacts on my own rig. To date I have worked 49 states, including Hawaii, plus Canada and 15 European countries. My antenna is a simple 40- and 15-meter dipole on sloping land giving it a height from 15 to 40 feet (8-12m). My shack consists of a bench with a bulletin board behind it. The bulletin board is getting covered with QSL cards because I like to QSL, whether local or DX.

I am in a wheelchair and am limited in my activities, but since I became a ham-radio operator, my life has changed. My parents had a phone put in my shack because I get many phone calls from other amateur radio operators. I have many visitors and many invitations to visit other hams at home. Hams are great people.

I enjoy *Ham Radio Horizons* because it's on my level of understanding. Keep up the good work with all the interesting articles." **HRH**

Any of our readers who would like to submit an entry for our Station of the Month feature are welcome to do so. Photographs should be black-and-white glossy prints, either 8x10 or 5x7 size. A good negative will be considered if it is of good quality. Sharp focus and good lighting tone are essential to proper reproduction. A one- or two-page typewritten description of the station, including type of operating you engage in, and biographical background, should accompany your entry.

More details? Ad Check page 78.



BENCHMARKS

Removable mount for vertical antennas

Hams were never meant to live on city lots! Or is it that city lots were never meant to have hams? Whatever the case, limited space for antennas always creates a problem. The vertical ground-plane antenna is, however, a good DX antenna, and can be used with limited ground area. My small backyard must be shared between antennas and what seems to be a never-ending supply of children. This never seems to be much of a problem in the winter months when they are in school or playing indoors. A ground-mounted antenna in the summer, however, represents a real safety hazard to running children. Because of very limited high-frequency operation during the summer months, you can remove the vertical antenna and not create a hardship.

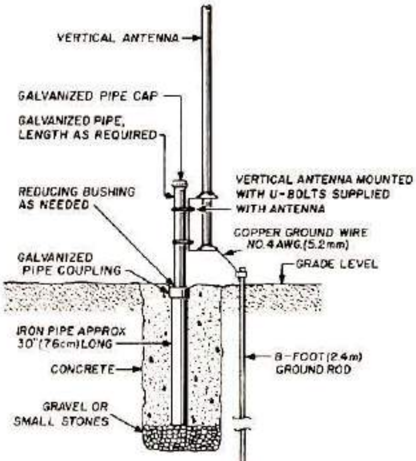


Fig. 1. This mount for a vertical antenna can be removed for safety when your operating season is finished. The buried section of pipe should be closed with a plug to keep water out of it when not in use.

Shown in **Fig. 1** is a method which I have been using for several years to mount my vertical antenna so I can remove it every spring and reinstall it every fall, with a minimum of effort. A section of standard (heavy-wall) iron pipe, with a coupling attached, is set in concrete into the ground approximately 30 inches (75cm). The top of the coupling should be slightly below ground level. In the fall another section of pipe is screwed into the coupling, fitted with a reducing bushing if necessary, to accommodate the vertical antenna's mounting bracket, and U-bolts.

Removing the antenna in the spring is easily done by unscrewing the top pipe and inserting a pipe plug of the right size to mate with the coupling. If all mating threads are well greased at assembly time, removal will be easily done. Since mechanical strength is no real problem, pipe sizes may be varied to use scrap pieces on hand and accept the size of the antenna clamp.

Removal of the ground rod is also easily done by using the bracket shown in **Fig. 2**. Simply slip the hole in the steel angle over the ground rod. Next, hook an automotive bumper jack through the U-bolt and begin jacking the ground rod out of the ground. The bracket binds against the ground rod and pulls it upward. When the jack has been extended to its maximum height, slide the bracket lower on the ground rod, lower the jack, and begin raising it again. Continue this procedure until the rod is completely removed.

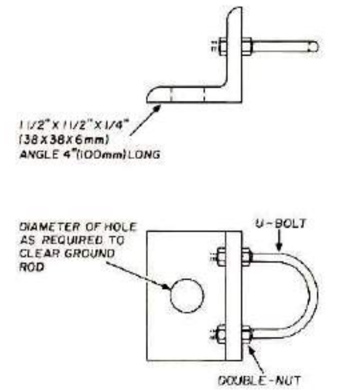


Fig. 2. A fixture to help pull the ground rod can be made from a small piece of angle stock and a U-bolt. A bumper jack supplies the lifting power.

With the ground rod removed and the pipe coupling plugged and below grade, there is nothing to interfere with the lawn mower, and you don't have to worry about children falling on any exposed hardware.

F. Neil Urban, W8CD

Cable feedthrough idea

After breaking a wood bit in a solid window sill, breaking the sash by *easy* drilling with carbide bits lubricated in kerosene, and finally, running out of places to drill holes in the cellar window frames for the entry (or is it exit?) of coaxial and rotator-control cable, I was finally tipped off to a simple and readily available solution to my problem: a clothes-dryer vent kit. It works!

These vent kits are available from discount stores, hardware stores, and appliance sales outlets for under ten dollars. You can install a 3 or 4 inch (7.6 or 10cm) vent in the cellar wall and then add, subtract, remove, and replace cables to your heart's content — quickly and easily. I stuff insulation or old rags around the cables to fill up the interior of the vent housing to prevent cold drafts and mice or other creatures from entering my shack.

The natural trap in the vent housing makes a perfect drip loop to prevent water from following the cables into your shack. My present installation includes five RG-8/U coaxial cables, three RG-58/U coaxial cables, two rotator-control cables, and a piece of solid-dielectric twinlead for my TV antenna. Believe it or not, there's room to spare, and it is a simple matter to snake them in or out.

I did not use the flexible hose that comes with the kit, but you may want to use it in your installation as a conduit to guide your cables under, over, through, or whatever.

So do it the easy way — add a dryer vent and be ready for the inevitable changes to your antenna farm without the necessity for making new holes each time you add or change a cable. I'd like to thank Rennie, WA1DHM, who first suggested the idea to me, although he disclaims originality. In any case, a good idea is a good idea, no matter where it comes from. My only problem is that it took me so long to find out about it.

Curtis Heuberger, WA1IUR

Two-meter receiver alignment

A good emergency signal source for the alignment of your 2-meter fm receiver's front end is an a-m/fm/PSB (public-service band) radio that can be found in many homes and shops.

I have two types of these multiband radios. One has a band that covers 108 to 174 MHz, and its oscillator operates 10.7 MHz above the input frequency. When tuning this radio near 136 MHz, I can receive its oscillator quite well on my 2-meter unit. To get a weak signal I move the radio to another room or even into the garage. The signal it puts out is very stable, and when the receiver is set for a discriminator zero, it will stay on frequency for 5 to 10 minutes.

The other radio I have has only a 148 to 174 MHz band, but its oscillator signal is 10.7 MHz below the tuned frequency. This one I tune to about 158 MHz and use it in the same way as the first radio.

I have also used one of these radios to check my 2-meter directional antennas. To do this I locate my mobile unit in a clear area and tune the PSB radio's oscillator to the 2-meter frequency I'm using. Then I set the PSB radio 100 yards (91m) away and make my antenna test. My better antennas can pinpoint the PSB radio's location.

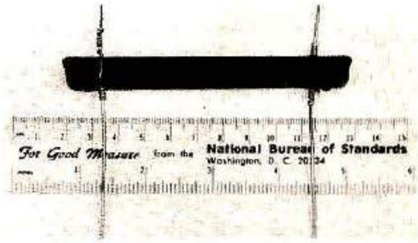
Duane J. Meyer, K9PVY

Feeder Spreader

I guess I'm just an experimenter at heart, but antennas have always fascinated me. Over the years I've had my share of them, too, but the open-wire-feeder type antenna such as the Zepp was always a favorite.

Nowadays it is difficult to find open-wire feedlines such as we used to make years ago, although for a short period of time, at the beginning of the TV-and-outdoor antenna-boom, *ladder line* of 450-ohm impedance was available. Now, even that is scarce, and most hams who want open-wire feedlines are out of luck unless they can homebrew something. This is where my other hobby comes in.

For sometime now my wife has been using an XL-70 Polaroid camera, mostly for indoor flash exposures. One day, as I was about to throw one of the used flash bars away, the plastic holder caught my attention. Hmmm . . . looked just like a spreader for an open-wire feedline.



The plastic holder from a flashbar can be used to make spreaders for open-wire transmission line.

Tearing the flashbar apart, I quickly and easily isolated the base portion which looked like it would do the trick. It's about 4-3/16 inch (10.6cm) long, 5/16 inches (8mm) wide, and 5/16 inches (8mm) high, and weighs only a few grams. The best part is that it already has two 2mm (.080 inch) diameter holes spaced 3-1/8 inches (8cm) apart. Since discovering the new spacer stock, I've been encouraging my wife to take as many indoor pictures as she wants (what am I saying!) and soon I'll have enough to build that 66-foot (20 meter) Zepp feedline that I've needed for the past year. I figure the spacing will give me a characteristic impedance of about 500 ohms.

Oh yes, before I forget, ask for General Electric Flashbar no. 10. I suppose other manufacturers make them, but these are the ones that my wife always seems to buy. Pretty soon we'll own a large block of film and flashbar stock, and I've had spots before my eyes for nearly a year now, but that's all right because my Zepp will be up in the spring.

Phil Ingraham, W2OSY

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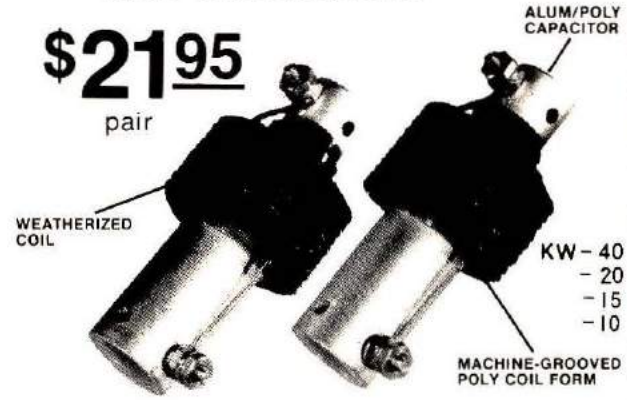

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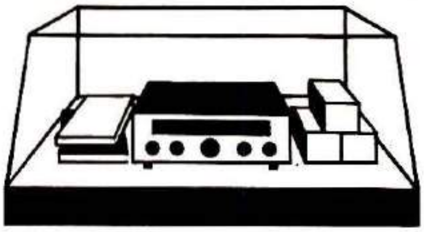


Kenwood TS-700S and VFO-700S

Kenwood has announced the new TS-700S, an all-mode, 2-meter transceiver. Based on the popular TS-700A, the TS-700S incorporates several new features such as a digital readout with "Kenwood Blue" digits, high-gain receiver pre-amp, a 1-watt low-power switch, built in vox, and CW Sidetone. It operates all modes: upper and lower sideband, fm, am and CW. The completely solid-state circuitry provides stable, long-lasting, trouble-free operation. You can operate the rig from your car or boat on 12-V dc, or as a home station with its built-in power supply. Frequency coverage is 144 to 148 MHz. The TS-700S automatically moves its transmit frequency 600 kHz for repeater operation; simply dial in your receive frequency and the radio does the rest for simplex, repeater, or reverse modes. Or, select your frequency by plugging a single crystal into one of the 11 crystal positions for your favorite channel. You'll have transmit/receive capability on 44 channels with 11 crystals.

The VFO-700S is a handsomely styled companion to the TS-700S. This unit provides you with the extra versatility and luxury of having a second vfo in your vhf shack, which is great for split-frequency operation and for tuning off frequency to check the band. The function switch on the VFO-700S selects the vfo in use, and the appropriate frequency is displayed on the digital readout in the TS-700S. In addition, a momentary-contact "frequency-check" switch allows you to spot check the frequency of the other vfo.

List price of the TS-700S is $679, and the VFO-700S lists at $119. Both units are available from authorized Trio-Kenwood dealers throughout the United States. For a list of authorized dealers and more information on the TS-700S and VFO-700S, write: Trio-Kenwood Communications, Inc., 1111 West Walnut Street, Compton, California 90220; or use *ad check* on page 78.

Hiram Percy Maxim — a Biography

Probably Hiram Percy Maxim has contributed more to amateur radio than any other single person. Historically, he founded *QST Magazine*, the American Radio Relay League, and the International Amateur Radio Union. He pleaded the amateur's cause very successfully before American and international forums bent on abolishing the hobby, and he held one of the most famous ham callsigns of all time: W1AW. Taken together, he organized, nurtured, defended, and disciplined the hobby in its critical formative years; amateur radio still bears the distinctive stamp of his gentlemanly personality.

Maxim is best known outside the world of amateur radio for his inventions and pioneering work in the development of the automobile and noise-control devices. A holder of 49 patents, he was also a pioneer in aviation, air conditioning, motion pictures, and radio astronomy. He was an accomplished international diplomat, screen writer, urban ecologist, and nationally-syndicated newspaper columnist. In short, he was a true Renaissance man; the embodiment of the line from *The Amateur's Code*, "an amateur is balanced."

This is the only available biography of a great and unique American character. It is a fascinating and painstakingly well researched account that brings his personality to life. The author, Alice Clink Schumacher, avoids dull scholarship and makes the reader feel that he is overhearing a collection of treasured family anecdotes told by close friends and relatives.

The book provides a unique insight into one man's life and an era of unprecedented technological progress in dozens of fields. Perhaps the feature which most commends this book to every amateur's library is the lengthy excerpting from Maxim's incomparable series of "The Old Man" editorials. Printed anonymously in early issues of *QST*, they are amusing, humorous yet thought-provoking caricatures of radio amateurs and their foibles. They are still amazingly accurate today.

Certainly few men were as well-liked and respected, nor did as much to make amateur radio the most gentlemanly of hobbies, than The Old Man — Hiram Percy Maxim.

Softcover, 153 pages, $4.50 postpaid Ham Radio's Communications Bookstore, Greenville, New Hampshire 03048. Order catalog HR-HPM.

Antenna Disconnect

Gold Line, of Norwalk, Connecticut, has introduced an antenna "Quick Disconnect" fitting that should make life easier for any user of mobile radio equipment. It is the model 1116 *Antenna Quick Disconnect*, which operates on the press-and-twist principle for attachment of the whip antenna to its base. This allows easy removal of the antenna for safety when having the car washed, for service in garages, or for storage of the antenna.

The adaptor has threads of 3/8-24, which is standard with many of the whips in use throughout industry. It measures 2-½ inches high and 5/8 inch (63x16mm) diameter.

Gold Line produces other accessories for mobile or fixed station use, including matching devices, filters, meters, and several adaptors and connectors for antennas and feedlines. For more information write to Gold Line, 25 Van Zant Street, East Norwalk, Connecticut 06855; or use *ad check* on page 78.

Magsat — Communications for the Deaf

Magsat is a small five-pound (2.3kg) portable alphanumeric readout unit designed to interface with an ordinary telephone and provide communications for the deaf. Basically, this is the way it works: Suppose you can't hear well enough to use the telephone, but have to communicate with someone. You plug Magsat into an ordinary household current receptacle, slide the switch to ON, and place the telephone handset into the cradle at the top of the Magsat unit. The display light (dial tone) will glow steadily, telling you that the line is open and ready for your call. Next, you dial the number you want, and the display light flashes each time the telephone rings. If the line is busy, the light flashes rapidly.

The person receiving your call places their telephone handset on their own Magsat unit, and answers you by typing a message. The message appears as a lighted display on your Magsat; for example, MARY HERE GA. You and your party now type to each other, and the message will be simultaneously displayed on both screens. Each letter appears at the right side of the screen and moves left as the words are formed. When the conversation is over, replace the handset on the telephone, and slide the switch to off. That's all there is to it!

Here are some of the other features that make the unit desirable: Large, easy-to-read letters in the electronic display; a single key for carriage return and line feed; keyboard speed that can exceed the fastest typist; every unit is equipped to accept a tape recorder; and the unit is easily carried in a matching attache-type case. It is virtually silent in operation, and velvety-smooth — being electronic rather than mechanical.

Magsat employs a five-level Baudot code, making it compatible with ordinary *Teletype* units for use on radio circuits. For example, each letter key is converted by means of a built-in converter to an audio tone, which may be transmitted by radio or telephone line. Radio amateurs will find Magsat ideal for a tiny RTTY terminal, and perhaps other uses.

Each Magsat unit is unconditionally guaranteed by the manufacturer to be free from defects in materials and workmanship for a period of one year from date of purchase. Magsat will make all repairs, and will even make out-of-warranty repairs at *cost*.

Magsat Corporation also offers a complete line of accessories, including a useful telephone flasher adapter that tells you when your phone is ringing.

The Magsat unit represents a five-year design and development program by a talented engineer who has made a long study of deaf persons' needs, and decided that, "there must be a better way."

The Magsat retails for only $695. Further details may be obtained from Magsat Corporation, 56 Arbor Street, Hartford, Connecticut 06106, or use *ad check* on page 78.

Hamtronics Test Probe Kits

Hamtronics recently added a line of test probe kits as accessories for your vtvm, fet vm, oscilloscope, and frequency counter. The kits are complete with probes, cable, all components, and instructions. They feature a handy spring-hook-type probe and ground clip for easy connection to even the smallest components. You will appreciate the convenience of the probe and the flexible cable after working with alligator clips and stiff cable for so long. The line of probes includes the following six types:

- TE-3 RF Probe — detects rf for vtvm or scope
- TE-4 Direct Probe — for ac and ohms measurements with vtvm
- TE-5 DC Probe — for dc measurements with 11-megohm vtvm or fet vm
- TE-6 Blocking Probe — series capacitor for signal generator or frequency counter
- TE-7 Wideband Detector Probe — for video i-f circuit monitoring with scope
- TE-8 Low Capacitance/High Impedance Probe — compensated probe for accurate waveform indications with scope

Kits are $7.95 each. For a complete catalog, including the line of vhf and uhf fm receiver, transmitter, and preamp kits, send a self addressed stamped envelope to Hamtronics, Inc., 182 Belmont Road, Rochester, New York 14612, or use *ad check* on page 78.

HORIZONS ad·scan

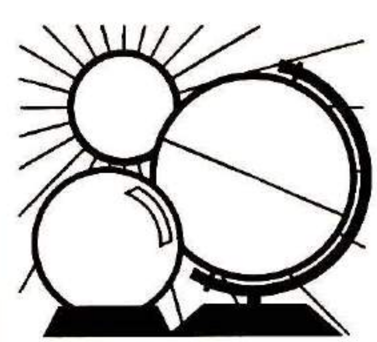
RATES Regular classified is available at 50¢ per word. Display classified (1 inch deep x 2¼ inches wide) is $50, or at the 12x rate is $35. All Ad Scan payable in advance. No cash discounts or agency commissions allowed.

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. *HORIZONS* 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 third preceding month.

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



DX FORECASTER

Propagation conditions for January should be markedly improved over those of only one year ago, with considerable solar activity boosting MUFs into very usable regions for much of the month. You may expect some ionospheric disturbances of a noticeable, but not severe, nature during the week or so between New Year's Day and January 10th; and again between the 13th and 18th. A very pronounced disturbance may be expected during the third week of this month, particularly between the 21st and 27th, and it could also be accompanied, or shortly followed, by unusual atmospheric conditions here and abroad. Keep your receiver tuned to WWV at 18 minutes after each hour and listen for the propagation data — particularly the A and K index information. Sharp increases in the K index mark geomagnetic disturbances, and you may be sure that band conditions will respond rapidly.

20 meters will continue to be the top DX band, but you will notice that *15 meters* is beginning to share the honors, with many good openings to all parts of the world. Be sure to check the next higher band whenever you hear good signals coming through. The bands marked with an asterisk (*) indicate when the next higher band is likely to be open to the area shown. Naturally, with the winter sun low in the sky, ionization will not be as great as during the fall and spring months. This means that the 10, 20, and 15-meter bands will close soon after dark, with the higher frequencies leading the way.

40, 80, and 160 meters will be very good this month, and much DX will be available from late afternoon through midnight until the early morning hours. As always, there will be a difference as to times of band opening, depending upon the frequency and your location. The chart will be most helpful in this respect. Twilight-zone propagation is a very good mode for working DX along the sunset-sunrise terminator. Try sunrise and sunset ± 1/2 hour or so. In general, the bands below 40 meters will begin to be very active after dark — just about the time that the bands above 40 meters have thrown in the towel for the day. Solar Cycle 21 is coming along nicely, with very noticeable increases in the monthly smoothed sunspot number, centered on mid 1976. This means that the 160-meter band may not be quite as good as last year, but will still be great for DXing.

Moon bouncers will like January 8th because the moon is at perigee — closest to the earth on that day. *VHFers* will find occasional openings during the passage of major storm fronts, and again during sporadic-E conditions — relatively rare in January. The *Quadrantid* meteor shower on January 8th will offer some meteor-burst propagation, but you'll need to be quick on the trigger to make a solid two-way QSO. Also, look for some vhf openings at times of ionospheric disturbance, particularly during the third week of the month. 50, 144, and even 220 MHz might provide some fun.

JANUARY

WESTERN USA

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

MID USA

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

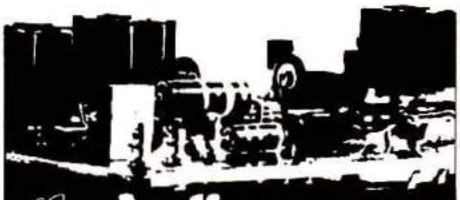
EASTERN USA

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

HAM CALENDAR

January 1978

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Straight Key Night Begins midnight New Years Eve — Full Zulu Period *Happy New Year*  1	FLORIDA HAM NEWS — SWAP NET By the Broward ARC — Ft. Lauderdale, FL — 146:31-91 at 7:30PM WEST COAST BULLETIN Edited & Transmitted by W6ZF 8PM PST 3540 kHz, A-1, 22 WPM 2	AMSAT Eastcoast Net 3850 kHz 8PM EST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz 8PM CST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 7PM PST (0300Z Wednesday Morning) 3	West Coast Qualifying Run 4	SAROC Convention — Sahara Hotel — Las Vegas, NV 5-8 Personal Communications Show (PC-78) melds with 1978 Winter Consumer Electronics Show — Las Vegas Convention Center — Las Vegas, NV — 5-8 5	6	 7
Hamfest & Swap & Shop — New Century Center — South Bend, IN — K9IXU 8	FLORIDA HAM NEWS — SWAP NET By the Broward ARC — Ft. Lauderdale, FL — 146:31-91 at 7:30PM 9	AMSAT Eastcoast Net 3850 kHz 8PM EST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz 8PM CST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 7PM PST (0300Z Wednesday Morning) 10	11	12	Personal & Small Business Computer Expo — Washington Hilton — Washington, DC 13-15 13	Ohio Area Repeater Council Meeting — Delaware County Historical Society — Delaware, OH  14
 See Jan. 1, 4, 14, 17, 21, 27, 29 15	FLORIDA HAM NEWS — SWAP NET By the Broward ARC — Ft. Lauderdale, FL — 146:31-91 at 7:30PM WEST COAST BULLETIN Edited & Transmitted by W6ZF 8PM PST 3540 kHz, A-1, 22 WPM 16	AMSAT Eastcoast Net 3850 kHz 8PM EST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz 8PM CST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 7PM PST (0300Z Wednesday Morning) W1AW Qualifying Run 17	18	19	20	ARRL Southeastern Div. Convention — Miami, FL — 21-22 ARRL VHF Sweepstakes — 21-22 21
Fort Wayne Winter Hamfest — By the Allen County AR Technical Society — Shiloh Hall — North of Fort Wayne, IN — WA9CED 22	FLORIDA HAM NEWS — SWAP NET By the Broward ARC — Ft. Lauderdale, FL — 146:31-91 at 7:30PM 23	AMSAT Eastcoast Net 3850 kHz 8PM EST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz 8PM CST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 7PM PST (0300Z Wednesday Morning) 24	25	26	W1AW Qualifying Run COWW 160 Contest — CW — 27-29 27	Simulated Emergency Test — 28-29 28
Classic Radio Exchange — By the Southeast ARC of Cleveland, OH — 2000Z 1/29 - 0300Z 1/30* 29	FLORIDA HAM NEWS — SWAP NET By the Broward ARC — Ft. Lauderdale, FL — 146:31-91 at 7:30PM 30	AMSAT Westcoast Net 3850 kHz 8PM EST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz 8PM CST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 7PM PST (0300Z Wednesday Morning) 31	*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.	**During the week of January 14-22, special Event Station, KM1CC, will be celebrating the 75th Anniversary of the first two way radio telegraph transmission between the United States and Europe by Guglielmo Marconi in 1903. The station will be operating from the original Marconi station location in South Wellfleet, Massachusetts. The sponsor of the station is The Town of Barnstable Radio Club of Cape Cod, Massachusetts. Operation will be on 160 through 10 meters, CW, SSB, RTTY, and Slow Scan TV. A 2 FM and a 6 SSB station are also planned. The FCC has granted special approval for the use of A2 on all amateur bands **and the famous sound of the 240 Hz**		**Marconi Rotary Spark Gap 1903 Station "CC" will be reproduced for CW QSOs.** The Cornish Radio Club will be operating special event station, GB3MSA, at Poldhu, England at the original Marconi station location during this period. The Irish Radio Transmitters Society will be operating with an EI0 Special Event call from a Marconi station site in Clifden, Ireland. W and K stations QSL with a SASE via W1GAY, Duncan Kreamer, Main Street, Vineyard Haven, Massachusetts 02568. DX QSL via W1 Bureau or W1GAY. KM1CC mail address: K1VV, R. J. Doherty, Control Operator-KM1CC, RFD #1, 14 Pine Street, Sandwich, Massachusetts 02563 USA.



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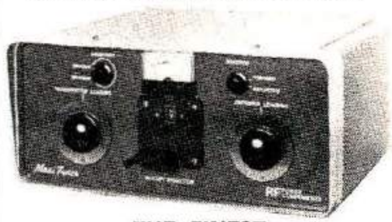

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Hamtronics ___ 246	Trop. Hamboree *
Heath ___ 060	Whitehouse ___ 378
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Limit 15 inquiries per request.

JANUARY, 1978

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More details? Ad Check page 78.

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CALIFORNIA
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San Diego, CA 92112
Ham Radio Outlet
999 Howard Ave.
Burlingame, CA 94010
Ham Radio Outlet
13754 Victory Blvd.
Van Nuys, CA 91401
Henry Radio, Inc.
11240 West Olympic Blvd.
Los Angeles, CA 90064
Henry Radio, Inc.
931 North Euclid
Anaheim, CA 92801
Webster Radio
2602 East Ashlan
Fresno, CA 93726

COLORADO
CW Electronics
1401 Blake St.
Denver, CO 80202

CONNECTICUT
Audiotronics*
18 Isaac Street
Norwalk, CT 06850

FLORIDA
Amateur Electronic Supply
621 Commonwealth
Orlando, FL 32803
Amateur Radio Center
2805 N.E. Second Ave.
Miami, FL 33137
Grice Electronics
320 East Gregory St.
Pensacola, FL 32501

HAWAII
Lafayette Radio Company
1111 Mc Cully St.
Honolulu, HI 96814

ILLINOIS
Erickson Communications
5935 North Milwaukee Ave.
Chicago, IL 60646
Klaus Radio, Inc.
8400 North Pioneer Parkway
Peoria, IL 61614

INDIANA
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133 South Pennsylvania
Indianapolis, IN 46240
Hoosier Electronics
43 B Meadows Shopping Center
Terre Haute, IN 47802

IOWA
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Council Bluffs, IA 51501

KANSAS
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8012 Conser
Overland Park, KS 66204

LOUISIANA
Digital Electronics, Inc.*
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New Orleans, LA 70190

MAINE
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Route 1 By-Pass South
Kittery, ME 03904

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Electronic International Service
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4033 Brownsville Rd.
Trevose, PA 19047
JRS Distributors
646 West Market St.
York, PA 17404

SOUTH CAROLINA
Accutek, Inc.
420 Laurens Rd.
Greenville, SC 29607

SOUTH DAKOTA
Burghardt Amateur Center
124 First Ave. N.W.
Watertown, SD 57201

TENNESSEE
Sere-Rose & Spencer Elec.
1465 Wells Station Rd.
Memphis, TN 38108

TEXAS
AGL Electronics
3068 Forest Lane #309
Dallas, TX 75234
Douglas Electronics
1118 South Staples
Corpus Christi, TX 78404
Electronics Center
2929 North Haskell
Dallas, TX 75204
Madison Electronics
1508 McKinney Ave.
Houston, TX 77002

UTAH
Manwill Supply Company
2780 South Main St.
Salt Lake City, UT 84115

WASHINGTON
ABC Communications
17541 15th Ave. N.E.
Seattle, WA 98155
Amateur Radio Supply Company
6213 — 13th Ave. South
Seattle, WA 98108

WISCONSIN
Amateur Electronic Supply
4828 West Fond Du Lac Ave.
Milwaukee, WI 53216

*Pending

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