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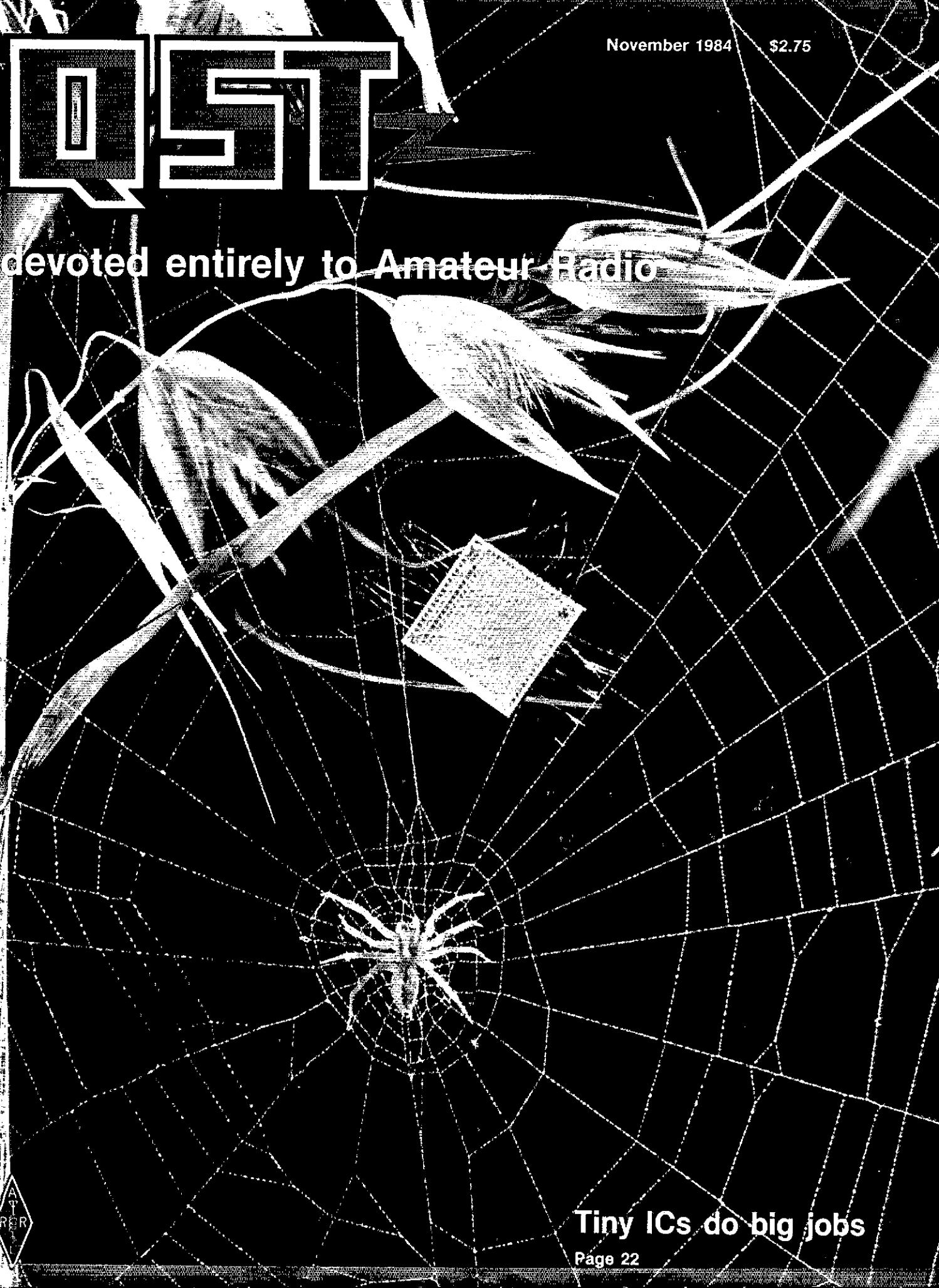


Tiny ICs do big jobs

Page 22

the tempo S-15

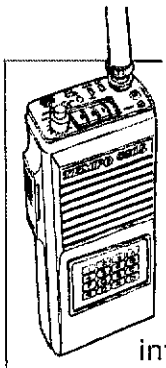
...a no nonsense radio that provides more power, broader frequency range and simplicity of operation

...the kind of hand held most people want...simple, rugged, reliable, easy to use. The S-15 offers a full 5 watts of power...power that extends your range and improves your talk power. Its state-of-the-art integrated circuitry provides far more reliability and ease of maintenance than conventional circuitry.

Consider these features before you decide on any hand held:

- 5 watt output (1 watt low power switchable)
- 10 MHz frequency coverage: 140-150 MHz (For export only: B version 150-160 MHz, C version 160-170 MHz)
- Electrically tuned stages. Receiving sensitivity and output power are constant over entire operating range.
- Three channel memory. (1 channel permits non-standard repeater offsets. 200 micro amp memory maintenance (standby)).
- A new "easy remove" battery pack
- One hour quick charge battery supplied (450 ma/HR)
- Plug for direct 13.8 volt operation
- Speaker/microphone connector
- BNC antenna connector and flex antenna
- Extremely small and light weight (only 17 ounces).
- Ample space for programmable encoder.
- Fully synthesized
- Extremely easy to operate
- Its low price includes a rubber antenna, standard charger, 450 ma/HR battery (quick charge type) and instruction manual.

OPTIONAL ACCESSORIES: 1 hour quick charger (ACH 15) • 16 button touch tone pad (S 15T) • DC cord • Solid state power amplifier (S-30 & S-80) • Holster (CC 15) • Speaker/mike (HM 15)



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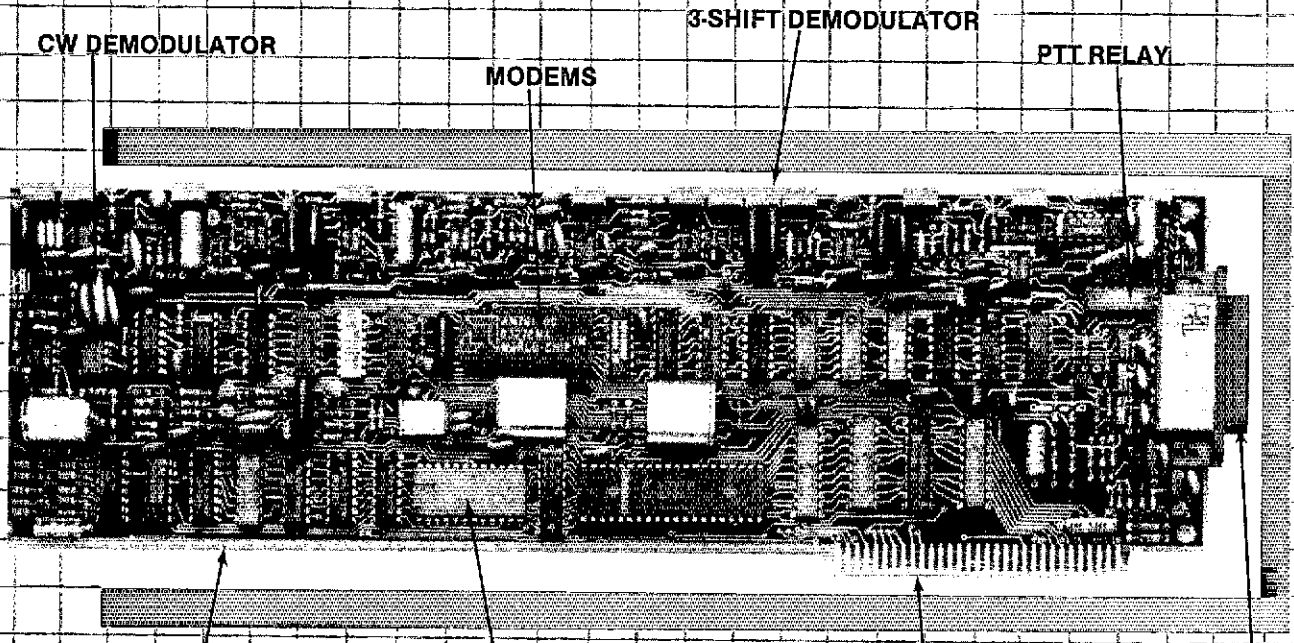

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IC-SM6
Desk Mic

The IC-751 is the most advanced amateur HF transceiver available on the market today... the new standard of comparison.

Receiver. ICOM's 100KHz — 30MHz general coverage receiver with a specially designed DFM (Direct Feed Mixer) utilizes FETS in the receiver front end which gives extremely low intermodulation distortion, +19dBm intercept point, and a high dynamic range. 105dB. With cascaded filters, the IC-751 is virtually immune [illegible] FL-44 8-pole [illegible] in the third IF is standard and provides exceptional receiver selectivity.

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32 Memories. An ultra versatile memory system allows storage of frequency and mode in each of the 32 memories. Data may be transferred from VFO to memory or from memory to VFO.

Standard Features. FM, FL-44A 455KHz high-grade SSB filter, SSB and FM squelch, built-in marker unit, convenient large controls, a new high-visibility fluorescent display and HM-12 Hand Mic.

Options and Accessories. Voice synthesizer, high stability master reference crystal, a wide range of CW filters, an external IC-PS15 or PS30 power supply, an internal IC-PS35 power supply, CT-10 computer interface unit, RC10 keyboard frequency controller, IC-2KL solid-state linear amplifier (160 — 15 meters), IC-AT500 automatic antenna tuner, IC-SP3 external speaker and IC-SM6 desk mic.

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November 1984 *Volume LXVIII Number 11*

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CONTENTS

OUR COVER
Big things are happening in the tiny world of microchips, and the use of that new technology in Amateur Radio is steadily expanding. See page 22 for the basics of digital signal processing and some of the possibilities for radio amateur application. Photo courtesy TRW.

TECHNICAL

BEGINNER'S BENCH

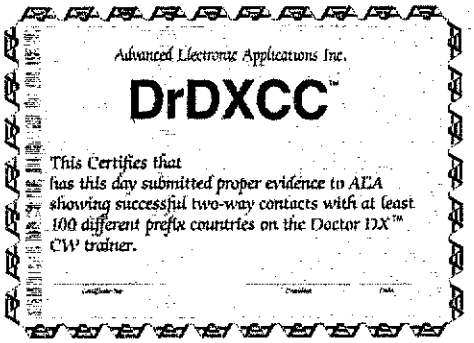
NEWS AND FEATURES

OPERATING

DEPARTMENTS

Doctor DX™ Challenge

BY AEA



DOCTOR DX CONTEST BOX

TOP SPRINT SCORES	TOP MARATHON SCORES
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2. _____	2. _____
3. _____	3. _____
4. _____	4. _____
5. _____	5. _____

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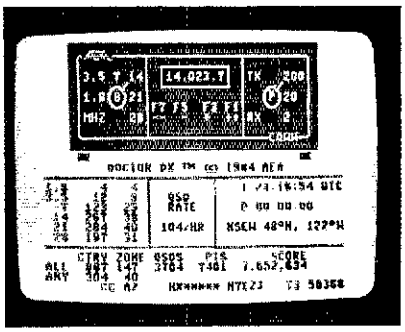

For good clean, competitive fun, Doctor DX™ shows your score and QSO rate for continuous monitoring of your improved CW operating skills. The DDX-64 can be a vehicle for fairly settling those club rivalries by competing with your friends under identical operating conditions.

AEA also has two on-going CW contests that you can enter with Doctor DX as your own schedule permits. The AEA SPRINT CONTEST is a timed non-stop eight hour event and the AEA MARATHON CONTEST is a timed 24 hour non-stop event. The top 5 contest scores will be published in our future advertisements and upgraded periodically as new higher scores are achieved.

In addition to the two AEA contests, we are offering award certificates for achieving certain milestones. You will be automatically alerted when you have achieved these milestones by a display at the bottom of the monitor screen.

AEA DrDXCC is achieved when you have worked 100 different countries, regardless of the frequency band or the amount of time operated. DOCTOR DX WAZ can be earned by working all 40 CQWW zones of the world, without regard to the band or duration of operating time. The DOCTOR DX HONOR ROLL is reserved for top notch operators capable of working 250 countries without regard for band or operating time. Additional endorsement awards are available for each additional 10 countries worked up to 300 (out of 304 possible) countries. AEA 5 BAND Dr DXCC is a very difficult award to achieve. It requires working 100 countries on each of five different bands, without regard for the amount of operating time.

Each award can be obtained by filling out a photocopy of the award application form (supplied) along with the score information and qualifying check sum from your screen display. Please enclose $3.00 to cover handling costs for each certificate ($1.00 for Honor Roll endorsements). Awards will only be granted to owners having a Doctor DX warranty card on file.

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220MHz BOOMER	1st Place
432MHz BOOMER	1st Place
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1st PLACE 2 METERS
WITH 12 X 32-19
PLUS
1st TO WORK SPACE SHUTTLE

They have talked to winning scores in many important amateur activities including the 1979, 80, 81 June VHF contests, 1981 Central States antenna measuring contest, 1981, 82 EME contests, 1982 Rocky Mountain antenna measuring contest and many more. Now there are three new numbers: the 424B, 24 elements for 432 MHz; the 410B, 12 elements at 432 MHz; and the 416TB, 16 elements at 435 MHz for satellite communications.
The new Boomer models feature insulated elements, stainless steel hardware, N type connector, T match feed and trigon reflectors.

SPECIFICATIONS AND FEATURES

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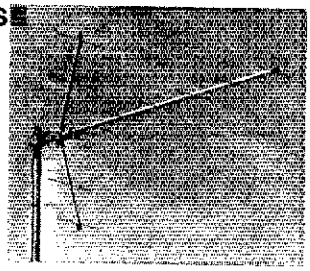
424-435 MHz, 7.6λ, gain *maximized, F/B ratio *excellent, beamwidth 19°, length 17.42 ft. 5.2 m.

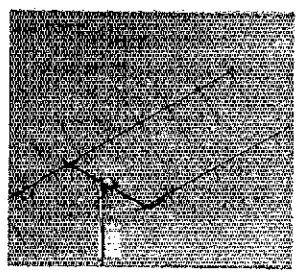
410B:

424-435 MHz, 2.2λ, gain *maximized, F/B ratio *excellent, beamwidth 33°, length 6 ft. 1.83 m.

416TB:

428-438 MHz, Circular Polarization 2.2λ gain *maximized, F/B *excellent, beamwidth 34°, length 6.7 ft. 2.03 m.





MORE BOOMER NUMBERS

32-19	144-146 MHz	19 elements
214B	144-146 MHz	14 elements
214FB	145.5-148 MHz	14 elements
228FB	145.5-148 MHz	28 elements
220B	220-223 MHz	22 elements
617-6B	50-51 MHz	6 elements

*estimated average retail price
*Gain and F/B ratio cannot be published in QST. They are included in Cushcraft specification sheets and other publications.

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Enjoy the thrill of OSCAR 10 with a Cushcraft antenna system, featuring the fabulous 416TB BOOMER, giving more performance through better electrical design and superior construction.

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TS-930S "DX-traordinary"

TS-930S

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The TS-930S is loaded with all the special features that you always wanted in an HF transceiver. Full coverage of the 160 through 10 meter bands, including the new WARC frequencies, (easily modified for HF MARS), plus a general coverage receiver that can tune any frequency from 150 kHz to 30 MHz. Operation in the SSB, CW, FSK, and AM modes, with selectable full or semi CW break-in. All solid-state, with 250 watts PEP input on SSB, CW, FSK, and 80 watts input on AM. SWR/power meter. Triple final protection circuits plus two cooling fans built-in. 10-Hz step synthesized frequency control. Available with optional automatic antenna tuner built-in, another industry first! Dual digital VFO's. Eight memory channels that store both frequency and band information, with internal battery back-up, (batteries not supplied). Dual mode adjustable noise blankers, especially effective in eliminating "woodpecker" type interference. SSB IF slope tuning, for maximum rejection of interference. CW variable bandwidth, with pitch and sidetone control. IF notch filter. Tuneable audio peaking filter. Unique six digit white fluorescent tube digital display is easy-on-the-eyes during those long contests. RF speech processor, for higher average "talk-power" SSB monitor circuit. 4-step RF attenuator. VOX. 100-kHz marker. AC power supply built-in, 120, 220, or 240 VAC.

TS-930S Optional Accessories: AT-930 automatic antenna tuner, SP-930 external speaker, with selectable audio filters, YG-455C-1 (500 Hz), YG-455CN-1 (250 Hz), YK-88C-1 (500 Hz) CW filter, YK-88A-1 (6 kHz) AM filter, all plug-in type, SO-1 commercial stability TCXO, MC-60A deluxe desk microphone, MC-80 and MC-85 communications microphones, MC-42S mobile hand microphone, TL-922A linear amplifier (not for CW QSK), SM-220 station monitor, PC-1A phone patch, SW-2000 SWR/power meter, 160 ~ 6 meter, SW100A SWR/power/volt meter 160-2m HS-4, HS-5, HS-6, and HS-7 headphones.

Isn't it about time you stepped into the winner's circle?

More information on the TS-930S is available from authorized dealers of Trio-Kenwood Communications, 1111 West Walnut Street, Compton, California 90220.

Specifications and prices are subject to change without notice or obligation.

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TR-7950, watts to see!

TR-7950/7930

The TR-7950/7930 has become the unanimous choice of the 2 meter FM operator! It stands alone in features, performance and reliability, with no other rig even close!

The TR-7950/7930 features a large L.C.D. display that is easy to read in direct sunlight and is back lighted for comfortable night-time viewing. It displays TRANS/REC frequencies, memory channel, repeater offset (+, S, −), sub-tone number (F-0, 1, 2, 3) tone, scan, and memory scan lock-out. It includes an LED S/RF bar meter, and LED indicators for reverse, center TUNING, PRIORITY and ON AIR. The 21 multi-function memory channels store frequency, repeater offset, and optional sub-tone channels. Memories 1 through 15 are for simplex or ±600 Hz offset. Memory pairs 16/17 and 18/19 are paired for non-standard repeater offset. Memories "A" and "B" set upper and lower scan limits, or are for simplex or ±600 kHz offset. In MEMORY mode, a circle of light appears around the memory selector knob. When the memory selector knob is rotated in either direction to channel 1, an audible "beep" sounds.

With 45 big watts, the TR-7950 is the most powerful 2 meter FM rig you can buy. The TR-7930 with a modest 25 watts is also available. A HI/LOW power switch allows power reduction to approx. 5 watts.

Other key features include: Programmable band-scan width, Center stop during band-scan, with indicator. Scan stops on busy channel and resume scan is automatic (time 5 sec. adjustable) or carrier operated. A scan delay of approx. 1.5 sec. is built-in. Scanning can also be accomplished with UP/DOWN microphone or "SC" key on front panel. Programmable priority alert can be set into any of 21 memory channels. With Alert switch "ON" a dual "beep" sounds when signal is present. The microprocessor is pre-programmed for simplex or ±600 kHz offset in accordance with the 2 meter band plan, with an "OS" key to allow manual changes in offset. The keyboard functions as a 16-key autopatch encoder during transmit. Frequency coverage is 142.000-148.995 MHz, and it has a repeater reverse switch and mobile mounting bracket. All these features are available in one compact, lightweight rig.

Yes, Kenwood is on top with the TR-7950! Its field proven reliability and matchless performance makes the TR-7950 the rig of tomorrow, today!!

TR-7950 optional accessories:

TU-79, three frequency tone unit, KPS-12 fixed-station power supply (7950), KPS-7A fixed-station power supply (7930), SP-40 mobile speaker, SP-50 mobile speaker, MC-55 mobile microphone with time-out timer, MC-46 16-key autopatch UP/DOWN mic, SW-100A/B power meters, PG-3A noise filter.

More information on the TR-7950/7930 is available from authorized dealers of Trio-Kenwood Communications, 1111 West Walnut Street, Compton, CA 90220.

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Maine — Clevis O. Laverty, W1RWG, 17 Fair St., Norway 04268 (207-743-2353)
New Hampshire — Robert Mitchell, W1NH, RFD 4, Blueberry Hill, Raymond 03077 (603-895-3456)
Rhode Island — Gordon F. Fox, W1YNE, 13 York Dr., Coventry 02816 (401-828-6045)
Vermont — Ralph T. Stetson, III, KD1R, P.O. Box 123, Milton 05468 (802-893-4656)
Western Massachusetts — R. Donald Haney, KA1T, RD 1-Box 237, Myrick La., Harvard 01451 (617-772-4126)

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Alaska — David W. Stevens, KL7EB, POB 103421, Anchorage 99510 (907-274-3051)
Idaho — Lemuel H. Allen, W7JMH, 1800 S. Atlantic St., Boise 83705 (208-343-9153)
Montana — L. C. "Les" Belyea, N7AIK, P.O. Box 327, Belgrade 59714 (406-388-4253)
Oregon — William R. Shrader, W7QMU, 2042 Jasmine Ave., Medford 97501 (503-773-8624)
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Pacific Division

East Bay — Bob Vallio, W6RGG, 18655 Sheffield Rd., Castro Valley, CA 94546 (415-537-6704)
Nevada — Leonard M. Norman, W7PBV, 1310 Hazelwood St., Boulder City 89005 (801-586-9859)
Pacific — James F. Wakefield, AH6CO, 647 Kunawai La., #201, Honolulu, HI 96817 (808-524-0050)
Sacramento Valley — Ron Menet, N6AUB, P.O. Box 244, Cedar Ridge, CA 95924 (916-272-4873)
San Francisco — Robert Odell Smith, NA6T, 320 Park St-P.O. Box 1425, Fort Bragg, CA 95437 (707-964-4931)
San Joaquin Valley — Charles P. McConnell, W6DPD, 1658 W. Mesa Ave., Fresno, CA 93711 (209-431-2038)
Santa Clara Valley — Rodney J. Stafford, KB6ZV, 5155 Shadow Estates, San Jose, CA 95135 (408-274-0492)

Roanoke Division

North Carolina — Rae Everhart, K4SWN, P.O. Box 41, Lexington 27293-0041 (704-249-8734)
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Rocky Mountain Division

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New Mexico — Joe Knight, W5PDY, 10408 Snow Heights Blvd., N.E., Albuquerque 87112
Utah — Ronald C. Todd, K3FR, 2112 W. 12060 S., Riverton 84065 (801-254-6051)
Wyoming — Richard G. Wunder, WA7WFC, Box 2807, Cheyenne 82001 (307-634-7385)

Southeastern Division

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Georgia — Edmund J. Kosobucki, K4JNL, 5525 Perry Ave., Columbus 31904 (404-322-2856)
Northern Florida — Phillip O'Dwyer, WF4X, 543 Mooney Rd., N.E., Fort Walton Beach 32548 (904-862-2353)
Southern Florida — Richard D. Hill, WA4PFK, 3800 S.W. 11th St., Ft. Lauderdale 33312 (305-583-6932)
West Indies — Gregorio Nieves, KP4EW, 1390 San Bernardo St., Altamesa-San Juan, PR 00921 (809-782-4375)

Southwestern Division

Arizona — Erich Holzer, N7EH, 3526 E. March Pl., Tucson 85713 (602-326-8978)
Los Angeles — John V. Walsh, N6UK, 1260 E. Sierra Madre, Glendora, CA 91740 (818-335-0036)
Orange — Sandra Mae Heyn, WA6WZN, 962 Cheyenne, Costa Mesa, CA 92626 (714-549-8516)
San Diego — Arthur R. Smith, W6INI, 4515 Melisa Way, San Diego, CA 92117 (619-273-1120)
Santa Barbara — Ernest L. Kapphahn, WB6HJW, 1404 Grand Ave., Arroyo Grande, CA 93420 (805-481-0311)

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Oklahoma — Dave Cox, NB5N, 1812 S. Umbrella Ct., Broken Arrow 74012 (918-250-2285)
Southern Texas — Arthur R. Ross, W5KR, 132 Sally La., Brownsville 78521 (512-831-4458)

THE AMERICAN RADIO RELAY LEAGUE, INC.

The American Radio Relay League, Inc., is a noncommercial association of radio amateurs, organized for the promotion of interest in Amateur Radio communication and experimentation, for the establishment of networks to provide communications in the event of disasters or other emergencies, for the advancement of the radio art and of the public welfare, for the representation of the radio amateur in legislative matters, and for the maintenance of fraternalism and a high standard of conduct.

ARRL is an incorporated association without capital stock chartered under the laws of the State of Connecticut, and is an exempt organization under Section 501(c)(3) of the Internal Revenue Code of 1954. Its affairs are governed by a Board of Directors, whose voting members are elected every two years by the general membership. The officers are elected or appointed by the Directors. The League is noncommercial, and no one who could gain financially from the shaping of its affairs is eligible for membership on its Board.

"Of, by, and for the radio amateur," ARRL numbers within its ranks the vast majority of active amateurs in the nation and has a proud history of achievement as the standard-bearer in amateur affairs.

A bona fide interest in Amateur Radio is the only essential qualification of membership; an Amateur Radio license is not a prerequisite, although full voting membership is granted only to licensed amateurs in the U.S. and Canada.

All membership inquiries and general correspondence should be addressed to the administrative headquarters at 225 Main Street, Newington, CT 06111 USA. Telephone: 203-666-1541, Telex: 643958 AMRAD NEWI. MCI MAIL (electronic mail system) ID: 215-5052 (user name: ARRL).

"It Seems to Us . . ."

This Month in QST . . .

. . . you will find a new feature we think you will like: a three-page, full-color section of news and features at the very front of the journal entitled, appropriately enough, "Up Front in *QST*." While Amateur Radio is a technical avocation, what makes it so fulfilling an activity is the great variety of fascinating people who have an amateur license as their common bond. Each month, "Up Front" will bring you a selection of lively vignettes about your fellow hams and the special things they are doing to add their unique seasoning to the flavor of Amateur Radio. By reading "Up Front" each month, you'll also get the highlights of the important news affecting radio amateurs without having to pore through the fine print.

The editorial staff is excited about "Up Front," not only for its content but also for the layout opportunities it provides. We will be able to make full use of color in the section, as well as on the first two pages of the lead article. While it's nice to be able to "dress up" the pages of your journal in this way, even more important is that it will make *QST* an even more effective medium for communicating what's exciting in Amateur Radio. We will be using a four-column format in the new section, and intend to take full advantage of the additional flexibility in layout thus provided. The perennially popular "League Lines" moves to page 14, to provide a smooth transition from the new section to the three-column format that we'll continue to use for the main body of the journal.

Like the rest of your membership journal, "Up Front in *QST*" is yours and what appears there depends on *you*. Features Editor Andrew Tripp, KA1JGG, has the job of selecting the best and most interesting items we receive, but he can't select what we don't receive! We're looking especially for crisp, clear color photos of hams *doing things*. Think of what *you* would find interesting to see in *QST*, and you should have a pretty good idea of what we're looking for.

"Up Front in *QST*" is the most dramatic change we have made to *QST* in several years, but in reality it's just one more step in a continuing process of evolution. More subtle, unheralded improvements have crept into these pages at a rather steady pace. If you compare the issue you have in your hands to one of just a couple of years ago, we think you'll see what we mean! — *David Sumner, K1ZZ*

This Month in Your Bookstore . . .

. . . you will find a new ARRL publication we *know* you will like: the 1985 *ARRL Handbook for the Radio Amateur*. The new edition of this perennial best-seller is the product of 17 months of team effort. The project as originally conceived involved resetting the type for the entire book, reorganizing the chapters, and expanding the contents from 648 pages to perhaps 800 pages. Even that, given all the other projects handled by the staff during the course of the year, would have been an ambitious undertaking. As time went on, though, the Technical crew found more and more material that had to be included if League members were to have the best possible *Handbook*. When the patient finally left the layout table, it had mushroomed in size to 1024 pages! As if that were not enough, some of those pages are very special, indeed: there are 16 pages of ready-to-use etching patterns on special stock, so they can be used directly in making printed circuit boards.

The picture story beginning on page 62 can give you only a taste of what was involved in bringing the 1985 *Handbook* to the bookshelves. Everyone involved is proud of the final product, and we think you will be, too. Look for it at your local dealer — just look for the four-pound book with the bright-orange cover! At 58% bigger than last year, with only a 25% increase in price, it's a bargain in anyone's book. — *David Sumner, K1ZZ*

Cards and plaque courtesy W6TC

EIMAC's new DX champion! The 3CX800A7.

Varian EIMAC continues to commit its development of reliable tubes for HAM radio.

The new, rugged 3CX800A7 power triode provides 2 kW PEP input for voice service or 1 kW cw rating up to 30 MHz. Two tubes will meet the new, higher power ratings authorized by the FCC.

Designed for today's low profile, compact linear amplifiers, the 3CX800A7 powerhouse is only 2½ inches (6.35 cm) high. Cooling requirements are modest and a matching socket, air chimney and anode clamp are available.

A data sheet and more information is available from Varian EIMAC. Or the nearest Electron Device Group sales office. Call or write today.

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UP FRONT in QST

The Test of Time

While the date and place may someday be the answers to a trivia question, the event undoubtedly will hold a significant place in Amateur Radio history. On September 1, at the ARRL Pacific Division Convention at Santa Clara, California, the first test session coordinated by the ARRL under the Volunteer Examiner Program, took place. A large team of Volunteer Examiners — among them NS6N, NV6D and AE6Z (l-r behind table) — handled the testing and scoring for the 102 amateurs who participated in this historic event.

The overall pass rate was 53%. The breakdown—Element, number of tests administered and pass rate: 1A, 1, 100%; 1B, 46, 58%; 1C, 16, 69%; 2, 1, 100%; 3, 37, 76%; 4A, 27, 52%; 4B, 9, 44%.

Tall in the Saddle

When the call went out for help in providing communications for the 24-hour Purina Race of Champions, members of the Cedar Mountain ARC took to the mountains of northern Wyoming. Stationed at various checkpoints throughout the race course — a 100-mile stretch through rugged terrain and grizzly country — KB7JZ (with the hand-held radio) and the other amateurs relayed information via 2 meters and some HF to Race headquarters. Despite having to operate from some pretty rough spots, brave a close encounter with a forest fire and watch over about 120 riders and their horses, the amateurs were able to stick to the game plan they had established eight months before. Things went so well that race officials have already asked the Cody, Wyoming, club back for next year's event. *(tnx NE7C)*

(KC7QE photo)

Have You Voted?

If you're a Full member in good standing in the Central, Hudson, New England, Northwestern, Rocky Mountain or Southwestern Divisions, and you haven't cast your vote for Director and/or Vice Director, time is running out to do so. Your ballot, to be valid, must reach ARRL Hq. by noon November 20. If you reside in one of these Divisions but haven't received a ballot by November 1, call Hq. immediately (see July Happenings for further details). Canadian members, who are electing their own Regional Directors, have the same deadline, but should mail their ballots to CRRL Hq., London, Ontario (see Canadian NewsFronts, page 73, for more information). Your vote is a voice in League affairs — make sure it's heard.

K1ZX Takes the Laid-Back Approach

Being confined to bed and in a body cast might keep most people down, but not Jim White, K1ZX, of Homestead, Florida. An avid CW contest op, Jim was determined to get on the air for Radiosport '84. With help from his parents, W1YL and W1CW, Jim was able to find a unique operating position in time for the contest — horizontal 4. In fact, he has found Amateur Radio to be an excellent form of therapy while recuperating from injuries received in a car accident. Jim hastens to add that there is no truth to the rumor that he has to get plastered before he gets on for a contest.

Taking the "Dis" out of Disability

Some time ago, a truck accident left Herb Taber, WB2RNH, of Delanson, New York, paralyzed. Rather than surrender to this seemingly insurmountable obstacle, Herb, with the help of his wife and friends, busied himself with activities he could accomplish — one of which was Amateur Radio.

With the help of Mike, WA2MXU, Herb studied and eventually worked his way up to General class, and set up a station. His equipment was specially fitted with handles adapted from ratchet wrenches, which enables Herb to change bands with the bump of a wrist. Other friends, Earl, W2ZQA, and Bob, N2AIA, helped Herb become "wheelchair mobile." They located an old, portable 2-meter rig, substituted a paddle switch for the PTT, and ran leads to the 12-V batteries that power the wheelchair.

Herb now has the world of Amateur Radio at his fingertips. So far, that world includes WAS on 10, 15 and 20 meters, as well as WAC — and his many friends on the airwaves. *(tnx N2AIA)*

TRN to Give Packet Radio Overview

"Packeteers" and others interested in knowing more about this exciting new mode for amateur communications should tune in to the North American Teleconference Radio Net on December 2 at 2400Z. Two leading authorities in packet radio technology, Lyle Johnson, WA7GXD, and Harold Price, NK6K, will give a presentation entitled "Packet Radio Overview and Perspective." Access to TRN is provided by more than 180 gateway stations, mostly VHF repeaters, linked to cover virtually every metropolitan area in the U.S. and much of Canada.

Sponsor for TRN is the Midway ARC, of Kearney, Nebraska, under the direction of club President Merlin "Mert" Feikert, WBØUSW, and Net Manager Timothy Loewenstein, WAØIVW. For more information on linking your repeater into the net, send an s.a.s.e. to TRN Manager, c/o Midway ARC, P.O. Box 1231, Kearney, NE 68847-1231.

No, *QST* hasn't gone into radio broadcasting. This small FM station, housed in a motel, is in Sedona, Arizona. *(tnx N6VI)*

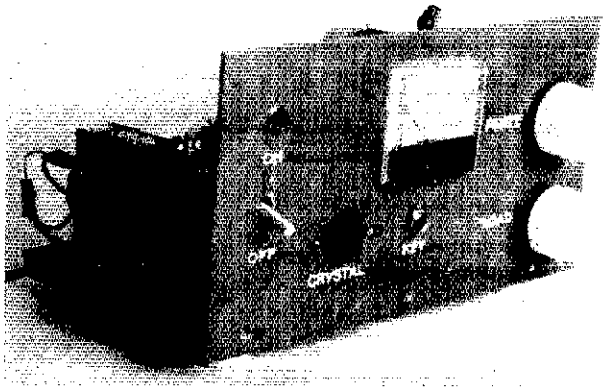
Bowdoin to Return?

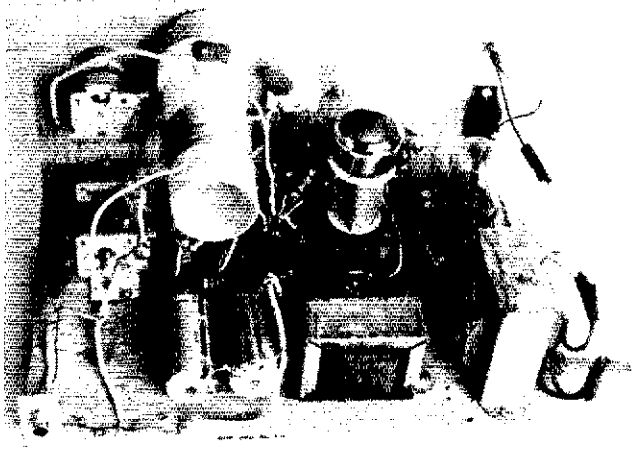
Efforts are underway by a group of former shipmates of the *Bowdoin* to raise the money needed to restore the 63-year-old schooner to seaworthy life. It was from aboard the *Bowdoin* in 1923 that Don Mix, operating WNP (Wireless North Pole) from 78° 30'N, contacted 1ANA in Massachusetts. It was the farthest point north for a QSO up to that time. Recently, the veteran of 26 voyages and 300,000 miles of Arctic exploration was moved from Mystic Seaport, Connecticut, to a shipyard in Bath, in its home state of Maine, to await possible restoration.

New 24-GHz Record

A new 24-GHz record apparently was set on August 11 when IØSNY/IC8 and I8YZO/8 established a two-way CW contact spanning 331 km. I8YZO/8 operated from Mt. Montalto (in the Aspromonte Mts.), in southern Italy, at an altitude of 1956 meters. IØSNY/IC8, operating from Mt. Epomeo, on the island of Ischia (off the coast of Naples), was at an altitude of 788 meters.

Douglas Fouts, WA6TDY, of Beverly Hills, had a novel way of celebrating his graduating from the University of California at Santa Barbara. He took a nine-day, 56-mile backpacking trip that eventually brought him to 11,400-foot-high Elizabeth Pass, on the border of the Sequoia and King's Canyon National Parks in the Sierra Nevadas. One can sure hit a lot of 2-meter repeaters from a spot almost on top of the world!





A Review of Fundamentals

As a "radio amateur licensed in this era of appliance operators," John Billones, WD6GGC, wanted to get back to basics. For starters, he built a 40-meter QRP transmitter with parts scrounged from the junk box: tuning knobs and feet made from plastic bottle caps, octal sockets for a crystal and a coil wound on a toilet paper tube, to name a few. It may be ugly construction, but it works! John has had many successful contacts with good signal reports, using an inverted V antenna.

Repeater Gets New Lease on Life

For a while, it looked like the Northern Berkshire Amateur Radio Club's repeater was going to lose its home atop Mt. Greylock in Adams, Massachusetts. Seems the state Department of Environmental Management thought the repeater tower and antenna were "unsightly" and ordered them removed. But local amateurs banded together and garnered the support of some state legislators, who introduced a bill to save the repeater. The result: Gov. Michael Dukakis has signed legislation giving NBARC a 20-year lease of facilities atop Mt. Greylock at a small annual fee. In appreciation, NBARC arranged to have the Governor greet hams over the 31/91 machine; 125 in seven surrounding states passed along their names and calls.

Want a Place Up Front in *QST*?

Have a news item, human-interest story or photo that you think other amateurs would be interested in? It may be appropriate for use in Up Front in *QST* or perhaps as a Stray. Here are some hints to improve your chances of getting that item in print.

1) Be sure the information is of interest to most readers.

2) Submit your item before deadline — the 8th of the second month preceding desired publication (i.e., must arrive at Hq. before November 8 for January *QST*).

3) Photographs may be color or B&W, but good-quality action photos have the best chance of being used.

4) Send all material to *QST* Features Editor, ARRL, 225 Main St., Newington, CT 06111.

Follow the above hints and maybe your item will find a place Up Front in *QST*.

New Form 610

Planning to upgrade? Renew? Change your address? Apply for a Novice exam? If so, you'll be facing a new FCC Form 610. Although Volunteer Examiners will have a big hand in filling out the recently revised form, the applicant's portions have not changed significantly. The new forms are available for a business-size s.a.s.e. from FCC Gettysburg, all FCC field bureaus and ARRL Hq. For an in-depth look at the new Form 610, see next month's Washington Mailbox.

Coupons in ARRL Books = Savings

Bought a new edition of a League publication lately? Then you may have noticed a "proof of purchase" coupon in the back. These coupons, found in ARRL publications worth $4 or more, entitle members to discounts on future goods or services obtained from Headquarters. This new program is being phased in gradually, as new books are ordered from the printer, so you won't yet find the coupons in all publications. The discount coupons are just another way your membership is valuable to you!

Among the many thousands of visitors to the Louisiana World Exposition in New Orleans was Goia Marconi Braga, whose father's accomplishments were featured in an Amateur Radio exhibit (see August *QST*, p. 52). Giving Ms. Braga a hearty welcome is Seymour D. Fair, the Expo's "ambassador-at-large." *(tnx W5LDH)*

League Lines...

NASA Hq. has forwarded to Johnson Space Center (JSC) the Joint ARRL/AMSAT proposal to have astronaut Tony England, WØORE, carry amateur equipment with him on his flight scheduled for next April. The proposal has been accepted philosophically by NASA; JSC engineering personnel must now make technical and feasibility assessments. ARRL expects NASA to send a letter to the two organizations in a few weeks informing them of acceptance, contingent upon the project meeting all NASA technical and operational criteria.

FCC released a Memorandum Opinion and Order on October 3 that will expand the RACES wartime frequencies to include the 6-meter repeater subband, 52 to 54 MHz. These changes, resulting from petitions filed by Gary David Gray, WB6HUG, the Southern California Repeater and Remote Base Association, and several county governments, become effective November 15, 1984. Details in next month's QST.

Bills designed to stifle malicious interference have been introduced into the House of Representatives and Senate. If passed and signed into law, the Bates Bill and the Goldwater Bill would amend the Communications Act of 1934. Details in this month's Happenings.

The Emergency Coordinator's Handbook, a comprehensive treatment of Amateur Radio emergency communications, is now available from ARRL Hq. Each ARRL Emergency Coordinator (EC) in the League-sponsored Amateur Radio Emergency Service has been direct-mailed a copy of this brand-new manual, which is designed to assist the EC in responding to the communications needs of the public more effectively. Please note that because of the massive size of the Handbook, there will be a $5 charge (to help defray printing and postage costs) to those requesting a copy who are not ARRL Leadership Officials.

To ensure the integrity of the review process, items in the Product Review section of QST are now purchased by ARRL. Once the review has run in QST, the items are sold to the highest bidder. Bids are announced in The ARRL Letter. Many ARRL Affiliated Clubs subscribe to the Letter and reprint the announcement in the local club bulletins. Individual ARRL members can subscribe for $19.50 per year. The Letter is also available on CompuServ's HamNet (GO HOM-11).

The 1985 ARRL Handbook for the Radio Amateur is going to be a blockbuster! With 1024 pages -- 376 more than last year -- this is the largest Handbook ever. Copies should be on sale in early November.

PRB-1, the League's request for a Declaratory Ruling of Limited Federal Preemption (see Happenings, this issue), is available from ARRL Hq. for a 9 X 12 inch s.a.s.e. with 88¢ postage attached. Comments supporting PRB-1 should be filed by all amateurs who have been hassled concerning their antenna structures.

VITA, Volunteers in Technical Assistance, has announced that the Tektronix Foundation of Oregon has donated a $5000 unrestricted grant for PACSAT (an Amateur Radio packet radio satellite) research and development.

A survey form has been sent to repeater operators using 145.25 MHz in order to determine the extent of harmful CATV interference. Repeaters experiencing harmful interference on adjacent channels will be provided a survey form upon request. ARRL Hq. contact is Katherine Hevener, WB8TDA.

Earlier this year, CRRL asked the Canadian Department of Communications (DOC) to allow a few days grace for amateurs wishing to write an advanced amateur exam one year after writing an amateur exam, and for those writing amateur or digital exams who wanted to use credits obtained on exams written one year earlier. DOC has now clarified the matter and complied with the CRRL request. One year will now be interpreted as "four examinations later."

W1AW operator job opening. If you are a General class licensee or higher and are interested in Hq. employment as a W1AW operator, please contact John Lindholm, W1XX, Communications Manager, ARRL Hq.

The new ARRL Net Directory is available from ARRL Hq. for a 10 X 13 inch s.a.s.e. with 88¢ postage.

Amateur Radio and the Games of the XXIII Olympiad

You won't find Amateur Radio in the official program, but nearly 700 volunteer hams saw to it that the Summer Olympics would be a smashing success.

By Chuck Lobb,* KN6H

While billions of spectators watched, some Southern California hams were having a once-in-a-lifetime experience. Part of it involved standing on the floor of the Coliseum, in a crescendo of sound, as 100,000 voices rose to greet Marathon winner Joan Benoit as she emerged from the tunnel. Part of it was an unashamed tear trickling down a cheek during the "Reach Out and Touch" song of the opening ceremonies. Part of it was the chest-swelling pride, the face-aching grin and perhaps a tear or two as the Olympic Torch passed through hometowns all across the land.

It was the XXIII Olympiad, the 1984 Los Angeles Olympic Summer Games — a time for sensual experience not seen or heard, but felt and absorbed and luxuriated in. It is the intent of this article not only to chronicle amateur activities, but also to provide a means of participating vicariously — to experience in some way what it meant to be a ham participating in this incredible event.

There was Darrell Pace, N8FTS, archery gold medalist in Montreal who now has a second gold; Sheila Conover, KB6CZX, a kayaker with her own special story (Sept. 1984 *QST*, page 60), and her coach, Billy Whitford, KB6CZY; Bill Lippman, Jr., W6SN, trustee of station W6USA at the Olympic Village in the 1932 Olympics, who bounced into NG84O at UCLA and sat down at the mike as if it were yesterday; marathon referee Allan Steinfeld, KL7HIR, who agonized over whether to help (and therefore disqualify) Swiss marathoner Gabriele Anderson-Schiess as she lurched that unforgettable lap around the Coliseum; journalist Luis Villanueva, XE1CRM, who poured story after story into the Mexican wire service Notimex; Paul Wang, KU6T, UCLA professor of engineering, who about 11 P.M. would show up at NG84O to pass the daily results of the Chinese team to BY1PK in Beijing; the team of Charles Breeding, KB7RC, and Manuel Romero, EA4JW, manager and director, respectively, of the entire International Broadcast Center in Hollywood, who were responsible for 5000 pieces of equipment, 600 circuits and 700 miles of audio and video cables.

The list goes on — nearly 700 hams participating in competitive venues and special events in 23 cities, from Palo Alto to San Diego, plus thousands of others who (thanks to Richard Ward, NG6O) voluntarily used 23 or 84 in their call signs to give commemorative QSOs and QSLs to those who couldn't be here. And, finally, there were the thousands of hams across the nation who lent their assistance to the 4000-mile trek of the AT&T Telephone Pioneers as they passed by bearing the precious Olympic flame (see sidebar story).

It was a complete immersion that for two weeks had hams glowing with personal pride. A piece of history was being written; ham radio was a critically important part of it, and we were representatives of ham radio.

Yachting

Unquestionably, this was the longest-running venue with the largest number of hams in the Games, as 186 yachts from 60 nations filled the Pacific Ocean from July 5 through August 10. Delivery, measurement and final acceptance of the competitive fleet stretched for three weeks, followed by one practice day and seven race days during the Olympic period.

Communications support for the venue had been rehearsed during the Olympic trials for three prior summers by Communications Chairman and Senior Race Officer Dr. Warren Bradley, KA6HNW, and Deputy Chairman Jim Michaels, W6PGM. The task involved recruiting and

*1843 West 244th St., Lomita, CA 90717

preparing a total of 237 hams for responsibilities, both on shore and aboard vessels, that involved the operation of five ham nets on 2 meters, marine communications on five channels and a sixth net of nonhams using commercial equipment.

Communications were divided into four zones and subdivided by support craft, judges' boats and escort boats. Overlaying the zone structure were an umbrella Net Control, Scoring Net, Officials Net, Race Operations Net, Official Vessels Net and General Information Net. The nets performed a control function for vessels in their jurisdiction, such as scoring, mark and patrol, and a variety of race management communications tasks. A total of 158 amateur operators were aboard this fleet.

Ashore, manning the various net controls, were an additional 20 hams plus 10 or so in the headquarters unit for coordination, technical expertise, equipment maintenance, logs and tapes, and courier services.

With three summers of pre-Olympic trial experience, communications had been honed to perfection. Even so, a few hams discovered to their dismay that salt spray and hand-held radios don't mix. An overall evaluation? Compliments poured in from the LAOOC Commissioner of Yachting and the Director of Races.

Equestrian

It was billed benignly as the three-day event, a sequence for horse and rider of dressage, a cross-country run and jumping. The cross-country run proved, however, to be anything but benign. It was a 25-kilometer (15.8-mile) stretch of roads and trails that added up to pure torture for both horse and rider. And 8 to 10 hours in the hot sun proved no picnic for the 80 hams involved, either.

Planning began in January 1984, when San Diego Section Manager Art Smith, W6INI, and Emergency Coordinator Steve Simek, WA2NNT, met with Neil Ayer, the LAOOC Event Director and Course Designer. A pledge was made to keep the entire operation low profile (i.e., off the air) with no public exposure, to minimize security problems. By late February, most of the final cadre of hams had been selected (not an easy task in view of stringent physical requirements).

By July 22, 80 licensed amateurs and 20 nonhams had completed the application, medical and screening process; had been issued the orange-and-gold service uniform of the LAOOC; and had gathered equipment for 144, 220 and 450 MHz and commercial operation. Testing and debugging began with six nets on three ham and two commercial bands — all cleverly funneled into the event control center by Bob Gonsett, WA6QQQ, and integrated into the emergency medical system.

A few days prior to opening ceremonies, a full dress rehearsal in real time was conducted. Participants included all hams, officials, volunteers and even a group of marathon runners acting as horses. Emergencies and typical accidents were simulated, with rough spots being ironed out.

The result of such meticulous planning was predictable: flawless performance. Hams on two nets were stationed at each of the 33 obstacles, plus physician, veterinarian, hospital, sports medicine, seven ambulances, seven mobile veterinary units and 12 roving medical teams. All operated with a first-class communications system. And the low-profile concept paid off. Net frequencies were not released until the final day, and security was never compromised.

Fortunately, the medical net had little traffic. One felled rider required precautionary hospitalization and a few spectators received minor first-aid treatment. To quote W6INI: "The Amateur Radio Service did a highly commendable job and can be justifiably proud of the superb manner in which communications were conducted."

Special Events Station NG84O

It was a long, uphill struggle that threatened to collapse at several points, but dogged determination by a handful of local hams finally saw the UCLA Olympic Village station come to life July 14.

The story of NG84O began in the fall of 1982. To champion the ham cause with the Los Angeles Olympic Organizing Committee, then-ARRL Southwestern Director Jay Holladay, W6EJJ, recruited George Morris, W6ABW, President of the Los Angeles Area Council of Amateur Radio Clubs, and Section Managers Stan Brokl, N2YQ, Fried Heyn, WA6WZO, and Bob Dyruff, W6POU, as well as Tom Rothwell, K6ZT, and Irv Emig, W6GC.

By the fall of 1983, optimistic indications led to the naming of Olympic Village Station managers for UCLA, USC and UC, Santa Barbara. Simultaneously, efforts were intensified to complete third-party agreements with as many of the 140 participating nations as possible. Only through the persistence of Holladay, Dick Mannheimer, K6LAE, and Marty Woll, N6VI, was the one station at UCLA finally approved, in May 1984.

There was little time remaining, but hams turned to. Mannheimer was named manager, Woll his assistant. Dick Ward, NG6O, offered his call. The 200 earlier volunteers for three stations were trimmed to 40, and scheduled three per shift covering 12-hour days for 4½ weeks. Pete Mathews, WB6UIA, organized the 2-meter/70-cm traffic-handling stations. Chip Margelli, K7JA, and Jim Rafferty, N6RJ, arranged for transceivers, beams and ancillary equipment. The San Gabriel Valley Repeater, W6QFK/R, was chosen to keep the managers in touch with the station.

By some miracle it all came together in two unbelievable months. NG84O went on the air from its ticket-booth location tucked into the corner of the campus, well off the beaten Main Street path. With a 100-W transceiver and masts at 15 feet to avoid

The Amateur Torch Relay Team

The Olympic Torch Relay, sponsored by AT&T, was a great undertaking — moving the Olympic Flame 9000 miles in all kinds of weather, over all types of terrain. And Amateur Radio helped make it a smashing success!

Nearly all of the Torch Relay workers, including the Cadre runners, were members of the Telephone Pioneers of America, an organization of people who have worked for the Bell System (as we knew it before divestiture) for 18 years or more and donate times to their communities. Some gave one or more vacation weeks, and a couple of retired folks helped on all 12 weeks!

The amateurs were responsible for maintaining radio communications between the 37-42 vehicles (it grew over 12 weeks!) as they zigged and zagged westward from New York to Los Angeles, passing through 33 states from May 8 to July 28. To help our Communications Van keep in constant touch with the "Core" and the "Caravan," we used 2-meter repeaters and simplex all across the country. We also used 70 cm in California to help overcome the crowded airways, and had HF gear to keep us in touch with "the folks back home," especially AT&T headquarters in New Jersey.

I was fortunate enough to be a Shuttle radio operator/navigator. In March, I participated in the Simulation Run to help work out the "bugs." In Week 1 of the actual Relay, I was part of the team that picked up the Flame at the United Nations, on May 8. In California, in Weeks 11 and 12, I helped bring the Flame down the stretch of the Run, and to the Coliseum on July 28. The job of "Drop" Shuttle was a demanding but rewarding one in the Torch Relay. We stayed ahead of the Core, "dropping off" the runners every 7 km and doing a little "PR" work with the runners and their Torches whenever we had an opportunity. The days were long, sometimes 20+ hours, but the crowds and adrenalin kept us going! What happened between weeks 1 and 12 of the Olympic Torch Run is now history — and wonderful memories for all who participated.

One important fact remains. Without the help of Amateur Radio, we never could have pulled it off! Our hearts go out and our hats are off to *all* the wonderful people who helped us with the use of their repeaters and provided other assistance. We can't thank you all enough!

In the words of Mr. Richard Boehner, Olympic Torch Relay Manager: "The Ham Radio network was the nerve center that kept the Olympic Flame on route; otherwise, we never would have made it out of New York! The communications was a dynamic operation which helped us keep on top of all the changes, and there were many: runners' schedules, meal stops and overnight changes, to name a few. Ham radio communications was the most important aspect of the Olympic Torch Relay." — *Ron Morais, KF1H, Torch 27, Yarmouth, Maine*

Marathon Medical communicators Joe Locascio, K5KT (left), and Tom Vegors, KF6JP, relay information to race officials at the start of the Men's Marathon. Joe and Tom were the ears and voices of senior Marathon physicians and Red Cross personnel. The uniforms they're wearing were standard issue for hams. *(photos by KN6H)*

surrounding trees, NG84O worked 40 countries in the first two weeks. (A linear raised this total to 84 in the remaining weeks.) Commemorative contacts topped 8000, a very satisfying total considering the station configuration and a badly disturbed ionosphere. For the operators selected for traffic-handling expertise, being on the bottom of pileups was quite an experience.

Traffic total exceeded 100, with perhaps three times that many athletes turned away for lack of third-party agreements. Heaviest traffic included messages to Australia, Brazil, Colombia, Israel, Romania and the United States, with messages also going to Zimbabwe and the remainder of Central and South America.

Among the many dignitaries who dropped in were Shozo Hara, JA1AN, President of the Japan Amateur Radio League; Don Wallace, W6AM, a top DXer with 366 countries; Bill Lippman, Jr., W6SN, Trustee of W6USA (the station at the 1932 Los Angeles Games); Monaco tennis coach Jean Pierre Gasparotti, 3A2LB; Philippine swimming coach Pete Lozada, DU1NRL; Austrian sailing team captain Harold Pieler, OE8LLK; and Ron Tucker, coordinator for the 1988 Winter Games in Calgary, who picked up a few pointers on how ham radio might be utilized there.

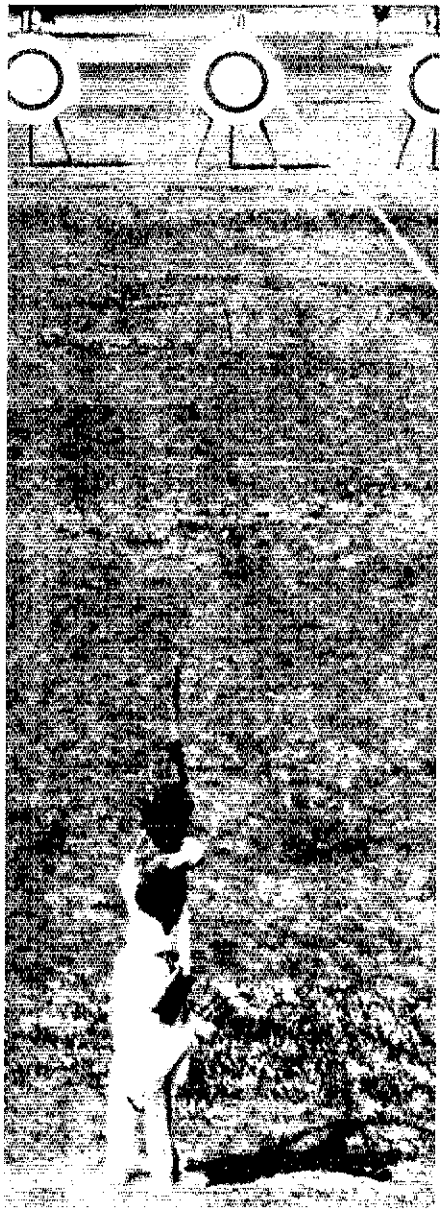
A bit of public exposure resulted from *Newsweek* magazine, the *Los Angeles Times* and the San Diego *Union* newspapers, and television coverage by CBS, CNN and a Brazilian TV company.

The Marathon

Commemorating the feat of a young Athenian communicator in 496 BC who ran 26 miles to report a military victory, the marathon today remains the most grueling event of the Olympics.

A mind-boggling organizational task involving 4000 volunteers began to evolve, including 60 individually selected hams operating four nets via two portable repeaters. The 42-km (26-mile) course, from Santa Monica City College to the Coliseum, was divided into seven zones, each with a Chief and Deputy Chief. Hams were stationed with all medical support units — including fixed aid stations every 5 km, five ambulances, a command car, two "sag wagons," 23 roving First Aid teams for spectators, 23 race management officials, security and law enforcement personnel, senior physicians with ham "shadows" — and with the ambulance dispatcher.

Bill Carpenter, WA6QZY, was tapped to head up the effort, beginning in early 1984, based on his experience with ARES, the Edgewood Amateur Radio Society (W6NRY) and the management of the extensive W6FNO repeater system, and in support of running events. By June, however, the task had escalated, requiring additional help from six more clubs. Eventually, 60 hams were qualified for assignments, including 31 on foot (spaced the length of the course), eight more in vehicles, four in the Coliseum, one with the ambulance dispatcher and 12 at headquarters, on a bluff overlooking the course. Networks included the Medical Net (exclusively hams) plus three nonham nets, each with a ham net controller. Two portable repeaters were erected on the bluff, both positioned and tested to ensure that operators with hand-held radios could easily communicate from every corner of the course. Added responsibilities included management and training of 200 participants in the nonham nets, plus maintenance, control, distribution and collection of 200 commercial hand-held units.



Gold medalist Darrell Pace, N8FTS, fires bullseyes on the 70-meter range on the second day of archery competition, duplicating a first-place finish he achieved at the Montreal Games in 1976. A 2-meter contact with Olympic Village station NG84O capped off his visit to the 1984 Games.

Did it work? In the words of Marshal Manager Len Wallach, the critical Medical Net needed the "communications experts" (the hams); having them proved to be an excellent decision. Under the control of Terrie Maguire, WA6MRZ, the W6NRY Medical Net ran smoothly and flawlessly. At one point, after a short period of monitoring, Senior Medical Officer Dr. Eugene Osher exclaimed, "Your communications are fabulous! How did you learn to do all that?"

As the August heat took its toll of competitors, medical personnel and hams were on the spot with sag wagons and ambulances. Even a spectator stepped on by a police horse received prompt medical attention.

TOP Sail '84

Tallships Olympic Parade of Sail was an international fleet of 25 sailing ships of 19th century vintage, assembled off the coast of Southern California in July for the largest parade of such ships ever held on the West Coast. As an Olympic Arts Festival event, the 35-mile-long parade began at noon July 4. Each vessel had a ham radio officer aboard, plus 40 additional hams aboard the escort fleet — all from the South Coast Radio Amateur Network, the Hughes El Segundo ARC and the Associated Radio Amateurs of Long Beach.

Communications support planning began months before, under Emmett Ingram, WA6HIG, and Henry Schmidling, WA6RJA, for the Tallships, and Jim Michaels, W6PGM, for the power squadron escort fleet. Recruitment of 65 hams, organizational meetings, and the establishment of a moving shore-based net control system and the inauguration of large-scale packet radio for the first time in a public event all consumed the full-time efforts of the organizers.

Police and Medical Support

Captain Keith Bushey, KF6UJ, of the Los Angeles Police Department is a firm believer in both preparedness and ham capabilities. Working with Los Angeles Section Manager John Walsh, N6UK, KF6UJ saw to it that surveillance base stations were installed at the city's Emergency Communications Center, at the Coliseum and near the Olympic Village at UCLA. This included a sophisticated linking arrangement tying operators and base stations together, with an autopatch to back up police landlines.

About 120 thoroughly screened ham volunteers qualified for surveillance duty from rooftops and other stragetic locations. All uncomplainingly worked eight-hour shifts for three weeks during the Games.

Further police support involved Ham Watch, a four-year-old organization in nearby Van Nuys. Lead by John Olip, WB6YQT, 27 hams contributed eight-hour shifts in assignments around the perimeters of the Olympics Villages at UCLA and USC.

The Los Angeles County Sheriff RACES received the services of the K6CPT mobile

van, under the direction of Dave Jensen, WA6HXF, with a dozen amateurs a day around the clock, seven days a week, providing backup communications services for local law enforcement and public safety agencies, and even the Department of Defense.

Also, a permanent ham station covering 7.1 through 440 MHz was installed at the Los Angeles Chapter of the American Red Cross. Capable of full emergency-powered operation, the station maintained around-the-clock contact during the Olympic period with comparable Red Cross chapters throughout Southern California, Arizona and Nevada.

Postscript

Our congratulations and heartfelt thanks go out to those hams across the nation who contributed to the success of the XXIII Olympiad; the list is still growing. For those who couldn't be there, we hope in some small measure you were able to capture the enthusiasm and the inner glow of those of us who were. And, of course, a special debt of gratitude goes to those who lent their time and talents to help put together this article, particularly Jay Holladay, W6EJJ; Dick Mannheimer, K6LAE; Art Smith, W6INI; Dr. Warren Bradley, KA6HNW; Lenore Jensen, W6NAZ; and the group who, in turn, helped them.

Let's do it again in another 52 years!

Amateurs at the Stanford Olympics: The Rewards of Service

By Patty Winter,* N6BIS

Mention "emergency communications" to most Amateur Radio operators, and they'll probably think of 2-meter radios and generators. But, in a disaster, there's a much more important element than equipment: people — and especially their willingness to meet the communications needs of any situation.

Actual disasters occur, but hams can frequently find public events to use as practice runs — and to experience some of the rewards of serving their communities. This past summer, a group of 11 amateurs in the San Francisco Bay Area had just such an opportunity: the 1984 Olympic Games. They took full advantage of the chance not only to sharpen their disaster skills, but to strengthen the reputation of amateurs as a valuable, multitalented resource in time of emergency.

Hams Become Olympic Volunteers

Ted Harris, N6IIU, began planning for Olympic participation by amateurs last December, when he found out that nine soccer games of the XXIII Olympiad would be played at Stanford Stadium, adjacent to the city of Palo Alto. As Disaster Director for the Palo Alto Area Chapter of the American Red Cross, ARES (Amateur Radio Emergency Service) Emergency Coordinator for Stanford University and a veteran of numerous disaster exercises, Harris was well aware of what amateurs could offer — and also of how to offer it.

"Some guys show up during a disaster unannounced and say, 'I'm a communicator; let me know if you need some communications.' At that point, the disaster director is going to be very uneasy about the whole thing.

"But imagine," Harris continued, "that you go to the same disaster-services person *before* an emergency and say, 'We have a group of people who are trained to assist you with emergencies. Our specialty is providing backup communications with battery- and generator-powered radios.' They'll start thinking, 'I'll bet I can count on these people when I need them. They're really willing to help.' The simple fact is that you may be terrific Amateur Radio operators, but if you're not meeting the needs of the people in charge, you're not doing your job."

Rick Joslin, WB5VUL, one of 11 operators who manned K84OG (K-84-Olympic Games) at the Stanford University Olympic soccer site, makes one of the more than 4000 contacts with 71 countries the station finally tallied. *(N6BIS photo)*

Harris contacted the LAOOC, and offered the services of local hams as volunteers at the Games. He was referred to the Technology Manager for the Stanford venue, Christopher Veal. After talking with Harris about the skills available from the amateurs, Veal convinced the LAOOC to define a new volunteer category: Emergency Communications.

From the outset, Veal and Harris built a lot of flexibility into the group's charter. "Basically," says Veal, "my definition of 'emergency' was anything we may have overlooked in planning the Games — or anything else that came up unexpectedly. Repairing a videocassette recorder so athletes can watch movies may not seem like the usual definition of an emergency, but when they're foreign athletes who are guests in your country, it becomes a matter of diplomacy — and by my standards, that's an emergency."

Group's Goals

Harris defined three goals for the Emergency Communications crew: to provide disaster communications, to run health-and-welfare traffic for the athletes and to operate a special-event station, if there was time. The headquarters for all this activity was the Palo Alto Red Cross emergency communications van, which spent the Olympics parked less than 100 feet away from Stanford Stadium, inside the fenced LAOOC administration area. The van was set up with complete HF and 2-meter stations, as well as a backup generator.

Although many Peninsula amateurs wanted to participate, Harris was forced by circumstances to restrict the team to 11 members. As full-time Technology volunteers, the hams needed high-level security badges, and it would have been impractical to obtain clearances for large numbers of people. Also, from his previous emergency communications experience, Harris was aware of how effectively a small, highly committed team can perform.

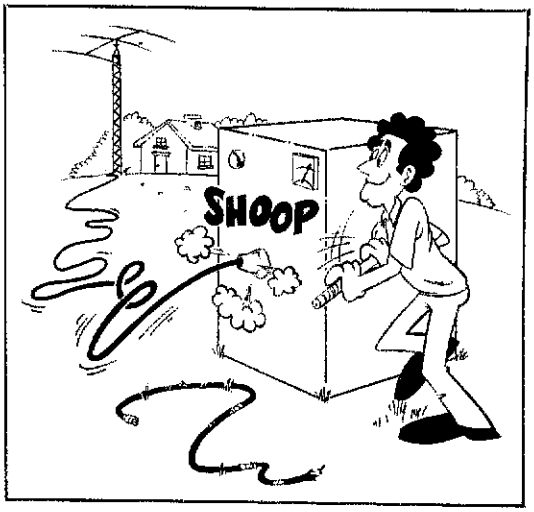
With that in mind, he set out to find 10 other amateurs. The job required a minimum commitment of eight hours a day for nearly two weeks; most ended up working 12- or even 16-hour days. Some of those selected were retired; others got paid leaves from community-minded employers.

Harris summarizes the outcome: "We didn't have a disaster, thank goodness. And we handled only a little message traffic, because of third-party regulations. So, theoretically, that left us with nothing to do but put our feet up on the desk, pick up the microphone, and spend the next 10 days talking to other hams. That, however, would have been a *big* mistake. We would have seemed indifferent, maybe even condescending. It would have been like saying,

(Continued on page 44)

*1225-120 Vienna Dr., Sunnyvale, CA 94089

Coaxial Cables: Their Construction and Use



Most hams give little thought to the cable that connects transmitter and antenna. Here is some background information that can help us understand coaxial cable and use it more effectively.

By John Magnusson,* W0AGD

It is common for a ham to consider coaxial cable with the same reckless abandon given an extension cord. After all, isn't coax about as involved as any other shielded wire? The center conductor is insulated, and the shield goes to ground — right?

Not quite. The simple hot/ground concept should be reserved for power-supply cables and jumper cords. Coaxial cable should receive the same respect as any other two-terminal device (see Fig. 1). After all, we rely on coaxial cable to provide several characteristics, some of which must provide operational stability over the long term. Also, the selected cable must provide optimum performance over a wide frequency range.

There is an impressive list of design considerations and production factors involved in the manufacture of coaxial cable. Each one is important in the end result. Variations produce the panorama of different sizes, features and costs of the more than 1500 types of coaxial cables available in the marketplace today. Manufacturers have the technical information in catalogs and data sheets; much of it is yours for the asking.

The four characteristics most important to the amateur are

- Surge impedance
- Velocity factor
- Attenuation
- Power-handling capability.

Impedance

The most common coaxial cable impedance used by amateurs is 50 Ω. Antennas, low-pass filters, pi networks and pi-L networks are usually designed for 50-Ω unbalanced operation. The 50-Ω characteristic impedance is a compromise between 75 Ω, which is best for low attenuation, and 30 Ω, which is best for power transmission. Thirty-ohm cables are not used for power transmission because the attenuation and capacitance values are high. Cable capacitance decreases as impedance increases. In applications that demand low capacitance (such as data transmission), cable with a characteristic impedance greater than 90 Ω is used. Coaxial cable can be manufactured in any impedance value from 35 Ω to 185 Ω. The impedance is established by the ratio of the center-conductor outside diameter to the outer-conductor inside diameter (see Fig. 2):

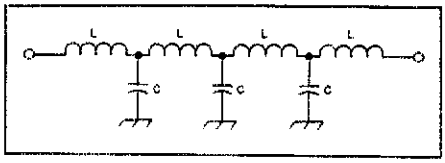


Fig. 1 — An equivalent circuit for a coaxial cable. L and C are specified, in value per unit length, by the manufacturer.

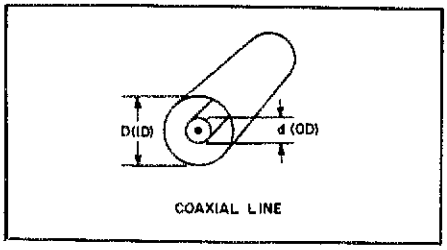


Fig. 2 — Coaxial-cable dimensions used in Eq. 1.

$$Z = \frac{138}{\sqrt{\epsilon}} \left(\log \frac{D}{d}\right) \qquad \text{Eq. 1}$$

where

Z = characteristic impedance
D = inside diameter of outer conductor
d = diameter of inner conductor
ϵ = dielectric constant of the core insulation (1.0 for air, approximately 2.3 for polyethylene)

Manufacturers control impedance by making the core first. The center conductor is run through an extruder, and the dielectric is extruded around it. If a solid copper or copper-clad aluminum center conductor is used, the tension used to pull the center conductor through the process must be monitored, as excessive tension can resize the center conductor. Speed and temperature must be monitored to ensure the correct outside diameter of the core. The outside diameter of the core establishes the inside diameter of the outer conductor. The impedance is raised if either, or both, of the following things happen:

- The diameter of the center conductor is reduced (through stretching).
- The outside diameter of the core is enlarged.

Velocity Factor

The dielectric material used in the core determines how quickly RF travels through the cable. Solid polyethylene slows the signal to 66% of the speed of light. Foam polystyrene provides a velocity factor of 91%.

*5329 Gladstone, Lincoln, NE 68504

Table 1

Common Coaxial Cables and the Characteristics that Determine Their Power-Handling Capability†

Cable	Center Conductor††	Dielectric†††	Max. V
RG-8/U	7 (no. 21)	Solid	5000
8/U type	7 (no. 19)	Foam	600
RG-58/U	1 (no. 20)	Solid	1900
58/U type	19 (no. 32)	Foam	100
RG-59/U	1 (no. 22)	Solid	2300
59/U type	1 (no. 22)	Foam	200

†Specifications vary among manufacturers.
††The number outside of the parentheses is the number of strands; inside is the size (A.W.G.) of the individual strands.
†††Polyethylene dielectric is used in all cables shown.

This slowed propagation can be used to our advantage. If you are building phasing lines or networks in which long lengths are needed, use cable with a low velocity factor. The lines will be physically shorter, with attendant reduction of weight, bulk and cost.

Attenuation

Cable attenuation is specified by the manufacturer. It is measured in dB/100 ft and increases with operating frequency.[1] The dielectric and conductor materials determine cable attenuation. Foam dielectric and tin- or silver-plated conductors are used to reduce attenuation. Size is also a factor: the loss in a ¼-inch-diameter coaxial cable is greater than the loss in a ½-inch coaxial cable (all else being equal). The size and construction of each cable is chosen to provide optimum operation.

Over a length of time, the center conductor and braid naturally corrode if unplated. This increases attenuation. "Bargain" coax that is corroded is no bargain.

Power-Handling Capability

The amount of power that a particular cable can safely carry is determined by its voltage and current limitations. Working voltages are published by the cable manufacturer, and it is a simple matter to calculate the peak voltage on the feed line of the installation. The allowable current determination is more complex. Duty cycle, environment (temperature and air flow) and insulation material each play a part. Generally, cable power rating decreases with increases in frequency, temperature, altitude and SWR.

Consider an Amateur Radio installation with 1 kW of RF output. RG-58A/U (solid dielectric) could be used with little danger of exceeding the working voltage:

$$E_{eff} = \sqrt{PZ} \qquad \text{(Eq. 2)}$$

where

E_{eff} = effective ac voltage
P = power in the line
Z = impedance of the line

Then

$$E_{pk} = E_{eff} \times 1.4142 \qquad \text{(Eq. 3)}$$

From Eq. 2 and Eq. 3, the peak voltage with 1 kW fed to a 50-Ω matched line is 316 V. This voltage level is no threat to solid-dielectric cables, but it exceeds the rating of some common cables with foam dielectric (see Table 1). At an SWR of 7:1, our hypothetical kilowatt station has an E_{pk} of 1106 V. This is well below the 1900 V allowed for RG-58A/U, but it is worthy of concern. Once the working voltage is exceeded, a pin hole through the dielectric and a carbon track through the hole are formed. Subsequent arcs can occur at much lower voltage.

The amount of current in the cable can be calculated from

$$I = \sqrt{\frac{P}{Z}} \qquad \text{(Eq. 4)}$$

where I = current.

When the system is matched, at 50 Ω, 4.47 A flows. The *ARRL Electronics Data Book* recommends that no. 20 A.W.G. wire (the center conductor of RG-58A/U) carry no more than 2.08 A at low frequencies. The situation is worsened at RF by skin effect.

For most amateur use, the duty cycle is so low that this substantial overload is permissible on current peaks. A small cable is capable of handling high power with a moderate SWR for CW and SSB use at HF (although larger cable is the best choice to reduce attenuation). Give thought to current limitations when choosing a cable for FM, RTTY, ATV or other high-duty-cycle applications. The cable manufacturer should be consulted in such cases.

Mechanical Considerations

We have discussed the four electrical characteristics originally mentioned. Equally important are the mechanical characteristics of coaxial cable.

In some of the smaller coaxial cables with stranded center conductors, you may find the use of copper-clad steel. This adds mechanical strength needed when pulling new cable into existing cableways or conduits. Use common sense when exerting stress on the cable. A "messenger" cable should be used to help support the coax on long overhead runs. Tie the cable to the messenger at regular intervals. The messenger may be metallic or nonmetallic, as long as it has the strength to support the cable.

The installation of coaxial cable also calls for attention to the minimum bending radius of the cable, which is normally 20 times the outside diameter of the coax. A ½-inch-diameter coax cable needs a 10-inch radius as a *minimum*. If you bend the cable too tightly, "cold flow" takes place inside the coax.

Cold flow can be demonstrated with an ice cube, a dish and a copper penny. First lay the penny flat on one of the ice cube surfaces to reduce its temperature to that of the ice. Next, pick up the penny with tweezers and set the edge on one of the remaining ice cube surfaces. Hold the penny in the upright position with the tweezer, press down on it with the pencil and watch it slowly cold flow into the ice cube. After about 10 minutes, the bottom half of the penny will be submerged into the ice cube.

This demonstrates that if you bend a coaxial cable into a small radius, the center conductor may cold flow to the inside of the turn, making its way through the dielectric over a period of time. The center conductor has a certain amount of "memory" of its position when the cable was straight, and since only the low density of the dielectric resists movement of the center conductor, the center conductor always wins!

Tips

Test new cables on the ground. Always check a new cable with an ohmmeter after connectors are installed. After the dc check, connect the new cable between an SWR meter and a dummy load, and test it at RF (see Fig. 3). It is much easier to replace a defective cable before it is completely installed.

Record the electrical length (electrical length equals physical length times velocity factor), and measure the attenuation (see Fig. 4) of cables that are important in your installation. The antenna impedance appears only at half-wavelength intervals (measured from the feed point) along a mismatched line. The Smith Chart helps calculate the actual load impedance, but

[1] m = ft × 0.3048; mm = in × 25.4; km = mi × 1.613.

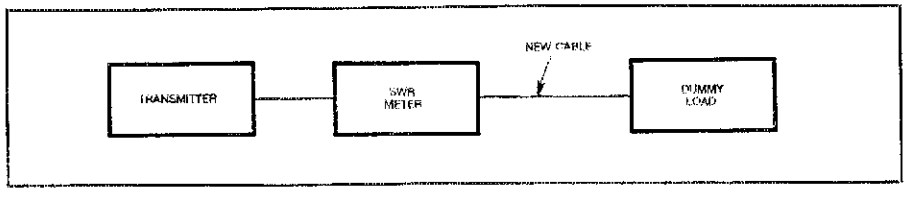


Fig. 3 — A test arrangement for checking the impedance of new cables. The SWR with the new cable should be nearly as low as that of the dummy load.

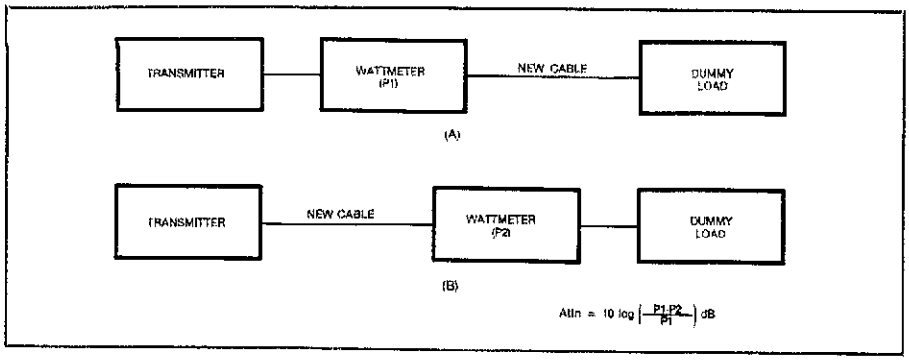


Fig. 4 — An equipment arrangement for measuring the attenuation of a new cable.

only if the electrical length of the line is known. Similarly, cable attenuation affects SWR measurements made far from the feed point (such as those made at your transmitter). You must know the cable attenuation to calculate the true SWR.

In theory, a λ/2, center-fed dipole mounted λ/4 above a perfect reflector should have a feed-point impedance of 72 Ω and be fed with a balanced line. In practice, a typical 80-meter dipole is mounted at about 0.15 λ (40 ft) over imperfect ground and fed with a low-grade coaxial cable. At 0.15 λ, the dipole impedance is close to 50 Ω. Low-grade cable allows considerable RF leakage (this is not so with high-quality, double-shielded cables), and it approximates balanced line in lengths of 100 ft or more. The antenna system described should work reasonably well, and the inconvenience of installing a balanced feed line is avoided.

Things to Come

Present technology has produced a real challenger to the coaxial cable. This is the optical fiber, or lightguide. A small optical fiber (smaller than a fishing line) can carry more information than a cable with 900 twisted pairs. In addition:

- no more RFI
- no more EMI
- no security invasion due to ingress or egress of the cable signal
- losses per mile that are less than the loss in 160 ft of coaxial cables.

While it is questionable as to when and how this new lightguide technology will become applicable to Amateur Radio, the excitement of learning about its vast applications is well worth the effort.

New Books

ELECTRONICS PRINCIPLES AND APPLICATIONS

by Kamiran S. Badrkhan and N. David Larky. Published by South-Western Publishing Co., Cincinnati, OH. First edition, 1984. Hard-bound, 7½ × 9½ inches, 628 pages. $29.93.

For the beginning electronics student, a well-illustrated, easy-to-understand textbook is most important, and much thought should be given to this selection by the instructor. As a class progresses, the book transforms into a "bible" of sorts, with the student often referencing its material.

Authors Badrkhan and Larky (WA6DHO) originally published their text with the intent that it be used in the classroom. If you are a student of electronics seeking a firm foundation of the basics, this book will prove to be a handy addition to the shelf.

The text consists of 16 chapters bursting with information on the electronics industry, components and theory. It reveals facts on ac and dc circuitry, test and measurement equipment, integrated circuits, and much more. Thirteen appendixes includes the standard but necessary schematic symbols, logarithmic tables and formulas. A glossary of terms is included, as well as a short section on soldering for the enthusiastic builder.

Anyone with the ability to solve algebraic equations can indulge in this material and benefit. Each chapter is compiled of topic sections, so the student is not overwhelmed with new material. A series of thought-provoking questions follows, each providing an opportunity for review. Topic sections within each chapter are straightforward and are kept short to eliminate confusion. A well-defined illustration, chart or symbol accompanies each new topic. Little is left to the imagination.

The book's appearance is inviting. The first chapter takes a detailed look at the history of electricity and electronics. Current job opportunities are realistically reviewed. Chapters are written in down-to-earth language, and its technical content is consistent throughout. With a copyright date of 1984, the authors were able to expose examples of basic electricity with the newest of technology. In many areas where information is introduced, the authors cite examples with which readers can identify easily. Without such a vehicle, the lesson might be misunderstood or not comprehended at all.

The Amateur Radio hobbyist who likes DXing or ragchewing may not be attracted to this type of technical literature. The operator who likes to build his or her equipment and does not work in the electronics field should take the time to browse through its pages, however. With information presented on laboratory procedures and equipment, and sections dedicated to each electronic component, it can be used as a reference guide at the work bench. And the authors take care to point out safety notes and precautionary measures to take when working around various materials to ensure the reader's well being.

Badrkhan and Larky seem to have been able to combine the basics of electronics and design techniques to produce a refreshing new book on an old subject. Instructors using this text with appropriate notes and teaching aids should enjoy a successful course. (The book's preface mentions the use of accompanying teaching aids. I have not seen these and thus cannot comment on them.) — *Maureen Thompson, KA1DYZ*

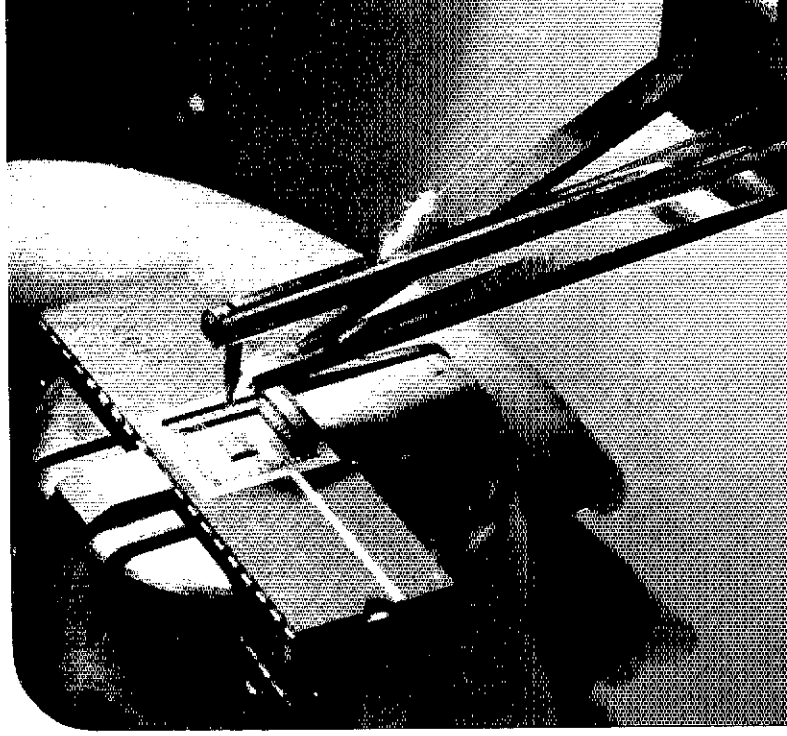
Next Month in QST

If you weren't the first on your block (or the last) to shoot a signal up to W5LFL in the Space Shuttle last year, you won't want to miss out when the next ham/astronaut orbits the earth. A December *QST* article describes a helical antenna designed expressly for Space Shuttle communications. Check it out!

The First Steps in Radio installment deals with that often-underestimated foe of all Amateur Radio operators — electrical hazards.

Elsewhere in the issue, you'll find an update of the VHF/UHF Century Club standings, and a clear, concise introduction to the latest reincarnation of our old friend, the FCC Form 610.

Digital Signal Processing for the Experimenter



Flash — A/D-igital data stream replaces an analog signal. DAC puts it back again!

By Rick Olsen,* N6NR

Have you ever watched a nationally televised sporting event and asked yourself the question, "How do they do all that fancy isolation and special effects stuff?" Contrary to popular opinion, it's not done with mirrors! Broadcasters use a highly specialized technique called digital signal processing (DSP).

DSP is not limited to TV, however. The medical profession uses DSP to create the images doctors use in computerized axial tomography (CAT) scanners and ultrasound analysis equipment. The military has used DSP in radar, sonar, missile tracking and secure communications for many years. DSP is used to assist geologists in exploring the earth for new resources, and astronomers in unraveling the mysteries of our universe. How can we use DSP in Amateur Radio? I thought you'd never ask!

Until recently, DSP required very expensive mainframe computers to do the necessary arithmetic processing. The equipment used to acquire and reconstruct the signals was also expensive and difficult to use. Developments in integrated-circuit technology have put DSP within the grasp of those who don't have a million dollars and an engineering staff with which to design a system.

Why use DSP at all? Well, things can be done in the digital domain that are difficult to reproduce with analog circuitry. Fig. 1 shows an example of a "brick-wall" low-pass audio filter. The roll-off of this filter is about 2000 dB per octave! To do this in the analog or "continuous-time" domain requires an expensive delay line, a box about the size of an Alpha 76 amplifier and a lot of patience in tuning it up. Today this can be done with a handful of ICs, namely an A/D converter, D/A converter, Multiplier/Accumulator (MAC), a Zilog Z80® microprocessor, some memory, and

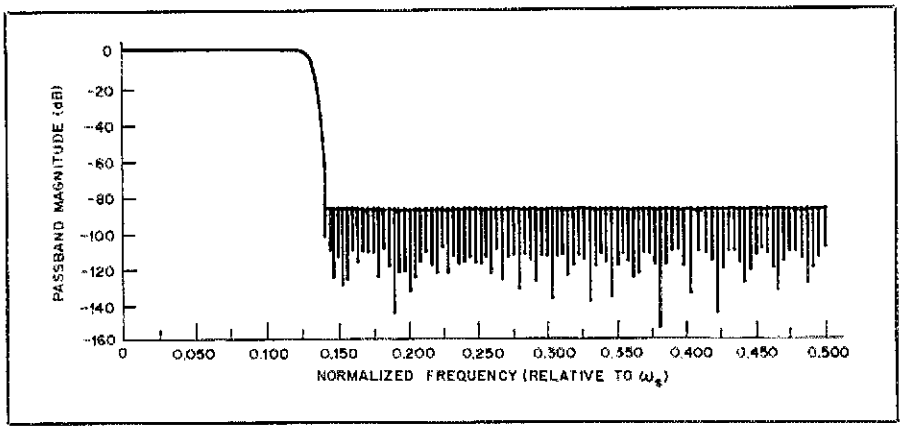


Fig. 1 — A low-pass digital filter exhibits 88 dB of stopband attenuation and has a passband ripple of only 1% with linear phase response. This is a 251st-order finite-impulse-response (FIR) design.

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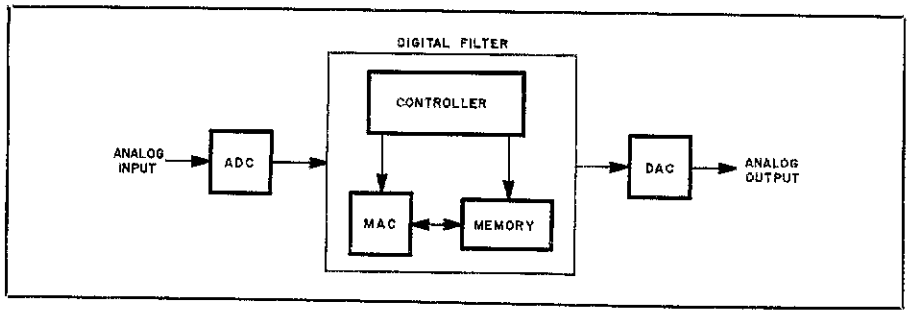

Fig. 2 — The digital filter in a DSP system contains a controller, MAC and memory (RAM or ROM). The A/D converter sampling rate must be at least twice the bandwidth of the analog input signal to avoid aliasing, a form of distortion.

a few other chips to hold it all together. See Fig. 2.

There are some data manipulations that can be done only in the digital domain. In the April 1984 issue of *QST*, Fred Williams described a frequency synthesizer that uses a number generator and a D/A converter instead of a phase detector and a frequency-divider chain.[1] This type of synthesizer is quiet and lends itself to spread spectrum applications. It is interesting to note that the same components used in the synthesizer are those used in the digital filter I mentioned.

What are these components and how are they used? The rest of this article will introduce you to the analog-to-digital converter (A/D or ADC), the digital-to-analog converter (D/A or DAC) and the multiplier/accumulator (MAC). I will begin with a brief explanation of sampling theory. An understanding of sampling theory is necessary for learning how DSP chips work. But don't worry; this stuff is pretty easy to learn.

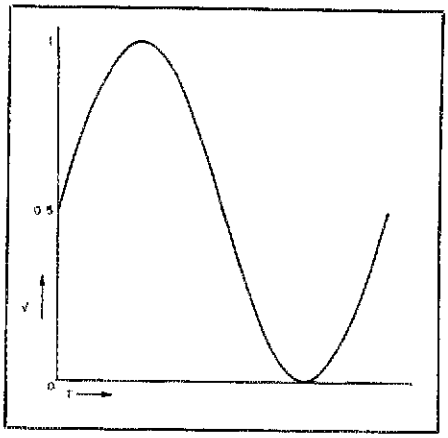

Fig. 3 — A sine wave represents a simple analog signal ready for processing.

Sampling Theory is a Different Way of Describing Signals

We're all accustomed to dealing with electrical phenomena in the analog world, where signals are continuous. When viewed on an oscilloscope, they look smooth. Fig. 3 illustrates a continuously varying signal, in this case a sine wave. The horizontal axis represents time and the vertical axis represents amplitude. The sine wave is drawn as a smooth curve whose amplitude varies constantly as time passes. It is easy for most of us to understand this phenomenon, and we have a mathematical system that allows us to describe it.

A DSP system cannot deal with signal changes in the continuous-time domain. Rather, it must look at the signal at some predetermined interval of time and assign a value to the signal each time it takes a look. This is called signal sampling in the discrete-time domain.

Confused? Take a look at Fig. 4. The signal processor describes the sine wave as a series of numbers that relate to the sampling frequency. This is done using an A/D converter. When it is time to convert the signal back into the time domain, a D/A converter is used. The signal processor commands the DAC to produce an analog signal according to the sampling period.

But wait! The signal still doesn't look much like the original sine wave. The holes need to be filled in. For that we use a method called interpolation, accomplished by placing either a low-pass or a band-pass filter at the output of the D/A converter.

There is one rule that must always be obeyed when sampling an analog signal: the Nyquist Criterion (named after the individual who discovered it). Nyquist stated that the sampling frequency must not be less than twice that of the highest frequency being sampled ($F_s > 2BW$). Fig. 5 illustrates why this is true. The relationship between the sampling frequency and the input frequency is essentially the same as that between the RF and LO frequencies in a receiver. Sum and difference frequencies are generated. Consequently, if the input-signal frequency and the sampling frequency are too close together, unwanted signals or "images" will appear at the output of the system when the signal is being reconstructed. This is a process known as "aliasing."

[1]Williams, F. J., "A Digital Frequency Synthesizer," *QST*, April 1984, pp. 24-30.

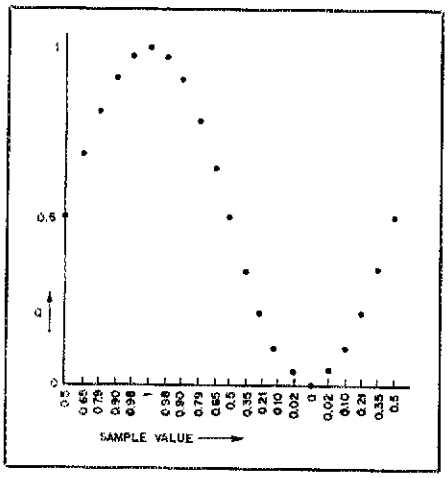

Fig. 4 — After the sine wave has been sampled by the ADC, a set of numbers can be used to represent the wave at the sampling points. This sine wave was sampled at a rate of 20 times the signal frequency.

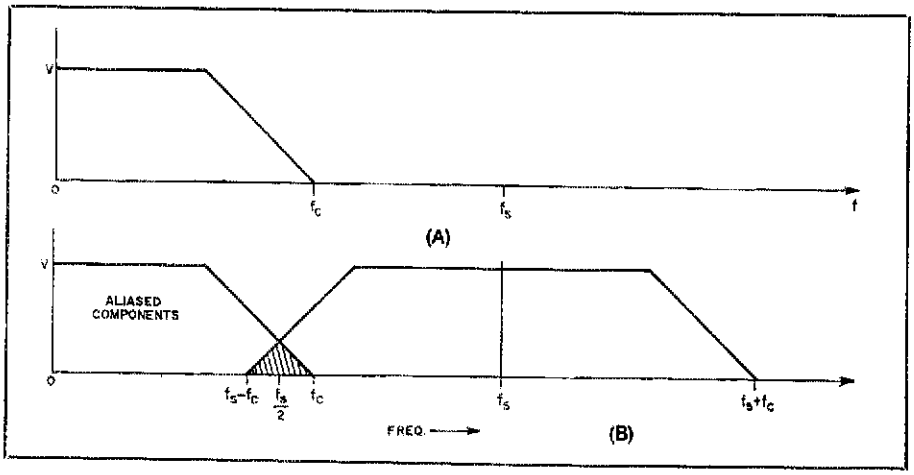

Fig. 5 — Undersampling of the band-limited analog signal shown at A results in overlapping of higher-order spectra as shown at B. This is called aliasing. Once aliased components have been generated, it is impossible to separate them from the original signal.

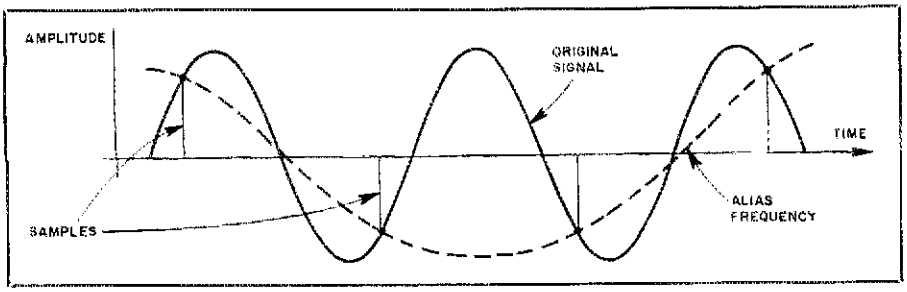

Fig. 6 — A low-frequency sine wave results from the undersampling that causes aliasing. Note that the sampling pulses define this low-frequency waveform as well as the higher-frequency undersampled wave.

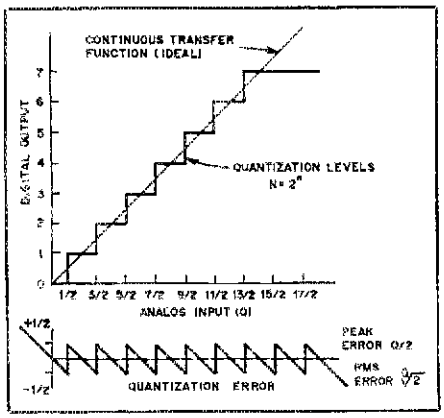

Fig. 7 — Quantization error (Q_e) from a successive-approximation ADC is shown.

Fig. 6 shows how this happens. When the DAC output goes through a low-pass filter, the resulting frequency is something other than what was originally sampled. Pay attention to Mr. Nyquist. He'll keep you out of trouble. In practice, we usually try to sample the original signal much more than twice every cycle to eliminate any chance of aliasing.

A DSP system can only evaluate a function as a series of discrete values. The tool for obtaining those values is the A/D converter. Think of it as the camera of the DSP system. The ADC takes pictures of the incoming signal by producing a numerical value at every sampling period.

There are many types of A/D converters. Some are known for the speed at which they operate, and some are known for the high degree of signal resolution they provide. The two most commonly used are the successive-approximation converter (SAC) and the full-parallel or "flash" A/D converter.

So What Is Resolution?

There is a limit to how closely an ADC can approximate a given voltage level. Fig. 7 shows why. The ADC approximates the linear curve by a series of stair-step values called quantization levels (Q). Depending on when the actual sample is taken, the sample can be in error (Q_e). I'll demonstrate the method for determining just how much error can be expected from a given ADC.

For example, let's use a 3-bit A/D converter to sample and quantize a 1-V linear ramp. How close can this ADC come to giving the true value for each sample? This is derived by using a simple formula:

$$Q_e = V/N \qquad \text{(Eq. 1)}$$

where Q_e is the quantization error, V is the full-scale input-voltage range and N (number of quantization steps) = 2^n (n = number of bits of resolution). In our example, $Q_e = V/2^3 = 1/8 = 125$ mV. This is a significant amount of error. How is it reduced? Increase the number of bits of resolution. If a 12-bit A/D converter is used, the quantization error drops to 244 microvolts! Don't forget, though, that speed (and cost!) is a limiting factor. As the speed increases, it becomes more and more difficult to provide a high degree of resolution.

Successive Approximation ADCs: The Old Reliable Tool

The successive approximation converter (SAC) has been around for a long time and is still the most common type of ADC up to a sampling rate of about 1 MHz. The name "successive approximation" stems from the fact that the converter arrives at a numerical value by making some intelligent guesses until it is satisfied that it has arrived at the closest answer. This is similar to the way a midway carnival worker might guess your age (providing you answer the questions correctly).

Fig. 8 shows a typical SAC. It consists of a single voltage comparator that is driven by a reference DAC and the input signal. The DAC forces a voltage at the input of the comparator as the decision range narrows. The information as to whether the voltage is above or below the reference is fed to the output register and appears as a coded value of the input signal.

Let's walk through the Fig. 8 example, and I'll explain just what is going on. First of all, the signal must be held at some constant value to give the SAC an opportunity to do its work. A sample-and-hold (S/H) circuit is used. The S/H circuit is a relatively simple tool. It functions like a switch and a capacitor between the incoming signal and the A/D. In the sample mode, the switch closes to charge the capacitor. At the instant the hold command is given, the switch opens and the most recent signal voltage remains across the capacitor.

Once the S/H circuit has done its job, it's time for the SAC to go to work. The D/A converter in the SAC is programmed to produce a voltage equal to one-half of the full-scale ADC measuring range. The comparator decides whether the input is above or below that level. In Fig. 8, the input is above the DAC value so a "one" appears as the first coded value. Next, the DAC increases the reference by one-half the previous amount. Now the input is below the reference and a "zero" appears as the second coded value. The DAC now drops the reference in an attempt to get closer to the input. You guessed it: The amount is again one-half the previous change. The SAC continues this process

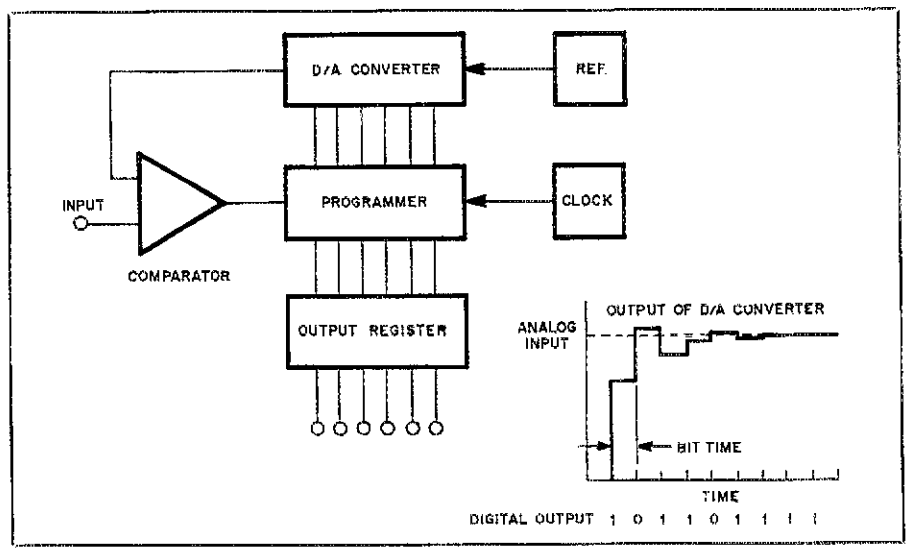

Fig. 8 — The block diagram of a successive-approximation analog-to-digital converter.

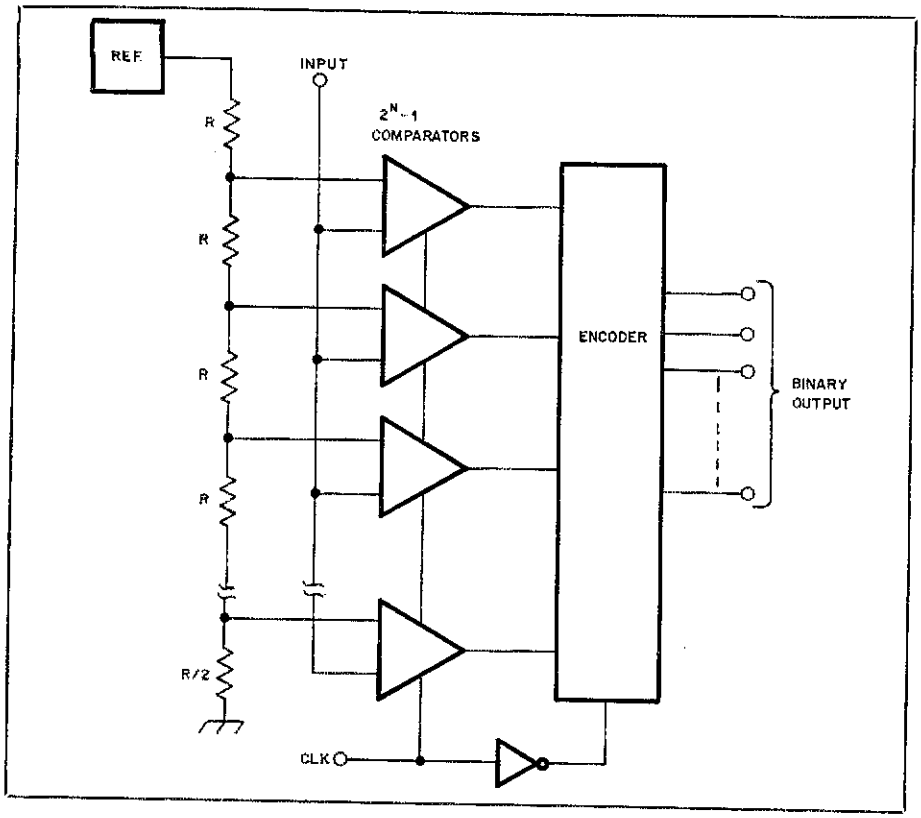

Fig. 9 — The block diagram of a flash A/D converter shows separate comparators in the input circuit.

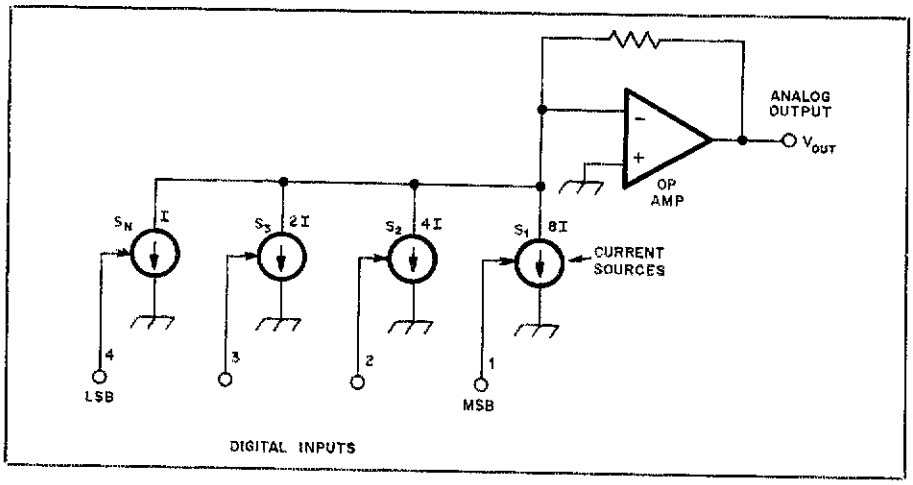

Fig. 10 — In a weighted-current-source DAC, the binary-weighted sources are switched by means of analog switches S1 to SN and summed by an op amp. A reference voltage and resistors establish the current sources. These resistors must all track to the required converter accuracy over all operating conditions.

until it can no longer divide the previous step in half. Then it sends the result to the output register.

Keep in mind this happens very fast. The SAC in Fig. 8 must make a decision nine times for every sample it provides. There are factors that limit the speed of an SAC. Remember that the signal must be held constant while the SAC works its magic. The higher the incoming-signal frequency, the harder it is for the S/H circuit to acquire and maintain this value. It follows then that the higher the speed of the S/H the higher the price tag!

The next problem is that of generating the reference for the comparator. The DAC takes time to settle at the right value each time it is commanded to change. Consequently, the faster the clocking speed, the more significant the settling time becomes. There are also limitations as to how fast the controller can output its instructions and how fast the comparator can provide a valid output.

Flash ADCs — Blinding Speed in a Small Package

I'll bet you're asking yourself, "Gee whiz, it sounds like this SAC is slow. How can I get rid of the DAC and the S/H circuit altogether?" Have I got a device for you! It's called the flash A/D converter. Yes, the name flash comes partly from its ability to work in a hurry. TRW makes a 6-bit flash converter that gives an answer every time it receives a clock pulse. By comparison, the SAC needs a clock pulse for every bit of resolution it provides. The flash ADC eliminates the need for an S/H circuit and reference DAC by providing a comparator for every quantization level except one ($2^n - 1$ comparators). The Q level that does not require a comparator can be the zero or full-scale point depending on how the reference is applied.

Fig. 9 shows the architecture of the flash A/D converter. One side of all the comparators is connected to the signal input. The other side is connected to a voltage divider chain that is fed by the reference. The reference is equal to the input signal peak-to-peak value.

The flash ADC performs a quantization in a relatively simple manner. When the rising edge of the clock arrives, the comparators quickly latch in a one or zero state depending on whether the input signal is above or below its reference point at that instant of time. The comparators that are referenced above the input signal remain turned off, representing the zero state. Those below the input signal level turn on and become a one. This creates what is known as a "thermometer code." After the falling edge of the clock pulse, the thermometer code is converted to a binary code. The number of bits in the code is equal to the number of bits of resolution.

To prove this we can evaluate the number of bits with the equation

$$n = \log Q / \log 2, \text{ or} \qquad \text{(Eq. 2)}$$

$$n = \log_2 Q \qquad \text{(Eq. 3)}$$

where Q is the number of points in the thermometer code (which equals the number of quantization steps).

Confusing? Just remember that the flash ADC can give an answer every time it receives a clock pulse and that it requires $2^n - 1$ comparators to perform its assigned function. What is significant is that every time the number of bits of resolution increases by one, the number of comparators doubles. A 9-bit flash ADC has 511 comparators. How can that many comparators be made to behave alike? This was not practical until the advent of fine-geometry integrated circuits. The 6-bit, 100-MHz ADC I mentioned has feature sizes as small as one micron. [Micron is short for micrometer (μm) or 10^{-6} m. 1 μm $\approx$ 0.00004 in. — Ed.]

D/A Converters Bring Us Back to the Analog World

In just about every DSP system, there is

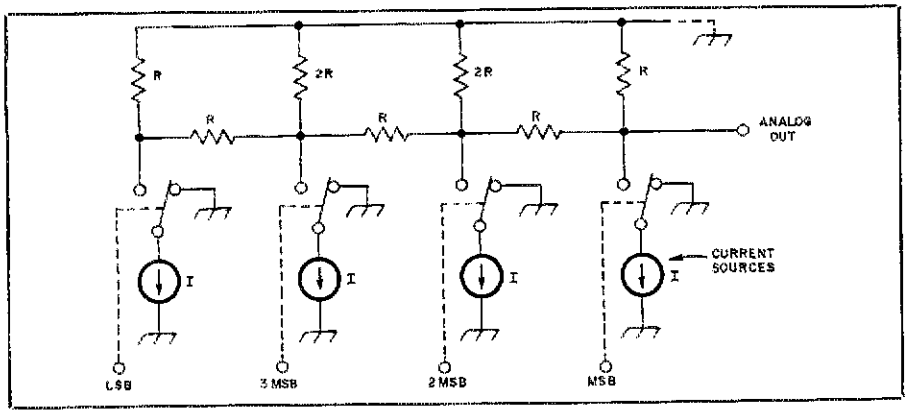

Fig. 11 — An R/2R ladder DAC employs two resistor values (R and 2R) and current sources of equal magnitude to produce a binary-weighted analog output in response to digital inputs.

a requirement to return the processed information to analog signals. Accomplishing this requires a D/A converter, often referred to as a DAC. To a DSP system, the DAC is the movie projector. How does it work? Take a look at Fig. 10.

As you can see, the DAC is not an ADC in reverse. The DAC is made up of a collection of current generators that feed a summing node. The first current generator value is equal to the smallest quantization level specified by the number of DAC resolution bits. This is also called the least significant bit (LSB). Each successive current generator increases by a factor of two to the value of the most significant bit (MSB), which equals one-half the full-scale output range. The output is fed to an amplifier that may be configured as either a current buffer or a current-to-voltage converter.

What Fig. 10 does not show is that all of the current generators are tied to a common reference. This presents a problem. As the number of bits increases by a factor of one, the current in the LSB generator gets smaller by a factor of two. Accuracy becomes the limiting factor. It can be improved by using an R/2R ladder as shown in Fig. 11. Now all of the current generators may be the same value. The limitation on the accuracy of the DAC now rests on the quality of the resistor ladder and that's where IC technology comes in. Because of the uniformity of geometry and metalization that ICs can provide, DACs can now provide accuracy down to the picoamp range.

Anatomy of a Glitch

The major limitation to the speed of a DAC is its ability to move quickly and accurately from one Q level to another. With current switches turning on and off, it takes time for the DAC to settle on a value. If the settling time is longer than the sampling interval, the accuracy will be poor. But there is a bigger problem connected with current switches. It's called the "glitch."

Look at Fig. 12. Here I have drawn the output waveform of an 8-bit DAC. If I'm not careful I can generate a lot of error. The problem centers around what happens between code 127 (binary 01111111) and 128 (binary 10000000). If the current switches don't open and close at exactly the same time, I can get a condition where the code 11111111 appears inside the DAC. This means that for a brief period of time I'll get a full-scale output. All I wanted to do was move from one Q level up to the next higher Q level.

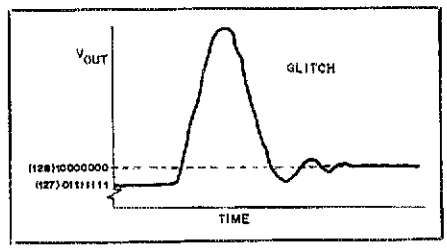

Fig. 12 — A graph showing a "glitch" that can occur if the current-switch timing in a DAC is incorrect.

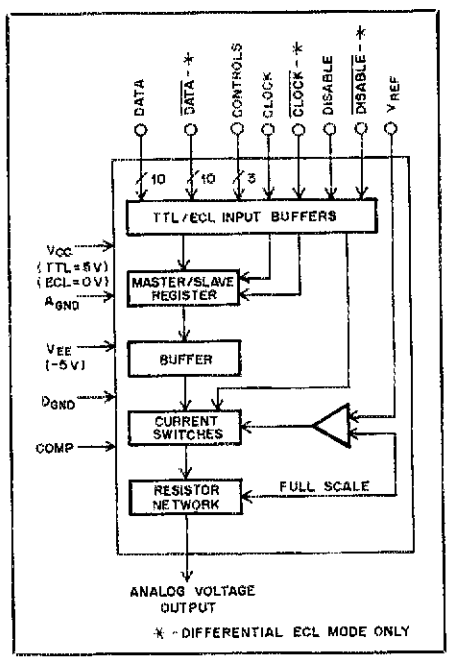

Fig. 13 — Available in 8, 9 and 10-bit versions, TRW LSI Products TDC1016J provides a voltage output at 20 million samples/s. It operates with either TTL or ECL inputs and has differential phase error of 0.5° and differential gain error of 1.0%.

How can this be eliminated? There are two commonly used methods. The first involves putting an S/H circuit at the output of the DAC and only allowing the output to change when everything has settled on the proper value. The second method involves the use of IC technology. Special care is taken in the design of the DAC to make sure that all of the lines going to the current switches are the same electrical length and that all of the current generators are identical. A master/slave register is placed at the DAC input to make sure that each bit in the coded word arrives at the current switches at the same time. Data buses can generate their own errors. Fig. 13 shows how all of this comes together.

One final note before moving on. In the section on sampling theory, I mentioned that the output of the DAC is a series of voltage levels that change at the speed of the sampling frequency. Fig. 14 shows how a DAC reproduces the linear ramp discussed earlier. Some DACs will hold the last value until it is time to change. This fills in the holes all right but it still does not reproduce a smooth, continuous output. Fortunately the solution is simple. A smooth curve can be accomplished by adding a low-pass filter to the DAC output.

Number-Crunching is the Domain of the MAC

Next to the 16-bit microprocessor, the busiest little piece of silicon I've yet run across is the Multiplier/Accumulator. In the analog realm, the MAC might take the shape of a gain control, a modulator or even a doubly balanced mixer. The MAC is the basic arithmetic building block of a DSP system. It performs arithmetic with binary numbers from the ADC, memory or other processing components within the system. Its output is fed to a DAC, more memory, or even other processors such as large computers or highly sophisticated array processors.

I mentioned binary arithmetic. This means that the number system the MAC uses contains only two digits, 1 and 0. Although it may seem a little odd, it works much the same way as our decimal system. Let's have a look. I'll multiply two numbers using both binary and decimal notation.

Decimal	*Binary*
5	101
× 6	× 110
30	000
	101
	101
	11110 (16+8+4+2+0 = 30)

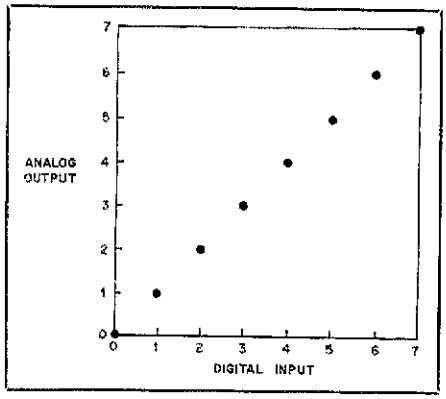

Fig. 14 — A DAC output isn't continuous because the device accepts a finite number of discrete input values and produces proportional outputs.

You can see that the procedure is the same for either number system.

But how does the MAC get the answer? It doesn't have any fingers or toes! It uses a large array of AND gates and adders arranged to perform the arithmetic much in the same way as is done with paper and pencil. You don't believe that an AND gate is a multiplier? Look at Table 1. The AND gate is set up so that A × B = C. The truth table for an AND gate is shown in Table 1.

It really is that simple. The challenge that faces the integrated-circuit designer is arranging AND gates and adders in such a way that 16-bit numbers can be multiplied.

Understanding how the MAC works inside is nice, but what is really required is knowing how to use it as a tool. About 80 to 90 percent of all the arithmetic operations required in a DSP system require the multiplication of two numbers and the summing-up or "accumulation" of the results.

Fig. 15 shows how this is done. Binary numbers are loaded into the X and Y registers and fed to the multiplier array. The product of the two numbers moves into the accumulator, where it is added to the previous product and so on. When the time comes to report the results, the output is enabled and the results are passed in the form of a most-significant product (MSP), a least-significant product (LSP) and an extended product (XTP). For the sake of the user's convenience (and sometimes the chip designer's, too) the output of the MAC is divided in half. The MSP is the upper half of the product and the LSP is the lower half.

Sometimes the MAC will have a few extra bits called the XTP. The reason this is required is that when a lot of accumulations are performed the resulting product gets larger than the number of bits available in the output register. These bits can overflow into the XTP and not be lost.

By the way, there is another device that

Table 1
AND Gate Truth Table

0 × 0 = 0
1 × 0 = 0
0 × 1 = 0
1 × 1 = 1

is a subset of the MAC and is simply called a multiplier. It contains the same multiplication array as the MAC but does not have the accumulator. This device is often used to precondition the data coming into the processor or to be used as a piece of a much larger and more sophisticated number cruncher.

There's Much More to Come

I've given you a thumbnail sketch of DSP and its three basic building blocks. That's enough for now. As the technology advances and prices fall, many DSP applications to Amateur Radio will develop.

In the future, you will be hearing about things such as direct synthesis and demodulation of SSB and how to set up a personal computer as a digital spectrum analyzer using the fast-Fourier transform (FFT) algorithm. In the meantime, if you want to get into the meat of DSP a little further, I have included an information reference list.

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Any of the TRW LSI applications notes listed may be obtained by writing to TRW LSI Products, P.O. Box 2472, La Jolla, CA 92038.

Rick Olsen was first licensed in 1964 as WN7CNP. He is the San Diego Section Technical Coordinator, and is a member of ARES. Most of his operating time is spent on the bottom end of the 40, 30 and 20-meter bands, where he operates 40 + WPM CW. He does not even have a microphone connected to his HF rig. He is one of three ARRL Technical Advisors appointed when that program first began.

Rick did most of his undergraduate work in electrical engineering at Arizona State, and received BSBA and MBA degrees from La Jolla University. He is presently a PhD candidate at La Jolla. After spending four years in the U.S. Navy during the Vietnam war, Rick has been employed at General Dynamics, Cubic Defense Systems and Motorola Semiconductor Systems, and is presently the Manager of Field Applications Engineering, TRW LSI Products Division. Besides Amateur Radio, Rick enjoys playing in a band that specializes in bluegrass music. Between all of this, he still finds time to devote to his wife and two children.

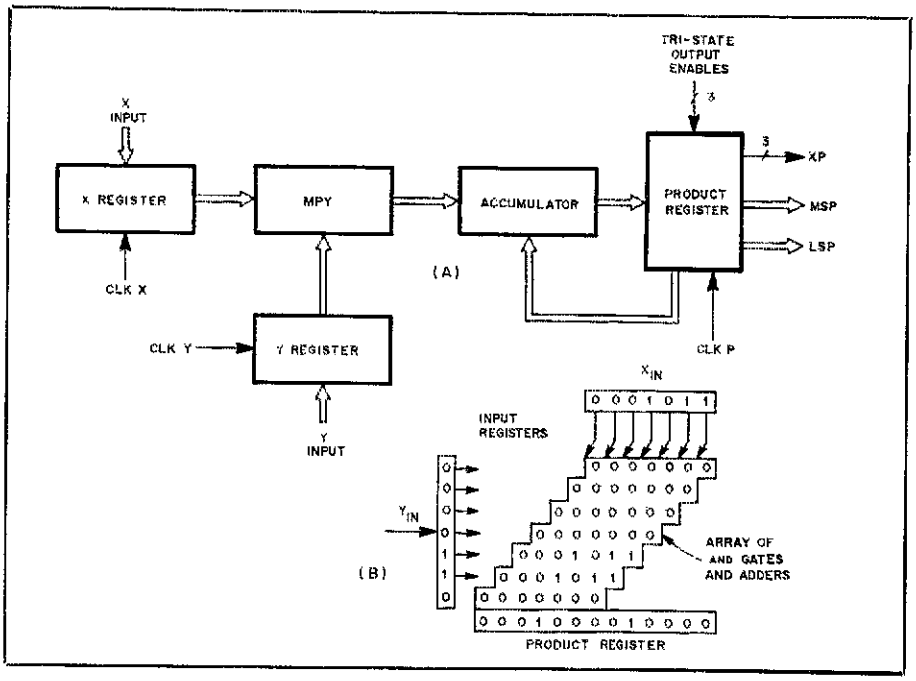
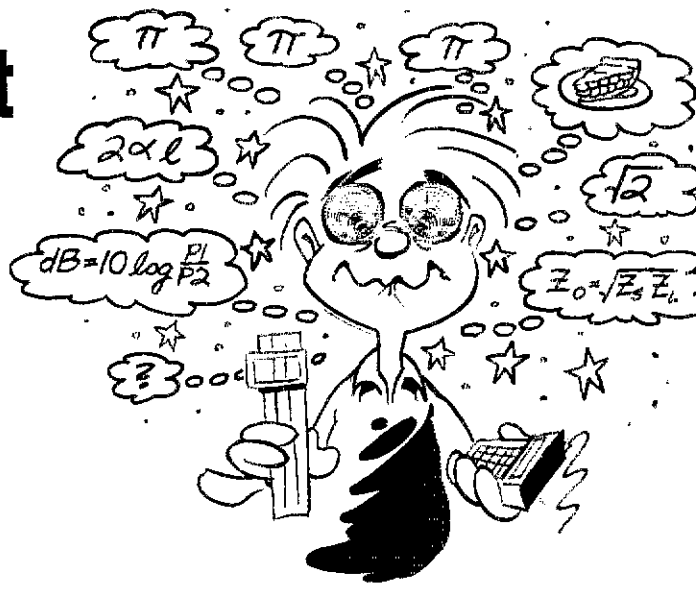


Fig. 15 — The block diagram of a MAC is shown at A. B illustrates the operation of the multiplier.

The Smith Chart in BASIC



Tired of struggling with Smith Charts? Mired in dots and circles? This BASIC program will help you find out what's really happening at the antenna.

By Crawford MacKeand,* WA3ZKZ

When working on an antenna system, sooner or later you'll discover that you really need to know what is happening at the antenna feed-point terminals. Sometimes you can place a noise bridge at the antenna feed point, and sometimes a more convenient point may be a half wave from the antenna feed point. In general, Murphy is likely to ensure that it's raining, the transmission line is 0.61387 wavelength long, it's nighttime, or any of a number of other things to discourage you from doing what should be done. Since there's only a piece of transmission line between you and the antenna, how come you can't "simply" calculate what's happening up there? If you've ever tried it, you know it's not that simple.

There are plenty of textbook transmission-line equations, but if you try to use them, you will discover a number of distressing realities. First, working with hyperbolic functions is not most hams' idea of a relaxing hobby. Second, when you throw in the vector relationships that apply, you will probably throw in the towel with them. Finally, and by no means least, most sources present us with equations that have been set up to use information in the forms that usually apply to telephone-cable systems: resistance (ohms/mile), inductance (millihenrys/mile), capacitance (microfarads/mile) and leakage conductance (mhos/mile). Not friendly at all!

The Smith Chart

In 1939, Philip Smith published the first of several articles in *Electronics* describing a new graphic technique for solving transmission-line problems. The techniques available on the Smith Chart open up all sorts of incidental benefits, too. For instance, you can easily see the effect of matching impedances, and that is a real plus. I have to admit, however, that graphic methods of calculation are not my strongest point. Have you ever tried to work out a series of matching-network problems, or solve for differing antenna impedances or line lengths and found yourself inextricably lost in a maze of multicolored circles, lines, arrows, notes and marks? I have! Since I have a background in telephone-cable transmission systems, and had an antenna project coming up, the next job elected itself with little opposition: I would write a BASIC program to replace Mr. Smith's chart. That's where MULTIVEC started.

Table 1
Smith Chart Transmission Line Calculations by MULTIVEC

Operating frequency: 5 MHz
Transmission line physical length: 100 ft.
Nominal characteristic line impedance: 50 Ω
Line attenuation (dB/100 ft at 10 MHz): 1
Velocity factor: 1
Line dielectric power factor: 0
Terminating impedance resistance: 25 Ω
Terminating impedance reactance: 0 Ω

Freq. (MHz)	*Rin/Rterm (ohms)*	*Xin/Xterm (ohms)*	*SWRin/ SWRterm*	*Af/As (dB)*
5	28.053	1.601	1.79	0.707
	25	0	2	0.856
6	40.012	22.661	1.77	0.775
	25	0	2	0.935
7	79.812	19.219	1.76	0.837
	25	0	2	1.007
8	65.436	−29.514	1.75	0.894
	25	0	2	1.074
9	34.34	−18.037	1.73	0.949
	25	0	2	1.137
10	29.368	3.198	1.72	1
	25	0	2	1.196
11	42.538	22.917	1.71	1.049
	25	0	2	1.252
12	80.26	14.555	1.7	1.095
	25	0	2	1.306
13	61.751	−27.953	1.69	1.14
	25	0	2	1.357
14	34.214	−15.79	1.68	1.183
	25	0	2	1.406
15	30.478	4.706	1.67	1.225
	25	0	2	1.453

MULTIVEC

This program originated with a fundamental mathematical equation and grew in size as I tackled each phase of development. I began by calculating resistance and reactance, then SWR at the near (shack) and far (antenna) ends and, ultimately, the matching networks. The program listing is given in Fig. 1. This program is heavily dependent on a vector calculation subroutine (see Fig. 2) that was developed initially to solve the problem of matching networks. An example of MULTIVEC output is shown in Table 1.

Input Data

When you first start using MULTIVEC, it asks a number of questions about the transmission line you are using, the load that's connected to it, and the frequency of operation. The program then gives you the option of taking a single answer for the parameters you have entered, or a range of answers for variable input quantities such as the cable length, its impedance or even its power factor.

Cable data is often presented in forms that look nothing like what the formula expects to see. It is often also given in graphical or tabular form for all the frequencies you are most unlikely to use! It bothers me to have to select values from a small graph when tables give me a feeling I am being more consistent.

The *ARRL Antenna Book* offers an equation that enables the computer to use the attenuation data quite easily, and the program is set up to request this information for 10 MHz, which is one of the frequencies normally given in

*115 South Spring Valley Rd., Greenville, DE 19807

```
10 REM Program "MULTIVEC" is Copyright (C) 1982 by J.C.B. MacKeand.
   All rights reserved. "MULTIVEC" is for Transmission Line calculations,
   especially at radio frequencies. It calculates and displays Zin, Iload,
20 REM SWRs and attenuation for lines with or without matching impedances.
   By J.C.B. MacKeand, 115 South Spring Valley Rd., Wilmington, DE 19807
   "MULTIVEC" Version 5.6 24 May 1984 ZK2 WA3ZKZ WA3ZKZ WA3ZKZ WA3ZKZ
30 REM Versions 2.n for Extended B.H. BASIC/HDOS. Versions 3.n through 5.n
   for MBASIC (Ver 4.82)/HDOS. Versions 6.n for BASIC-80 (MBASIC
   Ver 5.21) on CP/M80 (CP/M 2.2).
40 REM Near end impedance looking into line is Z(1,n). (Transmitter end)
   Far end impedance terminating line is Z(2,n). (Load end)
   Line characteristic impedance is Z(0,n)
50 REM Line transmission coefficient is G(n): n=1,2 for a (attn), b (phase)
   Z(n,1) Z(n,2) are Cartesian Real & Imaginary parts of complex Z(n,~)
   Z(n,9) Z(n,0) are polar Modulus and Argument of complex Z(n,~)
60 REM Z(19,1),Z(20,1) & Z(19,2),Z(20,2) are Real (1) & Imaginary (2) parts
   of complex sinh and cosh respectively of transmission constant G(n).
70 E$= CHR$(27):ERV$=E$+"p":XRV$=E$+"q":CB$=E$+"E":RSM$=E$+">5":RSM$=E$+"y5"
80 H$= " MULTIVEC Copyright (C) 1982 Transmission Line Calculator "
90 I$= " by J.C.B. MacKeand WA3ZKZ. Version 5.6 May 24th, 1984 "
100 DEFINT I,N: PRINT CB$: RSM$: TAB(12):ERV$;H$;XRV$; PRINT TAB(11);ERV$;I$
110 N1=N1+1: IF N1<255 THEN 110 ELSE PRINT XRV$; CB$; RSM$: REM mgd10c
120 DIM B(48,18),Z(48,9): CA=1: CB=1
130 DEF FN S(D) = (EXP(D)-EXP(-D))/2: DEF FN C(D) = (EXP(D)+EXP(-D))/2
140 DEF FN M(D1,D2) = SQR(D1*D1+D2*D2): DEF FN A(D1,D2) = ATN(D2/(D1+1E-06))
150 PRINT TAB(10): " Please enter operating data as requested. ": PRINT
160 F = 1E-06: INPUT "Operating frequency MHz. "; F
170 IF F<1E-05 THEN PRINT "Not a reasonable value. Please re-enter.": GOTO 160
180 L = 1E-06: INPUT "Physical length of transmission line ft." ; L
190 IF L<1E-05 THEN PRINT "Not a reasonable value. Please re-enter.": GOTO 180
200 Z = 1E-06: INPUT "Nominal characteristic impedance of line "; Z
210 IF Z<1E-05 THEN PRINT "Not a reasonable value. Please re-enter.": GOTO 200
220 INPUT "Line attenuation dB/100 ft. at 10 MHz. " ; A
230 IF A<0 THEN PRINT "Negative value not valid. Please re-enter. ": GOTO 220
240 V = 1: INPUT "Velocity factor for the line (<CR>=1.000) "; V
250 IF V<1E-05 THEN PRINT "Not a reasonable value. Please re-enter.": GOTO 240
260 IF V>1 THEN PRINT "VELOCITY FACTOR CANNOT BE GREATER THAN 1.000": GOTO 240
270 P = 3E-04: INPUT "Power factor for line dielectric (<CR>=0.0003) "; P
280 IF P>.1OR P<0 THEN PRINT"Not a reasonable value. Please re-enter."!GOTO270
290 IF P>.05 THEN PRINT "POWER FACTOR OUTSIDE RECOMMENDED LIMITS. "
300 R = 1E-03: INPUT "Resistive part of terminating impedance " ; R
310 IF R<1E-03 THEN PRINT "R must be > 0.001 ohms. Please re-enter.": GOTO 300
320 INPUT "Reactive part of terminating impedance " ; X
330 REM
400 PRINT: PRINTTAB(18)"** OPTIONS **": REM Use MM or mm for Z2.DAT
410 PRINT "(1) Multiple calculations with ranged variable.....(M)"
420 PRINT "(2) Graphic presentation of multiple calculations....(G)"
430 PRINT "(3) Tabular cultiple presentation on printer.....(P)"
440 PRINT "(4) Vector matching sub-routine (far end).....(VF)"
450 PRINT "(5) Vector matching sub-routine (near end).....(VN)"
460 PRINT "(6) Accept LC description of matching components.....(LC)"
470 PRINT: INPUT "Enter letter codes to select options. "; F$
480 PRINT: IF INSTR(F$,"M") OR INSTR(F$,"m") THEN 2000
490 REM
500 REM ************* Transmission Line Calculations *****************
505 IF C=0 THEN C=1E-04: NZ=1: REM Avoid division by zero in M option
510 IF A$="<" THEN F=C ELSE IF A$="!" THEN L=C ELSE IF A$="I" THEN Z=C
520 IF A$="a" THEN A=C ELSE IF A$="v" THEN V=C ELSE IF A$="p" THEN P=C
530 IF A$="r" THEN R=C ELSE IF A$="x" THEN X=C
535 IF NZ=1 THEN C=0: NZ=0: REM Restore value of C in M option loop
540 Z(1,1) = R : Z(2,2) = X : Z(0,1) = Z
550 IF INSTR(F$,"VF") OR INSTR(F$,"vf") THEN GOSUB 2200: REM Match at Z2
555 IF A<0.001 THEN G(3)=0: GOTO 570
560 G(3) = (A/3.1622B - 8.791E-P/V)*8OR(F) + 2.78*P*F/V
570 G(1) = G(3)*L/866.6 : G(2) = FNL/(V*156.6*F)
580 Z(0,2) = Z(0,1)*(P - G(1)/G(2)) : REM Y0 = R0(pf = a/b)
590 Z(19,1) = (FN S(G(1)))*COS(G(2)): Z(19,2) = (FN C(G(1)))*SIN(G(2))
600 Z(20,1) = (FN C(G(1)))*COS(G(2)): Z(20,2) = (FN S(G(1)))*SIN(G(2))
610 REM Calculate sinh & cosh of transmission constant.
620 D=2: E=20: I=1: M=3: GOSUB 2000: REM Z2.coshG1=Z3
630 D=2: E=19: I=1: M=4: GOSUB 2000: REM Z4.sinhG1=Z4
640 D=3: E=4: I=2B: M=7: GOSUB 2000: REM Z3+Z4=Z7
650 D=0: E=20: I=1: M=5: GOSUB 2000: REM Z0.coshG1=Z5
660 D=2: E=19: I=1: M=6: GOSUB 2000: REM Z2.sinhG1=Z6
670 D=5: E=6: I=2B: M=8: GOSUB 2000: REM Z5+Z6=Z8
680 D=7: E=8: I=32: M=9: GOSUB 2000: REM Z7/Z8=Z9
690 D=0: E=9: I=11: M=1: GOSUB 2000: REM Z0.Z9=Z1
700 Z(1,2) = Z(1,2) * SGN(Z(1,1)): Z(1,1) = ABS(Z(1,1)): REM Quadrant corr.
710 IF INSTR(F$,"VN") OR INSTR(F$,"vn") THEN GOSUB 2350: REM Match at Z1
720 CX=1000: REM Calculate loss G6 (flat) & G7 (with SWR effect) and truncate.
730 NT=1 : GOSUB 2500: REM Calculate input SWR
740 NT=2 : GOSUB 2500: REM Calculate load SWR
750 G(6) = INT((CX*G(3)*L/100)+.5)/CX
760 G(7) = INT(CX*4.343*LOG((EXP(2*G(1))-K*k*EXP(-2*G(1)))/(1-K*K))+.5)/CX
770 Z(1,1) = INT(CX*Z(1,1)+.5)/CX : Z(1,2) = INT(CX*Z(1,2)+.5)/CX
780 Z(2,1) = INT(CX*Z(2,1)+.5)/CX : Z(2,2) = INT(CX*Z(2,2)+.5)/CX
790 REM
1000 REM ************* Display for single calc. **************
1010 IF INSTR(F$,"M") OR INSTR(F$,"m") THEN 1210
1020 PRINT CB$ : PRINT
1030 PRINT "Resistive part of input impedance is "; Z(1,1);" ohms."
1040 PRINT "Reactive part of input impedance is "; Z(1,2)" ohms."
1050 PRINT "Standing wave ratio at input is "; : IF K(1)>100 THEN PRINT ">100"@
     ELSE PRINT K(1)
1060 PRINT "Standing wave ratio at load is "; : IF K(2)>100 THEN PRINT ">100"@
     ELSE PRINT K(2)
1070 PRINT "Nominal line attenuation is "; G(6)" dB."
1080 IF K(2)<=100 THEN PRINT "Total line attenuation is "; G(7)" dB." ELSE @
     PRINT "SWR too high for useful calculation of service attenuation. "
1090 GOTO 4000: REM End of calc. for single values.
1100 REM
1200 REM ********** Print-out modules for ranged variables. ***************
1210 N=N+1: IF N<>1 THEN 1240
1220 PRINT CB$ : PRINT : PRINT
1230 PRINT " "18$, "Rin/Rterm","Xin/Xterm","SWRin/SWRterm","Af/As dB"; PRINT
1240 PK$=STR$(K(1)): IF K(1)>100 THEN PK$=">100"
1250 QK$=STR$(K(2)): IF K(2)>100 THEN QK$=">100"
1260 QG$=STR$(G(7)): IF K(2)>100 THEN QG$="***": N9=1
1270 PRINT VM+SS+N(N-1),Z(1,1),Z(1,2),PK$,G(6)
1280 PRINT ,Z(2,1),Z(2,2),QK$,QG$
1290 PRINT: IF INSTR(F$,"P")=0 AND INSTR(F$,"p")=0 THEN RETURN
1300 IF N<>1 THEN 1490
1310 OPEN"O",1,"LP:"
1320 PRINT#1,"SMITH CHART TRANSMISSION LINE CALCULATION by MULTIVEC"
1330 PRINT#1," ": REM Set up problem for printed record.
1340 PRINT#1," PARAMETER UNIT VALUE"
1350 PRINT#1," "
1360 PRINT#1," Operating Frequency MHz. "; F
1370 PRINT#1," Physical Length of transmission line ft. "; L
1380 PRINT#1," Nominal Characteristic Impedance of line, ohms. "; Z
1390 PRINT#1," "
1400 PRINT#1," Line Attenuation dB/100 ft. at 10 MHz. "; A
1410 PRINT#1," Velocity Factor "; V
1420 PRINT#1," Power Factor for line dielectric "; P
1430 PRINT#1," "
1440 PRINT#1," Resistive part of terminating impedance, ohms. "; R
1450 PRINT#1," Reactive part of terminating impedance, ohms. "; X
1460 PRINT#1," "; PRINT#1," "
1470 PRINT#1,!B$, "Rin/Rterm","Xin/Xterm","SWRin/SWRterm","Af/As dB"
1480 PRINT#1," "
1490 PRINT#1, VM+SS+N(N-1),Z(1,1),Z(1,2),PK$,G(6)
1500 PRINT#1, ,Z(2,1),Z(2,2),QK$,QG$
1510 PRINT#1," "
1520 REM Control returns to the FOR/NEXT loops's GOSUB element. (Line 2160)
1530 RETURN
1540 REM
2000 REM ******** Loop sub-routine for ranged variables. ********
2010 INPUT "Enter name for variable to be ranged (F,L,Z,A,V,P,R,X) "; A$
2020 B$=A$: IF ASC(A$)<95 THEN A$=CHR$(ASC(A$)+32)
2030 IF A$="f"THEN B$="B$+" MHz" ELSE IF A$="l"THEN B$=B$+" ft."
2040 IF A$="z"OR A$="r"OR A$="x"THEN B$=B$+" ohms"ELSE IF A$="a"THEN B$=B$+" dB"
2050 IF A$="f"ORA$="l"ORA$="z"ORA$="a"ORA$="v"ORA$="p"ORA$="r"ORA$="x"THEN 2070
2060 PRINT "Variable must be F,L,Z,A,V,P,R or X. Please re-enter.": GOTO 2000
2070 PRINT:PRINT"Enter min. value, Size of step, No. of steps (VM), (SS), (NS)"
2080 INPUT "(Optimum no. of steps for graph option is 18) "#VM,SS,NS
2085 IF A<0>"X" AND VM<0 THEN PRINT "NEGATIVE MIN. VALUE NOT VALID": GOTO 2070
2090 PRINT"(Min. value will substitute for original entry of ranged variable.)"
2100 FOR C = VM TO (VM+RR*NS) STEP SS
2105 IF A<0>"X" AND C<0 THEN PRINT "NEGATIVE RANGED VALUE NOT VALID ": GOTO 3000
2110 IF (INSTR(F$,"MM") = 0 AND INSTR(F$,"mm") = 0) OR (A$<>"F") @
     THEN 2160 ELSE IF C<>VM THEN 2130
2120 INPUT "Load impedance may be INPUT from file SY1:Z2.DAT, <Y><N>"; J$
2130 IF J$<>"Y" AND J$<>"y" THEN 2160 ELSE IF C<>VM THEN 2150
2140 OPEN "I",#2,"SY1:Z2.DAT"
2150 INPUT #2, R, X
2160 GOSUB 500
2170 B(N,0)=C: B(N,1)=Z(1,1): B(N,2)=Z(1,2): B(N,3)=Z(2,1): B(N,4)=Z(2,2): @
     B(N,5)=K(1): B(N,6)=K(2): B(N,7)=G(6): B(N,8)=G(7)
2180 NEXT C
2190 IF N9=0 THEN 3000 ELSE PRINT "*** indicates SWR too high for "@
     "reliable calculation of these values.": GOTO 3000
2200 REM ***** Sub-routine for optional vector operations on Z2. *******
2210 N2=N2+1: IF N2<>1 THEN 2290: REM Set up input variables on one-pass basis.
2220 IF INSTR(F$,"LC") = 0 AND INSTR(F$,"lc") = 0 THEN 2260
2230 PRINT: PRINT "LC matching network to be specified at load (far end)."
2235 PRINT "Enter S for series LC, or P for parallel LC, followed by the value"
2240 INPUT "of L in microHenries (uH), then C in picoFarads (pF) "; ZA$, LA, CA
2250 IF ZA$<>"S" AND ZA$<>"s" AND ZA$<>"P" AND ZA$<>"p" THEN 2235 ELSE 2290
2260 PRINT "Enter parallel matching impedance at load (far end) R + jX"
2270 INPUT "Resistive part (ohms) "; Z(11,1)
2280 INPUT "Reactive part (ohms) "; Z(11,2)
2290 XL=6.2832*LA#: XC=1E+06/(6.2832*CA#): XS=XL-XC: XP=(XL*XC)/(XC-XL)
2300 IF ZA$ = "S" OR ZA$ = "s" THEN Z(11,2) = XS ELSE @
     IF ZA$ = "P" OR ZA$ = "p" THEN Z(11,2) = XP
2310 D=11: E=2: I=21: M=12: GOSUB 2800
2320 D=11: E=21: I=28: M=13: GOSUB 2800
2330 D=12: E=13:I=12: M=2: GOSUB 2800
2340 RETURN
2350 REM ***** Sub-routine for optional vector operations on Z1. ******
2360 N3=N3+1: IF N3<>1 THEN 2440: REM Set up input variables on one-pass basis.
2370 IF INSTR(F$,"LC") = 0 AND INSTR(F$,"lc") = 0 THEN 2410
2380 PRINT: PRINT"LC matching network to be specified at line input (near end)."
2385 PRINT "Enter S for series LC, or P for parallel LC, followed by the value"
2390 INPUT "of L in microHenries (uH), then C in picoFarads (pF) "; ZB$, LB, CB
2400 IF ZB$<>"S" AND ZB$<>"s" AND ZB$<>"P" AND ZB$<>"p" THEN 2385 ELSE 2440
2410 PRINT "Enter parallel matching impedance at line input (near end) R + jX"
2420 INPUT "Resistive part (ohms) "; Z(14,1)
2430 INPUT "Reactive part (ohms) "; Z(14,2)
2440 XL=6.2832*LB#: XC=1E+06/(6.2832*CB#): XS=XL-XC: XP=(XL*XC)/(XC-XL)
2450 IF ZB$ = "S" OR ZB$ = "s" THEN Z(14,2) = XS ELSE
     IF ZB$ = "P" OR ZB$ = "p" THEN Z(14,2) = XP
2460 D=14: E=1: I=21: M=15: GOSUB 2800
2470 D=14: E=1: I=28: M=16: GOSUB 2800
2480 D=15: E=16:I=12: M=1: GOSUB 2800
2490 RETURN: "
2500 REM *** Subroutine calculates SWR at near end and far end, K(1),K(2). ***
2510 REM Reflection coeff.= (Z-Z0)/(Z+Z0)! SWR = (1+|rc|)/(1-|rc|)
2520 REM Indicator "NT" selects Z,K for near or far end SWR.
2530 Z(17,1) = Z(NT,1)-Z(0,1): Z(18,1) = Z(NT,1)+Z(0,1)
2540 Z(17,2) = Z(NT,2)-Z(0,2): Z(18,2) = Z(NT,2)+Z(0,2)
2550 Z(17,9) = FN M(Z(17,1),Z(17,2)): Z(18,9) = FN M(Z(18,1),Z(18,2))
2560 K = Z(17,9)/Z(18,9)!: IF K>1 THEN K=1-(1E-06)
2570 K(NT) = (1 + K)/(1 - K) : REM K= reflection coeff.
2580 CA%=100 : K(NT)=INT(CA%*K(NT)+.5)/CA% : REM SWR to 2 places.
2590 RETURN
2800 REM ******** Complex vector handling sub-routine (Ver.2) ******************
2810 I1=INT(I/10):I2=I-10*I1:IF I<0OR I1>3 THEN2960 ELSEIF I1=10R I1=3 THEN 2860
2820 IF I2 = 0 THEN Z(M,1) = Z(D,1) + Z(E,1): Z(M,2) = Z(D,2) + Z(E,2):GOTO 2840
2830 IF I2 = 9 THEN Z(M,1) = Z(D,1) - Z(E,1): Z(M,2) = Z(D,2) - Z(E,2) ELSE 2920
2840 IF I1 = 0 OR I1 = 1 THEN RETURN: REM Returns cartesian result
2850 Z(M,9) = FN M(Z(M,1),Z(M,2)): Z(M,0) = FN A(Z(M,1),Z(M,2)): RETURN
2860 IF I2 = 0 THEN Z(M,9) = Z(D,9)          : Z(M,0) = Z(D,0)          : GOTO 2900
2870 IF I2 = 1 THEN Z(M,9) = Z(D,9)*Z(E,9): Z(M,0) = Z(D,0) + Z(E,0): GOTO 2900
2880 IF I2 = 2 THEN Z(M,9) = Z(D,9)/Z(E,9): Z(M,0) = Z(D,0) - Z(E,0): GOTO 2900
2890 IF I2 = 3 THEN Z(M,9) =  1  /Z(E,9): Z(M,0) =       - Z(E,0)  ELSE 2940
2900 IF I1 = 2 OR I1 = 3 THEN RETURN: REM Returns polar result
2910 Z(M,1) = Z(M,9)*COS(Z(M,0)): Z(M,2) = Z(M,9)*SIN(Z(M,0)): RETURN
2920 IF I2>3THEN2960 ELSE Z(D,9)=FN M(Z(D,1),Z(D,2)): Z(D,0)=FN A(Z(D,1),Z(D,2))
2930 Z(E,9) = FN M(Z(E,1),Z(E,2)): Z(E,0) = FN A(Z(E,1),Z(E,2)): GOTO 2860
2940 Z(D,1) = Z(D,9)*COS(Z(D,0)): Z(D,2) = Z(D,9)*SIN(Z(D,0))
2950 Z(E,1) = Z(E,9)*COS(Z(E,0)): Z(E,2) = Z(E,9)*SIN(Z(E,0))!: GOTO 2920
2960 PRINT "INVALID VECTOR OP CODE": CLOSE : GOTO 4000
2990 REM
3000 REM ********** Graphic presentation sub-routine (Ver.2) **********
3010 CLOSE: PRINT: PRINT: IF INSTR(F$,"G")=0 AND INSTR(F$,"g")=0 THEN 4000
3020 PRINT"Any calculated variable can be plotted against the ranged variable."
3030 PRINT" Input Resistance (1) Input Reactance (2)"
3040 PRINT" Load Resistance (3) Load Reactance (4)"
3050 PRINT" Input SWR (5) Load SWR (6)"
3060 PRINT" Nominal Atten. (7) Actual Atten. (8)"
3070 INPUT " Enter code for required plot. If none required, enter <0> "; HX
3080 PRINT: NM=N: IF HX=0 THEN 4000
3090 INPUT " Enter plot max. and min. values of selected variable "; UX, UN
3100 IF UX<=UN THEN PRINT " Max. must be greater than min!": GOTO 3090
3110 UD=(UX-UN)/4: FOR I3 = 0 TO 4: U(I3)=INT(100*(UN+I3*UD))/100: NEXT I3
3120 PRINT CB$: PRINT TAB(26)" VERTICAL CO-ORDINATE "!B$
3200 WX = ABS(N): IF (N+1)/2=INT((N+1)/2) THEN PRINT" "!B(WX,0),; ELSE PRINT,;
3250 G$=CHR$(42): J = INT(15 + 60*(B(WX,HX)-UN)/(UD*4))
3300 IF J >75 THEN J =76: G$=CHR$(62): GOTO 3320
3310 IF (B(WX,HX)-UN)<0 THEN J=0: G$=CHR$(60)
3320 PRINT TAB(J); G$; N=N-1: IF N>0 THEN 3200
3330 PRINT TAB(12)|"
     ----------
3340 S% = LEN(STR$(U(1)))/2: PRINT TAB(15-S%); U(0); TAB(30-S%); U(1);
     TAB(45-S%); U(2); TAB(60-S%); U(3); TAB(75-S%); U(4)
3350 PRINT: ON HX GOTO 3351,3352,3353,3354,3355,3356,3357,3358
3351 PRINT TAB(32)"INPUT RESISTANCE ohms." ;:GOTO 3360
3352 PRINT TAB(32)"INPUT REACTANCE ohms." ;:GOTO 3360
3353 PRINT TAB(32)"LOAD RESISTANCE ohms." ;:GOTO 3360
3354 PRINT TAB(32)"LOAD REACTANCE ohms." ;:GOTO 3360
3355 PRINT TAB(32)"INPUT STANDING WAVE RATIO";:GOTO 3360
3356 PRINT TAB(32)"LOAD STANDING WAVE RATIO" ;:GOTO 3360
3357 PRINT TAB(32)"NOMINAL ATTENUATION dB." ;:GOTO 3360
3358 PRINT TAB(32)"ACTUAL ATTENUATION dB." ;"
3360 PRINT TAB(60)"More plots <Y/<N>"!
3370 INPUT C$: N=NM: IF C$="Y" OR C$="y" THEN PRINT CB$: GOTO 3020
4000 PRINT: PRINT: PRINT TAB(5)! "To run another calculation enter C, "!e
" to return to HDOS enter <CR>. "!
4010 INPUT C$: IF C$="C" OR C$="c" THEN RUN
4020 SYSTEM: REM Files CLOSED at 3010
5000 REM All I,N are DEFINT A B(N,*) **1-9 C CA CB D E F G(*) **= 1,2,3,6,7
5010 REM I I1,2,3 J K K(*) **1,2 L LA LB M N N1,2,3,4,5,9 NM NB NT NZ
5020 REM P Q Q1,2 R B$ UD UN UX U(*) **0-4 V VM W X XC XL XP XR X9 Z Z(*,*)
5030 REM **1-20 & takes all values defined for variables D, E and M. **1,2,9,8
5040 REM A$ B$ C$ D$ CS$ E$ ERV$ F$ G$ H$ I$ J$ PK$ QK$ QG$ XRV$ ZA$ ZB$
5050 REM CX CA% HX B% W%
5060 REM Options included in Ver 5.6 are 1) Print, 2) Multiple, 3) Graph
5070 REM 4) Z1 Match, 5) Z2 Match, 6) LC Match, 7) Z2 File
5080 REM Program "MULTIVEC" is Copyright (C) 1982 by J.C.B.MacKeand
5090 REM End of listing (mgd10.bas)
```

Fig. 1 — MULTIVEC program listing.

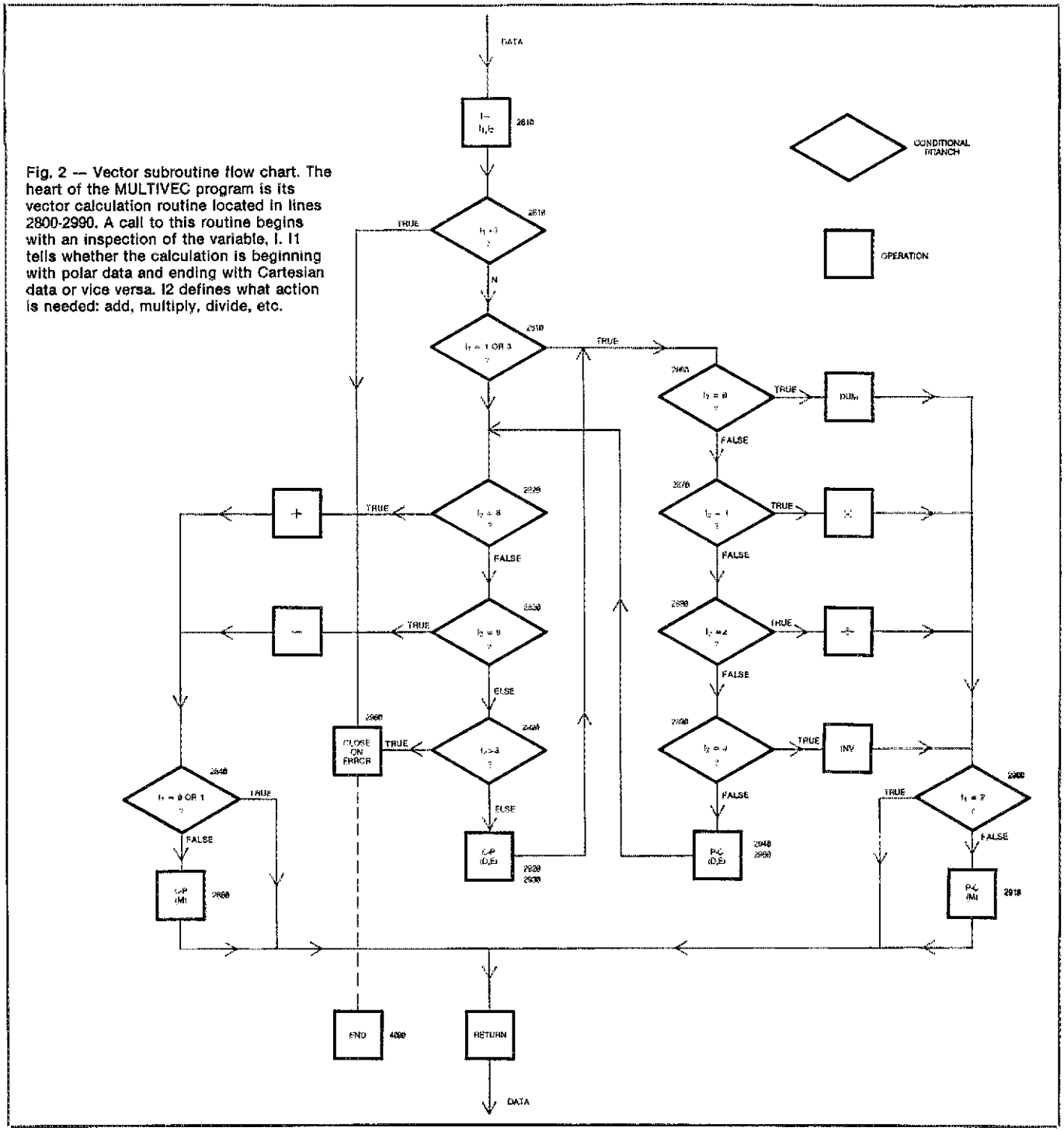


Fig. 2 — Vector subroutine flow chart. The heart of the MULTIVEC program is its vector calculation routine located in lines 2800-2990. A call to this routine begins with an inspection of the variable, I. I1 tells whether the calculation is beginning with polar data and ending with Cartesian data or vice versa. I2 defines what action is needed: add, multiply, divide, etc.

transmission-line catalogs. MULTIVEC interprets this data for a number of frequencies, but it is sensible to patch the program to accept the 100-MHz attenuation values given in the cable catalog if you are going to use the results at VHF.

All the other data is input in conventional units of ohms, feet, megahertz and so on, and default values are entered for a few "strange" numbers that need to be taken into account — where do you find the loss angle for RG-58 coaxial cable, for instance?[1]

[1]Notes appear on page 31.

Let's say you have done all the hard work (or you have the results of someone else's hard work) and you know the impedance of your antenna versus frequency. There is a feature in MULTIVEC that allows you to input this information as a data file and calculate and display the various parameters.

Graphic Output

This subroutine stores all the calculated output data and reorganizes it in such a way that it can be used to draw a graph of any of the calculated quantities against the variable quantity. Samples of MULTIVEC graphic output are shown in Fig. 3.

Using MULTIVEC

MULTIVEC is written in a widely used BASIC dialect (Microsoft™ MBASIC), and is configured for use with a Heath H19 terminal. Although the graphic subroutine does use some of the special features of the H19, the program can be adapted for use on other computers.[2]

The program requires a computer with 64 kbytes of RAM. Program run time is typically about a minute. It's a lot faster than doing the same work graphically, and spectacularly faster than doing the calcula-

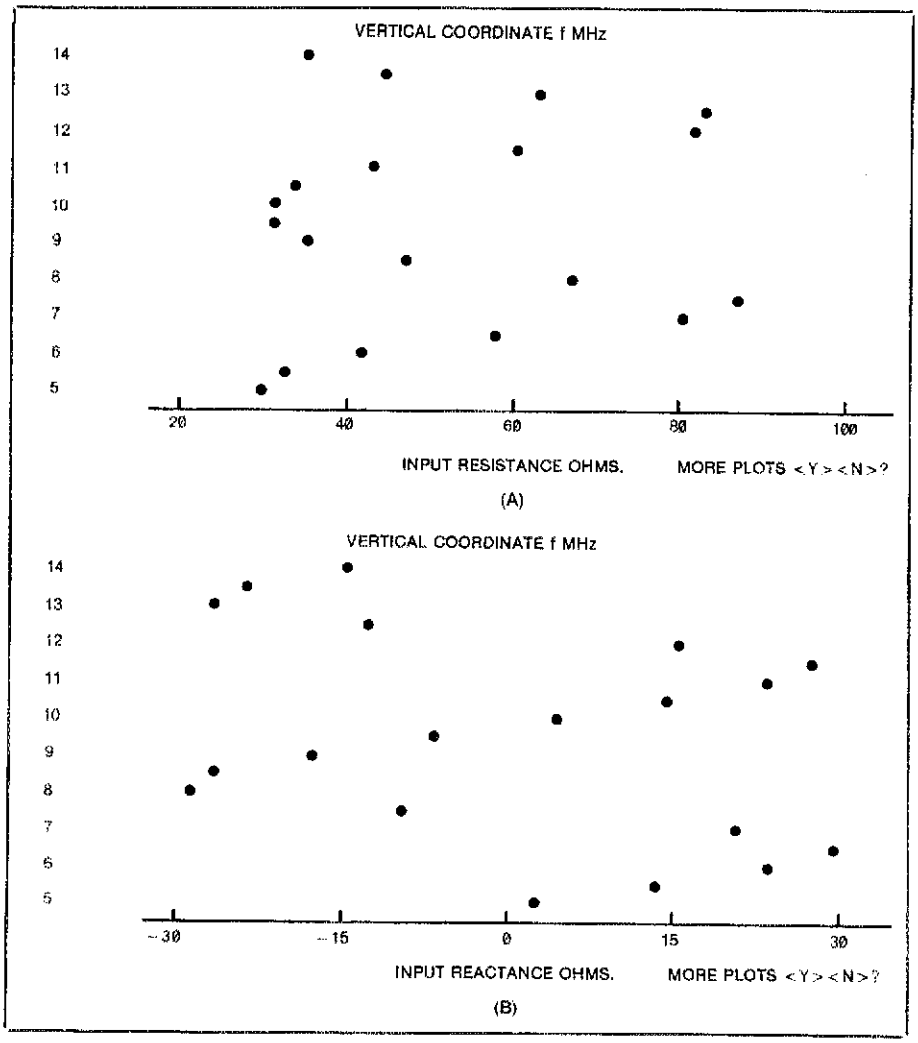


Fig. 3 — Resistance (A) and reactance (B) plots created by MULTIVEC.

Vector Subroutine Flow Chart Example

Let's follow a typical flow of data through the chart. This particular example will define Cartesian input, polar output and arithmetic division.

In line 2810, I1 and I2 are separated from I, and I1 is checked to see that it is a 0, 1 or 2. The data is routed to line 2820 since I1 = 1 and I1 = 3 are both FALSE. The next three branches are all FALSE, so the data falls through to lines 2920 and 2930 where it is converted to polar notation for the required division. At line 2880, the indicator I2 = 2 is recognized and the division takes place. (In vector division we divide the magnitudes and subtract the angles.) At line 2900, the polar-to-Cartesian conversion is bypassed since we have asked for polar output, and control returns to the main program from line 2900.

tions by hand, even with a calculator.

MULTIVEC enables me to analyze transmission-line systems that are altogether too laborious to handle by conventional graphic methods. The convenience of the speedy result makes antenna system work much more palatable for the enthusiast and more feasible for the nonmathematician. I hope this program will illuminate some of the areas I have found so tiresome. Good luck with your next antenna project — the only problem you're liable to have is finding a box large enough to hold all the printouts!

APPENDIX

The Equations

These are the formulas used in developing this program. Details may be found in references 2, 3 and 4.

The fundamental transmission-line equation is

$$z_i = z_0 \frac{(z_2 \cosh \gamma\ell + z_0 \sinh \gamma\ell)}{z_0 \cosh \gamma\ell + z_2 \sinh \gamma\ell} \quad \text{(Eq. 1)}$$

where

z_0 = characteristic line impedance (in ohms).
z_i = input impedance (in ohms).
z_2 = load impedance (in ohms).
γ = line propagation coefficient per unit length.
ℓ = physical line length (in same units as γ).

In raw form, the fundamental relation for line attenuation is given as

$$\alpha = \frac{R}{2Z_0} + \frac{GZ_0}{2} \quad \text{(Eq. 2)}$$

where

α = attenuation (nepers/m).
(Note: 1 neper = 8.686 dB)
R = cable ohmic resistance (ohms/m).
Z_0 = characteristic cable impedance (ohms).
G = cable leakage (S/m)
(Note: S = siemens, the unit of conductance; formerly mhos)

A more useful form of this equation is found in references 6 and 7; this is used for the extrapolation from base frequency (usually 10 MHz) to the working frequency

$$G3 = (A/3.162 - 8.791\ P/V)\sqrt{F} + 2.78\ FP/V \quad \text{(Eq. 3)}$$

where

G3 = attenuation in dB/100 ft of cable at the frequency of interest.
A = line attenuation at 10 MHz.
P = line power factor.
V = line velocity factor, typically 0.66 for coaxial cable, 0.98 for open-wire line.
F = frequency of interest (MHz).

In reference 4, I found a formula suitable for calculating the additional line loss caused by SWR:

$$\text{loss} = 10 \log_{10} \left(\frac{e^{2\alpha\ell} - K^2 e^{-2\alpha\ell}}{1 - K^2} \right) \text{dB} \quad \text{(Eq. 4)}$$

where

$\alpha\ell$ = total end-to-end line attenuation in nepers, when perfectly matched.
K = reflection coefficient on the line at the input.

(See *The ARRL Antenna Book*, p. 3-4.)

Notes

[1]mm = in × 25.4; m = ft × 0.3048

[2]I can provide programs on disk to run under HDOS or CP/M® 80 (CP/M 2.2). The disks can be 8-inch SSSD (standard IBM 3740 format) or Heath 5¼-inch, single-density, hard-sector (10). Price including postage is $35 for either format. (The ARRL and *QST* do not warrant this offer.)

References

1. P. H. Smith, "An Improved Transmission Line Calculator," *Electronics*, Jan. 1944, Vol. 17, p. 130; Jan. 1939, Vol. 12, p. 29; Mar. 1942, Vol. 15, p. 44.
2. E. C. Jordan, *Electromagnetic Waves and Radiating Systems* (New York: Prentice-Hall, 1950).
3. F. E. Terman, *Radio Engineer's Handbook* (New York: McGraw-Hill, 1943).
4. *Reference Data for Radio Engineers*, 3rd ed. (New York: Federal Telephone & Radio Co., 1949).
5. L. A. Moxon, *H.F. Antennas for All Locations* (London: RSGB, 1982).
6. G. Hall, ed., *The ARRL Antenna Book*, 14th ed. (Newington, CT: ARRL, 1982).
7. *RF Transmission Line Catalog & Handbook* (Wallingford, CT: Times Wire and Cable Co., Cat. No. TL-4, 1972).

Crawford MacKeand graduated from the University of Manchester, England, in 1954 with a B.Sc. He worked in the telecommunications cable field in England and Venezuela until 1961, then in chemical-plant instrumentation and electrical areas. Crawford is presently an engineering supervisor in his firm's central engineering group.

Since his high-school days, Crawford has been interested in radio. His first exposure to Amateur Radio came when he was an instructor at a British Army radar school (G3ETZ/A) in 1950. In 1968, Crawford came to the U.S., but was first licensed as G4ARR in 1971. He became an Advanced-class ticket holder (WA2ZVX) in 1972 while living in New Jersey. In 1975, Crawford moved to Delaware and received his present call, WA3ZKZ.

Crawford became an ARRL Life Member in 1974. His interests include RTTY, development of antennas and transmission systems, and computers. QST

BEGINNER'S BENCH

Improvisation, and Finding Parts

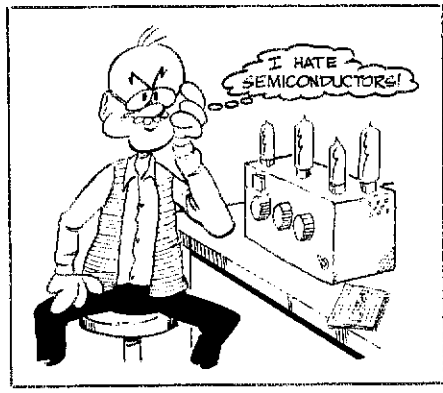
Mail-order components are available in proliferation, but some amateurs believe that parts are impossible to find. Perhaps the key to success in project completion is knowing *where* to look for those elusive items.

By Doug DeMaw,* W1FB

It's 92° today, and the humidity is 68%. As I write this page, I can see a ¾-completed 2-meter exciter strip that is waiting for three parts before I can finish the assembly. Strangely, a pile of bargain catalogs is within reach, but I am too lethargic to plow through them in quest of the missing components. It's just too hot and humid to get excited about the project. Well, this is one poor reason for not completing my workbench assignment.

Some of you may never get as far as the wiring of the first stage of a circuit — simply because you have become apathetic about the parts-procurement "problem." You may have concluded that it's easier to spend more money and be happy with gear of commercial origin. Although that approach is certainly an expedient, it cheats the ham (especially the beginner) from enjoying the pleasures of building and using homemade equipment.

If we don't build, it's unlikely that we will learn much of value to apply in the course of operating a station or putting one together. Our strength comes in part from practical experience when it is time to upgrade our license class. The so-called "AO" (appliance operator) may fail the exam, or might need to study the license manual over and over in order to absorb enough understanding to pass the amateur test. It is easy to avoid experimenting and building by saying, "I'd build something, but parts are impossible to find." I have also heard (many times) the comment, "I'd love to build something, but I don't understand anything but tubes." Chances are, that person knew nothing about tubes when first licensed, but was so eager to experiment that the needed knowledge came via the "learn by doing route." Therefore, learning to work with semiconductors can result in a similar technical education. We must realize that this *is* the semiconductor era, and parts for circuits that use these devices are of widespread availability at modest prices. In fact, I think that more parts are available at lower prices than ever in the history of Amateur Radio. We can thank the burgeoning technology and manufacturers' overruns for this!



Some Background

In bygone days, we hams dealt with large, central, mail-order outlets, such as Allied Radio, Newark, Burstein-Applebee, World Radio Labs and a host of others. Practically anything we needed for a project could be obtained for fair prices from those sources. Also, most cities had one or more local ham outlets that carried myriad parts for the experimenter. At one time, the practice of building station gear was the preferred rule rather than the exception. As an outgrowth of such activity, we could engage daily in stimulating and educational conversations over the air. It was great! Sadly, we seem to have a continuous race today toward acquiring the latest store-bought gear with the largest number of features. I have fallen prey to that fever myself, at least to some extent, for I could never hope to build a complex transceiver as cheaply as I can buy one, and I dare say it would be 10 times as large as the commercial counterpart! Nonetheless, I still like to design and experiment, and much of the accessory gear in my station is home constructed. All of my portable equipment is also homemade. For this reason, I keep a very large collection of parts catalogs on hand. I will include a list of my suppliers later in this article.

Unfortunately, we no longer have the corner parts store, nor do we have the big mail-order houses. Something went awry a few years ago, and economic chaos seemed to strike those operators. The amateur market became of no value to the big suppliers, owing to the exponential decline in home construction of ham gear. This affected the market, while TV repair shops became the focal point of the parts dealers. That, plus high minimum-order fees, ruined the amateur's chances for buying by mail. Another phenomenon took place: back orders galore! In order to keep a large catalog inventory, the distributor found it necessary to "work with someone else's money," so to speak. Drop shipping

*ARRL Contributing Editor, P.O. Box 250, Luther, MI 49656

from the factory came into being, thus enabling the distributor to avoid stocking certain items. Weeks or months would elapse (and still do!) before the customer received the parts, even though they had been paid for! Because of these problems, it is not hard to understand why some hams have tossed in the towel and gone the commercial route for ham gear.

Radio Shack represents the remaining bastion for small parts from the "corner store." But, most of the items are imported, and not too many are applicable to transmitter or Transmatch building, in particular.

This not-so-lighthearted dissertation is meant for the beginners to Amateur Radio. It is offered to help you to understand what has happened and why things are a bit tough these days when we try to collect enough component parts for a workshop job.

Old-Style Parts

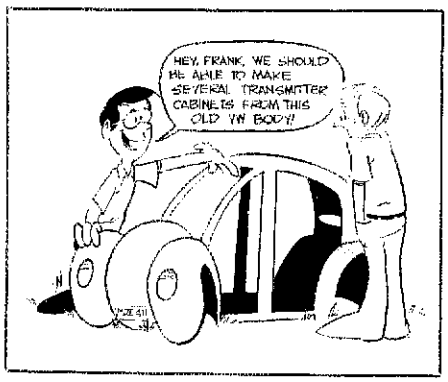
I am guilty, perhaps, of introducing a misnomer when I refer to some components as "old-style parts." The fact of the matter is that many of them are also modern-day parts, but not too easy to find or afford. I speak specifically of transmitting-grade variable capacitors, roller inductors, large knobs, big RF chokes and sockets for transmitting tubes. It boils down to a cartel style of vending for some outlets. For example, one established manufacturer of variable capacitors bought out the E. F. Johnson and Hammarlund rights to produce variable capacitors. I have never been successful in finding out how one might buy one or two items from that firm. The James Millen transmitting variables are available from a New England dealer by mail, but the price for large capacitors has become more than the pocketbook can bear![1] The cost of labor and limited production runs has created the high prices. The same is true of the receiving-tube industry. Be sure you have a strong heart before you try to purchase a 12AT7 or 6V6 tube! However, there is at least one source of tubes at reasonable prices.[2]

Luckily, Fair Radio Sales, in Lima, Ohio, has remained alive with its WWII surplus parts. All manner of transformers, composite transmitters and receivers, and variable capacitors are available from this firm (a large catalog, too). The rest of the true surplus dealers of major magnitude seem to have dried up and vanished, except for John Meshna Co. in Massachusetts.

Ham flea markets (Dayton especially) remain solid sources for nearly any electronics component we can envision, and prices are usually within reason. If you need large, hard-to-find parts, try running some Ham Ads in *QST*. I'm willing to bet that some amateur has just what you need, and would be delighted to get rid of it. This applies also to service manuals and collector's items.

The Fine Art of Improvising

Amateurs of yesteryear were known for their ability to improvise when they needed an unavailable part, or if they were a bit strapped for hobby money. That quality seems to have dwindled in recent years also. Hams were inveterate substitutors when building a piece of gear. Many panels were fashioned from Masonite® or plywood. I have seen an antifreeze can used as a cabinet for a 2-meter transmitter — and it looked nice with wood-grain contact paper on it. I have personally used numerous metal recipe-file boxes as enclosures for equipment. They are readily available and inexpensive. Some of you who are reading this article have used bread and cake pans as chassis (I did it also!), and found them to be entirely suitable. The variety stores today abound with items that can be used in our ham-radio work, including plastic devices that serve well as open-wire feedline spreaders. Aluminum cookie sheets are excellent as stock metal for bending small chassis or making panels. Galvanized-iron furnace ducting is easy to work with, and it is not expensive. It's no trick to form a cabinet from that material, and the seams will take solder nicely. A coat of spray paint will provide the finishing touches. Cutting can be done with a saber saw or a Dremel table saw.



Copper-clad PC-board material can often be sheared with a heavy-duty paper cutter if you don't mind sharpening the blade now and then. The cut sections can be soldered together to form a small chassis or cabinet. What simpler way could there be to obtain a custom-size cabinet in a hurry? An attractive covering for any homemade cabinet of this type can be made from scrap pieces of Formica.® I have had no trouble securing boxes of scrap Formica pieces from building contractors after they completed a job. I attach the Formica by means of contact cement and C clamps. In fact, I know some amateurs who use Formica in place of PC board. They glue strips of thin hobby copper to the Formica to create circuit-board foils.

Another source for small equipment enclosures is Band-Aid® boxes. I once built a QRP transceiver inside one of the larger boxes. The panel was recessed sufficiently into the box to allow the cover to be closed when the unit was not in use. The open cover served as a foot to tilt the unit upward when I was using it. A rubber band around the box (the long way) and the lid prevented the open lid from closing.

Improvisation applies to many areas of radio construction. For example, plucking plates from a too-large variable capacitor will bring the capacitance value down to a more workable value. Extracting every other plate from a closed-spaced variable capacitor will increase the effective power rating in terms of breakdown voltage. My first homemade CW rig contained two broadcast-band receiver variables that had been modified to 100 pF each by pulling plates. The added spacing between the plates handled my 50-W power level without mishap.

Parts Substitutions

There seems to be an inherent fear among some equipment builders when it comes to substituting one part for another. To be sure, some critical circuits need the exact part specified. Examples are the components in tuned circuits and parts where small tolerances (such as 1%) are shown on the schematic. Except for these critical places, most circuits can tolerate departures up to 20% from the rated value.

There are even some instances in which the value can be changed by as much as 10:1 without any serious effect on circuit performance. RF chokes and bypass capacitors usually fall into this category. Thus, if the circuit calls for a 1-mH RF choke, try a 2.5-mH choke, if you have one. Similarly, if your circuit specifies a 0.01-μF bypass capacitor, you should be able to substitute a 0.1-μF capacitor with no adverse effects. In these cases, the best rule is to go to the next-larger value available.

Transistors can be substituted in many cases. Let's say you need a 2N3904, but have none. A 2N2222 will do the job in good style with no circuit changes. I can't adequately stress the value of a semiconductor substitution booklet for the builder.

One must be cautious when substituting semiconductors, respective to the upper frequency limits when working at HF and above. Always check this specification and also the power rating first. The safe rule is to use a substitute with the same or greater f_T and power rating. The worst that can happen is excessive gain, which can

[1]Notes appear on page 34.

Suppliers with Catalogs†

All Electronics Corp., 905 S. Vermont Ave., Los Angeles, CA 90006, tel. 213-380-8000

BCD Electro, P.O. Box 830119, Richardson, TX 75083, tel. 214-690-1102.

Circuit Specialists, P.O. Box 3047, Scottsdale, AZ 85257, tel. 1-800-528-1417.

Diamondback Electronics Co., P.O. Box 12095, Sarasota, FL 33578, tel. 813-953-2829.

Digi-Key Corp., P.O. Box 677, Hwy. 32 South, Thief River Falls, MN 56701, tel. 1-800-346-5144.

Fair Radio Sales Co., P.O. Box 1105, 1016 E. Eureka St., Lima, OH 45802, tel. 419-223-2196.

Jameco Electronics, 1355 Shoreway Rd., Belmont, CA 94002, tel. 415-592-8097.

Marlin P. Jones & Assoc., P.O. Box 12685, Lake Park, FL 33403, tel. 305-848-8236.

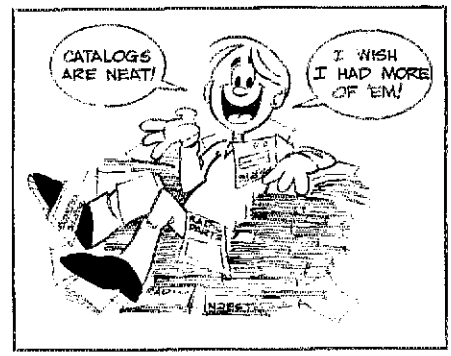
Mouser Electronics, 11433 Woodside Ave., Santee, CA 92071, tel. 619-449-2222.

Spectrum Electronics Parts, 5932 Market St., Philadelphia, PA 19139, tel. 215-472-0369.

Surplus Electronics Corp., 7294 N.W. 54th St., Miami, FL 33166, tel. 305-887-8228.

Surplus Sales, 2412 Chandler Rd., Bellevue, NE 68005, tel. 402-733-9190.

†The author and *QST* in no way endorse any of these dealers.



lead to instability. But, instability can be cured, so don't worry.

The Current Crop of Small Dealers

Many of you will be amazed to learn how many small surplus-parts dealers we have in the USA at this time. We don't hear about all of them because not all dealers buy magazine ads. I stumbled upon a number of them by accident, and heard about others from associates. I am amused when comparing prices for a given item as I browse through the catalogs. Certain suppliers, although they claim they are selling *surplus,* charge more for a part than if it were purchased new. Others ask only, say, 10% of the standard market value. I need not tell you which of the dealers get the bulk of my business! I'll let you send for the catalogs that the following dealers provide, then be the judge of which one is fair or not! If I have left out any similar dealers, I would be happy to have their catalogs for use in a future article reference. Neither the ARRL nor I endorse any of the dealers in the list. But, I have never been ripped off by any of them in my personal dealings.

In Conclusion

Periodically, I like to cover the subject of parts procurement in *QST,* recognizing that a new crop of readers shows up every few years. To those of you who have read my diatribes about the parts and their limited availability, I have tried to offer some new slants in this article.

Perhaps a look through the catalogs that can be obtained from the list I have provided will inspire you to warm up that soldering iron and try some new ideas. A final word of warning about mail ordering: Ask for a refund on those items that must be back ordered. If not, some suppliers will ship your order in dribbles, and you may get stuck with more than one UPS or Parcel Post fee! I mark my order blanks in red ink to read, "No back orders, please."

Notes

[1]RadioKit Co. (see *QST* ads for details).

[2]Lindal Tube and Transistor, Inc., 604 Market St., Newark, NJ 07105 (no phone orders; $15 minimum order).

Strays

QEX: THE ARRL EXPERIMENTERS' EXCHANGE

☐ Wonder what you've been missing by not subscribing to *QEX,* the ARRL newsletter for experimenters? Among the features in the October issue were:

- Understanding the makeup of LCDs, in Part 1 of "Liquid-Crystal Displays: An Established Example of Molecular Electronics" by Dr. I. A. Shanks
- A detailed report on routine packet-radio meteor-burst contacts on 6 meters between Iowa and Maryland, by Robert J. Carpenter, W3OTC
- Advice on "A Remote Terminal for your TI-99/4A Micro," from John S. Davis, WB4KOH

QEX is edited by Paul Rinaldo, W4RI, and Maureen Thompson, KA1DYZ, and is published monthly. The special subscription rate for ARRL members is $6 for 12 issues; for nonmembers, $12. There are additional postage surcharges for mailing outside the U.S.; write to Headquarters for details.

NAPLPS RTTY GRAPHICS

☐ The September 1983 issue of *QST* carried an article about a graphics code using the North American Presentation Level Protocol Syntax (NAPLPS). This system provides high-resolution text and graphics video displays. Normal RTTY methods can be used to transmit the ASCII files used to draw the graphics. Several firms have developed microcomputer software and hardware to decode the information. IC manufacturers are beginning to market complete decoder chips. A revolution in computer-graphics transmission is brewing.

What have amateurs been doing with this technique? Have you conducted any experiments with this new technology? Have you developed any circuits that make use of these NAPLPS ICs?

We at *QST* would like to hear about your efforts. Send a brief (one or two page) outline of your work to Paul Rinaldo, W4RI, Manager, Technical Department, ARRL, 225 Main St., Newington, CT 06111. — *Larry Wolfgang, WA3VIL*

STRAY HINTS

☐ "Strays" are those interesting fillers used when space allows in *QST.* Think you have an item with Stray potential? Here are some hints to help your submission become one. (1) Be sure the information will be of interest to most readers of *QST.* (2) Submit your material before deadline — the 8th of the second month preceding desired publication (i.e., arrive at Hq. before November 8 for January *QST).* (3) Any photographs you send should be good quality, black-and-white glossy prints. Color prints, slides and instant photos do not usually reproduce well.

Items submitted are normally acknowledged, but that doesn't necessarily mean that your Stray will be appearing in *QST.* We receive far more material than we can find room for. If you want your material returned, please include a statement to that effect and an s.a.s.e.

Follow the above hints and maybe your Stray will find a home in *QST.* — *Andrew Tripp, KA1JGG*

The Effect of Real Ground on Antennas

Part 5†: In the earlier parts of this series we learned about the antenna analysis performed by the Annie program. Now we see some of the program's features and the way it allows you to feed it the necessary information.

By James C. Rautio,* AJ3K

In the concluding part of this series, we will consider the radiation patterns from quad and long-wire antennas. You have learned much about the analysis performed by my ANNIE program, and I will give you a brief explanation of how some of the program works and the techniques I used in writing the code.

A cubical quad antenna is one that consists of two, square, 1-wavelength loops. The entire array forms a cube. When designing an antenna of this type, it is common to start with a few basic assumptions. For example:

1) It makes no difference whether a quad is fed at the corner or at the middle of one side.

2) It makes no difference whether a quad is oriented like a square or tipped up on a corner, like a diamond.

3) If the quad is oriented like a diamond (for mechanical strength), it should be fed at a corner (again, for mechanical strength).

Intuitively, these principles seem reasonable. But are they really true? Let's take a closer look. Fig. 1 shows the current distribution on a square loop, fed at the middle of the top side, and on a diamond loop, fed at the top corner. The arrows indicate the current-flow direction.

We don't need any equations or even a computer program to determine if one configuration is better. Imagine yourself as a rare DX station in the far field of the two quads of Fig. 1. Look at Fig. 1A and you can see that the current on the top side flows in the same direction as that on the bottom side. This means that the radiation from the horizontal parts add constructively. Now, look at the sides of the square loop. The current here flows vertically and in opposite directions on opposite sides. This means the radiation from the side currents adds destructively.

Thus, the sides of a square quad contribute nothing to the main beam. They serve only to carry current from the top to excite the bottom side. All of the radiating (for the main beam) is done from the top and bottom. Fortunately, the current maximums are on the top and bottom.

Looking at the diamond loop of Fig. 1B, we see that we actually have two V antennas, one inverted and the other not. As pointed out in Part 2 of this series, the horizontal current components (as indicated on the diagram) flow in the same direction and add constructively. Unfortunately, the vertical components flow in opposite directions, and add destructively. With only the horizontal currents radiating (in the main beam), the effective useful current is reduced to 0.707 times the current actually flowing in the loop.

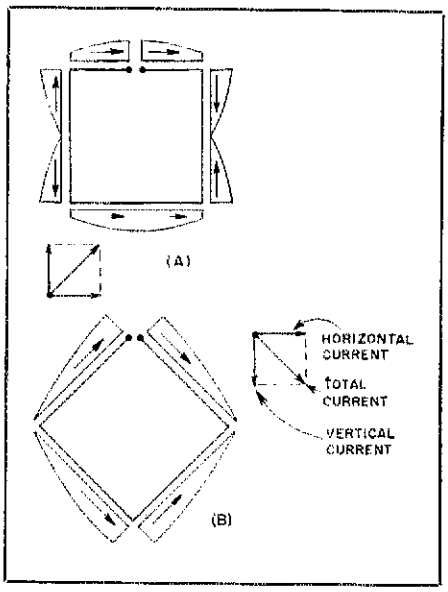


Fig. 1 — The quad can be oriented as a square (A) or as a diamond (B). In both cases, the vertical currents cancel, producing horizontally polarized radiation.

†Parts 1-4 of this series appear in February, April, June and August 1984 *QST*.

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How does this compare with the square quad, which loses only the current on the sides? It turns out that the total useful current on the top and bottom (the area under the sinusoidal curve) is also 0.707 times the total current! This suggests that it is indeed true that diamond and square quads will radiate equally well.

To double-check this conclusion, I used a numerical analysis program called MININEC to analyze a one-element quad loop.[1] MININEC uses a technique called Method of Moments.[2] All you need to specify is how the antenna wires are connected, the feed points and any traps or loads. MININEC will then calculate input impedance, antenna currents and antenna patterns. MININEC was used to analyze both a square and a diamond quad. Sure enough, both have the same gain.

It should be emphasized that when antenna currents cancel, no power is lost. Instead, the input resistance (or more precisely, the radiation resistance) decreases. This causes the antenna current (by Ohm's Law) to increase just enough to compensate for the cancelled current, and all of the power is radiated.

Improving the Quad

Now that we understand how the quad works, are there any ways we can make it better? As a first try, let's change the antenna so less current gets cancelled and more current adds constructively. We can do this with a square loop by making the top and bottom longer while shortening the sides. There will be more horizontal current (which adds constructively) and less vertical current (which adds destructively).

When MININEC is used to analyze such a 'rectangular' quad, however, the gain is less, not more, than for a square quad. MININEC also tells us the reason for this: The antenna input impedance increases (because there is less current cancelling). More current is lost from increasing the input impedance than is gained by less vertical-current cancellation. Several rectangular quads were analyzed, and the results strongly suggest that the square (or diamond) quad has the most gain of any rectangular quad.

Just a Little More Moment

Any loop antenna (such as a quad) has something known as magnetic moment. The magnetic moment is proportional to the loop current times the loop area. The more moment your antenna has, the better its radiation will be. The rectangle with the most area for a fixed (1-wavelength) perimeter is a square. Thus, the square has the most moment and the most gain. Is there any geometric figure that has a 1-wavelength perimeter and more area than a square? There sure is, and it's called a circle.

MININEC cannot analyze a circular loop. It can come close, however, by using an octagonal loop. MININEC says that a single octagonal loop will have 0.25 dB more gain than a square loop. A perfectly circular loop should provide slightly more gain. MININEC does not have the capability to analyze a two-element quad. It is quite possible that the two circular loops would provide an additional 0.5 dB of gain.

It is doubtful that making a circular loop instead of a square one is worth the trouble at HF. At VHF, however, where the loops become small and self-supporting, an extra 0.5 dB can be obtained rather easily. In addition, at VHF, losses become important. Substituting a circular loop will eliminate losses at the sharp corners of a square loop.

Seashore, Anyone?

As described, the vertical components of the quad cancel and the horizontal components add. This means that a quad, when fed at the top (or bottom) center, is a horizontally polarized antenna. At HF, horizontal polarization is probably the best for DX work over average ground. This assumes that the antenna can be built. It would be difficult, for example, to build the horizontal equivalent of three phased verticals for 80 meters! Thus, quads are best fed at the top or bottom.

The situation is different if you live near the ocean. With such a high-conductivity ground plane, vertical polarization can work wonders for low-angle radiation. If your antenna looks out over the ocean, by all means consider vertical polarization for any DX you want to work in that direction. Any quad may be converted to vertical polarization by feeding it at either side rather than at the top or bottom.

There is one problem with vertical polarization over the near perfect ground of sea water. A lot of very-low-angle radiation is present, but if the antenna has any height, there are quite a few nulls at higher radiation angles. This could cause a problem for less-distant DX contacts if the signals arrive on top of one of the antenna nulls. One way around this is to orient the antenna for part horizontal and part vertical polarization. Since the vertical and horizontal polarizations have their nulls at different angles, one may work (if the antenna polarizations of the two stations match) where the other won't. An antenna pattern for a quad with half vertical and half horizontal polarization over sea water is shown in Fig. 2. To do this with a quad, simply feed a square loop at a corner or a diamond loop in the middle of one side.

Long-Wire Antennas and Traveling Waves

Long-wire antennas are simple to build; for that reason they are popular. The antenna is just a length of wire with one end connected to the transmitter. If you have a solid-state transmitter, or are unable to fully load a tube-type transmitter with this antenna, a Transmatch is useful. If you want to get the exposed RF out of the shack (RF burns are nasty!) a length of transmission line can be used.

But what does the pattern of a long-wire antenna look like? Annie provides a quick first look at the answer.[3] Annie has the capability to analyze monopoles. A monopole is just one side of a dipole. You may recall from Part 2 of this series that two monopoles were joined at various angles to analyze the inverted V antennas. A monopole is assumed to have a sinusoidal current distribution (just like a standing wave on a transmission line), with the current going to zero at the far end. This is almost exactly the situation with a long-wire antenna. Thus, we can use a monopole to analyze this antenna. Or can we?

During the development of the Annie program, I have been careful to compare Annie's results with those of well-verified numerical analysis programs, one of which is MININEC. I got a big surprise when I

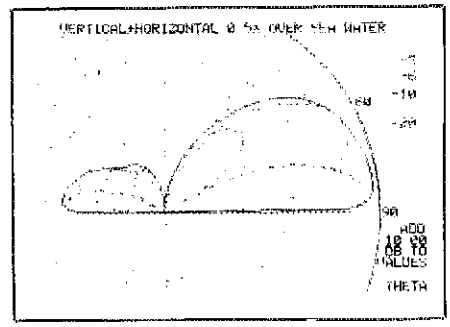

Fig. 2 — When the near-perfect ground of sea water is available, an antenna with both vertical and horizontal polarization may be used to give good coverage at both low and moderate radiation angles. This particular antenna is a 20-meter, 3-element Yagi at 35 feet, rotated 45° about the axis of its boom.

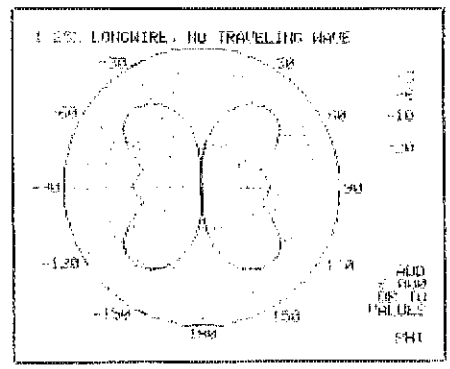

Fig. 3 — Except for the skewing caused by the traveling wave component, Annie provides a quick idea of long-wire antenna performance.

[1]Notes appear on page 39.

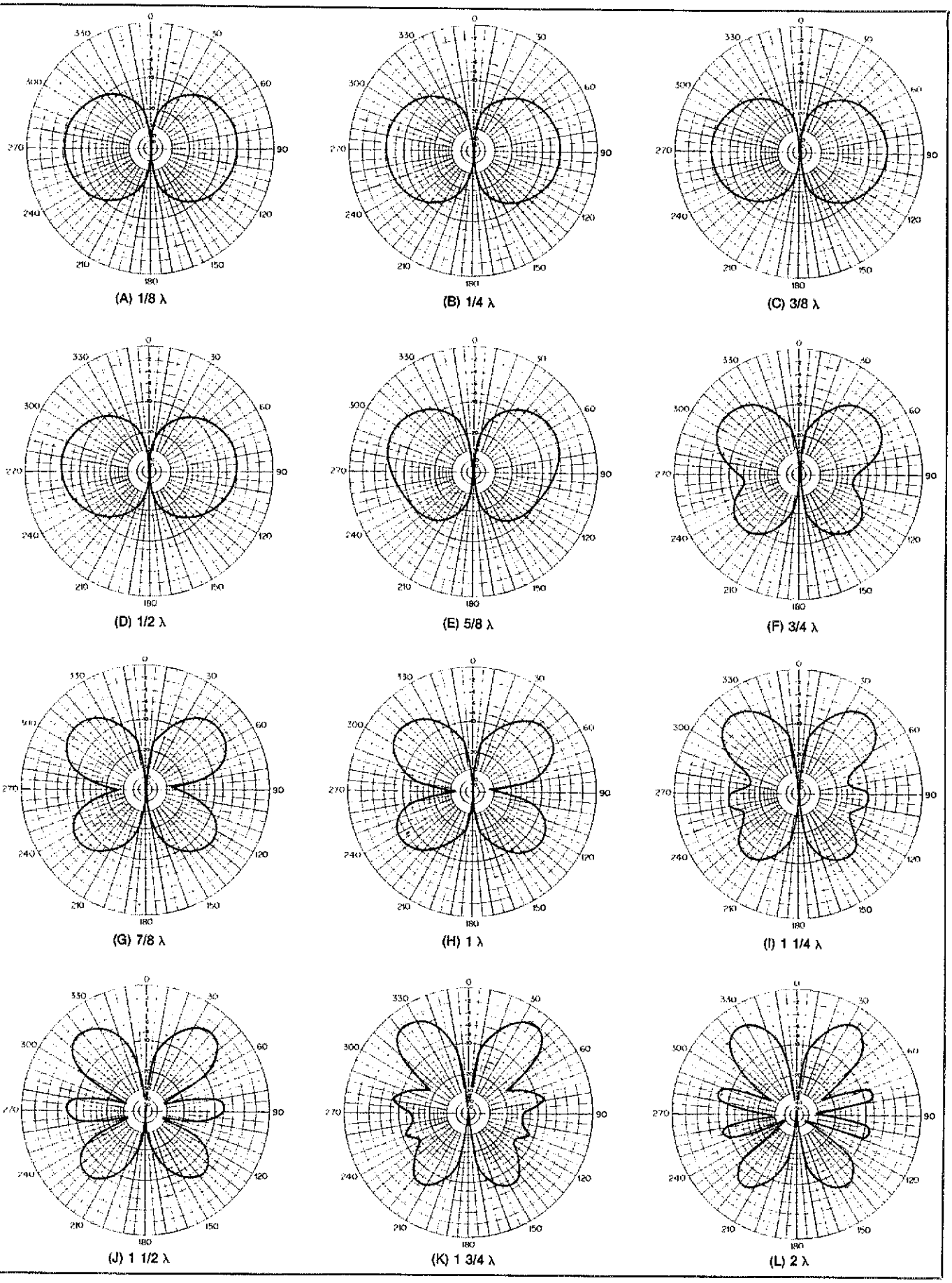

Fig. 4 — MININEC calculation of long-wire patterns include the traveling wave that causes the pattern to be skewed. These patterns are in free space, with the long wire along the 0° to 180° line. The feed point is toward the bottom of the page, which causes the patterns to be skewed toward the top. The length of each wire is shown. Add 6 dB to all values.

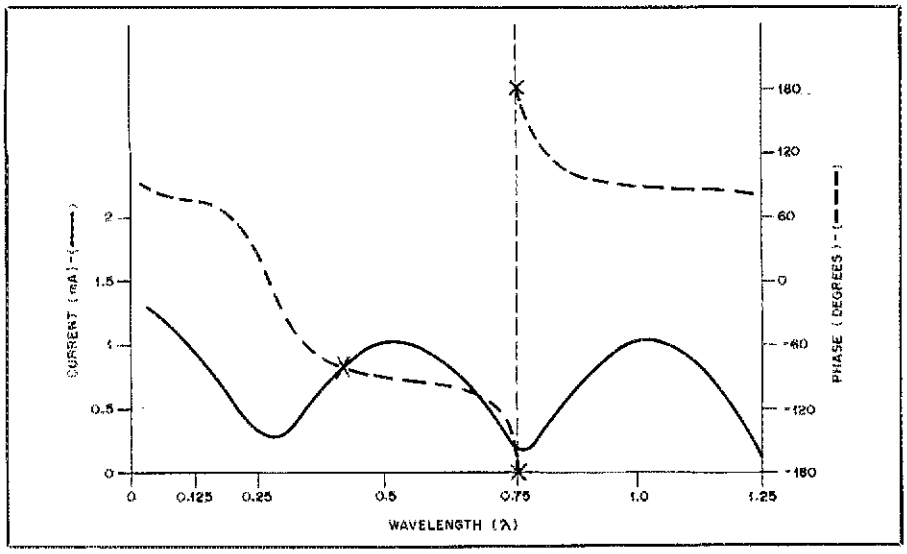

Fig. 5 — The current distribution along a 1.25-wavelength-long wire, with a 1-volt source. The decreasing phase represents a traveling wave.

used MININEC to calculate a long-wire antenna pattern. Fig. 3 shows the pattern of a monopole 1.25 wavelengths long calculated by Annie. The pattern of an equivalent long wire calculated by MININEC is shown in Fig. 4I. Note that both patterns have a similar shape, but that the MININEC pattern is skewed in one direction.

The explanation is found in the current distribution, but in the phase rather than the magnitude. Fig. 5 shows both the magnitude and phase of the current distribution. If we had plotted the phase of the current along a center-fed dipole, the curve would be flat. For the end-fed long wire, the phase steadily decreases as we progress from the feed point to the end of the wire.

What does a steadily decreasing phase mean? It means we have a traveling wave. Further, it is traveling in the direction of decreasing phase, from the feed point to the end of the antenna. This traveling wave causes the pattern to be skewed in the direction of wave travel. This came as a surprise to me, although it really shouldn't have, since I had read several months earlier that any antenna not center fed will have a traveling wave in addition to the usual standing-wave current distribution.[4]

Fig. 4 shows the MININEC-calculated patterns for long wires with a variety of physical lengths (not electrical lengths). Thus, if you are working on 80 meters and want a pattern corresponding to the 1-wavelength-long wire, use a wire that is 260 feet long.[5] The patterns of Fig. 4 were calculated in free space and show the directivity of straight horizontal long-wire antennas in the horizontal plane referenced to a dipole in free space. The horizontal patterns will retain the same general shape with ground included. A good ground will add up to 6 dB to the values shown. The pattern in the vertical plane (a theta cut) with ground included will be very similar to that of horizontal dipoles as calculated in the first part of this series.[6]

Keep in mind that if the long wire is a multiple of half wavelengths long, electrically, it will have a very high input impedance. It may be difficult to match this antenna to a 50-ohm transmitter impedance.

By the way, most of the plots shown in Fig. 4 took MININEC about three hours each to calculate on an Apple® II + computer. [The actual plots were done on an Apple //e, using a program written for that purpose, and then traced onto ARRL antenna-plotting paper. — Ed.] At the cost of not including the traveling wave, Annie required about 30 seconds to do the plot shown in Fig. 3!

Annie — A New Standard

When I was attending the University of Pennsylvania, almost every day I walked by the room where the first electronic computer, ENIAC, was built. Both hardware and software have made tremendous strides since then.

Annie takes advantage of one of the more recent developments in software. For many years, programmers have written software in the simplest way possible. This left many frustrated users saying less than nice things about computers. Today, programmers are taking care to write programs that are "user friendly." Annie uses a software technique called "forms." I'll describe Annie's forms with the hope that other programmers may find some useful ideas and perhaps even go it one better.

We have all had practice filling out forms. We had to fill out a form to get our ham licenses. Many of us fill out a form for income tax. The forms that Annie uses are quite similar. They ask you to supply specific information in a certain pattern that the program will be able to use to perform the necessary calculations.

Annie's first form is actually a menu,

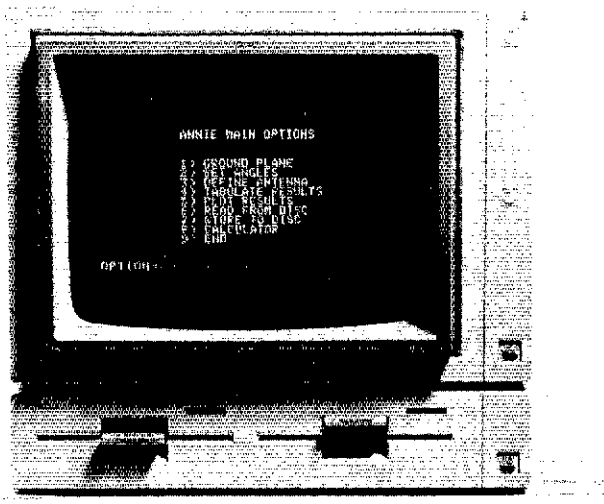

Fig. 6 — Annie's main menu is used to select the desired action.

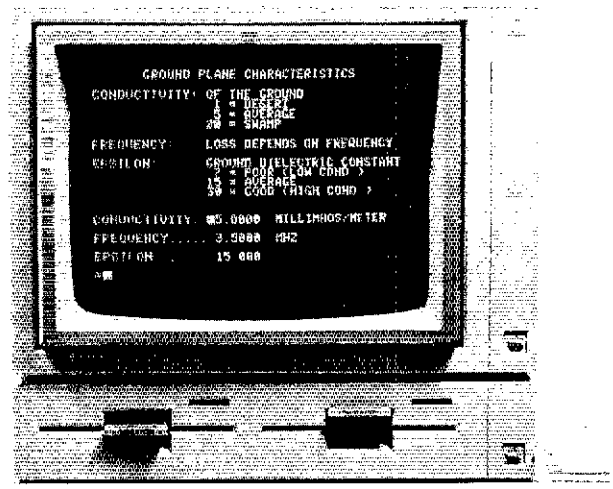

Fig. 7 — The ground-plane form is used to specify the characteristics of your ground.

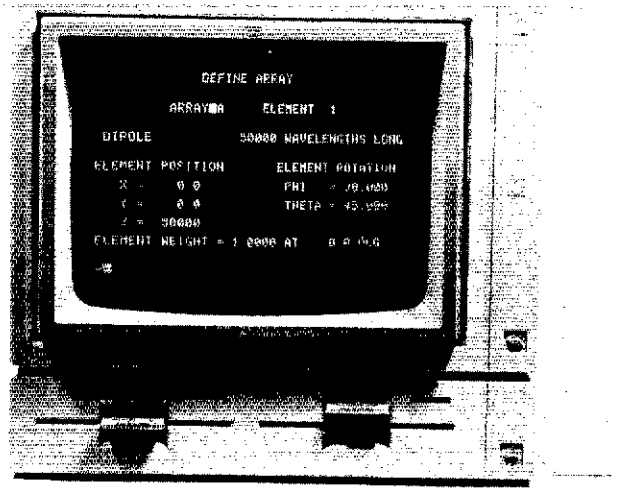

Fig. 8 — Using forms to specify the antenna avoids tedious, and often frustrating, question-and-answer sessions.

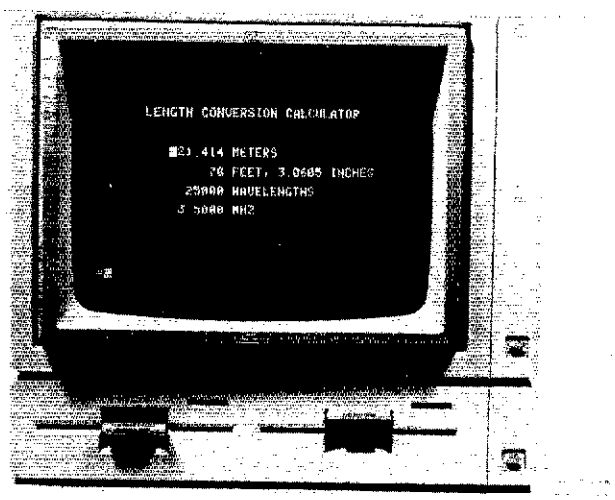

Fig. 9 — Conversions to feet, meters and wavelength are easy with the length-conversion calculator.

shown in Fig. 6. Select the desired option — for example, option 1 — GROUND PLANE — and press RETURN. In this case, the form of Fig. 7 will appear. Any number you now type will appear next to the "equals" sign at the bottom of the form. When you press RETURN, the number will be transferred into the form next to the "greater than" symbol. The "greater than" symbol can be moved to any of the three numbers on this form by repeatedly pressing RETURN. When the ground-plane conditions are set to your liking, a press on the ESCape key will return to the main menu (Fig. 6). On the C64 computer, function keys are used to control the forms.

With the selection of option 3 — DEFINE ANTENNA, the form shown in Fig. 8 is displayed. This form is the heart of Annie. The first entry identifies the array. Up to four arrays (A, B, C and D) may be specified and analyzed simultaneously. The second entry is the element number. Each array can have up to 16 elements. When either the array or element number is changed, all the other entries in the form are automatically updated for the appropriate element in the array.

The next entry is element type. Valid types are DIPOLE, MONOPOLE and ISOTROPIC. In addition, if you are specifying Array B, you can use all of Array A in any element of Array B. In Array C, you can use Arrays A or B as elements, and so on. The remainder of the form allows you to specify the element length, position, orientation, power and phase.

In this situation, you can appreciate the power of forms. Prior to forms, many programmers used question-and-answer sessions, which are easy to program. There are two problems with question-and-answer sessions, however. First, it is difficult to see the current status of all your variables. Second, if you make one mistake, you have to go back to the beginning. If the programmer takes the time to include forms, it is a lot easier on the user.

Annie can make an extensive tabulation of results. Calculated quantities are vertical, horizontal and total gain; polarization sense; axial ratio; tilt and phase. You can specify any quantity from any array for tabulation in any column. Data can be sent to a printer at any time, and up to 132 characters per line can be used, if needed. As always, information is specified using forms.

Annie's plotting capability is also quite considerable. Examples are shown in Figs. 2 and 3. Plots can be made with any magnification and positioned anywhere on the screen. Also, if you have ever tried to draw a circle with a personal computer, you've probably run into the aspect-ratio problem. The circle comes out as an oval. Annie allows compensation for the aspect ratio so that circles come out as true circles. Different printers will require different aspect ratios to print the circle, and a perfect circle on your video screen will not likely be a perfect circle on your printer.

All dimensions used by Annie are in terms of wavelength. Converting between feet and wavelength is a pesky task, so Annie includes a length-conversion calculator (Fig. 9). Position the cursor in the desired location and type in the new number, and all the other numbers will be updated to be consistent with the new number. For example, if you have an antenna 30 feet high at 14 MHz, just type in 30 for the "feet" position and 14 for the "MHz" position, and read off the height in wavelengths.

Annie also does some memory management. Most Apple II+ computers have only 48 kbytes of memory. Annie always checks to see if you have a 48-kbyte or a 64-kbyte Apple. If the extra 16 kbytes is present, it is used automatically. If not, Annie can still be used effectively. The full 64 kbytes of memory are used on the C64.

Conclusion

We have examined a variety of antennas in this five-article series. We found some new twists in an old friend, the horizontal dipole, in Part 1. Sagging dipoles and inverted V antennas were examined critically, with suggestions for improvements, in Part 2. Sloping dipoles, with their almost endless combinations, merited attention in Part 3, where we also touched on the field of adaptive arrays. Part 4 looked at some vertical antennas and pointed out the similarities between filter design and antenna design. In this, the concluding installment, we examined cubical quads and long-wire antennas. Then, we took a quick tour through the Annie software itself.

Writing this series has been a rewarding experience for me. I've valued the response of many *QST* readers. Those who have jotted a note on a postcard, or have even taken the time to give me a phone call, have really made all this worthwhile. I would like to thank Brian Edward for analyzing a number of antennas on the Numeric Electromagnetic Code Method of Moments (NEC) program (the "father" of MININEC), to help verify Annie's results.

Notes

[1]J. J. Julian, J. C. Logan, and J. W. Rockway, *MININEC: A Mini-Numerical Electromagnetics Code*, Naval Ocean Systems Center (NOSC) TD516, San Diego, Sept. 1982. This document is a 56-page user's manual for MININEC, and also contains a public-domain BASIC source listing. A minimum of 48 kbytes of memory is required. Copies of the manual, with several minor corrections, are available from author Rautio for $10. For a disk copy of the Apple version of MININEC, add $5.

[2]R. F. Harrington, *Field Computation by Moment Methods* (New York: MacMillan Co., 1968). Reprinted by Krieger Publishing Co., Melbourne, FL, 1982.

[3]Annie runs on the Apple II+ (48 kbytes), Apple //e or a Commodore™ C64 computer. It is available for $49.95 ($39.95 for the C64 version) plus $2 handling (NY residents add sales tax). Include full name and call. Sonnet Software, Dept. Q, 4397 Luna Course, Liverpool, NY 13088.

[4]E. C. Jordan and K. G. Balmain, *Electromagnetic Waves and Radiating Systems* (Englewood Cliffs, NJ: Prentice-Hall, 1968), pp. 356-359.

[5]mm = in × 25.4; m = ft × 0.3048.

[6]J. C. Rautio, "The Effect of Real Ground on Antennas," *QST*, Feb. 1984.

• *First Steps In Radio*

The Basics of Transmitters

Part 11: Last month we examined the fundamentals of receivers, so let's turn our attention toward the other half of a ham radio station — the transmitter, the amateur's on-the-air voice.

By Doug DeMaw,* W1FB

What is a transmitter? How much power must it generate to be effective? Must it be fancy in order to get the job done? Are transmitters expensive? Can I build my own transmitter? These are common questions asked by newcomers to Amateur Radio, and it is logical that the would-be ham feels a bit confused before obtaining answers to these important questions. Last month we learned the simple ins and outs of receiver circuits, so now we'll give similar treatment to transmitters.

The radio amateur has some options when acquiring a piece of transmitting gear. They include: (1) Purchase a new unit of commercial origin, (2) buy a used commercial transmitter, or (3) build a simple transmitter from a *QST* or *ARRL Handbook* description. The decision will be founded on how much money you can spare, whether or not you have the necessary faith in used equipment, or if you are sufficiently courageous to attempt home construction of your transmitter. I tend to favor the last choice, for as I recall my first years as a ham I recapture the thrill of talking around the world with a rig I built from scrounged and borrowed parts.

Whether you copy a design, modify one or start with your own design, there is a feeling of accomplishment that goes with the use of homemade equipment. The practicality of putting together a CW transmitter goes hand in hand with obtaining a Novice-class ham license, for CW transmitters are the least complicated and costly of the many types. Voice privileges are not available for Novices, so this makes things much simpler for the first-time builder. There are good circuits in back issues of *QST* and in the ARRL technical books.

Meet the Transmitter

In the early days of Amateur Radio, hams used what was known as a spark transmitter. By today's standards it is the most crude form of equipment for generating a Morse code radio signal. Voltage was fed to a mechanical interrupter that caused an arc when the telegraph key was closed. This wide-band energy was concentrated as much as possible in a narrow band of frequencies by means of a tuned circuit that was resonant at the desired operating frequency. The resultant note was broad and buzzy, but it could be copied. Such devices as a rotary spark gap, doorbell buzzer or Model-T Ford ignition (spark) coil were commonly used to cause the spark that became the radio signal. If we attempted to use that type of device today, our stations would interfere with every radio and TV set for blocks — or even miles! Furthermore, there would be room for only a few such signals in any of our CW bands!

After the spark transmitter was replaced by the vacuum-tube transmitter, things began to shape up in Amateur Radio. Greater distances were covered, and the ham bands could accommodate many signals at a given time. Early tube transmitters used a coil and a capacitor to control the operating frequency. This LC circuit was tuned to the desired operating frequency. Fig. 1 shows a simple version of this kind of transmitter. C1 and L1 are tuned to the operating frequency, and C1 is the main tuning control. C2 and L2 are also tuned to the operating frequency. L3 couples the output energy to the antenna system. This circuit is known as an oscillator or "LC oscillator." The key is inserted at J1. When the key is up, there

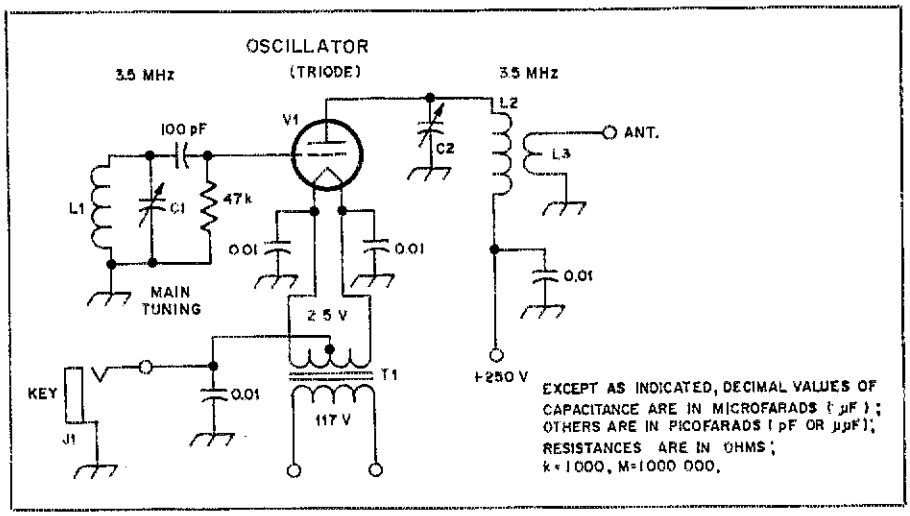

Fig. 1 — Circuit diagram of a vacuum-tube transmitter of the type used in the early days of Amateur Radio. C1 was used to change the operating frequency.

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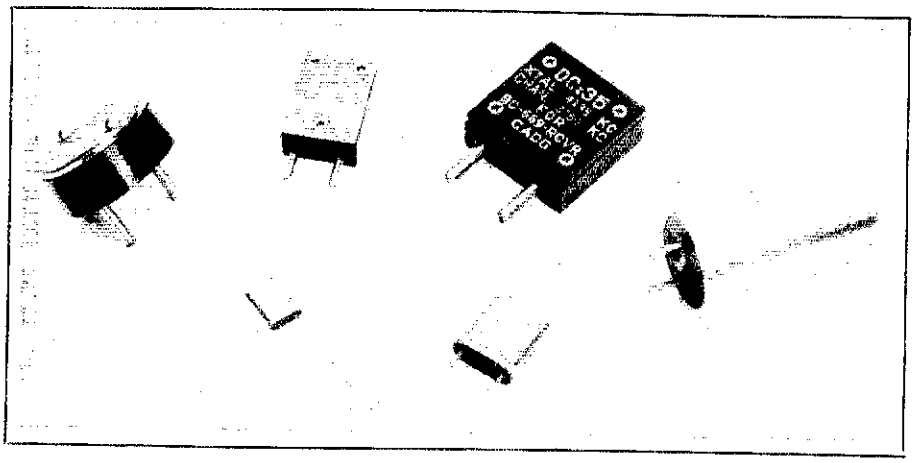

Fig. 2 — Photograph of various quartz crystals in their plug-in holders.

is no dc return to ground for the oscillator, V1, and no oscillation takes place. Key closure completes the dc circuit and causes power to be generated. Similar circuits are in use today, but not as transmitters. They may be used in some low-power part of a transmitter or receiver these days, but with semiconductors rather than tubes.

The most notable advance in transmitter technology during the early days of Amateur Radio came with the invention of the quartz crystal. It consists of a thin slab of rectangular quartz. The crystal is placed between two electrodes and enclosed in an insulating case or holder (see Fig. 2). When the crystal is excited electrically, as in an oscillator circuit, it vibrates. The operating frequency is determined by the number of times per second the quartz vibrates. For example, a 3.5-MHz crystal vibrates 3.5 million times per second. The crystal thickness determines the vibration rate. Hand grinding was the old method for crystal "tailoring," but an etching process is used today.

An example of a crystal-controlled oscillator is given in Fig. 3. It is an untuned oscillator because it has no adjustable coil and capacitor combination. It can operate only at the crystal (Y1) frequency. To change to a new frequency, we must plug in a different crystal at Y1. This circuit, like all oscillators, is basically an amplifier. But, part of the output power is routed back to the input of the amplifier to cause self-oscillation, or oscillation of the crystal.

Amplifiers should not oscillate when used strictly as amplifiers, but sometimes they do if careless design or layout permits output power to sneak back to the input side of the amplifier. This causes what is known as *instability*. So, a stage of that type becomes an oscillator, even though it is not meant to be one! The circuit in Fig. 3 is known as a Pierce oscillator — named after the man who invented it. There are many kinds of crystal oscillators, such as the Colpitts, tri-tet, Clapp, overtone and Butler. They all accomplish the same thing, but have different circuit hookups.

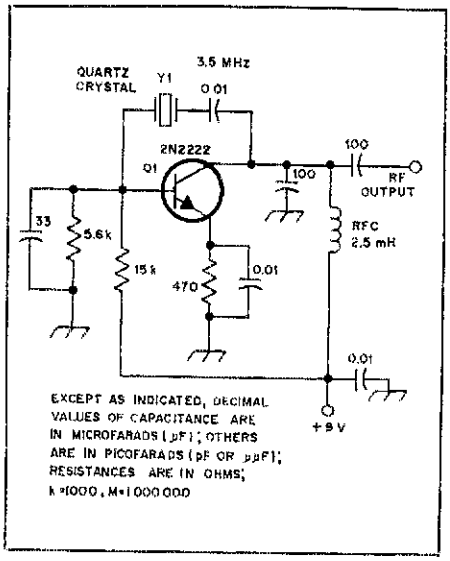

Fig. 3 — A crystal-controlled Pierce oscillator. This circuit may be used for a lab project, and can become a code-practice oscillator if used with a CW receiver.

You may wish to gather the parts for the circuit of Fig. 3 and assemble it. This will give you valuable first-hand experience concerning oscillator operation. You may hear the oscillator signal by tuning a short-wave receiver to the crystal frequency. If you open the ground connection for the 470-ohm resistor of Fig. 3 and insert a key, you may use the circuit for code practice. A CW receiver will be needed to hear the note well. Otherwise, you will hear only a thump when you key the circuit.

A Simple Transmitter

To illustrate the most simple of transmitters, let's look at Fig. 4. Here we have a one-transistor, crystal-controlled oscillator. With the parts specified in the diagram, we can expect approximately 0.25 watt (250 milliwatts) of output power. Although this may seem like too little power to communicate over anything but short distances, many hams specialize in talking around the world with QRP (low power) because it presents a challenge. This circuit, and a good antenna, can provide surprising results.

The crystal, Y1, determines the operating frequency. C1 and L1 are tuned to the operating frequency to ensure maximum power transfer to the antenna (maximize the signal output). The turns ratio on L1 and L2 is chosen to provide a proper impedance match between the collector of Q1 and the antenna feed line. Maximum power transfer can occur only when unlike impedances are matched. In other words, if the output of a transmitter has a characteristic impedance of 500 ohms and the antenna presents a 50-ohm characteristic, we would need to use some type of device (tuned circuit or transformer) to step the 500-ohm impedance down to 50 ohms.

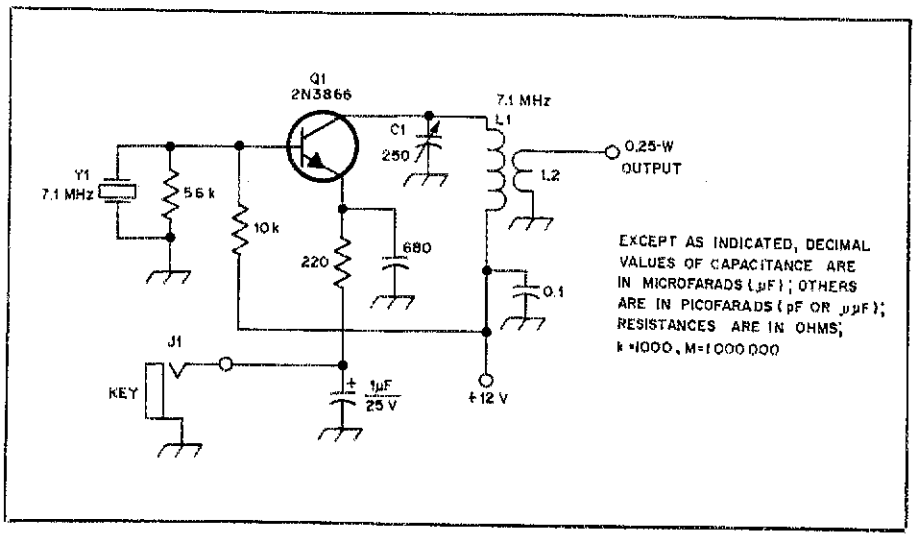

Fig. 4 — An example of a one-transistor, low-power CW transmitter. C1 and L1 are tuned to the operating frequency.

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For CW operation we need only to plug our key into J1 of Fig. 4. When the key is up (open), Q1 has no dc path to ground, and it can't oscillate. When the key is down (closed), the circuit oscillates and power is delivered to the antenna. If we desire more than 0.25 watt of power, we may add one or more amplifier stages after the oscillator. The power could be increased by this means to thousands of watts if that were our objective.

Voice Operation of Transmitters

There are three common voice modes for Amateur Radio — AM (amplitude modulation), SSB (single-sideband) and FM (frequency modulation). AM was the popular mode used in the early days of radio, and remains the method used in the standard broadcast band covering 540 to 1600 kHz. The amplitude of the transmitter carrier is varied in accordance with the voice energy, and a carrier plus two sidebands (upper and lower sideband, respective to the carrier frequency) result. SSB, on the other hand, provides only one sideband (upper or lower) and the carrier is suppressed. The resulting transmitter output power varies with the voice energy, much like AM. The advantage of SSB is that the transmitter is more efficient per watt in terms of overall power consumption, the signal occupies half the bandwidth of AM and power is not wasted in generating a carrier. The narrower bandwidth reduces congestion in crowded phone bands — a matter of great importance these days with so many hams on the air.

The FM technique is somewhat different than those of AM and SSB because the voice energy is used to shift or swing the operating frequency above and below the mean carrier frequency. This shift in frequency is called *deviation.* Voice energy may be applied directly to the transmitter oscillator to create FM. Another form of FM is PM (phase modulation). The end result of either system is the same. Fm receivers and transmitters will be discussed in more detail in a future installment of this series.

Representative Transmitter Arrangements

Whether a transmitter operates at VLF (very low frequency) or as a generator of microwave frequencies, the general scheme of things is the same. We must have a frequency source (local oscillator), subsequent frequency multipliers and/or amplifiers and resonant circuits. If voice operation is used, we need a *modulator.* It contains a speech amplifier and a circuit that applies the amplified audio data to the transmitter RF energy.

Fig. 5 shows a block diagram of a CW type of transmitter. We have included frequency doublers and amplifiers to provide a general idea of what might be found in a transmitter circuit. The frequency multipliers could be triplers or even quadruplers, if that would aid us in arriving at the desired transmitting frequency. On the other hand, we could design a transmitter that had no frequency multipliers: The transmitter output frequency would be the same as that of the oscillator. We might have one or two intermediate amplifiers to ensure the required excitation power to the final amplifier.

The oscillator in Fig. 5 need not be crystal controlled. Instead, we can use a VFO (variable-frequency oscillator), PLL (phase-locked loop) or a synthesizer to generate our operating or oscillator frequency. Most modern transmitters contain frequency synthesizers. They are very accurate and frequency-stable, and can be used to operate a digital frequency-readout display. In any event, all transmitters should contain a harmonic filter at the output in order to prevent the radiation of spurious frequencies that might interfere with other radio services, TV sets and FM radios.

The operating voltage for the power amplifier in Fig. 6 is processed by the modulator in order to provide amplitude modulation of the transmitter carrier. The remainder of the speech and RF stages are supplied with dc that contains no audio information. However, some transmitters use a small amount of modulated operating voltage on the stage immediately ahead of the power amplifier to ensure 100% modulation.

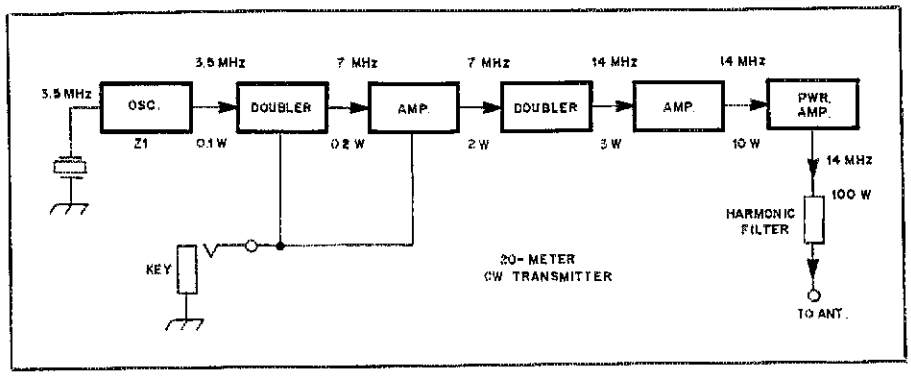


Fig. 5 — Block diagram of a simple CW transmitter with frequency doublers to increase the frequency from 3.5 to 14 MHz.

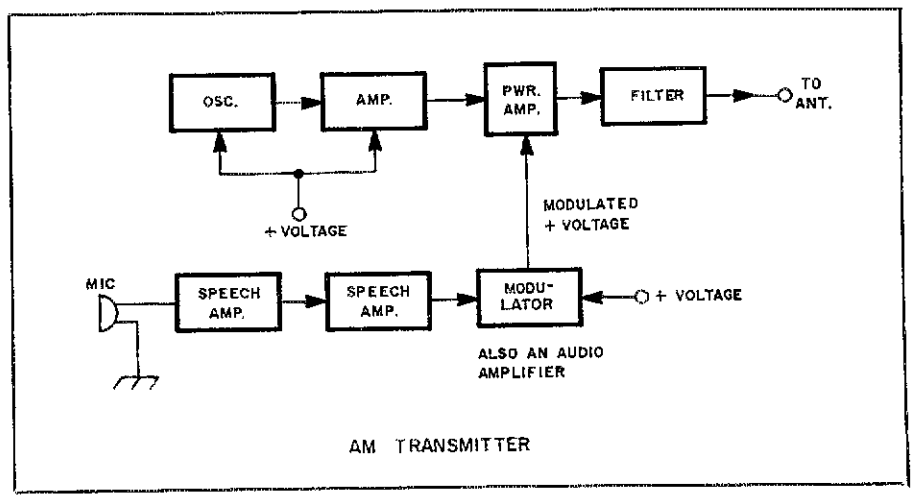
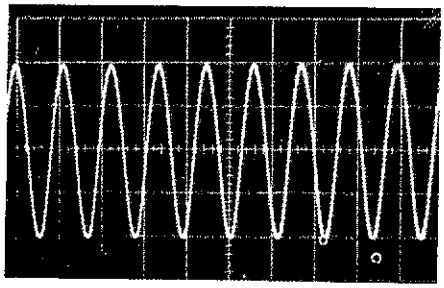
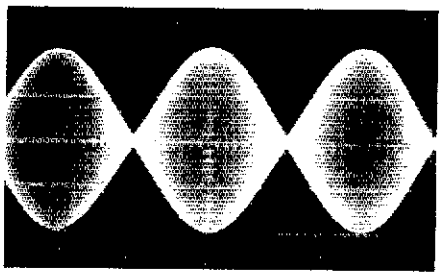


Fig. 6 — An AM transmitter is seen here in block-diagram form. The RF portion is the same as that of a CW transmitter. A modulator is used to provide AM voice output from the transmitter.



(A)



(B)

Fig. 7 — The photograph at A illustrates how an unmodulated RF wave form from an AM transmitter would appear on the face of an oscilloscope. Photograph B shows the wave form for a 100-percent-modulated carrier during AM operation.

Glossary

AM — amplitude modulation. A method of applying information to a carrier signal by superimposing the information-signal voltage on the carrier. The carrier amplitude is increased or decreased in proportion to the superimposed signal amplitude.

AMTOR — AMateur Teleprinting Over Radio. An RTTY communications method that employs error-checking procedures. Information is sent in groups of three characters (letters, numbers, punctuation, etc.). If the receiving station acknowledges correct receipt of a three-character group, the sending station transmits the next group. Should the receiving station not verify correct reception of the three-character group, the transmitting station retransmits the information. This form of RTTY overcomes the adverse effects of signal fading and interference, and ensures error-free information exchange.

ASCII — American National Standard Code for Information Interchange. A digital coding system that employs seven elements or *bits* to represent alphanumeric, punctuation and control characters. In Amateur Radio communications, the term is loosely applied to a form of RTTY communications in which ASCII is used to convey the desired information.

ATV — Amateur television. This term is usually applied to the fast-scan type of television, similar to that used by commercial TV stations. The video portion of the signal is amplitude modulated.

balanced modulator — a portion of an SSB transmitter that provides voice modulation of the carrier, then removes the carrier to leave only upper- and lower-sideband energy.

bandwidth — the amount of frequency occupied by a signal in terms of hertz or kilohertz.

carrier — the RF output from a transmitter, minus signal information.

deviation — the amount of frequency swing above and below the mean carrier frequency of an FM transmitter. The deviation is caused when audio-frequency voltage is applied to the oscillator.

discriminator — a type of detector in a receiver that has been designed for FM reception.

exciter/excitation — excitation is the RF voltage applied to an RF amplifier to cause it to amplify. An exciter is a circuit that provides excitation voltage.

FM — frequency modulation. A form of communication wherein the transmitted carrier frequency (rather than the carrier amplitude) is varied in accordance with the frequency of the modulating signal. The degree of modulation (the modulation index) is proportional to the amplitude of the modulating signal.

instability — an undesirable characteristic of an amplifier that self-oscillates.

modulator — the part of a transmitter circuit that applies modulation (audio-frequency intelligence) to one or more stages of the transmitter.

multiplier — a stage in a transmitter that doubles, triples, etc., the frequency that is applied to it.

PM — phase modulation. Another method for generating an FM signal.

ratio detector — a type of FM detector used in an FM receiver.

Repeater — A transmitter/receiver combination that receives and retransmits amateur or commercial signals at higher power levels and with a more effective antenna. This greatly increases the effective range of mobile, hand-held and/or low-power transmitters.

slope detection — a method of receiving FM signals with a standard AM receiver.

SSB — single sideband. A transmission method for creating a signal that has no carrier and just one sideband — upper or lower.

SSTV — slow-scan TV. A low-resolution, narrow-bandwidth method of picture transmission that uses audio tones applied to the modulator of a transmitter. Pictures may be transmitted in black and white or color.

synthesizer — a digital type of circuit for generating accurate, stable frequencies. Used in transmitters, receivers and test equipment. The frequencies are "synthesized" rather than generated directly by means of a crystal or LC oscillator.

Fig. 7A shows what we would see on an oscilloscope if we examined the output energy from the transmitter of Fig. 6, minus the modulation. In other words, the carrier would appear as a sine wave. But, when actuating the speech amplifier and modulator, the output wave form would appear as it is in Fig. 7B. In this example, the carrier is modulated 100% (ideal). If it is less than 100%, the signal sounds weaker in our receiver, and if the percentage is greater than 100, the signal is broad and distorted. Tubes or transistors can be used in the circuits of any of the transmitters discussed here.

Fig. 8 illustrates, in block-diagram form, the absolute basics of an SSB transmitter. The carrier is removed at the balanced modulator (balanced out, so to speak), which provides double-sideband, suppressed-carrier output to the sideband filter, FL1. Depending on the crystal used (Y1 or Y2), the output from FL1 will be upper- or lower-sideband energy, minus a carrier. The filter removes the unwanted sideband (AM transmitters transmit both sidebands, plus the carrier). The SSB energy is then routed to a mixer (as in a receiver) which is supplied in this example with 12.9-MHz energy from a local oscillator (VFO or synthesizer) to produce a sum frequency of 3.9 MHz.

Numerous other frequency schemes are popular. The one shown in Fig. 8 is but one of many combinations. The output waveform from a properly designed and operated SSB transmitter will look like that of Fig. 7B. Too high a level of modulation will cause distortion and broad signals, just as it does during AM-transmitter operation. Too little modulation will simply reduce the output power of the SSB transmitter. We should be aware that the carrier is never eliminated entirely by the balanced modulator, but it can be reduced to minus 50 dB or greater, which has the practical effect of eliminating it.

There are two methods commonly used for generating SSB signals. One is known as the filter method (Fig. 8), wherein a filter made from quartz or piezo crystals is used. In the other technique, known as the "phasing method," the unwanted sideband is removed by complex resistive and capacitive audio-phasing networks. Phasing types of transmitters have fallen out of popularity in recent years.

Other Amateur Transmission Modes

I would be remiss if I did not mention the additional transmission modes of ATV (amateur television), SSTV (slow-scan TV), RTTY (radioteletype), ASCII and AMTOR. For all practical purposes, the transmitters used for these more exotic communication modes follow the CW, AM or SSB formats described here. A proper treatment of how these modes differ from those we have already discussed would require more pages than we can devote to this article. But, you may find detailed information about these techniques, and those we have treated here, by referring to the *ARRL Handbook* and many past issues of *QST*. The ARRL technical department can provide a list of appropriate bibliographies from which to select suitable reference material. Please include an s.a.s.e. with your request.

Some Closing Thoughts

It is the intent of this article to familiarize you with the cornerstones of transmitter principles. Modern-day circuits are far more complex than the examples provided here, but the concepts are the same with regard to how the signal is generated. The schematic diagram of a typical modern

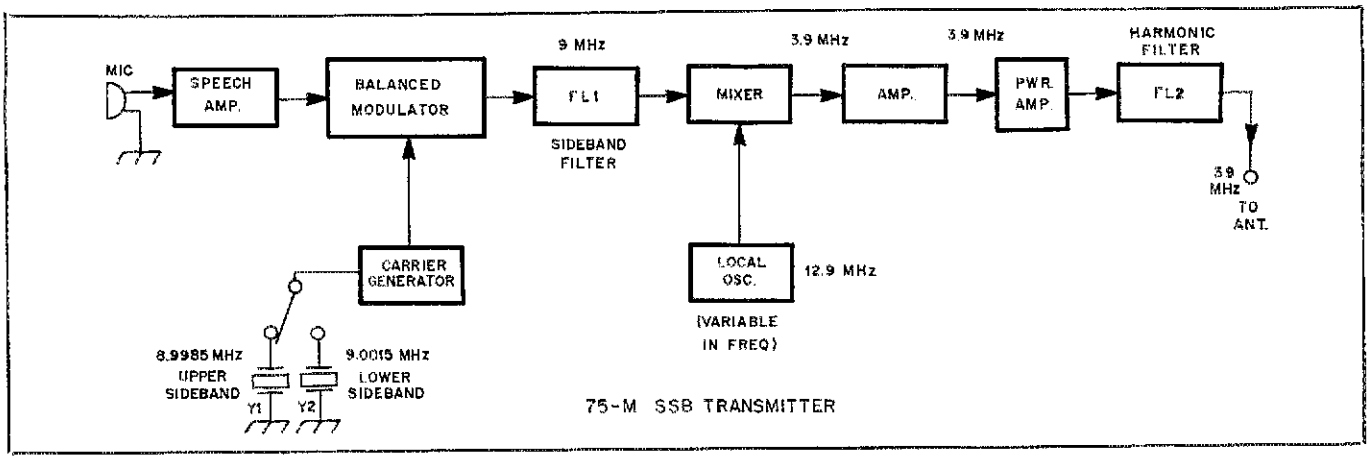


Fig. 8 — Block diagram of a single-sideband transmitter.

ham transceiver is so complicated that even *seasoned* engineers experience frustration when attempting to follow a single branch of a circuit. It would be absurd to force that kind of material on beginners, so we have followed a simplified "yellow brick road" in this installment. I want to encourage you to go beyond this treatment by reading more about these principles in the *ARRL Handbook*. A few practical experiments with the oscillator circuits from this article will be beneficial, too. Good luck!

(Continued from page 18)

'Talking to other hams is more important than your problems.'

"Instead," said Harris, "we made ourselves available to the managers for whatever appropriate help they might need. Not only did that approach give us a lot of satisfaction, but it also gained us tremendous respect from the Stanford LAOOC. People got to know that we were there, and available. We had a real advantage because, unlike ushers or security guards, we didn't have a specific assignment. We could be flexible."

The wide variety of talents among Harris's crew led to some other intriguing assignments. Sy Stein, M.D., WA6ROM, acted as net control for Red Cross medical efforts, which included 10 roving first-aid teams and two fixed stations. Then there were the 30 Crown Zellerbach Corporation buses arriving each evening with 1200 handicapped and underprivileged children from around the Bay Area. Barbara Mardesich, LAOOC Youth Services Manager for Stanford, asked for communications help at a managers meeting, and Ted Harris promptly volunteered his crew. Harris assigned Bob Tarone, WA6ZBX, to work with Mardesich on the problem. For the duration of the Games, Tarone and several other hams made sure the buses got through traffic to the correct parking area before the game, then helped get the kids back to the buses safely through post-game traffic. There was always one ham with Mardesich to relay information between her and the other traffic coordinators or local police.

To solve a communications problem at the venue administration offices, the Communications Crew installed packet radio systems at the stadium and at the LAOOC office in downtown Palo Alto. The goal was to overcome the problem of busy or unanswered phones ringing through to receptionists downtown. Before the packet system was installed, the receptionists had no easy way of getting the messages back to the managers, two miles away at Stanford. The packet system allowed them to send hardcopy messages back to the venue for easy retrieval by the administrators.

Aside from one board substitution, the two packet stations ran flawlessly 24 hours a day for 11 days, handling some 1300 messages in all. Harris, who is implementing packet systems for Red Cross disaster relief work, feels it was an important contribution to the Games. "Amateurs have to be innovative," he said. "We've got to take advantage of the latest technology if we're really going to be useful to the agencies we're trying to serve."

Team Finds Time for Radio

Amateur Radio participation in the Olympics wouldn't have been quite complete, of course, without every ham's favorite pastime — *playing* radio. Fortunately, if everything is well planned and luck is with you, even a major "disaster simulation" like the Olympics can leave some time free for that activity.

In Harris's original communications plan for the Olympics, spare time looked scarce, so he asked Ron Chiappari, N6AUV, to set up phone and CW stations outside the venue area and staff them with local hams. There was reason to believe that these (W23OG and W84OG) might be the only special-event stations operating from the Stanford Olympics.

But once the soccer activities were going smoothly, the possibility of running a special-event station from the Red Cross van looked more promising. By that time, a few days into the Games, W84OG and W23OG were going gangbusters, and Harris realized how many hams around the world wanted to make an Olympics contact. "I sat everyone down and said, 'Let's do as much as we can with this — it's hot.' "

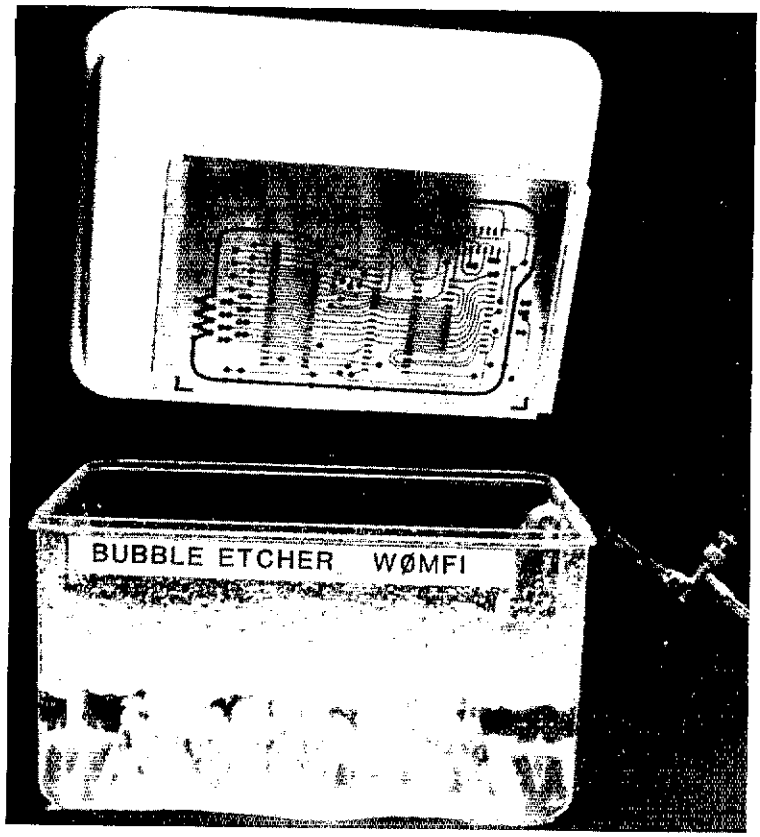
Being warm-blooded hams, Harris' team leapt at the chance. They kept K84OG (K-84-Olympic Games) on the air most mornings and evenings thereafter, logging more than 4000 contacts with 71 countries.

Participation Brings Rich Rewards

The success of K84OG was the final touch on an already highly successful enterprise. Ted Harris and his entire crew received rave reviews from Olympics staff for their efforts. Technology Manager Chris Veal called their help "invaluable," and Youth Services Manager Mardesich said they were "super, just super." As visible evidence of this esteem, each of the 11 volunteers received a gold medallion from the LAOOC.

But Harris prefers to stress the internal rewards from his team's participation in this unique event — rewards that he feels are available to anyone willing to take an active role in public events or disasters. "You'll come out feeling like you've really made a difference," he said.

Indeed, despite the hectic pace and sometimes grueling hours, all of Harris's volunteers say they'd do it all over again. And, in fact, destiny has generously stepped in to give them an opportunity: This January, the Super Bowl comes to Palo Alto — and Stanford officials have already asked Ted Harris and his team to be there to help!



A Bubble Etcher for PC Boards

How many times have you spent hours laying out a PC board and then ruined the board during the etching process? Worry no more!

By Jim Stinson,* WØMFI

Etching PC boards in a glass tray containing ferric-chloride solution heated on a hot plate presents many problems. Accidentally overheating the solution will quickly destroy its etching ability. The final results using the tray method are sometimes disappointing because of uneven etching of the copper foil. This creates discontinuities in the circuit pathways or bridges between them. Messing up the workplace with brown ferric-chloride stains is another problem with the primitive tray-and-hot-plate method.

A Better Way

After I looked at the commercially available etching units and their price tags, the challenge to design one that could be made from easily obtainable materials seemed to be a worthwhile project. This bubble etcher is the result of experimentation with, and the improvement of, etchers designed by others. The bubble etcher will etch single- or double-sided PC boards quickly and uniformly using ferric chloride or ammonium persulfate as the etchant.

Etchant temperature is maintained easily at 100° F by using an inexpensive, rectangular, plastic dishpan as a water-bath container in which the bubble etcher is placed.[1] The dishpan also acts as a catch basin for all the drips and spills that invariably occur during frequent inspection of the etching process.

A complete set of bubble-etcher parts, prior to assembly, is shown in Fig. 1, and a list of required materials is presented in Table 1. The bubble etcher tank is a plastic refrigerator box. This particular box is chosen because the tight, two-piece lid prevents splashes, and is dismantled easily to allow attachment of a PC-board holder to the underside of the lid. The PC-board holder is fabricated from ¼-inch clear

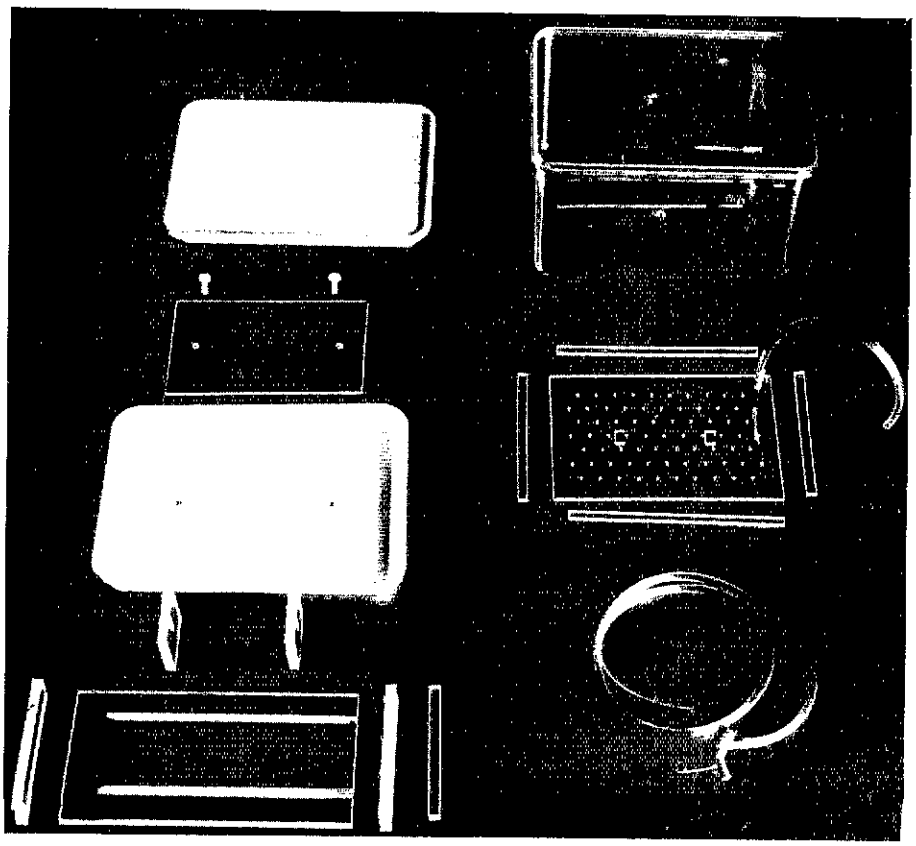


Fig. 1 — Individual parts of the bubble etcher prior to final assembly.

[1]Notes appear on page 56.

*938 2nd Ave. N, Sauk Rapids, MN 56379

Table 1

Materials List

1 — 1/4 × 3-1/2 × 6-3/4 inch PC-board holder clamp base.
1 — 1/4 × 1/4 × 3-1/2 inch clamp base stiffener.
2 — 1/4 × 5/8 × 3-1/2 inch PC-board clamps.
1 — 1/8 × 4-1/2 × 6 inch air-manifold top.
2 — 1/8 × 1/4 × 4-1/2 inch air-manifold spacers (ends).
2 — 1/8 × 1/4 × 5-1/2 inch air-manifold spacers (sides).
1 — 1/8 × 3 × 6 inch lid stiffener.
2 — 1/4 × 1-1/2 × 1-1/4 inch spacers for attaching the PC-board holder to the tank lid (see text for method of determining exact length).
2 — No. 4-40 × 5/8-inch Nylon machine screws.
2 — No. 8-32 × 1/2-inch Nylon machine screws.
1 — Rubber band.
1 — Plastic container, Eagle no. 6528, 82-oz clear-plastic food saver with pressure-seal lid or equiv.
1 — Two-way air-line connector with flow-control valve.
1 — Aquarium pump or other small air supply.
1 — Plastic rectangular dishpan for use as the constant-temperature water bath.

Miscellaneous

1 qt ferric-chloride or ammonium-persulfate etchant.
2 ft plastic air-line tubing.
Plastic-model cement or methylene-chloride solvent.
Clear silicone adhesive.

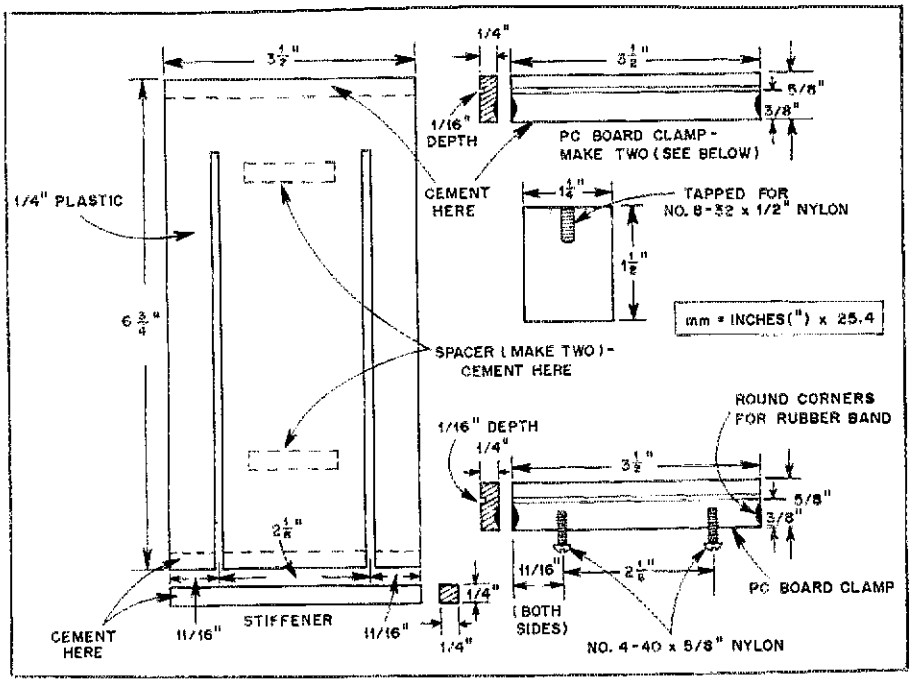


Fig. 2 — Component parts of the PC-board holder and method of construction.

plastic sheet, and patterned somewhat like the one described in *Electronics*, July 3, 1972, and reprinted in the *Radio Handbook*, 20th edition, 1975.[2,3] The construction is simplified by eliminating the need for a dovetail groove in the plastic block and the necessity of cutting and grinding glass with carbide tools.

Assembly

Refer to Fig. 2. Begin construction with a ¼ × 3½ × 6¾-inch plastic block. Using a table saw, cut two slits 5/8 inch in from each side, and to within 1 inch of the end. Reinforce the end where the saw cuts were started by cementing a ¼-inch-square plastic strip across the block. I used methylene chloride to cement the plastic parts together; a good-quality plastic model cement will also work if methylene chloride is unavailable.

The methylene-chloride solvent makes a neat joint, but things happen quickly and there is no opportunity to reposition a misaligned part once the solvent has been applied. (If you choose to use the methylene chloride, practice gluing some scraps of plastic together before proceeding with the project. Methylene chloride is volatile and will evaporate quickly, so keep the container tightly closed when not in use.) Use a small camel-hair brush to apply the solvent to the joint after carefully aligning the parts. Clamp the pieces together with clasp type clothespins or modeler's clamps.

PC-Board Holder

The two PC-board holder clamps are made from 1/4 × 5/8 × 3-1/2 inch plastic with a shallow saw kerf (approximately 1/16 inch) cut 3/8 inch from one edge. One of these two clamps is cemented to the plastic block at the end where the saw cuts end. Be sure the shallow groove is facing the other end of the block. The other clamp is drilled and tapped to receive two no. 4-40 × 5/8-inch nylon machine screws. These screw holes must be drilled accurately so they align with the two saw slots made in the plastic block.

Arrange the clamp so its groove faces the one already in place at the other end of the block. Install the nylon machine screws, but do not tighten them so they bind. The clamp should be free to move easily in the saw slots from one end of the block to the other. Wrap a light rubber band around the two clamps to provide spring tension. The clamping action will hold the PC board in place while etching occurs. Round the outside corners of the clamps to prevent cutting the rubber band.

To attach the completed PC-board holder to the lower side of the tank lid, use ¼ × 1½ × 1¼-inch plastic pieces. A ½-inch-diameter (or larger) plastic rod can be substituted for the spacers if available. Remember: No matter which material you choose, use a spacer length that will allow the PC board to just reach the surface of the solution when the lid is on tight. In my unit, 1½-inch spacers are used to bring the PC board in contact with the solution surface when using one quart of etchant. If you choose a different size or shape of etchant tank, the spacer dimensions will have to be altered.

Pour one quart of water into the tank, and mark the surface level on the tank side. Measure the distance from this line to the bottom surface of the lid when the lid is in place on the tank. This measurement will assist you in determining the exact spacer length.

Disassemble the two-part lid, and set aside the top part for reassembly later. Cut a 3- × 6-inch piece of 1/8-inch-thick plastic to act as a stiffener inside the lower lid. Drill two 5/32-inch holes 4 inches apart and centered through the stiffener plate and lower lid. Drill and tap the plastic spacers to receive the two no. 8-32 × ½-inch nylon machine screws used to hold the spacers to the lower lid. Attach the spacers to the lower lid and reassemble the two lid parts.

Now, position the lid and the spacers on the PC-board holder in correct alignment for cementing in place. Make sure the PC-board holder is positioned properly to clear the sides of the tank, and that the spacers are not interfering with the movement of the screw heads in the saw slots. Cement the assembly in place using solvent or plastic model cement. A finished PC-board holder is shown in Fig. 3.

Air Manifold

The air-distribution manifold in the etchant-tank bottom was chosen after considerable experimentation with aquarium aerators. I found it is difficult to get uniform bubble agitation using the aquarium aerators. Also, the etchant solution begins to disintegrate the aerators in a short time.

An air manifold (Fig. 4) is easy to construct using a 4-1/2 × 6-inch, 1/8-inch-thick plastic sheet. Lay out seven rows of

holes spaced ½ inch apart with ½-inch spacing between the holes. Stagger the layout marks for drilling the holes so that the holes in the adjacent rows will not be directly opposite each other. The center row has 11 holes. The rows on each side of the center row have 10 holes, then 11 holes, then 10 holes. This arrangement gives better bubble distribution and more uniform etching.

Drill out the holes using a no. 60 bit. After the holes are drilled, cement 1/8-inch-thick by 1/4-inch-square side-spacer strips around the plate perimeter. Cement two 1/8-inch-thick by 1/4-inch-square spacers spaced equally along the center line to give additional rigidity to the structure when attached to the bottom of the tank.

Before cementing the unit in place, drill a 3/32-inch hole near one corner of the plate to receive the air-supply fitting. Use aquarium air-supply plastic tubing and fittings (these parts are available from pet supply and variety stores). Drill the hole for the fitting as near the corner as possible to ensure that the plastic tubing will not interfere with the PC board being etched.

Cement the completed air manifold in place at the bottom of the etchant tank. Use silicone cement to attach the air manifold to the tank bottom so that if it has to be removed for any reason, it can be done without shattering the plastic parts.

Drill a 1/4-inch exit hole 3/8 inch down from the top of the tank near the corner and directly above the plastic tubing fitting in the air manifold. Drill three 1/8-inch holes at one end of the tank and 3/8 inch down from the top for air to escape from the tank while etching. Without the holes, the lid would be lifted off the tank by the air-supply pressure.

Air Valve

To regulate etchant bubbling action, install an adjustable air valve in the plastic tubing going to the air supply. This valve can be fastened to the water-bath container rim for convenience. The valve should be closed whenever the air supply is turned off to prevent syphoning the etchant into the air hose.

The bubble etcher will work on low air volumes and pressures, with 5-10 lb/in^2 being adequate. A good aquarium pump, or small compressor such as artists and hobbyists use, will work.

Operation

To use the bubble etcher, place the etchant in the tank, and fill the water-bath container with about 2 inches of warm (120° F) water. Place the tank in the water-bath, and allow the etchant to come up to working temperature (100° F). By starting with 120° water, the etchant should quickly warm up to working temperature. If not, add more hot water or start with a higher-temperature water bath. Be careful not to heat the etchant solution beyond 110° F or it may quickly lose its activity.

When you have the etchant at working temperature, place the prepared PC board in the holder with the circuit pattern facing the etchant solution. Put the lid on the,

(Continued on page 56)

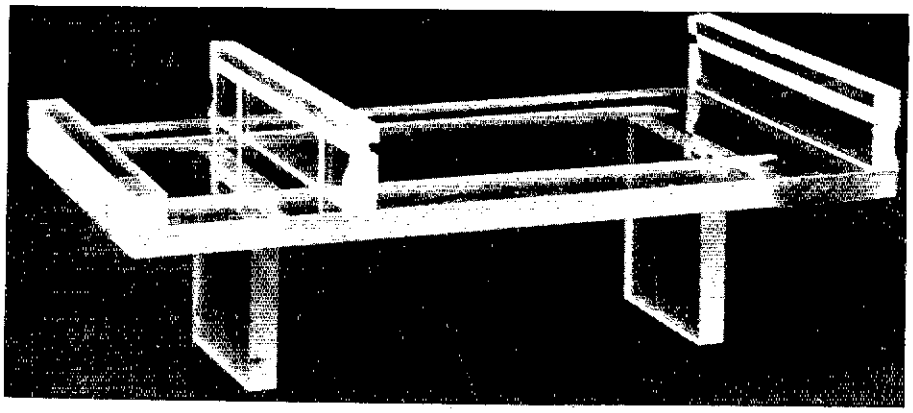


Fig. 3 — The finished PC-board holder. To accommodate PC boards of varying widths, the left-hand clamp is adjustable.

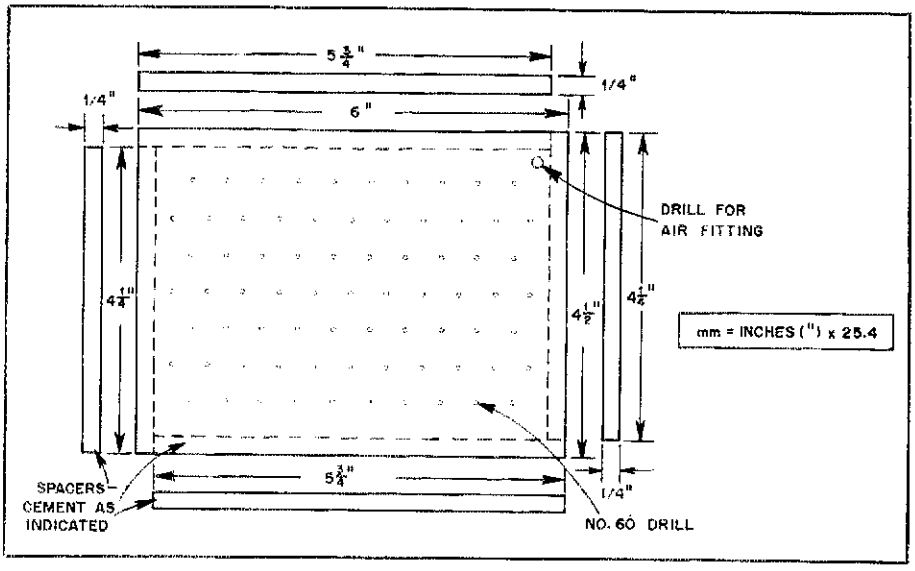


Fig. 4 — Air-manifold construction. This piece is made of 1/8-inch-thick plastic.

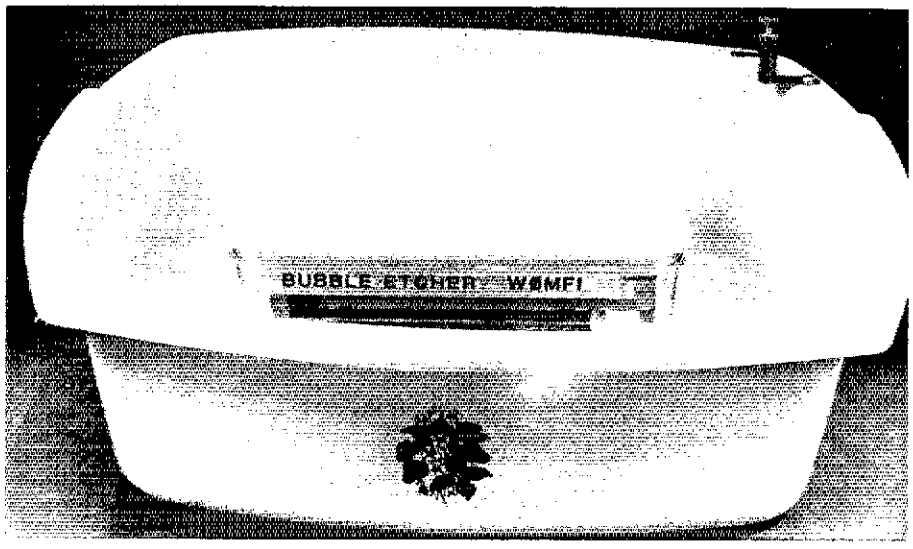
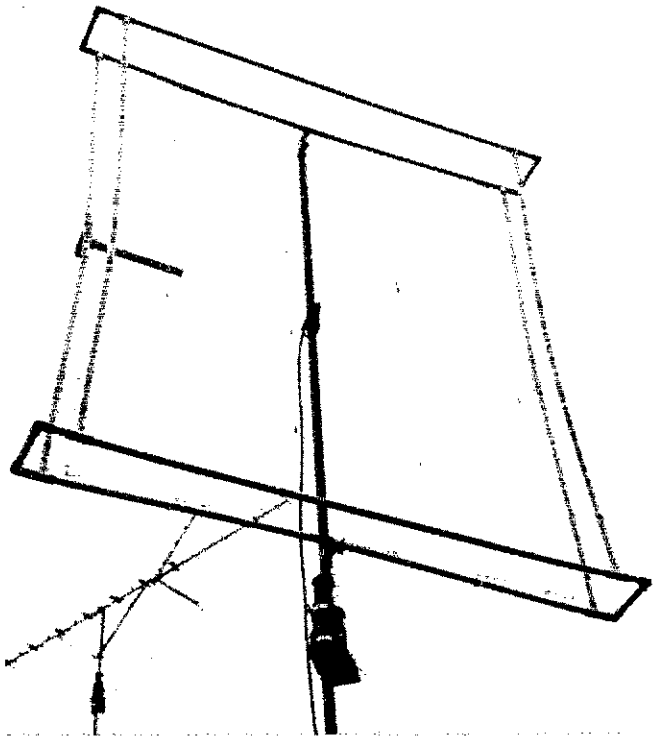


Fig. 5 — The Bubble Etcher at work. Warm water placed in the dishpan raises the etchant temperature. The dishpan also serves to catch any etchant spills.



Meet the Curtain-Quad Antenna

Some VHF and UHF enthusiasts maintain "There's nothing new under the sun," but W1HBQ proves otherwise — at least where full-wavelength loop antennas are concerned.

By J. Ross Anderson,* W1HBQ

Gain and bandwidth can be yours with a 3-wavelength loop as a basic antenna building block. This arrangement is possible as a multielement broadside-array collinear system with a single feed point.

Here's an opportunity for you to participate in the development of a new kind of antenna — the Curtain Quad. It consists of an array of broadside and collinear elements that provide high gain and broad bandwidth with no need for element tuning. Like other quad types of antennas, the radiating elements are connected on the ends by those elements that radiate only a negligible amount of energy. The Curtain Quad differs from other quad antennas in that many elements can be connected together to provide broadside and collinear gain.

Some Basic Configurations

Fig. 1 shows the basic types of quad antennas. A 1-wavelength loop forms the basis of the cubical quad, as illustrated at Fig. 1A. A 2-wavelength loop (X-Q quad) is shown at Fig. 1B. The 3-wavelength loop at Fig. 1C represents the fundamental building block for the Curtain Quad. The current reverses every half cycle, as indicated by the arrows. The illustrations show the 1- and 3-wavelength loops being fed at a current maximum. The opposite is true of the 2-wavelength loop, which is fed at a voltage maximum (current minimum). Each antenna type has one thing in common: The horizontal elements have their currents in phase. This causes broadside gain. The vertical elements have out-of-phase currents; therefore, they do not radiate appreciably. The vertical elements carry power to the horizontal elements.

Multielement Loop Arrays

A big advantage is common to the Curtain Quad: Additional elements can be connected to the low-current points of the antenna. In principle, this permits us to build very large arrays. Fig. 2 shows how the basic building blocks may be assembled to provide large high-gain systems. Fig. 2A (identical to Fig. 1C) depicts the basic building block. Since this antenna has two horizontal ½-wavelength elements in phase, it can be considered a two-element array. For your convenience you may consider the polarization of this antenna and the others discussed in this article as horizontal. Of course, if vertical polarization is desired you may rotate these arrays 90 degrees.

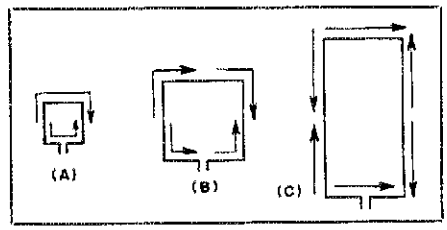


Fig. 1 — The three basic quad loops. At A is the 1-wavelength loop, the basis for the cubical quad. B shows the 2-wavelength loop, the basis for the X-Q Quad. C shows the 3-wavelength loop — the building block for the Curtain Quad. The arrows represent the direction of the current, which reverses every half cycle.

Fig. 2B shows how two of the loops may be connected to form a three-element array. This arrangement might be useful as the driven element of a stacked Yagi type of array, which is similar to the 1-wavelength loop that is used as a quagi driven element.

A seven-element array is shown at Fig.

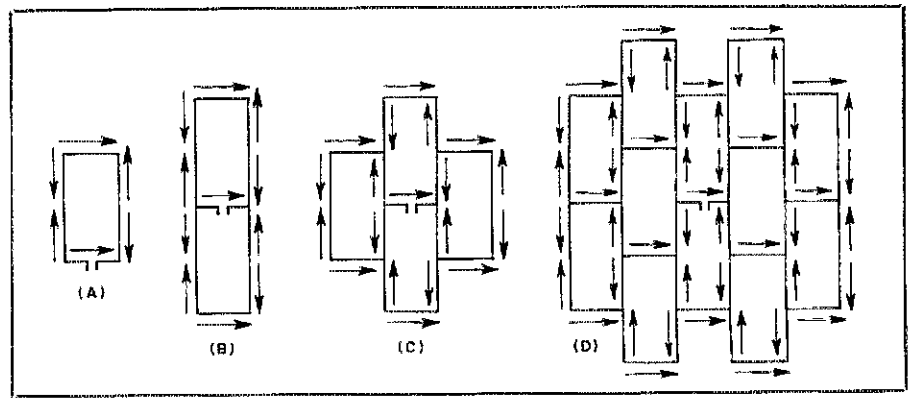


Fig. 2 — Various possible Curtain Quad arrays. A shows the basic building block, and can be considered a two-element array. B shows how two of the loops can be combined to make a three-element array. At C is a seven-element array. D shows how a 17-element array may be constructed.

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2C. This method provides both broadside and collinear gain. The former gain results from the vertically stacked horizontal elements. Collinear gain comes from the horizontally stacked horizontal elements. We will discuss construction and performance of a 435-MHz version of this antenna later in the text.

Fig. 2D illustrates how a 17-element curtain may be constructed. The maximum number of elements that can be connected in this way has not been determined. Certain characteristics may tend to limit the number of elements:

1) If the array is too large, the energy will radiate before it can be distributed over the antenna. How well the energy is distributed throughout the antenna will depend on the system Q: The greater the Q the better the distribution, but the smaller the bandwidth will become.

2) The greater the number of elements, the higher the feed impedance. This can be understood by considering the relationship between this antenna and a multiwire folded dipole (Fig. 3): The greater the number of dipole wires, the higher the impedance. For very large curtain arrays, the impedance may be too high for a convenient match to 50 ohms. The seven-element version has a feed impedance of some 1200 ohms.

Array Gain

The gain of a Curtain Quad will be approximately G = 10 log n, where n is the number of elements, and G is the gain in decibels over a dipole. If we place a reflective screen ¼ wavelength behind the array, our gain formula becomes G = 10 log n + 5.2. A seven-element version with a reflector should yield 13.7 dB of gain in theory. A Curtain Quad that is 10 elements across, and with 200 elements, might provide 28 dB of gain if the current were distributed uniformly throughout the antenna.

An important additional point to consider is that the physical length of any quad element is greater than the free-space length. This length increase depends on a number of factors, such as operating frequency and loop circumference-to-conductor diameter ratio.[1] I found that the individual Curtain Quad elements had to be increased by about 10% over those calculated from the *Antenna Book* equations.

Construction Details

I built an experimental antenna for 435 MHz with PVC pipe as the support material. There were two structures made from ½-inch-diameter Schedule 40 PVC pipe.[2] They were 66 × 81 inches and were spaced 7 inches apart. The supports could, of course, have been made from aluminum, wood or fiberglass.

Fig. 4 shows the construction method for the array. After one 66- × 81-inch section is assembled, lay a grid of nylon cord, spaced 15 inches apart, in both directions. Where the cords cross one another, bond them together with a drop of PVC cement. This grid provides a framework on which to build the array.

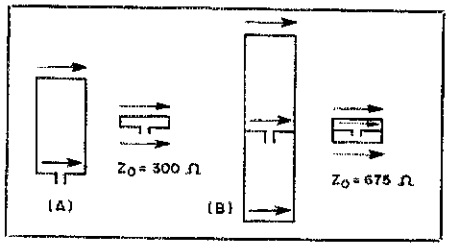


Fig. 3 — At A is shown that a two-element Curtain Quad has a current distribution similar to that of a folded dipole, and thus will have an impedance similar to it. At B, the similarity between a three-element Curtain Quad and a three-wire dipole is shown. The impedances shown are for the dipoles; the impedances of the corresponding Curtain Quads will not be as high for the dipoles.

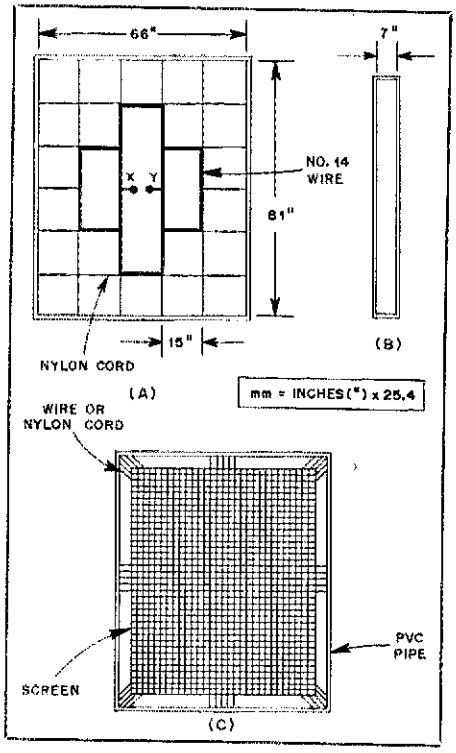


Fig. 4 — Front (A), side (B) and back (C) views of a seven-element Curtain Quad with reflecting screen for 435 MHz. The supporting structures will deform slightly from rectangular as the nylon cord is pulled tight.

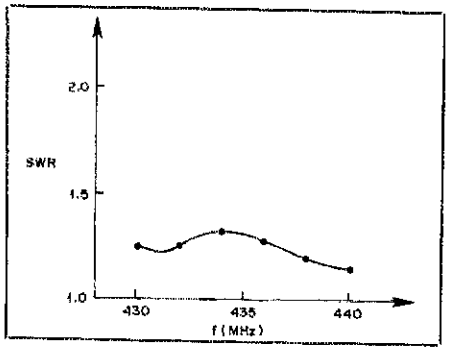


Fig. 5 — SWR of the antenna shown in Fig. 4 and described in the text.

Next, assemble the array while using no. 14 copper wire. Secure the antenna to the grid by means of tape or more nylon cord. The horizontal elements are 15 inches long and the vertical ones are 30 inches in length.

Now, stretch a 60- × 75-inch reflecting screen inside the remaining PVC frame. I used aluminum window screen for the reflector. A screen with wider mesh, such as chicken wire, will present less wind resistance. It will work fine provided the openings do not exceed approximately 0.06 wavelength. Make sure the screen is flexible enough to be stretched flat by the supporting framework.

The driven array and reflector are secured ¼ wavelength apart (roughly 7 inches at 435 MHz) by using short sections of PVC pipe. The 50-ohm feed line is connected to the antenna through a coaxial balun and ¼-wavelength transformer. The transformer is made from two pieces of no. 18 wire that are spaced 1.5 inches apart.

Performance Data

The antenna should work satisfactorily without any need for adjustment. But, if an SWR meter is available, the spacing of the ¼-wavelength transformer can be adjusted for the lowest SWR. Fig. 5 shows the SWR versus frequency for the antenna as measured through a 22-foot length of foam-insulated RG-8/U cable. The E-plane 3-dB beamwidth is approximately 40 degrees, while the 3-dB H-plane beamwidth is on the order of 30 degrees. Array gain can be calculated by

$$G(dB) = 10 \log (41{,}213/\theta_E\theta_H) - 2.14 \quad \text{(Eq. 1)}$$

where

θ_E is the E-plane beamwidth
θ_H is the H-plane beamwidth.

The Curtain Quad gain, determined by Eq. 1, is 13.2 dB, close to the 13.7 dB estimated earlier in this article.[3]

Future development of this antenna depends on you, the antenna designer. One possibility is a parasitic array of Curtain Quad elements. It seems likely that the spacing between elements in such an array will be on the order of wavelengths rather than fractions of a wavelength, as in a Yagi system. I am sure you can think of other approaches to try. Good luck and successful designing!

Notes

[1] G. Hall, ed., *The ARRL Antenna Book* (Newington: ARRL, 1982).

[2] mm = in × 25.4; m = ft × 0.3048.

[3] [The gain figures stated in this article have not been proven on an antenna test range, nor have they been verified by the ARRL. Bear in mind that the numbers given are theoretical. — Ed.]

Ross Anderson was first licensed in 1956. He received his BS degree in 1963, his MS degree in 1969 and his PhD from Stanford in 1976, all in electrical engineering. His professional career has been in the field of microwave research, working for various laboratories. He is presently on the staff of Avantek, where he is working with gallium-arsenide FETs. Ross's primary amateur interest is in antennas — especially quad types of antennas. He first thought about a planar array of quads in 1959, but a practical design was not completed until recently.

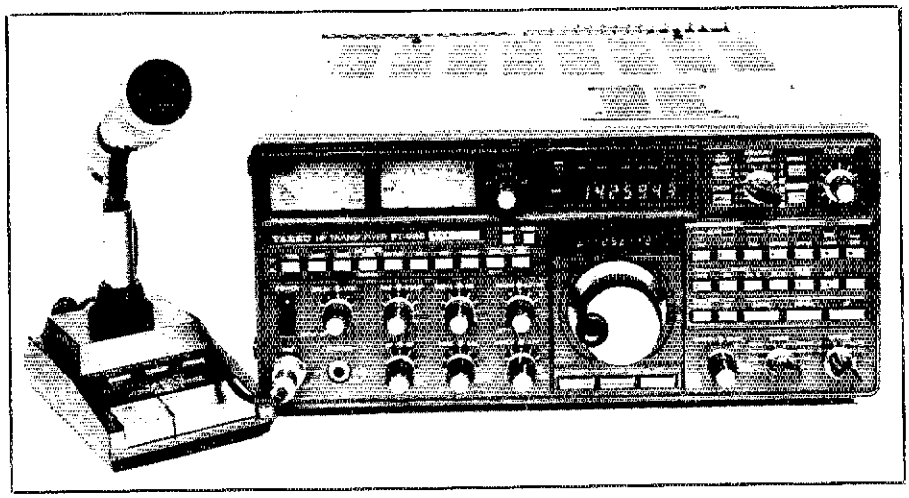
Product Review

Conducted By Paul K. Pagel,* N1FB

Yaesu FT-980 HF Transceiver

In 1983, Amateur Radio saw the birth of a new category of transceivers: the "big rigs." These rigs cover the seven currently available HF bands and the 17- and 12-meter WARC bands. They usually have a couple of VFOs; several frequency memories; a general-coverage receiver; dozens of knobs, buttons and connectors; and an on-board microprocessor to keep track of all of the "bells and whistles." The FT-980, Yaesu's entry in this category, goes one step further, offering the ability to control all of the frequency-related functions from an external computer.

With 60 front-panel controls and about 25 rear-skirt controls and connectors (Table 1), the FT-980 is a lot more complex and flexible than the TS-520S that I'm used to. However, I quickly learned enough to operate the rig. After a dozen contacts, I was able to use many of the advanced features of the '980 to great advantage.



Frequency Control

The FT-980 has two VFOs. One is the HAM VFO, which is used to transmit and receive within the existing and proposed ham bands. The other VFO is the general (GEN) VFO, a receive-only VFO used for 150-kHz to 30-MHz coverage. While this is straightforward, the novice '980 operator might be confused by the number of ways the rig can be tuned.

Three momentary-contact push buttons (DOWN, REPEAT and UP) comprise the BAND switch. When tuning the HAM VFO, these buttons move the VFO up or down into the next amateur band. When tuning the GEN VFO, each touch of the button moves the frequency up or down 500 kHz. Simultaneously pressing the REPEAT button and one of the other buttons causes the selected action to repeat about six times per second.

That's the simple part. After band selection, there are no fewer than six ways to change operating frequency: the main tuning dial, the DOWN-FAST-UP buttons, the 5-kHz DOWN and UP buttons, the keyboard and the MEMORY-select knob.

The main tuning dial has a knurled rubber sleeve around it, and a "speed knob" for fast tuning. The dial has a nice feel, although some operators might want it to be heavier. The VFO tunes in 10-Hz steps, and the tuning rate is a constant 10 kHz per dial revolution.

Immediately below the tuning dial (and on the base of the MD-1 microphone) are the DOWN-FAST-UP buttons. Holding just the DOWN or the UP button changes the VFO frequency at 300 Hz/s. Holding either of the buttons and the FAST button tunes at 30 kHz/s. Although these tuning rates are adequate for scanning through the band, it is usually necessary to use the main dial for final frequency adjustments.

The 5 kHz DOWN and UP buttons are used to tune in 5-kHz steps. Either of these buttons can also be used with the REPEAT button from the band switch for fast scanning.

Table 1
FT-980 Front- and Rear-Panel Controls and Connections

Front Panel

MOX
Automatic MIC gain control (on/off)
PROCESSOR (on/off)
ALC METER (peak HOLD/NORMAL)
CW CALIBRATE tone (on/off)
NOISE BLANKER (on/off)
AUDIO PEAK FILTER (on/off)
IF NOTCH (on/off)
AGC FAST/SLOW
AGC (on/off)
DISPLAY DIMMER (on/off)
FREQUENCY LOCK (on/off)
POWER
VOX gain
VOX DELAY (and BREAK-IN)
COMPRESSION
MIC gain
NOISE BLANKING time constant
DRIVE level
KEYER speed (for optional keyer)
IF MONITOR level
MIC connector
HEADPHONES connector
RF gain
AF gain
SQUELCH
AF TONE
AUDIO PEAK FILTER frequency
IF NOTCH frequency
IF SHIFT
IF WIDTH
MODE selection
ATTENUATOR selection
DOWN-FAST-UP freq. control
MEMORY CHANNEL selection
memory SHIFT
memory CHECK
memory WRITE 1
memory WRITE 2
Least significant digit blanking
VHF/UHF display selector (for outboard transverters)
SWR FORWARD SET adjustment

Keypad Area

CLARIFIER TX and RX
TAB SET (ON LOWER UPPER)
VFO selection HAM and GEN
frequency control SELECT
  VFO
  memory
  VFO receive
  memory receive
OFFSET FREQUENCY display (on/off)
KEY/ENTRY
clear ENTRY
5 kHz (DOWN UP)
BAND (DOWN REPEAT UP)

Rear Skirt

ANTENNA jack
KEY (MANUAL AUTO) jacks
ground lug
LINEAR AMPLIFIER (QSK or not)
keyboard TONE (on/off)
MARKER generator (on/off)
EXTERNAL receiver jack
EXTERNAL receiver switch
SEPERATE ANTENNA jack
FSK jack
RF OUT jack (for transverters)
PTT jack
AF OUT jack
IF OUT jack
PATCH IN jack
EXTERNAL speaker jack
computer control jack
ACCESSORY jack (1) (CPU I/O)
ACCESSORY jack (2) (Linear amplifier)
EXTERNAL control jack (CAT)
FSK SHIFT (170, 425, 850-Hz)
CW PITCH (500, 600, 700-Hz)
VOX ANTI-TRIP adjustment
AC line cord plug
LINE FUSE holder

*Assistant Technical Editor

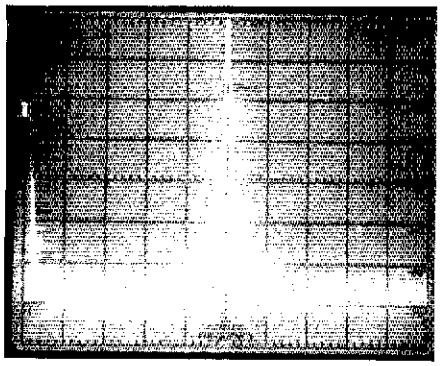


Fig. 1 — Worst-case spectral display of the FT-980. Vertical divisions are each 10 dB; horizontal divisions are each 5 MHz. Output power is approximately 100 W at 24 MHz. All spurious emissions and harmonics are at least 56 dB below peak fundamental output. The FT-980 complies with current FCC specifications for spectral purity.

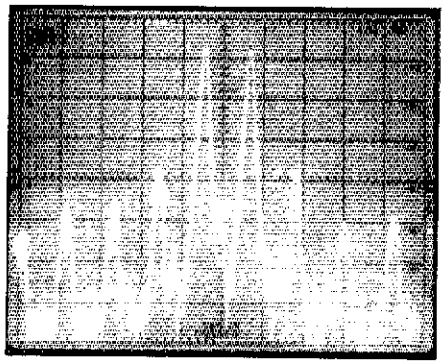
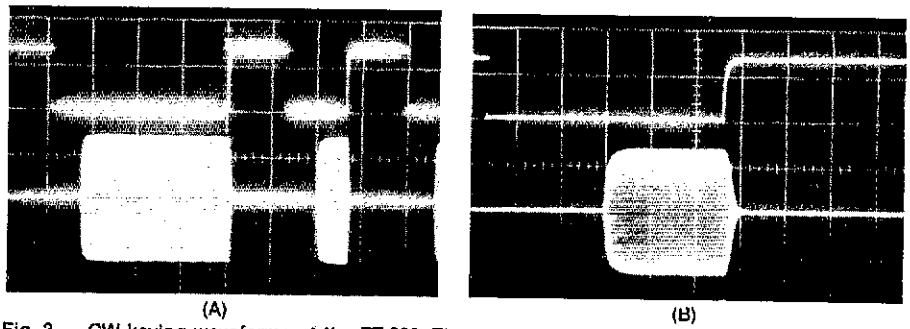


Fig. 2 — Spectral display of the FT-980 output during two-tone IMD test. Third-order products are 37 dB below PEP, and fifth-order products are 45 dB down. Vertical divisions are each 10 dB; horizontal divisions are each 1 kHz. The transceiver was being operated in the 20-meter band.



(A) (B)

Fig. 3 — CW keying waveforms of the FT-980. The upper trace is the actual key closure; the lower trace is the RF envelope. At A, each horizontal division is 20 ms. For this photo, the transceiver was being operated in QSK mode. The output waveforms for QSK and semi-break-in are identical; there is no noticeable change in weighting. At B, each horizontal division is 5 ms. There is an approximate 15-ms delay between key down and the generation of RF; the output pulse is also shortened by the same amount.

Perhaps the nicest way to change frequency on the '980 is via the front-panel keypad. To do this, you press the ENT key, enter the frequency you want, and then press the ENT key again. When you QSY a few kilohertz, you don't have to enter the entire new frequency; simply use the right arrow key to go over the digits that are to remain the same, and change only those digits that have to change. There is also a left-arrow key for backing up to fix entry errors. If you use the keyboard to enter frequency, you do not need to use the band switches to change bands. Selecting your favorite net frequency, or a frequency from which you want to "look around the band," is as easy as entering a number on a calculator. No more wearing out your wrist getting from one portion of the band to another.

The '980 has 12 memories that store operating frequency, mode and VFO. To store the displayed frequency in one of the first eight memory channels, simply press the WRITE 1 button. To store in memories 9 through 12, both the WRITE 1 and the WRITE 2 buttons must be pressed. To operate from a memory frequency, select the correct memory channel with the MEMORY CHANNEL knob, and then press the MR button (in the keyboard area). The CHECK button allows you to check the contents of a memory without affecting your operating frequency. The SHIFT button allows you to tune off of the selected memory frequency without affecting memory contents. Traffic handlers, DX chasers and contesters will love this generous allocation of memories.

Instead of the common RIT/XIT knob, the FT-980 uses the main tuning dial for these functions. Pressing the TX CLAR button turns the main dial into an RIT knob, and has a similar effect for XIT; RIT and XIT excursion is ±10 kHz.

If you work a lot of DX or 10-meter FM, or have some other need for split-frequency operation, the '980 has several split-frequency modes. Aside from the RIT and XIT, you can receive on a memory frequency and transmit on a VFO frequency, or vice versa. When receiving, the receive frequency is displayed. When transmitting, the transmit frequency is displayed. Or, you can press the OFFSET FREQ button and display the difference between the receive and transmit frequencies. Unfortunately, if you are trying to move your transmit frequency some known distance from your receive frequency, the OFFSET FREQ display is of little help, since it will be updated only when you transmit. Those who operate split frequency should also remember that they can't transmit using the GEN VFO, or memory channels saved from the GEN VFO.

It may seem that the '980 has more ways to change frequency than anyone could ever remember, let alone use. Every operator will have some preferred mode of operation, and use only those controls needed. For the demanding operator, there are no tuning abilities missing.

The FT-980 has a blue digital display, with 10-Hz resolution. The operator can suppress the 10-Hz digit by pressing a couple of buttons. The '980 also has a "synthesized analog display." This display is difficult to describe and almost as difficult to read. It's hard to understand why it was added to the rig.

The Receiver

The '980 receiver section is truly state of the art. It is blessed with versatile RF, IF and AF sections, but is also cursed with digital noise.

Audio

The review '980 is equipped with the optional SP-980 speaker. The SP-980 has an audio filter with three choices of low-frequency cutoff and four choices of high-frequency cutoff. This filter makes it easy to tailor the audio to your tastes. The speaker can handle audio from two sources, using a front-panel switch to select the active source. With its headphone jack and rear skirt auxiliary output, the SP-980 is a useful station accessory.

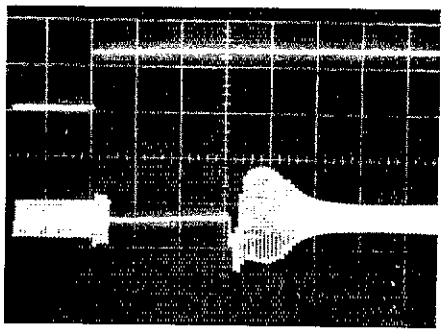


Fig. 4 — FT-980 receiver recovery time. The upper trace shows the key opening; the lower trace shows receiver audio output. Horizontal divisions are each 5 ms. There is an approximate 18-ms delay before receiver recovery. (See the sidebar for a further discussion of receiver recovery time.)

The FT-980 transceiver has a well-designed audio section. The TONE control, which used to be standard on general-coverage receivers, has been restored on the '980. Yaesu also added an effective audio peak filter (APF) to the rig. This filter is activated and tuned from the front panel. It provides a noticeable increase in selectivity when used in the CW mode, and can be used to greatly enhance the performance of an external CW demodulator.

IF

The FT-980 also has several well-thought-out IF controls. Concentric with the APF control is an IF NOTCH control. The notch, which can be turned on and off with the NOTCH button, tunes from 500 to 2700 Hz (when demodulated). This notch is useful for eliminating heterodynes when listening to broadcast stations on shortwave bands or when trying not to listen to broadcast stations on the 40-meter band. The '980 also includes the now-common IF WIDTH and SHIFT controls, and a noise blanker for "woodpecker"-type noise.

Pleasant surprises are in store for the CW operator: a way to zero-beat received stations and a way to change the CW receiver offset. For zero-beating, the transceiver will produce a tone at a frequency equal to the offset between the transmitter and receiver. When the incoming CW note matches this tone, the FT-980 transmitter will be on the same frequency as the station being received. A switch on the rear skirt allows the

Some Thoughts on Transceiver Turnaround Time

In this FT-980 product review, you will notice that we have measured "transceiver turnaround time." With many amateurs using AMTOR and experimenting with packet radio, the time that it takes a rig to switch from receive to transmit and from transmit to receive is becoming important. The AMTOR specification leaves only 170 ms for a block of characters to be acknowledged by the receiving station. In this time, the transmitting station, among other things, must switch to receive and the receiving station must switch to transmit. These switching times often limit the distance over which two AMTOR stations can operate. Whenever possible, we will publish turnaround statistics for radios reviewed.

Transmitter turn-on time can be read directly from the CW waveform figure. It is the time between key closure and full RF output.

Receiver recovery time is measured by injecting a signal into the receiver antenna jack and keying the transmitter on and off via the PTT line. The recovery time is the time between when the transmitter is turned off (the PTT is unkeyed) and receiver audio comes back up to nearly 100%.

What are "good" transceiver turnaround characteristics? Obviously, if it takes 170 ms for your rig to generate RF, you cannot use it for AMTOR. If you want to figure it out, the longest path length that can be used on AMTOR is equal to ([0.170 − turn-on time]/2) × speed of light. [Path length is not the great-circle distance between the two stations, but the distance that the RF wave travels from one station to the ionosphere and back down to the other station. The path length is always greater than the great-circle distance between the two stations. — Ed.] Your receiver recovery time limits the closest stations you can work. Your receiver must recover within twice the propagation delay plus the other station's transmitter turn-on time.

Transceiver manufacturers have not had to worry about these performance characteristics of their radios before, so many radios now on the market do not switch quickly. Now that manufacturers are aware of the requirements for transceiver turnaround, we should notice some improvement in newer models.

Yaesu FT-980 HF Transceiver, serial no. 040313

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Frequency coverage: Receive — 150 kHz to 29.9999 MHz; Transmit — 1.5-1.99999, 3.5-3.99999, 7.0-7.49999, 10.0-10.49999, 14.0-14.49999, 18.0-18.49999, 21.0-21.49999, 24.5-24.99999, 28.0-29.99999 MHz.	As specified. As specified.
Modes of operation: CW, FM, SSB, AM, FSK.	As specified.
kHz/turn of knob: Not specified.	10.
S meter sensitivity (μV for S9 reading): Not specified.	160 m, 69; 80 m, 57; 40 m, 63; 30 m, 86; 20 m, 55; 17 m, 55; 15 m, 55; 12 m, 55; 10 m, 80.
Transmitter power output: 100 W — SSB, CW; 25 W — AM; 50 W — FM, FSK.	Power output: 160 m, 110 W; 80 m, 115 W; 40 m, 110 W; 30 m, 110 W; 20 m, 115 W; 17 m, 120 W; 15 m, 120 W; 12 m, 125 W; 10 m, 110 W.
Harmonic suppression: Better than 50 dB.	56 dB (see Fig. 1).
Third-order IMD: Better than −40 dB.	−37 dB (see Fig. 2).
Receiver sensitivity: (2-30 MHz) less than 0.25 μV for 10 dB S+N/N.	Receiver dynamics measured with optional 600-Hz CW filter installed.

	80 m	*20 m*
Noise floor	−137 dBm	−138 dBm
Blocking DR	Noise limited	Noise limited
IMD DR	Noise limited	Noise limited
Third-order intercept	Noise limited	Noise limited

IMD measurements were attempted at 20, 30 and 50-kHz signal spacing, but could not be made because of synthesizer noise.

Size (HWD): 6.2 × 13.8 × 14.6 in (157 × 350 × 370 mm).
Weight: 7.7 lb (37 kg).

selection of 500, 600 or 700-Hz CW offset. Changing the offset actually recenters the IF passband, changing the sidetone and the CW CAL note. The range of sidetones should be fine for most operators. Unfortunately, some CW demodulators need a higher tone.

RF

The receiver has two dual-FET RF amplifiers — one for the GEN VFO, and one for the HAM VFO. While general-coverage signals are passed only through a low-pass filter, the ham-band signals are subjected to both low-pass and high-pass filtering, resulting in better image rejection. As well as the usual RF gain control, the '980 has selectable 10, 20 and 30-dB RF attenuators.

Receive Problems

It is unfortunate that the digital technology that makes some of the aforementioned receiver flexibility possible also creates some receiver weaknesses. Phase-locked loops and digital control signals generate RF noise, and there is plenty of this noise to be heard in the FT-980 receiver. Lab measurements of the receiver dynamic range were limited by phase noise, and operation on 80 meters (with at least one FT-980) was disturbed by noise from the digital display.

Will this noise bother you in normal operation? That depends on what you call "normal." For casual operation (which includes much of my operating), the receiver is fine — the added IF and AF controls are outstanding. In demanding applications, such as contesting or weak-signal DXing, the receiver weaknesses will begin to show. During contests and in crowded shortwave broadcast bands, strong signals in the receiver passband will mix with PLL noise and degrade reception of nearby signals. When you're searching the bands for weak DX stations, it is hard enough dealing with external QRM and QRN without having to contend with unwanted signals generated within the receiver. Designing the perfect digitally synthesized receiver is no small task.

The Transmitter

The '980 has a solid-state, no-tune transmitter. It is rated at 100-W PEP output for CW and SSB, 50 W on FSK and FM, and 25 W on AM. The transmitter will operate only within the ham bands; in fact, the transmitter will operate only on frequencies derived from the HAM VFO. Even if you are within the ham bands, you can't transmit using the GEN VFO or memory frequencies stored from that VFO.

The transmitter power will be automatically reduced if the SWR goes above 3:1. The SWR shutoff circuit does not seem to be oversensitive, as some of the circuits in earlier no-tune rigs were.

The Fan

When the transceiver temperature rises above some (unspecified) threshold, a fan comes on to cool the final amplifier section. The fan is quiet, but not so quiet that you can't tell that it's on. Unfortunately, the fan often comes on when you are only receiving. Perhaps the temperature threshold could have been higher.

SSB Operation

Since the fan does make some noise, it is good that Yaesu included an "automatic mic-gain control" (AMGC) for use during SSB transmission. Signals from the microphone that are below the AMGC threshold will not be amplified. Thus, background noises (like the fan noise) will not be transmitted. The AMGC can (and must) be defeated for AFSK transmission.

The '980 also has an RF speech processor for SSB operation. On-the-air reports indicate that the processor, when correctly adjusted, produces intelligible signals and provides some increased copy on marginal paths. For adjusting the processor, one of the '980 meters can be switched to read RF compression (in decibels) and the IF monitor can be used to listen to the processed signal.

Other Modes

Non-SSB operators are not neglected by the designers of the FT-980. The rig has full QSK for CW ops, and direct FSK (with 170, 425 or 850-Hz shift) for RTTY operators.

Metering

The transceiver has two meters. One of them can be switched to read final-amplifier voltage or current, processor compression (dB), power out (W), FM discriminator (zero center) or relative forward power. The second meter is used as an S meter, an ALC meter (with selectable peak-reading ability) or an SWR meter.

The CAT System

One reason I was excited by the prospect of reviewing the FT-980 is that it is the first of Yaesu's CAT System radios. The CAT System is a series of Computer-Aided Transceivers to be offered by Yaesu. The CAT rigs, with appropriate interfaces and software, can be controlled by an external computer. For my Apple II+, the interface and software come as the Yaesu FIF-65. Interfaces for other computers should be supplied soon.

Hooking up the FIF-65 is easy. The interface card plugs into an Apple II peripheral card slot, and a cable connects the interface to a socket in the back of the FT-980. The software disk does not contain Apple's disk operating system (DOS). A disk containing DOS must be loaded before the Yaesu CAT program can be run. When you run the program, you are greeted by some animated graphics, and then you can get down to business.

What can you do with this CAT now that you have brought it into the shack? From your computer keyboard you can control selection of frequency, VFO, mode, split-frequency operation, RIT/XIT, memory channels (loading, recalling, scanning, shifting), IF shift and width, and FSK shift. You can also put the rig into a few interesting scanning modes. There's a "programmable memory scan," which scans between any two memory channels. The '980 scans in 10-Hz, 100-Hz or 5-kHz increments, up or down. In addition, you can perform TR switching. Each of these functions is controlled by a three-character command, and the current status of the FT-980 is displayed on your computer screen, updated as necessary.

The software is not easy to use. The three-letter commands are hard to remember. The computer's memory and versatility are not tapped, and all I have is the radio front panel duplicated by my computer keyboard and monitor. Also, my computer can't be used simultaneously to send and receive RTTY, which is usually what I want to do when I'm on the air.

I think that computer control is useful, but I don't think this software takes advantage of the potential of computer control. Yaesu did include enough information in the FIF-65 manual to write some interesting and useful software. Perhaps they are waiting for someone else to write it.

Aside from possessing more of that elusive quality "user friendliness," what should CAT software do? It should take advantage of the computer! Why should the computer be tied to scanning at a fixed rate between two memory channels? It could be switching between several frequencies (say a few DX pile-ups), waiting a few seconds on each one (maybe a bit longer on that rare one), and then moving on. This is possible, just not implemented.

All of which is not to say that I found the CAT system useless or boring. Being able to see the RIT/XIT and the IF shift and width right on the screen is great. Having all of the radio data and control accessible at one receptacle on the back of the rig made me think of remote control, remote bases and message systems that could be commanded to move to a quiet frequency or a better band. The applications of the CAT system are limited only by your programming skill and your imagination.

There is one bug to watch out for. If you turn off your computer without explicitly returning control to the transceiver, your FT-980 will not respond to its front-panel controls — even if you turn it off and back on. You must turn on your computer, load the program and issue the "REM 2" command.

Conclusions

As one of the "big rigs," the FT-980 is a great transceiver. It is versatile and convenient to operate, and has features that will appeal to SSB and CW operators. The rig's only weakness is the receiver, which did not rise above the digital noise that dominates most of the available synthesized receivers.

For most operators, the CAT system is a novelty. For those interested in remote bases and other remote-control applications, it's great. When there is one program that will control the rig, keep the log and operate RTTY, the CAT system will really purr. — *Jeff Ward, K8KA*

MAXCOM ANTENNA MATCHER AND DIPOLE CABLE KIT

☐ Wouldn't you like to have an antenna-matching unit that automatically matches your dipole or long-wire antenna to 50 ohms with an extremely low SWR over several HF amateur bands? Imagine the convenience of flipping the band switch and merely tuning the rig into the antenna for any HF band! Let's include the 1.8- and 50-MHz bands as well, just for good measure, okay?

Sure you would like to own such a unit! Probably what comes immediately to your mind is some kind of elaborate mechanical tuner with servo mechanisms and sophisticated control circuits. We've all heard that such units exist (they are actually used in military communications) and we've read articles from time to time about home-constructed automatic motor-driven matching units for various antenna installations.

The Maxcom High Speed Automatic Antenna Matcher is marketed as a very broadband matching device with all these capabilities, and it uses *no moving parts*. The manufacturer claims that it offers an SWR of less than 1.5:1 over the frequency range from 0.3 to 70 MHz. This applies when the device is used with a dipole of any length greater than 70 ft, including drooping dipole (inverted V) arrangements, or any "long wire" greater than 35 ft in length.[1] And what's more, the matcher insertion losses are 2.8 dB or less from 1.5 MHz upward in frequency, according to the specifications.

That sounds too good to be true, doesn't it? Is this really possible in a small white box that weighs only 2 pounds? You can't tell by removing the cover of the box, for the inner parts are obscured by epoxy filling.

Four versions of the antenna matcher are available: the Maxcom 200, the Maxcom 500, the Maxcom 1000 and the Maxcom 2000. These numbers refer to the maximum PEP ratings in watts for the different versions. The 200, 500 and 1000-W models each weigh 2 pounds and come in aluminum boxes measuring 4¾ × 3¾ × 2¼ inches. The 2000-W model weighs 4 pounds and comes in an enclosure measuring 7½ × ¾ × 2¼ inches.

In November 1983, a Maxcom 200 antenna matcher was submitted to *QST* for advertising examination. Because of the epoxy filling we couldn't examine the inner parts, so we had to resort to external measurements only. These measurements indicated the presence of resistive elements inside the box. To confirm this finding, we had X-rays taken of the unit. Sure enough, three power resistors, along with a toroidal matching transformer, revealed themselves in the X-rays.

Our conclusion then was that the device amounts to a swamping resistance placed directly at the feed point of the antenna. Because that matcher was submitted only for brief examination, it was not put on the air. Instead, it was returned to the would-be advertiser at the conclusion of our tests, and advertising of the product was not accepted.

The Product Review Unit

Wanting an off-the-shelf matcher for the preparation of this review, we arranged for its purchase through an amateur whose name and call are not associated with the ARRL as an elected official or as an employee. We purchased the 200-W model and, to ensure that the device was operated exactly as recommended by the manufacturer, we also purchased the optional dipole cable kit for use with the matcher.

X-rays were also taken of this unit, and the views showed it to contain the same types of components as the first unit received. These X-rays are shown in Fig. 5. Three power resistors are clearly visible inside the enclosure.

A 2000-W version of the matcher was donated to ARRL Hq. after it had been subjected to testing by another purchaser. Fig. 6 is a photograph of this matcher after much of the epoxy filling was removed. Eight power resistors are used in the high-power version, to provide a greater dissipation level. Four of the resistors are 800 ohms in value, and the other four are 80 ohms. These are 50-watt resistors, the same size used in the 200-W version.

Removing the cover of the Maxcom 2000 revealed several components mounted on a circuit board, just beneath the cover. X-rays of this unit taken before the expoxy was removed showed the board to be "floating" inside the enclosure, with no connections to any of the other components. This circuit board is visible at the left in the photo, and is apparently a scrap surplus board; a portion was sliced off to enable a fit inside the enclosure. The board serves no operational purpose in the matcher.

Mechanical Details

The materials used in the manufacture of the Maxcom Matcher are top quality. The enclosure is a sturdy aluminum box with a white enamel finish. The porcelain feed-through insulators are rugged, with heavy nickel plating on the terminals. The SO-239 connector is not an economy item.

Available as an optional extra is a dipole cable kit. Included in the kit are two 50-ft lengths of heavy stainless steel aircraft-type cable, assembled with crimped lugs for connection at one end to the matcher and with porcelain end insulators at the other. This is used as the dipole radiator.

Also included is a 100-ft length of top-quality 50-ohm coaxial cable (foamed dielectric), assembled with PL-259 connectors at each end. These are soldered connectors, not the economy crimp type. In addition, there is 50 ft of braided nylon line for supporting the antenna and a roll of Coax-Seal® for weatherproofing the installation. All are materials for a first-class installation, to be sure.

But How Did It Check Out?

Laboratory measurements with a General Radio 1606-A RF impedance bridge revealed that with the 100-ft length of coax supplied in the dipole cable kit, the SWR was indeed less than 1.4:1 in spot checks of every U.S. amateur band, 1.8 through 30 MHz. However, *these results were obtained with the Maxcom Matcher alone — no antenna attached.* These tests indicated the equivalent swamping resistance of the matcher is approximately 63 ohms at 1.8 MHz, and decreases with frequency to about 31 ohms at 28 MHz. That's just about what you'd expect

[1] m = ft × 0.3048; mm = in × 25.4; kg = pounds/2.2.

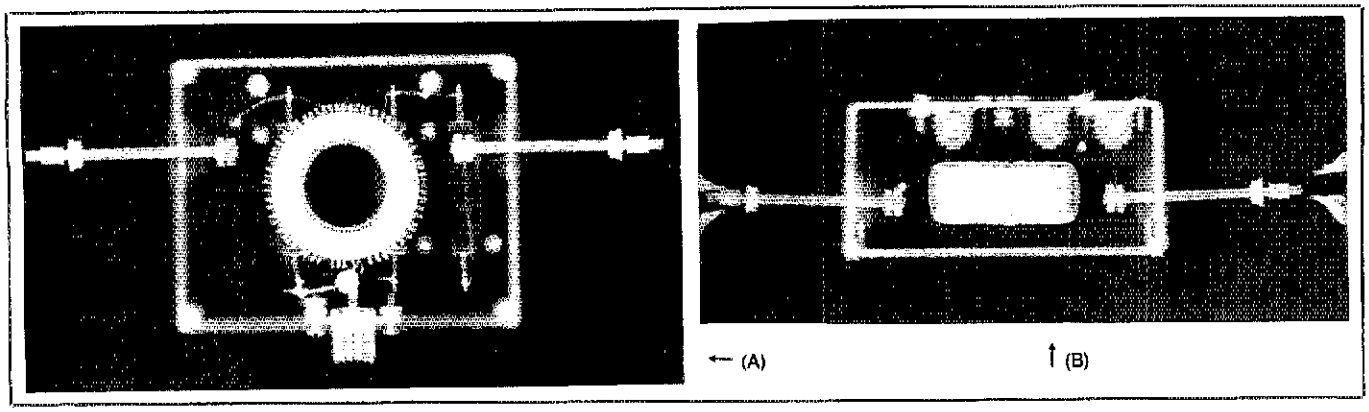


Fig. 5 — At A, an X-ray view from the top of a 200-watt Maxcom Antenna Matcher. A toroidal transformer and its windings are evident in the center, and three power resistors show up faintly in the background. At B, a view from the coaxial-connector end shows an edge-wise look at the toroid. The three power resistors with their cooling fins are evident at the top of the enclosure in this view.

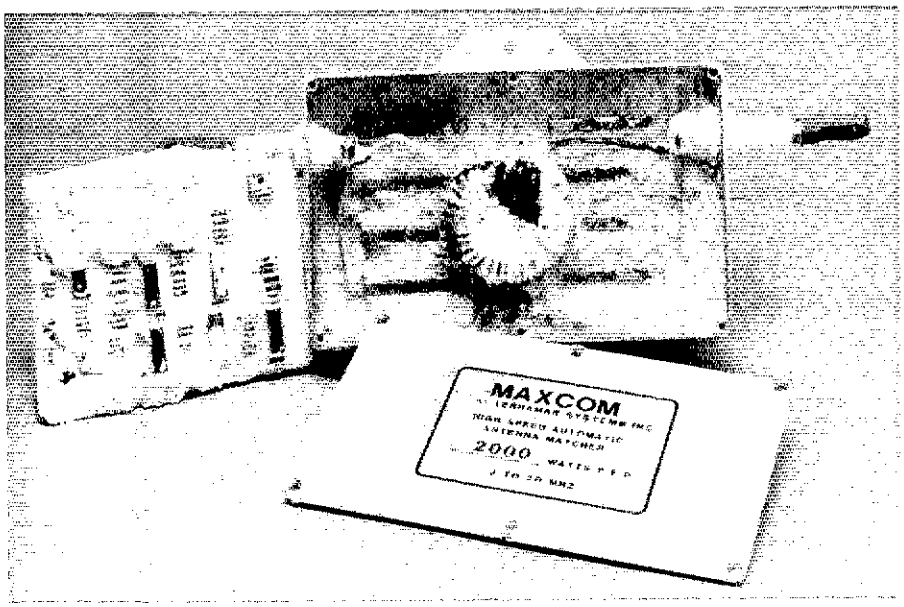


Fig. 6 — A 2000-watt Maxcom Matcher with much of the epoxy filling removed. The circuit board scrap at the left was merely "floating" inside the enclosure, with no operational purpose. Eight 50-watt resistors are used in this high-power model.

from a dummy antenna.

The Maxcom system was installed in a drooping dipole configuration with the center at a height of 50 feet. The ends were 20 feet in the air. The matcher is placed at the feed point of the antenna. As a receiving antenna, the system is not bad ... signals can be heard. During tests the loudest received signal peaked at S9 plus 10 dB on a receiver that is very generous in signal-strength readings. In several hours of operation, contacts were difficult to come by on 75 meters with a 150-watt SSB transmitter. I was unable to make any contacts on higher frequency bands (below 75 meters) during the test period, using the same 150-W transmitter. Bands above 21 MHz were unusable at the time.

How does the Maxcom system compare with other antennas? Antenna experts know that comparative gain tests with a reference antenna are unreliable unless made on an antenna test range, a facility the ARRL does not own. Further, signals propagated via the ionosphere undergo random fading, making comparative tests even less reliable, especially on a short-term basis. As a very rough comparison, however, S-meter indications were that the response of the Maxcom system on reception appeared to average 20 dB or so below that of a small 2-element triband beam on 14 MHz, with differences ranging from 15 to 35 dB at various times. (Comparison numbers will change with different antenna wire lengths on the matcher.)

The Maxcom Automatic Antenna Matcher is manufactured by Magnum Distributing Inc., 1000 S. Dixie Hwy. W. no. 3, Pompano Beach, FL 33060, tel. 305-785-2002. The sole distributer is N & G Distributing Corp., 7201 N.W. 12th St., Miami FL 33126. Price classes: Maxcom 200, $600; Maxcom 500, $800; Maxcom 1000, $900; Maxcom 2000; $1000. The dipole cable kit is offered for an additional $100 with each Maxcom Matcher. — *Jerry Hall, K1TD*

Strays

I would like to get in touch with...

☐ anyone who knows the whereabouts of an indicator for a Calorimetric RF wattmeter, Model 641. Leonard L. Jezorek, W4LC, 20 Celestial Way, Juno Beach, FL 33408.

☐ anyone with a schematic diagram for a Galaxy III, serial no. 51203M1032, and power supply, serial no. 5408N1578. William Peck, 1028 West Ash, Salina, KS 67401.

☐ anyone involved in a technical net. Jordan Hillrich, VE5AGC, 732 Queen St., Regina, SK S4T 4A3, Canada.

☐ anyone with a schematic diagram or manual for an EICO Model 425 oscilloscope. Brett Orr, 255 Cameron Ave., Windsor, ON N9B 1Y5, Canada.

☐ anyone who has information on the alignment procedure for an Allied AX-190 receiver. Graig Hinton, WBØIAH, 2668 N. Riviera Dr., White Bear Lake, MN 55110.

☐ anyone with assembly instructions for a Telrex TB3-H triband beam antenna. Mac McCarthy, WH6ARS, 46 Ohukai St., Kihei, Maui, HI 96753.

☐ anyone having a schematic diagram for a 1914 Grebe Radio, CR-9. Kenneth M. Hout, KA3LEF, RFD 3, Box 514, Everett, PA 15537.

Steven Rich, WA1DFL, of Revere, Massachusetts, gets fellow ham travelers coming and going with his license plate. Pictured are Lynne (left), daughter of photographer VE1GO, and her friend Erin.

Hints and Kinks

Conducted By Larry D. Wolfgang,* WA3VIL

TOROID-COIL-WINDING AIDS

☐ In reading Doug DeMaw's article, "Learning to Work with Toroids," in the March 1984 issue of *QST*, I was especially interested in Fig. 6 on how to wind a toroid using a bobbin to hold the wire. About 15 years ago, I had occasion to wind a transformer to build a 12-V dc to 28-V, 400-Hz converter to power aircraft-type synchronous motors. The amount of wire involved almost filled the hole in a 1½-inch-OD toroid.[1] I used a technique adapted from the mechanical method employed by the General Radio Company to wind their Variac® variable autotransformers. Fig. 1 helps explain the steps involved in this procedure.

Determine the length of wire needed and form it into a coil with a diameter about twice that of the toroid form (Fig. 1A). Tape one loose wire end to the adjoining turn. Then thread the other end through the toroid and tape that end to the adjoining turn (Fig. 1B). Rotate the coil through the toroid until all of the wire goes through the toroid (Fig. 1C). Free one end of the wire, and use a piece of tape to secure it to the core, leaving a long enough piece to make your connection later (Fig. 1D). Now rotate the wire coil so that wire is transferred to a tight winding around the toroid, as shown in Fig. 1E.

Continue this process until the coil is complete. Multilayer windings present no problem. It is easy to wind enough wire to fill the hole in the toroid! — *John Riggin, KE6ZY, Pebble Beach, California*

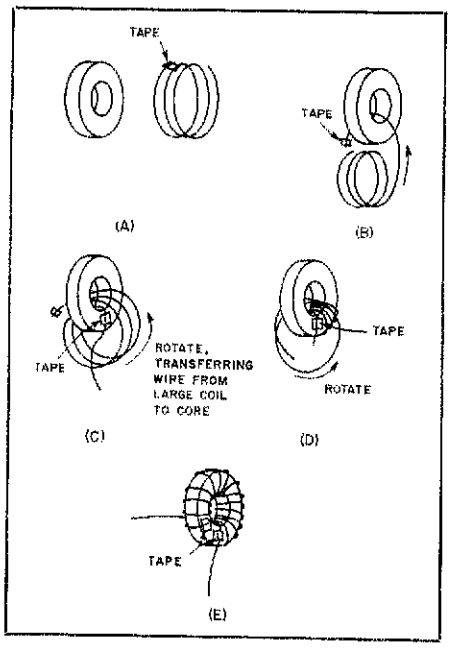


Fig. 1 — Diagram illustrating the steps used by KE6ZY to wind a toroid coil. See text for a complete explanation.

☐ I was winding a toroid for a 160-meter circuit using a shuttle similar to the one shown in *The Radio Amateur's Handbook*.[2] This method turned out to be a disaster for me because the wire slipped off the shuttle too easily. I designed a new shuttle to use for this purpose, and I found it to work much better. Fig. 2 shows the device I made.

Anyone can make a similar shuttle. All it takes is a coffee-can lid or similar plastic cover, a sharp knife or shears, and perhaps a paper punch to make the holes. The dimensions are not critical, as long as the shuttle is narrower than the hole in the toroid you plan to wind. I believe the biggest advantage of this type of shuttle is the way I shaped the "keeper" at the edge of the hole. This holds the wire in place until you are ready to remove another turn from the shuttle. — *Harold Muensterman, N9DEO, Evansville, Indiana*

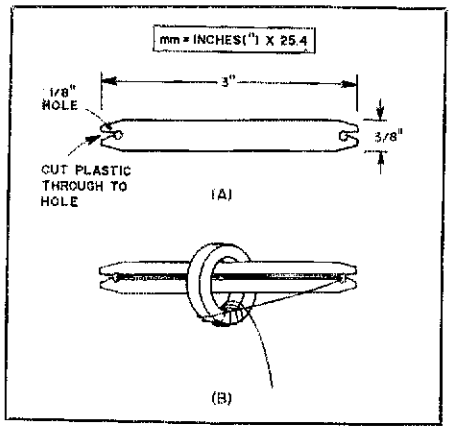


Fig. 2 — A diagram showing the fabrication of a toroid-winding shuttle from a plastic coffee-can lid is shown at A. The use of this shuttle is illustrated at B.

LOCATING CATV INTERFERENCE SOURCES

☐ I have found what I believe to be an effective technique for locating leaks in cable TV systems. The method involves listening for the Doppler shift of the leaking signal as you drive by in your car.

The amount of Doppler shift, in hertz, is simply the number of signal wavelengths that you cross per second. At 40 mi/h (64 km/h), the Doppler shift on 2 meters is about 9 Hz. This is a small frequency change, but remember that you will hear twice this change as you pass the source. The frequency will be 9 Hz higher than transmitted as you approach, and 9 Hz lower when you pass it. I have found this shift to be plainly audible with my mobile SSB rig.

To track down a leak, tune your mobile SSB receiver to the channel E video carrier (145.25 MHz). Switch on the noise blanker if you have one, and adjust the RIT control to provide a low-pitched beat note, just high enough in frequency to be audible. This will make the frequency change easier to detect. When you drive past the leaky tap, the signal strength will peak on the S meter and there will be a sudden change in the beat note. If you pass close by the leak, such as on a pole by the street, the shift will be more rapid and the signal will be stronger than if the leak is farther away, as within a subscriber's house. If there are multiple leaks nearby, there may be an interference pattern that will be a little more confusing. This may take some experience to sort out.

With a little practice, you'll soon find that you can quickly isolate a CATV leak. At that point, you should report your results to the cable company so they can correct the problem. — *Phil Karn, KA9Q, Berkeley Heights, New Jersey*

DIODE-RING PRODUCT DETECTORS

☐ There have been a great number of changes in receiver design in the last few years. I have noticed that one little-changed area is the diode-ring product detector. It is a good design, simple and inexpensive. Most transceivers use an old point-contact diode such as a 1N60 for this task. I began to wonder if there were any newer diode types that would give better performance. The product detector holds an important place in received-signal processing, and a deficiency at this point would drastically affect the overall receiver quality. With this in mind, I began reading and gathering information. I discovered that Schottky diodes might offer some improvement, but no one seemed able to give a clear explanation why.

I decided that some experimentation was in order. So I tried a set of Hewlett-Packard 5082-2835 passivated Schottky diodes in my transceiver. [These diodes are available from Radio Shack, part no. 276-1124. — Ed.] The receiver audio quality improved greatly. Each signal was clearer and much more distinct. Trying to find an explanation for my results, I consulted H-P application note 956-3 for information about these diodes.

I learned that the "corner frequency", or the frequency below which distortion begins to rise, is lower for the passivated diodes than for the point-contact ones. [Passivation is a manufacturing process whereby an oxide layer is formed over the silicon surface. Photographic techniques are used to open a small hole in the oxide, and a metal is deposited in the hole to make a small-area Schottky barrier. — Ed.] Some other hybrid diodes and unpassivated Schottky devices, or "mesh" diodes have an even lower "corner frequency," as shown in Fig. 3. [Mesh diodes are formed by depositing metal onto the semiconductor surface through a screen to form the Schottky barrier. — Ed.] Below a critical fre-

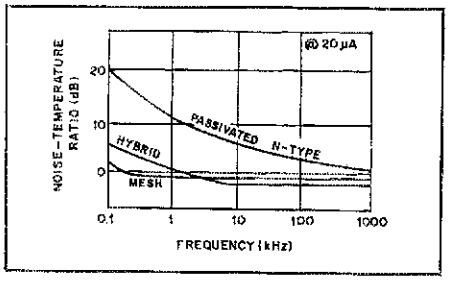


Fig. 3 — Graph showing noise-temperature ratio versus frequency characteristics for several types of Schottky diodes. The noise increases sharply below a certain frequency for each different diode type. The curve for a point-contact type of diode is much higher than the ones shown here.

[1]mm = inches × 25.4.

[2]G. Woodward, C. Hutchinson and P. Rinaldo, Editors, *The Radio Amateur's Handbook*, 61st ed. (ARRL: Newington, 1983) p. 2-31.

*Assistant Technical Editor

quency, noise and distortion increase dramatically. In the audio-frequency range, a point-contact-variety diode contributes to the distortion of a received signal! A normal Schottky diode is quite an improvement, but the mesh type is clearly superior. When I tried a set of H-P 5082-2900 diodes in my TS-830S, I was rewarded with clear, smooth audio from the product detector.

You will have to rebalance the detector after the new diodes have been installed. I am not sure of the procedure required by other rigs, but for my Kenwood TS-830S it was a fairly simple process. Connect an oscilloscope to the primary side of the last IF transformer and adjust the scope to display an incoming signal. Reduce the RF gain to zero and adjust the detector for minimum feed-through signal from the carrier oscillator.

I have used this modification in a number of receivers, and have had excellent success in all cases. The 5082-2900 diodes cost about $3 in single quantities. For a list of authorized distributors, contact: Hewlett-Packard Components, 350 West Trimble Rd., San Jose, CA 95131. — *The Rev. Doug Millar, K6JEY, National City, California*

TV SIGNAL STRENGTH AND TVI

☐ After my neighbor purchased a video cassette recorder (VCR) he began to experience some very strong TVI from my Amateur Radio Station. I contacted the ARRL for assistance, and received some suggestions from Chuck Hutchinson, K8CH. Chuck indicated that many VCRs use diode switching systems, and that it is very difficult to cure interference problems of that type. The fundamental signal is simply overloading the VCR circuitry and causing the interference. Chuck stated that the only solution he knew to be effective was to reduce the level of the transmitted fundamental getting to the VCR.

My neighbor's TV-antenna system consisted of a good antenna, a 300- to 75-ohm balun, 75-ohm coaxial cable feeding the antenna, with another balun and a splitter inside the house. It occurred to me that if reducing the interfering-signal level would help the problem, then it might be true that increasing the desired TV signals could also help! We installed 300-ohm ribbon cable, removing both baluns and the splitter. The received picture was much clearer, but the TVI was still present.

At this point, I contacted my friend Albert Onley, K4VHV. When he came to visit, he mentioned that he remembered hearing that there is a converter in some VCRs that operates around 8 MHz. He also dredged up from memory a simple trap that cured the problem. Albert wound six turns of RG-59/U coaxial cable on a 4½-inch-diameter form, leaving about 4 or 5 inches of cable extended from each end. Next he trimmed a bit of insulation off the cable to bare the shield braid at both coil ends, and then he soldered a 150-pF trimmer capacitor across the braid of the coil. With a 75- to 300-ohm balun on one end and an F connector on the other, we installed this trap between the 300-ohm feed line and the VCR.

The results were all out of proportion to the cost and time involved! Trap tuning did not seem critical. In fact, it may be possible that a coaxial-cable coil would act as an RF choke, doing the job without the tuning capacitor. No more TVI, and no complaints from my neighbor. In fact, he is convinced that I am a genius! The signal strength improved so much by installing the 300-ohm cable that a station 55 miles away now comes in like a local station.[3]

In my opinion, increasing the desired-signal strength to the set did almost as much good as the trap. I have no way to measure the insertion loss of the baluns and splitter, but judging by the improved signal strength, I estimate the total loss of the coaxial cable, two baluns and splitter to be on the order of 6 dB. — *Wally Millard, K4JVT, Camden, North Carolina*

A NOMOGRAPH FOR RELAY-ARC-SUPPRESSION FILTERS

☐ Almost everyone who has worked around electronic equipment has experienced the problem of erratic operation and noise caused by arcing relays. Whenever a relay opens a current-carrying circuit, an arc is created. The arc intensity depends on factors such as circuit voltage and current, type of load and relay speed. When energy released by the arc is induced into electronic circuitry, it causes problems.

To avoid this difficulty, the arc should be suppressed to keep radiated energy to a minimum. One simple way to do this is to connect the series combination of a resistor and a capacitor across the relay contacts. One equation that has been used to calculate the optimum component values is:

$$R = \frac{E}{10\,(3.16\,\sqrt{C})^{(1+50/E)}} \qquad \text{(Eq. 1)}$$

where E is the circuit voltage and R and C are the resistor and capacitor values.

With only one equation and two unknowns, an infinite number of RC combinations are possible. Final selection will depend on such factors as component power levels, voltage ratings and availability. The nomograph shown in Fig. 4A makes it possible to estimate various combinations quickly. This will allow you to evaluate the components in your junk box to see which ones might be used.

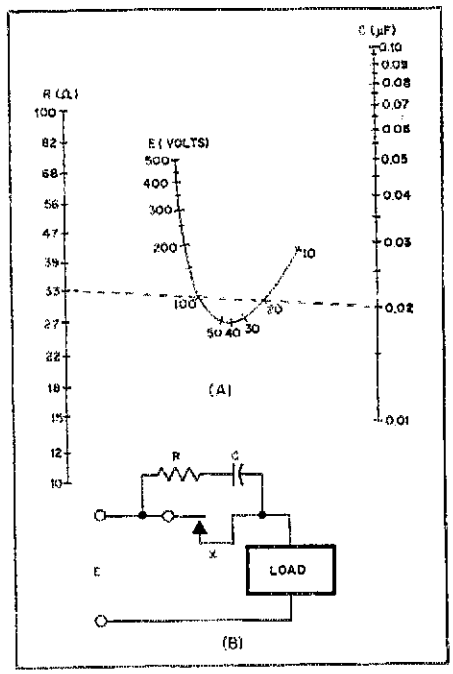


Fig. 4 — A nomograph for estimating the proper RC values for relay-arc-suppression filters is given at A, and an example circuit is shown at B. The dashed line on the nomograph represents one possible solution to the sample problem.

As an example, look at the circuit shown in Fig. 4B. A relay has an open-circuit voltage, E, of 100 V across the contacts. Find the RC combination needed to suppress the arc. The dashed line drawn on Fig. 4A illustrates one solution. A line is drawn through 100 on the E scale to intersect with 33 on the R scale. Now we can see that a 0.02-μF capacitor would be satisfactory. Notice that this same RC combination would be proper for a 20-V circuit as well. If you have a different value capacitor available in a suitable voltage rating, then you could draw another line on the nomograph to correspond with that capacitor. — *James McAlister, WA5EKA, Conway, Arkansas*

[3]km = miles × 1.609

(Continued from page 47)

tank, turn on the air supply and adjust the air-control valve for adequate bubble agitation. Inspect the etching progress after about two minutes. If the solution is fresh and the temperature is correct, the board may be completely etched in 3 to 8 minutes, depending on the thickness of the copper foil laminate. After each use, the etchant should be poured back into its storage container, and the etcher tank should be rinsed with water to prevent sludge buildup in the air manifold. A bubble etcher at work is shown in Fig. 5.

Summary

The bubble etcher works well using a variety of circuit-board materials, from flea-market bargains with unknown specifications to materials purchased from PC-board suppliers. The etcher has been used to prepare single- and double-sided boards with equally good results. The final product is well worth the small cash outlay and construction effort.

Notes

[1]°C = 5/9 (F − 32°); mm = in × 25.4; m = ft × 0.3048; l = qt × 0.946; ml = oz × 29.57; kg/cm² = lb/in² × 0.0703.

[2]H. Levin and G. T. Oppenheimer, "Etching Your Own PC Boards Quickly and Accurately," *Electronics*, July 3, 1972, pp. 105-106.

[3]*Radio Handbook*, 20th ed. (Indianapolis: Editors & Engineers), pp. 33-9 to 33-11.

Jim Stinson has been a ham since 1953. He received his first call, WØQCN, while living in North Dakota. After a stay in California as K6CUO, Jim returned to the Midwest and received his present call in 1965. An Extra Class ticket holder since 1980, Jim is an Assistant Professor in the Technology Department at St. Cloud University and has a Master's degree in industrial arts. His areas of expertise are in graphic arts, and include photographic screen printing, offset lithography, and color and black-and-white photo finishing.

Technical Correspondence

Conducted By
Bob Schetgen,* KU7G

C 64 KEYBOARD MACHINE-LANGUAGE ROUTINE EXPLAINED

☐ The following listing is the machine-language portion of the Commodore 64 CW-keyboard program that appears in the January 1984 *QST* (pp. 13-16) and May 1984 *QST* (p. 45). The listing contains an explanation for each instruction with added notes to help the reader understand how the program functions. A flow chart gives a smooth interpretation that can be followed easily. Flow-chart headings are included in the listing to help you follow the program logic.

The BASIC-language portion of the keyboard program places a speed constant in location 252 and the ASCII value of the character (labeled CHAR in the listing and flow chart) to be sent in location 1019. The program accepts only characters with ASCII values between 44 and 90. Instructions 853 through 859 reject invalid characters and return control to the BASIC program.

Morse code is based on certain time relationships between the various code elements. The length of a dot or dash and spaces between elements, characters or words all have specific proportions. In this program, all timing is done by

*Technical Editorial Assistant

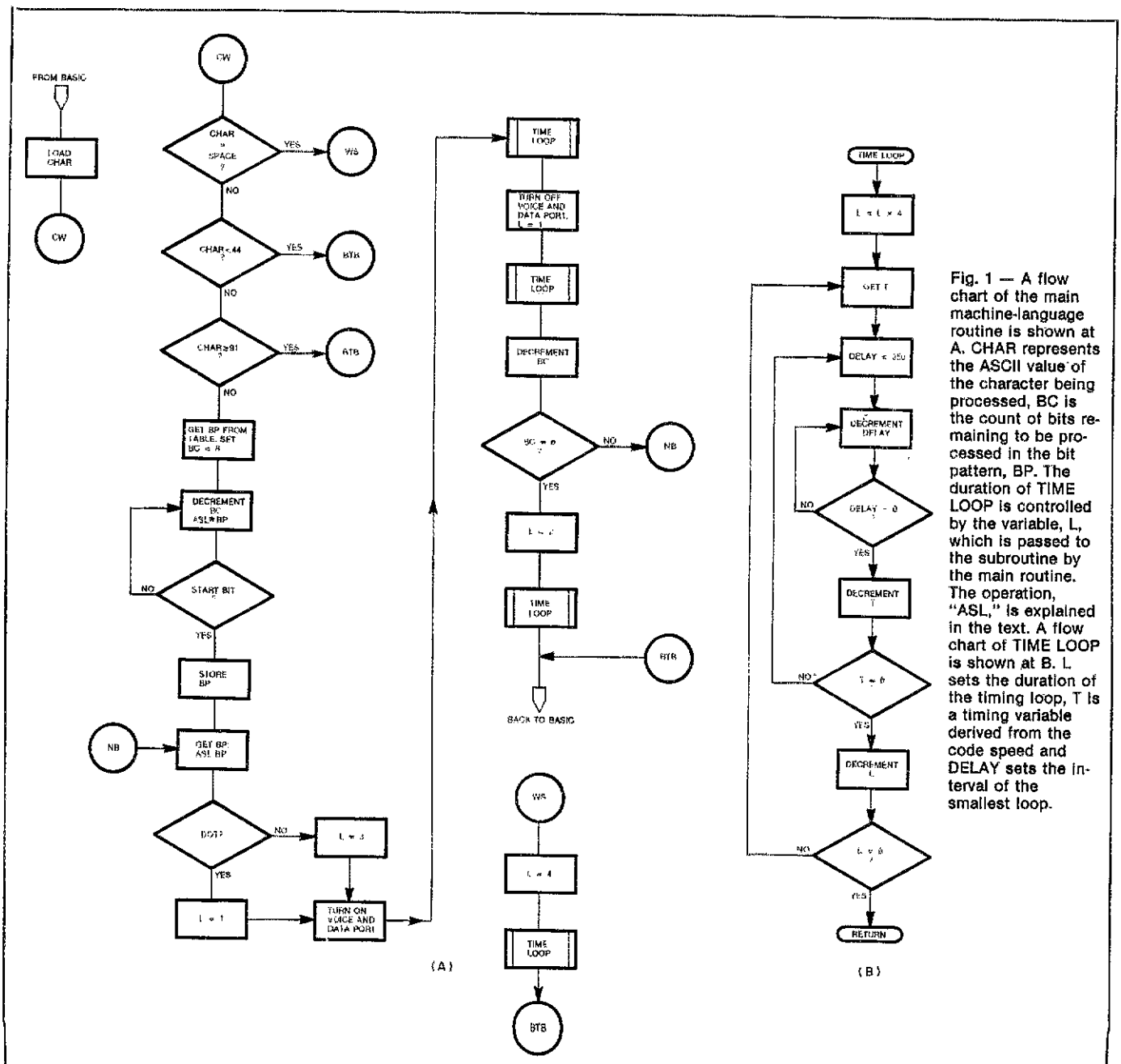


Fig. 1 — A flow chart of the main machine-language routine is shown at A. CHAR represents the ASCII value of the character being processed, BC is the count of bits remaining to be processed in the bit pattern, BP. The duration of TIME LOOP is controlled by the variable, L, which is passed to the subroutine by the main routine. The operation, "ASL," is explained in the text. A flow chart of TIME LOOP is shown at B. L sets the duration of the timing loop, T is a timing variable derived from the code speed and DELAY sets the interval of the smallest loop.

Machine-Language Routine Listing for the Commodore 64™ Keyboard Program

The left-hand column shows the beginning address of each instruction in decimal notation. Column two shows the mnemonic for the instruction, and columns three through five show the hexadecimal code and operands for the instruction. The word "location" is abbreviated as "loc." in the listing.

Mem Loc.	*Op Code*	*Operation*	*Purpose*
[Entry from BASIC]			
1009	LDA AD FB 03	Load A from loc. 1019	Get ASCII value of CHAR
1012	JMP 4C 51 03	Jump to location 849 [CW]	
[CW]			
849	CMP C9 20	Compare A to 32	Check for space
851	BEQ F0 67	Branch to 956 on equal	If space go to [WS]
853	CMP C9 2C	Compare A to 44	Check for below 44
855	BCC 90 4E	Branch to 935 on carry clear	If below 44 go to [BTB]
857	CMP C9 5B	Compare A to 91	Check for 91 or above
859	BCS B0 4A	Branch to 935 on carry set	Go to [BTB] if equal or greater
861	TAX AA	Transfer A to X	Place ASCII value in X
862	LDA BD $0396,X	Load A from 918 + X	Load bit pattern (BP)
865	LDY A0 08	Load 8 into Y	Set bit count (BC) to 8
867	STY 84 FB	Store Y in location 251	Store BC
869	ASL 0A	Shift A left 1 bit	Look for start bit
870	DEC C6 FB	Decrement loc. 251	Reduce BC by 1
872	BCC 90 FB	Branch to 869 on carry clear	Repeat if bit is zero
874	STA 85 02	Store A in loc. 2	Save remaining BP
[NB]			
876	LDA A5 02	Load A from loc. 2	Load remaining BP
878	ASL 0A	Shift A left 1 bit	Check next bit
879	STA 85 02	Store A in loc. 2	Save remaining BP
881	LDY A0 01	Load 1 into Y	Store dot weight (L = 1)
883	BCC 90 02	Branch to 887 on carry clear	If dot, go to 887
885	LDY A0 03	Load 3 into Y	Store dash weight (L = 3)
887	LDA A9 11	Load 17 into A	Prepare for voice
889	STA 8D 04 D4	Store A to 54276	Turn on voice
892-904	EA	13 No Ops	See text
905	LDA A9 01	Load 1 into A	Prepare for output
907	STA 8D 01 DD	Store A to 56577	Turn on bit 1 of port B
910	JSR 20 A8 03	Jump to subroutine at 936	Go to TIME LOOP
913	LDA A9 00	Load 0 into A	
915	STA 8D 04 D4	Store A to 54276	Turn off voice
918	STA 8D 01 DD	Store A to 56577	Turn off port B
921	LDY A0 01	Load 1 into Y	Dot-space weight (L = 1)
923	JSR 20 A8 03	Jump to subroutine at 936	Go to TIME LOOP
926	DEC C6 FB	Decrement loc. 251	Reduce BC by 1
928	BNE D0 CA	Branch to 876 if not zero	Go to [NB] if not done
930	LDY A0 02	Load 2 into Y	Character-space weight (L = 2)
932	JSR 20 A8 03	Jump to subroutine at 936	Go to TIME LOOP
[BTB]			
935	RTS 60	Return from subroutine	Return to BASIC program
Time Loop			
936	TYA 98	Transfer Y to A	Load weight (L) 1 = dot 1 = dot space 2 = character space 3 = dash 4 = word space
937	ASL 0A	Shift A left 1 bit	Multiply L by 2
938	ASL 0A	Shift A left 1 bit	Multiply L by 2 again
939	TAY A8	Transfer A to Y	Store L
940	LDA A5 FC	Load A from loc. 252	Get time constant (T)
942	LDX A2 FA	Load 250 into X	DELAY = 250
944	DEX CA	Decrement X	Reduce DELAY by 1
945	BNE D0 FD	Branch to 944 when not zero	Loop until zero
947	SEC 38	Set carry flag	Prepare to subtract
948	SBC E9 01	Subtract 1 from A	Reduce T by 1
950	BNE D0 F6	Branch to 942 when not zero	Do again until zero
952	DEY 88	Decrement Y	Reduce L by 1
953	BNE D0 F1	Branch to 940 when not zero	Do again until zero
955	RTS 60	Return from subroutine	Return to main routine
[WS]			
956	LDY A0 04	Load 4 into Y	Weight for word space (L = 4)
958	JSR 20 A8 03	Jump to subroutine at 936	Go to TIME LOOP
961	RTS 60	Return from subroutine	Return to BASIC

Look-Up Table

MEM LOC	*CODE*	*ACTUAL CHAR*	*MEM LOC*	*CODE*	*ACTUAL CHAR*
962	73	,	986	0C	D
963	31	BT [-]†	987	02	E
964	55	.	988	12	F
965	32	/	989	0E	G
966	3F	0	990	10	H
967	2F	1	991	04	I
968	27	2	992	17	J
969	23	3	993	0D	K
970	21	4	994	14	L
971	20	5	995	07	M
972	30	6	996	06	N
973	38	7	997	0F	O
974	3C	8	998	16	P
975	3E	9	999	1D	Q
976	2A	AR [:]†	1000	0A	R
977	45	SK [;]†	1001	08	S
978	80	[<]†	1002	03	T
979	36	KN [=]†	1003	09	U
980	80	[>]†	1004	11	V
981	4C	?	1005	0B	W
982	C5	BK [@]†	1006	19	X
983	05	A	1007	1B	Y
984	18	B	1008	1C	Z
985	1A	C			

†Procedural signs are sent by pressing the key shown in brackets.

Table 1

Element Weight Control for the Commodore CW Keyboards

Element	*Normal Weight*	*Location*
Dot	1	882
Dash	3	886
Inter element space	1	922
Character space	2†	931
Word space	4††	957

†A character space is sent immediately after a dot space. The normal weight is, therefore, one greater than the value stored at the location.
††A word space consists of the weight shown plus a preceding character space.

a single routine. Program logic keeps track of the progress as each character is formed. A dot-length space (dot space) follows each dot or dash. At the end of each character, an additional two dot spaces are sent to complete a character space. A word space is handled as a separate function, but the same timing routine is used. The timing routine (TIME LOOP) is entered several times during the operation of the larger routine.

Instructions 940 to 953 comprise a delay loop based on weighting (L), a time constant (T) and a delay count (DELAY). The delay count is fixed at 250, but the time constant is changed to set the code speed, and the weight constant is varied to suit the particular element of a character. Anyone may vary the weight of the code elements by changing the values at the locations shown in Table 1.

Instruction 862 loads the bit pattern for a character to be sent from a look-up table beginning at location 962. The table is organized so that the location of each character bit pattern can be calculated by summing 918 with the ASCII value of the character. Both the sum and load operations are performed by instruction 862. For example: The ASCII value for "A" is 65, therefore the bit pattern for "A" (with a start bit added) is found at location 918 + 65 = 983. [An explanation of the bit patterns appears in the Jan. *QST* article. — Ed.]

For Newcomers to Machine Language

The 6502 and 6510 microprocessors read addresses in reverse order. When two consecutive memory locations hold the hexadecimal values FB and 03, respectively, the hex address represented is 03FB, or decimal 1019.

Each processor contains three working registers that can be used by the program. These are the Accumulator, X and Y registers. They are represented in the listing by A, X and Y, respectively.

When a JSR (jump to subroutine) instruction is encountered, the program branches to the subroutine and performs the instructions there until an RTS (return from subroutine) instruction is encountered. Program control then returns to the next instruction following the JSR.

Table 2
Hexadecimal Numbering

Decimal	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Hex	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F

Table 3
Sample Branch Values

0 = + 1 = −								
	128	64	32	16	8	4	2	1	bit value
F6 = 1	1	1	1	1	0	1	1		0 = 118 decimal
4E = 0	1	0	0	1	1	1			0 = 78 decimal

Branch instructions do not show the destination address in a straightforward manner. All branch instructions use relative addressing. The range of relative addressing is 127 bytes forward and 128 bytes backward from the address *following* the branch instruction. Since a memory location holds eight bits, it can represent any number from 0 through 255. It would appear that you could branch further than 127 locations, however, one bit must be sacrificed to indicate the jump direction. The 65xx processors use the high-order bit for this purpose. Because the high-order bit has a value of 128, the maximum value of a forward jump is 255 − 128 = 127. The maximum value of a backward jump is 128 − 0 = 128. Look at Table 2 and Table 3 while considering these examples:

The instruction beginning at location 950, BNE D0 F6, is followed by instruction 952. Since the high-order bit is one, the branch causes a backward jump. Add up the bit values, but disregard that of the high-order bit:

64 + 32 + 4 + 2 = 118

Since this is a negative branch, subtract the result from 128:

128 − 118 = 10

Now, subtract 10 from the next instruction address:

952 − 10 = 942

The instruction causes a branch to location 942 when the accumulator contents are not equal (BNE) to zero.

Now consider a forward branch (high-order bit of zero). Instruction 855, BCC 90 4E, is followed by instruction 857. Add up the bit values:

64 + 8 + 4 + 2 = 78

Since this is a forward branch, add the branch to the address of the next instruction:

857 + 78 = 935

The instruction branches to location 935 when the processor carry flag is clear (BCC).

The mnemonic, "ASL," represents "Arithmetic Shift Left." This instruction causes each bit in the accumulator to be shifted left one position. The most significant bit is shifted into the carry position. In the keyboard program, the ASL instruction is used to examine successive bits of the bit pattern by testing the carry position after each shift. When the accumulator contents are stored, the bit that was last examined is lost because "carry" is not part of the accumulator. This means that only the remaining bit pattern is saved. An ASL is also a quick way to multiply a binary number by two. ASL is used for multiplication at the beginning of TIME LOOP.

Locations 892 to 904 are filled with the hexadecimal byte "EA," meaning that no operation (NOP) is performed. Machine-language programs have many locations, such as the look-up table, that cannot be changed. Programmers often allow extra space for a group of steps or discover a more compact way of performing a task. When steps are not needed, they are filled with NOP instructions so that other portions of the program need not move. — *Thomas R. Behra, KA8NRZ, Canton, Ohio*

Feedback

☐ Please make the following corrections to Fig. 1 of "A Cathode-Driven Tetrode for 6 Meters," September 1984 *QST*, p. 12. The secondary winding of T1 should show a center-tap wire to ground. Also, R3 should be a 1-W resistor. Author Munyon points out that the input-circuit efficiency can be improved by changing the value of C2 to 200 pF and placing the tap on L1 at two turns from the hot end.

Strays

THANKS, MIRAGE

☐ The ARRL would like to gratefully acknowledge the donation, by the Mirage Company, of a B1016 repeater amplifier. This amplifier is currently in service on the W1AW AX.25 packet-radio repeater, which is the hub of a growing Connecticut Valley packet-radio network. The W1AW packet-radio repeater is a simplex repeater on 145.01 MHz, the coordinated frequency for the EASTNET packet network. Along with the B1016 amplifier from Mirage, the W1AW packet repeater uses a Vancouver Digital Communications Group (VADCG) terminal node controller, a modified VHF Engineering repeater and an Iso-Pole antenna donated by Advanced Electronic Applications. The repeater and the W1AW packet-radio bulletin board serve about 20 stations in central Connecticut. Stations from the Boston network often use W1AW, and the EASTNET network should cover the entire East Coast of the United States in a few months. — *Jeff Ward, K8KA*

TA Emil Pocock, W3EP, relaxed and ready for an evening of DXing

TA PROFILES

☐ Introducing Emil Pocock, W3EP, the newest member of our ARRL Technical Advisor team. His expert advice on radio propagation, especially in respect to VHF and UHF, will benefit all radio amateurs. First licensed in 1961, as KN3OKC, Emil received his Extra Class license in 1964. His Amateur Radio interests, primarily VHF-oriented, are DX and weak-signal work, contesting, propagation studies and mountaintopping.

Emil earned his BA from the University of Maryland in American Studies and a PhD in History and American Studies from Indiana University, where he was a member of the Indiana University ARC. His professional area of expertise being United States history, Emil is a lecturer in History at the University of Georgia.

Besides Amateur Radio, Emil is interested in meteorology and wildflower horticulture, enjoys hiking and camping, and is an active participant in sports, especially racquetball. — *Marian Anderson, WB1FSB*

FEMA Communications, from the Top Down

ARRL volunteers, armed with the newly inked ARRL/FEMA agreement, now play a significant role in federal emergency communications plans.

By F. Dale Williams,* K3PUR

On August 3, at a ceremony in Washington, DC, ARRL President Larry Price, W4RA, and FEMA Director Louis Giuffrida affixed their signatures to a Memorandum of Understanding between the two organizations. FEMA stands for the Federal Emergency Management Agency, whose task it is to handle complete disaster-management responsibilities for the U.S. government, and to provide support to state and local civil-preparedness and emergency-management authorities. FEMA also is in charge of administering the Radio Amateur Civil Emergency Service (RACES).

The signed ARRL/FEMA agreement provides substantial evidence of official FEMA recognition of the ARRL emergency preparedness program, notably the League-sponsored Amateur Radio Emergency Service (ARES). The document can be a powerful tool in "selling" ARES capability to local emergency management officials, while enhancing the growth of dual ARES/RACES relationships at the municipal and state level. (Copies of the agreement are available from ARRL Hq. for an s.a.s.e.)

FEMA, a relatively new government agency, has great significance to the Amateur Radio Service. Therefore, this article discussing the FEMA structure and how radio amateurs logically fit in is presented for the information of *QST* readers. While FEMA is charged with responsibilities other than communications, it is clear that without communications none of its other functions would be possible.

Disaster-Communications Hub

As with most agencies of the federal government, FEMA's headquarters is located in Washington, DC. It can be considered the hub of the disaster-communications network, with spokes feeding 10 regions across the United States and its territories/possessions.

Each of the 10 FEMA regions (shown in the sidebar) has a federal facility that houses the day-to-day operations, as well as functioning as the Emergency Operations Center (EOC) during times of disaster. Included in these facilities are offices, meeting rooms, communications centers and provisions to supply a cadre of disaster-team personnel. Available communications include landline (telephone), RTTY (landline and HF), HF, VHF and UHF. The federally implemented disaster plan encompasses all 10 regions, which are, in turn, responsible for activities within their region.

Each of the states is responsible for the enactment of legislation that establishes a state office of Disaster Emergency Services and the provisions and funds with which to operate. This office is normally established at the capitol and is under control of the governor. As part of the legislation establishing this office, additional paragraphs may provide for the appointment of emergency-preparedness officials at the county or lower level. The resulting organizational diagram is depicted in Fig. 1.

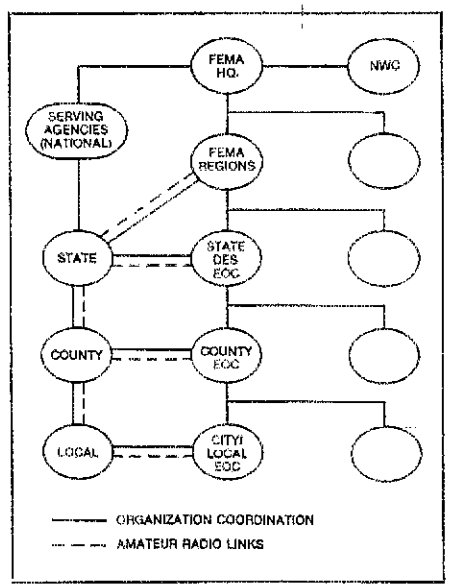


Fig. 1 — Emergency/disaster organizational structure and communication links.

The National Warning Center (NWC) originates warning messages to FEMA regions and other agencies. These messages may indicate exercises, tests, fallout, natural or man-made disasters, or any threat to an area of the United States. As the organizational lines tie the various offices together, so should the lines of communication be formed. Each state EOC should be linked with FEMA through the EOC of the appropriate region, and county EOCs should have communications lines with the state EOC.

Each geographical entity (city, county, state) acts as an area emergency/disaster office. If the situation becomes too large for them to handle, they may request assistance from the next-higher office. However, when the problems are passed on, so is the responsibility, and the requested office takes over command. City and county offices normally have the following official resources available to them: police, fire, maintenance and emergency preparedness. Coordination for all these services takes place at the applicable EOC.

At the state level, some additional resources may be called upon: National Guard, State Police, State Maintenance, Department of Disaster Emergency Services, Forest Service/Parks Service and Social Services.

Additionally, these community resources are available at all levels: Amateur Radio (ARES/RACES), Red Cross, Salvation Army, REACT, other NVOAD (National Voluntary Organizations Active in Disaster) agencies,[1] Civil Air Patrol, Search & Rescue, Hospitals/paramedics and National Weather Service.

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In 1982, President Reagan made public a seven-year civil defense program. One part of this plan provides for continuity of government during and after attack, and the ability to respond to large-scale natural and other domestic disasters. This portion of the program outlines a massive upgrade of the present communications system to include various state-of-the-art developments. Most of the present state and local networks rely on commercial telephone lines, which are vulnerable, causing degradation or disruption of response and recovery activities.

The plan, therefore, is to provide a survivable telecommunications and warning system using RF equipment as the primary means of communication. Included in the design of such a system must be some means of protection against the effects of electromagnetic pulse (EMP) caused by nuclear weapons and the capability of continued operation through auxiliary power sources, such as emergency generators.

Unfortunately, accomplishing such a grandiose plan, assuming that the funding can be obtained, does not rely on simply integrating a number of available systems already on the market. The past decades have seen very little interest or further development in equipment and techniques in the LF and HF regions of the spectrum. Now that applications of meteor burst, low-frequency ground wave, etc., are regaining popularity, new developments will be required.

In addition to rejuvenating some old techniques with new modifications, the FEMA system will also include satellite and line-of-sight (LOS) links. To permit greater flexibility, part of the system will be installed in self-contained shelters and vans, which can be assigned to required areas within the various FEMA regions.

How Amateur Radio Fits In

How does all this affect emergency/disaster communications in general and Amateur Radio support in particular? First, the increase in equipment and capabilities at the national and regional level will require additional FEMA personnel, new procedures and increased liaison and coordination between FEMA, at all levels, and the states. The state EOCs will be required to add additional equipment to interface with FEMA and update their current procedures. Consequently, greater coordination and planning will be required between the states and their county, local and volunteer/support agencies (such as Amateur Radio — ARES/RACES).

It is virtually impossible to coordinate disaster activities at the state or higher level without receiving valid information from the various disciplines within the affected area. These communications originate from a number of sources, by various means, on different frequencies. The efficient operation of any disaster center requires input from as many sources as possible, but on the minimum number of links.

This means that as much information as possible should be funneled to a single relay at the lowest possible level. The normal EOC maintains operating positions for their departments: police, fire, maintenance and possibly emergency preparedness. All the information coming into the EOC from the various links must be combined and provided to the decision makers and/or to the next higher level. During emergency/disaster operations, however, there are many other agencies and organizations providing support that require guidance from the EOC and must report progress back to the EOC. Some of these groups have their own radio frequencies, and some have no means of communication outside of the telephone.

These problem areas provide a golden opportunity for Amateur Radio organizations specializing in emergency communications to provide a necessary service. Rather than have an operating position in the EOC for every support agency already using assigned frequencies, Amateur Radio operators can supply this link up to the various organizations. Of even greater importance is the providing of communications to those agencies that do not have this capability. This is a large job and requires advance coordination and planning to operate successfully. Where possible, similar types of operations, such as care and shelter, should be combined under one leadership. This is most easily accomplished by having the Red Cross Disaster and Social Services coordinate the volunteer groups offering the same service. The Red Cross operation itself requires multiple communication facilities at the main office, shelters, Disaster Action Teams, hospitals and at the scene.

One of the biggest problem areas is Welfare traffic. This operation normally takes two paths: those inquiries passed through the Red Cross network and those received via Amateur Radio. In both cases, replies to these Welfare messages should be obtained from Red Cross lists, since the Red Cross has this official function. The League's National Traffic System (NTS), through ARES, typically handles such traffic. In-state inquiries may be referred to the Red Cross offices, as appropriate.

As the disaster communications system becomes more sophisticated, additional requirements will probably be levied on the Amateur Radio Service. Greater communications capability at the top level requires more information from the field. New technical developments will also affect the amateur community, and we must maintain our proficiency while adopting these new capabilities.

Satellites offering communications channels for emergency/disaster operation are in the wings, and will require some new technology to provide amateur mobile/portable operation. Packet communications and repeater linking are making progress, but more remains to be done to facilitate the relay of long-haul traffic across the nation.

The basis of all emergency/disaster communications is advance planning and coordination, and this task will become more demanding as requirements increase. If you are affiliated with ARES or RACES, your most important job is liaison and coordination with the agencies requiring communications support and the government officials responsible for maintaining the disaster plans. Second, but of no less importance, is the organization and preparedness of your own group. Only with continued coordination, preparation and practice can you expect to be called — or be ready when you are called!

Now it's official! ARRL President Larry Price, W4RA, and FEMA Director Louis Giuffrida at the signing ceremony that began an ARRL/FEMA link that will allow both organizations to provide enhanced disaster communications. ARRL's Perry Williams, W1UED, and Samuel W. Speck of FEMA look on.

FEMA Regional Offices

Region I: CT, ME, MA, NH, RI, VT
442 J. W. McCormack, Boston, MA 02109, tel. 617-223-4741
Region II: NJ, NY, PR, VI
26 Federal Plaza, Room 1349, New York, NY 10007, tel. 212-264-8980
Region III: DE, MD, PA, VA, DC, WV
Curtis Bldg., 7th Fl., Sixth & Walnut Sts., Philadelphia, PA 19106, tel. 215-597-9416
Region IV: AL, FL, GA, KY, MS, NC, SC, TN
Gulf Oil Bldg., Suite 664, 1375 Peachtree St., N.E., Atlanta, GA 31792, tel. 404-881-2400
Region V: IL, IN, OH, MI, MN, WI
300 South Wacker Dr., 24th Fl., Chicago, IL 60606, tel. 312-353-1500
Region VI: AR, LA, NM, OK, TX
Federal Regional Center, Room 206, Denton, TX 76201, tel. 817-387-5811
Region VII: IA, KS, MO, NE
Old Federal Office Bldg., Room 405, Kansas City, MO 64106, tel. 816-374-5912
Region VIII: CO, MT, ND, SD, UT, WY
Federal Regional Center, Building 710, Denver, CO 80225, tel. 303-234-2553
Region IX: AZ, CA, HI, NV
211 Main St., Room 220, San Francisco, CA 94105, tel. 415-556-8794
Region X: AK, ID, OR, WA
Federal Regional Center, Bothell, WA 98011, tel. 206-481-8800

ARRL (as well as the Red Cross and the Salvation Army, among others) is a member agency of NVOAD.

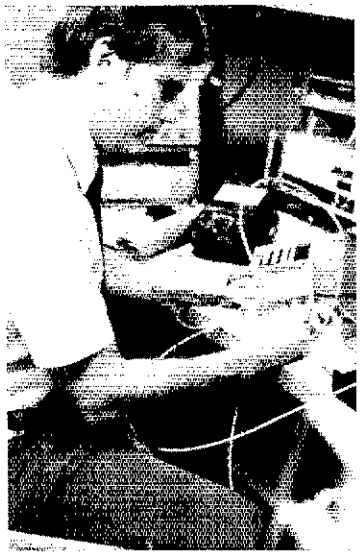
The Making of the Handbook, 1985

The countdown began on a warm summer's day in July 1983. During a publications planning meeting, the group decided to launch a brand new Handbook for 1985. Now — after a year's worth of designing, building, writing, editing, rewriting, reediting, typesetting, laying out, proofreading, correcting, checking, rechecking and, finally, approving page proofs — all systems are GO as we await shipment of the largest, and probably the best, book the League has ever produced.

Those of us who were part of this challenging team effort eagerly await the arrival of the 1985 ARRL *Handbook for the Radio Amateur*. We trust that League members, and everyone involved with radio communication, are doing likewise.

The photos on these pages convey a general idea of what goes into the production of a 1024-page book, but to fully appreciate what was involved, you'll have to buy one for yourself! See page 111 (and pp. 164-166) for more information, or see your local dealer. — *Joel Kleinman, N1BKE*

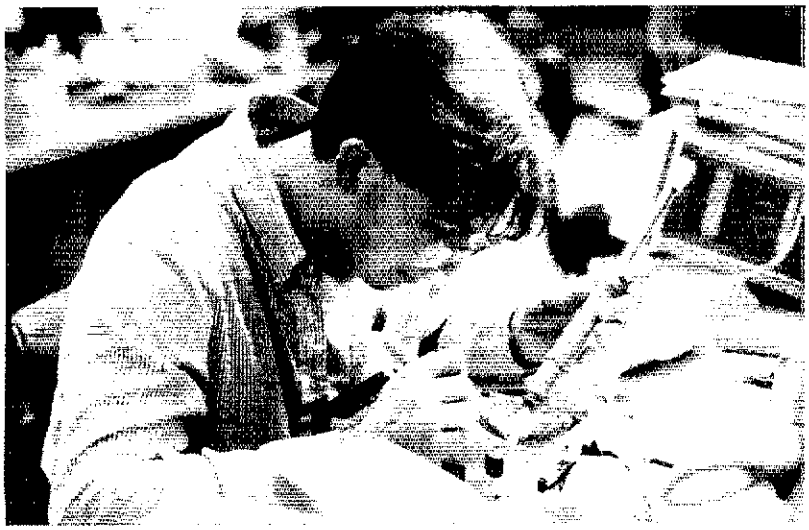
Planning and organizing the contents of the book fell on the shoulders of Handbook Editor Chuck Hutchinson, K8CH, and Senior Technical Editor Paul Rinaldo, W4RI. They also recruited and worked closely with the many contributors to the book (it would be impossible to list them all here, but they're given credit on the book's title page).



While carrying out writing and editing duties, Mark Wilson, AA2Z, found time to design and build several new projects. Mark has been designated editor of the 1986 Handbook.

Two members of the editorial team, Maureen Thompson, KA1DYZ, and Bob Schetgen, KU7G. Bob wrote a chapter, while Maureen handled several jobs, including proofreading (with help from Greg Bonaguide, WA1VUG, and Mike Kaczynski, W1OD). Let's see; that's 300 words per page, times 3000 pages . . .

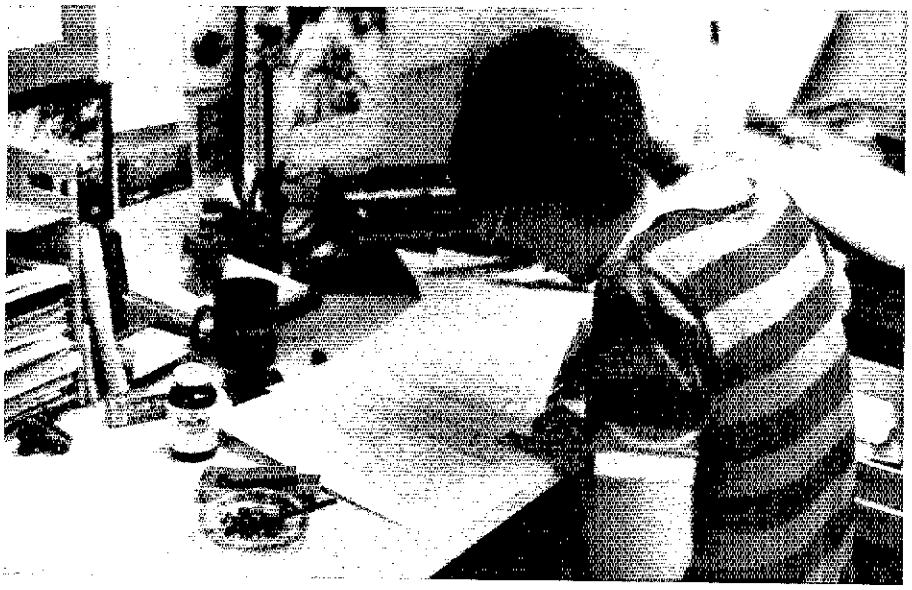
Responsible for several Handbook chapters, as well as the microcomputer-to-typesetting interface, Jerry Hall, K1TD, was another key member of the Technical Department editorial team. The interface worked this way: Once a chapter had been proofread and edited in the Technical Department, it was transferred electronically to one of many Handbook disks inside the Production Department's typesetting machine, saving weeks of precious time.



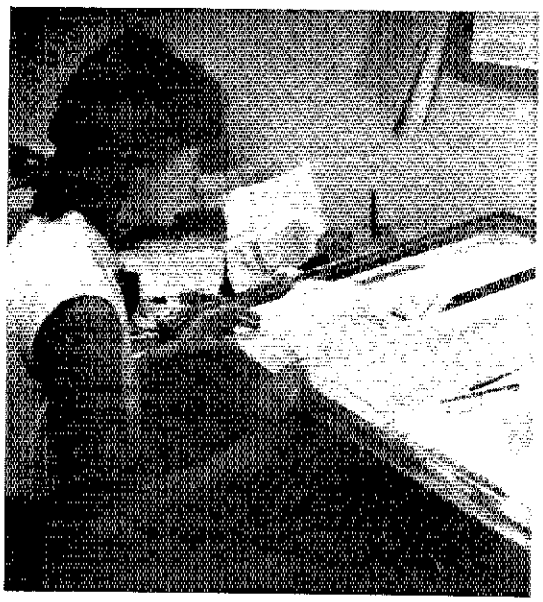
Another who contributed his design and construction talents to the book was Jeff Ward, K8KA. The result is a Handbook with many, many new — and useful — projects.

On the production side of things, David Pingree was responsible for drawing the new schematics that appear in the book — and there were a whole bunch of 'em.

Debbie Sandler and Julie Shain didn't mind using the floor to accomplish their task of bringing drawings and text together, chapter by chapter. After all, they couldn't find a desk that would hold everything!



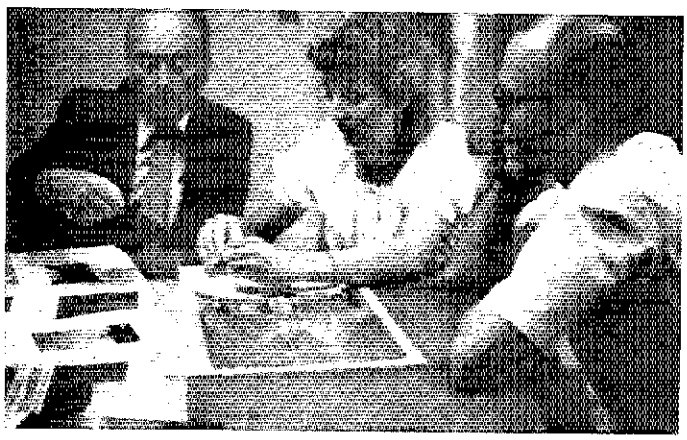
Once a chapter had been "pasted up," proofread and checked by any number of editors, it was up to Shelly Fuini (among her many other production responsibilities) to make the text corrections.



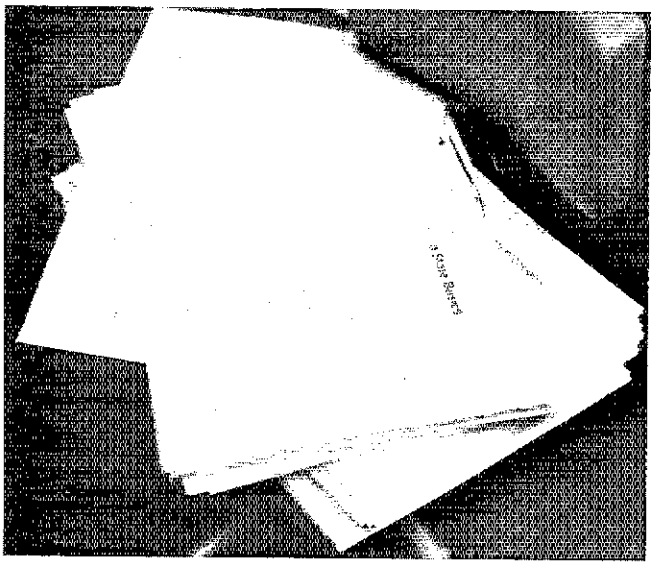
↑ With various remedies close at hand, Production Supervisor Brooke Craven puts the final touches on the index. It was her job to lay out all 1024 pages of the 1985 Handbook, and to supervise the production process.

Photos by N1BKE

← Julie (along with Debbie) was responsible for pasting up the corrected copy on layout boards. After production work ended, they returned to college, no doubt considering changing majors!



If you like the book's cover, you have these people to thank: From the left, the engraver (who produced it), Sue Fagan (who designed it) and Laird Campbell, W1CUT (who, with assistance from Joel Kleinman, N1BKE, oversaw the production end of the entire project). Part of Laird's job was to see that the printer had a sufficient supply of paper — the equivalent of three boxcars full!



Some chapters of what was to become the 1985 ARRL *Handbook for the Radio Amateur* await packing and shipping to the printer. Meanwhile, feeling an immense sense of relief, members of the Hq. staff could take a couple of deep breaths — and then look ahead to the 1986 edition. ■

Happenings

Conducted By Richard K. Palm* K1CE

ARRL Opposes 220-MHz Takeover Attempts

As reported last month, two organizations have petitioned the FCC requesting that the 220-MHz band be shared with land mobile radio services. The Land Mobile Communications Council (LMCC) asked the Commission to examine potential frequencies for future land mobile use. Besides 800 MHz, the LMCC suggested that FCC consider use of other areas of the spectrum, including 220-225 MHz. Sideband Technology, Inc. (STI) proposed that 216-222 MHz be segmented into 5-kHz channels, and be dedicated exclusively to private and government narrowband land mobile radio systems.

ARRL's opposing comments to the two petitions proceed along similar lines, although in the case of the LMCC's petition the League confines its comments to the threat to the 220-225 MHz band. (The LMCC petition primarily seeks land mobile access to the 800-MHz spectrum, an issue on which ARRL takes no position.) The League's position is that both petitions are out of order and premature at this time, as they presuppose the availability of 220-225 MHz for land mobile use, and that this supposition is false in view of recent Commission spectrum-allocations actions domestically.

In its *Second Report and Order* in General Docket 80-739, the FCC stated with respect to the 220-225 MHz band:

"The spectrum requirements for this band are currently undefined. However, as noted in the NPRM there is an FCC/NTIA working group developing an allocation plan for this band. Therefore, we will maintain all three allocations — amateur, fixed and mobile — pending the results of this effort. *It is noted that no assignments will be made to the fixed and mobile services until the allocation and service rules are finalized.*" (Emphasis added)

Therefore, both petitions "jump the gun" and presume a very specific (and unlikely) outcome of a detailed planning study yet to be completed. Moreover, on August 28, 1984, the Chief of the Private Radio Bureau dismissed a Petition for Rule Making that requested amendment of the Amateur Radio Service Rules to authorize voice privileges for Novice class licensees on a portion of the 220-MHz band. The Chief of the Private Radio Bureau stated that:

"The spectrum requirements for the 220-225 MHz band are currently undefined. The Second Report and Order in General Docket 80-739, released December 8, 1983, regarding the implementation of the final acts of the World Administrative Radio Conference (WARC), Geneva, 1979, stated that both the FCC and the National Telecommunications and Information Administration (NTIA) are studying possible uses of the 216-225 MHz spectrum. Thus, it is not appropriate to consider petitions which could have a major impact on the 220 MHz band until these matters have been resolved."

Accordingly, that petition was dismissed as being premature. Identical treatment of the LMCC and STI petitions, "which could have a major impact on the 220 MHz band" is necessary if the FCC is to be consistent, the League argued.

The League goes on to assert that there is an ongoing need for long-range planning concerning the 216-225 MHz spectrum. In September 1981, the NTIA released a report entitled, "Spectrum Resource Assessment in the 216-225 MHz Band." One specific conclusion of the report was:

"Planning of the band is required to assure that compatible operations are achieved between adjacent channel TV receivers, existing radars, the Inland Waterway Communications System, Amateurs and new Land Mobile Services in the band. Although ideally suited for expansion, the band requires careful planning between the FCC and Federal Government agencies to achieve expansion in a compatible and timely fashion."

The ultimate recommendation of the NTIA report was that "FCC, NTIA and IRAC must plan the 216-220 MHz band by examining spectrum management and congestion problems in other land mobile bands. A preliminary sharing plan should be developed jointly, and a Notice of Inquiry prepared for public release. Public comments should be carefully reviewed and appropriate rulemaking actions taken."

Furthermore, NTIA remarks contained in the NTIA Table of Frequency Allocations in Chapter 4 of the *Manual of Regulations and Procedures for Federal Radio Frequency Management* state, concerning the 220-225 MHz band, "This allocation is subject to further discussion between the FCC and NTIA as part of their long-range planning activities."

The express need for long-range planning and a methodical plan of action for the 216-225 MHz band endorsed by the Commission in its *Second Report and Order* in Docket 80-739, together with the Commission's specific warning that "no assignments will be made to the fixed and mobile services until the allocation and service rules are finalized," make it clear that the LMCC and STI petitions are premature and inappropriate, and should be dismissed without action, the League said.

1900-2000 kHz UNDER FIRE

The FCC has issued a *Notice of Proposed Rule Making* proposing to allocate the 1900-2000 kHz band to the nongovernment Radiolocation Service on a primary basis because of an anticipated expansion of the AM broadcast band that would force certain radiolocation stations to move. Comments in PR Docket 84-874 are due October 26, with reply comments due November 23. The League has filed a motion with the FCC to hold this NPRM in abeyance pending the resolution of a related ARRL petition filed, ironically, the day before the Commission released its NPRM. The League filed its *Petition for Initiation of Inquiry Proceeding* on September 10, asking that the Commission initiate an inquiry into the present use of radio-frequency spectrum in the medium-frequency band by non government radiolocation users. The purposes of the inquiry would be to define the spectrum requirements of individual users and to determine the number of individual radiolocation stations necessary in a given geographical area.

ARRL filed its petition because it has noted repeated instances of claims by licensees and users of non government radiolocation stations of the need for additional spectrum above 1800 kHz. There are several cases of claims of entitlement to frequency bands now occupied by Amateur Radio operators made by radiolocation users without the slightest attempt to establish technical need. The FCC appears willing to acquiesce to these claims, which are unbacked by technical justification. This assertion is all the more apparent now that FCC has issued its proposal, as stated above, to allocate 1900-2000 kHz to nongovernment radiolocation users.

The history of U.S. preparation leading up to WARC-79 clearly shows that there was never a plan to exclude amateurs from the 1900-2000 kHz band, or to permit radiolocation to occupy the band on other than a secondary basis. The WARC-79 Final Acts gave radiolocation the following allocations in the 1600-2000 kHz band: 80 kHz on a secondary basis at 1625-1705 kHz; and 95 kHz at 1705-1800 kHz and 150 kHz at 1850-2000 kHz on a shared, coprimary basis. While this was a larger allocation than the U.S. had proposed in Docket 20271 (the WARC preparation docket), it still permitted full amateur use of 1800-2000 kHz, as proposed in that docket.

Subsequent to WARC-79, the FCC began implementation of the 1979 WARC treaty by issuing five *Notices of Inquiry* in Docket 80-739. This proceeding culminated with the release of a *Notice of Proposed Rule Making* making specific proposals for accommodating domestic spectrum allocation needs while implementing the WARC-79 Final Acts. Although the FCC in this NPRM stated that it did "not intend to reopen a general discussion of issues or to initiate discussion of new issues in this proceeding," it proposed *for the first time to allocate 1900-2000 kHz to radiolocation exclusively*. It included a footnote allowing amateurs to use the band on a secondary basis until such time as radiolocation moved into the band, which FCC said was several years away. This major alteration to the frequency allocations table was proposed despite (1) the specific U.S. proposal to WARC-79; (2) the WARC-79 Final Acts; and (3) the Commission's stated intention in the NPRM *not* to revisit the decisions made in the extensive preparations for WARC-79.

The crux of the League's argument is that none of the reasons given by non government radiolocation users for the need for additional spectrum, or indeed for the spectrum it now has, has ever been technically supported or quantified. A major reallocation of radio-frequency spectrum should be predicated on a technical basis and not merely on the claims of attorneys representing non government radiolocation users.

The League requests that the Commission ask, in its inquiry, such questions as (1) whether it is true that radiolocation operations have become more efficient over the years, (2) whether the medium-frequency band is the most efficient for such operations, (3) what the limits are of Loran-C and NAVSTAR systems such that medium-frequency radiolocation systems are still required, and (4) whether the use of spread-spectrum radiolocation systems in the 420-450

*Acting Manager, Membership Services Department

MHz band obviates the need for medium-frequency radiolocation operations.

Finally, the League asserts that the technical justifications for the use by radiolocation of additional spectrum space have not been explored but only alleged and accepted by the Commission on their face, and that therefore an inquiry is needed into the spectrum efficiency of medium-frequency radiolocation operation, available existing spectrum alternatives and the present loading status of existing radiolocation frequency bands before making any further medium-frequency allocation to the radiolocation service.

LEAGUE REQUESTS FEDERAL PREEMPTION OF LOCAL AMATEUR RADIO ANTENNA ZONING

On July 16 the ARRL filed a *Request for Issuance of Declaratory Ruling* with the FCC. The League asked the FCC to issue a declaratory ruling delineating the limitations of local zoning and other local and state regulatory authorities over federally licensed Amateur Radio facilities.

The League feels that such a ruling is necessary because of continuing encroachments by municipalities on the right of amateurs to erect effective antenna systems. The League states:

"Were such local regulation clearly necessary in furtherance of the protection of health and safety of the local citizenry, little could be said about it. Yet it is seldom that a municipal restriction on amateur antenna systems which actually impairs the station's communication effectiveness bears any trace of a basis in safety or health concerns. Recently enacted ordinances limit, for example, the length of the boom on a horizontal antenna array and the *number* of discrete antennas, regardless of support structure, lot size, or degree of conformity with safety requirements of building codes. This has been done without any findings made by the local zoning authority as to the need for such limitations. They have rather been arbitrarily established."

In 1977, the Commission issued a *Public Notice* entitled "Local Laws Regulating Radio May Be Pre-empted by Communications Act." The Notice discussed the Commission's jurisdiction and preemptive authority over local regulation of radio. However, it offered no means by which a municipality might judge whether a particular ordinance is unduly restrictive or should be federally preempted. It is incumbent on the FCC to provide that guidance, the League feels. It is necessary now to stem the tide of local ordinances that impair effective amateur communications, rendering the Amateur Radio Service less capable of performing its public-service obligations.

Therefore, the Commission should declare that there is a limit to local jurisdiction over Amateur Radio stations, according to the League's *Request*. That limit is reached when the local ordinance renders an amateur station ineffective or incapable of transmission or reception in an efficient manner. The League asks the Commission to issue a statement that indicates that while conditions may be placed on an antenna installation to ensure that reasonable local interests are met, those conditions cannot be so restrictive as to prevent antenna effectiveness.

The FCC seeks comments on the League's filing. Comment deadline is November 9, with reply comments due by December 14. An original and four copies must be filed with the Secretary, FCC, Washington, DC 20554. Please refer to document number PRB-1. It is important to submit reasoned, well-thought-out, factual comments. If you have had your amateur operations impaired by unduly and/or unfairly restrictive antenna ordinances, tell the Commission. Be sure to include important information, such as legal and professional expenses incurred and time lost from work. A copy of the League's filing is available from ARRL Hq. for an s.a.s.e. with 88 cents postage.

MALICIOUS-INTERFERENCE BILLS INTRODUCED

Bills designed to curb malicious interference have been introduced into the House of Representatives and the Senate. H.R. 6195, introduced by Rep. Jim Bates (D-CA), proposes to add a new section to the Communications Act of 1934. This new section would come after Section 302, which deals with *devices* that interfere with radio reception. The new section (302A), would cover persons (rather than devices) who willfully or maliciously interfere with radio communications. The Bates Bill then goes on to amend Section 510(a). This section authorizes the forfeiture of equipment for willful and knowing intent to violate FCC Rules under the new, proposed Section 302A.

On the Senate side, Barry Goldwater (R-AZ) has introduced S.2975, which takes a somewhat different approach. "This bill is desirable because the present law is not comprehensive or clear," the Senator said. Although Section 303(m)(1)(E) of the Communications Act appears to prohibit willful or malicious interference, it may apply only to FCC licensees and only authorize suspension of an operator's license.

The Senator went on to say, "I think that enactment of this bill also would substantially assist the Commission in curtailing willful and malicious interference by elevating such activity to a criminal offense pursuant to Section 501 of the Communications Act. This section provides for both a fine of up to $10,000 and imprisonment for up to one year for a first offense and the same fine and up to two years' imprisonment for repeated offenses.

"Presently Section 502 which makes violations of the Commission's regulations or treaty provisions a crime, provides only a maximum penalty of $500 and no imprisonment. Thus, amending the act to statutorily prohibit willful or malicious interference substantially increases the penalties for such actions.

LEAGUE OPPOSES SEVEN-DAY REEXAMINATION PETITION

The ARRL has filed comments in opposition to a petition filed by Phil H. Miller, KB8QX. The current FCC rules provide that an applicant who fails an Amateur Radio examination element must wait at least 30 days before taking that element (or a higher-class element) again. Miller requests that the waiting period be reduced to seven days.

The League opposes this petition because it is inconsistent with the recently implemented Volunteer Examination Program. Amateur examinations are, for the present, designed by Volunteer Examiner Coordinators (VECs). While it is important for a VEC to frequently change the questions used in the examinations to discourage rote memorization by repeated test taking, it is impractical to expect a VEC to change a test design more than monthly or bimonthly. If a VEC who provides examination opportunities regularly were to ensure that the same set of questions is not used in successive examination sessions, it would be forced, under Miller's proposal, to change examinations weekly and distribute them to its Volunteer Examiners. This is an unreasonable burden to place on VECs and VEs.

NO BREAK FOR AMers, SAYS FCC

On July 22, 1983, the FCC adopted a *Report and Order* in PR Docket 82-624 replacing the former input-power-measurement standard in the Amateur Radio Service with a power-measurement standard based on peak-envelope-power (PEP) output, with 1500 W being the maximum allowable power. The Commission recognized that this would have an impact on AM double sideband (DSB) operations, typically limiting such operations to half of their previous maximum allowable operating power. The FCC grandfathered the input power measurement rules for AM DSB operations until 1990 to minimize the immediate impact of this rule change.

Now, the Commission has denied two petitions for reconsideration asking that AM DSB operators be permanently exempted from the new output-power measurement rules. The FCC feels that it cannot justify a permanent and continuous expense, both for equipment and training, to make a special power measurement for amateurs who happen to engage in AM DSB operations, particularly since they constitute only one percent of the U.S. amateur population.

In the same action, the Commission granted in part a *Motion for Clarification* filed by the ARRL. The Commission had stated in its *Report and Order*, regarding the methods it would use in measuring the output power of an Amateur Radio station, "Should we decide upon other standards in the future, we will release them in public notices." The League sought clarification on whether this statement was meant to include the actual output power limitation, the methods used for measurement of output power, or both; in either case, the League maintained simple public notice would be inappropriate, and that such changes require notice and comment rule-making proceedings.

The FCC's response is that it would indeed submit any proposed revision of the 1500-W PEP output power limitation to a full notice and comment rule-making proceeding, but that announcement of changes in FCC measurement methods was simply a general statement of procedure and not subject to the notice-and-comment provisions of the Administrative Procedure Act.

The FCC did make a minor change to its Rules to correct an inadvertent error. *To update Part 97 in* The FCC Rule Book, *Second Edition (red cover), Second Printing, make the following change:*

1) In Section 97.67(b), starting with third line, delete all after "1500 watts," and substitute therefor, "except as provided in other limitations of these rules."

ARRL FOUNDATION AWARDS SCHOLARSHIPS

The ARRL Foundation has awarded its scholarships for the 1984-1985 academic year. The recipient of the $500 Paul and Helen Grauer Scholarship is Jeffrey Westcott Koch, WBØYKG. This scholarship is awarded to a student of electronics, communications engineering or a related field

Be a Contributor to the Goldwater Scholarship Fund

Here's your opportunity to thank Barry, K7UGA, for his long-term staunch support of the Amateur Radio Service and to let him know of your appreciation. Send in your contribution *now*.

If your contribution is $25 or more, we will list your name and call in *QST*. If your contribution is $100 or more, in addition to your name and call appearing in *QST*, you will receive a signed photograph of the Senator, suitable for display in your hamshack. And for contributions of $1000 or more, in addition to the above, we'll put your photo in *QST* and you'll receive a personal thank you call from Robert York Chapman, W1QV, President of the ARRL Foundation, which is administering the Goldwater Scholarship Fund.

We welcome *all* contributions, regardless of size. Please help us achieve our goal of building an endowment sufficient to fund the Goldwater Scholarship in perpetuity. What better way to honor a great amateur, a great statesman and a great human being? Please make your check payable to the ARRL Foundation Goldwater Scholarship Fund, and send to ARRL Foundation, 225 Main St., Newington, CT 06111.

Recent contributors of $25 or more include: Bennett R. Adams, K4EZ; Curtis Bartholomew, AL7FR; Robert L. Beacham, WD9IIB; Paul J. Beringer, W7WRT; J. L. Boockholdt, AA5F; Bernarr Bowdoin, K4HKR; Dewey L. Byerley, W6RDK; Ed Bullock, K4HW; John E. Coleman, W8SK; Confederate Signal Corps, Inc., W4VTA; Charles E. Dewey, Jr., WØCD; Chuck Dorian, W3JPT; Drumlins Amateur Radio Club, WA2AAZ; Fred Dahnke, WB6IQV; Harold Drooz, W2HZG; James Eberwine, W4APV; Richard R. Farman, K2QR; Arthur L. Flanner, WBØWRG; Raymond Fredrickson, K9HMA; Steve Gecewicz, KØCS; Edward Greenwald, KA2IVA; Mark Goltermann, WB9FPR; William Good, Jr., W1GS; Andrew M. Gudas, WB6RIU; M. A. Griswald, W8JXM; Ed, W5FRZ and Nan Hall; John M. Haluska, WB2WXO; Charles B. Johnson, Jr., WA4ECG; H. Gordon King, W4XI; Raymond Knefel, KØKN; Godfrey B. Lowther, WØFCJ; In memory of Herman Lukoff, W3HT; Tony Maugeri, W2SDO; George W. Murray, WB4DYQ; Wayne Matlock, WA6VZI; Rufus L. McCraken, KH6QL; Thomas Meyer, Jr., N4CYV; John May, KE5LA; Daniel L. McMillin, W4DGE; E. Clayton Miller, W9LSR; Raymond Miller, W5REC; Edward L. Morgan, NØFIE; Henry Mott, Jr., W2DFL; Joseph Moulton, Jr., W2NLJ; Robert Olson, AFØM; Phillip M. Park, KC4NH; Frank A. Pitman, Jr., WD4DSS; West Park Radiops, W8VM; Michael Riley, WF4R; W. M. Riley, WA4BKB; Leroy Richardson, W6RFK; Col. Charles C. Rollins, Jr., W4EWX; Joel Rose, N8JR; S. Bud, WAØYIH and Joy M. Schieving; Carl Schultz, Jr., KA6KWB; Alfred E. Schwaneke, WØGS; James E. Sheperd, WA1UGW; John W. Simpson, N6CSC; Six Meter Club of Chicago, Inc., K9ONA; N. Cliffe Smith, W1SG; Edson Snow, W2UN; Gerald A. Squires, K6LN; Dick Stewart, KL7DK; W. J. Stewart, AA4I; James St. John, KD4PV; Ernest N. Storrs, K4BNO; Raymond Teeter, N2RT; Tom S. Teetor, W9NOL; Bethany Walt, KA4WRJ; John Walt, W4LNX; Harley J. Walker, W6RUG; Joe E. Warden, W8LNO; Harold A. Wendt, W9BXM; Walter Warman, W1KVK; Dexter Wheeler, W1TUM; Ernest F. Wilcomb, W3MS; Victor Woodling, W9JNH; M. C. Zervantian, W6DIS.

who resides in, and attends an accredited college or university in, the ARRL Midwest Division. Jeffrey is majoring in electrical engineering at the University of Missouri-Rolla, and has earned many honors and distinctions. He is an a Advanced class licensee, enjoys late-night DX and helping young people get started in Amateur Radio.

The Perry F. Hadlock Memorial Scholarship of $500 is awarded annually to a student of electrical engineering who is a General class or higher amateur. This year it goes to Tyler Alan Brown, KKØX, an electrical engineering major at the University of Minnesota. Tyler is an Extra Class amateur who enjoys high-speed CW, DX and contesting. He spends his free time teaching licensing classes, including a Novice class for the Courage Handi-Ham System.

The Long Island School Scholarship assists Long Island (New York) residents attending Long Island schools, emphasizing the importance of electronics in the curriculum and Amateur Radio in the extracurricular interests of the applicant. Three $500 scholarships were awarded this year. One went to Nikolaos Garbidakis, N2EHH, an electrical engineering student at City College of the City University of New York. He established the City College Amateur Radio Society and serves as its president.

The second award goes to David R. Borenstein, KA2HTV, a freshman at the State University of New York at Stony Brook. He is an Extra Class licensee who participates in public service and traffic handling, and likes to help young people. He is pursuing a career in electrical engineering.

The third recipient is Steven E. Atkin, KA2INN. Licensed since 1980, Steve enjoys CW, DX and ragchewing, and is a member of the Radio Central ARC and ARRL. He will attend the State University of New York at Stony Brook with the ambition of earning a PhD in Biochemistry. His interests include ecology, French, video, art and stamp-collecting.

KI6U AWARDED FIRST GOLDWATER SCHOLARSHIP

The initial award of the ARRL Scholarship Honoring Senator Barry Goldwater has been made to Paul D. Sargis, KI6U, an electrical engineering student at California Polytechnic State University. Paul is a straight-A student and an Extra Class ham who operates on all HF bands as well as 2-meter FM. He enjoys computer programming and electronic kit building, and his career goal is to advance the state of the art in radio communications. The latest list of contributors to this worthwhile scholarship appears elsewhere in this column.

AMATEURS WIN LICENSE PLATE VICTORY IN ARIZONA

Thanks to the efforts of Arizona hams, the governor has signed a bill authorizing reduced fees for Amateur Radio call letter license plates. The fee for original Amateur Radio operator plates has been reduced to $15 (versus $25 for other special plates), and the renewal fee has been reduced to $5 (versus $10 for other special plates).

SECTION MANAGER ELECTION NOTICE

To all ARRL members in the Montana, Mississippi, Iowa, Arizona, Orange, Northern Texas, Arkansas, Kentucky and Wyoming Sections: You are hereby solicited for nominating petitions persuant to an election for Section Manager. Incumbents are listed on page 8 of this issue.

A petition, to be valid, must contain the signatures of five or more Full ARRL members residing in the Section concerned. Photocopied signatures are not acceptable. No petition is valid without at least five signatures *on that petition*. It is advisable to have a few more than five signatures on each petition.

Petition forms (CD-129) are available on request from ARRL Headquarters, but are not required. The following form is suggested:

(Place and date)
General Manager, ARRL
225 Main St., Newington, CT 06111

We, the undersigned full members of the ... ARRL Section of the ... Division, hereby nominate ... as candidate for Section Manager for this Section for the next two-year term of office
(Signature ... Call ... City ... ZIP ...).

An SM candidate must be a resident of the section, a licensed amateur of Technician class or higher, and a Full Member of the League for a continuous term of at least two years immediately preceding receipt of a petition for nomination.

Petitions must be received at Headquarters on or before 5:30 P.M. Eastern Local Time December 7, 1984.

Whenever more than one member is nominated in a single Section, ballots will be mailed from Headquarters on or before January 2, 1985. Returns will be counted February 19, 1985. SMs elected as a result of the above procedure will take office April 1, 1985.

If only one valid petition is received for a Section, that nominee shall be declared elected without opposition for a two-year term beginning April 1, 1985.

If no petitions are received for a Section by the specified closing date, such Section will be resolicited in April *QST*. An SM elected through the resolicitation will serve a term of 18 months.

Vacancies in any SM office between elections are filled by appointment by the General Manager.

You are urged to take the initiative and file a nominating petition immediately.
David Sumner, K1ZZ
General Manager

REPEAT NOMINATING SOLICITATION

Since no petitions were received for the West Indies Section by the petition deadline of June 8, 1984 as a result of notices in the April and May *QST*, nominating petitions for this Section are herewith resolicited. See the above notice for details on how to nominate.

SECTION MANAGER ELECTION RESULTS

The following were elected for a two-year term of office beginning January 1, 1985:
Uncontested

Eastern	
Massachusetts	Luck Hurder, WA4STO
Missouri	Benton C. Smith, KØPCK
Nebraska	Vern J. Wirka, WBØGQM
Southern	
New Jersey	Richard Baier, WA2HEB
South Carolina	James G. Walker, WD4HLZ

Conducted By Ellen White,* W1YL/4

Views from the Top

Earlier this year, this column editor conducted a mailing to a number of non-W/VE hams sharing the distinction of being at the top *of the DXCC Honor Roll. They "worked 'em all" — but still have had DX problems and experiences particularly unique to their part of the world. This month, and in the issues ahead, we plan to share their views with you.*

OH2BH

Martti Laine was first licensed in 1961, but Amateur Radio turned out to be more of a lifestyle than a hobby! The early years saw OH2BH involved in club activities, CW operation, then SSB, contests and VHF. Soon it became obvious that DXing on *both* sides of the circuit was paramount. In DX, Martti finds Amateur Radio at its best — talking to people of all nationalities and making friends worldwide. His world traveling has led him to visit hams in, and operate Amateur Radio from, more than 75 countries — including two "new" ones he helped bring about, 3CØ and OJØ.

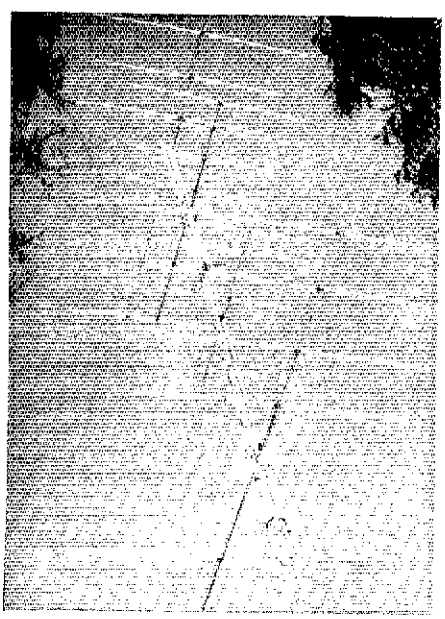
OH2BH is an active member of the Northern California DX Foundation, and aids NCDXF activities by being a European Advisor. High on the list of Foundation priorities is establishing Amateur Radio permanently in many Third World countries. He feels that there is a high degree of satisfaction in hearing *local* people operate their *own* stations from a rare country.

His most exciting DX trip took him to Equatorial Guinea and Annobon for a few weeks, while activating 3CØ for the first time. On that trip, he contracted an almost-fatal case of malaria. His efforts to activate Albania have been impressive, and Martti feels that the prospect of permanent ZA activity is within the realm of possibility. Future trips that hold special interest for him might well be Peter I Island, with an enroute stop at Bouvet.

OH2BH

OH2BH advice: "Meet the experienced hams and talk to them openly. Ask them questions. Believe them and hold them in esteem. They are the ones who have made Amateur Radio into what it is today. On the air, listen, listen, listen. Don't talk. Let's all try to make our personal contribution and make Amateur Radio even better for the future." *(Special thanks to Martti for permission to use some of this material, which appeared last fall in ARI's* Radio Rivista.)

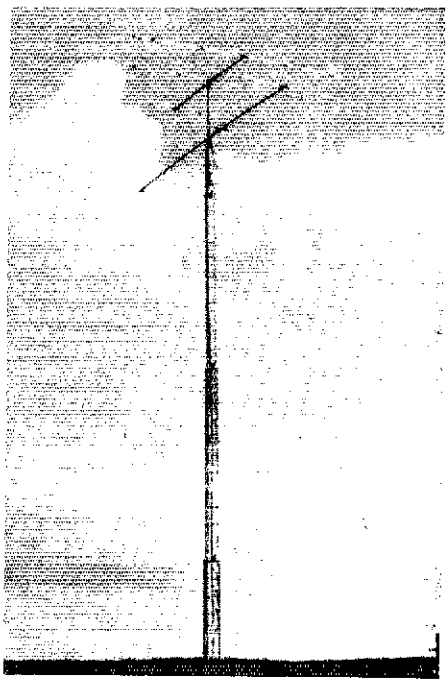
*19620 SW 234 St., Homestead, FL 33031



OH2BH stacks 6-L beams on 20 at 140/70 feet, and beams for 15 and 10 meters at 120/95 feet. A full-size 40-meter 3-L array is on a similar 140-ft tower about 150 feet away!

DJ2BW

West Germany's DJ2BW, a member of the First Class CW Operator's Club, is a member of the DXCC Honor Roll, having "worked 'em all" on mixed mode and phone. Hermann is also on the CW Honor Roll, needing just 11 to top that roster as of this writing. The Pacific path is particularly tough at his West German location, on both 40 and 80 meters. KL7 is tough on 80, too! HF antennas include a four-element monobander on 20 and three-element duobander on 21/28 MHz.



DJ2BW, 4-L monobander on 20, 3-L duobander for 10/15.

LU6DJX

July 1981 How's DX? contains several pictures of then 71-years-young active radio amateur LU6DJX. Now 75 years of age, Alfredo pursues active phone and CW DXing, principally on 40-10 meters — 80 continuing to be a problem what with a lack of antenna space.

He notes that his best time for Europe is the South American winter season. Propagation usually is poor from his location to the Indian Ocean south zone. Not too surprisingly, Central America and the Caribbean present a problem because of the signals generated by W/VE. The harder the mode/band, the more excitement he feels when working DX (i.e., 40-meter SSB)! LU6DJX, always a gentlemanly DXer, says it always affords him pleasure to be ready to work others.

LU6DJX receiving one of his many trophies — this from a Naval Officer — "Liberty Frigate Instruction Seventh Travel Around the World."

DX operating aid no. 1

DXing Cook Islands style takes place from an A-frame like this on Rarotonga, thanks to ZK1CG.

COOK ISLANDS

ZK1CG affords a rare pictorial look at the beauties of the Cook Islands: "unhurried, unspoiled, unforgettable." Easy to reach by air, the Cook Islands lie virtually in the center of the Polynesian triangle of the South Pacific — flanked to the west by Tonga and Somoa, and to the east by Tahiti and French Polynesia. Victor, ZK1CG, and XYL Marsha host Tiare Village in Rarotonga, with every facility for a delightful ham-type vacation. Victor would be delighted to enlighten you via Box 489, Rarotonga, Cook Islands, South Pacific; phone, Rarotonga 23-466; telex, Savetax 62028; or cable, Tiare Village, Rarotonga. Vic makes special mention of thanks to JA1ACB for putting Rarotonga on the air on teletype. Vic is now looking for a monitor with a green or amber screen. *(North Cooks info also via ZK1CG.)*

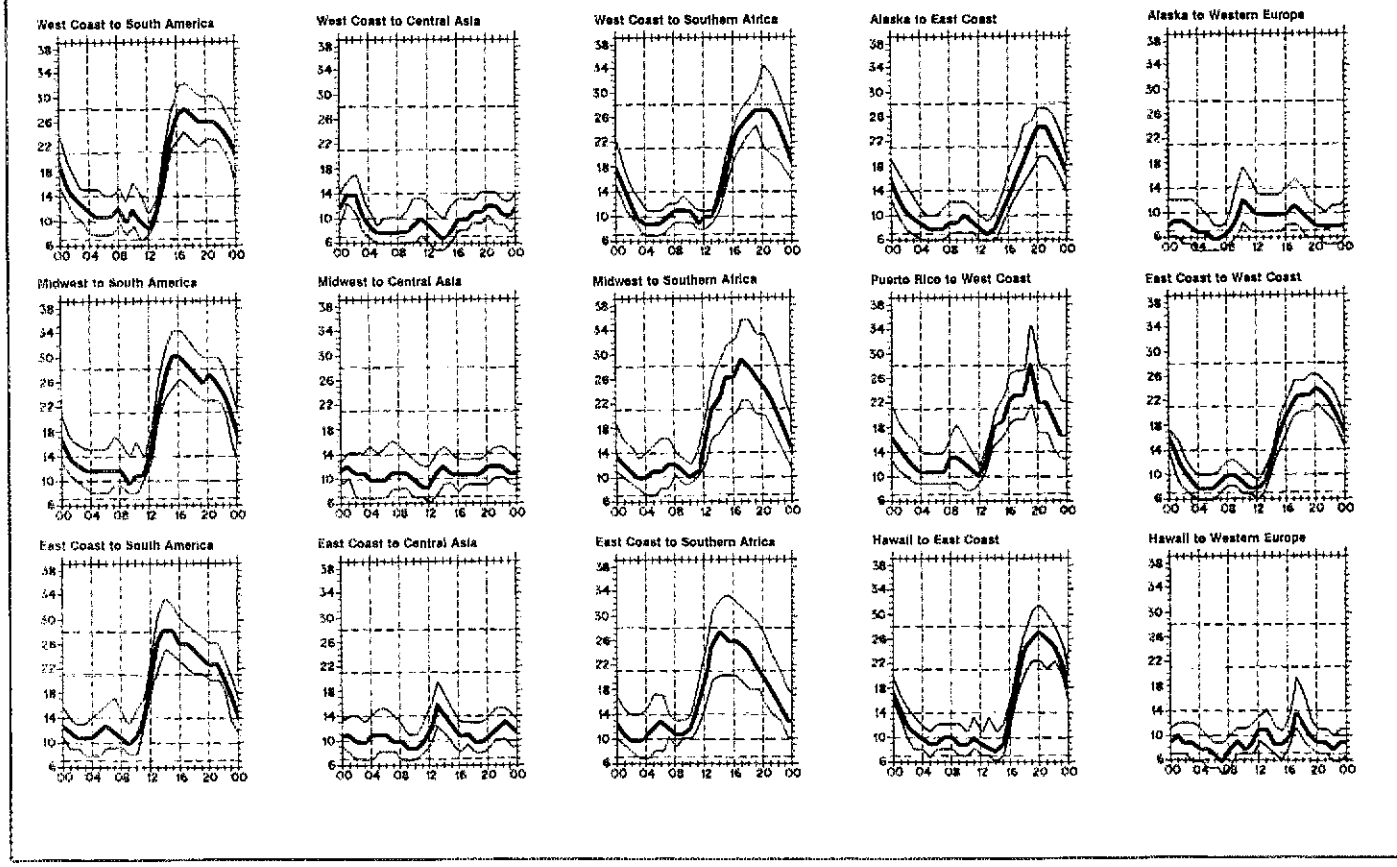
NYC NATIONAL CONVENTION SURVEY

A pulse-taking at the ARRL National Convention in July makes good food for thought for all column readers.

The biggest problem in the DXCC program today is: need some new countries at reasonably short intervals — it's too easy — it looks like a rush to add new countries and stretch the criteria to push the total numbers up — too many minute or truly uninhabited areas to work — people get credit for list-operation contacts — too much emphasis on top positions in the Honor Roll, too intense — changing country status — definite determination of what constitutes a DX country — letting politics enter the verification of a country status — obtaining documentation from rare operations — no problems.

The direction I'd like to see the DXCC program go is: recognize the vast difference between traditional DXing and list/net operation — no changes necessary — more emphasis on broader awards program — don't change Honor Roll requirements — development of a DXCC award for working numbered quadrants on a grid system, in concert with the current DXCC — begin an educational program for the DX station operator, giving them suggestions on how to cope with pileups — DXCC subcategories based on station equipment to make it more interesting — more "countries"; the more, the better — a DXCC endorsement for under 200 W.

Re How's DX: more emphasis on ethics and man-



When are the bands open? These charts predict this month's average propagation conditions for high-frequency circuits between the U.S. and various overseas points. One chart for East Coast to West Coast is also included. On 10 percent of the days of the month, the highest frequency propagated will be at least as high as the uppermost curve (highest possible frequency, or HPF). On 50 percent of the days of the month, it will be at least as high as the middle curve (maximum usable frequency, or MUF). On 90 percent of the days of the month, it will be at least as high as

ners — current activities — upcoming expeditions and details of past operations — less info on DX history — less emphasis on propagation/conditions — let's have a DX tip of the month.

Special thanks to all who filled out the survey!

THE CIRCUIT

☐ San Felix: Hot news at the very beginning of September was an operation by the Chilean Radio Club and Navy for close to a two-month period. The "new" operators went with little prior experience to prepare for handling the massive pileups. Cards go via Box 700, Santiago, Chile.

☐ Mozambique: AB4Y (see first Circuit item in the September 1984 issue) continues to pursue permission. Another of Chuck's ventures is starting up an organization of American hams residing in foreign countries. Chuck would like to publish a newsletter, exchange ideas, help obtain equipment in countries where gear must be air-freighted in, etc. In addition, he'd like to cooperate in a vacation exchange program. For U.S./APO mail write to Chuck Martin, AB4Y, American Embassy Maputo, Department of State, Washington, DC 20520; International Mail address is Chuck Martin, C.P. 783, Maputo, Mozambique.

☐ Help! DJ5JH is looking for "Bill," ET3WM, re a CW two-way from late July 1976. KNØV worked and needs CR7LE for October 1972 on 10 meters under KNØV's old call of WAØYLE. WBØBJP is still on the hunt for the QSL whereabouts of TY4MA for a December 1976 contact.

☐ Honor Roll Families: The June issue, page 62, and the September issue, page 52, noted serious family DXers. Jogging our mind now is gentlemanly Massachusetts Honor Roller W1HZ, justifiably proud of his H-R son, K1HZ. Truly "one-of-a-kind" has got to be Honor Roll member G3HCT, shown in the June Honor Roll as is his father, G2BOZ, *and* brother, VK6HD (who originally made the Honor Roll under the call G3HDA)!

☐ Marion Island: WA2HZR forwards an article he culled out of the February 1984 issue of *South Africa Panorama*. If you can get your hands on it, you'll see knock-out pictures of the fauna of Marion Island, which (with Prince Edward Island) constitutes a focal point in ongoing South African sub-Antarctic research. Dave will be back in ZS-land in November/December for another CW expedition from a homeland and *(also)* working on ZS2MI! He'll pay particular attention to long path on 20 meters at 1200-1300Z to W/K/VE, also on 40 meters at 0300-0400Z.

☐ Operator Referral System: Interested in being part of a contest or DXpedition operation? Get a large s.a.s.e. off to N7DF, Box 125, Holton, KS 66436, for registration forms and additional information (no fees).

☐ V2A: KA2DIV will be operating from Antigua for several months, 10-80 meters. QSL via Joe, WB4OSN.

QSL Corner

Administered By Joan Hushin, KA1IFO

Here is some information for those of you who would like to QSL direct to the station location. It is passed along as we receive it and, therefore, may not be accurate. The call sign in parentheses is the QSL manager.

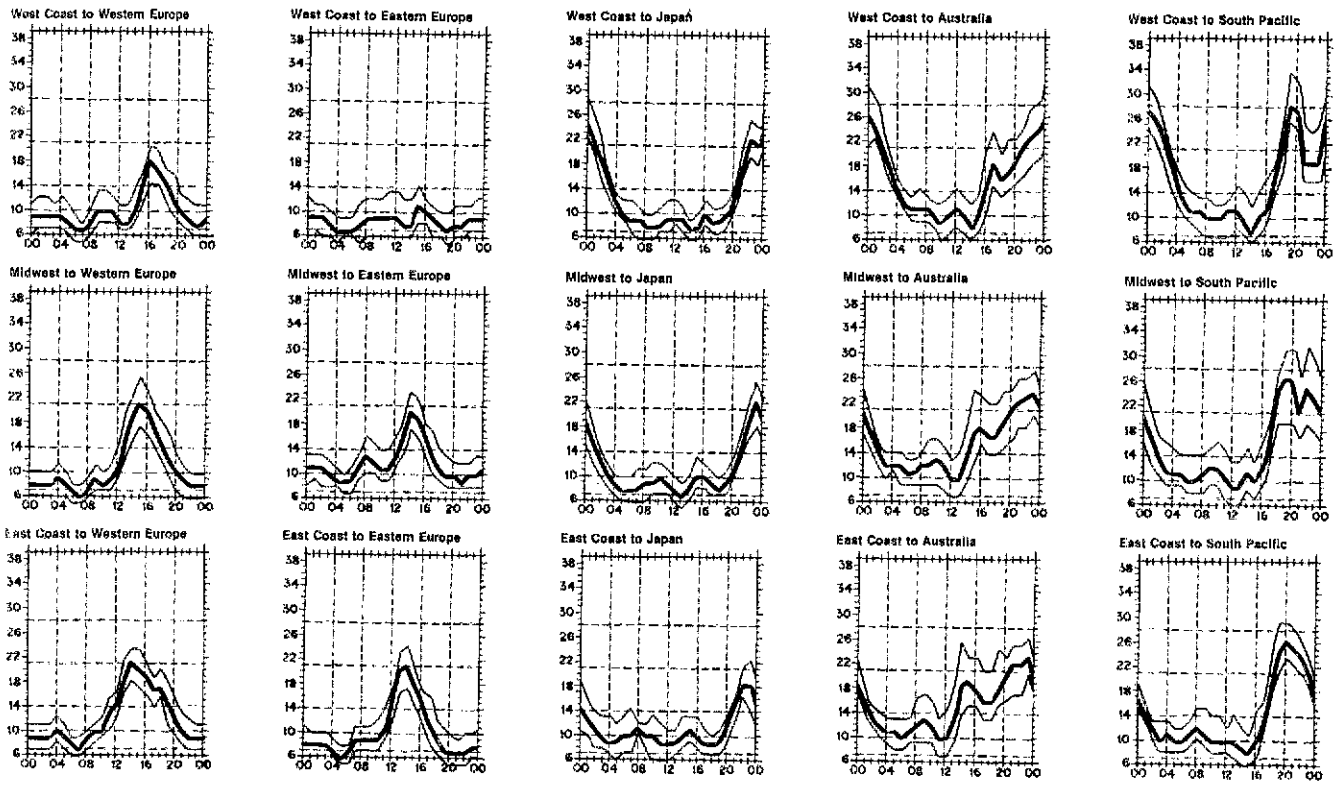
A92DQ (K2IJL)
FOØKW (WB6RFI)
HI8CH (VE1GU)
HI8RAU (VE1XA)
J39AA (VP2KG)
J39BS (VP2M)
J39CM (VP2MLD)
J6LT (VK5ATB)
OHØAM (OH2BAZ)
OHØBA (OH2BAZ)
OE2FAC (VP2MN)
OE3YHU (VP2MO)
OH9TH/4U (OH9RJ)
TK6JUN (F5IY)
TU2NA (K2IBW)
T31AT (G4GED)
VP2MKS (K5VZN)
VP2EH (KC5EA)
VP2VCW (N6CW)
PJ4CR (6Y5JT)
YB2ARH (K2ROR)
YV4CMG (KR2K)
YV4DJZ (KR2K)
5B4LP (KA3FIB)
5H3JR (W2SNM)
5W1EJ (WØWP)
7X2BK (F6EWK)

QSL Manager Volunteer

WB3CDX

Special Notes

☐ September 1984 QSL Corner, page 53, contains information on the operation of the ARRL Outgoing Overseas QSL Service. June 1984 QSL Corner contains information and addresses for the Incoming Bureaus. For information on bureau operations (Incoming and Outgoing), send a self-addressed, stamped envelope to ARRL QSL Bureau, 225 Main St., Newington, CT 06111.



the lowest curve (optimum traffic frequency, or FOT). See April 1983 *QST*, page 63, January 1977 *QST*, page 58, September 1977 *QST*, page 35 and January 1979 QST, page 11 for a complete explanation. The horizontal axis shows Coordinated Universal Time (UTC); the vertical axis, frequency in MHz. Data are provided by the Institute for Telecommunication Sciences, Boulder, Colorado. These predictions, for November 15 to December 15, 1984 assume a sunspot number of 39, which corresponds to a 2800-MHz solar flux of 93.

DX Century Club Awards

Administered by Don Search, W3AZD

The ARRL DXCC is awarded to amateurs who submit written confirmations for contacts with 100 or more countries on the official ARRL DXCC List. You may also submit cards to endorse your award in 25-country increments through 250, 10-country increments through 300, and in 5-country increments above 300. The totals shown below are exact credits given to DXCC members from August 1 through August 31, 1984. An s.a.s.e. will bring you the rules and application forms for participation in the DXCC Program.

New Members

Mixed

DJ9IW/106 DL1FBW/105 DL4GBA/112 F6BLP/255 F6IFE/106 F8RR/101 G3ALI/326 IK6BOB/141 JA1MDK/310 JG1JWP/110 JH1CTQ/105 JH1KKT/122 JK1FNN/109 JA2WCC/106 JG2MWA/132 JJ2BBZ/200 JJ3EBR/110 JA4XZR/110 JA9EYI/109 JY9TS/110 LA1KK/105 OH6LX/115 OK2SAI/100 OK3CFF/126 OK3CFK/139 SM6NJK/109 SM7LPY/133 TN8AJ/185 VQ9NN/112 YO3JW/320 YO4ZL/106 YU1PJQ/110 YU2LAW/128 YV5CFA/295 ZS6BUR/107 4X4JJ/144 4X6DF/176 N1AWJ/107 KA2IOF/100 KB2ST/226 KX2X/105 N2EAW/101 W2KKT/107 WA2PGH/113 KK3V/105 K3APM/137 K4WQB/115 KF4BA/100 K7DOR/223 KA7A/101 KA7NXV/103 KG7Z/164 WI4R/262 K5JM/320 WD5JWG/104 KZ6Z/151 K7DOR/223 KA9JOL/102 KV9C/107 KA9DXE/113 KS9C/KH2/105 WA7WEB/104 K8KUZ/112 KS8Q/158 KA9JOL/102 KV9C/107 W9NZW/152 KB9PY/127 KS9C/KH2/103 WB9QMU/106 W9DFT/171

Radiotelephone

G4MTC/106 G4RAB/126 I1CCA/107 IK1AVW/109 I4GHW/193 IK8BOB/138 I8AQZ/122 JF1RDC/108 JH1CTQ/105 JA2QZY/110 JG2MWA/132 JA4XZR/109 JA5BLS/110 LA1PBA/101 PA0ZW/103 SM7LPY/123 TI2KD/104 VK4EJ/103 VP2MCG/108 VU2CK/102 YO3JW/282 YV5CFA/295 ZP5JAF/153 6Y5AM/159 N1AWJ/106 W1IMV/101 KB2ST/213 KY2J/107 N2AWM/213 WA2PGH/100 KG3R/202 WA3QKX/185 WB3AIT/189 K4PR/226 K4WQB/115 N4HRZ/105 NR4R/110 W4UIQ/103 WC4B/100 WD4AFY/100 KA5HSA/103 KZ6Z/143 WA6JOA/103 KC7FS/113 KD7LK/100 KG7Z/151 N7CSH/114 KC8YW/112 KS8Q/104 WB8QMU/106 KA9PJZ/100 KV9C/107 W9NZW/152 KB9PY/127 KS9C/KH2/103 W0DFT/171

CW

A4XJP/106 F6IFE/105 G3VTY/105 I1JQJ/112 JA1JAT/144 JA1MDK/286 JG1JWP/105 JJ2BBZ/110 LA4DCA/118 PA3DBG/105 OK3CFK/103 SM6NJK/105 YU2LAW/118 4X4JJ/100 9G1GE/100 KF2G/188 WB2WBU/106 KK3V/105 K3APM/103 AA4V/150 KA4QZJ/100 WB5ZPD/105 WD6AXA/103 KS8Q/121 KX9B/139 WD9DUC/100

RTTY

W5DOZ OH2TI

160 Meters

K9UWA W2FZY

5BDXCC

K1HMO DL6RAI PY2FR YU1YU K9IW DJ5DA CE6EAT YV3BFR SK6AW AD8O KR7Y LU9FFA YO3JW ON6YH W1BWS

Endorsements

Mixed

CE3GN/304 CO2HQ/225 CT1FL/331 CX2CS/247 DJ2BV/165 DJ2BW/351 DJ3AS/228 DJ5LA/333 DJ7AX/186 DK1RV/277 DK8DB/283 DL4YAH/295 EA6DE/283 EA7LQ/308 EA8OZ/307 F2BS/336 G3SJH/319 G3TJW/330 I2MQP/306 I2XIP/306 I5EFO/300 JA1GZI/273 JF1RDC/152 JH1QOJ/321 JJ1UJK/151 JA2ELA/206 JA4LXY/316 JA8GXP/315 JA7BAL/300 JA7FS/321 JA9GPG/185 JA9NLE/293 LA5YJ/317 LA3XI/322 OE1ZL/255 OE2VEL/307 ON4DM/357 ON4SH/293 ON4SW/280 ON5WQ/256 ON6YH/270 ON7WW/303 OZ7XG/202 PY1LW/303 PY1SJ/269 PY6ABZ/226 SM5BFC/312 SM7BAU/305 SM7IZL/237 SM7TV/321 SM0MC/311 SP6FER/256 VE3CUI/200 VE3IR/311 VE5XV/220 VE7DXN/265 XE1OW/297 XE2ADY/154 YO3AC/331 YU2TS/291 YU4HA/340 YV5HUJ/217 YV5BNR/278 YV5DFI/325 ZL1BIL/307 K1HMO/308 K1TN/322 K1VSJ/200 K1WJL/310 KB1U/270 KB1W/202 KG1M/253 KI1G/235 KV1S/177 N1AFC/260 W1BWS/296 W1ENE/301 W1HOF/217 W1JNZ/185 W1LMO/200 W1OR/322 WA1AYS/233 WB1DLH/204 WB1DQC/307 K2AIO/302 K2OLG/296 KA2CDJ/158 KA2HMJ/203 KA2HWY/131 KB2HZ/298 KB2RV/301 KK2I/307 KQ2O/300 KU2C/175 N2EDF/170 NA2J/272 W2LL/342 WA2ISM/260 W2JGR/305 W2VP/206 WA2UXC/292 WB2GYS/180 AD3Z/311 K3OXS/150 K3RV/270 N3ARV/259 N3CYI/204 N3TO/283 W3OP/335 WB3LHY/150 AA4MM/335 K4KJZ/306 K4KPH/294 K4KUZ/306 K4LRX/200 K4PRT/277 KC4B/284 KD4TQ/154 KG4W/309 N4AXT/300 N4BQD/260 N4CIS/255 N4DDK/220 N4WJ/321 ND4Y/225 NF4Z/197 W4TFB/329 W4VOS/154 WA4TLI/316 WC4B/175 WD4RJQ/178 WD4W/176 AE5H/300 KA5HSA/155 W5OB/349 W5DL/338 W5IB/270 W5INL/275 W5JLU/310 W5UCY/178 W5YH/288 WB5LBR/140 WD5DEQ/164 AI6Z/232 N6OC/314 W6AYQ/281 W6BYH/337 W6DBP/283 W6EYR/329 W6GYM/270 W6MUS/304 W6SIJ/300 W6OUL/277 WA6SIX/253 WA6WZO/316 WB6FCR/285 WB6ZUC/315 K7OXB/321 K7ZBV/299 KQ7H/200 N7BES/271 W7FP/311 W7HRD/280 W7JBS/262 W7NP/290 W7PEW/125 K8JRM/299 K8MR/210 KG8K/153 KM8E/183 KZ8Y/306 N8TN/322 W8MFB/207 W8YAH/289 WB8ZRL/297 WD8IZE/262 KG9N/290 AI9F/292 KR9P/270 KS9Y/198 N9BOK/228 N9CPW/252 W9LYN/159 W9MP/175 W9NYG/203 W9TX/284 WA9OVU/279 WB9OJE/201 WD9BEG/253 WD9HMQ/143 AE0K/312 K0AXU/250 K0JFN/259 K0VZR/254 KA0CPY/271 KB0PY/128 KC0XK/243 N0XA/307 N0ZA/295 W0JLC/279 W0NS/310 W0WP/314 WA0JYJ/305 WA0TKJ/317 WB0RXF/250

Radiotelephone

CE3GN/304 CO2HQ/225 CT1FL/331 CX2CS/247 DJ2BV/165 DJ2BW/351 DJ3AS/228 DJ5LA/333 DJ7AX/186 DK1RV/277 DK8DB/283 DL4YAH/295 EA6DE/283 EA7LQ/308 EA8OZ/307 F2BS/336 G3SJH/319 G3TJW/330 G4FCT/158 HB9AHL/319 HB9G/283 HB9RX/324 HB0NL/155 I2MQP/306 I5EFO/297 JA6GXP/312 JA7BAL/281 JA9GPG/185 JA9NLE/284 KH6OR/346 LA3XI/321 LA5YJ/313 LU2DX/320 LU3MCJ/226 OE2VEL/305 OK1MP/338 ON4DM/357 ON4SW/222 ON6YH/232 ON7WW/300 PA0HBK/280 PA0KB/312 PS7JD/219 SM5BFC/306 SM0MC/303 SV8RX/204 VE3BDB/330 XE1OW/297 XE1NI/313 XF4MDX/151 YO3AC/315 YO3JU/333 YV5DFI/325 Z21BP/296 ZL1BIL/307 ZS3TL/150 4Z4ZZ/150 8P6OV/227 KG1M/241 KS1S/274 N1API/277 W1BWS/283 W1ENE/274 W1NBE/159 WA1AYS/233 WA1WTP/287 WB1DQC/307 K2OLG/295 K2PWG/186 KQ2IL/225 KA2CDJ/150 KA2HMJ/149 KA2HWY/130 KB2HZ/294 KD2BW/140 KK2I/305 W2EKO/283 W2GZA/262 W2JGR/300 W2NCL/305 W2VP/202 WA2BGE/270 WA2ISM/250 WA2MXW/292 WA2UXC/291 K3BCG/309 K3DYX/184 K3KA/309 K3RV/203 KB3PJ/319 KC3KV/301 KG3K/301 KM3Y/279 N3KR/157 K4BFJ/202 K4ETB/181 K4JDJ/226 K4KJZ/306 K4LR/300 K4UAS/306 KF4M/289 KG4W/300 KV4F/300 N4AXT/298 N4DDK/209 W4TFB/322 WA4TLI/311 WF4V/312 AE5H/293 KB5PJ/239 W5INL/274 W5LVD/296 W5SGI/290 W5UAW/335 W5YH/268 WB5LBR/127 AI6Z/192 K6DQ/285 KA6JDH/156 KD6ZM/154 KJ6Z/127 N6HVZ/138 N6OC/313 W6BSY/349 W6GYM/270 W6KON/323 W6MUS/295 W6ZPV/281 WA6WZO/316 WB6FCR/277 AI9F/263 K9DXO/316 KD9EB/156 KS9R/226 W9LYN/151 W9MWO/324 W9TX/263 K0VZR/250 KA0CPY/271 KB0HJ/271 KC0SV/125 KC0XK/198 KZ8Y/303 N8BLD/185 W8GUS/300 WB8ZRL/290 WD8IXE/235 AI9F/263 K9DXO/316 K7ICW/300 K7OXB/315 K7ZBV/295 N7BES/269 N7US/315 W7FP/309 W7JBS/260 W7OM/323 K8JRM/294 K8MR/151

CW

DJ2BV/201 DJ2BW/310 DK1RV/149 DL1QT/199 DL5FF/258 DL7WL/265 G4MVA/155 HB9ALO/290 JA1CZI/250 JJ1UJK/151 JA4LXY/278 LA3XI/293 LB1GB/161 OK1MP/297 ON4SH/264 ON4SW/233 ON6YH/218 ON7WW/292 P29JS/162 PY2FR/257 PY2TM/308 SM7IZL/172 VE3CKF/303 VO1CA/193 YV5HUJ/207 AI1S/272 W1BWS/266 W1ENE/199 K2AIO/201 KA2HMJ/187 KQ2O/225 KU2C/152 K3KA/297 K4CEB/302 K4KUZ/292 KZ4V/176 AE5H/252 W5IB/257 W5LVD/289 W5YH/235 AI6Z/187 KB6WI/151 W6MUS/217 W6OUL/230 K7NN/252 K7ZBV/253 N7CW/294 N7US/252 ND7K/131 WA7ZWG/125 K8MR/133 KZ8Y/254 WA8SXQ/283 WB8ZRL/231 WD8IXE/171 AA9F/129 K9ZO/260 KG9N/168 W9TX/194 AE0K/270 K0IFU/137 K0RP/260 KH0S/150 W0JLC/263 W0WP/308

RTTY

W3KV/216

DXCC Notes

Baker, Howland and American Phoenix Is.

The ARRL Awards Committee met to consider the recommendation of the DXAC to delete the Baker, Howland, and American Phoenix Islands DXCC listing, and to add a new DXCC country, Baker and Howland. The Committee REJECTED this proposed action by a vote of 6 to 1. Therefore, the present listing remains but will no longer include the American Phoenix Islands, since sole jurisdiction has been under the Republic of Kiribati since September 23, 1983. Thus, no deletion or addition to the DXCC list will occur.

Correspondence

Conducted By Peter R. O'Dell,* KB1N

All letters will be considered carefully. We reserve the right to shorten letters selected in order to have more members' views represented. The publishers of *QST* assume no responsibility for statements made herein by correspondents.

QST GOES TO THE DOGS

☐ While I am not any longer a member of ARRL, my dog is. This started back years ago, when your management decided that *all* hams must be readjusted, re-examined, incentive licensing to be the thing to do, etc. I wrote ARRL at that time several nasty letters, and received several (nasty) in return. At that time, I stated that my name would not ever be again in the rolls of ARRL. Until now, it has not been. Since I wished to continue with *QST*, I enrolled my dog, a German Shepherd by the name of *Mandy Hund*. (I have had, since then two Mandy Hunds.) Each year, the dues are paid, and the dog gets his/her certificate, but I could not teach either Morse!

It was at the time that the new building was being funded, the one, or one of the ones, who suggested that anyone that would contribute $5 or more would receive a certificate. I guess this must have caught on, since I sent $5 and did receive a certificate.

Anyway, at 61 years of age, I wished you to know that you have had a dog for a member for a good number of years, but now that the original lousy top management has changed much for the better I thought that I should confess.

If you print this, I will be somewhat amazed but pleased, too, since it will prove that the old hide-bound hogwash is gone! — *Nick K. Thompson, W1DXR, Gorham, New Hampshire*

[Editor's Note: Well, Nick, we don't share your view of past League management, and we're sorry to lose as faithful a member as Mandy, but we're glad to welcome you back!]

BAD MANNERS

☐ K1ZZ's recent article on spectrum management above 50 MHz (September *QST*, p. 9) contained a number of good points, but it reminded me that our record of managing spectrum in the HF is still wanting. The U.S. phone band expansion has not, apparently, compensated for the temporary loss of propagation on 10 and 15 meters, and a lot is being said in anger on a crowded 20-meter band, which one wouldn't want a prospective ham (or the FCC) to hear. Yet, still 7s talk to 7s and 9s work 8s on our best (often only) DX band when 40, 80 and often 2 meters would suffice.

No amount of expansion on 20 will do the trick if the other bands are ignored. Think about the distance you want to cover and *then* reach for the band switch. — *Denis Battrum, VE5KX, Saskatoon, Saskatchewan*

RECTIFYING A MISTAKE

☐ I hope that I won't have to spell this out in detail, but my memory is not so short that I can't remember that a 6AL5 is no oscillator tube.

If there has been some immense breakthrough, please publish immediately the circuit in "sugar coated" fashion. (I am referring to W4TNF's "no budget" hamming response on page 50 of September *QST*.)

This reminds me of the AM days when I used to tell everyone that I was running a pair of 872s modulated by a pair of 866s (with an 83 oscillator, of course). — *Red Blanchard, W6AG, Los Angeles, California*

1001 REASONS NOT TO QSL

☐ Here's a bunch of my 1001 reasons not to QSL: (1) "I don't have the time." (Oh yeah? But you have the time to rag-chew hour after hour, day after day, don't you?) (2) "I can't afford to QSL." (No? But you can spend thousands on rig and antenna.) (3) "I don't keep a log." (What do you think? You think that when I send you a card, I'm just makin' it all up?" (4) "I don't have a *Call Directory*." (Ya don't need one. Just use the address on my card!) (5) "I never QSL stateside." (Izzatso? May I ask how you got your WAS?) (6) "Your card is not very attractive." (What are we doing here — judging a beauty contest or confirming a contact?)

C'mon, hams! Refusing to QSL after someone has sent you their card first is simply thoughtless and inconsiderate. Let's all keep in mind the personal contact and friendly communication that make Amateur Radio the great hobby it is. — *Roland L. Craig, Jr., WX4X, Virginia Beach, Virginia*

STEREOTYPING HAMS

☐ After a lapse of many years, I had occasion to attend the League's (national) convention this year in New York.

While impressed by the evident technical advances on display, I was taken aback by the antiquated and stereotypical view of men and women reflected in the convention program. I refer to the separate "welcome ladies" program with such relevant topics to amateur radio as "the care of your skin and how you can look like a million dollars," "counted cross-stitch made easy" and "How Many Ladies Can Take Any Vegetable and Make a Very Special Decoration to Put on a Platter." In a high school or college setting, Federal Law prohibits such sex-stereotyped course offerings, e.g. shop for men and home economics for women.

I trust the League intends to treat its members on an equal and non-discriminatory basis and that it will be able to promote the interests of all members free of the inappropriate sexual stereotypes reflected in the last convention program. — *David B. Rigney, WA2CDQ, New York, New York*

[Mr. Rigney is the General Counsel of the City University of New York.]

ARRL IS GOOD

☐ We will have Amateur Radio examinations at the Louisville Hamfest September 29 and 30 because of a tremendous amount of work and effort by our local VE team. Also, Curt Holsopple, K9CH, manager of the ARRL VE Program, has prepared an excellent reference manual despite the short time schedule imposed on him. It is his devoted effort which enables others to be upgraded and advance in Amateur Radio. Curt has spent many hours on the telephone advising us and others. Congratulations on a job well done. — *Roy Dobbs, W4KHL, Louisville, Kentucky*

ARRL IS BAD

☐ I am very disappointed in the lack of leadership aggressiveness on the part of the League. Now that individual clubs have laid the groundwork for and are running self-administered exams smoothly, the League has graciously decided to step in as "national VEC." Your timing being coincidental to the FCC allowing a $4 maximum fee certainly does not enhance your position from this observer's viewpoint.

This writer feels that you've really missed the boat, and should come forward in any given call area only if asked. The local organizations really are doing a splendid job so far.

How about some photos of naked radios? — *Hank Goldman, WA2OVG, Riverdale, New York*

WHAT'S UP, TEACH?

☐ President Reagan recently recommended a teacher be the first civilian passenger on one of the near future shuttle missions. I propose that a teacher, preferably one of physics or mathematics, who is also a licensed amateur radio operator be selected. — *W. Frank Hale, N4JTY, Fairhope, Alabama*

QSK ANYBODY

☐ The Q signal "QSK" means, "I can hear you between my signals." If followed by a question mark, it means, "Can you hear me between your signals?"

If you hear someone calling "CQ de (call sign) QSK" it means the operator is asking you to break. It is not a request to work break-in. You do not need break-in capabilities. It is just a good operating technique to shorten CQ calling. If you hear a CQ QSK and want to QSO the other station, hold your key down for one second while zero-beat on the other station's frequency. The CQing station will hear you, will sign again and send a "K."

Although Q signals were originally developed for CW, it is possible that a VOX-equipped-phone-rig operator might conceivably use such procedure also. There is nothing in the rules indicating that Q signals cannot be used on phone, although some operators seem to be quite upset when hearing Q signals on phone. The use of Q signals on phone is a ham tradition and has been used for more than half a century. Q signals must not be confused with 10 codes, which were developed by the emergency services and were later used by CBers. A 10 code may have different meanings in different services and might be construed as being a form of cipher, which is illegal on the ham bands. Q signals always have the same meanings and are internationally recognized. — *Bob Shrader, W6BNB, Sebastopol, California*

*Public Information Coordinator, ARRL

The New Frontier

Conducted By Bob Atkins,* KA1GT

Diode Mixers and Noise Figure

On the other higher microwave bands, particularly 10 and 24 GHz, preamps are rare and receivers usually rely on a simple single-ended diode mixer as the first receiver stage. For maximum sensitivity, it is important to minimize the overall receiver noise figure. In the case of a diode mixer first stage, the overall receiver noise figure is given by

$$NF_{RX} = L_c + IF_{NF} \qquad \text{(Eq. 1)}$$

where

L_c is the mixer conversion loss (dB)

IF_{NF} is the noise figure of the IF stage

This relationship holds for IF frequencies above about 1 MHz. Below that frequency, there is an increasing contribution from diode flicker noise. Lower IF frequencies are normally only used in systems such as Doppler radar.

It can be seen, therefore, that the noise figure of the IF stage adds directly to the overall receiver noise figure. Thus, for a low overall noise figure, the lowest-noise IF preamp possible should be used.

Conversion loss, a measure of the ratio of the signal at the RF port of the mixer to that produced at the IF port, is more complex. It consists of three terms:

conversion loss = matching loss + parasitic loss + junction loss

Matching loss is dependent on the impedance match at the RF and IF ports of the mixer. Less-than-perfect match results in less-than-perfect power transfer, and so increases matching loss. The following relationship holds between matching loss and the VSWR at the RF and IF ports:

$$\text{matching loss} = 10\left[\log_{10}\frac{(VSWR_{RF}+1)^2}{4VSWR_{RF}} + \log_{10}\frac{(VSWR_{IF}+1)^2}{4VSWR_{IF}}\right] \qquad \text{(Eq. 2)}$$

Parasitic loss is loss of signal power due to the diode parasitic elements C (junction capacitance) and R_s (series resistance). Also involved is R_j (the diode junction resistance), which is established by the local oscillator drive level. For any diode there will be a value of R_j, and hence local oscillator drive level, which will minimize parasitic loss. Junction loss is a characteristic of the voltage-vs.-current characteristics of the diode junction itself and the circuit conditions at the RF and IF ports.

Theoretical calculations show that for an ideal broadband mixer the minimum conversion loss is around 3 dB, with half the input RF power appearing at the IF port and half being dissipated in the image termination. (In the mixing process, two frequencies are generated — RF + LO and RF − LO; one is wanted, and the other is the image.) For an ideal narrow-band mixer, it can be shown that the minimum conversion loss is 0 dB. Such an ideal mixer does not, of course, exist in the real world.

Low conversion loss can be achieved in what is termed an image-recovery mixer, which in practice can have 1 or 2 dB lower loss than a simple mixer. In an image-recovery mixer, energy generated at the image frequency can be reconverted to generate power at the desired IF. This is brought about by terminating the mixer ports in such a manner (by correct filtering and phasing) that unwanted energy is reflected back into the mixer in the correct phase to add to the desired IF output. Because design of such mixers is complex, and improper adjustment can lead to increased conversion loss, they are not often used in amateur equipment.

In summary, to minimize the noise figure of a system using a simple diode mixer front end, one should

1) minimize the noise figure of the IF amplifier;

2) make sure the RF and IF ports are matched to the mixer;

3) adjust LO power for minimum conversion loss;

4) choose a diode with low parasitic and junction loss (good "noise figure"). Diode "noise figure" from specification sheets usually is a measure of mixer noise figure in a standard circuit, and includes contributions from all the sources discussed here.

10-GHz NEWS

Jim Hagen, WA4GHK, has written with details of his recent 300-mile contacts on 10 GHz with Todd Roberts, WD4NGG. Equipment used was the same at both stations — 10-mW Gunnplexers on 10.2500 and 10.2799 GHz running narrow-band FM to 1-meter dishes. The path worked was from Hilton Head, South Carolina, to Palm Bay, Florida (an over-water path). From August 6 to 9, contacts were made with full quieting on NBFM. Jim reports that conditions on the lower bands were quite good, but activity was low. Reception of UHF TV from Beaufort, South Carolina, was noticed all day, every day, from August 2 to August 9. On August 7, WD4NGG was heard by Jim from the roof of his house, about 2 miles inland, with severe horizon blockage and about 40 miles of mixed land/water path at the Florida end.

This seems to have been quite an opening. Jim wonders what the current North American DX record is on 10 GHz. If anyone has a claim to a contact over 300 miles, please send the information to the conductor of this column.

2.3-GHz NEWS

Paul Wilson, W4HHK, has sent in details of recent activity on 2.3 GHz in grid square EM55 (Memphis, Tennessee, area). He worked N4MW/5 on August 18, for the first Tennessee/Mississippi QSO on 2.3 GHz. N4MW was using a fully portable station with about 2 W out, and a hand-held (rusty) coffee can as an antenna! Paul now has six states on 2.3 GHz. Also up there in the states count is W8YIO, who sent along information that he now has five states worked in three call areas.

WA4HGN, Savannah, Tennessee, has also been active. On August 10, he worked WB5LUA over a 508-mile tropo path after several weeks of schedules. On August 21, he worked N4MW (2 W out) and WA4PGJ (0.5 W out).

On EME, W4HHK copied signals from WA4HGN at strengths ranging from 219 to 319 on August 21. WA4HGN also copied his own echos for the first time. A two-way contact was not attempted. Both stations are now arranging EME tests with European stations.

MICROWAVE DEMONSTRATIONS

On a couple of occasions (most recently by WA3WGV), I have been asked about the availability of low-cost, low-power microwave equipment suitable for demonstrating microwave principles to such groups as high school students or radio clubs. One source of such information is an article by Yardley Beers, W0JF, titled "Inexpensive Sources and Detectors for Microwave Demonstrations," published in the *American Journal of Physics*, Vol. 51, No. 10, Oct. 1983, pp. 925-929. In this article, a simple 13-cm oscillator using an MRF-901 is described, together with a hot-carrier diode detector and some suitable antennas and experiments. Total materials cost is estimated to be about $25 if everything is bought, and construction requires only simple hand tools.

Simple equipment for 10 GHz is a little more difficult to build, but not beyond the abilities of the amateur. The RSGB *VHF/UHF Manual* contains constructional details of Gunn oscillators and many waveguide components. Alternatively, DROs (dielectric resonance oscillators) that put out 10 mW or more at 10 GHz may be purchased for around $40 from Applied Invention, RD 2, Box 390, Rte. 21, Hillsdale, NY 12529. 10 GHz waveguide components can often be found at flea markets; alternatively, Lectronic Research Laboratories (Atlantic and Ferry Ave., Camden, NJ 08104) sells a set of microwave waveguide components specially designed for demonstration purposes and a book, *Introduction to Microwave Techniques* by R. W. Tinnell, that describes a series of experiments with 10 GHz waveguide systems.

Mini Directory

As a convenience to our readers, here is a list of items of particular interest and when they most recently appeared in *QST*.

Advisory Committee Members	March 1984, p. 60	November Sweepstakes Rules	Oct. 1984, p. 90
Board Standing Committees (Minute 65)	May 1984, p. 60	Pending Dockets	Feb. 1984, p. 65
Call Sign Assignment System	June 1983, p. 61	QSL Bureaus Incoming	June 1984, p. 62
Contest Guidelines	July 1984, p. 88	Outgoing	Sept. 1984, p. 53
License Renewal Information	Jan. 1984, p. 51	*QST* Abbreviations List	Jan. 1984, p. 53
Major ARRL Operating Events and Conventions — 1984	Jan. 1984, p. 52	Reciprocal-Operating Countries	Nov. 1983, p. 71
MARS Information	April 1984, p. 86	Third-Party-Traffic Countries	Oct. 1984, p. 73
		U.S. Amateur Frequency and Mode Allocations	Sept. 1984, p. 47

*103 Division Ave., Millington, NJ 07946

Canadian NewsFronts

Conducted By Harry MacLean,* VE3GRO

Lake Ontario Tall Ships

Hams in the Kingston, Ontario, and Watertown, New York, area gave a real helping hand to Kingston's organizing committee for the Tall Ships Rendezvous in July. Because of lack of knowledge of what to expect and some misunderstanding as to what was possible, the call for amateur assistance went out rather late. Nevertheless, a dozen or more Kingston hams pitched in with great gusto. For several days, the Operations Centre at Kingston City Hall kept going around the clock.

Equipment was borrowed from Bert Hovey, VE3EW, and Jack Whittingham, VE3YC. Out in the lake, Ed Robinson, VE3MYC, operated from a small Canadian Armed Forces vessel that followed the fleet. Using the Watertown repeater, W2WLR/R, with a lot of co-operation from George Bonadio, W2WLR himself, Ed managed to provide much better communications than could have been provided any other way.

On duty in the Operations Centre, through the days and one long night, were Bill Bushnell, VE3DXY; Bernie Burdsall, VE3NB; Buster Doubleday, VE3NF; Bill Mason, VE3NFU; Pat Stever, VE3MPZ; Ted Toogood, VE3HOC; Ron Walsh, VE3IDW; Jean Whitcomb, VE3MNI; and Rick Whitcomb, VE3NWT. Don Chown, VE3NFG, was amateur representative and co-chairman of the city's organizing committee.

An interesting feature to many people "reading the mail" was the use of the call sign XO3KAR by the base station. Kingston was officially celebrating Ontario's bicentennial by hosting the Tall Ships, so the use of the special prefix was entirely appropriate for the Kingston Amateur Radio Club station.

When the ships finally arrived in Kingston, a somewhat smaller net took care of communications for berthing, still using many of the operators listed above. The help of the hams was a significant factor in making the Kingston visit of the Tall Ships one of the best-organized activities the captains had seen. — *Don Chown, VE3NFG*

CRRL NEWS

☐ The CRRL Executive Committee met in Toronto August 26 to examine petitions filed by members nominating candidates for CRRL Regional Directors. These directors will serve two-year terms that begin on January 1, 1985. The following were unopposed and declared elected without balloting: Western Region — William Kremer, VE7CSD; Quebec Region — Albert Daemen, VE2IJ. Ballots were ordered mailed to CRRL Full Members in three remaining Regions. Candidates are as follows: Prairies Region — Bert Anderson, VE4AP; Bill Gillespie, VE6ABC; and John Gowron, VE4ADS; Ontario Region — William Loucks, VE3AR; and Raymond Perrin, VE3FN; Atlantic Region — Ronald Hesler, VE1SH; and Andy McLellan, VE1ASJ.

Marked ballots will be received at CRRL Elections until noon EST November 20, 1984. They will be counted shortly after in the manner prescribed by the CRRL By-laws. Results will be announced on W1AW late November 20, in the *CRRL News* bulletins and in *QST*.

☐ Manitoba Section Manager Peter Guenther, VE4PG, will retire in January, after serving as Section Manager for seven years. In his letter to CRRL, he indicated his strong, continuing support for the League. Jack Adams, VE4AJE, will complete Peter's term. Jack is a mining inspector whose work takes him all over Manitoba. He's worked with Peter as an Assistant Section Manager and is well known to amateurs throughout the province.

DOC NEWS

☐ Planning ahead? Next year, DOC will hold Amateur Radio examinations across Canada on February 13, April 17, June 19 and October 16. Submit applications to DOC by January 16, March 20, May 22 and September 18, or about one month before the date of each writing.

☐ Earlier this year, CRRL asked DOC to allow a few days' grace, one way or the other as required, for amateurs wishing to write an Advanced Amateur exam "one year" after writing the Amateur exam, and for candidates for Amateur or Digital exams who wanted to make use of credits obtained on an examination "one year" earlier. DOC examinations were being scheduled on the same months from year to year but were not exactly "one year" (that is, 365 days) apart. This had caused problems at some DOC offices.

DOC has now complied with the CRRL request. "One year" will be interpreted as "four examinations later." What if your local radio inspector hasn't heard of this ruling and you still run into problems? Just ask him to check with Telcom Regs in Ottawa.

☐ DOC does crack down on illegal operations. A Port Colbourne, Ontario, man was recently sentenced to a $250 fine or 10 days in jail for operating GRS (CB) equipment without a licence.

SECTION MANAGER ELECTION NOTICE

To all CRRL members in the Ontario Section: You are hereby solicited for nominating petitions pursuant to an election for Section Manager. Name of the incumbent appears on page 8 of this *QST*.

A petition, to be valid, must carry the names of five or more Full Members of the league residing in the Ontario Section. Photocopied signatures are not acceptable. Signatures must be *on the petition*. It is advisable to have more than five signatures on the petition.

Petition forms (CD-129-C) are available from the CRRL Headquarters office in London, Ontario, but are not required. The following form is suggested:

(place and date)

The Secretary, CRRL
Box 7009, Station E
London, ON N5Y 4J9

We, the undersigned Full Members of the League residing in the Ontario Section, hereby nominate ... as Section Manager for the next term of office. (signatures ... calls ... addresses, including postal codes ...)

A Section Manager candidate must be a resident of the Section, a licensed amateur holding a Canadian Amateur Certificate or higher, and a Full Member of the League for a continuous term of at least two years immediately prior to the receipt of nomination at the CRRL Headquarters office.

Petitions must be received at the CRRL Headquarters office on or before 5:30 EST December 7, 1984.

If only one valid petition is received, the person nominated will be declared elected. If more than one valid petition is received, there will be a balloted election. Ballots will be mailed from the CRRL Headquarters office on January 2, 1985. Returns will be counted on February 19, 1985. A Section Manager elected as a result of these procedures will serve for a two-year term that will begin on April 1, 1985.

If no petition is received by December 7, 1984, the Ontario Section will be resolicited in April 1985 *QST*. A Section Manager elected after resolicitation will serve for 18 months.

Vacancies in Section Manager offices will be filled by appointment made by the CRRL Secretary, acting on advice from the CRRL Board.

You are urged to take the initiative and file a nominating petition immediately.
Harry MacLean, VE3GRO
CRRL Secretary

Here's everyone the photographer could round up at the close of the August 4 CRRL Board Meeting: Front row (l-r): VE3CJ, W4RA, VE3KGS, VE3CDM and VE3GRO. Back row (l-r): VE3ZJ, VE3BMG, VE7CSD, VE2IJ, VE3AR, VE6AW, VE1ASJ, VE3FN and VE3FON. Not shown: VE3AND, who took the picture.

*163 Meridene Crescent West, London, ON N5X 1G3, Tel. 519-433-1198

The World Above 50 MHz

Conducted By
Bill Tynan,* W3XO

A Common Meeting Place

An often-heard comment is that VHFers need a place to meet and exchange ideas — sort of a village square for the world above 50 MHz. The various VHF conferences serve this function to some extent, but they are each held only once per year, and a relative few can afford the time or money to attend. Over the past few years, when 10 meters was open almost daily, 28.885 MHz was used on an almost-continuous basis for worldwide exchanges of information, principally for those interested in 6 meters. The Central States VHF Society's Sunday evening net, which meets at 2030 Central Time on 3818 kHz, is a good place for North American stations to set up schedules and talk things over. This same frequency is also often used at other times, such as during DXpeditions or meteor showers. There are also the 20-meter moonbounce nets, which hold down 14.345 beginning at 1600Z each Saturday and Sunday. These have been quite successful for establishing schedules and circulating news on the EME front.

But, there is really no longer any meeting place to serve interests of the general VHFer in a similar way that 28.885 did for several years. Once again, however, the moonbouncers have led the way by establishing regular get-togethers on the OSCAR 10 satellite. There should be no reason why some of the rest of us should not follow their lead and take advantage of this first-class communications facility. The following are a few pieces of information to help those with little or no satellite experience.

The OSCAR 10 Mode B uplink extends roughly from 435.04 to 435.17, which produces outputs in the 2-meter band from 145.830 to 145.960. To aid in canceling out Doppler, the passband is inverted, so that signals on the low end of the uplink passband come out on the high end on the downlink. Obviously, sidebands are reversed as well. It is customary to transmit on lower sideband to produce an upper-sideband signal on 2 meters. The General Beacon can be heard at approximately 145.810. A 70-cm rig capable of producing 10-100 W into an antenna with 10 dB or more of gain should suffice. On 2 meters, a good SSB/CW receiver, preceded by a low-noise preamp, preferably mounted at the antenna, will do fine. GaAsFETs are becoming the almost-universal choice for this job.

As with the uplink antenna, the downlink antenna should have in the neighborhood of 10 dB of gain. It is not necessary that either antenna be circularly polarized, but many satellite operators do take this route to reduce QSB. On the other hand, I have heard many stations with very steady signals who are using plane polarized antennas, just like those we use for terrestrial work. It will be necessary, for consistent operation, to be able to aim the antennas in elevation as well as azimuth.

For purposes of defining where the satellite is in its orbit, it carries an internal clock called the "mean anomaly (MA) counter," which counts from 0 to 256. The center of this range, 128, corresponds to apogee, the highest point in the orbit. This is the most desirable portion of the satellite's circuit of the earth in which to work. Since each orbit is in the order of 11.5 hours long, OSCAR 10 is near apogee for several hours.

The new operating schedule, instituted at the end of August, calls for Mode B to be active from MA 032 to 099 and 117 to 189. Between MA 100 to 116, the satellite is in Mode L (1269 up to 436 down). This applies for every day but Sunday. On Sundays, Mode B is active throughout the entire period. Seven days per week, both transponders are off from MA 190 through 256 and up to 031. This is to provide for battery charging. Since this is during the perigee portion of the orbit, not much useful operating time is lost because of this off-period.

Because of the rather strange nature of the highly elliptical orbit OSCAR 10 is in, specific times to hold daily schedules cannot be defined. It is better to define them in terms of the mean anomaly counter. The best way to keep track of this, as well as to determine azimuth and elevation pointing information, is with a computer. An expensive one is not necessary. Anything from the $100 variety on up will be satisfactory. AMSAT has software available at very nominal prices for most types of popular computers. A note to AMSAT at 850 Sligo Ave., Suite 601, Silver Spring, MD 20910, stating the type of computer you may have (or are considering acquiring) will bring further information on available programs.

The moonbouncers have staked out a spot to meet on the OSCAR 10 downlink of 145.950. They get on at various times, normally when the satellite is in view of both Europe and the Americas. It would seem appropriate for this same frequency to be used for general VHF get-togethers. To start the ball rolling, let's define a mean anomaly of 117 on Saturdays and Sundays for beginning our skeds. Other days can be added later, if warranted. Remember that this is the time when Mode L is switched off and Mode B is activated, except on Sundays, when it is on for the entire time. The actual time of day will vary from day to day and from week to week. Without a computer and the proper software, the best way to estimate the time is from the apogee times AMSAT provides on their weekly HF nets. The principal one of these meets on Tuesdays at 2100 Eastern Time on 3855. This is followed one hour later by a Midwest net on the same frequency, and a West Coast addition begins at 2000 Pacific Time.

In the space available, I have been able only to scratch the surface of the subject of amateur satellite communication. Additional information can be found in many *QST* articles, *The Radio Amateur's Handbook* and, probably the best source of all, the League's publication, *The Satellite Experimenter's Handbook* by Martin Davidoff, K2UBC. This excellent book is available directly from ARRL, AMSAT or many Amateur Radio equipment dealers.

In addition to providing a great way to get together, OSCAR 10 operation should be a natural for VHFers. Many already have most, if not all, of the necessary equipment. Techniques we have learned in our VHF and UHF work are certainly germane also to satellite operation. Besides, OSCAR 10 provides something to do with the VHF gear during the coming months when band conditions will not be at their best.

CU on the bird!

SEPTEMBER VHF CONTEST REPORT

"Conditions were flat to rotten." That's what we normally hear following one of the major VHF contests; but the one held September 8 and 9 was a different story. This year's September QSO Party was blessed with generally excellent conditions of both the E_s and tropo variety. The Eastern part of the country experienced a massive tropo opening reminiscent of that of September 1979. Like that one, it was a classic case of a large high-pressure area holding a hurricane off the Southeast coast. The mountaintop stations were particularly favored, but everyone who was active got in on the act.

Contacts from New England to the Carolinas were common, and even a few northern Florida stations were worked. It is understood that the W2SZ group, operating from Mount Greylock in western Massachusetts, worked several Florida stations on 70 cm. This conductor heard K2TXB in Southern New Jersey work a Florida station on 2 meters at 11 Sunday morning! By Sunday evening, the opening extended from the Carolinas all the way to VE1AHM in FM76. From just north of where Hurricane Diana was lurking off the coast, W5HUQ/4 near Jacksonville was able to work as far as W1TKZ/1 in southern Vermont on 2 meters and W2SZ/1 on both 2 meters and 70 cm. W4WDH Oxford, Georgia, reports that he contacted 28 2-meter stations in 20 grids with a barefoot TS-700 and a pair of homebrew eight-element Yagis.

Not to be outdone, 6 meters put on quite a show of its own, with double-hop openings both Saturday and Sunday evenings. Saturday evening was the turn for the Mid Atlantic stations with a two-hour opening producing many Midwestern contacts and a few as far as Colorado and New Mexico. The next evening, it was the Southeast's turn. WD4FAB in the Orlando area reports working many Midwestern stations plus a sprinkling in New Mexico, Nevada and California. K6LMN was one of those striking it lucky. Operating from Mt. Bill Williams near Flagstaff, Arizona, Roger netted 105 stations in 50 grids. It is hard to believe that this was September, not June!

ON THE BANDS

Reports keep arriving on the Perseids, and one must conclude that it was a pretty good shower, despite some initial reports to the contrary. WØKEA, who says he is new at the game, writes that he operated from atop a 9200-foot peak near Aspen, Colorado, in DM69. Phil notes that the rare grid made him quite sought after. Using a combination of random operation and 3818 for skeds, he worked WA4VWR Tennessee; WB5GZQ, K7CW/5 and K5SW Oklahoma; K6PVS and K6JYO California; KB7W Idaho; WBØTEM Iowa; WA1JXN/7 Montana; and K5YY Arkansas. All of this was with 100 W from a Mirage B-108 into a single 13-element KLM. Phil found the 75-meter frequency quite helpful for setting up schedules, but suggests a 40-meter spot for daytime use might be helpful, too.

Another who found the shower quite productive was K5SW. Sam worked a total of 19 stations in 14 states, from Connecticut to California, all 10 continental U.S. call areas plus VE3. Sam's grid total after the shower stood at a healthy 128. But there's more to come!

On the tropo scene, KØTLM Kansas City, Missouri, found four good days, during the period of August 21 through 25, with stations as far east as Georgia, W4GJO; as far north as Duluth, Minnesota, WØPN; and well into Texas, N5BLZ and N5BHZ. Tom was also active on 1¼ meters and 70 cm during this event. On 1¼, he worked nine stations in eight different states. On the higher band, he logged 15 stations in six states. KA9OKH Evansville, Indiana, took good advantage of the tropo session, too. Having been properly

*Send reports to Bill Tynan, W3XO, P.O. Box 117, Burtonsville, MD 20866, or call 301-384-6736 to record late-breaking information.

50-MHz DX Standings

DXCC countries based on information received as of September 15, 1984. Space limitations dictate that continental U.S. and lower-tier Canadian stations with fewer than 15 countries, except those who claim WAC, not be listed. Crossband totals listed are those not duplicated by 6-meter two-ways. Credit has not been given for contacts made with stations known not to be authorized 50-MHz operation as the time of the contact; otherwise, countries are those listed in latest ARRL DXCC Country List. Unless stated otherwise, totals are those worked by individual or club stations at a single location or multiple locations within a radius of 150 miles. A "†" indicates the use of two or more QTHs in the same country but separated by more than 150 miles. Deadline for next update is September 1, 1985.

	1	2	3	4
VE1YX*	77	76	17	16
JA4MBM*	77	76	0	0
KH6IAA	73	70	0	0
KBWKZ*	69	68	17	16
VE1BNN	69	68	6	6
WB4OSN*	69	67	8	6
LU3EX*	69	67	0	0
K5FF*	69	66	3	3
JA1RJU*	68	68	0	0
W5VY*	67	63	11	9
W4OO*	66	66	4	—
W5FF*	66	63	2	2
WD4IYS*	65	65	15	14
WB2MAI	65	65	9	7
W2IDZ*	65	64	12	11
WA7JTM*	65	61	1	1
WA5IYX*	65	55	10	8
K1TOL*	64	64	0	0
W2CAP/1*	64	62	17	12
W8CMS	64	62	12	9
JA1VOK*	63	63	0	0
W5HUQ/4*†	63	59	17	9
W3XO*	63	55	15	7
ZD8TC*	62	62	10	—
JA2DDN*	62	61	0	0
N3AHJ*†	62	59	13	11
WA4OWC*	62	54	0	0
JA3EGE*	61	60	0	0
WA4UAS*	61	59	0	0
W4CKD*	61	58	20	18
WA8LXJ*	60	55	18	18
W3JO	59	59	10	4
JA5HTP*	59	58	0	0
K4KUZ*	59	57	0	0
W6XJ	59	—	3	—
WB7OHF*	58	58	1	0
W4WHK	58	54	18	8
KA1PE*	58	54	0	0
W6BJI*	57	56	2	2
LU9AEA	57	56	0	0
WA2BPE*	56	56	14	6
K4CKS*	56	54	18	13
W5DZF/4*	56	54	2	2
WB2CZB*	55	55	15	12
K1ZFE*	56	55	5	5
LU3DCA	55	55	0	0
KA1BRD*	55	55	0	0
W3IWU*†	55	54	15	15
JE1TGN*	54	54	0	0
WA6BYA*	54	53	0	0
N6AJ*	54	51	1	0
LU7DZ*	54	48	0	0
WA6JRA*	54	18	3	1
K5CM*	54	—	—	—
W7KMA*	53	52	2	1
K8EFS*	53	51	18	15
JA2ODM*	53	48	0	0
W5UWB*	53	42	0	0
WB8BKC*	52	52	16	15
JA0AGA*	52	52	0	0
WA1OUB	52	51	16	13
W1QXX	51	50	14	12
N5DBB*	51	50	1	1
K5SW*	51	49	10	10
N5KW*	51	48	—	—
K5ZMS*	50	50	2	0
K3QMX*	50	49	12	12
WB2PMP/4*	50	49	10	9
W6SMS*	50	48	1	—
PY2XB*	50	47	2	1
WB7TOV*	50	47	0	0
N6CT*	50	44	1	1
WA7EPU*	49	49	1	1
N0LL*	49	48	8	8
WA9AHZ*	48	48	14	14
W1JR*	48	46	9	8
N5DDB*	48	46	1	1
W2MPK*	48	44	13	7
JF3KQA	47	47	0	0
WA1UQC*	47	45	16	3
W1EJ*	46	45	14	12
WB8GEX*	46	44	14	12
K0GJX*	46	44	3	2
K2QIE*	46	43	7	2
WA6PEV*	46	43	3	3
K2QWD*	46	39	13	11
K1ICM*	45	45	15	8
JA9DUR*	45	45	0	0
WB8GEW*	45	44	5	5
W2RTW	45	44	0	0
WB2WSV*	45	42	2	2
XE1GE	45	42	1	1
WA8ONQ*	45	41	7	7
W3BWU	44	43	11	11
K8UNV*	44	42	2	2
K1MNS*	44	42	0	0
JA2GHT	44	42	0	0
WA5HNK*	44	38	14	14
K2YOF	43	43	13	13
WA3DMF	43	42	17	17
AE3T*	43	42	14	14
W4NVW/3	43	42	3	0
WB8KAY*	43	42	0	0
K6QXY	43	42	0	0
KS2T	43	41	0	0
WD4FAB*	43	39	7	5
N4TL	43	39	3	3
WB4NMA	43	—	0	0
KA0AYN*	42	41	0	0
KG6DX	42	40	0	0
K4QXX	42	39	1	1
LU8BF	42	39	0	0
KG6JDX*	42	38	0	0
KH6FLD	42	35	0	0
CX8BE*	42	29	0	0
N5BBO*	41	41	5	5
K1FWF*	41	40	18	10
WA1AYS	41	40	15	14
W5KRH*	41	39	3	3
WB4RUA	41	39	0	0
WB5CHW*	41	37	7	4
JG3AOD*	41	37	0	0
K7ICW	41	34	1	1
WA0CSL*	41	15	6	4
VP2VGR*	41	—	11	—
K4VPK*	40	39	7	7
N5WM*	40	39	6	5
WB8YFE*	40	39	5	5
K6KLY	40	39	0	0
KA1A	40	39	0	0
W1AIM	40	37	3	0
W5HN*	40	35	0	0
VP2MO	40	34	0	0
WB6KBZ*	40	29	1	0
N9CEX*	39	39	6	6
KA1DHO	39	38	12	9
K0TLM*	39	36	5	5
K1SF	39	35	8	8
WB6BMB*	39	34	0	0
K1FJM/4*	38	38	7	6
JA1NVG	38	38	0	0
KA1DHO	38	37	13	9
WA7UJH*	38	37	0	0
WB5JAR*	38	34	7	6
N7AKB*	38	34	1	1
VE3ASO*	38	31	0	0
WA1CRE	37	36	5	4
ZL1MQ	37	36	0	0
JA7QVI	37	35	0	0
W1GXT	37	34	12	4
K3ICH/4	37	32	0	0
W3OTC	37	31	0	0
K7GGJ	37	28	0	0
WB0ZKG*	37	20	4	3
WD2AKA	36	34	9	6
WA0SBZ*	36	33	3	2
W3WFM	36	33	1	1
K4QXX	36	33	0	0
K0AYN*	36	33	0	0
W6ABN*	36	32	3	3
JH3WXB	36	32	0	0
K3HCE	36	31	6	4
WA9ETW*	35	34	2	2
KB4CRT	35	33	1	1
WA5UFH*	35	33	0	0
K0UDZ*	35	32	3	1
KC2TX/5	35	32	1	1
N6AMG	35	26	0	0
W2VO*	35	26	0	0
K0US*	35	21	1	1
K4GOK	34	34	13	12
N7DB	34	34	0	0
K1DAT	34	33	8	5
W0JR*	34	33	0	0
W5NZS*	34	33	0	0
WA6CRA/4	34	31	8	8
KA0ETE*	34	31	0	0
WA1ZUB	34	30	11	7
WD2AFH	34	28	4	0
K1SC/7	34	28	2	2
WA5VJB	34	27	1	1
VP2MJ	34	26	1	1
K6JYO*	34	22	0	0
W2LT	34	20	9	0
W2CNS*	33	32	10	4
WA7GCS	33	32	0	0
W2RLV	33	31	3	2
KA4AOK	33	30	11	6
N6RZ	33	24	1	1
AE9M*	33	23	11	1
WB8PAT*	32	32	11	9
K6GSS	32	32	0	0
K2OV6	32	31	13	12
K5VVV*	32	31	3	0
AD1C	32	31	0	0
KS4J*	32	31	0	0
N6VI	32	31	0	0
K6PHE	32	31	0	0
N7ARC*	32	31	—	—
WB8IGY	32	30	9	7
K8TGC	32	30	4	4
K6QAX	32	29	0	0
K1ZKR	32	29	0	0
WB2QLP/4	32	26	5	4
W5NKG	32	25	2	1
K4LFF*	32	22	0	0
VE4AS*	31	30	2	0
WA2EQK	31	29	6	6
N4VC	31	29	1	0
VE3DSS*	31	28	13	7
W1GXT	31	27	13	2
WB6NMT	31	26	2	1
VE1RC	31	26	0	0
W2BN	31	24	4	1
LU6DLB	31	16	0	0
WB0PKN*	30	29	6	5
N4CD	30	27	12	8
K6JZK	30	27	0	0
JG3RGG*	30	22	0	0
K4ROM	29	27	5	5
WA0NOK	29	27	2	1
K8RZB*	29	26	8	3
VE3FDP	29	25	10	8
WB2TMD	29	25	6	4
WA8OGS*	29	25	0	0
8P6KX	29	24	8	2
WB7SLY	29	20	1	1
C5AEH*	29	—	13	—
VK2BA	28	28	0	0
KC0J*	28	27	0	0
N5JM	28	25	3	3
N5DDS*	28	25	2	2
W9TC	28	25	—	—
N7AQM*	28	22	1	1
VE3EVW	28	17	13	7
WA5QCP	27	27	0	0
KQ0J*	27	25	0	0
N6AMD	27	25	0	0
KA7IXS	27	23	0	0
KA5CAW	27	23	0	0
K9SM*	27	21	6	4
YV4UY	27	20	0	0
N2ASC	26	26	3	3
VK2DDG	26	25	2	—
VE5LY	26	25	1	1
K9XY*	26	22	0	0
WA9DYT	26	22	0	0
K0SE*	26	21	2	2
NP2AE	26	21	0	0
KA1CDZ	26	13	15	3
WA2YWP	26	13	4	2
K1LPS	25	25	4	4
VK3OT	25	25	0	0
N9ANO*	25	25	0	0
N7EIJ	25	25	0	0
KA0CDN	25	25	0	0
WA5OLT	25	22	5	5
K1LPS	25	22	4	0
JF3TDC	25	22	0	0
W0RGU*	25	21	3	3
VE5JQ	25	20	2	2
N8AXA*	25	19	5	4
XE1FE	25	17	1	1
9Y4LL	25	13	0	0
W8NE/4*	24	24	1	1
WA4TJW	24	24	0	0
K0SFH*	24	23	1	1
KD4HP	24	21	4	2
W9NAW	24	20	2	2
JM1LCW	24	17	0	0
KJ3F	23	23	0	0
WA9DYV*	23	22	1	1
HC8VHF*	23	—	4	—
OA8V	23	—	0	0
VK2VC	22	22	0	0
N4MM	22	22	0	0
W7KNT	22	22	0	0
WB8AAG	22	22	0	0
WB0RJR	22	19	4	2
W7HAH	22	19	0	0
WB2QLP	22	18	5	4
KA1YQ	22	17	7	1
K7NV	22	16	1	1
KB7N	22	16	0	0
PY2TTV*	22	15	0	0
KA5FLE*	22	14	0	0
KA1GIY	22	12	2	1
JE3YIA	22	12	0	0
HC1MD/HC5	22	—	2	—
KA0CDN	21	21	0	0
WD0FOY	21	21	0	0
VK2QF	21	20	0	0
WB4WXE	21	20	—	—
WB6CTQ	21	19	0	0
KD8PY	21	19	0	0
K6ZMW	21	18	0	0
NI6E	21	16	0	0
K1HTV/3	21	15	17	3
9Y4JW	21	12	1	1
WD8OXK	20	19	2	2
JG3JLC	20	19	0	0
W8QOI	20	18	2	2
VK3XQ	20	18	0	0
K2JF	20	17	5	5
VE1BUF	20	15	4	3
KA6ING	19	19	0	0
WA8LLY/6	19	19	0	0
ZB2BL	19	18	8	4
W9OEH	19	—	0	0
VE6CX	18	18	1	0
W0LSD	18	18	0	0
N0AJU	18	16	0	0
VK5LP	18	16	0	0
WA4TNV/KL7	18	15	0	0
WA0OFO	18	14	1	1
KC4KK	18	14	0	0
K9LCR	17	17	3	3
VK3AMK	17	17	0	0
VK4TL	17	17	0	0
WB9OPD	17	16	1	0
KB7Q	17	16	0	0
VK7JG	17	15	0	0
VK4AYX	17	14	0	0
KA4CRT/5	17	14	0	0
HK4EB	17	13	0	0
WB4SLM	17	10	0	0
W0PVL*	16	16	0	0
K0CJ	16	15	5	2
VK4ALM	16	15	0	0
VK4ZSH	16	15	0	0
KL7GLL/4	16	14	0	0
W0PKN	16	12	1	1
W8SMD	16	11	5	5
OA8CW	16	—	0	0
K0WM	15	15	1	1
W7IDZ	15	15	0	0
VK3NM	15	15	0	0
VK3AUI	15	14	0	0
VK3AQR	15	14	0	0
WA6HXM	15	13	0	0
N5BOG	15	13	0	0
8P6CX	15	11	2	1
V2ADX	14	4	0	0
EI2W	13**	—	—	—
KL7JAI	13	13	0	0
WA8LHK*	12	12	2	1
VP9WB	12	11	4	1
W1QXX/KP4	12	10	0	0
G4BPY	11**	11	34	30
AL7FH	11	11	0	0
AL7C	11	11	0	0
J6LOV	11	9	2	2
JN1DQO	11	5	0	0
GW3LDH	11	—	3	—
VK6OX	10	10	1	1
KL7WE	10	10	0	0
KL7JJH	10	10	0	0
KL7IKV	10	10	0	0
ZD7BW	10	10	0	0
FK8EB	10	10	0	0
SZ2DH	10	—	0	0
XE2BC	10	—	0	0
WB4WXE/KL7	0	8	0	0
G5KW*†	9	4	35	—
VK6RO	8	8	3	3
VP2VDL	8	6	0	0
G3COJ	8	5	20	4
GI3ZSC	8	—	—	—
G4JCC	6**	4**	37	35
8P6MH	6	6	4	1
G4GLT	6	—	13	—
G3PWK	6	—	12	—
GW3LDH	6	—	—	—
GW3MHW	6	—	—	—
WB4YLR	5	5	0	0
GU2HML	5	—	16	—
G4HUP	5	—	—	—
G4JLH	5	—	—	—
G2AOK	4	—	—	—
G4BAO	4	—	—	—
GM4FZH	3	—	—	—
VK2ZDI	2	2	0	0
SM7BAE	1	1	6	3
SM6PU	0	0	23	10
DJ2RE	0	0	14	9
DK6JL	0	0	11	4
SV1DH	0	0	10	—
CT2EE	0	0	5	2
OZ9QV	0	0	5	1
G3VZJ	0	0	4	4
G3PLP	0	0	4	2
I5CTE	0	0	4	0
GJ3YHU	0	0	4	—
G4ANT	0	0	3	2
G3TAA	0	0	3	2
F6EMT	0	0	3	2
HA6NP	0	0	3	—
HB9QQ	0	0	2	2
G3RDQ	0	0	2	2
OE1HGW	0	0	2	1
OZ7IS	0	0	2	—
G4IDE	—	—	18	—
GM4WOJ	—	—	9	—

1 — 6-meter two-way claimed
2 — 6-meter two-way confirmed
3 — Crossband (6 to 10) claimed
4 — Crossband confirmed
* 6-meter two-ways claimed with all continents
** Includes 4- to 6-meter crossbands and 4-meter two-ways

set up for SSB/CW operation for only one month, he ended up with 22 states and 52 grids. WD0FOY adds his comments on the same opening. Al says that on the evening of August 24 things were quite good, with eight contacts in six grids, but that the following night conditions got really hot, producing contacts in 50 different grids, 24 of them new for him.

Another of the many taking advantage of the superb conditions was WB4NXY Muldrough, Kentucky. After picking up two new states during the Perseids — KB5PX Louisiana and W1VD Connecticut — Greg added W0ANH Minnesota during the tropo opening to bring his total to 34, along with 20 new grids. He reminds us to keep a close watch on our TV sets for signs of tropo openings. K5SW Muskogee, Oklahoma, made a veritable contest out of it, working 64 stations in 16 stations on 2 meters between 0020Z August 24 and 2359Z August 27. His grid total for the band now stands at an impressive 136! Not satisfied with that, Sam added six contacts in five states on 1¼ meters and 11 contacts in eight states on 70 cm. This same air mass must have drifted to the east because K1FO in the Hartford area reports working stations as far west as Chicago on 70 cm the evening of August 28. Steve hooked up with W9ZIH Illinois; K9UIF Indiana; W8IDU, WB8BKC, WA8HTL and W8YIO Michigan; and Ohio stations K8DW and WA8TXT. His 70-cm totals now stand at 25 states and 58 grids. Steve also contacted WB8BKC and W8IDU on 1¼ meters during the same opening, for two new grids on that band. There, his stats read 22 states, 10 call areas and 23 grids.

W4LNG Atlanta advises us of another tropo opening that took place September 4. This one provided good signals from the Houston area, including contacts with N5BLZ, W5EUB and WA5RNL, along with stations in Louisiana and Georgia.

In addition to being open during the contest, conditions here in the East were quite productive for several days thereafter. Not many details are in yet, but it is known that stations in New Jersey, New York and New England were working as far west as the Chicago area.

W4HHK's state total for 13 cm has been boosted to six thanks to the efforts of N4MW, who put Mississippi on using a portable station consisting of a varactor doubler delivering 5 W to a rusty coffee-can antenna held by Dave's wife. The distance was only about four miles, so it wasn't a difficult contact, but probably represents the first work between Tennessee and Mississippi on the band. In addition, W4HHK reports a successful moonbounce test between his station and WA4HGN. Paul was able to receive echoes from WA4HGN at about 219. WA4HGN also heard his own echoes. W4HHK also notes that WA4HGN completed a contact August 10 with WB5LUA McKinney, Texas, over a 508-mile path. The two had been attempting to work for some weeks (also see The New Frontier, this issue).

FM/RPT

Conducted By Stan Horzepa,* WA1LOU

220 Battleground

The following is contributed by Arthur Reis, K9XI, the editor and publisher of 220 Notes, a publication dedicated to the joys of 220-MHz operation. For more information, send an s.a.s.e. to 220 Notes, c/o Walt Altus, WD9GCR, 215 Villa Rd., Streamwood, IL 60103.

By now, you would have to be totally inactive to be unaware of the latest threat to Amateur Radio's 220-MHz allocation. It is not the first threat we've experienced recently, but it is the one threat that has galvanized amateurs in a way and to an extent not seen in years.

The 220 situation is interesting from several standpoints. We have seen our adherence to the spirit and the letter of the FCC Rules being used against us in the matter of keeping certain control, link and remote base frequencies confidential to avoid unauthorized access, by not having them listed in the *ARRL Repeater Directory*. And, we have witnessed the unscientific reliance by some on one source of data as representing amateur usage of 220 — the aforementioned *Directory* — when the *Directory* itself was never intended for that purpose.

Virtually lost in all of this political hoopla is the notion of what the 220-MHz band means to this hobby. Too many amateurs look at 220 as being another 2-meter band when, in fact, 220 is developing a character of its own. While 144 MHz is known as the "home of the amateur repeater," with almost 75% of the band devoted to that mode of operation, only about 60% of 220 is FM repeater country. This, plus an additional 1 MHz of spectrum, leaves room for several types of operation that are either illegal or impractical on 144 MHz.

56-kBd Data Communications

The first is data communications. Most of the 144-MHz band was planned and developed before computers became an important part of our hobby, leaving insufficient space for present and future data communications. Additionally, 220 MHz is the lowest amateur band on which high-speed data rates, up to 56 kBd, are legal. If we are the wise spectrum planners we should be, 220 should be the place for high-speed data transfer for three reasons.

First, 450 MHz is already well-developed with FM repeaters, satellite operations and ATV. Second, at the present state of the art, propagation, equipment cost and procurement tend to preclude, for the moment, operation at 1215 MHz and above. Thus, 220 is seen as the best short-to-midterm solution for high-speed data transfer. Third, the area north of "Line A" (any point within 75 miles of the Canadian border) stands to lose 420-430 MHz operation, which would preclude any new operating modes on 450 in that area, and I would suggest across the rest of the country as well, given nationwide standardization. In addition, there are several areas of the country, adjacent to certain military installations, where amateur use of 450 is severely hampered by power restrictions.

That 220 is taking preeminence in data communications is evidenced by a paper presented at the Third Annual ARRL Digital Networking Conference by Bob Bruninga, WB4APR. He mentioned 220 as the ideal band for data trunking in Phase II of EASTNET, a Washington-to-Boston data-relay trunking system, because of the high data rates available there. Eventually, 220-MHz 56-kBd channels, 100 kHz wide, will be on line to handle most of the intercity traffic, with both 144 and 220 MHz being utilized for both low- and high-speed local data entry ports.

To be compatible with Canadian regulations, the high-speed channels are proposed at 220.55, 220.65, 220.75, 220.85 and 220.95 MHz. Ten low-speed channels are proposed on 20-kHz centers, beginning at 221 MHz. If you are interested in the full text of Bob's paper, contact either myself or Bob Bruninga, WB4APR. I predict that within 10 years, a data network, such as the one between Boston and Washington, will be nationwide, with 220 MHz as the central band in the project. That is, if we don't lose 220 first.

Low Cost Repeater Control and Linking

The second use of 220 is repeater control and links. This is illegal on 144 and, although 420-450 MHz may be the favorite band for this mode, it may be virtually eliminated above Line A. Unless repeater owners in that area are willing to pay a lot more to put their control activities above 1215 MHz, 220 is the only other place that is both cost-efficient and effective. In time, the rest of the country will follow suit. The loss of 220 MHz could cause some very big problems for this aspect of the hobby.

The third use of 220 is remote-base operation. In quite a few areas of this country, 220 MHz has become *the band* for remote-base operations. Two meters is too crowded to handle this mode, and 450 is getting that way; 450 MHz will not be abandoned by remote bases (except above Line A), but 220 will handle the overflow much like it is handling the 144-MHz repeater overflow.

220 MHz is coming into its own in EME and other weak-signal work. The first 220-MHz WAS was awarded last January, and now there are more than a half-dozen stations with that honor. As the publisher of *220 Notes*, I am now beginning to hear from hams who have not seriously considered VHF as an operating mode, but are now looking at 220 as a means of expanding their horizons. All I can say to them is, "the more, the merrier."

Finally, there's the backbone of VHF, FM and the repeaters. I foresee 450 MHz becoming the highest practical frequency band for mobile and portable communications because of the relative cost of equipment, propagation limitations and the question of what, if any, long-term effects there might be from exposure to RF energy.

Of the three repeater bands in general use, 220 is still the most underdeveloped. Why beat your brains out trying to get a 2-meter frequency pair on an already jammed band when you could usually get a pair without difficulty on 220? And, you will generally find the nicest operators on 220 just waiting for you.

One way of saving 220 is to phase out the old crystal-controlled radios, which now make up perhaps 80% of the rigs on this band — or, at least, put synthesizers on them. With the crystal rigs, one only knows what's happening on 12 frequencies, and no more. This not only contributes to reduced use of all of the band, but it gives us less of a sense of all the things that are actually going on in the band. We tend to think the band is deader than it actually is.

When confronted with the assumption that 220-222 MHz was not being used for anything by the hams, a lot of us had no way of really knowing if it was right or wrong. It took some of our brethren (with synthesized rigs) to say, "Hey, that's not true!" Besides, when was the last time you saw a crystal-controlled radio in general use on 144 MHz? With three synthesized base/mobile radios now available for 220, plus more than a half dozen hand-held rigs, there's no excuse for the typical 220 operator to not be a part of the synthesized '80s.

Where 220 is concerned, the ante is now up. "Use it or lose it" means it. If we can populate this band before the FCC is faced with the decision of whether to turn RM-4829 and/or RM-4831 into Notices of Proposed Rule Making our chances of keeping all of the band will be improved. As Jim Smith, WB9EEA, put it, "They who has the band in three years, has it. Period." How true it is. The ball is now in our court. The time is now. Let's go for it.

TRACKING DOWN INTERMOD

Is your repeater suffering from intermodulation interference, also known as "intermod"? Intermod is the mixing of two frequencies that produces a signal on a third frqeuency and sometimes that third signal manages to interfere with the transmitter or receiver of a repeater.

Tracking down the source of intermod can be frustrating.To make matters a little more manageable, a computer may be used to help find the culprit.

A FORTRAN computer program was written by Peter Dehaan to do the job. A listing of the program appeared in the June 1983 issue of *Mobile Radio Technology*, and the article that accompanied the program included some tips on how to convert the program to BASIC. If intermod is a problem, this program may provide a solution.

REPEATER LOG

According to reports received between April 10 and September 10, repeaters were involved in the following public-service events: 28 weather emergencies, 5 crimes, 17 medical emergencies, 173 vehicular emergencies, 13 fires, 3 search and rescues, 69 public safety events, 55 drills/alerts and 3 power failures.

The following repeaters were involved (followed by the number of events): WA1DGW 37, K1FFK 3, WA1GTT 1, W1PW 1, WB2OXB 1, WB2RUH 3, W2VL 25, WB2ZCM 2, WA2ZWP 12, N3BFL 21, VE3TTT 2, W3UER 5, W3VRZ 3, WK4F 1, W4HBB 3, WB4QES 85, WA4SWF 14, K4VUW 1, KA5L 1, W6APZ 1, W6ASH 3, WD6AWP 18, WB6BJO 1, WB6CAN 1, KH6H 2, KH6HHG 2, W6HUK 2, K6JE 10, K6LY 1, KA6MNA 1, WB6OQS 11, WA6UGY 1, K7OMR 4, W7WGW 9, K8DDG 34, WD8IEL 8, KA8OFE 1, K8QYL 1, WA8ULB 11, WDØBQM 4, WØES 1, WØKUJ 3, WØMXW 2, WBØSBH 1, KØSCM 12.

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YL News and Views

Conducted By Jean Peacor,* K1IJV

Radio Time

It's the old law of averages. When you really want to do something, you will find the time to do it. If you were to analyze your *radio time,* guess would have it that it's pretty much when you want it to be. This is special time spent with old friends, making new friends, providing public service or working toward the unending list of goals and challenges found in Amateur Radio.

Radio time at the Rehabilitation Center of St. Jude Hospital in Fullerton, California, is particularly special. April Moell has made it so. April, WA6OPS, has been Director of Occupational Therapy at the hospital for 12 years. First licensed in 1976, she feels privileged to have introduced the Rehab Radio Project in 1977 after a donation of radio equipment made it possible. [See "Rehab Radio," Sept. 1979 *QST*, p. 60, for more information. — Ed.]

Amateur Radio as a therapeutic tool has produced amazing results for the rehabilitation of many people. It opens up an entirely new world for those undergoing extensive rehabilitation following strokes, head injuries, spinal-cord injuries and other impairments. For some, it provides the opportunity for speech therapy in relaxed circumstances; others reap the benefits of listening; and for many the details of log keeping and making out QSLs or stamping them proves most beneficial.

April Moell, WA6OPS, shown with an eager group of participants during a Friday morning Rehab Radio session.

Every Friday morning, April is on hand to witness the tremendous progress accomplished through the Rehab Radio Project. Using the hospital's call, WD6BPT, the station becomes active. Patients are accustomed to interaction with other patients and the medical staff. On Fridays, the opportunity is there to learn to interact with others. In April's words, "There is nothing like the smile that you see on a patient's face when he or she hears his or her name come over the radio."

April is also active in hospital disaster communications. An Emergency Coordinator with the Amateur Radio Emergency Service (ARES), her primary responsibility is support communications for hospitals. Orange County has a unique system that currently supports 12 hospitals with internal and external communications in the event of a major medical emergency, phone outage or area-wide disaster.

April currently holds an Advanced class license. Her husband, Joe, KØOV, is the primary consultant for technical matters involving Rehab Radio as well as the hospital disaster support group. Their joint efforts add to the quality of life of others as well as to their own.

YOU KNOW WHEN THE TIME IS RIGHT

Somewhere around age 10, Mary Baxter discovered the fascination of radio shacks while traveling onboard ships as her family moved either from one Consular post to another or sailed back and forth to the States. One radio operator taught Mary the Morse code and how to send messages, when he wasn't too busy. She wanted to become a ham then.

Later, at Mt. Hermon School in Northfield, Massachusetts, W1ZPB invited Mary to join a Novice class. At the time, she was teaching at both Northfield and Mt. Hermon Schools as well as keeping house and helping raise their four children. There was no time for additional undertakings. Then Mary retired.

At 64, Mary got her Novice ticket. She is now WB1GXZ — QTH East Norwalk, Connecticut. All it took was for her cousin, WB8RSI, to say, "Why just talk about being a ham? Do it." When she started studying, Mary didn't know what a capacitor was. She now knows that it is possible to learn both code and theory. She also knows how lucky you are when you find a super Elmer as she did in Phil, W1UL, who also lived in Norwalk at the time. Mary earned her Novice ticket in 1978 and her Tech and General in 1979, and has had her Extra Class license since 1982. One of her most cherished certificates is her First Contact Certificate.

Sometime in 1980, a friend asked Mary to compose some messages to help in attaining his goal of BPL. Curiosity aroused, Mary started listening to traffic nets to hear the messages passed. That's how traffic handlers are born! She first tried the Hit and Bounce Slow Net, then discovered the very fine training course given on the New Jersey Slow Net. She became a regular on the North East Novice Net (NENN).

Her radio activities now consist of traffic handling on almost all levels. Mary is active on the First Region Net, Cycle 2, and Eastern Area Net three days a week. She loves CW. She is assistant net manager as well as an instructor on the New Jersey Slow Net and the Net Manager of the West Connecticut Net, and is net control station on the Hit and Bounce Slow Net (HBSN). She has helped with the taping of study material for some operators unable to find the material needed on tapes or in Braille. Both Connecticut and New Jersey have awarded her Certificates of Merit. Mary has also earned the coveted BPL medallion.

Mary has been told that to learn what it takes to become a ham is something one does for oneself. She doesn't believe it! Some of the best traffic handlers on the air have helped her in many ways: She well remembers the help from W1UL, and she credits her first transmitter to W1CTF. Her 39 years of teaching Spanish, French, Latin and Biology at the Northfield schools paved the way for her enjoyment now in teaching traffic handling. She discovered the thrill of talking to a Venezuelan in Spanish or of trying out her French on the air. Her enthusiasm and generous contributions to the state of the art are certainly proof that, at age 64, Mary knew the time was right for her to become a ham.

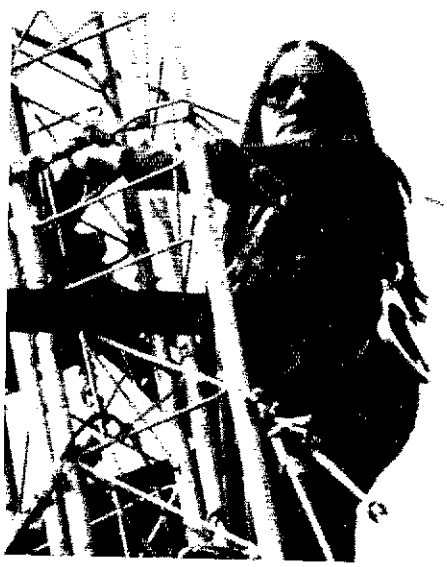
Norwalk, Connecticut's Mary Baxter, WB1GXZ

HOW HIGH IS UP?

When you have a 110-foot tower and do all your own antenna work, and have a picture showing you 90 feet off the ground, that's *up* and that's *high*. Laryl Berry, KM7Z, of Mulino, Oregon, was doing exactly that at the time the picture shown with this column was taken.

Laryl's OM, Patrick, KN7B, writes with pride about Laryl's accomplishments since she joined the Amateur Radio ranks about five years ago. His contribution makes it possible to write here about another exciting YL.

"Laryl got her Technician (N7BMY) after only two weeks of study, her General two weeks later and her Extra shortly thereafter. She is a regular TCC (Transcontinental Corps) station, handling a weekly station U sked. She is active on the Oregon Section CW net in addition to the daytime and evening Region Nets.



Laryl Berry, KM7Z, 90 feet up and climbing

"Fond of ragchewing and DXing, Laryl has obtained DXCC — all CW. [She needed only five or six cards for 5BWAS — all CW — at the time KN7B wrote, and no doubt has obtained that now — Ed.] She is learning American Morse as well as working at increasing her 35-WPM code speed.

"Among her other interests are a collection of old telegraph keys, which include models made by Bunnell, Martin, Martin-Bunnell and Vibroplex. She also collects Amateur Radio postage stamps, and has an almost complete collection.

"Laryl is president of the U.S. QSL Service, a free domestic QSL bureau formed in 1980. She personally handles thousands of cards each month in addition to raising our three children. I don't know how, but she also finds time for hamming.

"Laryl is available for skeds most times. She can have the computer figure out the best propagation time and band if you wish. As you can tell, she would prefer CW."

*Country Club Dr., Monson, MA 01057

IARU News

Conducted By Richard L. Baldwin,* W1RU

IARU Regional Conferences

The "business" of IARU is transacted in a series of triennial conferences, one each year in one of the three IARU regions. At these regional conferences, the member-societies of the region meet to discuss common problems, to find common solutions and to otherwise promote the vitality of Amateur Radio in the region. It is through the mechanism of the regional conference that the individual IARU member-society, the fundamental unit of the IARU, provides input to the international scene and exercises its leadership.

In 1984 Region 1 held its triennial conference in Cefalu, Italy. In 1985, Region 3 will hold its triennial conference in Auckland, New Zealand, and in 1986 Region 2 will hold its conference in Buenos Aires. Prior to each conference, the member-societies are urged to submit papers on the subjects that concern them and to make preparations for sending a delegation that will be able to make a substantial contribution to the work of the conference.

In this connection, the following excerpt from an August RTTY bulletin sent to Region 2 members over W1AW is quite apropos:

"We are starting to prepare for the next Region 2 conference. Although it seems early to start organizing this event, the Executive Committee would like to place significant emphasis on preparing subject matters to be discussed. As pointed out in other bulletins, we are establishing project directors to prepare material for the conference. Therefore, we ask all member societies to first let us know what subjects you would like to be included in the conference work. For example, International Beacon Projects, Intruder Watch activities, multilateral agreements, international standards for amateur radio, review of the IARU Constitution and the Region 2 bylaws, etc. We are also interested in knowing what societies will be able to provide the capable participants to chair the various working groups. Please start thinking now of how and to what extent your society can participate in the conference. We will have the following committees during the conference. Committee A, which deals with all administrative items and will include the study of the IARU and Region 2 Constitution and Bylaws. Committee B will deal with all technical and operative matters. Committee C is the credentials and treasury. Committee D is VHF/UHF and satellites, and will include specialized communications. Committee E was created at the last conference and will be the financial committee in charge of creating the budget for the next three-year term and to establish the priorities of the region for that period. In order for the conference to be successful, we must have well-prepared individuals who can head each of these committees. We feel it is appropriate that each society be aware of the many committees that will be working and how they will be represented in each one. Furthermore, the Executive Committee of Region 2 will be supplying background material on a number of new subjects to be dealt with.

Finally, in 1986 at the conference, we could be as close as four to six years away from the next General WARC. This statement is made on the basis of the comments made by ITU officials in various meetings around the world. It could very well be that the 1986 conference will be one of the most important ones if a WARC will be held in the early 1990s instead of 1999 as now planned. The Executive Committee feels that there is more than a fifty percent chance of an early WARC. Are we prepared for it? Can we adequately represent the growing needs of amateur radio? Will we be able to start our preparations in 1986? Is Region 2 ready for this new challenge? These items will make the 1986 conference extremely important and all societies must participate, no matter how big or small they are. Each country represents a vote in ITU. Each vote is of crucial importance for amateur radio. We all have a responsibility to the future of amateur radio. We not only expect each society to be present, but to be prepared and ready to help meet our major objectives.

*President, IARU

IARU OFFICERS

ARRL, as the International Secretariat of IARU, has, under the provisions of the new IARU Constitution, designated David Sumner, K1ZZ, to serve as IARU Secretary, continuing in a role that commenced when K1ZZ became ARRL Secretary in 1982.

In consultation with the IARU Administrative Council, ARRL nominated Richard L. Baldwin, W1RU, to serve as IARU President and Carl L. Smith, WØBWJ, to serve as IARU Vice President. Those nominations are now before the membership of IARU for ratification, a procedure that should be completed by January 15, 1985. The terms of Messrs. Baldwin and Smith run until 1988, when the nomination/consultation/ratification procedure will be carried on again.

IARU INTRUDER WATCH UPDATE

The IARU Intruder Watch has been functioning, with varying levels of activity, since about 1960. It was particularly active prior to WARC-79, and produced data that were useful in the preparation for that conference. There has been a growing perception that steps need to be taken to revitalize the Intruder Watch, and indeed such action has already been taken by ARRL.

At its Paris meeting in July, the IARU Administrative Council, responding to a recommendation of the Region 1 conference in Cefalu, formed an international study group to determine how the IARU Intruder Watch might be perked up. This group, under the chairmanship of the president of IARU, and with representatives from each region, will exchange ideas by correspondence and then meet to consolidate their work and prepare a final report. The in-person meeting will likely take place in March in the Federal Republic of Germany.

Shozo Hara, JA1AN (seated), president of the Japan Amateur Radio League, is an Olympic dressage judge (an equestrian event) of international reputation. In that capacity, he attended the summer Olympic games in Los Angeles. During his two-week stay, Mr. Hara visited special-events station NG84O as the guest of ARRL Vice President Jay Holladay, W6EJJ (standing).

Strays

QST congratulates...

☐ the following radio amateurs on receiving Atlanta Radio Club Trust Fund Scholarships in 1984:

• Alan H. Knight, WD4PZN, of Lineville, Alabama — Michael Zuckerman, K4AEJ, Memorial Scholarship

• Stephen K. Bright, KB3SF, of Gwynedd Valley, Pennsylvania — Clifford Q. Trichler, W4IO, Memorial Scholarship

• Thomas E. Warfel, KA8HML, of Cincinnati, Ohio — William A. Clark, N4YO, Memorial Scholarship

I would like to get in touch with...

☐ amateurs interested in the applications of robots or factory automation. Bernie Kapus, KQ3Z, 312 Partridge Run Rd., Gibsonia, PA 15044.

☐ any hams interested in restoring historic or old houses, particularly Queen Anne Style. George Fisher, KCØKM, 3127 2nd Ave., S., Minneapolis, MN 55408.

Amateur Satellite Program News

Conducted By
Bernie Glassmeyer,*
W9KDR

INTERIM OSCAR 10 OPERATING SCHEDULE IN EFFECT

The new OSCAR 10 operating schedule went into effect on September 3, when DJ4ZC at Marburg loaded the new software to the spacecraft. The new schedule affects Mode B and Mode L. Similarly, it revises dramatically the program of events on the various beacons.

The new transponder schedule is being described as an interim measure designed to provide adequate safety margins while maintaining good service to the user community. The interim operating schedule was required to compensate for a significant series of eclipses occuring each orbit throughout September and October. [The next eclipse period will occur for a much longer time — from approximately early January until late April 1985 — Ed.]

The maximum-duration eclipse in this series was attained on or about September 21, when OSCAR 10 was out of sunlight for 1.2 hours per orbit. This amounts to not less than a 10% reduction in available solar-derived energy (poor sun-angle effects make the cumulative effect somewhat larger than the 10% reduction).

Beginning toward late October, the eclipse duration will migrate. DJ4ZC, in his text on both the General Beacon CW Bulletin and in the PSK message blocks, suggests a further schedule revision will occur in October. Presumably, this will represent a schedule responsive to the improved eclipse situation.

The interim transponder operating schedule is for Monday through Saturday. On UTC Sundays, Mode B will replace Mode L such that Mode B will run continuously from Mean Anomaly 32 through 189, as follows:

Mean Anomaly Start	*Minutes Past Perigee*	*Mean Anomaly End*	*Minutes Past Perigee*	*Transponder Operating Mode*	*Episode Duration (Minutes)*
32	87.5	99	270.7	B	183.2
100	270.7	116	317.2	L	46.5
117	317.2	189	516.8	B	199.6
190	516.8	255	699.5	Off	82.7
0	0	31	87.5	Off	87.5

Based on prior discussions, if a schedule revision in late October provides increased operating time, the period after Mean Anomaly 190 may be available. In the example shown in *ASR No. 83*, Mode B was extended through 218. Whether this can be achieved will depend on how well the spacecraft battery fares with the eclipses. If the engineers have done their homework well, the battery will be in excellent shape. In the extremely unlikely event that a miscalculation has been made, the spacecraft could suffer irreparable damage to its primary battery. Thus, caution is the watchword here.

The Beacon schedule revision is long-term, as it is not expected to be revised any time soon. The new beacon schedule is responsive to the expressed desire of many to make better use of the Beacon facility. Consequently, the new Beacon schedule will contain much useful information, such as Keplerian element sets by which one may calculate the satellite's accessibility. Moreover, an RTTY segment is now included in both the Mode B and Mode L Beacon transmissions. The new Beacon schedule is as follows:

Minutes Past Hour	*Beacon Mode*
00-04	CW†
05-14	PSK
15-19	RTTY
20-29	PSK
30-34	CW†
35-44	PSK
45-49	RTTY
50-59	PSK

†Substituted by RTTY when in Mode L

This is the Mode B Beacon (145.810 MHz) schedule. When Mode L is on (MA 100-116), the schedule will be the same except where RTTY will be substituted for CW (denoted by "†"). The Mode L Beacon is heard most often on the Engineering Beacon frequency, 436.04 MHz. CW is sent at approximately 13 WPM. RTTY is standard 170-Hz shift FSK at 50 bauds. PSK is 400-baud ASCII.

There will be two separate CW bulletins sent. QTC001 is sent on the hour, while QTC002 is sent on the half hour.

Each RTTY bulletin will contain both CW bulletins text (QTC001 and 002) as well as telemetry data showing various spacecraft operating conditions. The parameters will be published soon. The RTTY bulletins will contain, specifically, the Z block (similar to the Y block of PSK telemetry), G block no. 1 (QTC001), another Z block and a final G block (QTC002). That is, the G blocks will be the same as the CW text except that LF/CR will be inserted. *(Inx ASR No. 86)*

AMSAT Net Change

AMSAT's 75-meter net frequency has been changed to 3855 kHz to permit General class check-ins. The East Coast, Mid-Continent and West Coast nets are still at 2100 hours every Tuesday evening.

W1AW Bulletins via OSCAR 10

Did you know that W1AW was the first OSCAR 10 Bulletin station activated? Bulletins are transmitted during the normal W1AW schedule whenever the satellite is in range of Newington.

Monitor near 145.840 MHz for CW bulletins and 145.972 MHz for SSB bulletins when the satellite is in range of ARRL Hq. and your location. For the latest W1AW schedule, see August 1984 *QST*, page 75.

Monthly Listings

☐ *ASR* (Amateur Satellite Report) is available for $22 ($30 overseas) for 26 issues (1 year) from Amateur Satellite Report, 221 Long Swamp Rd., Wolcott, CT 06716.

☐ AMSAT membership is available for $24 per year ($26 outside North America). Life Membership is $600. Subscription to six issues of *Orbit* magazine each year is inseparable from membership. Write to or call AMSAT Hq., P.O. Box 27, Washington, DC 20044, tel. 301-589-6062. VISA/MC cards accepted.

☐ ARRL members only send a 4- × 9-in s.a.s.e. with your call sign to ARRL for a complete, monthly orbit schedule for all operating Amateur Radio satellites. Please mark the s.a.s.e. with the month needed, to help us ensure that the envelopes are filled properly. A year's supply of s.a.s.e.'s may be sent in at one time, but be sure to affix 2 units of postage to each s.a.s.e.

☐ The OSCARLOCATOR package second revision is now available for $8.50 U.S., $9.50 elsewhere. This package and *The Satellite Experimenter's Handbook* contain all the information you need to get started using the Amateur Radio satellites. The latest OSCAR 10 Tracking Cursor drawing needed for the OSCARLOCATOR appears in October *QST*, page 65.

☐ A free package of information about AMSAT and the Amateur Satellite Program is available from ARRL Hq. This package is intended for those with no knowledge of the program.

Johnson Space Center participants in the STS-9 AMRAD effort (bottom to top, left to right): Row 1 — W5SBS, NASA; KN5H, Ford. Row 2 — W5AVI, NASA; WD5EEV, LEMSCO; K9RY, LEMSCO. Row 3 — W5DID, NASA; KG5U, NASA (W5RRR club president). Row 4 — W5EZ, NASA; W5LFL, NASA; W5OBR, NASA. Row 5 — WA5RDO, NASA; WD5EEU, CSC; Gary Gail, Ford. Row 6 — Capt. Bob Harris, USAF; Wayne Cope, LEMSCO; W5OJ, NASA. Row 7 — WB5APU, NASA; KS5H, Ford; Larry Johnson, LEMSCO. Top — K5BWT, LEMSCO. Not shown: WA5SFY, NASA; KC5RG, NASA; WB5LHV, LEMSCO; WA5NOM, NASA; W5SPD, NASA. Organizations identified are Lockheed Engineering and Management Services Co. Inc. (LEMSCO), Ford Aerospace and Communications Corp., Computer Sciences Corp. (CSC), the National Aeronautics and Space Administration (NASA) and the U.S. Air Force.

*Satellite Program Manager, ARRL

Affiliated Clubs in Action

Conducted By
Steve Place, WB1EYI

This month marks the kickoff of QST's *new club column — Affiliated Clubs in Action. As the title suggests, ARRL's 1873 affiliated clubs are an active bunch. Long ago we recognized that radio clubs are one of Amateur Radio's most valuable resources; we figure it's time to draw on that resource and share our Affiliated Clubs' ideas, programs and activities with all* QST *readers.*

To keep this column interesting and useful, we need your help. Special Service Clubs routinely keep us up to date on what they're doing and what approaches they've found work best for particular projects. And those of you who've kept us on your club-bulletin mailing lists have already given us a wealth of ideas to share in future columns.

Here's your chance to have your affiliated club recognized for its good work. News, ideas, suggestions, questions, problems, solutions, complaints, cartoons, club projects and photographs — especially creative, high-quality photographs — are welcome; remember that QST *is a binational journal and we're looking for items that have broad appeal. Send your contributions to Affiliated Clubs in Action, ARRL, 225 Main St., Newington, CT 06111.*

TECHNICAL ADVANCEMENT — ANY CLUB CAN DO IT!

Most experienced amateurs believe that the technical side of Amateur Radio *is* important. In the first place, a competent communicator must be able to tell whether his station is working properly and know what to do if it is not. He must be able to maintain communications despite equipment failures or catastrophes that affect all or part of his normal station capabilities.

Furthermore, the current Basis and Purpose of the Amateur Radio Service speaks of "...the amateur's proven ability to contribute to the advancement of the radio art" and of "Expansion of the existing reservoir...of trained operators, technicians and electronics experts." When we compare the increasing need for technically trained people in today's society with the current severe shortage of engineering manpower, the technical side of Amateur Radio takes on even greater importance. And activity that serves to interest young people in pursuing a technical career is important to our national interests.[1]

But what can a mere local club do to stimulate interest in technical activities? A good number of ARRL Affiliated Clubs consider "mere local club" to be fighting words! They'll tell you there's no better way for an average ham to go beyond what's needed to pass the exam and to develop an appreciation for the technical side of radio than to get involved in club technical activities. It's cheaper than a formal class, you get to pick what you're interested in learning, and you can zip or plod through at your own pace; best of all, you're likely to have someone with experience and a good grasp of the fundamentals in your very midst.

Sound good, but you're short on ideas? Well, the list of suggested club technical activities and resources is *too long* to enumerate here. A few technical programs from some of our Special Service Clubs are described below. Your first step should be to elect a Club Technical Coordinator who can survey your club's resources — who's involved in or interested in what? — and contact your ARRL Section Technical Coordinator (via your Section Manager). There's no need, nor is there a benefit, in making your club's technical activities painful; as with any club program, your objectives should be service and fun.

Technical Advancement, Special Service Club Style

A number of clubs have technical programs at each (or every other) monthly meeting; Suffolk County (New York) RC invited its ARRL Technical Coordinator to give a presentation on AMTOR.

Wide Area Data Group (Nevada) has a full-blown Technical Committee headed by a Technical Director; they involve all club members in developing and maintaining a state-wide repeater system, remote bases on 2 and 10 meters, links on 220 and 450 MHz and a 6-meter repeater/remote base network. The complexity of the system has led to technical-training sessions for all members.

The Phil-Mont Mobile RC (Pennsylvania) has developed and maintained a number of Amateur Radio emergency communications vehicles; with over 30 years of experience behind them, the club even conducted a seminar entitled "Mobile Radio Emergency Operations Centers" at the 1982 IEEE International Communications Conference.

The Platinum Coast (Florida) ARS has ongoing working groups in digital repeaters and club construction projects (which have included building modified "double-ducky" direction finders and their "Antenna Ohmmeter").

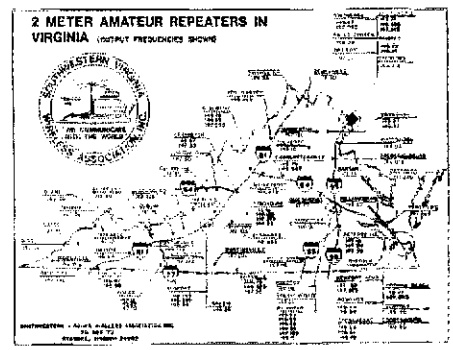
North Seattle (Washington) ARC has sponsored a club-meeting program series on such topics as microcomputers and "Hints and Kinks"; they've also invited local experts to hold sessions on subjects as varied as the communications network of the City Fire Department, QRP operation, new equipment (by the manufacturer!) and radio-controlled model planes.

Great Bay (New Hampshire) RA sponsors tutorial working groups in SSTV, EME, RTTY and computers.

Southern Maryland ARC has access to an 84-ft dish antenna that its members use to gain proficiency in EME.

Whatever your members' interests, use a little imagination. There's more to the technical side of radio than knowing just enough to pass an exam. Be careful, though, for when you aren't studying "under the gun" of an exam date fast approaching, you might even find that you're enjoying yourselves. Get the gang together and give it a shot.

For a complete discusson of the area of technical advancement (excerpted from the ARRL "Long Range Planning Committee, Phase II Report" and from ARRL Affiliated Club program reports) send a business-size s.a.s.e. with 37 cents postage to ARRL Affiliated Clubs in Action, Technical Advancement, 225 Main St., Newington, CT 06111. Please include your affiliated club's name or, if your club is not affiliated with the ARRL, give us your club's name, location, service area, type of club and its approximate size with your request. And let us know what you do to advance the technical side of Amateur Radio in your club.



REPEATER MAPS AVAILABLE

Two-meter-repeater users in the Roanoke Division are kerchunking less and enjoying it more! Virginia repeater maps, produced by the Southwestern Virginia Wireless Association (an ARRL-Affiliated Club), have been so well received that work has begun on a series of similar maps for neighboring states as well. Single copies for local reproduction are available at no charge from SWVWA (P.O. Box 73, Roanoke, VA 24002); please include an s.a.s.e. with your request. *(fnx David Jones, N4JED)*

Special Service Clubs

A growing number of ARRL-Affiliated Clubs have pledged to serve their communities and Amateur Radio more actively as Special Service Clubs in the coming year. We welcome our newest SSCs and encourage you to get in touch with them. (Number of members is in parentheses.)

Bill Gremillion Memorial Radio Club (52)
P.O. Box 2327, Newnan, GA 30264

Brazos Valley Amateur Radio Club (74)
P.O. Box 1630, Missouri City, TX 77459

Butte Amateur Radio Club (72)
P.O. Box 4036, Butte, MT 59701

Flathead Valley Amateur Radio Club (47)
P.O. Box 2549, Kalispell, MT 59901

Green Valley Amateur Radio Club (35)
601A North LaCanada, Green Valley, AZ 85614

Larkfield Amateur Radio Club (225)
4 Marshmallow Dr., Commack, NY 11725

Mecklenburg Amateur Radio Society (243)
2425 Park Rd., Rm. 023, Red Cross Bldg., Charlotte, NC 28203

Ogden Amateur Radio Club Inc. (44)
P.O. Box 3353, Ogden, UT 84409

Rockford Amateur Radio Association (114)
P.O. Box 1744, Rockford, IL 61110

Silver Springs ARC, Inc. (149)
3480 S.E. 26th Ct., Ocala, FL 32671

Sonoma County Radio Amateurs, Inc. (93)
P.O. Box 116, Santa Rosa, CA 95402

Southern Maryland Amateur RC (117)
P.O. Box 273, Cheltenham, MD 20623

Tu-Boro Amateur Radio Club (18)
23-26 125 St., College Point, NY 11356

Volunteer Amateur Radio Club (9)
P.O. Box 74, Burns, TX 37029

For information on ARRL's Special Service Club program, contact the Affiliated Club Coordinator in your ARRL Section; your Section Manager (page 8) or Hq. has the address.

Affiliated Club Coordinators

Affiliated Club Coordinators (ACC) are volunteer League officials appointed to support clubs' efforts in their ARRL Sections. You'll find that your ACC cares about Amateur Radio clubs (ARRL-affiliated or not) in your Section, and wants nothing more than to help you develop into the most effective club you can be — your ACC is a valuable friend whom you should get to know better.

A number of ARRL Sections have openings for Affiliated Club Coordinators. If you're interested in helping clubs and you're in one of the following Sections, contact your Section Manager to discuss the opportunity. His or her address is on page 8 of *QST* each month.

AL DE EBAY ID KY MS ORG SV SF SJV SD STX WMA WY West Indies.

[1]From "Long Range Planning Committee, Phase II Report," ARRL, 1981.

[2]Manager, Club and Training Dept., ARRL

Silent Keys

It is with deep regret that we record the passing of these amateurs:

W1HGG, Adam Morrison, Derry, NH
W1QKG, Kenneth A. Cheverie, Eliot, ME
W1SOU, Theodore H. Boisvert, St. Albans, VT
W1UWS, Harold F. Thompson, Springfield, VT
W2AIW, Charles W. Rogers, Manasquan, NJ
W2CNJ, David DeWitt, Poughkeepsie, NY
W2CUC, Francis Heller, Mt. Holly, NJ
KA2FKK, Ronald W. Lawton, Heuvelton, NY
W2GZQ, Michael A. Fiehl, Vestal, NY
KA2KFW, Kaleva E. Lifter, Scotia, NY
W2KQ, Osmun W. Lorini, Closter, NJ
WB2MUS, Saul Brandt, Redondo Beach, CA
WA2QGV, Herman "Bud" Fischer, Westfield, NJ
W2QYT, John L. Pogue, Rochester, NY
W2RFL, William C. Waelder, Syracuse, NY
WA2VEG, Russell Hobert, Scarsdale, NY
N3CAI, George H. Potts, Roseto, PA
W3CHR, Vernon F. Knepp, Lewistown, PA
KA3CSZ, Duane C. Nichols, Salisbury, MD
W3DRD, Edwin N. Limberger, Sr., Newark, DE
K3PPW, John J. Krall, Dunbar, PA
*WA4BMW, James M. Oesterreich, Pensacola, FL
W4DKE, Lewis L. Moore, Greensboro, NC
W4EIB, Clarence I. Hinds, Jr., Montgomery, AL
K4ETS, Stanley A. Crosby, Fort Lauderdale, FL
K4FKR, Thomas W. Snow, Port Charlotte, FL
*K4HKN, Gene T. Tuttle, Big Pine Key, FL
K4ISG, James R. Balmer, Venice, FL
WB4IUE, Harry E. Thurston, Chattanooga, TN
K4JTC, Howard W. Martin, Decatur, GA
W4KDN, William J. Sharp, Norfolk, VA
K4KIB, Rudolph A. Axelson, Springfield, VA
WD4KOK, Edward R. Felton, Finger, TN
WB4LRP, Robert L. Johnson, Palatka, FL
W4MMB, Fred M. Stafford, Atlanta, GA
WA4MOJ, Leroy A. Arch, New Port Richey, FL
KM4N, William B. Jibb, Tallahassee, FL
W4NCD, Joseph M. Arnold, Fort Meyers, FL
W4PCN, Goodrich F. Williams, Manteo, NC
W4YEL, William W. MacLaughlin, III, Memphis, TN
W4YM, Louis W. Van Slyck, Temple Terrace, FL
K4ZDS, William W. McDowell, Okeechobee, FL
K5AV, Wilbur H. Cummings, Houston, TX
WA5BHF, Bruce M. Bartee, Hamilton, TX
W5BML, Cyril F. "Tom" Toman, Houston, TX
KA5GJX, Michael D. Lewis, Shreveport, LA
W5GXU, William L. Baird, Graham, TX
W5HAF, Earl L. Blair, Carlsbad, NM
*W5HAG, Sheldon H. Dike, Albuquerque, NM
K5HRX, Carrie B. Roark, San Angelo, TX
*WB5MPB, Roland J. Roy, Laredo, TX
K5MUL, Bernard L. Abadie, Lafayette, LA
W5SZR, Robert L. Shimek, Carlsbad, NM
W5ZNQ, Elvis M. Gorman, Fort Worth, TX
N6CP, William J. Rolly, Kelseyville, CA
K6CZO, Alfred L. "Roy" Kite, Fresno, CA
KB6GN, Harold P. Davis, Carson, CA
W6INP, Arthur Robin, Stockton, CA
*WB6NAF, William H. Hammer, Los Angeles, CA
W6NTB, John D. O'Neill, San Marcus, CA
W6NTO, William H. Morgan, Carson, CA
WA6OKM, David C. Hansell, Canoga Park, CA
WA6QVV, Raymond C. Olson, Sacramento, CA
WB6RPK, Charles J. Weber, Jr., San Lorenzo, CA
W6TQE, Edward "Steve" Robinson, Jr., Mission Viejo, CA
WB6TUV, William J. Ponkow, Modesto, CA
WA6TZH, Wilbur B. Peard, Scotts Valley, CA
W6WBC, Carl R. Whitlow, San Jose, CA
W7AOO, Allan A. Ramey, Lewiston, ID
KA7BSS, James E. Jenkins, Orcas, WA
W7FDJ, William V. Sherry, Saint Helens, OR
W7HUL, Carl A. Suriano, Seattle, WA
WA7ILL, George S. McLean, Manson, WA
W7LUH, Charles M. Butler, Sr., Albuquerque, NM
K7PLR, James R. Smith, Phoenix, AZ
W7VKO, Cecil C. Armstrong, Phoenix, AZ
K7WYT, Earnest C. LuBean, Yuma, AZ
W7ZDE, Sherwood J. Blaylock, North Ogden, UT
N8COR, Harley Mullvain, Flint, MI
KA8DSL, John A. Yanosko, Mayfield Heights, OH
W8EUH, Harold A. Barber, Genesee, MI
W8III, Elmo R. Laucks, Sault Sainte Marie, MI
W8IIA, Harry C. Lewis, Trenton, MI
W8IWT, John "Jack" Graft, Canfield, OH
KA8IYH, T. A. "Art" Ward, Jr., Huntington, WV
K8LGA, Ann Warren, Fairfax, VA
WD8MKR, Elmer J. Whitmore, Ashley, OH
W8TNV, Lawrence H. Strayer, Kent, OH
WA9AEP, Emmett D. Shippy, Kendallville, IN
KA9CFR, Richard J. Maskal, Lebanon, IL
WA9FRX, George Babich, Sr., Maple Park, IL
W9GJG, Carl M. Huth, Richmond, IN
W9IMN, John Huscava, Chicago, IL
W9KXE, C. Louis Miller, Chicago, IL
WB9NLW, Vernon L. Taylor, Middletown, IL
K9QXK, Howard A. Olson, Elmwood Park, IL
W9RYU, Harry J. Studer, Milan, IL
WB9UQL, Tore S. Karlson, Cicero, IL
W9URQ, John W. Yockum, Jr., Princeton, IN
W9WGA, Leonard R. Warning, New Lenox, IL
WDØCTJ, Lee T. Silvernail, Kansas City, MO
*WØENO, Francis J. Duff, Longmont, CO
WØFAJ, William J. Hassing, Jackson, MN
WØPTJ, John R. Hanmore, Cripple Creek, CO
WAØSYM, Cornelius J. Stegink, Orange City, IA
WBØSZM, Clare G. Shappee, Walpole, MA
*WØTT, Robert D. Morrison, Parkville, MO
WØUAC, Robert F. Johnson, Bismarck, MO
KH6JID, Richard C. Latham, Honolulu, HI
VE3CFR, Lloyd G. Wright, London, ON
VE3IDO, Henry W. Brunton, Ottawa, ON
VE4AJF, John G. Franz, Winnipeg, MB
G3BZZ, Tom Edgar, Newcastle Upon Tyne, Northumberland, England

*Life Member, ARRL

In order to avoid unfortunate errors in the Silent Keys column, reports of Silent Keys are confirmed through acknowledgment only to the family of the deceased. Thus, those who report a Silent Key will not necessarily receive an acknowledgment from Hq.

Note: All Silent Key reports sent to Hq. must include the name, address and call sign of the *reporter* as well as the name, address and call of the Silent Key in order to be listed in the column. Please allow several months for the listing to appear in *QST*.

50 Years Ago

November 1934

☐ With interest building and things generally humming on 5 meters, inspired by his consistent Hartford-Boston link, Ross Hull turns his skills to 224 Mc., with a Yagi antenna, one of the new acorn tubes for receiving, and an 800 in the transmitter.

☐ 1IMM ignores the usual cautions for maximum crystal current and puts 100 watts into a 211 oscillator/transmitter.

☐ Detroit is a pioneer city in the use of radio for police communications, and now adds a cooperative agreement with selected amateurs who will be available 'round the clock for supplementary and disaster circuits.

☐ If you want to make a good Sweepstakes score this year, get ready for nine — repeat, nine — days of intensive operating. Maybe you can beat last year's winning score of 495 contacts — that's more than 2 an hour (for the total contest time). A message exchange, minimum of 5 words text, is required for proof of solid contact.

☐ This is ballot time to choose League Directors. The editorial points out that those elected will run the affairs of our association, and calls for careful selection of capable candidates to ensure continued future progress.

☐ KA1NA has put up a new "V" antenna and is laying down a healthy signal from the Philippines clear to the U.S. East Coast.

☐ W1CTE got permission to visit AT&T's transatlantic telephone installation in New Jersey, and regales us with descriptions of multiple transmitters, each with six 10-kW water-cooled tubes in the output, and 16 massive antennas — one a mile long in the direction of England.

☐ The relay rack not only conserves floor space and provides maximum accessibility, says W2BLL, but also can serve as a neat and effective operating position. He describes a number of possible setups for various house locations.

☐ Hopefully ending hassles over what country (or colony, or island) is in which continent for purposes of the Worked All Continents Award, the International Amateur Radio Union has now adopted an official map with specific boundary lines.

☐ For those not reluctant to cut into a page of *QST*, the Communications Department section includes a large-print table of the new R-S-T reporting system, so you can post it at the operating position.

☐ To the amateur examination question, "What is a gain control on a radiotelephone transmitter?" one applicant responded, "Gain control is the law which prevents an amateur from taking money for transmitting messages."

25 Years Ago

November 1959

☐ The log periodic antenna can work over a 10:1 frequency range and still provide good directivity. W1FVY explains its workings and shows design data for ham versions — fixed rather than rotatable because of the substantial weight.

☐ Taking advantage of readily available surplus units, K4EEU built a sideband exciter for less than $150, still with all of the conveniences and features found in most advanced units.

☐ In our current obsession with standing-wave ratios, we need to have careful design and construction in our measuring unit or we may get substantial reading errors. W3KDZ outlines some of the weak spots and how to remedy them.

☐ W1ICP, intent on keeping costs down for his audience of newcomers, again delves into war surplus and shows Novices how to revamp the BC-457 and BC-459 to employ the required crystal control.

☐ Leaky insulators, loose tie wires, and corroded hardware — these are three of the possible causes of power line noise. W1FTX describes his experiences in solving such problems and compliments the power company for its cooperation. (Utility employees seldom hear such noise because their mobile radio uses f.m.)

☐ At the Geneva (Switzerland) world radio conference, the United States is battling to keep the present 4-27 Mc. portion of the spectrum in status quo. (The alternative is likely expansion of the shortwave broadcast bands and resultant impact on amateurs.) No points yet for either side.

☐ Forty hours is the maximum time you can be active in the Sweepstakes contest during two weekends in November.

☐ For mobile use W2CZM built a 25-watt modulator using transistors, occupying a fraction of the space that would have been required for a tube setup.

☐ DX enthusiasts are getting more and more organized. Now we have the "Yasme Foundation," which from donations by new-country-hungry hams will finance VP2VB trips to exotic lands.

☐ The Southern Wisconsin and Northern Illinois club supplied an informative book on amateur radio to public and school libraries, and reaped a harvest of participants in its courses aimed at helping interested persons pass the ham exam.

☐ W8CBM designed a simple transistor unit to serve as a pocket tuning aid for the sightless, but also finds it useful for general measuring purposes around any ham shack.

☐ W1HKK relates his experiences with Russian amateurs during a visit to the Soviet Union. — *W1RW*

Coming Conventions

SOUTH FLORIDA SECTION CONVENTION
November 24-25, Clearwater

The beautiful Sheraton Sand Key Resort, on the sparkling waters of the Gulf of Mexico in Clearwater, will be the site of South Florida ARRL Suncoast Convention sponsored by the Florida Gulf Coast Amateur Radio Council. There will be a huge flea market and commercial booths, all indoors. Amateur exams will be administered at the convention on Saturday, November 24, at 8 A.M. (The cutoff date for applications was October 20. See this column, last month.) Frank Butler, W4RH, ARRL Southeastern Division Director, will participate in the Convention activities, and Leland Smith, W5KL, Vice President of QCWA, will be guest speaker at the QCWA luncheon on Saturday at noon. A women's luncheon and fashion show will be held on Sunday. Our famous Luau will be held Saturday evening. We advise everyone to get their tickets early, as the luncheons and Luau may be sold out by convention time.

Some interesting programs are planned, including technical talks and demonstrations of the latest methods of amateur communications. There will be the usual club meetings and traffic nets. The ARRL forum will be held on Saturday afternoon, hosted by Frank Butler, W4RH. There will be a QSL contest, so bring your cards and display them in the lobby.

Registration tickets will be $3 until November 17, and $4 at the door. The Saturday luncheon is $8, Sunday luncheon $7 and the Luau $15. Swap tables are $12 for both days. Make checks out to FGCARC and mail to FGCARC, Box 157, Clearwater FL 33517 (s.a.s.e., please). Rooms at the hotel are $46. Write or call Sheraton Sand Key Resort, 1160 Gulf Blvd., Clearwater, FL 33515, tel. 813-595-1611, and mention the Convention (do not use their 800 number). A free shuttle bus from a remote parking lot will run on both days. Talk-in stations will be 37/97, 96/36 and 224.94. For convention information, write to FGCARC, Box 157, Clearwater, FL 33517, or call Eli Nannis, K4JMH, Convention Chairman, at 813-595-3111.

†November 24-25
South Florida Section, Clearwater

ARRL NATIONAL CONVENTIONS

October 4-6, 1985
Louisville, Kentucky

September 5-7, 1986
San Diego, California

June 19-21, 1987
Atlanta, Georgia

†At press time, Amateur Radio exams are scheduled to be given at this convention. For other exam opportunities see Hamfest Calendar.

Hamfest Calendar

By Marjorie G. Tenney,* WB1FSN

[Attention those who send in items for Hamfest Calendar and Coming Conventions: Postal regulations prohibit mention in *QST* of prizes of any kind and games of chance such as bingo. Hamfest information is accurate as of our deadline; contact sponsor for possible late changes.]

Connecticut (North Haven) — November 11: The Southcentral Connecticut Amateur Radio Association (SCARA), will hold its 5th Annual Electronics Show and Flea Market at the North Haven Recreation Center on Linsley Street. The show will feature the latest in ham radio, computers and electronics. Admission is $1.50, children under 12 free with an adult. Tables are $10 in advance for the main hall and $12 at the door. Reservations are strongly advised. Setup is at 8 A.M. for vendors; doors open at 9 A.M. and close at 3 P.M. A special exhibit area with setup security arrangements for new equipment vendors will be made available. Checks should be made payable to "SCARA" and sent to Tony Vanacore, AK1O, P.O. Box 81, North Haven, CT 06473. Send s.a.s.e. for confirmation, directions, etc. Call 203-484-4175 (home) or 203-239-5321, ext. 311 (days), for further information. Talk-in on W1GB 01/61.

†**Florida (Ft. Lauderdale) — December 1-2:** The Broward County ARC hamfest will be held at the Omni Auditorium on the Broward Community College North Campus from 9 A.M. to 5 P.M. Flea market, exhibitors, technical program. Admission is $4 in advance, $5 at the door. Talk-in on 31/91. FCC exams will be given, Technician through Extra Class (ARRL VEC). For further information, advance registration and table reservations, please contact Billy K. Lewis, WD4NEA, 7891 Hood St., Hollywood, FL 33024. For information on volunteer examinations, please contact William J. Manley, KB4XE, 4170 N.W. 106 Ave., Coral Springs, FL 33065.

Georgia (Stone Mountain) — November 10-11: The Alford Memorial Radio Club will host the 12th Annual Stone Mountain Hamvention at beautiful Stone Mountain Park. Hours are from 9 A.M. to 5 P.M. on Saturday and from 9 A.M. to 3 P.M. on Sunday. Admission is $4; this includes both days' admission, parking at the hamfest site and the Saturday night cookout. Activities take place at Lakeside Center, with spacious inside dealer displays and light refreshments in the hospitality room. Plans are at this time to give exams, Novice through Extra Class, at the Stone Mountain Inn, Saturday and Sunday mornings beginning at 8:30. Talk-in on 16/76. Full hookup campground adjacent to Lakeside Center. For more information, contact Jim Garner, KE4BI, 490 Village Green Court, Lilburn, GA 30247, tel. 404-921-7588.

Illinois (Grayslake) — November 4: The Waukegan CAP will hold its 4th annual hamfest at Lake County (IL) Fairgrounds, Rte. 45 & 120, Grayslake, from 7 A.M. to 5 P.M. Admission $3, tables $5. Further info and reservations: S.a.s.e. to CAP, 637 Emerald, Mundelein, IL 60060.

Louisiana (West Monroe) — November 10: The Twin City Hams will sponsor a hamfest at the Convention Center, West Monroe. Features: new dealers, swap tables, exams, all indoors. Talk-in on 25/85. For further information and reservations, contact Benson Scott, AE5V, 107 Contempo, West Monroe, LA 71291.

Massachusetts (Feeding Hills) — November 10: The 35th Annual New England DXCC Dinner will be held at the Concord Lodge of Elks, Baker Ave., W. Concord (near Rte. 2 & 62). Action begins at 2 P.M. with a variety of DX talks and slide programs, including videotapes of VU7WCY and XU1SS. Charge for the afternoon session is $2. Cocktail hour is at 6 P.M.; a seven-course family-style dinner featuring roast beef is at 7:30 P.M. Banquet speaker is Fred Laun, K3ZO (ex-HS1ABD). Cost for the evening is $14.95. For more info contact Steve Tolf, K1ST, 12 Phylmor Dr., Westboro, MA 01581.

Massachusetts (Billerica) — November 17: The Honeywell 1200 Radio Club, sponsor of 147.72/12 repeater, and the Waltham Amateur Radio Association, sponsor of 146.04/64 repeater, will hold their annual Amateur Radio and electronics auction at the Honeywell Plant, 300 Concord Rd., Billerica, Exit 27 off Rte. 3. Snack bar and bargain parts store. Doors open at 10 A.M. Free admission and parking. Talk-in on both repeaters. Formore information, contact Doug Purdy, N1BUB, 3 Visco Rd. Burlington, MA 01803.

Michigan (Oak Park) — November 25: The Oak Park High School Electronics Club presents the 15th Annual Swan-N-Shop from 8 A.M. to 4 P.M. at Oak Park High School. Donations $2, eight-foot tables $6. Refreshments. East and West doors open at 6 A.M. Send s.a.s.e. to Herman Gardner, Oak Park High School, 13701 Oak Park Blvd., Oak Park, MI 48237, or call for more information 313-968-2675.

†**Michigan (Hazel Park) — December 2:** The Hazel Park ARC hamfest will be held at Hazel Park High School. Admission is $3. For further information, contact Randal C. Arnoldi, N8DEI, Chairman, 23705 Vassar, Hazel Park, MI 48030:

†**New York (Stony Brook) — November 25:** Radio Central ARC presents the 6th Annual "Ham-Central," an all-inside flea market and hamfest at the giant 12,000-square-foot main social hall of Temple Isaiah, 1404 Stony Brook Rd., Stony Brook, Long Island. Doors will open at 7:30 A.M. for sellers and dealers; 9 A.M. for general admission. Closes at 3 P.M. Seminars on DX, OSCAR, antennas; Q&A periods follow each. General admission is $3, women and children under 12 free. Table space: $7 for a full 8-ft space, includes one free admission. Bring your own tablecloths. Talk-in on 144.550/145.150 and 52. Call now for reservations and additional information: Bob Yarmus, K2RGZ, tel. 516-981-2709, (Monday/Friday after 6 P.M.) 3 Haven Ct., Lake Grove, NY 11755.

†**North Carolina (Greensboro) — November 24-25:** The Greater Greensboro Hamfest, sponsored by the Mark 4 Radio Club, will be held at the National Guard Armory, Greensboro, from 9 A.M. to 5 P.M. Advance admission is $3.50, at the door $5. Help with loading,

†ARRL Hamfest

*Convention/Travel Coordinator, ARRL

unloading. Hot food and beverages. Talk-in on 144.650/145.250, 146.835/147.435 and 52 simplex. For information and reservations, contact Coy Hennis, WD4NHL, tel. 919-294-2841, or Fred Redmon, N4GGD.

†**Ohio (Massillon) — November 11:** The Massillon ARC will sponsor "Auctionfest 84" at the Massillon K of C Hall, off Rte. 21, from 8 A.M. to 5 P.M. Sellers setup at 7 A.M. Admission is $2.50 advance, $3.50 at the door. Many tables available at $7 per 8-foot space. Refreshments available and sit down dinner. Plenty of free parking. Auction starts at 11 A.M. Talk-in on W8NP, 78/18. For advance registration and info, contact MARC, 920 Tremont Ave., S.W., Massillon, OH 44646. S.a.s.e. please.

†**Pennsylvania (South Greensburg) — November 3:** The Foothills ARC will hold its 16th Annual hamfest at St. Bruno's Church in South Greensburg. Tickets are $2 or 3/$5. Indoor flea market tables are $5. Refreshments, food. Mobile check-in on 78/18. For further information, advance tickets or tables, contact WA3HOL, or write FARC, P.O. Box 236, Greensburg, PA 15601.

Pennsylvania (Sellersville) — November 4: The R. F. Hill ARC will hold its annual indoor Winterfest at the Sellersville National Guard Armory. Doors open at 8 A.M. Entry is $2. Women and children are free when accompanied by a paying ham. Food available; many restaurants nearby. The Armory is located approximately 5 miles from the Pennridge Airport, halfway between Philadelphia and Allentown, near the junction of PA Rtes. 309 and 563. Talk-in on 144.59/145.19, 28/88 and 52 simplex. Talk-in station will be W3AI. Vendors may reserve space by writing P.O. Box 29, Colmar, PA 18915, or calling 215-721-0278. (Those telephoning should expect to have their calls returned collect during the evening.) Space is approximately 6 ft by 6 ft indoors and one parking space with frontage outdoors. Purchase of a vendor space receives a single admission. Vendors must supply their own tables.

Note: Sponsors of large gatherings should check with League Hq. for an advisory on possible date conflicts before contracting for meeting space. Dates may be recorded at ARRL Hq. for up to two years in advance.

In Training

AFTER THE CLASS, WHAT'S NEXT?

One goal probably stands out in the minds of many Amateur Radio students: to successfully complete the course and get a license. As an Amateur Radio instructor, encourage your students to extend that basic, but necessary, goal. You know there is much more to meeting the license requirements, understanding and enjoying the many aspects of the service. Your teaching style and overall attitude toward instructing can inspire your students to look beyond their immediate goals to join the amateur fraternity.

All this may take more time than a 10- or 12-week course permits. As an instructor, or Elmer, plan to make some time available after the course is completed. It's an opportunity to initiate newcomers or new upgrades into the amateur community under the watchful eyes of experienced operators.

Learning Together

Since your class has studied and learned as a group, suggest that they stick together for awhile. A little moral support from peers or a chance to struggle over a project together will keep the interest high. Lead your crew in an antenna-raising party. Make preparations, gather equipment and materials and then converge on one graduate's property (with his permission, of course!) to set up, string up and even test that antenna. Prepare your fledgling licensees for operation! They'll ride on the enthusiasm.

How about station equipment? You most likely have been asked questions about what kind of equipment to buy and where to find it. To the new or prospective ham, the market for used and new radio equipment is "out there somewhere." In many cases, you are the link to making sure the two parties meet. Several instructors have reported that they coordinate equipment searches, and bring potential buyers and sellers together. Of course, a hamfest is a logical place to shop for station parts and accessories. Supply current information about these upcoming flea markets and events in the area or, better yet, tell your students how they can receive this information more directly from *QST*.

Setting up a station and getting on the air are exciting times. With background you provided in class, efficient and safe operating procedures and goals should be in the minds of each licensee. It's time for each individual to put words into action. A little coaching on your part, if requested, will help recent licensees achieve a successful start in Amateur Radio.

The Club Connection

Let your local radio club support your efforts after the class. Have the club organize a corps of Elmers to be available to assist newly licensed or upgraded amateurs. This represents a time-saving and practical advantage for everyone. A club member close by is more likely to find time to assist a new Novice licensee. Also, new operators will have the chance to get to know more hams in the area. Radio clubs will welcome the chance to invite new members to join and get involved. Keep up the work through operating events by setting up a Novice station in contests. Introduce new members in your newsletter, and arrange an on-the-air meeting for all the graduates to check into a special roundtable. These are just a few ideas that your club may try to keep Amateur Radio interest growing after the class has graduated.

The Next Step

Upgrading one's license is assuredly a goal that will tempt the radio amateur to hit the books again. Instructors: A teaching challenge awaits you! What better way to complete the circle of experience for new radio amateurs than to lead a higher-level licensing course? You have already helped prospective Amateurs earn their first licenses and have ushered them into many radio-related activities. You may offer an upgrading class to coincide with an exam session. Now that the Volunteer Examiner Program is running, it should be easier to coordinate your class with a Volunteer Examiner-sponsored test session.

Make sure students who do not pass the exam know that you're willing to help them pass the next time. Simply remind the students when the next class or test session will be held. Offering to help newcomers become licensed, join a local group and get on the air is an invaluable service. Your instructing efforts will inspire class members and others to contribute to Amateur Radio. — *Steve Ewald, WA4CMS, Assistant Training Manager*

Strays

During its annual hamfest, the Indianapolis ARA fulfilled its pledge to donate $1000 to the ARRL Foundation's Goldwater Scholarship Fund. WA9FUD (right) presents the check to ARRL President W4RA (left) as Central Division Director W9PRN looks on.

I would like to get in touch with...

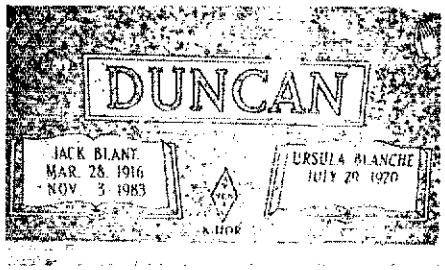
☐ any hams interested in learning Spanish and having on-the-air practice sessions. Larry Feick, NFØZ, 3333 W. Wagontrail Dr., Englewood, CO 80110.

EARLY-RADIO REFERENCES

☐ Not long ago, I accidentally came across two really old "callbooks." One is *Radio Stations of the United States.* It was published by the Department of Commerce, Bureau of Navigation, Government Printing Office, Washington, DC, and is dated July 1, 1913. Part 1 lists land stations, ship stations and all U.S. call signals. Part 2 lists all amateur stations licensed through June 30, 1913.

The other publication's covers are missing, making positive date identification difficult, but pencilled-in notations seem to indicate it is of the same era as the first book. This publication lists wireless stations of the world.

It is my intention to keep those documents in my personal files, but anyone who possesses a genuine interest in these historical items may contact me. — William D. Watt, WA6HYC, 1733 So. Ditmar St., Oceanside, CA 92054, tel. 619-439-8814.



As a lasting tribute to her husband, K4IOR, and his love for Amateur Radio, Mrs. Jack B. Duncan had his call sign and the League diamond included on the gravestone. She met Jack because he and her brother were hams.

Public Service

Conducted By Robert J. Halprin,* K1XA

Ham Radio Helps Out at Red Clay

Bike-A-Thons — certainly! Soap box derbies — sure! Marathons, regattas, Special Olympics, cross-country meets — of course! But coordinating an Indian council meeting? What a place for ham radio!

But this was no ordinary Indian council meeting, and hams were not only there, they played a vital part in coordinating some of the most memorable activities for the Cherokee Nation since its division in 1838. This was the first council meeting held by the entire Cherokee Nation since that infamous year, when 17,000 Cherokees were herded together at a little town called Red Clay, Tennessee. Taking with them an "eternal flame," symbol of their faith, they were forced to march along the "Trail of Tears" to a new reservation in Oklahoma, a trek along which about 4000 Indians died. A much smaller remnant of about 1200, refusing to be driven from their historic tribal lands, hid out in the mountains of western North Carolina and eastern Tennessee. Years later, this remnant was granted a federal reservation located around the North Carolina town of Cherokee, 50 miles west of Asheville.

In 1951, coals from the eternal flame were carried from Oklahoma to the town of Cherokee, symbolizing the unity of the people. Other than that, little communication has taken place between the two branches, and slowly they have begun to differ in their way of life, their customs and even in their language.

Recently, the two groups decided to hold a joint council meeting at which they would reaffirm their kinship and conduct tribal business of equal importance to both groups. It was only fitting that the meeting should be held at Red Clay, now a State Historical Area, and that the eternal flame should come full circle. The dates set were April 5-7, 1984.

Plans were made for a group of nine Cherokee relay runners to carry the flame from the town of Cherokee along the 125-mile stretch of highway to Red Clay. At the park, the arrival of the flame would signal the start of the festivities, conducted by Chief Robert S. Youngdeer of the Eastern Band, Chief Ross Swimmer of the Oklahoma Nation, numerous other tribal dignitaries from both branches, and Governor Lamar Alexander of Tennessee.

Park Supervisor Jennings Bunn and Park Ranger Tom Shouse needed some way to coordinate events so media personnel would be ready to take pictures at the moment the runners swept around the curve and into the park. They were also becoming apprehensive about traffic management and crowd control, as media coverage — both in southeast Tennessee and nationally — was arousing public interest, and the number of daily visitors was projected at 20,000 to 30,000.

Ray Bowman, WA4ZUD, of the Chattanooga Amateur Radio Club, heard the publicity and was eager for area hams to offer their services in any way they could. Neither Supervisor Bunn nor Ranger Shouse was familiar with ham radio except in the most general terms, and they had no idea of the extreme flexibility of 2-meter radio in such situations. However, as Red Clay is outside the police jurisdiction of both Chattanooga and Cleveland, Tennessee, and the men would have to depend on volunteer help, they decided to include this unknown group.

Ray contacted Presidents Charles Curle, AD4F, of the Chattanooga Amateur Radio Club, Barbarra Gregory, WA4RMC, of the Chattanooga/Tri-State FM Association and Russ Lawson, WB4LCB, of the Cleveland Amateur Radio Club, and received the enthusiastic support of all three groups. At a meeting with Ranger Shouse, club members offered to monitor the last 5 miles of the relay in order to integrate the arrival of the torch-bearing runners with the opening ceremonies. Hams also agreed to use 2 meters to coordinate the numerous activities taking place on the 275-acre state historical area, aid auxiliary police in traffic control on the narrow one-way roads, and help the Cherokee Police in providing security for the chiefs and other dignitaries. In addition, hams who were "off duty" would circulate through the crowd, keeping an eye out for lost children, pick-pockets or any other problems.

While the Tri-State Association and the Cleveland Club were basically concerned only with the 2-meter activity, the Chattanooga Club decided to operate a special-event station in addition. Since plans for the club's participation were made too late to publicize the proposed station, members decided to go ahead and see how many contacts they could make. As it turned out, they made 75 contacts in 28 states and four foreign countries — certainly not an overwhelming record in the usual run of things, but the rangers were quite impressed.

As they saw the ease with which hams armed with 2-meter hand-held rigs tracked down lost children, kept in touch with key figures in the weekend celebration, and held traffic on the winding roads until a "wrong-way Willie" could get through, the park rangers also came to have great respect for this aspect of ham radio activity.

Working from Thursday through Saturday, 26 members from the three radio clubs put in long, hard, but very rewarding hours. It was a once-in-a-lifetime opportunity to see the workings of the Cherokee Council, see the historic tribal dances and meet many of the Cherokee people in an informal situation — and to enhance ham radio's public service image in a most unusual way. — *Charlie Ann D. Curle, WG4G, Chattanooga ARC, P.O. Box 13, Chattanooga, TN 37401*

AMATEUR RADIO + FIREMAN'S OLYMPICS = SUCCESS

The 1984 California Fireman's Olympics, held August 26-31, were hosted by Santa Clara Firefighters. These Olympics have been occurring since 1972, alternating between Northern and Southern California, featuring 17 events with over 2500 participants from fire departments throughout California. However, the 1984 Olympics had something a little different — Amateur Radio.

The idea came from Randy Miltier, N6HMO, who is also a member of the Santa Clara Fire Department. After attending an Olympic committee meeting and hearing of the communications problems that occurred in 1982, Amateur Radio seemed like a natural. In 1982, Santa Clara Firefighters hosted the Olympic Games for the first time and tried using CB and Fire Department radios to cover the events, some of which were over 50 miles away over mountainous terrain.

Randy, N6HMO, contacted Bill Robinson, WB6OML, who is an Emergency Coordinator for Silicon Valley Emergency Communications System (SVECS) and asked him if Amateur Radio operators were available to help the firefighters with their communications. Of course, Amateur Radio operators love this sort of thing so the wheels were turning immediately. Bill, WB6OML, contacted Don DeGroot, KA6TGE, SVECS Emergency Coordinator for Santa Clara, and told him of the upcoming challenge.

Weeks prior to the Olympics, WB6OML and KA6TGE made announcements over many 2-meter nets in the area soliciting volunteers to work four-hour shifts, anywhere from 6 A.M. to 7 P.M., Sunday through Friday. The toughest slots to fill were from 8 to 5 as most people have full-time jobs. However, the challenge was met, as 50 radio amateurs from three counties volunteered their time and resources to help support the Olympic Games. Amateurs worked 412 hours, and another 50 hours went into planning and scheduling for a total of 462 hours! Don, KA6TGE, put in over 48 hours as Olympic Control at the Marriott Hotel in Santa Clara. KA6TGE received short relief help from Bob, K6DHO, and Randy, N6HMO. Lou, WB6BPU, acted as a backup to Olympic Control from his home in case KA6TGE got tied up on one rig while someone was calling on the other. Two rigs were used, one to work the out-of-town events and one to work local events. The SVECS repeater, WB6ADZ, at 146.715, was used for Olympic Control.

Mutual aid between amateurs of different jurisdictions and counties to cover the events that were held out of town went very well. Bill, WB6OML, said, "Even when I was wrong, my colleagues made it right! I called Len, WA6ADA, at Livermore to handle the Motorcross which turned out to be out of his territory. He took the initiative to contact Bill, WA6ZFZ (Contra Costa County ARES/RACES), who picked up the ball and got the job done. I've heard of interterritory friction, but I sure didn't find any here. When I called Roy, AA4RE, for help from Gilroy, he lined me up with Ed, KA6FXW, who said, 'How many, when, and where.'

"Susan, WA6OCV, said she'd see what she could do at Santa Cruz. The Santa Cruz ARES not only staffed the surfing event, but they spent the day chasing the event up and down the coast as the wave patterns changed! All these groups responded on short notice to events that were subject to last-minute changes. This operation crossed both territorial and section lines without a ripple." The Amateur Radio operators did their job and did it well. The Firefighters, from local and distant departments, were impressed by our skill and knowledge in communications. I'm sure Amateur Radio will stick in the minds of many of the firefighters who participated in their 1984 Olympics. In fact, Amateur Radio may become a regular event in the California Fireman's Olympics. — *Randy Miltier, N6HMO, Santa Clara, California*

WINSTON-SALEM CAP SUPPORTS ARES IN RESPONSE TO FIRE

Winston-Salem, North Carolina, Sunday, 12 Aug.: A normal, albeit rainy, Sunday night at Forsyth Memorial Hospital. During the evening, a problem in the electrical system plunged the hospital into darkness and filled some areas of the building with smoke. It also wiped out the in-house phone system. Emergency power had the darkness enlightened within a few minutes, but considerable smoke still inundated the nursery and intensive-care units, necessitating evacuation to another hospital and to the Red Cross. The phone system remained dead.

Forsyth County ARES was alerted by the city public safety and by the hospital authorities to provide help in communications. The call went out on the amateur repeater. The amateurs responding included many of the CAP communicators. Moments later, Boyce Rogers, WB4WOM, Winston-Salem CAP Squadron Emergency Services Officer and Forsyth County ARES member, alerted the remaining Civil Air Patrol communicators.

*Deputy Communications Manager, ARRL

Fred Horton, NA4P, CAP Squadron Communications Officer and ARES NCS, provided a link at Baptist Hospital to which many of the ICU and infant ICU patients were evacuated. Cadet Daryl Shaw, KB4GVU, joined to help there later. Jack Moorefield, N4INE, North Carolina CAP Wing Deputy Commander, was working at the evacuation dispatch at Forsyth. He and Rogers were providing the interface between amateur and CAP communications. Bill Batts, KB4EAT, was acting net control for the CAP.

On the amateur side, Connie Conrad, K4BE, was doing his usual masterful job as net control on the Winston-Salem 04/64 machine. Tom Pugh, KB4JO, was handling communications and arrivals at the Red Cross Chapter House. Several other amateurs were serving at various locations and many amateurs and CAP communicators were standing by ready and willing to relieve should the emergency last into the late night.

Once more, when the alert sounded, Forsyth County ARES and the Winston-Salem Civil Air Patrol joined forces to get the job done. — *Winston-Salem Squadron, Civil Air Patrol, P.O. Box 4224, Winston-Salem, NC 27115-4224*

PUBLIC SERVICE DIARY

☐ Eastern New York — May 29. At 9 A.M., the Schenectady Office of Emergency Preparedness, utilizing an Amateur Radio operator, brought up K1FFK/R and requested that stations monitoring from Eastern New York assist in flood reporting. Amateurs were also notified that the National Weather Service in Albany was experiencing a power outage. A battery-powered Amateur Radio station was dispatched to the Albany NWS. Once operational, it provided liaison between Eastern New York repeaters, K1FFK and the NWS. The operations were terminated three hours later as the threat of flooding diminished. (WB1HIH, SEC WMass)

☐ Burlington, Vermont — May 31. In the early morning hours, the Red Cross alerted WA1YEH and requested RACES assistance. Heavy rains in southern Vermont had caused severe property damage and all emergency services were being called out. An emergency net was immediately formed on W1ABI/R with 10 amateurs responding. These amateurs were dispatched to the agencies involved and areas affected by the rising water. Information relayed by amateurs included details of damage, location and use of Red Cross shelters, reports of water levels on various streams and rivers, weather data and other messages. The emergency net closed down after seven hours of operation.

The next week, another high water emergency called RACES back into action. Well over 27 amateurs responded. Headquarters were established at the Northern Vermont Chapter Red Cross in the Burlington ARC/Red Cross Radio Room. Approximately 168 transmissions were made on the BARC VHF repeater during 8½ hours of operation. (KD1R, SM VT)

☐ Bronx River, New York — June 25. Shortly after 7 A.M., K1BTD/2 heard WB2DOE/mobile requesting emergency assistance via the K2KLN VHF repeater. K1BTD/2 responded. WB2DOE/mobile reported that he was on the Cross Bronx Expressway, driving over the Bronx River, watching a man who was obviously intending to jump. K1BTD/2 immediately notified the authorities. The man jumped but was rescued by police officers who had arrived on the scene. (K1BTD)

☐ Dover Township, Ohio — June 30. After leaving home for a walk, an elderly man was reported missing when he did not return within a reasonable amount of time. Amateur operators coordinated search teams, the Sheriff's Department and the Athens County EOC during the search. WD8EMS finally located the man along a rural road, uninjured. (W8KVK, EC Athens Co.)

☐ Sonora, California — July 7. The Calaveras ARC was called in to assist California Department of Forestry firefighters in a communications capacity during a large forest fire. A communications link was established between the fire camp in Jamestown and CDF Headquarters in San Andreas. (KA6CUJ, EC Calaveras Co.)

☐ Jessup, Georgia — August 16. At approximately 4 P.M., Radar Approach Control at Travis Field (Savannah) lost radio contact with a single-engine aircraft enroute from South Carolina to Florida. Radar determined that the aircraft was wandering off course. Minutes later, it disappeared from the radar screen. At about the same time, KA5SEN was mobile near Jessup when he heard an aeronautical mobile calling MAYDAY on the local VHF repeater. N4IJO had the foresight to bring his handheld with him on the flight and reported that the aircraft had experienced a complete electrical failure and needed immediate assistance. KA5SEN drove to a pay telephone, called the radar facility at Travis Field and reported the emergency. KA5SEN then relayed emergency instructions from the facility to the aircraft. Minutes later, the aircraft made a safe emergency landing at Glynco Jetport in Brunswick. (W4FGX)

☐ Bloomington, Indiana — September 8. While camping in Monroe County, KW9F learned that an eight-year-old boy at an adjacent campsite had taken one of his grandfather's heart pills. KW9F called for assistance on K9OK/R and was answered by N9DHX who relayed the information to the Indiana Poison Control Center. The center advised that the boy should be transported to the Bloomington Hospital for treatment. KW9F notified the Bloomington Police Department of the situation and requested their assistance through traffic. The boy and his parents were driven to the hospital by KW9F. (N9DHX)

☐ Owensboro, Kentucky — September 11. W4OYI and WB4ANL responded to a KY Disaster and Emergency Services call reporting a gasoline spill at a bulk storage tank. Evacuation plans were readied, but the spill was found to be minor. (KA4BCM)

AMATEUR RADIO EMERGENCY SERVICE REPORTS

☐ Northeast Oklahoma — April 26. ARES/RACES operators were out in force for the better part of the day as tornadoes and severe thunderstorms buffeted the area. Several tornadoes caused major property damage, injuries and fatalities. Amateurs assisted in damage assessment surveys, providing communication links and handling Welfare traffic the following day. (K5ENA, DEC NE Oklahoma)

☐ Owensville, Missouri — April 27. At 5:31 P.M. the National Weather Service issued a tornado watch for an area immediately west of St. Louis. The Zero Beaters/ARES Weather Network was activated on WAØYFA/R with 25 check-ins. The ARES spotters provided the NWS with numerous and accurate weather observations. A tornado caused extensive damage in the Owensville area. Amateurs offered their assistance in a communications capacity the following morning. (K9OCU, DEC Franklin, Gasconade, Montgomery, Warren Cos.)

☐ Sarasota, Florida — May 5. At 2:30 A.M., the Red Cross was notified of a fire at a local migrant worker camp. N4EWR was informed and went to the scene of the fire. The fire had left approximately 150 people homeless. The Red Cross headquarters was notified of the situation via the Sarasota Emergency RA repeater. (WB3EMQ)

☐ West Virginia — May 7. The West Virginia Office of Emergency Services was activated in the morning when heavy rain was causing the worst flooding in seven years along the Tug Fork River in southern West Virginia. Residents of three counties were affected by the rising water. ARES/RACES members were alerted and had an amateur station on the air in the EOC at 9:30 A.M. The station was in operation for 36 hours with eight amateurs alternating duties. In preparation for any eventuality, an HF link was setup with an operator with portable equipment ready to be heliported to the stricken area. Operations were terminated the evening of May 8. (KB8ZM, EC Kanawha Co.)

☐ Vernon, Vermont — June 15. At approximately 10 A.M., an alert was called at the Yankee Atomic Power Plant near Vernon. Local amateurs were contacted and requested to monitor the Mt. Greylock VHF repeater for further instructions. Had the alert escalated to a "Site Emergency" or "General Emergency," the amateurs would have been deployed to nearby towns to provide back-up communications. Although no amateurs were requested to move to their assigned town, one amateur operated from the EOC in Warwick as telephone communications to the Fire Department EOC were out. After approximately four hours, the alert was dropped as plant officials contained the problem. (WB1HIH, SEC WMass)

☐ Forney, Texas — June 26. While driving through Forney, N5DBQ noticed large, low threatening clouds moving into the immediate area. A few minutes later, he observed three possible funnel-type formations at the base of the cloud formation. Within range of W5FC/R in Dallas, he requested assistance. The National Weather Service was notified through another Dallas repeater. While the NWS was tracking the formation, N5DBQ drove to the Forney Police Department to spread the word. Eventually the cloud formation passed through the area and conditions returned to normal. (N5DBQ, EC Kaufman Co.)

☐ Dayton, Ohio — July 11. At 10 A.M., W8ILC received a telephone call from the Dayton Fire Department stating that a serious highway accident involving a tank truck leaking possibly toxic chemicals may require evacuation of the immediate area. The fire department requested that amateurs assist the public safety agencies during the possible evacuation. Fifteen minutes later, the ARES mobile communications van was ready and a stand-by crew alerted. An "all clear" was sounded at 12:15 P.M. when the chemical was determined to be nontoxic. (W8ILC, DEC Greene and Montgomery Cos.)

☐ Southwest Minnesota — July 16. At approximately 5 P.M., SKYWARN spotters were activated as a cold front was moving through the area and the Twin Cities had received reports of property damage by high winds. As the front progressed into the Olmsted County area, spotters reported winds in the 50-60 mph range. At about 6 P.M., a tornado was sighted by a highway patrolman. The tornado caused light damage. The SKYWARN operations were terminated when the front passed. (KØTS, EC Olmsted Co.)

☐ Ocala, Florida — July 25. The Environmental Protection Agency notified Marion County Civil Defense that a small Ocala subdivision (consisting of 150 homes) had its water supply contaminated with EDB, and that the EPA had issued an order that the State of Florida must supply the residents with drinking water. The Civil Defense Director, KA4YBY, announced to the Marion County Emergency Net that volunteers would be needed to supply communications and coordinate transportation for the 12 gallons of drinking water allotted to each household in the subdivision. Nine amateurs responded. Within three hours, every household in the affected area had been supplied with drinking water. (W4UEA, SEC NFla.)

☐ Aurora, Colorado — August 2. A swimming pool house fire at the Arapahoe County Apartment Complex resulting in a chlorine gas hazard required the evacuation of 400 residents. District 22 ARES responded to a request by the Red Cross to provide communications between the site of the fire and the Arapahoe Red Cross building. Two days later, the same apartment complex caught fire. District 22 ARES was asked to provide communications from the fire to the Arapahoe Red Cross building as before. (WDØDGL, Asst. EC District 22)

☐ Allegany County, Maryland — August 13. After heavy rainfall, flash flooding threatened the communities of Hyndman, PA, and Ellerslie and Corriganville, MD. N4GII, although his home had been damaged by the swiftly rising water, maintained communications with amateurs outside the danger area. At this point, the Allegany County, Maryland, Civil Defense offered assistance although the stricken community was across the Pennsylvania state line. Seven amateurs arrived on the scene and set up a mobile communications center while three amateurs were dispatched to the Civil Defense EOC. Two other amateurs maintained VHF and HF links with amateurs in Pennsylvania who were handling communications from further upstream. Operations were terminated at 2 A.M., August 14 when conditions returned to normal. (K3OMN, EC Allegany Co.)

☐ Cumberland, Maryland — August 14. At approximately 8 A.M. a contractor digging with a back hoe broke the telephone cable serving Memorial Hospital, which is the shock trauma and medical command unit for the Western Maryland area. Civil Defense requested amateur assistance to maintain communications between the EOC and the hospital. Six operators responded with three reporting to the EOC and two reporting to the hospital's emergency room (N3BLP, a Supervising RN, was already in the emergency room with her hand-held). The communications emergency was terminated at 3:50 P.M. when telephone service was restored. (K3OMN, EC Allegany Co.)

ARRL SECTION EMERGENCY COORDINATOR REPORTS

☐ For August, 33 SEC reports were received, denoting a total ARES membership of 19,021. Sections reporting were: AK, AZ, ENY, EMA, EPA, IN, KS, KY, ME, MN, MS, MO, NE, NFL, NTX, OH, OK, ON, PAC, SV, SDG, SJV, SCV, SC, SD, SFL, TN, UT, VA, WA, WMA, WNY and WI.

NATIONAL TRAFFIC SYSTEM

Bill, WB9NVN, is assistant manager, 9RN/c4; Mary, WB1GXZ, is assistant manager, 1RN/c2. The following amateurs received 9RN/c4 certificates: NW4A, N9AEI, W9CSJ, N9DR, N9EM, KA9FEZ, K9GMZ, KZ9I, WB9NVN, K9QEW, KW9T, KB9X, W9XD. 2RN/c4 certificates to: W2GJ, W2XS, WB2KLF (all first annual), KU2N (second annual), KC2PB (third annual). 4RN/c2 certificates to: WD4FTK, WB4PNY, WA4LJI, W3ATQ, W4JLS, AA4AT, KB4OG, K3RZR, KA3DTE, W3BBN, KA4DHP, WD4CNQ, WD4CNR, WB4WII, KD4PJ, WA4OBR, W4GRO, KA4KJI, K4NLK, WD4LRG, W4TWD, W4FMZ, K4ZN, WB4NTW, WB4RUJ, N9ECB, KA4ATM, WB4WYG, WX4J, KY4U, N4PL, WA4QXT,

WB4ADL, NF4O, NZ4O, WB2NVJ, N4ADI, WD4RIQ, W4NFK.

August Reports

1	2	3	4	5	6	7
Cycle Two						
Area Nets						
EAN	31	928	29.9	.576	93.5	
CAN	31	1027	33.1	.606	100.0	
PAN*	58	889	15.3	.556	93.0	
Region Nets						
1RN	59	465	7.9	.344	87.0	100.0
2RN	53	240	4.5	.244	65.5	93.5
3RN	31	322	10.4	.403	89.5	93.5
4RN	62	464	7.5	.350	75.0	100.0
RN5	62	951	15.3	.501	94.9	100.0
RN6	62	495	7.9	.340	97.6	93.5
RN7	62	525	8.5	.490	84.8	91.9
8RN	62	394	6.4	.394	96.2	100.0
9RN	62	483	7.8	.338	100.0	100.0
TEN	62	686	11.0	.411	72.0	100.0
ECN						74.2
TWN	58	407	7.0	.330	67.1	93.5
TCC						
TCC Eastern	109[1]	665				
TCC Central	85[1]	496				
TCC Pacific						
Cycle Four						
Area Nets						
EAN	31	1870	60.3	1.402	93.5	
CAN	31	1146	36.0	1.089	100.0	
PAN	31	1139	36.7	.892	95.2	
Region Nets						
1RN						96.8
2RN	90	696	7.7	.511	94.2	93.5
3RN	62	310	5.0	.428	98.4	100.0
4RN						90.3
RN5						100.0
RN6	62	649	10.5	.583	92.1	96.8
RN7	62	551	7.7	.713	92.2	98.4
8RN	60	510	8.5	.453	89.0	93.5
9RN	62	661	10.7	.640	96.0	100.0
TEN	62	446	7.2	.423	70.4	100.0
ECN						87.1
TWN	13	59	4.5	.460	91.0	90.3
TCC						
TCC Eastern	141[1]	904				
TCC Central	54[1]	410				
TCC Pacific	114[1]	763				
Sections[2]	6931	26,423	3.8			
Summary	8252	45,864	5.6			
Record	8995	51,307	15.2			

*PAN operates both cycles one and two.
[1]TCC functions not counted as net sessions.
[2]Section and local nets reporting (239): AENB AEND AENK AENW AENX AENY AENZ ATNM WAEN (AL), ATEN (AZ), SWN (AZ/NM), BCEN (BC), NCN NCTN RTTY/V SCN SCN/V (CA), DEPN DTN SEN (DE), BEN CFRN DEN ENMC FAST FMSN FMTN FPON FPTN GCVTN GN LSTTN NFPN PBTN PEN PRVAN QFN SEFTN SVTN SWFTN TPTN VEN (FL), CGVN CSC GCN GSBN GTN RAEN (GA), PTN (HI), IMN (ID/MT), ILN ISN ITN (IL), ICN IRN ITN QIN (IN), CSTN KMWN KPN KSBN KWN QKS QKS-SS (KS), 4ARES 7ARES 11ARES CARN KYN KYPON MKPN NKARC PAWN TSTMN WTEN (KY), CITN EM2MN EMRI EMRIPN EMRISS HHTN NEEPN WMEN WMFN WMN (MA/RI), MEPN MMN MTN WRIN (MB), AEN CMEN MPSN PTN SGN (ME), MACS MITN MNN QMN UPN (MI), MNAMWXNT MSN/1 MSN/2 MSPN/E MSPN/N MSSN MTN PAW (MN), ACAN CMEN HBN IFN JCC LAAN LOZARCW LOZARFM MEOW MOFON MOSSB MTTN PTN RRARS SARN STAN (MO), CNCTN NCEN NCMN RARS (NC), CN CSN (NC/SC), BRARES BVARES CC2MN EN2MN MARES MNARES MNPN NCHN NCN NE40 NE75 NSN PV2MN SBARES WNN (NE), GSFM GSPN MCEN (NH), JSARS MCN MSWWARC NJM NJN NJPN NJVN SJVN SWARN (NJ), NSN (NV), BSN CDN CNYTN EPN HVN NYPON NYS NYS/E NYS/L NYS/M OCTEN QNET SCVHFTN SDN WDN (NY), ALERT BNR BRTN BSSN COARES COTN MCTN O6MN OSSN WCTN (OH), CARA EATN OCWN OLZ ONON OPEN OTWN QCWA-63 STN (OK), OLN OPN OSN OSND (ON), BSN LBLARES OHNN OSN PTTN SOFM THN (OR), 3ARES ATN D5ESN (PA), QSN (PQ), GPD2MN LC2MN SCNTN SCSSBN (SC), BHN SDEN WCEN (SD), TNCN TNPN TNVN TSRN (TN), DFW TEX TSN TTN (TX), BUN DCESN UCN (UT), SSN STARES SVEN VLN VN VSBN VSN VTN (VA), EWTN NTN NWSSBN PSTS WARTS WSN (WA).

1 — NET
2 — SESSIONS
3 — TRAFFIC
4 — AVERAGE
5 — RATE
6 — % REP.
7 — % REP. TO AREA NET

Transcontinental Corps

1	2	3	4	5
Cycle Two				
TCC Eastern	116	94.0	1352	665
TCC Central	93	91.4	1031	496
TCC Pacific				
Summary	209	92.7	2383	1161
Cycle Four				
TCC Eastern	155	91.0	1796	904
TCC Central	62	83.9	896	410
TCC Pacific	124	91.9	1506	763
Summary	341	88.9	4198	2077

1 — AREA
2 — FUNCTIONS
3 — % SUCCESSFUL
4 — TRAFFIC
5 — OUT-OF-NET TRAFFIC

TCC Roster

The TCC Roster (August) *Cycle Two* — Eastern Area (KA1GBS, Director) — W1AF AA4AT N1BHH WB1BYR KA8CPS KK3F WA2FJJ WD4FTK KA1GBS WB3GZU KO2H KB2HM WD8LRT K8OZ W8PMJ W8QHB W1QYY KB3UD AF8V W2VY N2XJ W1XX WB8YDZ. Central Area (N5AMK, Director) — N5AMK K9AZS N5BT W5CTZ N5DFO KAØEPY NG5G KW9J W4JL WA4JTE W9JUJ K5KJN W5KLV WB9NVN WB5OXE KD5RC K5UPN WF4X WB5YDD. Pacific Area (WØHXB, Director) — NI6A KT6A N7CSP NØCXI KU6D KB7FE W7GHT N6GIW WØHXB W5JOV KR7L KBØMB KD6ME K6OWA WAØOYI KF7R ND5T NV6T W7TGU K6UYK KO7V WB7WOW. *Cycle Four* — Eastern Area (W2CS, Director) — AA4AT VE3AWE K1BA W3BBN KI3C WA4CCK N3COY W2CS N8CW KA3DTE WB2EAG W1EFW W2FR WD4FTK KA1GBS W2GKZ VE3GOL WB3GZU KB2HM WB9IHH W1ISO K4JST KN1K N4KB AH2M W2MTA W1NJM W8PMJ WB4PNY W3PQ W8QHB W1QYY W2RQ K3RZR KA1T KB3UD WB4UHC W4UQ W2VY VE1WF W2XD N2XJ W1XX N8XX WB8YDZ K4ZK K2ZM W2ZOJ. Central Area (K5GM, Director) — WØAM W9CXY KØEZ W5GHP K5GM WØHI K5OAF W5RB N5TC W5TFB K5TL WB9UYU KB9X KV5X. Pacific Area (KN7B, Director) — ADØA KØBN KCØD W7DZX W6EOT W7EP W7GHT N2IC W6INH W5JOV W7LG W7LYA WB7NHR WØOGH ND5T W7VSE W6VZT KM7Z VE7ZK.

Public Service Honor Roll August 1984

This listing is available to amateurs whose public service performance during the month indicated qualifies for 60 or more total points in the following nine categories (as reported to their SM). Please note maximum points for each category: (1) Checking into CW nets, 1 point each, max. 30; (2) Checking into phone/RTTY nets, 1 point each, max. 30; (3) NCS CW nets, 3 points each, max. 12; (4) NCS phone/RTTY nets, 3 points each, max. 12; (5) Performing assigned NTS liaison, 3 points each, max. 12; (6) Delivering a formal message to a third party, 1 point each, no max.; (7) Handling an emergency message, 5 points each, no max.; (8) Serving as Emergency Coordinator or net manager for the entire month, 5 points, max. 5; (9) Participating in a public service event, 5 points, no max. This listing is available to Novices and Technicians who achieve a total of 40 or more points. Stations that are listed in the Public Service Honor Roll for 12 consecutive months, or 18 months out of a 24-month period, will be awarded a special PSHR certificate from ARRL Hq.

250 K7VW
240 KB7FE
207 W9FZW
205 KK1A
188 W7LRB
170 K5CXP
157 N8FCQ
156 KAØEPY
153 W2PKY
149 WB7WOW
145 WB7OGA
144 KT5Y
137 K4SCL
136 KS5V
135 KK3F
133 W9YCV
127 W2VY
125 WD8MIO
124 WA4QXT
120 WB2UVB
119 W2MTA
118 WF4X AL7W
117 WB1HIH
116 KAØARP
115 KA1EXJ W7VSE N4GHI KA1GBS
114 KC9CJ
113 KØSI
112 KB2HM
111 AA4AT WB1GXZ WB2OWO
110 WF4Y
109 WA2FJJ KD8KY K4JST
108 K6UYK W7JMH
AE5I
107 WA2ERT/3 N2XJ WD9FRI
106 W9JUJ
105 KA8GJV WA4CCK WBØTED KF8J
104 K4ZK WD4ALY W1KK
103 KJ3E KB4WT WD4JDH
102 KA4BCM
101 KB4OZ
100 WA2JBO W3YVQ WB6TIF WB4YQP
99 W6RNL WA4PFK AF3S
98 KM9B
97 WB2VUK KC2ZO
N5AMK
96 W6VOM WAØTFC N7CSP KA6BNW KC2TF
95 N9BDL NDØN
94 K5OAF KAØBWM
94 WA4LXP ND2S KØPCK WB6QBZ WX4I AG9G KB5EK W9DM
93 W2BIW K8ND KA2MYJ W4CKS KA4SAA
92 K7GXZ WB2MCO
91 KF4U KD5FR KV5X KAØBCB WX4H
90 WB6DOB
W5CTZ
WA1YNZ
KI5P
KA4AMC
89 K4VWK WB5YDD WB2IKL
88 NT4S N7DOC KA4MTX KC3Y W2AET AK1W
87 KR4V
86 WB4WYG WA4EIC
85 WA2KOJ KB4GPN KA5LQA KA1GWE WØKK WB2IDS
84 KC4VK WA7VTD WD5GKH WB1GLH
N1BJW
83 KA4GUS
82 KX7W WX4J
81 WB2KCR N1AJJ WB5MMI WB2RBA KL7IJG
80 W6NTN KA1T KB9LT K7LG AD7G
79 WB5SRX
78 N2BGP K2YAI
77 W6INH KA9FFO K8JDI
76 WDØDVG N4PL KB4LB
W6NL
75 WB7OEX KT6A KC3AV WD4PBF WA8GMT N1BYS
74 K6APW KV8Q KA2OPG K2ZM
73 N7BGW N5DFO
72 W4LXB
71 KG2D N8EVC NØEVC WA3UNX
70 WDØBOX
69 W5KLV AIØO W6IPL W1RWG WA8HGH
VE2EDO
68 N8AEH VE2FMQ N4EDH WD9DNQ KB4RNP
67 WA8MAZ KA5AZK WBØHOP K3NNI WA4EYU WB4TZR
66 NI6A KU2N AI6E WA6QCA KA1EPO
65 KA3DTE K8AGD
64 N6FWG
60 AK2E K2ZVI
46 N2EQM/T

Brass Pounders League August 1984

The BPL is open to all amateurs in the United States, Canada and U.S. possessions who report to their SM a message total of 500 or a sum of originations and delivery points of 100 or more for any calendar month. All messages must be handled on amateur frequencies within 48 hours of receipt in standard ARRL form.

1	2	3	4	5	6
W3CUL	638	1056	1501	134	3329
NØBQP	32	1526	99	960	2617
WAØHJZ	0	1185	26	778	1989
WDØDVG	622	14	622	1	1259
W9JUJ	0	590	587	5	1182
W3VR	302	281	415	29	1027
WD8MIO	49	364	432	26	871
KA1GBS	2	475	338	14	829
K3QXC	387	24	375	2	763
KØRXK	0	339	375	0	710
K6UYK	43	324	313	14	694
WA4JDH	1	363	323	2	689
WB7WOW	5	415	219	8	647
KA9FEZ	1	330	287	11	629
N4GHI	38	269	262	23	592
AA4AT	34	275	257	10	576
KW9J	1	310	257	7	575
KT5Y	2	299	231	26	558
NE8X	14	259	271	12	556
W5GHP	3	48	484	6	541
KK1A	71	181	180	100	539
W7DZX	16	265	251	4	536
WB2OWO	19	214	283	10	526
WF4X	9	270	223	22	524
W7VSE	4	274	231	14	523
WB5YDD	3	274	215	30	522
W5CTZ	1	222	288	6	517
W8QHB	0	236	278	0	514
N1NH	0	259	245	6	510

BPL for 100 or more originations plus deliveries:

W7LRB	215
W9FZW	167
WB2UVB	128
W1FYR	116

1 — CALL
2 — ORIG.
3 — RCVD.
4 — SENT
5 — DLVD.
6 — TOTAL

Independent Nets (August 1984)

1	2	3	4
Amateur Radio Telegraph Society	31	484	305
Central Gulf Coast Hurricane	31	150	2212
Early Bird	62	1626	—
Empire Slow Speed	31	46	424
Golden Bear	31	117	1740
IMRA	27	591	1367
Mission Trail	31	158	913
New England Novice	31	84	269
Southwest Traffic	31	201	1206
West Coast Slow Speed	30	98	489
20-Meter ISSB	27	548	266
75-Meter ISSB	31	381	824

1 — NET NAME
2 — SESSIONS
3 — TRAFFIC
4 — CHECK-INS

Rules, ARRL 10-Meter Contest

The rules for this year's 10-Meter Contest are the same as last year's. Keep in mind that a phone QSO is worth two points, and each CW contact is worth four points. A bonus is provided for each Novice/Technician contact; such contacts are worth eight points each.

Official entry forms are available from ARRL Hq. for an s.a.s.e. If you need log sheets for more than 200 QSOs, please include one extra unit of First Class postage for each five sheets ordered.

Rules

1) **Object:** For amateurs worldwide to exchange QSO information with as many stations as possible on 28 MHz.

2) **Contest Period:** Second full weekend of December (December 8-9, 1984). Forty-eight-hour period; all stations operate no more than 36 hours. Starts 0000 UTC Saturday; ends 2400 UTC Sunday. Listening time counts as operating time.

3) **Categories:**

(A) *Single Operator:* One person performs all operating and logging functions. Use of spotting nets (operator arrangements involving assistance through DX-alerting nets, etc.) is not permitted.

(1) Mixed mode (phone and CW)
(2) Phone only
(3) CW only

(B) *Multioperator:* Single transmitter, mixed mode only. Those obtaining any form of assistance, such as relief operators, loggers or use of spotting nets.

4) **Contest Exchange:** (A) W/VE stations (including KH6/KL7) send signal report and state or province (District of Columbia amateurs may send "DC" in the exchange, rather than "Maryland." However, "DC" and "Maryland" count as the same multiplier). (B) DX (including KH2/KP4, etc.) transmit signal report and serial number starting with 001. (C) Maritime or aeronautical mobile stations send signal report and ITU Region (1, 2 or 3). Novice and Technician stations sign /N or /T.

5) **Scoring:**

(A) QSO Points: Count two points for each complete two-way phone QSO. Count four points for each complete two-way CW QSO. Count eight points for QSOs with U.S. Novice or Technician stations (28.1 to 28.2 MHz only) — signing /N or /T. Higher class licensees: Remember that your power limit in this segment is 200-W output!).

(B) Multipliers: Fifty U.S. states, Canadian call areas (VE1-8, VY1, VO1-2), DXCC countries (except the U.S. and Canada), ITU regions (maritime and aeronautical mobiles only).

(C) Final Score: Multiply QSO points by the sum of states/VE call areas/DXCC countries/ITU regions. Example: WB5VZL works 2539 stations, including 1633 phone QSOs, 896 non-Novice CW QSOs, 10 Novices, for a total of 6930 QSO points. He worked 49 states, 10 Canadian call areas, 53 DXCC countries and a maritime mobile station in Region 2 for a total multiplier of 113. Final score = 6930 (QSO points) × 113 (multiplier) = 783,090 points.

6) **Miscellaneous:**

(A) Call signs and exchange information must be received by each station for a complete QSO.

(B) No crossmode contacts; CW QSOs must be made below 28.3 MHz.

(C) Mixed-mode single operator and all multioperator stations may work stations once on CW and once on SSB.

(D) Your call sign must indicate your DXCC country (K6LL in Arizona need not send K6LL/7, but K1JD in Hawaii must send K1JD/KH6).

(E) One operator may not use more than one call sign from any given location during the contest period.

(F) All entrants may transmit only one signal on the air at any given time.

7) **Reporting:**

(A) Official forms are recommended (available for an s.a.s.e. or two IRCs from ARRL Hq.).

(B) Logs must indicate time in UTC, mode, call and exchange for each QSO. Multipliers should be clearly marked in the log the first time worked. Entries with more than 500 QSOs must include cross-check sheets (dupe sheets).

(C) Postmark your entry by January 11, 1985.

8) **Awards:** A certificate will be awarded to the highest-scoring single-operator station (in each category) from each ARRL Section and DXCC country. Top multioperator entries in each ARRL Division and each continent will receive certificates. Additional certificates will be awarded as participation warrants.

9) **Conditions of Entry:**

(A) Each entrant agrees to be bound by the provisions, as well as the intent, of this announcement, the regulations of his or her licensing authority and the decisions of the ARRL Awards Committee.

(B) Disqualifications: Excess duplicates and call sign/exchange errors. See January 1984 *QST*, page 80, for complete details.

Rules, ARRL 160-Meter Contest

The rules for this year's "Top Band" contest are the same as last year's. As was the case last year, DX stations will send signal reports only. Remember that W/VE stations are prohibited from transmitting in the 1825-1830 kHz DX Window.

Official entry forms are available from ARRL Hq. for an s.a.s.e. If you want enough log sheets for more than 300 QSOs, please include two units of First Class postage. Good hunting!

Rules

1) **Object:** For amateurs worldwide to exchange QSO information with W/VE amateurs on 1.8 MHz **CW only**. DX-to-DX QSOs are not permitted for contest credit.

2) **Contest Period:** 2200 UTC November 30 until 1600 UTC December 2. Forty-two-hour period with no time limitation.

3) **Categories:**

(A) *Single Operator:* One person performs all transmitting, receiving, spotting and logging functions.

(B) *Multioperator:* Single transmitter only. Those obtaining any form of assistance, such as relief operators, loggers or use of spotting nets.

4) **Contest Exchange:**

(A) W/VE: Signal report and ARRL Section.

(B) DX: Signal report. Country name is obvious from the prefix. Send ITU Region if maritime or aeronautical mobile.

5) **Scoring:**

(A) QSO Points: Two points for QSOs with amateurs in an ARRL Section. W/VE stations count five points for DX QSOs.

(B) Multipliers: ARRL Sections plus VE8/VY1 (maximum of 74) and DXCC countries (W/VE participants only).

(C) Final Score: Multiply QSO points by multiplier. Example: K1MM works 357 stations, including 13 DX stations, and has a multiplier of 67. His score would be 753 QSO points (344 × 2) + (13 × 5) multiplied by 67 for 50,451 points.

6) **Adherence to Band Plan:** W/VE stations may transmit only in the segments 1800-1825 and 1830-1850 kHz, in conformance to the ARRL band plan.

7) **Reporting:**

(A) Official forms are recommended (available for an s.a.s.e. or two IRCs from ARRL Hq.).

(B) Logs must indicate time in UTC, call and exchange. Multipliers should be clearly marked in the log the first time worked. Entries with more than 200 QSOs must include cross-check sheets (dupe sheets).

(C) Postmark your entry by January 4, 1985.

8) **Awards:** A certificate will be awarded to the top-scoring single-operator station in each ARRL Section and DXCC country, and to the top-scoring multioperator stations in each ARRL Division and continent.

9) **Conditions of Entry:**

(A) Each entrant agrees to be bound by the provisions, as well as the intent, of this announcement, the regulations of his or her licensing authority and the decisions of the ARRL Awards Committee.

(B) Disqualifications: Excess duplicates and call sign/exchange errors. See January 1984 *QST*, page 80, for complete details.

Contest Corral

A Roundup of Upcoming Operating Events

Conducted By
Edith Holsopple,* N1CZC

Oct. 31

West Coast Qualifying Run, 10-35 WPM, at 0500Z Nov. 1 (9 P.M. PST Oct. 31). W6OWP prime, W6ZRJ alternate. Frequencies are approximately 3590/7090 kHz. Underline one minute of the highest speed you copied, certify that your copy was made without aid and send it to ARRL for grading. Please include your full name, call sign (if any) and complete mailing address. A large s.a.s.e will help expedite your award or endorsement.

NOVEMBER

Oct. 31-Nov. 1

YL Anniversary Party, phone, October *QST,* page 75.

3-4

ARRL November Sweepstakes, CW, October *QST,* page 90.

International Police Association Contest, sponsored by the IPARC German Section, from 0600Z to 1000Z and 1400Z to 1800Z each day, Nov. 3-4. CW, Nov. 3; phone, Nov. 4. Non-IPA stations work IPA members only. Exchange signal report and serial number. U.S. stations also send state. IPA members send IPA with exchange. Phone and CW contests are separate. Work stations once per band on each mode. Count 1 point per QSO with non-IPA members and 5 points per QSO with IPA members. Multiply by sum of IPA countries/states worked per band. Suggested frequencies: phone — 3.650 3.775 7.075 14.295 21.295 28.575 MHz; CW — 3.575 7.025 14.075 21.075 28.075 MHz. Mail entries by Dec. 31 to Anton Kohten, DK5JA, P.O. Box 40 01 63, D-4152 Kempen 1, Federal Republic of Germany. For more information, contact WA8VDC, 4828 Elm, Newport, MI 48166.

8

W1AW Qualifying Run, 10-35 WPM, at 0300Z Nov. 9 (10 P.M. EST, Nov. 8). Transmitted simultaneously on 1.818 3.58 7.08 14.07 21.08 28.08 50.08 147.555 MHz. See Oct. 31 listing for more details.

10

Manitoba QSO Party, October *QST,* page 75.

ALARA Contest, October *QST,* page 75.

10-11

Delaware QSO Party, October *QST,* page 76.

European DX Contest, RTTY, October *QST,* page 76.

10-13

Montana QSO Party, October *QST,* page 76.

17-18

ARRL Sweepstakes, phone, October *QST,* page 90.

VK vs. the World, QRP, sponsored by the CW Operators QRP Club, from 0000Z Nov. 17 until 2400Z Nov. 18. CW only. Contact each station once per band in each 24-hour period. QRP stations sign QRP for identification. Categories are QRP, single operator, multiband or singleband; QRP, multioperator, multiband or singleband; QRO, single operator, multiband or singleband. Work the entire 48 hours, or any 24 consecutive hours. Exchange is six digits: RST and a serial QSO number. To score, count 6 points per QSO if your output is less than 1 W; 5 points if it is over 1 W to 2 W; 4 points for over 2 W to 3 W; 3 points for over 3 W to 4 W; 2 points for over 4 W to 5 W. QRO stations count 1 point per contact with QRP stations. Multiply by the number of IARU zones worked on each band for the total score. For a bonus, multiply total score by 1.5 if station was erected within 24 hours before the contest date and used battery, solar, wind or hand-generated power. Use separate log sheets for each band. Include all pertinent information on a summary sheet. Certificates. Mail entries to be received by Feb. 26 to P.O. Box 109, Mt. Druitt, N.S.W. 2770, Australia.

North Carolina QSO Party, sponsored by the Alamance ARC, K4EG, from 1700Z Nov. 17 until 2159Z Nov. 18. Work stations once per band and mode. Work mobiles again as they change county. NC-to-NC QSOs allowed for QSO point credit. Exchange signal report and QTH (county for NC stations, ARRL Section for others). Suggested frequencies: phone — 3.980 7.280 14.280 21.380 28.580; CW — 60 kHz up from lower band edges; Novice — 20 kHz up from lower band edges. For complete rules and scoring procedures, write to NCQP Coordinator, c/o K4EG, Alamance ARC, P.O. Box 3064, Burlington, NC 27215.

Missouri State QSO Party, sponsored by the Northland ARA, from 0001Z Nov. 17 until 1800Z Nov. 18. All amateur bands except 30 meters. No repeater QSOs. Work stations once per band and mode. Work mobiles again as they change counties. Exchange signal report and QTH (county for MO stations; state, province or country for others). Suggested frequencies: phone — 1.835 3.963 7.230 14.280 21.380 28.570 145.43; CW — 1.805 and 10 kHz up from band edges; Novice — 25 kHz up from band edges. Count two points per phone QSO, five points per CW QSO. MO stations multiply QSO total by total MO counties, states, provinces and countries worked. All others multiply QSO total by MO counties (max. 115) worked. Certificates. Send summary sheet by Dec. 1 to Northland ARA, P.O. Box 6710, Kansas City, MO 64123.

All Austrian CW 160-Meter Contest, sponsored by the OVSV, from 1900Z Nov. 17 until 0600Z Nov. 18. Frequency range is 1.810-1.850 MHz. Exchange RST plus QSO number beginning with 001. No crossband QSOs. Count 1 point for each QSO. Each OE district (OE1-OE9) counts 2 multiplier points. Each other prefix counts 1 multiplier point. Send logs by Dec. 31 to OVSV, "AOEC-1984," P.O. Box 999, A-1014 Vienna, Austria.

19

W1AW Qualifying Run, 10-35 WPM, at 2100Z (4 P.M. EST). See Nov. 8 listing for more details.

DECEMBER

1-2

ARRL 160 Meter Contest, this issue, page 87.

TOPS Activity Contest, sponsored by TOPS International, from 1800Z Dec. 1 until 1800Z Dec. 2. CW only, 80 meters. Single-op stations must take one seven-hour break, multiop stations may operate the entire 24 hours. Classes are single operator, multioperator, and single op-QRP (5 W or less input). Frequencies are 3.500-3.585 MHz. The lowest 12 kHz is reserved for DX contacts. Exchange RST and three-digit serial number. TOPS members also give their membership number. Count 1 point for QSOs with own country (each call area in W, VE, VK, PY, U and JA counts as a separate country). Count 2 points for QSO with own continent. Count 6 points for each QSO with another continent and count 2 bonus points for QSOs with TOPS member (TOPS members get 3 bonus points for QSOs with other members). For final score, multiply total points by the number of prefixes worked. Participation certificates for North American entries. Send logs before Jan 31 to Bertil Arting, SM3VE, Bergesvegen 26, S-823 00 Kilafors, Sweden.

Telephone Pioneers QSO Party

4

West Coast Qualifying Run, 10-35 WPM, at 0500Z Dec. 5 (9 P.M. PST Dec. 4). See Oct. 31 listing for details.

7

W1AW Qualifying Run, 10-35 WPM, at 0300Z Dec. 8 (10 P.M. EST, Dec. 7). See Nov. 8 listing for details.

8-9

ARRL 10 Meter Contest, this issue, page 87.

HA-DX Contest (this year's rules not received).

22-25

I Brasil Halasz/Pinheiro QSO Party

23-26

II Brasil Halasz/Pinheiro QSO Party

27

W1AW Qualifying Run

30

Canada Day Contest

*Communications Assistant, ARRL

Special Events

Conducted By
Edith Holsopple, N1CZC

Hollywood, Maryland: Throughout *1984,* the staff and management of the Naval Air Station Patuxent River Amateur/MARS Radio Station are offering QSL cards commemorating Maryland's 350th Anniversary. Station W3PQT/NNNØNGT operates 80-10 meters and 2 meters on an operator-available basis.

Blythewood, South Carolina: K4MJN will operate 1400-1800Z *Nov. 3* during the J. Gordon Coogler poetry festival. Operation on 14.290 MHz from 1400 to 1800Z, and on 21.390 MHz from 1800 to 2200Z. Certificate for s.a.s.e., QSL and contact number.

Benicia, California: The Benicia ARC will operate KA6BPR from 1500 to 2400Z on *Nov. 10* from the Clock Tower Fortress. Approximate frequencies: phone — 7.240 14.240 21.360 28.510; CW — 7.110 14.110 21.110 28.110. Send your QSL and an s.a.s.e. for a QSL/certificate to BARC, Box 899, Benicia, CA 94510.

San Diego, California: The North Shores ARC will operate K6HAI from Shelter Island in San Diego Bay on *Nov. 10,* from 1800 to 2400Z. Operation will be on 15 and 20 meters, 25 kHz up from the bottom edge of the General class bands. QSL via 2410 Deerpark Dr., San Diego, CA 92110.

Nitro, West Virginia: Tri-County Ham Club will operate W8WVA to commemorate the "Living Memorial to World War I," from 1700Z *Nov. 10* until 2200Z *Nov. 11.* Operation 25 kHz up from lower General 75, 40 and 20-meter band edges. Certificates via P.O. Box 1107, St. Albans, WV 25177.

East Aurora, New York: Members of the Armored Force AR Nationwide Emergency Team (A FAR Net) will operate from 1200Z *Nov. 10* to 2400Z *Nov. 11* to commemorate Veteran's Day. Operation on 7.285 14.325 21.375 28.640 MHz. Certificate available for a QSL and s.a.s.e. to Alfred G. Beutler, 36 Manchester Rd., East Aurora, NY 14052.

Artificial Island, New Jersey: Public Service Electric and Gas Co. ARA will operate WA2FHZ at the Salem Nuclear Generating Station from 1400Z *Nov. 17* to 1400Z *Nov. 18.* Frequencies: phone — 3.930 7.230 14.260 21.260 21.560; CW/Novice — 30 kHz from lower band edges. QSL via P.O. Box 543, Belmar, NJ 07719.

Plymouth, Massachusetts: Whitman ARC and Plimoth Plantation are sponsoring a special-events station from 1300Z to 2000Z *Nov. 22* for Thanksgiving. WA1NPO will operate from Plimoth Plantation, while GB2UST and GB4UST will operate from the astronomical observatory at Sidmouth above the English Channel. Operation will be on the following times/frequencies: 1300-1430/21.260; 1430-1730/7.280 or 7.050; 1730-2000/21.385; 1300-1600/14.255 or 14.180; 1600-2000/14.345 MHz. Certificate via P.O. Box 48, Whitman, MA 02382.

Hollywood, California: The BOMB Squad (Best of Mt. Baldy) will operate W6HCP from 1600Z on *Nov. 25* to 1400Z *Nov. 26.* Operation from the communications center of the Hollywood Christmas Parade will be on 7.284, 14.284 and 21.284 MHz. S.a.s.e. to W6GVR for commemorative QSL.

Note: The deadline for receipt of items for this column is the 15th of the second month preceding publication date. For example, your information would have to reach Hq. by November 15 to make the January issue. For the convenience of those wishing to operate, please be sure that the name of the sponsoring organization, the location, dates, times(Z), frequencies and call sign of the special event station are included. Requests for donations will not be published.

Section News

The ARRL Field Organization Forum

Coordinated By Jim Clary, WB9IHH

CANADA

ALBERTA: SM, E. Roy Ellis, VE6XC — SEC: VE6XC. A/SM: VE6AMM. STM/NM/DEC/ASPN & ATN: VE6ABC. Mammoth preparation in radio systems being tested by Alta hams for Papal visit in Sept. Huge crowds expected in Edmonton to number between 250,000 and 400,000. Organizers are beating the bushes for volunteers. Nets continue to struggle with poor sigs and few checkers. Traffic: (July) VE6CHK 39.

MANITOBA: SM, Peter Guenther, VE4PG — VE4PG is at present sort of unsettled down due to selling his own and others real estate. In the meantime will operate portable from other locations until a suitable location can be found. I can be reached by phoning 1-204-326-3587. My apologies for the inconvenience. VE4LB is now the net manager for MTN, the CW net and your help would be appreciated as he will need net control stations, as well as TEN reps. My sincere thanks to VE4IX for holding down that position for so many years. VE4AFO net manager for MEPN will be out of the hospital in a few days after a complete checkup. Plans for SET are underway and VE4FK will be rebuilding the entire setup. There has been some interference since the phone expansion and we are hoping that MEPN, the Manitoba Evening Phone Net, which has been on 3765 for over 30 years, will not suffer too much. Mac, VE4TE is now back in action after a stay in the hospital. MEPN QNI 958, QTC 38, Sess. 31. MTNQNI 117, QTC 18, Sess. 17. MMN QNI 624, QTC 31, Sess. 31. WRIN QNI 247, QTC 1, Sess. 9. Traffic: VE4IX 106, VE4NUF 71, VE4NE 50, VE4TE 32, VE4PG 24, VE4AAD 23, VE4JA 19, VE4CR 8, VE4LB 6, VE4GB 4, VE4AET 3, VE4FK 3, VE4MG 3, VE4ADS 2, VE4JK 2, VE4PA 2, VE4AEY 1.

MARITIME/NEWFOUNDLAND: SM, D. R. Welling, VE1WF — Congrats to VE1FQ upon being named Citizen of the Year in Lower Scacville, N.S. Amateurs in Halifax and Moncton participated in various public service activities during the summer. Many visitors were heard on the repeaters, hope they enjoyed their stay. There will be a Maritime Convention in Saint John, N.B. on Octobe 18th, 1985 weekend. Make your plans now to attend as it promises to be a big convention. Have a copy of the VCR tape "Amateur Radio's Newest Frontier" which is available for showing to clubs. Make your reservations now. Silent Key — VE1BBY. Urgently need volunteers to assist in various section activities. Net and Traffic info will be continued next month.

ONTARIO: SM, Larry Thivierge, VE3GT — BM: VE3LST. PGL: VE3AR. SEC: VE3GV. A/STM: VE3GT. TC: VE3EGO. NTS cw stalwart VE3HGJ has returned to Oakville from St. Catharines and hopes to be back on the nets shortly. Nice to hear VE3ISW on the air again after a two year absence. VE3GTF and the Eastern Counties Cornwall ARES group generated good press clippings for Field Day in three local newspapers. ECs VE3DVE VE3FAM VE3FCU and VE3WV have stepped down after a number of years service. Congrats to the Peterborough ARC in their successful efforts to locate a senior citizen who was reported missing. Taking part in the effort were VE3s: MKB BNV FDP IQZ RA BAU MCC MQB XQ IRK MCD SG ARG KQH BAZ. Incidentally their new Club call is now VE3RB. New UHF repeater in Oakville is VE3OKV on 448.15/443.15 MHz. London ARC net on 3.750 MHz each Sunday at 1100 local is looking for more check-ins and also more net controllers. Members of the North Shore ARC who took part in providing mobile communications service for the CNE's Warrior's Day Parade were VE3MKC VE3IHC VE3MLW VE3IND. These members along with VE3IBO VE3SJ VE3HE also worked as guest operators at VE3CNE. Regretfully I report that VE3AM and VE3OX have become Silent Keys. Niagara Peninsula ARC station VY3VM was active in a public service communications display for the Ontario Bicentennial with 35 amateurs taking part. VE3PR is now active as VE4OK from Winnipeg. Welcome VE3DKN, ex-VE2FT, to Oakville. VE3ZK has introduced a new bulletin board service called "The Letter Box' to the London RTTY scene. The call is VE3TLB and operates on 147.450 MHz simplex. VE3PY is stepping down after a successful tenure as editor of the Ottawa ARC Bulletin. New members of the QCWA Chapter 73 are VE3MS VE3SV VE3IHN. Enjoyed my vacation in the Atlantic provinces and managed to work through VE1HI, VE1CBC and VE1LCA repeaters. Many VE3s were there also. Traffic: VE3BCZ 192, VE3KK 122, VE3DPO 110, VE3AWE 97, VE3EWD 69, VE3KCZ 68, VE3KCZ 68, VE3KXB 68, VE3WV 62, VE3GNW 53, VE3BDM 46, VE3AJN 42, VE3FGU 41, VE3GT 33, VE3BAJ 18, VE3WM 14, VE3KLX 11, VE3DZH 7, VE3MCO 7, VE3WG 6. (July) VE3AWE 90.

QUEBEC: SM, Harold Moreau, VE2BP — STM: VE2EDO. BM, VE2ALE. PIO: VE2YW. TC: VE2ED. NM's: VE2EDO and VE2FSA. Candidates for code and theory classes are in great number, most clubs have already started. Again this year VE2EVW has a full class room. VE2IJ, was re-elected as our CRRL director, congrats. "Quelques notes sur RAQI" (voir QST de Septembre, Canadian News Fronts, page 57), felicitations a VE3GRO et ceci prouve ce que CRRL peut faire pout nous au Quebec. Traffic: VE2EDO 76, VE2EC 41, VE2BP 9, VE2EKC 8.

SASKATCHEWAN: SM, W. C. Munday, VE5WM — STM: VE5HG. SEC: Vacant. TC: VE5GF. NMs: VE5EX VE5HG VE5NJ VE5AEJ VE5AEM VE5BAF. Net reports received: MJARC-2: 30 sessions 250 QNI RARA-2: 29 sessions 433 QNI PWXN: 30 sessions 534 QNI. Attendance on the nets held up extremely well over the summer months and a big thank you is extended to the Net Managers and control stations that made this possible. The summer months have been busy with public service events and many road races, parades, etc. Have benefited from Amateur Radio communications. Thanks to all the hams who volunteered their time, equipment and expertise. Regina welcomes VE5RC on his move from Saskatoon. Traffic: VE5AGM 12, VE5WM 3.

ATLANTIC DIVISION

DELAWARE: SM, John Hartman, WA3ZBI — STM: W3DKX. SEC: W3PQ. PIO: N3DIP. PSHR: K3JL W3DKX WA3DUM. S.A.R.A. provided communications for Senior Citizens Day on Sept. 7 at Rehoboth Beach. The A.W.A.R.E. Club had J. Kiessler, KQ3S, third district Volunteer Examiner as guest speaker at their Sept. 20 meeting. DTN: QNI: 396 QTC 47 sess. 23. DEPN: QNI: 67 QTC 17 sess. 4. SEN: QNI: 41QTC 0 sess. 4. Traffic: W3QQ 88, W3DKX 76, WB3DUG 34, WA3WIY 24, WA3ZBI 23, K3JL 15, KA3IXV 12, WA3DUM 10, N3DCK 9, KC3JM 7, W3FEG 6, K3ZXP 3, KC3FW 2.

EASTERN PENNSYLVANIA: SM, Mark J. Pierson, KB3NE — ACC: KB3NE. PIO: W3AMQ. SEC: WA3PZO. SGL: N3CJP. STM: KA3GJT. DEC's: K3QXC KB3LR KB3UD N3AIA N3BFL W3EEK AA3C.

Net	Time	Freq.	QNI	QTC	Sess.
EPA	7/10 P.M. Dy	3610	417	196	59
EPAEPTN	6 P.M. Dy	3917	379	151	31
PTTN	6:30 P.M. Dy	3610	197	72	31

Loval and VHF Net reports: (QNI/QTC/Sessions) VHF Traffic Net 222/49/13, PWAARES 65/5/4: MARC ARES: 63/9/4: D6ARES; 59/2/5: ATN 48/9/10: MONT ARES: 36/0/4. New STM: Dan Finegan, KA3GJT. Nice to have Dan helping us serve the E. Pa. area. Warminster ARC did a fine job of message handling at the recent "Grange Fair '84". More than 200 pieces of traffic was passed. The club and I both want to thank N3COY and KB3UD for their excellent help in passing the "out of town" traffic. Congrats to N3DZG for a new General class ticket. R.F. Hill ARC will hold its hamfest on Nov. 4th in Sellersville, Pa. The Mt. Airy "Pack Rats" held it's annual Seminar and Hamfest on Oct. 6, and 7, and again it was a great success. This is my last report as SM for E. Pa. and I want to thank everyone for their support and some of you for your endless patience and help. I do hope your continued cooperation will be given to Jim Post, KA3A, the new SM. Traffic: K3QXC 763, N3COY 349, KA3DLY 225, W3IPX 191, KA3IMF 168, N3CD 130, WB8KPE 116, AA3B 115, WA3GLX 47, W3AQN 46, K3AO 44, KC3LY 32, W4UQ 32, W3ADE 11, W3FAF 10, W3TWV 9, N3BFL 7, W3VA 6, W3HK 5. (July) N3BFL 6.

MARYLAND-DC: SM, Karl R. Medrow, W3FA — KJ3E is mobiling in New England. KC3D has an idea and a roll of wire! KA3EWV has almost recovered from summer! It is back to work for W3ZNW. WA2ERT was acting NCM for the MEPN. W3MSN has a problem finding the right sized envelopes for the new QSL bureau! N3CTM retired this August. WA3TAI was struck by lightning-wrecked his gear and knocked him down — that is too close. KC3DW handles much traffic under difficult conditions. W3OYY is looking for more MDC PON ckins. W3LDD has slim DX pickings these days. WB3BFK is getting to the hamfests! W3DQI, a volunteer, has a traffic total surge. K3NNI is an MSN instructor, KC3AV practices what he preaches — recruit. W3YVQ's efforts to line up repeater coverage for RACES becomes more appreciated as practice is put to work. KC3Y will slow down for winter — maybe! W3FZT keeps us posted on Washington County doings. K3MR is QRV almost any duty. WA3VPL says nice to have the antenna repaired and to be back on the air. W3FZV is back to night classes early this year. WB3FUE and the Delmarva RC are helping with the Skipjack Races. KK3F is close to becoming a blast on 80 mtrs. W3UT's jobs take him statewide. KG3M has his own radio bulletin board system on 144.91 MHz simplex mode 110 ASCII at 1700-2200 local time and 1200-2200 weekends, and he monitors 147.63/03 same times. K3CMN with W3CYZ KK3L K3MW N4GII AJ3S WB3BMR WB3AXV N3BJP WA3THK and W3SQA were involved with the Hyndman area flood. WA3SYE W3SQE K3HYE N3BJP K3NWI and N3BLP (Supervisory RN with a hand held) covered the loss of telephones at the Memorial Hospital. Well done! K3DI and W3MR are Amateur Auxiliaries in the FCC FOB. Newsletters from GARC, LARC Feedback, IBM-ARC, and SMAR appreciated. FAR awarded 15 scholarships. MEPN/KJ3E 31/165/26.2. Top V were KJ3E, KA3CDQ, W3FA, W3YVQ and W3DKX. MDC PON/W3OYY 5/1/12. WR PON/WB3BFK 20/17/10. WC 2 Mtr/WA3VDX 4/1/12. MSN/KC3AV 31/65/8.2. Traffic: KJ3E 212, KK3F 173, W3FA 159, KC3Y 119, KC3DW 109, K3NNI 107, KC3AV 96, WA2ERT/3 94, W3YVQ 89, W3DQI 57, KA3EWV 42, W3FZV 35, WB3BFK 30, W3UT 27, WB3FUE 15, K3MR 13, W3ZNW 11, W3LDD 10, WA3VPL 7, KC3D 4.

SOUTHERN NEW JERSEY: SM, Richard Baier, WA2HEB — SEC: K2QJ. STM: WB2UVB. ACC: K2IXE. TC: W2IJX. SGL: W2XQ. PIO: WB2RVE. BM: WB2UVB. Congrats to KB2MY. Bob has completed training and has been certified as the first Official Observer in the Amateur Auxiliary of the FCC's Field Operations Bureau for our section. In this position, Bob will be listening around the bands and noting such things as rules violations, signal quality and so forth and letting these stations know about it in a friendly way. Rather than go into specifics, please read pages 11-13 of the August, 1984 edition of QST for full details. Since monitoring the VHF bands is included in the plan, we need more OO's in our section. If you have a SINCERE DESIRE to help your fellow amateurs avoid getting a "pink QSL card" from the FCC, I'd like to hear from you. It may sound corny but, as the saying goes, "We need you!". Traffic: WB2UVB 309, WB2IKL 122, KC2PB 55, KA2CQX 26, WA2MGV 16, WA2HEB 13, KA2ANJ 9. (July) WA4JRP 24.

WESTERN NEW YORK: SM, William W. Thompson, W2MTA — SEC: W2BCH. ACC: N2EH. PIO: WA2PUU. OO/RFI: W2AET. TC: K2QR. BM: W2GLH. SGL: KO2X. Congrats to KA2EMO KA2KLM N2TW, winners of Foundation For Amateur Radio scholarships. Appointments: (EC) KZ2R Orleans. (OBS) K2KWK. (ORS) N2DC WA2FJJ WA2HSB W2ICE W2PPS, (NM) WA2KOJ W2MTA WB2OWO. Thanks to KC2QQ past manager of Western District Net. Amateur Auxiliary certified Official Observers: W2AET N2NW WA2PJC K2UCO. OBS reports: WB2DSR K2KWK WA2ZPE. PSHR: W2AET KG2D KA2DQA WA2FJJ VE2FMQ W2GJ WB2IDS WA2KOJ W2MTA KU2N WB2OWO WB2RBA ND2S K2YAI. BPL: WB2OWO.

NYS/1*	3677	1000/Dy	WB2EAG	320-149-31
WDN/1*	04/64	1100/Dy	WB2OWO	357-126-31
Mike Farad	3925	1300/M-S	VE2FMQ	181-040-27
NYPON*	3913	1700/Dy	WA2KOJ	591-419-31
NYSPTEN	3925	1800/Dy	WB2HKU	586-085-31
ESS	3590	1800/Dy	W2WSS	424-046-31
OCTEN/E*	34/94	1830/Dy	WB2HLY	621-089-31
Q Net	31/91	1830/Dy	KA2CMQ	307-009-30
WDN/E*	04/64	1830/Dy	WB2OWO	541-194-31
Blue Line	93/33	1900/Dy	WA2SEF	269-012-26
NYS/4*	3677	1900/Dy	WB2MCO	455-191-31
JCARCN	10/70	2000/Dy	WA2WAX	
OARCN	25/85	2000/Wed	K2VTT	059-000-05
BRVSN	055/655	2100/Dy	WB2OFU	370-008-31
CNYTN*	90/30 +	2115/Dy	WA2PUU	349-049-31
OCTEN/L*	28/88	2130/Dy	WB2HLY	261-040-30
STAR*	99/39	2130/Dy	N2BLX	
WDN/L*	04/64	2130/Dy	WB2OWO	669-235-31
NYS/5*	3677	2200/Dy	WB2MCO	389-297-31

*NTS Net, ARES: WNYECN LCARES SLVARES NARA CDECN. Refer to Net Directory, support your local Amateur Radio Emergency Service operations. HATS OFF to ARES for moving up to Class I nationally, 32 of 40 counties now have an EC! Traffic Handlers' info Net 1600 Sundays 3913 kHz. Comms: Many thanks for (fourth) FB Empire State Games showing by WA2PUU and her crew — KA2AFF BHB BNL CUN FEP FII HGB HQF HUQ HWK IAY IVK KLM KMT OWJ PYM RIR SIU TNK TPI TPO K2MPE QR SDD NA2A KY2F KD2CV KC2GZ HJ KB OY YW KB2CE N3AAJ N2AGO ARE AZU CCN COJ DCI EGK EH ELE FAR WB4OAT WB5JZP WB2BWQ CBC FXH FXS HWE JSB LCP NCK PEL PTN QKO VAR WGF WMB ZJY WA2FLX FSU FXS HRS IDA KFA KFV KOJ MQM OJI PUU UGE URK WAX YES YRO W2ABV BCH CM FB GA HOS IH IXR PPS ROO TKG TQF WNK WQ YRL. Next year, BUFFALO, it's your turn to shine. WA2OEP reports Woodman's Field Day Canoe Races, plus four drills in Lewis County. Today 113 stations in WNY hold 147 appointments amongst 1900 Members. . .in 30 of 40 counties. . .do you have an appointment? Traffic: WB2OWO 526, WB2IDS 443, WA2FJJ 295, W2MTA 254, VE2FMQ 253, W2AET 230, WA2HSB 202, WA2KOJ 152, ND2S 131, KG2D 127, K2YAI 122, WB2QIX 116, AF2K 96, W2ZOJ 86, KA2QIK 77, KU2N 74, W2FR 65, KA2DBD 59, W2GJ 59, WB2RBA 49, KA2DQA 45, W2UYE 40, WA2SMZ 36, N3DPE 33, WB2KCT 29, KC2QQ 28, KX2T 27, W2PPS 11, WA2OEP 9, K2IUT 6, WB2NAO 4, KC2SJ 4, K2VR 3. (July) WA2NKC 61, N3DPE 42.

WESTERN PENNSYLVANIA: SM, Otto L. Schuler, K3SMB — SEC: AB3Q. STM: AC3N. ACC: N3EE. OO/RFI: KN3B. PIO: WB3IZJ. TC: W3FE. BM: WN3VAW. SGL: K3HWL.

Net	QNI	QTC	Sess.	kHz	T/D
WPACW	327	139	31	3585	7:00 P/D
WPAPTN	455	118	31	3983	6:15 P/D
WPA2MTN	442	66	31	14628/88	8:00 P/D
NWPA2MTN	428	8	31	145.13/53	0200 UTC

Due to sending my work sheet instead of the final copy of the Section News Letter, the section tfc for the nets was not included. The tfc for the nets for July is as follows: WPACW Net is QNI 324, QTC 109. WPAPTN QNI 449, QTC 81. WPA2MTN QNI 442, QTC 44. NWPA2MTN 366, QTC 8, all had 31 sessions. Silent Keys as reported to me are W3API W3KUZ K3PPW & K3VQV. Our condolences are extended to their families. Upgrades to General: N3ESD (was KA3LKG), N3DWS (was KA3LKF), N3DZF (was KA3HBL). KA3MNC/KA3AIN's father is a new Novice. W3MMY's article in the Indiana ARC Sine of the Times is very informative on the dangers of low voltage and high current that is not realized by many. It is worth noting that more people are killed by the use of electricity in the home than high voltages on transmission lines, etc. The RACES group in Beaver Valley assisted at the refinery explosion and fire that occurred in Freedom, PA. The R.A. of Erie was very busy with events such as bike races this month. Allegheny County ARES provided communications for the second annual Grand Prix Vintage Car Races in Schenly Park. Abt 30 ARES Members assisted both days and all are waiting for next year. Traffic: W3EGK 304, W3OKN 233, WA3DBW 98, WA2QNT 91, N3FM 87, W3NEM 86, W3NGO 69, WA3UNX 66, K3NPW 63, KC3JQ 54, W3RUL 54, AC3N 53, K3SMB 45, WN3VAW 30, N3WS 22, W3KUN 19, W3MML 16, W3GUK 15, N3KB 8, W3TTN 8, W3SN 5, K3NPX 4, KB3NV 4, WB3KJH 2, K3LTV 2. (July) N3WS 58, WN3VAW 38.

CENTRAL DIVISION

ILLINOIS: SM, David E. Lattan, WD9EBQ — SEC: W9QBH. STM: KB9X. OO & RFI: W9TT. BM: K9ZDN. PIO: WD9EED. SGL: W9KPT. ACC: WB9SFT. ASM: K9ORP.

Net	Freq	Times (Z WIN)	QNI	QTC	Sess.
ILN	3698	0030/0400 Dy	580	319	30
ITN	3705	0100 Dy	275	92	30
ILPN	3915	2230 Dy (X Sn)	667	108	?
NCPN	3915	1300 Dy (X Sn)	458	92	27
NCPN	7270	1815 Dy (X Sn)	226	92	27
IEN	3940	1500 Sn	112	2	4
IARES	3915	2230 1 + 3 Sn	48	—	2
ISN	3905	0000 Dy	467	218	31

Illinois was represented 98% to 9RN by stations K9AZS K9BVE N9DR KA9EWN KA9FEZ K9GMZ KZ9I KW9J KD9K KJ9L WB9NVN W9NXG K9QEW K9SW N9TN and KB9X. Illinois was represented 100% to D9RN by stations KA9FEZ W9HOT KW9J K9EHP WB9ODN and K9AZS. D9RN was represented 100% to CAND by stations K9AZS KW9J KA9FEZ and WB9NVN. This month we welcome W9TT, Bill Christman of Barrington as the new OO/RFI coordinator for the Illinois section, replacing Spike, K9MX, who moved out of state on business. Bill has been very active as an OO in Illinois for a number of years and takes over the post just as the first of Illinois OOs have passed the examination for participation in the FCC FOB Amateur Auxiliary. W9CJW reports that the first volunteer testing in Southern Illinois (held at Southern Illinois University in Carbondale) was an unqualified success with 90% of the applicants passing their exams. We wish a quick recovery to W9RTD, Rudy, who is bouncing back from a stay in the hospital. W9LNQ reports that the HAMFESTERS RC hamfest this August had 6000 in attendance. WA9ZCK has an MSO in operation from a 400 foot tower in Cobden. The MSO normally operates 110 baud ASCII but can also be operated at 45 baud Baudot. The system has message store/forward and a bulletin board. All amateurs are invited to use the system which is on 145.7 MHz using standard RTTY tones on FM AFSK. WA5ZHV reports that Metro-east amateurs KA9HDZ W9JIT W9UH KA9JRC W9MPD KA9IXA and EC NA9X helped to "promote harmony" in St. Louis by providing communications for the annual convention and contest of the Society for the Preservation and Encouragement of Barbershop Quartet Singing in America which was held

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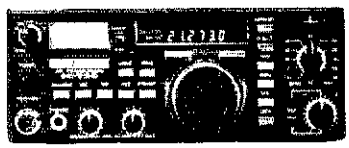

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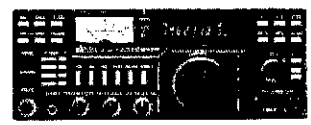

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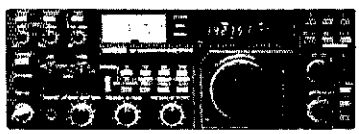

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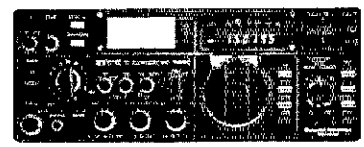

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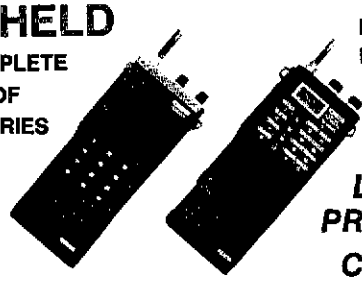

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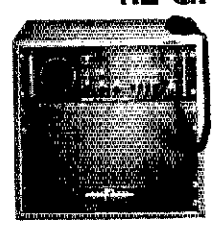

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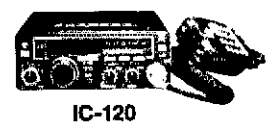

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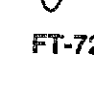

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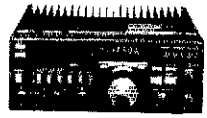

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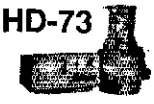

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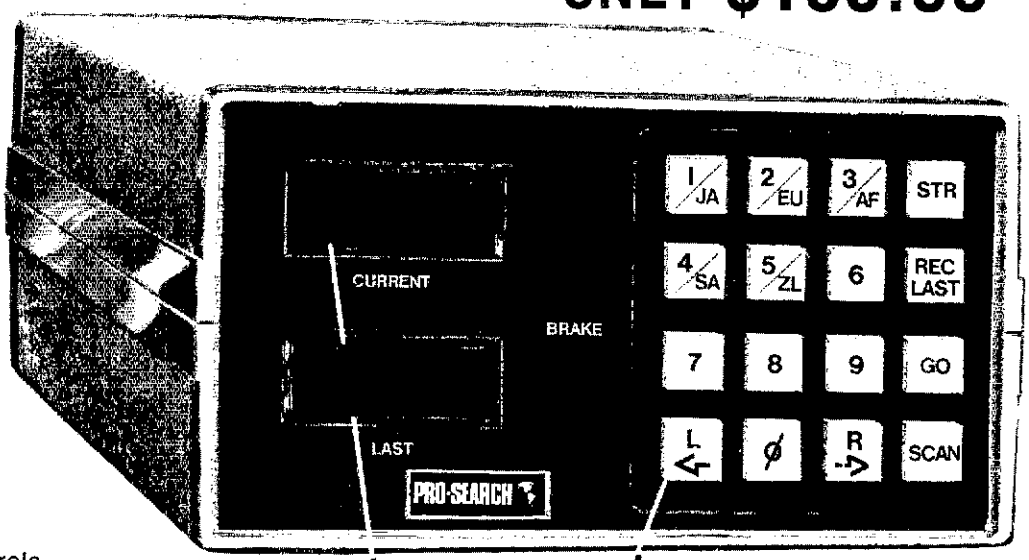
ONLY $199.95

For Contesters, DX'ers, Handicapped Operators and General Purpose Ham Operators:

The Most Advanced Antenna Control Availble...

- **Bright Easy to see ½" LED's.**
- **Automatic Brake Control**
- **Single Button Movement**
- **2 Memories**
- **Punch in Headings**



Current Heading Display

Programmable Keyboard and Memory Functions

Contesters:

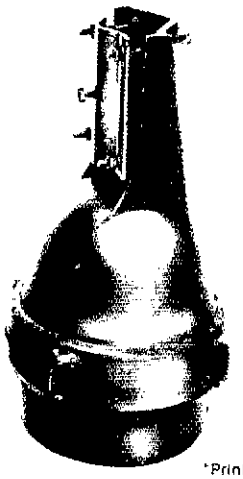
Pro-Search Rotor Controls handles your Rotor for you! No Mods to your Rotor just connect your present 8 wire cable to our unit and it will allow you Hands Off Operation while brightly displaying your Rotors position on ½ inch LEDS.

DX'ers:

The PSE-1A automatically handles the Rotors brake protecting you against accidently dropping it in while your Rotor is still moving.

New or Old Hams:

Need a complete system? Add a new Telex Ham-IV for only $119.00 when purchased as a package! Don't miss this one offer only available for a limited time...Pro-Search The Quality Controller Company.



PSE-1A + Ham IV*	318.95
PSE-1A + T2X*	358.95

*Printed with permission of TELEX/HY-GAIN

WHY NOT HAVE THE BEST IN CONTROL SYSTEMS FOR PENNIES MORE?

Compare Our Price To A Manual System
— Very Close —
In Performance Light Years Away!

Remember You Only Make This Purchase Once.

Pro-Search is Adaptable To Many Systems, Simple To Install.

No modifications are necessary.

Disconnect your present antenna control system and connect ours.

PSE-1A is used with HAM-M, HAM-II, III, IV, and TX2. Other models available.

To Order:

1-800-325-4016
1-314-994-7872 (Missouri)

Or Write:

Pro-Search Electronics Inc.
1344 Baur Boulevard
St. Louis, Mo. 63132
*Patent Pending

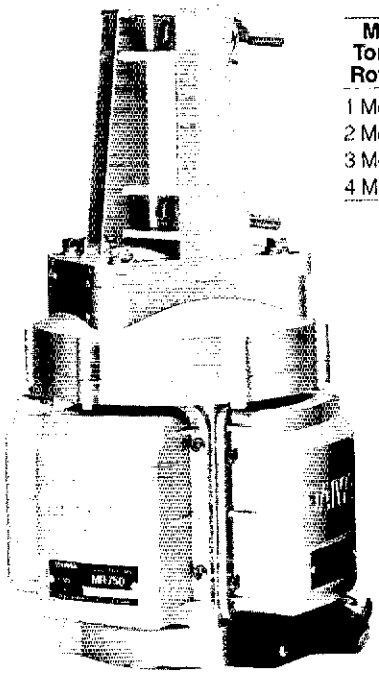
PRO-SEARCH
Reaching The World

New Multi Torque

Check These Features:

1. The rotator frame can house up to 4 motors to increase the torque and load capacity of your antenna system.
2. Each motor is equipped with a Super Wedge and Clutch brake system which works independently from the main frame gear train.
3. Maximum brake power is 18,300 lbs/in when 4 motors are installed. The main frame and reduction gear train have been designed to withstand maximum wind loading.
4. The motor unit can be dismantled easily for maintenance if required.
5. A 1½" to 2½" diameter can be installed and aligned easily with the rotator center.
6. Low voltage (24VAC) motors are used to ensure safety during installation work on the antenna tower.
7. Low cost 6-wire control cable can be used for the low voltage motors.
8. The control panel can be removed easily for calibrating the direction indicator.
9. Balanced type control knobs have quick lock mechanisms on both sides.
10. The advanced Super Wedge and Clutch brake system (Slip clutch type) provides exceptional holding power and protects the rotator mechanism from excessive torque.
11. Lower mast bracket MS-1 is available (optional).

MR-750E/MR-750PE



Multi Torque Rotator	Output Torque lbs/in	Brake Power lbs/in
1 Motor	610	5,200
2 Motors	1,200	9,600
3 Motors	1,800	13,900
4 Motors	2,400	18,300

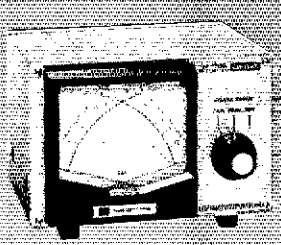
MR 750E Rotator
Standard Model
(58 sec/rotation)

MR 750PE Rotator
For use with
Pre-Set Controller
(58 sec/rotation)

MR-300E
High Speed Model

For rotating VHF/UHF antennas at high speed

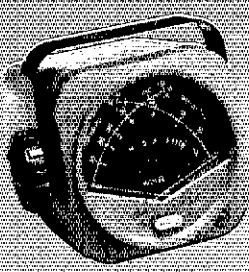
SWR & POWER CROSS NEEDLE METERS

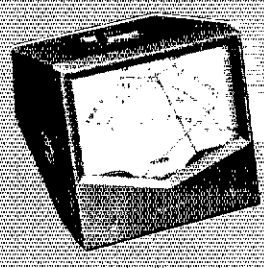


Top Quality

CN-720B
Frequency Range: 1.8-150MHz
SWR Detection Sensitivity: 4 W min.
Power: 3 Ranges (Forward, 20/200/2000 W)
(Reflected, 4/40/400 W)
Dimensions: 180×120×130 mm;
7.12×4.75×5in.

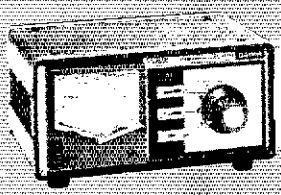
CN-620B
Frequency Range: 1.8-150 MHz
SWR Detection Sensitivity: 4 W min.
Power: 3 Ranges (Forward, 20/200/2000 W)
(Reflected, 4/40/400 W)
Dimensions: 165×75×97mm
6.5×2.9×3.8 in.





	CN-410M	CN-460M	CN-465M
Frequency Range:	3.5-150MHz	140-450 MHz	140-450 MHz
SWR Detection Sensitivity:	3 W min.	3 W min.	3 W min.
Power Range: Forward	15 W/150 W	15 W/150 W	15 W/75 W
Reflected	5 W/50 W	5 W/50 W	5 W/25 W
Dimensions:	71×78×100 mm; 2.8×3.1×3.9 in.		

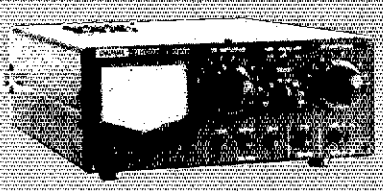
All Models Back Lit, with mobile bracket.



CN-630
Frequency Range: 140-450 MHz
SWR Detection Sensitivity: 4 W min.
Power: 2 Ranges (Forward, 20/200 W)
(Reflected, 4/40 W)
Dimensions: 180×85×120 mm;
7.12×3.37×4.75 in.

	CN-520	CN-540	CN-55
Frequency Range:	1.8-60 MHz	50-150 MHz	144-250 MH
Power Range:	200/2000 W	20/200 W	20/200 W
Dimensions:	72×72×95 mm; 2.83×2.83×3.74 in.		

ANTENNA TUNERS



	CNW-518	CNW-419	CL-680
Frequency Range:	3.5-30 MHz (6 bands)	1.8-30 MHz (17 bands)	1.8-30MHz(17 bands)
Power Rating:	1 kW CW (50% duty)	200 W CW (3.5-30 MHz)	200W CW(3.5-30MH
		100 W CW (1.8-3.4 MHz)	100W CW(1.8-3.4 MH
Output Impedance:	10-250/25-100 ohm (On 3.5 MHz)	10-250 ohm	10-250 ohm
Dimensions:	225×90×275 mm; 8.9×3.5×10.8 in.	225×90×245 mm; 8.9×3.5×9.6 in.	165×75×97mm 6.5×2.9×3.8 in

Antenna Rotator

Pat. Pend.

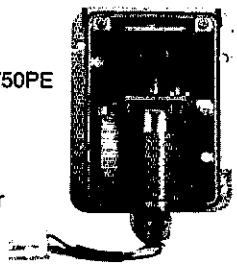
Up To Four Motors For Extra Torque and Braking

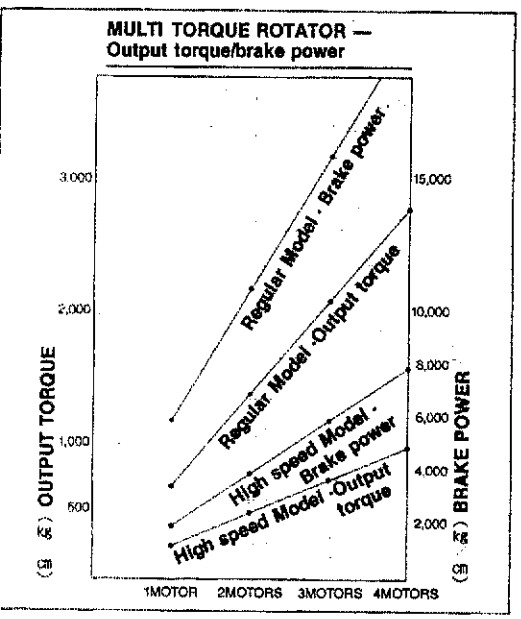
CR-4 Manual Controller for use with MR-750E and MR-300E Rotators

CR-4P Controller with Pre-Set function for use with MR-750PE Rotators

MR-750U Motor For use with MR-750E and MR-750PE Standard Rotators

MR-300U Motor For use with MR-300E High Speed Rotator





SPECIFICATIONS

■CONTROLLER UNIT

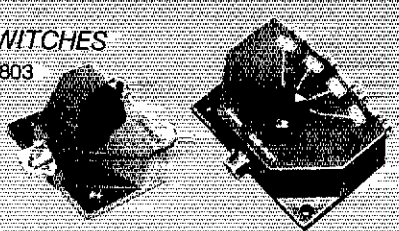
	CR-4 (for MR-750E/MR-300E)	CR-4P (for MR-750PE)
Power source	117 V AC (50/60 Hz)	
Power consumption	200 W (with 4 drive motors)	
Motor running voltage	24 V AC	
Dimensions	180 mm (W) × 125 mm (H) × 175 mm (D)	
Weight	9 lbs (4 kg)	
Operation	Manual	Manual/Pre-set

■ROTATOR UNIT

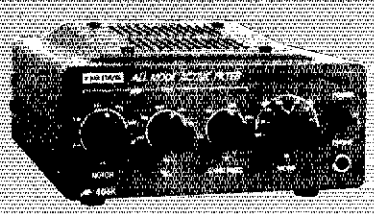
		MR-750E/PE	MR-300E
Rotation time	60 Hz	58 seconds (60 Hz input)	
	50 Hz	70 seconds (50 Hz input)	
Output torque Brake power	1 motor	610 lbs/inch (700 kg/cm) 5,200 lbs/inch (6,000 kg/cm)	220 lbs/inch (250 kg/cm) 1,700 lbs/inch (2,000 kg/cm)
	2 motor	1,200 lbs/inch (1,400 kg/cm) 9,600 lbs/inch (11,000 kg/cm)	440 lbs/inch (500 kg/cm) 3,500 lbs/inch (4,000 kg/cm)
	3 motor	1,800 lbs/inch (2,100 kg/cm) 13,900 lbs/inch (16,000 kg/cm)	650 lbs/inch (750 kg/cm) 5,200 lbs/inch (6,000 kg/cm)
	4 motor	2,400 lbs/inch (2,800 kg/cm) 18,300 lbs/inch (21,000 kg/cm)	870 lbs/inch (1,000 kg/cm) 7,000 lbs/inch (8,000 kg/cm)
Rotation angle		375 degrees	
Permissible mast size		1-1/2 ~ 2-1/2 inch (38 ~ 63 mm) <diameter>	
Control cable		6-wire cable 0.5sq ~ 1.25sq (AWG16/18/20 etc.)	
Continuous running		5 minutes Max. permissible	
Unit weight		16.5 lbs (7.5 kg) <with 1 motor unit fitted>	

COAXIAL SWITCHES

PAT. No.59-000803



	CS-201 2position	CS-201G 2position	CS-401 4position	CS-401G 4position
Frequency:	600 MHz	1.3 GHz	800 MHz	1.3GHz
Connectors:	SO-239	N type	SO-239	N type
VSWR:	Below 1.1.2			
Insertion Loss:	Less than 0.2 dB			
Isolation:	better than 50 dB at 300 MHz better than 45 dB at 450 MHz adjacent terminal.			



AUDIO FILTERS

AF-606K & AF-406K

Four stages of filtering...variable bandwidth over broad range... remarkably improved reception for all modes...razor sharp CW reception...built-in speaker.

The AF-606K adds PLL Tone Decoder circuitry for the ultimate in CW reception...PLL locks onto the desired CW signal and reproduces it with utmost clarity.

Dimensions: 150×62×150 mm; 5.9×2.4×5.9 in.

POWER AMPLIFIERS

	LA-2035	LA-2035R	LA-2065R
Band:	144-148 MHz	144-148MHz	144-148MHz
Input Power:	0.5-3 W	0.5-3 W	0.5-5 W
Max. Output Power	30 W plus	30 W plus	60 W plus
Power Consumption:	13.8 VDC, 4.5 A max.	13.8V DC, 6A max	13.8V DC, 5A max.
Dimensions:	100×35×125 mm; 3.9×1.4×4.9 in.	100×35×125mm 3.9×1.4×4.9in. Pre-Amp. Built-in.	122×45×175mm; 4.8×1.7×6.9 in. Pre-Amp. Built-in.

ELECTRONIC KEYER **DK-210**

CW is both communication and art. Sharpen your "fist" with Daiwa precision!

Dealer Inquiries Invited

DAIWA

DAIWA U.S.A. INC.,

1908A Del Amo Blvd.
Torrance, CA 90501
(213) 212-6057
TELEX 887631 DAIWA UD

in Kiel Auditorium last month. PIO/EC WD9EED is keeping busy with presentations on amateur radio to local civic groups and disaster planning in Piatt County. Piatt County ARES provided two way communications for a number of community events this summer. Please remember to report activity to WD9EED for public information and to WD9EBQ for inclusion in QST. Traffic: KA9FEZ 629, KW9J 575, WB9NVN 224, W9NXG 201, KB9X 176, W9HOT 125, W9HLX 124, KD9K 95, KA9EWN 90, W9DBQ 65, K9QEW 65, WB8RFB 49, WA9SHE 46, W9TCO 36, K9EHB 28, KZ9I 23, W9HBI 19, KB9QX 18, KA9BBV 14, W9VEY/M 12, KA9PKG 12, W9LNQ 8, WD9EED 5, K9WMP 5, KN9BAM 5, WA9SID 5, WA9RUM 4, N9EPE 3, W9RTD 3, KA9RUH 2.

INDIANA: SM, Bruce Woodward, W9UMH — SEC: WB9ZQE. STM: W9JUJ. SACC: K9TUS. STC: WD9ADB. SGLC: WA9VQO. SOOC: KJ9G. August reports:

Net	Freq.	Time Daily UTC	QNI	QTC	QTR	Sess.
ITN	3910	1330/2130/2300	2983	342	2266	93
QIN	3658	1430/0000/0200	785	375	1822	93
ICN	3708	2315	112	39	701	31
IRN	3629	0000	196	80	923	31
IWN	3910	1310	1919		418	31
IWN VHF	Bloomington		1273		291	31
IWN VHF	Kokomo		1094		231	31

Hoosier VHF Nets for August. QNI 6918, QTC 170, Bulletins 49, QTC 8392 sessions 129 for 21 nets. 9RN Cycle four QNI 391, QTC 661, QTR 1039 for 62 sessions. In 100% stns. N9AEI, W9EI, N9HZ, KJ9J, W9JUJ, WA9QCF, WB9UYU, K9WWJ. D9RN 483 messages in 1429 minutes IN 100% stns. W9JUJ, K9CGS, W9PRU, KA9EIV, KB9NR, N9DWU. CAND 1027 messages in 31 sessions. D9RN 100% stns. W9JUJ. Appointments: Net Manager (ICN) KW9D. Emergency Coordinator: N9CXI Vigo County, KC9YC Pulaski County, WA9BXR Tipton County, K9DFK Clinton County. Amateur Auxiliary to the FCCs Field Operations Bureau: W9TT WA9VRV AB9A KC9ED W9UL KM9A K9FW, W9MM KB9DE WB9JUV WA9OQT (total 11 to date). Silent Key W9CBZ. Amateur Testing is being done in most sections of Indiana. Anyone needing information can contact me. If you are giving tests please keep me informed. Congrats to the Inland Steel ARC soon to become ARRL affiliated. Congrats to the Dekalb County ARC soon to become our newest SSC. It was a real pleasure to join with the Poverty City trailer group and Valida Woodward, XYL of W9DL (Silent Key) for a very special breakfast on Saturday August 25, 1984. Present were W9AUN W9DKP WA9NII W9URS K8CPT K9CEG N9EAI and the Drumms. W9UEM and K9FHQ were there later. K9FVL and K9GBR could not make it. I read a card from Carrie Bowman XYL W9FMJ (Silent Key). It was a pleasant walk down memory lane. I received one "ATTABOY" for repairing an antenna. Every year several VHF CLubs plan a visit from Santa at the local hospital. It is a fine activity and I hope many groups plan to do it again this year. Traffic: W9JUJ 1182, WB9UYU 207, KJ9J 188, W9EI 179, KM9B 120, W9PRD 97, WD9HII 56, KA9FFO 56, WA9QCF 48, W9UMH 45, K9KTB 41, N9AEI 39, KD9DU 33, WB9AWI 31, W9PMT 31, KW9D 30, KB9HH 29, W9UEM 27, AB9A 26, WB9ZQE 25, K9DER 23, K9PS 19, N9DYC 18, WD9DWD 15, KC9TA 15, WA9OKK 13, K9BRF 10, WD9CIV 10, W9RTH 10, WD9ART 9, KK9N 9, K9FW 8, W9XD 7, N9DOK 5, KC9K 5, KA9LAU 5, K9FHQ 4, W9ZGC 4, W9BDP 3, K9SBW 3, W9URS 3, K9DIY 2, W9IOH 2, W9UPI 2, WB9AJY 1, KD9DE 1, W9KMY 1.

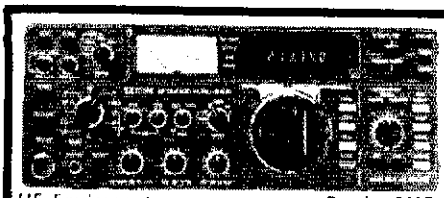
WISCONSIN: SM, Richard R. Regent, K9GDF — SEC: W9OAK. STM: K9UTQ. ACC: AE9K. BM: KA9CPA. OO/RFI: KA9IKR. PIO: K9ZZ. SGL: AG9V. TC: K9GDF. Happy Birthday K9FH Nov. 13th. K9GDF talks VEP to South Milwaukee, Washington, Sheboygan and Ozaukee Radio Clubs and visits Milwaukee ARES during August. Affiliated Club Coordinator, AE9K is delighted to set up programs for your club and explain SSC or ARRL affiliation advantages. OOs KA9IKR and K9UTQ now Auxiliary Monitoring stations. W9YCV works rare DX through OSCAR 10. KY9P awarded 6-meter VUCC. W9ODV cartoons for QCWA and QST SKN. Verify repeaters with Frequency Coordinator WA9JOB. Submit Sweepstakes CLUB scores. WB9BZW operated Science World '84 at Pigeon Lake. Upgrades: Extra KA9RHN; General KA9PCO; new Stevens Point Novices KA9SEN, KA9SGE. WD9EKV fiancee new Novice KA9SJO, both M.S.O.E. seniors. K9IZV NCS Milwaukee area general topic computer net, meets 9 P.M. Thursdays on 146.91. Everyone welcome to Wisconsin Novice Net, WNN — A slow and easy way to practice CW or learn traffic handling. KA9OBP and pet frog practice American Morse code. WB9NRK reports Green Bay 2-meter net doing well. KA9CPA BPL.

BWN	3984	6:00 A.M.	WD9IID	1261-1440-27
BEN	3985	12:00 P.M.	WB9ESM	781-188-31
WSBN	3985	5:30 P.M.	WA9ZTY	786-264-31
WIN-E	3562	7:00 P.M.	WB9ICH	280-185-31
WIN-L	3562	10:00 P.M.	K9LGU	226-120-30
WSSN	3645	6:30 P.M.	KC9CJ	146-24-31
WNN	3723	6:00 P.M.	KA9OBP	140-26-31
XPO	3925	12:31 P.M.	WA9YVC	293-17-23
WCWTN	31/91	6:00 P.M.	N9DHT	532-23-31
NWTN	34/94	6:30 P.M.	N9BDL	440-37-31

Traffic: KA9CPA 2292, W9CBE 310, K9GDF 305, W9YCV 301, WA9WYS 218, W9CXY 216, W9IEM 183, WA9YPY 178, WD9IID 126, W9UCL 125, KC9CJ 113, W9DND 110, WB9ICH 104, AG9G 100, WB9ESM 86, N9BDL 82, KA9AFB 77, W9FDY 77, KA9BHL 75, KA9OBP 75, K9FHI 69, K9AKG 65, WB9JSW 64, K9LGU 50, KG9B 41, WD9FRI 41, W9LDO 40, K9UTQ 33, N9BCX 30, W9SQ 30, WA9YVC 27, N9DCF 25, WA9DXW 21, KY9V 18, KN9P 14, WD9DNQ 11, K9BED 10, KV9U 9, W9UW 7, KA9BHK 6, WA9BZW 6, KA9NOT 4, KZ9V 4, WB9NRK 4, AE9H 2, KY9P 2. (July) W9FDY 44, WA9BZW 12, WB9NRK 5.

DAKOTA DIVISION

MINNESOTA: SM, Helen Haynes, WBØHOX — ASM: KCØT. SEC: KAØARP. STM: KDØCI. Hello to all in the Minnesota Section. This edition comes to you from South Haven as KDØCI appears to be involved with other matters this month - HI HI! Congrats to Kenny and Mary, KDØCI and KAØAJF, on their wedding and I hope they have a very nice trip. It will be nice to have them both in one place HI HI. I would also like to thank Helen WBØHOX for all the fine work she has done over the past years as the SM of Minnesota. We all wish you well, Helen, and we will look for you on the air. Thanks again for a job well done. During the month, there was a lot of amateur activities. On August 4th the Park Rapids Club sponsored a Hamfest and from what I was told, all had a great time. Also on the 4th the MSN picnic was held at Lake Coronis hosted by WDØBGS and again all present had a lot of fun. I was glad to be able to attend the St. Cloud Hamfest on Aug. 12. There was good attendance and it seemed as though all had a fun day. It also seems as Aug. was the month for vacations. KAØODQ was absent for a while with his family and KAØARP and family traveled to the Dakotas. Glad to have



ICOM

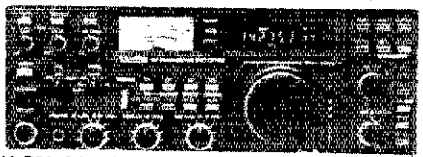
HF Equipment

	Regular	SALE
IC-740* 9-band 200w PEP xcvr w/mic	$1099.00	869.95

***FREE PS-740 Internal Power Supply & $50 Factory Rebate - until gone!**

PS-740 Internal power supply	159.00	149.95
*EX-241 Marker unit	20.00	
*EX-242 FM unit	39.00	
*EX-243 Electronic keyer unit	50.00	
*FL-45 500 Hz CW filter (1st IF)	59.50	
*FL-54 270 Hz CW filter (1st IF)	47.50	
*FL-52A 500 Hz CW filter (2nd IF)	96.50	89.95
*FL-53A 250 Hz CW filter (2nd IF)	96.50	89.95
*FL-44A SSB filter (2nd IF)	159.00	144.95
SM-5 8-pin electret desk microphone	39.00	
HM-10 Scanning mobile microphone	39.50	
MB-12 Mobile mount	19.50	
Options also for IC-745 listed below		
IC-730 8-band 200w PEP xcvr w/mic	$829.00	569.95
FL-30 SSB filter (passband tuning)	59.50	
FL-44A SSB filter (2nd IF)	159.00	144.95
FL-45 500 Hz CW filter	59.50	
EX-195 Marker unit	39.00	
EX-202 LDA interface; 730/2KL/AH-1	27.50	
EX-203 150 Hz CW audio filter	39.00	
EX-205 Transverter switching unit	29.00	
SM-5 8-pin electret desk microphone	39.00	
HM-10 Scanning mobile microphone	39.50	
MB-5 Mobile mount	19.50	
IC-720A 9-band xcvr/.1-30 MHz rcvr	$1349.00	869.95
FL-32 500 Hz CW filter	59.50	
FL-34 5.2 kHz AM filter	49.50	
SM-5 8-pin electret desk microphone	39.00	
MB-5 Mobile mount	19.50	
IC-745 9-band xcvr w/.1-30 Mhz rcvr	$999.00	789.95
PS-35 Internal power supply	160.00	144.95
CFJ-455K5 2.8 kHz wide SSB filter	4.00	
HM-12 Hand microphone	39.50	
SM-6 Desk microphone	39.00	

**See IC-740 list above for other options (*)*



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

Options: 720/730/740/745/751	Regular	SALE
PS-15 20A external power supply	$149.00	134.95
EX-144 Adaptor for CF-1/PS-15	6.50	

Options - continued	Regular	SALE
CF-1 Cooling fan for PS-15	45.00	
EX-310 Voice synth for 751, R-71A	39.95	
SP-3 External base station speaker	49.50	
Speaker/Phone patch - specify radio	139.00	129.95
BC-10A Memory back-up	8.50	
EX-2 Relay box with marker	34.00	
AT-100 100w 8-band automatic ant tuner	349.00	314.95
AT-500 500w 9-band automatic ant tuner	449.00	399.95
AH-1 5-band mobile antenna w/tuner	289.00	259.95
PS-30 Systems p/s w/cord, 6-pin plug	259.95	233.95
OPC Optional cord, specify 2 or 4-pin	5.50	
GC-4 World clock	99.95	94.95
HF linear amplifier	Regular	SALE
IC-2KL w/ps 160-15m solid state amp	1795.00	1299
VHF/UHF base multi-modes	Regular	SALE
IC-251A* 2m FM/SSB/CW transceiver	$749.00	499.95

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IC-551D 80 Watt 6m transceiver	$699.00	599.95
EX-106 FM option	125.00	112.95
BC-10A Memory back-up	8.50	
SM-2 Electret desk microphone	39.00	
IC-271H 100w 2m FM/SSB/CW xcvr	899.00	799.95
PS-35 Internal power supply	160.00	144.95
PS-15 external power supply	149.00	134.95
CF-1 Cooling fan for PS-15	45.00	
EX-144 PS-15/CF-1 fan adaptor	6.50	
AG-25 Mast mtd. GaSFET preamp	84.95	
IC-471H 75w 430-450 SSB/CW/FM xcvr	1099.00	989.95
PS-35 Internal power supply	160.00	144.95
PS-15 20A power supply	149.00	134.95
CF-1 Cooling fan for PS-15	45.00	
EX-144 PS-15/CF-1 fan adaptor	6.50	
AG-35 Mast mounted preamp	TBA	
IC-271A 25w 2m FM/SSB/CW xcvr	699.00	619.95
PS-25 Internal power supply	99.00	89.95
AG-20/EX-338 2m preamplifier	56.95	
IC-471A 25w 430-450 SSB/CW/FM xcvr	799.00	699.95
AG-1 Mast mounted 15dB preamp	89.00	
PS-25 Internal power supply	99.00	89.95
Common accessories for 271A/H and 471A/H		
SM-6 Desk microphone	39.00	
EX-310 Voice sythesizer	39.95	
TS-32 CommSpec encode/decoder	59.95	
UT-15 Encoder/decoder interface	12.50	
UT-15S UT-15S w/TS-32 installed	79.95	
VHF/UHF mobile multi-modes		
IC-290H 25w 2m SSB/FM xcvr, TTP mic	549.00	489.95
IC-490A 10w 430-440 SSB/FM/CW xcvr	649.00	579.95
VHF/UHF/1.2 GHz FM	Regular	SALE
IC-22U 10w 2m FM non-digital xcvr	299.00	249.95
EX-199 Remote frequency selector	35.00	
IC-27A Compact 25w 2m FM w/TTP mic	369.00	329.95
IC-27H Compact 45w 2m FM w/TTP mic	409.00	369.95
IC-37A Compact 25w 220 FM, TTP mic	449.00	399.95
IC-47A Compact 25w 440 FM, TTP mic	469.00	419.95
UT-16/EX-388 Voice synthesizer	29.95	
IC-120 1w 1.2 GHz FM transceiver	499.00	449.95
ML-12 10w amplifier	TBA	
6m portable	Regular	SALE
IC-505 3/10w 6m port. SSB/CW xcvr	$449.00	399.95
BP-10 Internal Nicad battery pack	79.50	
BP-15 AC charger	12.50	
EX-248 FM unit	49.50	
LC-10 Leather case	34.95	
SP-4 Remote speaker	24.95	

Hand-held Transceivers

Deluxe models	Regular	SALE
IC-02AT for 2m	349.00	299.95
IC-04AT for 440 MHz	379.00	339.95
Standard models	**Regular**	**SALE**
IC-2A for 2m	239.50	214.95
IC-2AT with TTP	269.50	219.95
IC-3AT 220 MHz, TTP	299.95	239.95
IC-4AT 440 MHz, TTP	299.95	239.95

Accessories for Deluxe models	Regular
BP-7 800mah/13.2V Nicad Pak - use BC-35	67.50
BP-8 800mah/8.4V Nicad Pak - use BC-35	62.50
BC-35 Drop in desk charger - all batteries	69.00
BC-60 Six position gang charger - all batts	TBA
BC-16U Wall charger - BP7/BP8	10.00
Accessories for both models	Regular
BP-2 425mah/7.2V Nicad Pak - use BC35	39.50
BP-3 Extra Std. 250 mah/8.4V Nicad Pak	29.50
BP-4 Alkaline battery case	12.50
BP-5 425mah/10.8V Nicad Pak - use BC35	49.50
CA-2 Telescoping 2m antenna	10.00
CA-5 ⅝-wave telescoping 2m antenna	18.95
FA-2 Extra 2m flexible antenna	10.00
CP-1 Cig. lighter plug/cord - BP3 or Dlx	9.50
DC-1 DC operation pak for standard models	17.50
LC-02AT Leather case for Dlx models w/BP-7/8	39.95
LC-2AT Leather case for standard models	34.95
LC-11 Vinyl case for standard models	17.95
LC-14 Vinyl case for Deluxe models w/BP-7/8	17.95
RB-1 Vinyl waterproof radio bag	30.00
HH-SS Handheld shoulder strap	14.95
HM-9 Speaker microphone	34.50
HS10 Boom microphone/headset	19.50
HS-10SA Vox unit for HS-10 (dlx only)	19.50
HS-10SB PTT unit for HS-10	19.50
ML-1 2m 2.3w in/10w out amplifier	SALE 79.95
ML-25 2m 2.3w in 20w out amplifier	SALE 179.95
SS-32M Commspec 32-tone encoder	29.95

Shortwave receivers	Regular	SALE
R-71A 100 Khz-30 Mhz digital receiver	$799.00	689.95
FL-32 500 Hz CW filter	59.50	
EX-310 Voice synthesizer	39.95	
RC-11 Wireless remote controller	59.95	
CR-64 High stability oscillator xtal	56.00	
R-70 100 Khz-30 Mhz digital receiver	749.00	569.95
EX-257 FM unit	38.00	
IC-7072 Transceive interface, 720A	112.50	
FL-44A SSB filter (2nd IF)	159.00	144.95
FL-63 250 Hz CW filter (1st IF)	48.50	
SP-3 External speaker	49.50	
CK-70 (EX-299) 12v DC option	9.95	
MB-12 Mobile mount	19.50	

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them all back home safe. As of Sept. 1, all the section phone nets meet on 3,929, the noon net at 12:05P and the evening net at 5:30P. Congrats to the following up-grades: Tech to Gen-NØFPB, Gen to Adv-WBØSPG and NØFKU, Adv to Extra- KDØNZ WDØBAC. I know that there were more at the radio camp but I did not get all of those. My sincere condolences to the family and friends of Steven R. Nelson, AIØE. Steven was very active in the Willmar Club and we were all sorry to hear that he became a Silent Key. NMs (with assistants): MSN/1 WØEHI (WØGRW), MSN/2 KAØEPY (WØOJH), MSSN KAØODQ (KAØARP), MSPN/N KAØJUX (WBØJUL), MSPN/E WDØBGS (KAØBFP), MNAMWXNT WDØBAC, PICONET WØHZU (WAØTFC).

Net	Freq	Time	QNI	QTC	Sess.
MSN/1	3685	6:30P	306	126	31
MSN/2	3685	10:00P	254	60	31
MSSN	3710	6:00P	138	13	27
MSPN/N	3929	12:05P	734	98	31
MSPN/E	3929	5:30P	1054	130	31
MNAMWXNT	3929	6:15P	0	0	0
PICONET	3925	9:00A	2495	—	—

Traffic: WAØTFC 375, KAØEPY 324, WØEHI 301, WØHZU 182, KAØARP 143, KAØJUX 107, NØCLS 72, WBØHOX 65, KØCVD 56, W9DM 50, KDØCI 45, KY9I 35, WDØBGS 34, WØGRW 24, KØOGI 24, KTØR 24, KCØT 23, KN9U 10, WBØUKI 9, KZ8H 7, WAØONJ 4, KAØAJF 1.

NORTH DAKOTA: SM, Ron Roche, KØALL — WBØKKG will be moving from Grand Forks to Fargo. Plans are now being made to link the 146.700 repeater in Grand Forks to the 146.97 in Fargo. This will extend the coverage for SKYWARN. I still need candidates for the Amateur Auxiliary program. The TRARC in Dickinson is ready to go the VEC program. KNØA will be taking over as SM effective Oct. 1. He would appreciate any news items you have and your net reports by the 6th of each month. Data Net 180 QNI, 10 QTC. Goose River 70 QNI, 3 QTC.

SOUTH DAKOTA: SM, Fredric Stephan, KCØOO — Here we are again at the start of the good season for decent radio propagation and all the upcoming contests and operating events. We hope to hear you involved in one or another of them. Please send in your traffic reports and all related materials to our new STM, NBØD and she will dispose of them in the appropriate fashion. Two or nine. All emergency coordination information, of course, should go to WØYMB in Mobridge. Your section manager is still hoping for more station and club news items for inclusion in this little column. Let the others around the state share your good news. The weather information net apparently does not plan to move frequency as has been done by two other nets. The Noon Jacks and Queens net has gone to 3870.0 according to reports from WAØVRE. The Mavericks net has headed for that frequency also, but no exact time for their Hit and Bounce has been determined as yet. Some amateur will undoubtedly fill us in on this important detail. More volunteers are needed for an adequate VEC program in South Dakota. Contact WBØLTV.

DELTA DIVISION

ARKANSAS: SM, Joel M. Harrison, WB5IGF — SEC: N5BPU. STM: AE5L. TC: W5FD. ACC: AD5M. PIO: K5DW. SGL: W5LCI. Repeater coordinator: WB5FDP. The Section Manager's Newsletter is being mailed to all field appointees and clubs in the state. If you would like to receive one, let me know. Is your club receiving the benefits of ARRL affiliation? Contact Morris, AD5M for more information. W5KL is using a new center fed Zepp at 90 feet. Don't forget that the Arkansas Phone Net is now on 3885 kHz and OZK CW Net is now on 3745 kHz due to the recent band expansion on 80. The times remain the same. Congrats to our traffic handlers this month. Traffic: W5TUM 98, WD5FCE 61, W5QFU 45, W9OK 30, WB5IGF 24, W5RIT 17, AE5L 16, W5UAU 10, W5KL 8, AD5M 4.

LOUISIANA: SM: John Wondergem, K5KR — SEC: KA5PFB. ACC: K5DPG. SGL: KD5SL. OO/RFI: WB5TPG. The West Central La. Amateur Radio Club was recently formed in Leesville with 32 members. WB5NAA, pres: W5YZL, v.p.; N5CB, sec-treas. Meetings 1st Thurs. mo. Contact WB5NAA. The Leesville repeater on 147.96/36 has been relocated with increased coverage. Welcome aboard to Jim Bonnough, WB5TPG of Shreveport as the North La. OO/RFI Coordinator. A former La. SEC, he became the 1st in La. to complete the new OO/RFI Program and be designated a member of the Amateur Auxiliary to the FCC Field Operations Bureau. If you enjoy the discipline and accomplishments of traffic handling there are vacancies in the La. slow and high speed CW nets and voice net with plans to activate a RTTY net soon. Contact W5GHP for more info. Almost every area of the State would benefit from increased participation in the La. Emergency Net. No previous experience required. Check in on 3910 kHz at 8 PM Monday nights with net control N5ADF.

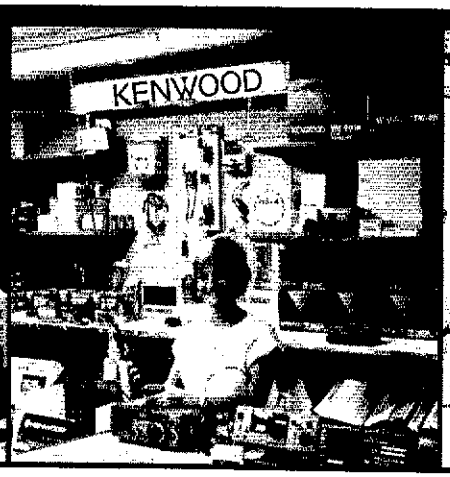
LTN	3910	6:30 PM Dy	N5ANH
LAN	3615	7:10 PM Dy	N5BFV
LSN	3703	7:30 PM Dy	WA5ANV
LEN	3910	8 PM Mon	N5ADF

Traffic: W5GHP 541, KE5PP 120, K5TL 114, WB5LBR 52, WA5TQA 26, N5ANH 19, K5WOD 19.

MISSISSIPPI: SM, Paul Kemp, KW5T — SEC: N5DDV. STM: KB5W. Freq. Coord.: NF5Q. Tnx to W4WLF for FB job as SM. Good to see WD5EYM and K5UTH back with us after a stay in the hospital. Congrats to upgrade to Adv.: K5RUV KA5TGI KA5TFE and N5GVX. KK5K and WBZG passed OO certification exam and now members of Amateur Auxiliary to FCC Field Op Bureau. Freq. change for MSBN, MMN and ARRL info net now on 3862.5 kHz. N5DDV confirmed old timer now with certificate in hand. With regrets K5BAK now Silent Key. K5OAF needs more help on MTN. Lets all join him on 3665 kHz at 2345Z daily. CAND (W5KLV) 31 sess. 1027 QTC. DRN5 (WB5YDD) 62 sess. 951 QTC. MTN (K5OAF) 31 sess. 139 QNI 37 QTC. MSBN (KW5T) 31 sess. 2174 QNI 49 QTC. GC5B (W5JHS) 31 sess. 1116 QNI 7 QTC. MMN (WB5RMW) 26 sess. 374 QNI 8 QTC. Traffic: N5AMK 390, K5OAF 263, KT5Z 185, W5WZ 43, KT5Z 26.

TENNESSEE: SM, John C. Brown, NO4O — ASM & ACC: WA4GLS. OO/RFI: W9FZW. PIO: WK4V. SEC: WA4GZQ. SGL: WA4GZZ. STM: NG4J. TC: W4HWK. The operation of the Volunteer teams seem to be getting into full swing in the section. At this writing there are three groups administering examinations under this program, the ARRL, Mid South and Western Carolina ARS. The Mid South is located in Memphis and the WCARS-VEC in Ashville, North Carolina. This diversity of authorized groups should insure that all that wish to upgrade or become an amateur do so with little difficulty in reaching a testing location. The rate of passing has been reported about the same as when the FCC was giving the tests. We are well on the way into the fall and winter conditions and that means that the amateur bands are reaching out much farther. That will mean that we all must exercise some restraint in the use of high power and inclination to start squawk-

Rob, WA3QLS



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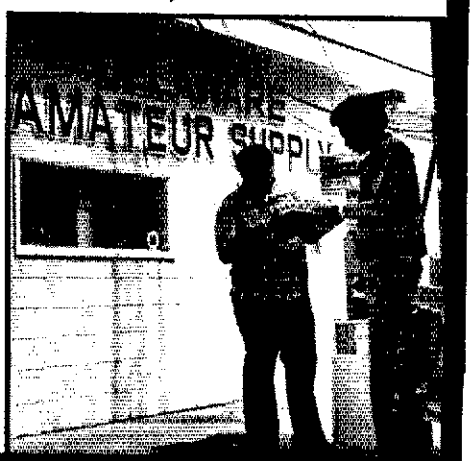

ing when we hear someone close by our operating frequency. Just move the enhancement features of the rig to a lower level of operation. "Courtesy is contagious". Hey, your SM has been advised about some more 2M repeaters going on the air. The Jackson Club is about to place a new one on 144.71/145.31. All repeaters must be coordinated with WB4HAP/WD4KWP and staff as they are the official agency in TN. The SM has not awarded a BPL award in some time. The honor goes to W9FZW. Would like to enlarge the number. Traffic for the section is as follows: LF — Sessions-79, QNI-3243, QTC-189; VHF-sessions-73, QNI-1740, QTC-497; TN CW - sessions-48, QNI-254, QTC-81; RTTY - sessions-27, QNI-6, QTC-3. Activity on the RTTY net seems to be increasing. FB. The CW net honor roll recipient is K9IMI. Traffic: W9FZW 348, KA4RSC 165, W4DDK 123, K4WOP 48, K4WWQ 47, WD4GYT 27, W4PFP 24, NN4S 22, WB4YPO 20, NV4Z 19, WV4E 14, K4JGW 14, WB4TDB 14, KE4LS 12, W4TYV 11, W4PSN 9, WA4HKU 8, KB4GLB (N4KQX) 4, NY4N 2.

GREAT LAKES DIVISION

KENTUCKY: SM, Ann Jackson, KA4GFU — STM: KA4BCM. SEC: WA4JAV. OO/RFI: N4GD. BM: WA4AGH. PIO: K4TAJ. New River City ARA Officers: N4EBS, pres; KB4AHV, v.p.; WA4AXN, sec.; and WB4FSX treas. Congrats to WB4FAT on his new call KI4LA and to his 8 year old daughter, Allison, on her new call KB4LEW. Rumor has it Yaesu was so impressed by this young lady she was awarded a new rig. Thanks to N4JLT for taking up the slack on KTN. It's appreciated. K4ZGV spent two weeks in Grenoble, France attending the institute conference on Phosons as part of the American Physicist contingent. Net reports (Aug.):

Net	Time	Freq.	QNI	QTC
MKPN	8:30 AM EST	3959 kHz	1003	139
KTN	7:00 PM EST	3959 kHz	946	93
KYN	10:30 PM EST	3600 kHz	132	73
KNTN	7:00 PM EST	3727 kHz	286	59

CARN 130 19, KYPON 57 8, NKARC 45 1, PAWN 79 0, TSTMN 516 50, WTEN 38 1, 3ARES 34 4, 4ARES 56 5, 7ARES 42 0, 11ARES 61 7. Traffic: WA4JTE 317, KA4BCM 100, WD4IYI 95, KB4OZ 75, KA4SAA 74, KA4MTX 35, WD4PBF 35, KA4SKV 32, K4HOE 31, WA4SWF 24, WD4BSC 22, WB4ZDV 21, K4MHL 19, W4WQV 16, WA4AVV 15, WD4IYH 14, WA4JAV 14, KA4YIV 11, WA4YPQ 11, WK4D 9, N4HZT 9, WD4CQF 8, KA4GBZ 8, W4PKX 7, WD4IXS 6, N4GD 5, WA4NOG 5, KZ4G 3.

MICHIGAN: SM, James R. Seeley, WB8MTD — ASM: WA8DHB. SEC: WA8EFK. STM: WD8RHU. ACC: K8SB. PIO: KC8K. SGL: N8CNY. TC: WB8BGY. BM: KZ8V.

Net	Freq	Time/Day	QNI	Tfc	Sess.	Mgr
MITN*	3953	1900 Dy	593	285	31	WD8EIB
QMN*	3663	1800 Dy**	799	254	62	W8UE
MACS*	3953	1100 Dy**	512	126	31	K8LNE
UPN*	3922	1700 Dy**	689	89	35	WA8DHB
GLETN	3932	2100 Dy	376	85	31	WB8AXI
MNN*	3722	1700 Dy**	223	71	59	KA8NCR
WSSBN	3935	1900 Dy	648	35	31	WB8EYM

*NTS nets. Times local. **QMN late net, 2200; MNN late net, 2000; MACS Sn, 1300. ARES net Sn, 3932, 1730. ARRL Info Net, Sn, 3953, 1500. Traffic Workshop, Sn, 3953, 1600. 3932 is MI HF emer. freq. Upgrade to General, WB8AFO, to Tech, long-time coming, KA8AMJ. We just got to know WA8ZYW and now he's NJ8M. The TASYL net has changed freq. to 3932. WA8DHB notes that our UPN, in its own quiet way, has been setting attendance records: Since Nov. '83, each month's check-ins has exceeded those of the same month in the previous year. Will they carry this to the limit? Is MI big enough? From Monroe County, modestly reported by W8YZ, comes the tale of yet another source of RFI run to ground and returned to the factory. K8AMU was the principal victim, or at any rate the first to make a serious complaint. W8YZ was the keen-scented hunter who tracked the offending fox to its lair — the front door, at least, of a local poodle parlour. The intrepid WA8EFK was the one to enter the den, HT held high, and discreetly catch in its act... an electronic dog de-flea-er! Quoth the proprietress "...dum thing never did work right..." The MI Area Repeater Council would like to be on the mailing list of every amateur newsletter in the state. If enough interest is shown, an "Editor's Special" MARC letter will be started and circulated on an exchange basis. The address is: MARC, Box 194, Mount Pleasant, MI 48858. The Council also has offered its services as a state-wide clearing house for information on volunteer license examinations. The more input received, the more valuable will this service be. Traffic: KA8CPS 437, AF8V 392, WD8LRT 236, W8UE 191, N8EBG 112, WA6TMH 108, WD8DUO 90, KA8QVH 84, WB8YDZ 80, WB8MTD 77, KA8NCR 75, WA8DHB 73, N8CNY 72, K8GXV 72, K8OCP 54, KA8OID 54, WD8EIB 49, W8IHX 47, K8KQJ 44, K8UPE 43, WD8MJB 42, WB8SYA 42, K8ZJU 41, W8YIQ 34, WB8BHP 29, N8EBN 24, W8YZ 21, WD8KQC 18, K8EQO 15, KA8PQH 14, KA8PAK 13, WB8TTA 13, W8VIZ 13, KS8P 9, WB8YRY 8, W8SCW 5, K8DD 4, N8CQA 3, WB8ITT 3, KB8TD 3, W8URM 3, KB8GT 2, N8BKM 1. (Aug. W8QHB 514 BPL)

OHIO: SM, Allan L. Severson, AB8P — SEC: K8AN. STM: K8OZ. ACC: K8US. PIO & SGL: N8CVK. TCC: KB8MU.

Net	QNI	QTC	Sess.	Time (local)	Freq.
BN	360	236	62	6:45/10 P.M.	3.577
BNR	303	94	31	6:00 P.M.	3.605
BSSN	420	224	59	9:45 A.M./7:15 P.M.	3.927
ONN	87	27	23	6:30 P.M.	3.708
OSN	269	141	31	6:10 P.M.	3.577
OSSBN	1811	1268	93	10:30 A.M., 4:15 & 5:45 P.M.	3.9725
OSSN	128	76	29	6:45 A.M.	3.577
O6MN	294	15	31	9:00 P.M.	50.160

Belated congrats to the folks at Massilton ARC who in March celebrated the 50th anniversary of their affiliation with the ARRL. A most honorable accomplishment! Regular readers of this section (I know that there are definitely several — they always comment when the dreaded typos mangle a call) will remember my pride and (dare I say?) my enchantment with Erica, KA8NXV, our 8-year-old Novice of a few years past. Erica, now a middle-aged 11, has been joined by her 8-year-old sister, Denise, KA8VAL, in Amateur Radio's ranks. Dad and Mom are also licensed, N8CGE and N8FLT respectively. This, to me, is a tremendously important item that makes me ask again: how do we attract our youth to Ham Radio so it can always flourish with new vitality? As I've said before, TSRAC in Southeast Ohio has at least some of the answers, and I wish every club in Ohio would have someone write Box 240, RD 1, Adena, Ohio 43901 to get some ideas from it. Sorry for this addition to your correspondence, Ralph, but I know you won't mind because you feel as strongly as I do. This is my penultimate (gosh, I like that word, and seldom have the courage to use it) column. Just as well since another of my favorite newsletter editors is hanging up the quill after five years. Bob, N8ADA, of Dara's RF-Carrier, has provided some terrific copy, and I'm really

going to miss his news. I know DARA will too. And heartiest congrats to DARA and, especially, Judy, KG8P, for the long hours devoted to the volunteer examining program this year. She set standards and an example that we're all going to have to battle to meet in the years to come. Again, well done. Judy! Club elections: DARA; W8RKL, pres.; KR8B, v.p.; WD8CYD, secy.; KG8Q, treas. Upgrds, to Extra, WB8VGE. Appointment, , EC Monroe Co., KA8SQY. Congrats to all of you!

Local Nets	QNI	QTC	Sess.
ALERT	86	9	4
BRTN	274	123	31
COARES	141	4	4
COTN	12	40	9
MASER	73	2	4
MEDINA	387	47	31
TSRAC	1194	98	46
WAYNE CO.	188	28	30

Traffic: WD8MIO 871, NE8X 556, W8PMJ 454, WB8JGW 448, WD8KFN 429, K8JDI 398, K9OZ 310, KV8Q 303, N8FCQ 258, KD8KY 221, W8BQ 216, K8ND 215, W8QZK 209, WA8HGH 206, WA8SSI 169, KA8GJV 143, KB8P 143, KF8J 140, W8SKP 128, N2NS 105, WA8GMT 102, WD8KBW 98, KA8CGF 97, WB8MEK 95, KA8ICB 94, N8AKS 87, W8EK 86, K8TVG 81, N8CW 79, W8FG 75, WB8KWD 70, WD8NED 68, W8CXM 66, KA8MFG 66, K8AN 62, N8AEH 61, WD8IKC 59, KA8KHS 55, N8EVC 48, K8DXZ 33, K3RC 33, K8CMR 25, WD8RGS 25, WB8HHZ 22, WA8HED 21, WB8MRL 21, WD8RGP 20, K8VOY 20, NC8Q 19, WA8DYX 18, N8FPH 18, K8EF 17, KD8SS 16, K8EM 15, W8LT 13, KA8GGZ 12, W8BHL 11, WB8NHV 10, WD8EKI 9, WD9HDZ 9, N8CJS 7, WD8OYK 7, K8CKY 6, W8FUP 6, N8CGM 5, N8AJU 4, WB8KKI 4, WB8NTR 3, KA8MEB 2. (July) K8ND 206, WB8KWD 154, W8FUP 12, WB8NTR 4.

HUDSON DIVISION

EASTERN NEW YORK: SM, Paul S. Vydareny, WB2VUK — SEC: AK2E. STM: WB2MCO. ACC & SC: N2BFG. BM: WB2EAG. SGL: KB2HQ. TC: KC2ZO. ASM. News Ed: WA8MAZ.

Net	Time/Day	Freq.	Net Manager
EPN	2300Z	3.902	KC2TF
ESS	2300Z	3.590	W2WSS
NYS	0000/0300Z	3.677	WB2MCO
NYS/M	1500Z	3.677	WB2EAG
NYPON	2200Z	3.913	WA2KOJ
NYSPTEN	2300Z	3.925	
CDN	2330Z	146.34/94	WB2ZCM
HVN	0030 S-M-T	144.535/135	N2BDW
HVN	0030Z W-S	146.37/97	N2BDW
SDN	0230Z	147.66/06	K2ZVI
SCRN	0100Z	147.735/135	KV2U

Net Reports: AESN-QNI-40 QTC-0; ATEN-QNI-16 QTC-3; ESS-QNI-442 QTC-46; NYPON-QNI-591 QTC-419; NYS/M-QNI-320 QTC-149; NYSE/L-QNI-844 QTC-488; SDN-QNI-318 QTC-103. Club News: SARA had picnic on 26 Aug. WECA had K2BQ speak on DXing and contesting. WARA had program on Cellular Tel. CCNR reports WB2GMN Silent Key. New ECs WA2CCY Saratoga, KA2DKX Greene. New ORS-KA2MYJ KA2TOC. New Novice/Tech net CDEN-Tues. 3.705 MHz 0300Z Weds. All welcome. WFMRA giving FCC exams Thurs. Dec 27-forms in by Nov. 28. PSHR: W2PKY WA2JBO WB2VUK KC2ZO KC2TF W2BIW KA2MYJ WB2MCO WB2KCR KA2OPG K2ZM WA8MAZ KA2TOC AK2E K2ZVI N2EQM. Traffic: KC2ZO 308, K2ZM 250, W2PKY 238, KC2TF 163, WA2JWL 153, WB2MCO 148, WB2VUK 126, WB2KCR 102, KA2MYJ 90, W2BIW 74, WA2JBO 69, KA2OPG 52, WA2CJY 42, WA8MAZ 38, KA2TOC 38, N2EQM 29, K2ZVI 27, AA2Y 26, N2BFG 13, N2AWI 11, AK2E 10, N2CWV 6. (July) WB2MCO 141.

NEW YORK CITY-LONG ISLAND: SM, John H. Smale, K2IZ — SEC: WA2SUB. ACC: WB2IAP. OO/RFI: NB2T. TC: W2JUP. PIO: W2IYX. The following are traffic nets in and around the section:

NLI CW*	3630 kHz	1900/2200	N2AKZ
NCVHF	6.145/745	1930 M-F	K2MT
SCVHF	4.77/5.37	2030 M-F	W2GZD
BAVHF	6.07/67	2000 M-F	WB2BNA
ESS	3590 kHz	1800	W2WSS
NYS/M	3677 kHz	1000	WB2EAG
NYS	3677 kHz	1900/2200	WB2EAG

*Denotes section net, all times are local, please try and help out by checking in whenever possible. I hope that everyone has a happy Thanksgiving. Officers for the Wantagh RC are: pres.; KI2M, v.p.; K2ES, treas.; WA2PPV, Rec. sec.; NE2N, Corr. sec.; KZ2M, Sgt. at Arms; KA2FVM. W2CJN ran tests on several of the popular ant. with the ICOM 2A and the results were published in the Aug. issue of the Grumman newsletter. To ask for a reprint please try writing to Skip Courtney, K2UAT Mail Station C01-14, Grumman Aerospace Corp. Bethpage NY 11714. NA2V served as NCS for the Pepper Martin run on July 4th while KC2ZF coordinated the Advance Memorial Day run and the Liberty Cup Races, some of the stations which helped out were W2MUD WA2IAF K3SUM KA2AME KC2ZF. The Larkfield ARC has been officially designated a Special Service Club. Anyone wanting meeting information for the Kings County RC, please contact Richard Statfield at 212-376-7103 in the evenings. W2DUK has been appointed AEC for the Town of Babylon. The Great South Bay ARC spent a busy summer providing communications for the Kismet Shrine Circus, 4th Annual Babylon Village run and The Jewish Arts Festival of Long Island. Radio Central's 450 MHz rptr is on the air, the xmit is 449.525 and rec is 444.525, access is with a PL 2A, and the machine will be fully slaved to 2 Mtrs. Harry, N2AWM retired down to Fla the 1st part of Sept. KA2SLF passed his General. NB2T reports the Tu-Boro RC is now on 223.42 simplex. It is with deep regret that we list Art Ford, W2MAE as a Silent Key. Newest members of Larkfield ARC are KB2PY KA2UJD W2IGM, their membership is now over 200. WB2IDP is now attending SUNY Stoney Brook. Traffic: W2GKZ 124, K2YQK 108, KC2YZ 60, K2GCE 44, N2BGP 42, NB2T 40, K2MT 27, W2DBQ 26, K2JFE 6, WB2IDP 3. (July) KC2YZ 60, K2MT 20.

NORTHERN NEW JERSEY: SM, Robert Neukomm, KB2WI — SEC: WB2VUF. STM: W2XD. BM: N2BOP. RCC: W2CC. SGL: W2KB. PIO: WB2NQV. TC: AD7I. ACC's: KK2U KY2S. NMs: W2CC KB2HM WB2RMJ WB2ANK WB2IQJ WB2QMP N2XJ W2PSU.

NJM	3695	1000 Dy	31	191	82
NJPN	3950	1800 Dy	35	363	121
		0900 Sn			
NJSN	3735	1830 Dy	31	274	146
NJN/E	3695	1900 Dy	31	267	177
NJN/L	3965	2200 Dy	31	208	109
TCETN	147.255	1930 Dy			
OBTTN	147.12	2000 Dy	31	321	108
NJVN	49/49	2230 Dy	31	259	115
NJRTTY	147.51	Autostart			

Our director W1IHA has appointed WB2VUF to the Emergency Communications Advisory Committee and Bob replaces KB2KW who has resigned. I have received the resignation of WB2IQJ, NM of the NJSN. Pete has served valiantly for several years and many novices have graduated through his training sessions. Pete is to be congratulated for a "job well done" and especially for the excellent course he has designed. Pete has been quite ill for many months yet occassionally is able to check into many of our nets. Get well soon, Pete! WB1GXZ has assumed Asst. NM of NJSN and she presently reports 5 stations in training with traffic being the greatest since January. The net is in dire need of Net Control Stations and we invite NJN members to join the net. Jersey Shore Chaverim "Ham Club" reports a successful "Hamfest" with $650 donated to the JCC. Their first meeting of the fall season was held at the Jewish Community Center in West Deal, NJ and they have a 2 meter net meeting the first Thursday of the month on the Allaire repeater at 9PM on 145.10. Their Torrah study net meets daily except Shabat at 3.825 MHz at 8 PM. Ramapo Mountain ARC reports: Club participation in the annual International Boy Scout Jamboree of the Air. Join them and listen for WA2SNA operating from Camp Tamarack. The general meeting of the October 3rd meeting will have our Director and Vice Director as guest speakers. John W2AD gave a talk/slide show to the Greenbrook Repeater Group on a recent trip to Russia and China and hand-delivered a QSL to a HT in Outer Mongolia. Rev. Thomas Sable, SJ also gave a talk/slide show on the IMRA. Father Tom is WD6FZN. BARA reports a Special Events station from K2UFM's QTH on the weekend of August 18. Talzo N2ATT videotaped the event and K2TM reports 325 QSOs. Neptune ARC reports a successful "Hamfest" by the Gloucester County ARC with FCC exams being held — Novice through Extra. Traffic: W2VY 359, N2XJ 292, KB2HM 224, KB2WI 70, W2ZEP 69, W2RRX 53, KD2BE 50, WB2QMP 48, WB2ANK/T 47, W2XD 30, W2CC 22, W2UH 27, KA2OIW 18, W2NKD 6.

MIDWEST DIVISION

IOWA: SM, Bob McCaffrey, KØCY — SEC: WA4VWV. STM: KAØX. PIO: KBØZP. SGL: AKØQ. ACC: WBØQAM. TC: KØDAS. BM: KØIIR. Looks like the Section will be very active this fall. KØKQJ was recognized for his "Outstanding Service and Contribution to the 75 Meter Net." The Award was presented at the highly successful 75 Mtr Picnic Aug. 26th. KAØILR presented the "Evans Memorial" Award at the DSM Hamfest. The March of Dimes presented a plaque to Polk County ARES. WDØGWN is the new EC in Webster County. IaCy provided 17 hours of communication for the IaCy Triathlon. The Waterloo Club helping with "Cattle Congress" parade. There are two more 2Mtr RTTY MSO, in addition to Council Bluffs (KAØJRQ), in Mason City and Dubuque. Soocy starting Novice classes again as well as participating with "RiverCade."

Net	Freq	UTC	QNI	QTC	Sess.
TLCN	3560	0030-0400 Dy	338	183	62
75M Phone	3970	1830-2330 M-Sat.	2160	200	54
ICN	3713	7 P.M. (local) M-F	157	72	22

WØRPK completed first 2 Mtr Meteor scatter with Packet, also on 6 Mtr. Take SET exercise and your reports now. Iowa did great last year. Lets do even better this year. Have a Turkey in November, NOT a HAM. Traffic: WAØAUX 308, WDØFWB 248, KØGP 186, WØSS 167, WØYLS 104, NCØR 88, NØCWW 83, AEØR/KAØX 78, WBØUFF 75, W4JL 57, WBØAVW 56, KDØI 46, KAØADF 45, WØBW 45, KØCY 32, WØHTP 38, KBØOZ 28, KCØSC 24, KØBRE 19, KAØBRE 18, KDØBG 14, NØBKB 14, NEØP 13, NØETC 6, NØEFG 5, KCØXL 2, WDØFOY 2. (July) KBØOZ 106.

KANSAS: SM, Robert M. Summers, KØBXF — WØFRC In and out of the hospital again. Top of the list other good news — WØQMT now has an antenna that works on 75. Congrats to WAØTKJ on his Extra!! WØKL reports activity down ARES wise — vacation month. I wish someone would let my employer know that August is vacation month. Several have voiced interest in the SET plans this Oct. A few changes should bring a few surprises. The Hiawatha ARC members furnished radio link between Red Cross shelter and Sheriff's Office during the Wolf River flash flood June 9/ Zone 2 on the ball! Our sympathy to WDØFIT of the QKS-SS gang on the recent death of his father. Amateurs in Salina will provide communications for the GO-Cart races the last of Sept. They will also be involved in the Bike-A-thon for Diabetics Foundation and a Walk-a-thon, all in Sept. A busy group? Naw, just routine!

Net activity August:

Net	Desg.	QNI/QTC	Mgr.
Kansas Sideband	KSBN	897/143	WØFRC
Ks Phone	KPN	339/6	WØFRC
Ks Wx AM	KMWN	603/535	WAØLBB
Ks Wx PM	KWN	806/498	WAØLBB
Central States Tfc	CSTN	1926/111	WAØOMB
Ks CW	QKS	280/105	WBØZEN
Ks Slow Speed	QKS-SS	46/8	WØMYM

Consult your net directory for time and freqs. Ya dont got one??? Write your SM or ask ARRL. Traffic: WØFRC 300, KSØU 163, WØFIR 160, WAØLBB 128, WØKL 123, WØQBK 119, WØOYH 118, WØHI 110, WBØZEN 76, NBØZ 61, WØFDJ 55, KØBXF 40, KDØJM 12, WØRBO 10, NØBDG 15, KØGSC 14, WØMYM 7, WAØOWH 7, WØPB 6, KAØE 1.

MISSOURI: SM, Ben Smith, KØPCK — Missouri Section OO's: WAØITU and NØEVC have passed the certification exam and are now fully-fledged members of the Amateur Auxiliary. We would like to see more Missouri amateurs apply for OO appointments. Contact WBØRHK, Missouri OO/RFI Coordinator for details. KØORB has received an ORS appointment. The Northland ARA will be hosting the Missouri QSO Party in November. They hope a large number of amateurs from Missouri will participate. A plaque will be awarded to the Missouri amateur with the high score. The Southside ARC will have a Hamfest Oct. 28 at the Grandview Jr. High School. Contact Southside members for information. This year's Amateur Radio Booth at the Missouri State Fair was active with lots of interest shown by the fair goers in the operation of the station. Again this year the Central Missouri Radio Association coordinated the project with many other clubs donating time and money to make the station a success. Over six hundred messages were originated, a large number of amateur radio promotion material handed out and a lot of questions answered by the amateurs working at the booth. Clubs assisting with the State Fair Station this year were: McDonnell Douglas ARC, Zero Beaters ARC, Macon ARC, Lake of the Ozarks ARC, Heart of America Radio Club, Mid Missouri ARC, Tri-County ARC, Rolla Regional ARS, Independence FM ARC, Central Missouri Radio Club and Northland ARA. Thanks to all the clubs and amateurs who helped with the operation. Nets reporting:

Net	Sess.	QNI	QTC	Day	Time	Freq.
MOSSB	30	579	267	Dy	6PM	3.963
MON	62	437	228	Dy	7/9:45PM	3.585
MEOW	30	418	72	Dy	5:30PM	3.963

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POLARIZATION
FEEDPOINT IMPEDANCE
HALF-WAVE DIPOLE
QUARTER-WAVE VERTICAL
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TELEGRAPHY ABBREVIATIONS
RADIO WAVE PROPAGATION
SKY WAVE AND SKIP
GROUND WAVE
HARMONIC INTERFERENCE
SWR READINGS
SIGNALS AND EMISSIONS
HACKSAW
KEY CLICKS-CHIRPS
SUPERIMPOSED HUM
SPURIOUS EMISSIONS
COMPUTERS
OSCAR
ATV-SSTV
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RADIO WAVE PROPAGATION
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MTTN	29	169	33	M-Sat	7:30PM	3.730
PTN	13	53	16	MWF	9:30PM	21.114
HBN	18	303	15	M-F	1105PM	7.280
RRARS	30	344	10	Dy	9PM	146.19/.79
MOFON	3	13	7	W	8:15PM	222.42/4.02
LOZARFM	5	129	4	F	9PM	146.13/.73
CMEN	5	82	3	W	9PM	146.16/.76
LAAN	4	32	2	M	8PM	146.10/.70
LOZARCW	4	20	2	Th	9PM	3.707
STAN		204	0	M	8PM	146.31/.91
SARN	4	48	0	Tu	9PM	146.43/7.03
ACAN	5	45	0	Th	9PM	147.82/.22
IFN	3	21	0	W	7.30PM	147.84/.24

WDØDVG 1259, KT5Y 558, KØSI 368, NDØN 267, KØPCK 251, WØBMA 174, AIØO 124, KØBM 95, KØORB 60, WBØHQP 57, K2ONP 57, NØSS 54, KØDSQ 45, WØNUB 42, NØEVC 37, WØOUD 33, WAØHDQ 6, K9OCU 1.

NEBRASKA: SM, Vern Wirka, WBØGQM — KDØEV, Mike Lennen of Omaha is the new Public Information Officer (PIO) for the Nebraska Section. The section bulletin will now be transmitter on Sunday of each week. The RTTY Bulletin will be at 1815 UTC on 7085 kHz at 60 WPM. The phone bulletin will be at 1815 UTC on 7282 kHz at 1900 UTC. This change is to accommodate schedules that the section officials have to keep. There is a need for more Omaha area stations willing to pick-up incoming traffic directed toward the SM. The efforts of KØDKM and WAØPCC are greatly appreciated in getting traffic to the SM but more help is needed. This is especially true on the Evening Nebraska Storm Net which meets on 3982 kHz at 0030 UTC. 73, Vern Wirka, WBØGQM. Traffic: KØDKM 152, WBØTED 131, WØKK 104, KAØBCB 48, KØIXV 30, KAØBWM 15, WDØBOX 11, WBØGMQ 9, WDØEGK 8, KAØELE 6, WAØBOK 5, WDØBQG 3, WAØOQX 3, KØFRU 2, WØNIK 1, KØUDW 1.

NEW ENGLAND DIVISION

CONNECTICUT: SM, Robert Koczur, K1WGO —

Net	Freq.	Time/Local	QTC	QNI	NM
CN	3640	1900/2000	207	280	K1EIR
CPN	3965	1800 Dy/1000 Sn	108	310	KA1BHT
NVTN	28/88	2130	20	231	WA1EMI
WCN	78/18	2030	95	449	WB1GXZ
RTN	13/73	2100	81	295	KA1JAN

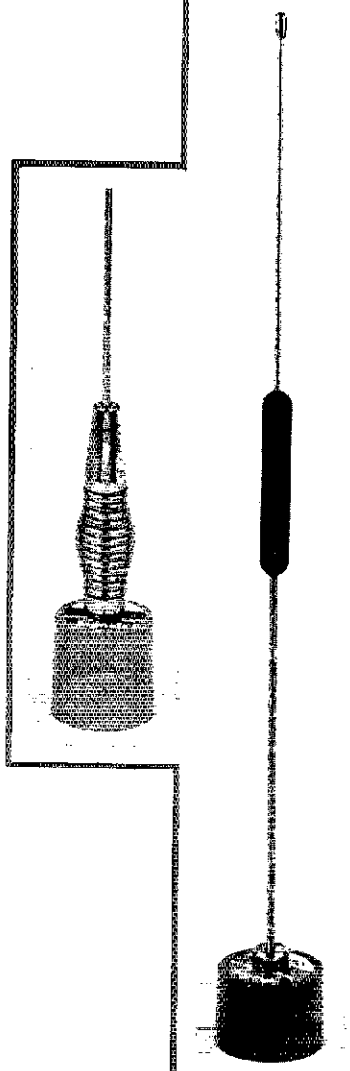
After five years of section-level administrative responsibility, the time has come for me to move along to new adventures. I have enjoyed very much the opportunity to serve our section and to develop the numerous programs of the ARRL within it. As I reflect upon this period, I am especially proud of the many activities in which the section has been involved: the fight over the No-Code proposal, the implementation of the Section Manager system, the CAP/CT ARES Agreement, the new frequencies and expanded phone bands, sanctioned amateur radio programs in the public schools of Connecticut, a section-wide OBS, PIO effort, the new Volunteer Examiner Program, the upgraded OO/Amateur Radio Auxiliary program, the growth of ARES activities/membership, and the rapid growth of the "new-Technology" modes of operation. We are an active section and can take pride in our accomplishments. Finally, I would like to thank the members of my leadership team for their support, the many affiliated clubs who have provided me with information on amateur radio activities in their respective areas, and to the many section members that I have had the privilege of meeting and corresponding with, for their friendliness and positive input. It has been honor to serve the section and I wish K1WGO all the best in carrying on the fine tradition of excellence established in the Connecticut Section . . . 73 Pete, KA1KD. . . Now the news. Happy Thanksgiving to all. WB9IHH has received his FCC RADAR Endorsement. FARA involved with the Oyster Festival in Norwalk. Nutmeg Chapter QCWA up to 86 members. All section clubs PLEASE make sure that your correct mailing address is on file at Hq. KM1E recently operated from the home of S79WHW. With winter weather approaching always remember to leave a break between repeater transmissions. Traffic: W1EFW 341, WB1GXZ 272, KA1GWE 161, K1EIC 152, K1EIR 121, K1UQE 116, KA1JAN 86, KA1EGE 68, K1AQE 52, KA1BHT 52, W1BDN 43, WB8TDA 33, KA1XG 28, N1BOW 18, K1FYS 10, W1CUH 7.

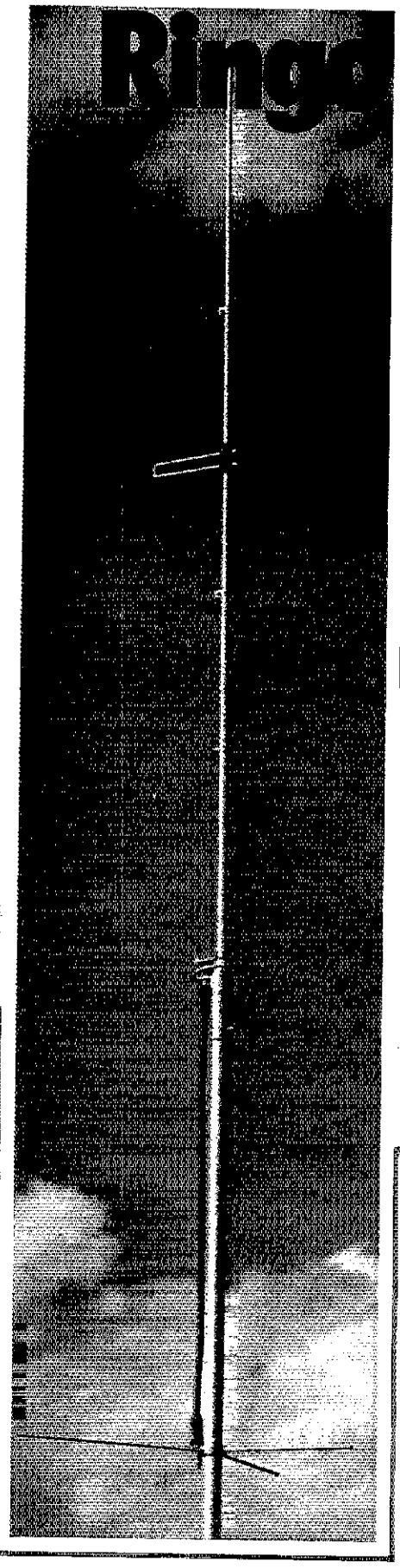
EASTERN MASSACHUSETTS: SM, Rick Beebe, K1PAD — STM: KA1GBS. SEC: W1IAY. ASM: K9HI. ACC: K1AZE. OO/RFI & BM: WA4STO. TC: KA1IU. PIO: WA1IDA. SGL: K1BCN.

Net	Mgr.	Freq.	Time (loc)/Dy	QNI	QTC
EMRI	WA1LPM	3.658	1900/2200/Dy	466	480
EMRIPN	K1BGW	3.880	1730/Dy	314	309
EM2MN	KA1AMR	23/63	2000/Dy	502	162
NEEPN	K1BZD	3.945	0830/Sn	62	11
HHTN	WB1CMQ	04/64	2230/Dy	380	235
EMRISS	N1AJJ	3.715	2030/Dy	238	94
CI2MN	N1BYS	045/645	1930/Dy	273	99

Well, I've been SM (previously SCM) for 6 years now and I have decided to not run for reelection. I'll continue as Vice Director but with family commitments and work, I don't feel that I am putting everything I should into the SM job, so it's time for someone else to take a shot at it. At this writing, I know of at least one petition, so there is at least one interested party. KD2BE, who operated Cycle Mobile with a tour group on the Cape this summer, wrote to compliment the CI2MN for excellent service on the group's traffic. The hams on the Cape sure know how to make the tourists feel welcome! Sturdy Memorial Club is still taking advantage of the ARRL Outgoing QSL Bureau by sending in the whole club membership's cards. WA4STO is rapidly getting all of his OO's accredited under the new Volunteer Monitoring Program. KA1MI, from Nepra, gave an interesting talk at the Barnstable Radio Club with the able assistance of W1TTY. Massasoit Club suffering from some drift problems on their repeater. The Pilgrim Massasoit and Whitman Clubs combined to have a flea market in Taunton. It sure is good to see our clubs cooperating in their activities. Our STM, KA1GBS, has passed her Extra. Billerica Club had an interesting talk on SWLing. WA1TBY put out another great issue of the NETWORKS with a nice article on tfc handling of the future. There are four or five traffic handlers with packet stations on the air, so I expect that we in Eastern Mass will be on the leading edge of changes in how we handle tfc in the future. Mail traffic anyone? Colonial Wireless has moved their repeater to 144.52/145.12. Traffic: KA1GBS 829, KA1EXJ 296, N1BGW 291, K1ZYW 226, N1AJJ 212, K1GRP 194, WA1TBY 169, N1BHH 160, KA1AMR 127, K1CB 111, WA4STO 102, W4NWM 96, W1CE 94, KA1EPO 89, WA1LPM 80, N1ER 68, N1BYS 50, K1ABO 35, WA1FNM 35, KA1KVI 31, WA1SNH 26, WA1DXT 25, K1BZD 24, KA1EID 19, W1QLL 15, N1CKN 10, K1LCQ 7, KA1DJV 6, W1ZHC 4. (July) K1ZYW 185, KO1O 62. (June) KO1O 66, K1LCQ 10, KA1DJV 8.

MAINE: SM, Cliff Laverty, W1RWG — SEC: KL7IJG. STM: AK1W. PIO: KA1TJ. TC: KQ1L. OO/RFI: W1KX. BM: W1JTH. ACC: KB1JF. SGL: K1NIT. Aroostook ARA fur-





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nished comms Solon triathlon Aug. 25 with KA1ENL KA1KME KA1CQX K1TFX N1BJW WA1UPK KA1CNC W1JSY K1TFW N1BGO WA1YNZ KA1JC W1UWT. Comms for Dollars for Scholars provided by KA1FX6 KA1FXI K1EMK KA1C KA1BHF KA1AVU N1BLZ. Maine PIAs include N1CFL N1CIQ N1BTE N1CST. Aug 1 KA1TJ KA1JOJ KB1JF prov comms Northern Lights Classic 5 km foot race Aug 11 KA1TJ KA1TE WA1JCN W1KX KB1JF prov comms Wilton Blueberry Festival 10 km foot race. PSHR: WA1YNZ 90, AK1W 88, N1BJW 84, WB1GLH 84, KL7IJG 81, W1RWG 69.

Sea Gull	27	1000	180	K1GUP
Late Pine Tree	23	105	34	WA1YNZ
CenMaine Emer	9	216	16	W1WCI
MePub Svc	4	86	4	KL7IJG
AroostookEmer	4	59	2	WA1YNZ

Traffic: W1ISO 151, KA1JOJ 113, WB1BYR 88, WB1GLH 84, N1BLZ 70, N1BJW 64, AK1W 62, W1RWG 62, KL7IJG 61, W1BMX 45, WA1YNZ 38, WB1CBP 33,W1KX 28, KA1JPR 19, W1WCI 19, W1JTH 16, N1BUG 14, W1EZR 12, KA1KFC 9, KA1FTL 7, KA1TJ 7, W1OTQ 5, W1AHM 2, W1CTR 1.

NEW HAMPSHIRE: SM, Robert C. Mitchell, W1NH — STM: W1TN. SEC: Open. NMs N1NH KI1M. W1BYS back in Florida. KA1LHF KA1LJI now Techs. N1ANC Silent Key. Larry's former call was W1CVK. K1ACL now District Emergency Coordinator, a stepping stone to Section Emergency Coordinator. KA1KTI now Advanced. W1OMZ to have UHF repeater soon. W1HJT seen at Charlotte VT hamfest. KB1MV now Extra. New England DXCC meeting is Nov. 10. Only EC reports were W1FYR, N1ACB K1OIQ. The Nashua 2 Mtr & 220 Mtr repeaters now tied together. W1RCC mobiling to California and back. KA1ACC needs 3 more for 5BDXCC. Another great 1RN outing and meeting at W1QYY's QTH. Our thanks to Tom and Zalga for their outstanding hospitality. K6UXO/1 now ORS. Happy Halloween. Traffic: N1NH 510, N1CPX 316, K6UXO 213, KK1E 193, W1TN 166, W1FYR 165, KI1M 116, N1AK8 87, K1UWB 76, W1CUE 70, K1TQY 58, W1ALE 49, K1PQV 44, KA1HPO 34, WA1YZN 26, KV1S 10, K1UQX 9, K1OIQ 7, N1ALM 6, N1BVI 6, W1LQQ 4, KA1GOZ 4.

VERMONT: SM, Ralph Stetson, KD1R — Greetings from Vermont, where fall is in the air and the leaves are starting to show their colors. As we drive to work lets try to be aware of the kids returning to school. Fine job to KU1H for first VT station to work BY land (BY5RA) reported by K1OXD better luck next time Dave. Well done to Al K1YZK and to Kerry KA2UOQ for the work done with Jerry Lewis MDA fund raiser on Channel 22. By now I'm sure that you have all participated in SET 1984 so let's get the reports in on time. Nets: VTN 31/133/85; Carrier 27/737/42; VTPhone 4/64/8; CVFMN 4/38/3; VTFMN 31/557/64; GMN 27/316/28; VTSSB 31/419/87; VTRFD 4/47/11. PSHR: AE1T 110; KT1Q 88, N1ARI 86, KD1R 68, AE1T 156, W1KRV 88, KT1Q 73, KD1R 65, N1ARI 62, N1COB 42, W1KJG 17, W1OAK 16. As you fill out your Station Activity cards, turn them over and fill out the PSHR section as well. I'm sure more then 4 of us qualify each month. So Very 73 til next month. Traffic: AE1T 156, W1KRV 88, KT1Q 73, KD1R 65, N1ARI 62, N1COB 42, W1KJG 17, W1OAK 16.

WESTERN MASSACHUSETTS: SM, Don Haney, KA1T — STM: W1UD. TC: KA1JJM. OO/RFI: N1CM. PIO: WB1CJH. SEC: WB1HIH. Pleased to welcome WA1MLH as Asst. EC for So. Worcester County. Congrats to WA1MJE and N1AZG as first in WMA to be certified as FCC Amateur Auxiliary, extension to OO activities. Very successful Yankee Rowe test with over 30 ops assisting CD and Red Cross. HCRA plans to give amateur exams on Jan. 12. KA1APR has new way to lower antenna SWR — take lightning hit on top of vertical. WMA ARES and Nat'l Weather Boston and Albany have Statements of Understanding; KA1JJM appointed liaison by NWS. Regret to advise that KA1BNN and WB1EKC Silent Keys. WA1FCD (Scott at W1PUO) moved back to EMA after two years of high traffic and ARES activity in WMA. PSHR: WB1HIH, W1KK, KA1EKQ, KA1T. Traffic: KA1T 168, W1UD 163, W1SJV 142, KA1EKQ 97, WB1HIH 88, W1KK 54, K1JHC 28, KR1R 24, WA1OPN 23, W1ZPB 6, WA1MJE 1.

NORTHWESTERN DIVISION

ALASKA: SM, David W. Stevens, KL7EB — STM: KL7T. SEC: KL7QS. OO/RFI: AL7FL. PIO: NL7CP. Congrats to Neol Chenoweth who passed the Official Observer certification and is now an Amateur Auxillary to the FCC Field Operation Bureau. KL7GNP-QSL Manager is requesting all hams to send their address and changes to 4304 Garfield Anchorage, AK 99503. The September flea markets were a tremendous success, thanks goes to all the workers. Alaska Pacific Net 14.292 @ 6 A.M.; Montley Group 3933 @ 9 P.M.; Seasaw Net 3900 @ 8 P.M.; Snipers Net 3920 @ 7 P.M. Traffic: AL7FJ 74, KL7VL 51.

IDAHO: SM, Lem Allen, W7JMH — SEC: KD7HZ. STM: W7GHT. PIO: WB7PFQ. OO: KU7Y. Club News: Twin Falls Club has a booth at the fair with ham radio demos. Kootenai Club also at their fair, helping with tickets, etc. Boise Club held Volunteer conducted FCC Exams Aug. 6 and will go again with exams on Saturday, Oct. 27, at 9 A.M. at Boran High School. Next sked exam Feb. 5. ARRL Matters: NW Director Mary Lewis, W7QGP, and husband, W7JWJ, gave VE Seminars at Twin Falls and Boise, preparing VE's for giving their first exams. Their efforts were well appreciated. People and Things: K7OAL trying new portable antenna. N7DHM has new 2-M antenna up. W7BNE W7BMS WA7NRP winterizing 146.40/00 Harrison repeater. Cinnabar 147.84/24 repeater and Snowband 146.02/62 repeater back on normal status (even better). KA7PMP upgraded to Extra. N7FDW N7GJQ WB7VWH now Generals. KA7THF KA7HAF now Techs. Congrats all! Write me if you upgrade, and I'll publish it here. Net Reports:

Net	Freq. Md	Time (local)	Sess.	QNI	QTC
FARM	3935 LSB	8 P.M.	31	1676	40
ICD	3990 LSB	8:10 A.M.	23	675	22
IMN	3635 CW	9 P.M.	22	228	93

General: Check your guy wires this year. What damage would you sustain if a guy wire broke? Replace your Feed Lines every 5 years. Sunlight deteriorates polyethylene. Traffic: W7GHT 147, W7JMH 68, K7TM 11, N7DHM 7. (July) K7TM 11.

MONTANA: SM, Les Belyea, N7AIK — SEC: W7LR. STM: KF7R. OO/RFI: KS7U. ACC: WB7TWG. PIO: WA7GQO. SGL: W7JMX. ASM & TC: K0PP. BM: KB7SE. New officers for the Treasure State chapter #104 QCWA are W7DB, pres.; W7BIS, v.p.; W7DEO, secy.; W7OIO, historian; K7GL W7BOZ W7JMX VE6VN, directors. The Gallatin ARC will offer amateur exams Novice through Extra in Bozeman on Saturday, November 10 in room 540 Federal Building, send Form 610 to the SM (see page 8 this issue for address), walk-ins will be welcome. New Novice operators

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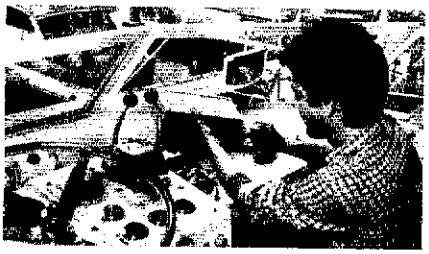

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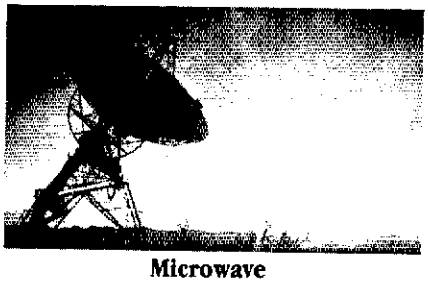

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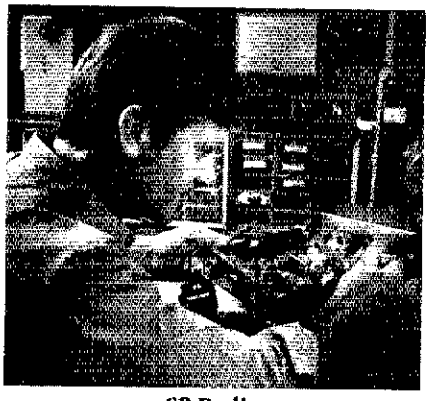

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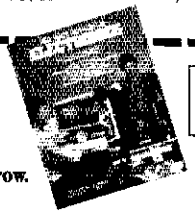

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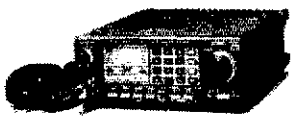

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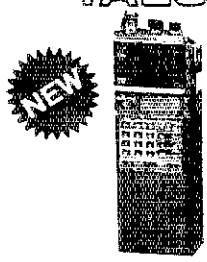

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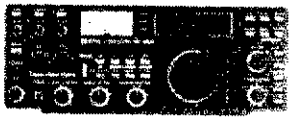

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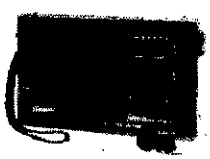

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in Libby are KA7TQY and KA7TRW age 11 and 10. Congrats to the Butte ARC headed by WA7PZO for making ARRL Special Service Club, we now have four in Montana. The Yellowstone ARC will conduct this year's Montana QSO Party from 1700Z Nov. 10 to 0400Z Nov. 11. Sorry to report WA7HIX W7JLD and W7RJR as Silent Keys. PSHR KA7NMA.

Net	Sess.	QNI	QTC	Mgr
MTN	31	1224	173	KB7SE
IMN	22	205	65	KY7I
MSN	3	26	0	K0PP

Traffic: WB7WVD 122, KA7NMA 63, N7AIK 45.

OREGON: SM, William R. Shrader, W7QMU — STM: W7VSE. SEC: N7CPA. PIO: KC7YN. SGL: KA7KSK. ACC: WB7WTD. RFI: AK7T. OO: N7SC. STC: N7ENI. Upgrades: KA7QPP (Tech); KA7IKN KA7CXP KD7WD (Adv). Congrats. This list should increase in length with the new VE exams being administered throughout the section. Big news for Amateur Radio this month was the saving of at least one life during the Willamette Raft Race for Muscular Dystrophy due to the excellent communications team of KA7QQV WB7OEX KD7YB KA7CUI KA7KDM and others. They were members of the Marion-Polk ARES group and coordinated two rescues during the race. McMinnville ARC display at the Yamhill Co. Fair was a success. W7TC KA7FEE KA7FEF and WB7NLP are the first members of the Amateur Auxiliary of the FCC Field Operations Bureau. KB7CW proud father of new YL harmonic. Father Moran, 9N1MM, will be in Portland in early September sponsored by the OTVARC, Hoodview ARC, and the Willamette Valley DX Club. Large group of traffic handlers on PSHR this month: AL7W W7VSE WA7VTD N7DOC N7BGW KX7W WB7OEX KX7T. Great work! OSN totals: QNI 577, QTC 734. Traffic: W7VSE 523, W7LRB 215, W7ZB 182, AL7W 170, K7OVK 127, KX7W 109, N7DOC 99, KX7T 74, WB7OEX 71, N7BGW 33, W7DAN 1. (July) W7LRB 26.

WASHINGTON: SM, Joe Winter, WA7RWK — STM: K7GXZ. SEC: W6IIH. PIO/SGL: W7CKZ. TC: K7UU. OO/RFI Coord.: KB7WC. BM: KD7G. ACC: WB7QNS.

Net	Freq.	Time(Z)	QNI	QCT	Mgr.
WARTS	3970	0200	2824	189	W7SFT
WSN	3590	0245/0545	534	155	N7CSP
PSTS	145.33	0130/0630	173	124	W7IEU
NTN	3970	2000	1150	70	W7UU
EWTN	146.04	0130/0630	81	72	WA7CBN
NWSSB	3945	0230	702	147	K7WNE

Eve Anderson, WB7QNS replaces K7RS as ACC on his resignation. I wish to thank Willis for the fine job he has done and wish Eve much success in her new job. Eve's address is 517 Berkeley Ave. W, Tacoma, WA 98466, 206-564-8347. Contact Eve if you wish to become an ARRL Affiliated Club, a Special Service Club or other club matters. The Amateur Auxiliary for volunteer monitoring began on Sept. 1 but is not fully implemented. Please read the article in QST pg. 11. We need more Official Observers and need to create Local Interference Committees. This new and important program needs YOU to help "keep our house in order" by helping our fellow hams with their on-the-air operating. I hope you will contact me (see QST pg. 8 for address) and request an application. Nominations will be solicited soon for the 1984 Hiram Percy Maxim Memorial Award (QST, Aug. 1983, p. 54/Dec. 1983, p. 65). It would be wonderful if you nominated the winner. Now is the time to think about nominating some worthy young League member from this section. Lower Col ARA W7DG the 1st Spec. Serv. Club in the Section is now displaying the SSC logo on their newsletter. The Chehalis Valley ARS had a two-day amateur radio demonstration at a local mall. KD7TH was in charge. Radio Club/Tac.: 20 members provided comms. for the Puyallup River Raft Race from Orting to Puyallup, KD7QI coordinated 2 mtr. and 220 MHz. freqs., KA7DGX was at starting, K7QLC and W7OIV kept track of everything on computers while others were at check points. W7DK club jackets are very popular. Over 100 are worn now in the Tacoma area. Look for the blue and gold! It was my pleasure to visit with the active and growing Issaquah ARC. KIRO TV's WX man, Harry Wappler, gave an interesting program. KC7KR, NCS for "Harrys Hams" made the arrangements. The club donated a full set of ARRL books to the Public Library. WB7VAS heads the 1985 Crooked Stick & Rat's Nest Contest. Look for it! Mount Baker ARC: 7 mbrs. furnish comms for Everson Days and 5 turn out for simulated Earthquake drill. Their monthly bunny hunts are still popular. Traffic: WB7WOW 647, W7DZX 536, KD7ME 425, W7LG 233, WB7OGA 188, K7GXZ 167, N7ANE 166, N7CSP 142, K47F 94, W7HNA 60, W7GB 58, K7CTP 47, W7IEU 41, KR7L 38, N7DDP 36, WA7BDD 28, W7APS 25, KD7MW 22, K7AJT 18, N7FXM 17, W7LUP 16, K7OXL 8, W7AIB 3.

PACIFIC DIVISION

EAST BAY: SM, Bob Vallio, W6RGG — Asst SMs: W6ZF N6DHN. SEC: W6LKE. STM: NI6A. K6APW maintained his NCS skeds using battery power while on vacation. OO K6ARE is the First in our section to pass the certification exam and is now a full-fledged member of the Amateur Auxiliary to the FCC's Field Operations Bureau. Congrats! The Alameda/Contra Costa County Bloodbank has a new HF antenna installed by WD6FRP KB6P KB6APL KG6HF NI6A WA6KTL; all of whom are officers of the Northern Alameda County ARES group. NI6A is working on his Packet Rdio gear, but he took time out to help KB6BGB WB6HPA & WA6KTL install a new 2 mtr antenna at the Berkeley Red Cross. K6MFV W6SZN & I attended the Clayton City Council hearing on their proposed antenna restriction ordinance. Almeda County RACES is working on their newly acquired COMM VAN. MDARC held their annual picnic at Lafayette Reservoir. NBARA's new board member is N6IIP. Traffic: W6VOM 201, WB6DOB 172, K6AGD 130, K6APW 110, NV6T 69, NI6A 29. (July) WB6DOB 169, WB6UZX 34.

NEVADA: SM, Leonard M. Norman, W7PBV — SEC: WB5VDV. STM: W7BS. DEC: K7HRW. TC: K7ICW. ACC: KX7Q. Nevada Bell Telephone Company is offering directory listing for ARO's. They appear in their directory under "R". W7VR spoke to NNARA members about crystals. While some Southern Nevada Radio Amateurs were visiting Flagstaff Hamfest others: N7BDM W7BES N7BIG N7BIH N9CBD W9CKM KA3CZZ KA7DMY WB7EHN N7KR W7LTL KA7RKO N7SSB K7THB WA7UHZ KC7YX and others were assisting the Red Cross with communications for flood victims of Moapa Valley. WB7VUK and KD7KC are setting up a repeater before we loose 220. AD7K repeater update: 04/65 LAS, 04/64 Montezuma Peak (20 W of Goldfield at 85K), 18/76 Kingman AZ, 25/85 Warm Springs Sumit 50 E of Tonopah, 19/79 Apex, 22/82 Utah Hill (St. George, UT) 28/88 Mt. Potosi (SW LAS), 31/91 Logandale, 34/94 Tropicana (LAS), 09/89 LAS, 18/78 RACES 21/81 Henderson, 24/84 Apex. Traffic: W7BS 83, W7PBV 5.

PACIFIC: SM, James Wakefield, AH6CO — Look to your local club for your VE appointment. If it is not a VEC then

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contact BIARC, HARC, or MAUI clubs for the VE appointment. HARC plans first testing in November and Maui is scheduled for first part of January. Equipment acquisitions are KH6IJ a TR7600A, KH6GJN a SB220, and AH6CO a very used Temp 2020. KH6MX on Maui also has a TR-7600A. Maui members on Run to the Sun on August 5 were AH6AM WH6C AH6DV AH6EE KH6H NH6H KH6HA KH6MD NH6O KH6SQ and KH6UU. Appointments are available and urged for those who really want into Ham Radio. New OO program looks good. EC always good and others to fit your interest. Short News this month due to Pacific Division Convention. CUL. Traffic: KH6RQ 55, KH6HIJ 46, KH6H 3.

SACRAMENTO VALLEY: SM, Ron Menet, N6AUB — I am very sorry to announce that I have accepted the resignation of Jack Littleton, KY6Q, Section Traffic Manager, effective 1 November 1984. Jack has done a tremendous service to the Sacramento Valley Section through the almost single-handed creation of a formal NTS traffic system. Such a system has never before existed. This has been done in spite of many obstacles. You have our sincere gratitude, Jack. Jack resigns due to increased pressures of both school and full-time employment. We will, therefore, be looking for a replacement for Jack. Hopefully, he/she will come from within the group which has participated in the SVTN. Any volunteers? We would all be the loser if Jack's efforts were allowed to simply die. Special thanks also to Tom Dollard, WB6WFG for his continuing efforts with the State Legislature in Sacramento. Have a good SET. Traffic: K6SRF 114, N6CVF 112, WA6WJZ 91, N7AUB 17, KY6Q 12, WB6SRQ 10.

SAN FRANCISCO: SM, Bob Smith, NA6T — STM: K6TP. SEC: KE6LF. SCRA is our first SSC Club in the section, also was the first club in the section to administer Amateur Testing at their Flea Market. The Volunteer Examining Program is underway at the Club Level. MARC had guest speakers from VIACOM CABLE at a recent meeting — better get used to talking to them now — you will probably have to contact them sooner or later about CATVI. REDXA had Fr. Moran, 9N1MM, as their guest speaker. A good turn out made Fr. Moran very welcome for dinner and his presentation. Don't forget the 'REDWOOD EMPIRE AWARD' during the Oct. QCP. Work one station in each of the Redwood Empire counties and submit it to REXDA for the Award. Hats off to the G.S. Ladd Radio Club and their help with the Olympic Torch Relay — good job. DNARC is meeting first Wed. of the month, check the local rptr. for time and place. Recent PSHR members: KK1A, W6IPL, W6RNL, K6TP, K6TWJ, W6NL & N6FWG. Try handling traffic and join the fun and public service. Traffic: KK1A 539, W6IPL 440, K6TP 183, W6NL 158, K6TWJ 96, N6FWG 95, WB6RTE 10. (June) W6NL 253. (May) W6NL 374.

SAN JOAQUIN VALLEY: SM, Charles McConnell, W6DPD — SEC: WA6YAB. STM: N6AWH. TC: WA6EXV. Asst. SMs: W6TRP and K6YK. W6UKT is a Silent Key. The Kings ARC now meets on the 1st Thursday of the month in Armona. KI6U won an ARRL Foundation Goldwater Scholarship. Congrats Paul. KB6AMM and KB8DXZ are Generals. KB8BZG and KB5EEV are Techs. WD6BLH has WAZ. W6JOV has a TR2600. WD6DET N6AWH K8ZTT and W6DPD have IC O2ATs. WB6MCG has an IC 37A. K6DT has returned to Bakersfield and was able to get his old house back. AH6CO (ex W6PSQ) visited in the Section after attending the Pacific Division Convention. The 1985 Fresno HAMFEST is set for May 3-5, 1985 at the Tropicana Inn in Fresno. The Swap area will be covered this year. The 1985 DX Convention is April 19-21, 1985, at the Centre Plaza Holiday Inn in Fresno. Mark your calendars now so you do not miss these 2 outstanding events. I wish everyone a Happy Thanksgiving. Traffic: N6AWH 55, W6SX 41, W6DPD 25, WA6YAB 20, WD6FRS 6, N6IWD 4.

SANTA CLARA VALLEY: SM, Rod Stafford, KB6ZV — STM: W6PHT. SEC: K6ITL. ACC: W6MKM. PIO: N6BIS. TC: K6HLE. Welcome to the new Public Information Officer, N6BIS. The PIO is the section resource person on public information and public relations matters and is also responsible for recruiting and guiding the activities of the local Public Information Assistants within the section. N6BIS is currently working on establishing a speakers bureau in the section made up of amateurs who are willing to go out into the non-ham community and give non-technical amateur radio talks to groups such as service clubs, schools, etc. If you are interested in becoming a PIA or speaking to non-amateur groups in your area, please contact the PIO. Now that the 1984 Pacific Division Convention is history, it's time to begin planning for the 1985 convention. As yet, no one in the Division has stepped forward with a proposal to host the event. Talk it up at your club meetings to see if your club or a couple of clubs can combine their efforts and plan the convention. K6EUB recently became a Silent Key. He was very much involved in public service communication in and around the San Jose area and was a past board member and past president of the Santa Clara Valley Repeater Society. K6GZK has a new 10 mtr FM repeater on the air on 29.640 MHz. W6NLG has been appointed a VEC and provides a recorded telephone message regarding upcoming testing sessions in the Division under the new VEC program. The number for the recording is 408-255-9000. W6PRI operated as W23PRI during July and August to commemorate the 1984 Olympics. He spent a great deal of time working the Novice portions of the HF bands to allow Novices the opportunity to work a 'W23' station. N6IIU organized a special event coinciding with the Summer Olympics Soccer Games held at Stanford. KB4OG and W23OG were the calls used to handle traffic for the olympic soccer players and to operate the special event station. Over 4,000 contacts with 71 countries were made during the operation. Participants included N6IIU, KA6PLO, K6OG, WB6OML, WA6ZBX, KA6NDX, WB5VUL, W6ASH, N6JCD, N6AUV & WA6ROM. In Palo Alto, several amateurs provided communications for the bicycle race through a business district of that city. KT6W acted as net control and was supported by W6CIE, W6HFJ, WA6NIL, WA6OHQ & KA6YFB. Now that FM equipment for 23 cm is commercially available, activity on that band has increased recently. KU6U and KA6EOT own and operate K6GHZ/R on 1291.00 MHz. WA6AXX/R is on 1292.10 MHz. Both repeaters have good coverage in the San Jose-South Bay Area. The Williams Hill Amateur Radio Relay Society has a new repeater on the air on 145.49 according to WB6IZF. The call sign is KA6AZI/R. They have a net on that frequency on Tuesdays at 1900 local. The Williams Hill group just had their 7th Annual Smoked Hamfest. Attendance was good and so was the BBQ. WA6HAD has been busy copying W1AW bulletins dealing with the VEC testing program and then transmitting them on the Novice portions of the 40 meter band. Those of you who are interested in emergency communications should be getting all your equipment rounded up in case this winter turns out to be a 'wet one.' Check your battery packs, chargers, generators and your foul weather gear to make sure all

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IC-27H/voice synth 319 m
IC-211 2m Xcvr 299 mce
IC-251A 2m Xcvr 389 me
IC-255A 2m FM Xcvr 169 c
IC-490A 430-440 Xcvr 429 m
SM-2 Desk mic 25 mc
HM-12 Hand mic 25 m
IC-2AT 2m FM HT 169 e
BC-30 Desk charger 49 e
KDK
FM-2016 2m FM Xcvr $159 c
FM-2030 2m FM Xcvr 189 f
KANTRONICS
Interface II,c64 hamtext demo $299 v
Hamsoft for VIC-20 29 w
Field Day II Reader 89 c
KENWOOD
TS-130S Xcvr $469 wfc
TS-130SE Xcvr 469 f
MB-100 Mobile mt 19 m
TS-180S/DFC Xcvr 459 w
TS-180S/DFC/CW filter 489 mf
PS-30 Power supply 99 w
TS-520 Xcvr 399 mfce
TS-520/CW filter 429 e
TS-520S Xcvr 429 mw
TS-520SE Xcvr 449 mfe
VFO-520 Remote VFO 99 ve
SP-520 Speaker 19 e
TS-530S/CW filter 519 v
TS-530S/270/1.8 filts 549 m
TS-820/DG-1 Dig Xcvr 499 mfe
TS-820S Xcvr 529 ce
VFO-820 Remote VFO 129 f
TS-830S Xcvr 599 mf
TS-830S/500 Hz 629 m
TS-830S/500/1.8 filts 659 m
SP-230 Speaker 49 m
DFC-230 Dig freq control 119 c
DFC-230 (new close-out) 169.95 mfve
VFO-240 Remote VFO 119 f
PC-1 Phone patch 49 f
SM-220 Monitor scope 259 w
BS-8 Pan kit 49 e
SM-220/BS-8 299 m
R-300 SW receiver 149 c
R-1000 SW receiver 299 mf
TS-600 6m Xcvr 449 m
TS-700A 2m Xcvr 329 mc
TS-700S 2m Xcvr 369 fc
VOX-3 VOX accessory 19 m
TM-201A 2m FM Xcvr 239 f
TR-7400A 2m FM Xcvr 169 m
TR-7730 2m FM Xcvr 189 w
TR-7850 2m FM Xcvr 249 mw
TR-9000 2m Xcvr 289 w
RM-76 Control unit 49 e
PS-20 4.5A ps 29 m
MC-50 Desk mic 29 m
MC-30S Hand mic 19 mw
MC-35S Hand mic 19 m
HC-10 Clock 69 m
MFJ
949B Ant tuner $ 89 w
MACROTRONICS
CA-650 Interface/Apple $ 79 m
TA-650 Interface/Apple 79 m
MICROLOG
ACT-1 Terminal $289 w
NEC
JB-1201M 12" grn monitor $119 m
NYE VIKING
SKM-1 Memory keyer $ 99 w
PACE
Comm. II 2m FM Xcvr $149 w
Comm I 2m FM HT 69 m
Comm. MX 2m FM HT 69 m
PANASONIC
RF-2600 SW receiver $119 w
WV-1400 B & W camera 129 w
ROBOT
70 Monitor $149 v
400 Scan converter 329 m
800H/800CH kit Term 369 c
SPECTRONICS
DD-1K Kenwood dig disp $ 69 c
SWAN/CUBIC
102BX Xcvr $399 e
102BXA Xcvr 449 c
PSU-6 Power supply 99 c
TEMPO
Tempo One Xcvr $249 c
AC One* AC ps 89 c
*Not sold separately
DC One DC ps 49 c
S-15 2m FM HT 189 m
TEN-TEC
505 Argonaut Xcvr $199 m
509 Argonaut Xcvr 249 m
AC-5 5w ant tuner 9 m
206 Calibrator 19 m
210 1A power supply 19 m
405 50w linear 149 m
251 9A power supply 79 m
525 Argosy Xcvr 329 e
276 Calibrator 19 m
520 Triton II Xcvr 289 m
545 Omni-A Xcvr 299 m
546 Omni-D ser B/CW/NB 469 m
546C Xcvr/2 CW filts 649 m
560 Corsair Xcvr 769 me
560/250/500/1.8 849 m
263 Remote VFO 139 m
580 Delta Xcvr 399 mc
283 Remote VFO 129 mw
252 Power supply 79 m
255 Power supply 129 m
260 Power supply 139 me
280 Power supply 99 m
670 Keyer 19 m
227 Ant tuner 59 c
214 Desk mic 29 m
234 Speech proc 69 m
TORRESTRONICS
Dig disp; Ten-Tec Omni-A $ 59 m
TRAC
TE-464 Keyer/CW proc $ 39 m
UNIDEN BEARCAT
BC-300 Scanner $269 c
VOCOM
Power Pocket Amp $119 m
YAESU
FT-200 Xcvr (Tempo One) $249 f
FP-200 AC supply 89 f
FV-200 Remote VFO 89 f
FR-101DIG/6m/2m/FM 289 m
FT-101 Xcvr 379 f
FT-101B Xcvr 389 c
FT-101B/CW filter 419 m
FT-101E Xcvr 449 c
FT-101EE/CW filter 429 v
FT-101EX Xcvr 389 mw
FT-101EX/AM filter 429 m
FT-101EX/DC 429 m
FT-101Z analog/CW/fan 469 m
FT-101ZD Dig Xcvr 469 mw
FT-101ZD/CW filter 499 v
FT-101ZD Mk II Xcvr 549 m
FT-101ZD Mk III Xcvr 549 m
FV-101Z Remote VFO 89 mv
YC-601 Dig display 99 w
FT-301DIG/CW filter 349 m
FT-301AD/CW filter 389 f
YO-301 Monitor scope 169 m
FT-901DM Xcvr 589 mv
FT-902DM Xcvr 769 wt
YK-901 Keyboard 89 m
FT-107M/DMS/CW filt 499 w
FTV-107 Xvtr w/2m 189 f
FV-707DM Dig VFO 89 m
FT-ONE/4 filts/ram/fm 1489 e
FP-757GX Power supply 119 f
HF/726 HF module 159 m
FRG-7700/MU Rcvr/mem 399 me
FRT-7700 Ant tuner 39 m
FRV-770DF Rcv VHF conv 79 m
FTV-250 2m Xvtr 149 f
FT-620B 6m Xcvr 289 w
FT-627RA 6m FM Xcvr 199 m
FT-221R 2m Xcvr 289 m
FT-227R 2m FM Xcvr 129 e
E-72S 6.5' cable 15 w
E-72L 13' cable 19 w
FT-730 440/ces autopch 349 v
FT-780R 430 Xcvr 399 m
FT-404R/TTP 440 HT 119 m
SC-1 Stn console 89 m
FP-80A 4.5A ps 49 w
MD-1B8 Desk mic 29 v

TVRO EQUIPMENT

AMPLICA
100° LNA $149 m
DRAKE
ESR-24 Satellite Rcvr $369 m
GENERAL INSTRUMENTS
CRHF Satellite Rcvr $799 m
GILLASPIE
7600 Satellite Rcvr $199 m
WILSON
YM-1000 Satellite Rcvr $269 m

9-25-84

(1) This list was prepared from an inventory taken on the date shown. The letters after the prices indicate in which store the equipment was located at that time. The quantities vary. In some cases there are several of an item; others, only one. Due to the lead and distribution time of this publication, some of the items may have already been sold by the time you see this ad. However, due to the number of trades we are involved in each day, some items are in stock that are not listed. (2) We reserve the right to sell certain power supplies and accessories only with matching transmitters or transceivers, depending on our stock situation. (3) Sometimes used gear is serviced after we receive your order. Please allow for a few days delay in shipping your order. (4) No trades on used gear. (5) Used gear policies do not apply to New Equipment special, Closeouts, etc.

USED AES SHOP TEST EQUIPMENT

HEWLETT-PACKARD
608E 10-480MHz sig gen 1895
8640B 5-1024Mhz sig gen w/options 002/003 5895
SINGER-GERTSCH
FM-10CS w/RFM-10A, FIM-3 & ODM-1 4995
OAM-1 AM module for FM-10C 395

Location	Local Phone	Nationwide	In-State
m = Milwaukee, WI 53216; 4828 W. Fond du Lac Ave	(414) 442-4200	1-800-558-0411	1-800-242-5195
w = Wickliffe, OH 44092; 28940 Euclid Ave	(216) 585-7388	1-800-321-3594	1-800-362-0290
f = Orlando, FL 32803; 621 Commonwealth Ave	(305) 894-3238	1-800-327-1917	1-800-432-9424
c = Clearwater, FL 33515; 1898 Drew Street	(813) 461-4267		
v = Las Vegas, NV 89106; 1072 N. Rancho Drive	(702) 647-3114	1-800-634-6227	
e = Chicago, IL Erickson Communications (Associate)	(312) 631-5181		

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Order Hours: M-F 10 a.m.-7 p.m.
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Virginia orders and quotes call toll free: 800-572-4201

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Terms: No personal checks accepted. Prices do not include shipping. UPS COD fee: $2.25 per package. Prices are subject to change without notice or obligation. Returns are subject to a 15% restocking fee. All items are covered by the manufacturers' warranties.

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Lacombe, Louisiana 70445
Information & Service: (504) 882-5355

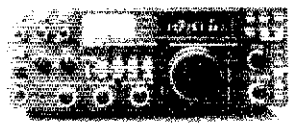
Ask us about any AT&T telephone, answering machine business system, smoke alarm, medical alert, or accessory.

AT&T PHONE CENTER

ICOM

HF TRANSCEIVERS

IC 745
HF XCVR/Gen Cov RCVR 777.95



IC 751
HF XCVR/Gen Cov RCVR 1179.00
With PS35 installed 1299.00

IC 730
8-band Transceiver with Mic 549.95

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IC 271A
All-mode 2m Transceiver 599.00
IC 271H New 100-watt 2m XCVR ... 789.95
IC 27A New 2m compact mobile ... 329.95
IC 290H 25-watt all-mode 2m XCVR 479.95

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NEW IC 02AT
2m Handheld
10 Memories
Battery backup
Scanning; LCD readout
Offset in memory
Keyboard select PL tones
Uses 2AT accessories

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IC 3AT 220 MHz HT/Touchtone ... 229.95
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IC37A 220 MHz 25-watt mobile 399.95
IC 47A 430-440 25-watt compact ... 415.95

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All-mode 430-450 XCVR 689.95
IC 471H all-mode 75-watts out ..... CALL
IC 490A all-mode 430-40 XCVR 575.95

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RP 3010 440 MHz 899.00
RP 1210 1.2 GHz ..... CALL

Call for repeater-mobile unit special packages.

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M80C Commerical M80 ..... 429.95
New M5 all-channel HT 325.95

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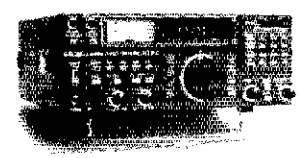
PS 15 12V for HF 146.00
PS 25 for the 271A 89.95
PS 30 System Power Supply 229.95

SWL RECEIVERS



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General Coverage Receiver

COMMERCIAL LAND MOBILE AUTHORIZED DEALER
Call for information

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229 1kW Tuner/Meter 249.95
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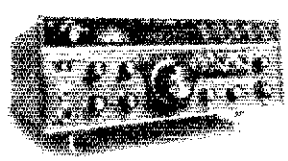
2991 Battery Pack for 2591 ..... 39.00
2700 Speaker Mic for 2591 ..... 39.00
—All Accessories in Stock—

New Century 22 CW Xcvr ..... CALL
2510 Model B 399.95
Satellite Station for Oscar 10



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Model 560—999.95

Full line of accessories in stock for Corsair and Argosy: power supplies, VFOs, and filters. Call for Quotes

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SM3 Speaker Mic 34.50

KDK

NEW FM2033 2m 25-watt 259.95

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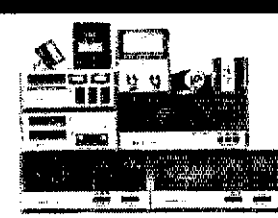
—Call for Quotes—



WELZ

TP5X Handheld watt meter 18.95
SP10X 1.8-150MHz Watt Meter 32.95
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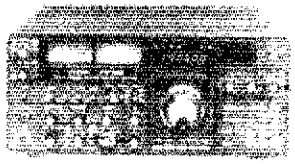
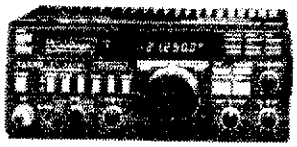
HF TRANSCEIVERS



FT One Transceiver . . . . . CALL
All-mode, General coverage RCVR



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with General Coverage RCVR
includes CW keyer, AM/FM, CW filter

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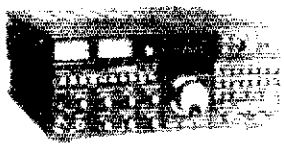
Compact HF XCXR

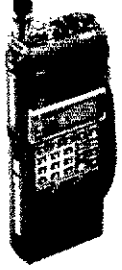


FT 980 CAT System . . . . SPECIAL 1469.95
AC Power Supply, Full Break-in CW,
SSB/AM/FM/FSK, RF Speech Processor

SWL RECEIVER

FRG 7700 General Coverage 419.95
VHF Converters, Active Antennas available

HANDHELDS



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NOW IN STOCK
2m Handheld
Introductory
Special . . . . . CALL

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All accessories in stock including:
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(Optional modules for 6m, 430,440 MHz)
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With General Coverage Receiver
Optional Automatic Antenna Tuner

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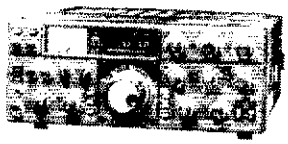
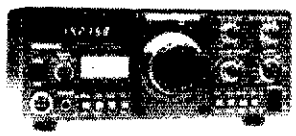
With General Coverage Reciever



TS-830S Transceiver . . . . . CALL
160-10 Meter With Power Supply

TS-530SP Transceiver . . . . . CALL
160-10 Meter
With Power Supply & Notch Filter



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Compact 80-10 meter

RECEIVERS

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General Coverage Receivers

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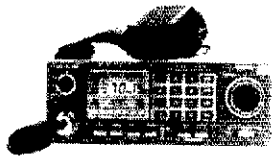

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2-meter Mobile Units, 45 or 25 Watts

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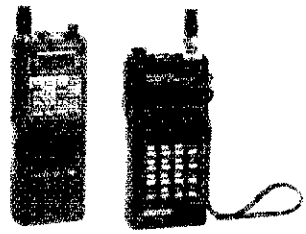
2m/70cm FM Mobile Transceiver

TM-201A/TM-401A . . . . . CALL
2m/70cm FM Transceiver, 25 or 12 Watts

TW-4000A . . . . . CALL
Dual Band 2m/70cm FM, 25 Watts

NEW TS-711A/TS-811A . . . . . CALL
2m/70cm All-mode Transceiver
Useable as mobile or base station

HANDHELDS



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2m FM Transceiver with memories,
LCD, scan, digital code squelch

NEW TH-21A, 21AT/TH-41A, 41AT . CALL
2m/70cm Ultra-compact FM Transceiver
Pocket size, Optional touchtone pad

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Revisions 3.2 now available!

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is in order. DECs, ECs and AECs should be checking into the ARES SCV Section Net on 145.45 on Wednesdays at 1900 local. The SCV Section Managers Net is a place where you can get information about ARRL activities and other items of interest. If your club or group is involved in some activity, announce it on the Sec. Mgrs Net on Tuesdays at 2100 local on 146.76 or at 2130 local on 146.925. Traffic: W6YBV 399, W6KZJ 209.

ROANOKE DIVISION

NORTH CAROLINA: SM, Rae Everhart, K4SWN — SEC: AB4W. STM: K4NLK. BM: K4IWW. PIO: WA4OBR. SGL: AB4W. ACC: K4SWN. Congrats to recent upgrades: WD4CNQ, KA4KVL, KB4HJP. To WC4T for being appointed Division Assistant Director. To TEARC (High Point Club) on becoming a VEC. To WC4T and KF4WY on becoming a Charlotte VEC. The VEC program is going great in the state with 80 Extras and 30 Advanced registered with ARRL/VEC. With 4 VEC's in NC Section, all VEC's need to work with each other in scheduling exams, coordinating exam material and information. With the more experienced VEC's giving the New VEC's tips and answer any questions pertaining to any problems. November Exam Schedule: November 4 Concord Hamfest; November 10 TEARC VEC High Point; November 24/25 Greensboro WCARS/VEC. WB4HRR has gotten SKY-WARN Weather Net operational in mountain foothills. 40M band conditions worst ever for net operations - NJ4L/KB4IVV. Super large crowd at Shelby Hamfest. STM K4NLK had a good traffic meeting was swell meeting traffic handlers. SEC AB4W had a large meeting concerning SET, EC work, HAM WATCH program. HAM WATCH plates now available for $4.00. Order thru your EC or AB4W. You get your own callsign on this special plate. K4CAW and WB4EXW worked much 2mtr EME and WAS. Interested in League's new Volunteer Monitor Program? Write me. It's new FCC/ARRL monitoring agreement for our self-policing of the airwaves. Hurricane Diana landed on NC. Strange lady but NC Amateurs were prepared and waiting. The Governor and state officials placed a lot of importance on ham radio for very reliable emergency communications. Many volunteers moved into stricken areas. Those trained in traffic handling and ARES really paid dividends in this disaster. The SEC worked very close with the VA/SC SECs. Thanks to all who gave of their time and equipment. Forsyth Co ARES provided emergency communications in local hospital fire. Tnx Forsyth Sqdrn CAP newsleter. Happy Thanksgiving to all. Traffic: K4NLK 277, WB4WII 186, KA4EYF 183, NJ4L 139, WB4HRR 136, WB4N 99, WA4MNR 91, WA4OBR 78, WD4LRG 76, KB4FWL 47, K4JHF 47, N4CJJ 42, WD4CEB 37, K4SWN 37, WB4FQK 33, NE4J 26, K4DDY 23, N4UE 23, K4GI 20, WD4HTE 18, K4QXA 14, KA4YMY 14, KU4W 10, WA4TTS 9, W4PRG 8. (July) N4UE 15.

SOUTH CAROLINA: SM: Jimmy Walker, WD4HLZ — Hurricane Diana bumped the SC coast but saved its worst for NC. And once again, you responded to the communication emergency with determination and dedication. Shelters were set up in Horry and all adjacent counties. Red Cross officials requested that amateurs provide communication for these shelters and you responded as professionals. The training you have participated in over the last 3 years proved invaluable during the tornado and hurricane disasters. Now you know what is required to support a disaster area during a communication emergency. One concern I have is Net activiation (mainly local VHF). The answer I get as to why a net was not in session during a set of conditions, "There wasn't an emergency." With this attitude you have lost your most valuable resouce — REACTION TIME. If you activate after someone declares an emergency, you will be several days too late. RETHINK your position and be SELF-STARTING. Traffic: K4WJ 249, K4ZN 214, W4ANK 133, W4NTO 107, KB4BZA 86, W4FMZ 77, W0IKT 77, K4FRX 52, KA4LRM 41, WJ4P 29, K4ZB 23, WB4UDK 20, WD4FJP 17, WA4MIY 13, KA4AUR 11, WA4JWS 8, W4DRF 2.

VIRGNIA: SM, Claude Feigley, W3ATQ — STM: WD4ALY. SEC: WB4UHC. ACC: WD4KQJ. OO/RFI: W4HU. BM: AB4U. PIO: WN4VAU.

VTN	1 PM	3097/7260	AA4AT
VSBN	6 PM	3947	WB2OMZ
VSN	6:30 PM	3680	KB4WT
VN (Early)	7 PM	3680	K4JST
VN (Late)	10 PM	3680	KR4V
VLN	10:15 PM	3947	KA4IUM

KB4WT WB4CGI W4HU KE4EQ WA4PGM and WB4J have passed their exams and are now certified members of the Amateur Auxiliary. Anyone who is interested in joining this monitoring program contact W4HU or the SM. W8IRT and K4JDJ are new OO's. N4VG and KB4KPY are new OBS's. More Bulletin Stations are needed contact AB4U or W3ATQ for details. WB4FDT has moved to Williamsburg to complete his Masters Degree. Congrats to Gay, W4UG and John, N4MM, on their reelection as Director and Vice Director of the Roanoke Division. The following DEC's reported for August: KA3DTE KA4ERP N4EXQ NM4R WA4RTS WB4SHK K4VWK WB4ZNB and K4BAV. 19 ECs submitted reports. All ARRL appointments are being reviewed. If you hold an appointment such as: ORS OO OBS OES EC or DEC you are required to submit monthly reports of your activity to maintain your appointment. PSHR leaders for the month are N4GHI AA4AT K4JST WA4CCK WD4ALY and KB4WT all with over 100 points. N4GHI and AA4AT made BPL. ARRL has started issuing a Packet-Radio newsletter called "Gateway". Subscriptions are available to ARRL members and nonmembers at $6.00/member and $9/nonmember. Traffic for the month — 3286 with 45 stations reporting. Traffic: N4GHI 592, AA4AT 576, WA4CCK 288, WD4ALY 274, W3ATQ 262, N4EXQ 206, KR4V 188, WD4OCW 164, KA3DTE 133, K4JST 118, NN4I 107, K4ECD 102, KB4OG 102, KA4IUM 100, WB4PNY 82, KB4WT 74, K4JM 66, NT4G 52, WB4UHC 37, KI4LO 35, KB4PW 30, K4MLC 28, K4VWK 28, N6ANQ 18, N4IBY 18, WB4DQZ 17, N4FNT 17, WB4EBD 15, KA4ERB 15, WA4TVS 14, WB4KIT 12, KE4AP 9, K4GR 8, NW4O 7, WB4ZNB 6, N3RC 5, WB4FDT 4, W4LXB 4, W4PVA 4, KC4HN 3, W4KX 2, N4LE 2, W4TZC 2.

WEST VIRGINIA: SM, Karl S. Thompson, K8KT — SEC: K8QEW, STM: KD8G, SGL: K8BS. ACC: WA8CTO. TC: K8CG. Rpt. Coord: WD4KHL. WV Fone Net has now moved to 3865 still at 6 PM each day. Come by and join in. Tnx to TSRAC who helped with net more. I attended both the Bluefield and Ripley Hamfests and met lots of friends at both. Regret to report that W8PZT and K8BEP are Silent Keys.

Net	Freq.	Time	QNI	QTC	Sess.	NM
Hillbilly	14290	Noon Sn	118	17	4	KC8YU
WVNN	3730	6:30	131	25	30	KD8RD
WVMD	7235	11:45	716	46	31	W8FZP
WVFN	3865	6:00	669	103	31	N8AJC

Traffic: KZ8Q 204, WD8LDY 132, W8JWX 96, W8LYV 61, KA8OGF 51, K8UOY 50, N8AJC 46, N8EMQ 44, W8FZP 41, K8TPF 34, WA8KCJ 32, K8KT 29, K8QEW 24, KD8G 23,

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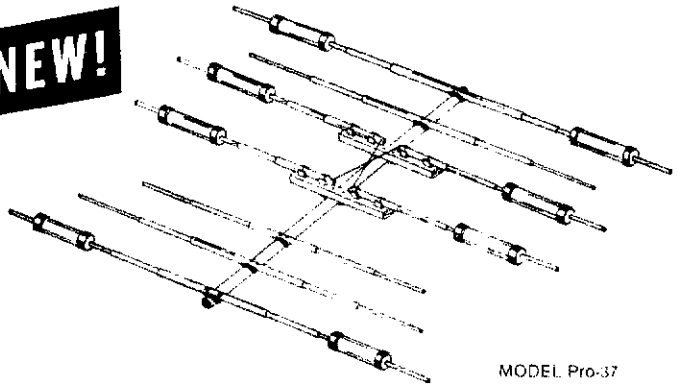
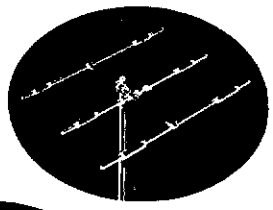


MODEL Pro-37



TA-33 Jr
Three element rotary beam aerial.
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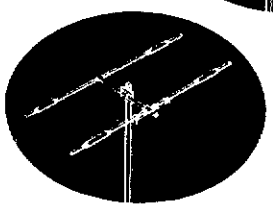
Rated to 300W.



Two element rotary beam aerial.
10-15-20M.
Rated to 300W.
MODEL TA-32 Jr

The Pro-37 follows in the Mosley tradition of high performance, dependability, and quality construction. The Pro-37 is pre-drilled for easy assembly. No adjustments or measuring. Average assembly is about 1½ to 2 hours. As with all the Mosley antennas we use stainless steel hardware throughout. Rugged construction makes our antenna the cleanest, strongest of its class, no cluttered elements or boom to cause electrical and mechanical problems down the road. Put it up and leave it up. In performances it has no peers...It is as broadbanded or broaderbanded than any antenna made. Its gain and front to back is as good or better than other antennas in its class, even those with longer booms. Mechanically we feel it's the best built.
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We're quite excited about the Pro-37 and we know you will be too!

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V-4-6

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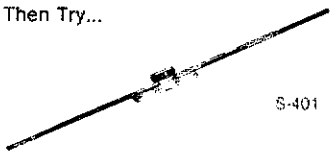
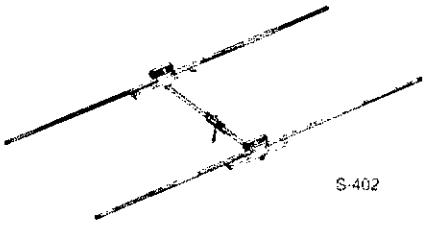


S-401

BROADBANDED SINGLE ELEMENT
Can be made into 2 element or 3 element later.



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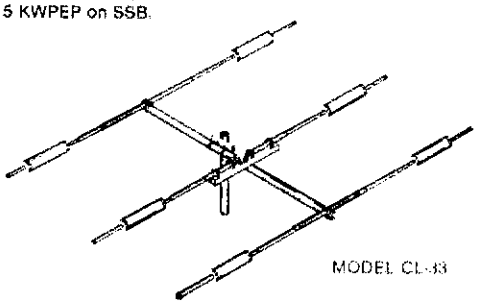

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W8HZA 19, NC8G 6, WDØAII 3.

ROCKY MOUNTAIN DIVISION

COLORADO: SM, Bill Sheffield, KQØJ — SEC: WBØFQB. STM: WDØAIT. ACC: WBØDUV. OO/RFI; NCØF. TC: KQØP. SGL: WDØGQL. BM: WØMDT. PIO: KAØPYH. DEC's WBØTUV & KCØWR. Nov is the last mo that testing will be done by the FCC in Denver for amateur licenses. Colo has always had a FCC office so it was not difficult to travel. With the new VE program and with testing beginning in mid-January and continuing through the year at different pts in the state at school clubs, hamfests & special activities, we should have a full range of testing programs. The OO/RFI Coord, NCØF has been notified that nearly all present OO's have completed their exams and qualify for the Amateur Auxiliary. Congrats to all. NCØF is trying to promote new members for this very important program. Let him know if you can help. Our SET program this year was probably the most productive we have ever had in Colorado. Most of our EC districts completed a successful SET with their new ARES members getting involved. Name droppers: NØETI new ham radio school principal for the ARA one of the largest well respected school. KAØPYH new section PIO. KDØRW & NCØF technical committee for the section repeaters. Happy Thanksgiving. NETS: Col; QNI 686, QTC 41-inf 146, Time 735,26 sess. CWN; QNI 121 QTC 98 Time 558, 31 sess. CWXN; QNI 2963, QTC 3419, Time 2790, 31 sess. HNN; QNI 1450, QTC 111-inf 246 Time 1383, 31 sess. NCTN; QNI 191, QTC 63, Time 328, 23 sess. Traffic: NØBQP 2617, WAØHJZ 1989, KØRXK 710, KØJAN 441, NØCXI 280, WØACH 240, WDØAIT 159, KBØZ 148, NØDZA 122, WØLAE 100, WØEJD 65, AIØW 41, WBØNHA 36, W5HRS 30, KØDJ 22.

NEW MEXICO: SM, Joe T. Knight, W5PDY — DEC: KB5XD. STM: KV5U. NMs: WA5UNO K5LL. W5VFQ. TC: W8GY. ACC: W5HD. Southwest Net (SWN) meets daily on 3583 at 1930 local and handled 198 msgs with 155 stations in. New Mexico Roadrunner Net meets daily on 3939 at 0100 UTC and handled 174 msgs with 997 stations in. New Mexico Breakfast Club meets daily on 3939 at 0630 local and handled 121 msgs with 895 stations in. Yucca 2-Mtr Net 78/18 & 93/33 handled 8 lsgs with 84 checkins. Caravan Club 2-Mtr Net 66/06 handled 8 msgs with 131 checkins. SCAT 2-Mtr Net 66/06 handled 18 msgs with 420 checkins. Early Birds, 10 msgs & 661 QNI. Sorry to report the passing of W7LUH. Welcome to NM KI3L & WBØCMZ both of Gallup. W5NUI moved to Oregon and is certainly missed. Traffic: ND5T 434, W5DAD 172, N5EXC 82.

UTAH: SM, Ron Todd, K3FR — STM: W7OCX. SEC: NA7G. BM: WA7MEL. OO/RFI: KD7FL. ACC: KB7XO. PIO: N7BHC. TC: K7RJ. Now that many of you are recovering from some of the early examinations by volunteers it would be a good time to think how you can help the process; your comments on the conduct, content and format will be greatly appreciated by both the League and the volunteers. Speaking of volunteers, if you really want to get in to having a quality licensing program, your help is what we need. Contact your local club or the Volunteer Examiners in your area. You need not be an Extra Class, as monitors and helpers are always needed. With the holiday season fast approaching, I hope that you have your skills up for handling traffic and other activities of this time of year. Your SM would like to hear from you on activities such as Talk to Santa like UARC will be doing at SLC hospitals again this year. Contact Dave, N7BHC (801)-967-5896 if you need help in arranging PR for your event; he was super in getting "Newest Frontier" aired on TV along with PR before hand. Happy Holidays to all. Traffic: K7HLR 275, WA7MEL 135, WA7KHE 104, W7OCX 16, KO7H 10, N7BQE 3.

WYOMING: SM, Dick Wunder, WA7WFC — Asst. SM: KA7AWS. W7TVK. I would like to express my thanks to WØOGH, for the fine job as Section Traffic Manager. Larry has accepted a transfer to Phoenix, AZ. Good luck in the new job. KC7QE N7GED & N7BVX were some of the communicators assisting with the Race of Champions 100 mile horse race. W7JID N7EQC NG7L & WA7LEA were part of the volunteer examiners administering exams at the WIMU Hamfest in Jackson, WY this month. RACES is alive and doing well with KD7AN as State RACES Officer. KC7AR reports the Wyo. Cowboy Net held 23 sessions with 726 QNI & 20 QTC. Traffic: WB7NHR 301, W7HLA 23.

SOUTHEASTERN DIVISION

ALABAMA: SM, Joseph Smith, WA4RNP — SEC: N4DMA. STM: NAJAW. SGL: KA4WVU. PIO: WO4W. BM: KF4VV. OO/RFI: K4ELV. The ARRL Sweepstakes are this month with CW Nov 3rd and 4th and Phone on Nov 17th and 18th. No job is finished until the paperwork is done so let me clear up some confusion about forms used by appointees. The CD-210 form or a message containing the same info should be sent to the SM by the sixth of each month by each EC, ORS, and other traffic handlers for inclusion in this column. The CD-212 should be sent to the SEC by each EC or DEC. The net reports go to the STM and OO/RFI reports go to the OO/RFI coordinator. The OBS reports go to the BM. Any PIA reports or public service reports go to the PIO. W4NTI has begun a 10 mtr SSB net on 28.7 at 8:30 local on Mondays in an attempt to foster like nets around the state to provide a backup for the 2-Mtr repeaters should they fail in bad weather. August reports — PSHR: WD7JDH, WX4I WA4LXP W4CKS KB4GPN and WA4RNP. BPL: WD4JDH. DRN5 reports 955 messages in 62 sessions with AL rep by W4WJF WA4JDH W4CKS WB4IXA NW4X and WX4I. CAND reports 1027 messages in 31 sessions with DRN5 rep by NW4X WX4I and W4CKS. Traffic: WA4JDH 689, W4CKS 140, NW4X 78, WX4I 73, WA4LXP 44, WA4RNP 41, KB4GPN 25,K4AOZ 22, W4DGH 12, WB4TVY 12, KC4AF 10.

GEORGIA: SM, Eddy Kosobucki, K4JNL — SEC: WB4ABY. STM: K4VHC. ACC: WA4ABY. BM: W4BIA. OO/RFI: W4RZL. PIO: WA4PNY. SGL: W4BTZ. TC: K4UDR. NWS: WA4PZD 1984-85 Atlanta RC leadership-KC4MJ, pres.; KF4MK, v.p.; KF4CQ, sec; N4IBK, treas.; WA4WKC, act; WA4ABY, editor; KF4CQ 1985 Hamfestival Chrm. W4RMJ, W4RZL & W4ARH are full-fledged members of the Amateur Auxiliary to the FCC's Field Operations Bureau. In order for the (VOLMON) Volunteer Monitor Program to be successful we need more of u members. I know that many of you are more than qualified, have the necessary equipment & the time. Won't some of u come forward & volunteer. Savannah amateurs received Proclamation from the City of Savannah for their continuous assistance in providing communications to the citizenry. Congrats to both the Macon & Warner Robbins amateurs for the FB job during the Ga State Special Olympic Games. Sunbelt Expo agn handled in first class fashion by the gang in Colquitt County. All of our Georgia section nets need support. Won't u take a few minutes a couple nights a week to give them some support. BGMRC in Newnan now the 4th SSC club in the section. Who's next? MALARC gang continue with fantastic activities. Don't forget the annual

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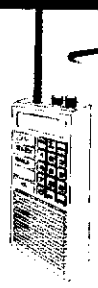

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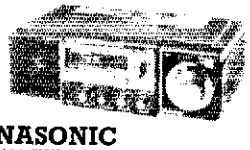

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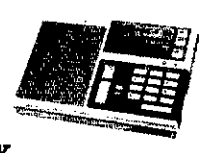

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ege, inc.

Stone Mt. Hamvention on Nov 10 & 11. They promise the best one yet. Tnx to all in the section for the phone calls & sympathy cards we received on the death of my wife's father. Happy Thanksgiving. Traffic: W4PIM 203, K4NM 46, K4EV 34, K4VHC 28, W4JWO 24, W4BIA 22, N9ECB 16, WB4NTW 16, W4HON 12, K4BAI 8.

NORTHERN FLORIDA: SM, Phil O'Dwyer, WF4X — OO/RFI: K4JJE. Welcome to Jim Stone, K4JJE our new OO/RFI Manager. The new FCC Amateur Auxiliary program for Official Observers has generated lots of interest; inquiries on this and the OO program as well as OO reports should be sent to Jim. K4MZK was our first to be accredited to the Amateur Auxiliary Program. The Silver Springs club in Ocala became the fifth to earn the Special Service Club Award. N4ADI will be glad to provide info on this award. Remember that the ARRL Hq is still interested in getting reports on CATV! and that the cable companies are responsible for correcting problems. WB4YQP is new manager of QFNS and invites OT Timers as well as Novices to join him on 3715, daily at 8 P.M. CDT or CST. Condolences to family and friends of W4IQB. Terrible RF propagation has forced traffic nets to adopt new procedures, relay stations act as alternate NCS and stations QSY to two meters or to lower HF band. Traffic: WF4X 524, N4PL 330, WA4QXT 297, WB4ADL 280, WF4Y 201, WX4H 196, WA4EYU 131, KB4LB 112, KF4U 110, KB9LT 110, N4EDH 108, WB4TZR 102, WD4IIO 101, WB4GHU 94, WB4YQP 92, KC4VK 91, K4VND 90, KD4KK 79, N4HMD 76, W4MGO 72, W4GUJ 64, WD4IUI 58, W4KIX 53, KC4FL 52, WX4J 49, W4DTV 39, KI4CQ 35, N4JAQ 33, NQ4P 25, WD4MLQ 25, NS4C 24, N4UF 20, KF4RR 17, WD4JDU 15, KA4OFG 15, WD4HBP 14, N4JHI 12, N4ADI 12, KF4TM 10, WD4EQB 9, NA4F 9, KF4GY 8, W4FI 8, W8IM 5, N4IIP 5, WB4FJY 5, WD4AWG 4, N4DY 2, WA4PUP 2, N4HTU 1.

SOUTHERN FLORIDA: SM, Richard D. Hill, WA4PFK — SEC: W4SS. STM: K4ZK. TC: KI4T. BM: WA4EIC. ACC: AA4WJ. PIO: W4WYR. SGL: KC4N. OO/RFI: W4SS. WA4EIC reports total bulletin activity of 135 bulletins received and transmitted this month. Bulletin stations reporting were: WA4EIC 20, WD4KBW 6, AA4MI 27, K4IEK 12, W4DL 28, WT4F 20, AA4BN 18 and W4ESH 6. W4LLA is working a carrier in the Mediterranean and handled 129 phone patches during August. KE4O is back on QFN and is the Thursday night RN5 rep — KE4O says computer operation is taking some time to get used to. W1NJM sent a radiogram to me from Newington and said he expects to be back in Florida about December 4. Lou in Naples is now N4KNP — he is ex-KA4ASZ. W4MPV has been very active on the SWFTN as an NCS — five times during August. The Melbourne Hamfest in early September wa excellent as usual — it was a wet weekend due to the sudden development of a tropical storm off of the coast. The traffic handlers breakfast was one of the best attended in my memory — there were close to forty persons in attendance. 73 de WA4PFK. Traffic: W3CUL 3329, W3VR 1027, K4IA 297, K4ZK 297, K4SCL 287, WA4PFK 278, K4EUK 205, KA4GUS 167, KJ3T 160, WA4EIC 155, AF3S 82, WB4AID 80, W4NFK 77, W4DL 76, KA4AMC 71, KA4NXF 63, KA4FZI 60, WA4HXU 57, KF4RL 56, WB4WYG 56, W4DVO 50, W4ESH 50, KY4U 50, WB4GCK 49, KE4O 49, WD4CHO 44, WD4KBW 44, KA4YHS 43, K4FQS 42, AA4BN 39, W3TLV 39, NJ4O 34, KA4BBA 32, W4PKP 31, KF4JA 28, AA4MI 27, KB4KB 25, K9ALX 24, W4LLA 24, K4JI 15, K4JLL 15, WT4F 14, WB8SNT 14, K4IRT 12, K4OVC 12, KA9AKY 11, K4FQU 11, KB4ELQ 10, KA4GDU 10, WD9AEP 9, WK4F 9, W4MPV 9, KB4AB 8, WV4F 8, KA4KDD 8, K7LCA 7, W4WYR 7, WD4NXK 6, WO4D 5, N4IXQ 5, W4MFD 5, KA4SIH 5, KB4AXD 4, KA4RWV 4, K4VSN 4, NX4X 4, KA4EBO 3, KD4GFI 3, W4NNW 3, WA4VGX 3, N4HAS 2, N4ILN 2, KA8AQA 1, KA8CXQ 1.

WEST INDIES: SM, Gregorio Nieves, KP4EW — West Indies Net Slow (WINS) daily 7 P.M. (2300 UTC) on 3.710 MHz. West Indies Net Central (WINC) daily 6:30 P.M. (2250 UTC). West Indies Net Borinquen (WINB) on 3.930 MHz LSB (2250 UTC). The Puerto Rico Amateur Radio Club counted the ballots for the new Board of Directors and as of this report the names are known but the new Board positions will not be known until they meet next week to elect the officers among themselves. This month of September the PRARC will celebrate the annual convention at the town of Bayamon in the "Colonia Hispanoamericana" where some previous conventions have taken place. Congrats to NP4FQ who upgraded to Advance Class. KP4DJ reports the following totals for WINS: QND 313, QTC 0, QNI 82, 31 sessions. Traffic: KP4DJ 28.

SOUTHWESTERN DIVISION

ARIZONA: SM, Erich J. Holzer, N7EH — STM: W7EP. NM's: WA7KQE, WA7FDN, K6LL. August has passed bringing the return to school. KB7FE reports that he and the following helped provide emergency communications when over 47000 phones in NW Phoenix went out of order disrupting routine comm. for Thunderbird Samaritan Hospital: N7GCC AJ7I KA7RFF KD7XG WA7VAH KB7FF K7TJZ N7BHY KA7FQO KA7RBF KA7SWF KA7NEM KA7SDI and K1BOT. The Coconino ARC reports that the following help provided communicatons for the Senior Olympics: N7CXF KA7MGO WA7LTH KA7PZL and WB7EVX. W7YS reports that WB7DGM became a Silent Key. W7YS has qualified as a full fledged member of the FCC's Field Ops Bureau. PSHR this month goes to KB7FE. ATEN QNI 895, QTC 193. SWN QNI 155, QTC 198. As this report goes to press not many reports in but this gives me an opportunity to remind you that there are still openings in the ARRL field organization in AZ. Traffic: KB7FE 404, W7AMM 260, K6LL 201, WA7KQE 50, W7KXE 35, K7JKM 19, K7NMQ 18, K7POF 12, KA7HEV 9, K7RDH 8, WA7NXL 3, WB3LQQ 2. (July) K7RDH 6.

LOS ANGELES: SM, John Walsh, N6UK — ASM: N6ZH. STM: W6INH. SEC: N6ZH. ACC: NF6D. The period of the '84 games was supposed to be "catch-up" time for many of us but has turned out to be "clean-up" instead. Equipment is still finding its way back home, hopefully, in time for the Fall hamming season. The new season starts with a few announcements. We are pleased that N6ZH has accepted the position of Assistant Section Manager. His public service record is known by many and we welcome him to this new assignment. He will continue as SEC until this position is filled next month. Notification has been received that N6MJ N6PE and K6CL have passed the new certification exam and are now members of the FCC's Field Operations Bureau Amateur Auxiliary. Others engaged in this activity should complete the test and mail it to ARRL headquarters. The ARES commitment to the Section has taken another step with preliminary discussions with representatives of the Los Angeles City Fire Department. An optimum method of interfacing with LAFD is being discussed. The QCWA Chapter 7 will have it's Fall Dinner in October. The Olympics did not generate

as much traffic as expected for NTS. K6UY handled most of it. AD7G has been QRL lately due to work. W6ORF has been busy with RTTY messages. Traffic: K6UYK 694, K6YBV 327, W6INH 273, AD7G 153, WA6OCM 67, W6HKE 22, W6ORK 15, K6CL 12, WD8FWZ 5.

ORANGE: SM, Sandra Heyn, WA6WZN — SEC: W6UBQ. STM: WA6QCA. ACC: KA6NLY. BM: W6DXL. OO/RFI Coord: W6RE. PIO: NS6W. SGL: N6HIQ. TC: AA6DD. DECs (by counties): WB6JBI (Orange); W6LKN (Riverside); WA6IKH (San Bernardino); KA6HII (Inyo). Congrats to W6RE, NF6T and W6DXL who have successfully passed the new OO test. Anyone interested in participating in "Operation Santa Claus" contact N6BVU 714-772-5451. Cocachella Valley ARC pres. NR6P reported successful ham booth at Palm Desert Town Center Mall. ATV was used in supporting comm for the Tall Ships Parade; participating hams included: N6AZV, WB6BAP, WB6FLG, KA6HNL, KA6HRE, NQ6J, WB6LQP, NQ6O, KE6RJ, WA6SVT, WB6VVV. ATVers use 146.43 MHz FM for coordination; this is a good place to monitor for ATV info. The Calif Awards Hunters Club maintain the following nets: Sun 9 A.M. 146.52 MHz fm (NC NR6O), Sun 11 A.M. 145.80 MHz A.M. (NC K6HHN), Mon 8:30 P.M. 144.35 MHz ssb (NC WD6AWE) Sun 9:30 A.M 50.175 MHz ssb (NC WA6SBX), Sun 10 A.M. 50.4 MHz A.M. (NC KF6LE). The So Calif Net (SCN) publishes a monthly bulletin "Zero Beat" supported by voluntary donations for info contact editor AI6E. For info on Fountain Valley Amateur Comm Team (FACT) contact pres. KA6TLY or city coordinator N6HIQ. For info on Laguna Amateur Radio Service (LARS) contact KF6SW, N6ITQ or W6JYS. Citrus Belt ARC (C-Bar-C) pres. KE6HR is moving to Oklahoma. For info on current VEC testing in Orange County contact W6IBR. For info on chess nets contact WB6JNA. PSHR: WB6TIF KA6BNW WB6QBZ W6NTN AI6E WA6QCA KA6JHK/t.

Net	Freq.	Time	QNI	QCT	NM
SCN/1(20+)	3598	7 P.M.	266	252	AI6E
SCN/2(13-)	3598	8:15 P.M.	183	98	AI6E
SCN/V(fm)	146.645	9 P.M.	539	430	WA6QCA
RTTY/V	145.12	9 P.M.	485	132	KA6HJK

Traffic: KA6HJK 210, WB6RIF 206, WA6QCA 167, AE0A 136, WB6QBZ 123, N6GOT 106, K6GGS 100, W6RE 93, AI6E 87, KA6BNW 84, W6CPB 42, W6NTN 34, KZ6D 9, K6ZCE 9.

SAN DIEGO: SM, Arthur R. Smith, W6INI — PIO: WA6CUP. ACC: WA6COE. TC: N6NR. BM: WA6HJJ. STM: N8GW. SEC: W6INI. The ARES CW Net (ARESN) has moved to 3725 kHz. Novices and Techs are welcome. Time: 0930 each Sunday. WA6IIK is NCS. Keep monthly traffic reports routed to N6GW by 4th of month. NCTN met 30 times, handled 69 msgs. WANTED: Stations to regularly copy W1AW official bulletins by CW or teletype. Official Bulletin Station appointments available. Contact W8INI for details (addr page 8). Phone 273-1120. WA2NNT and KA6VMK are the recipients of plaques from the SD Amateur Radio Council for their leadership and organizing efforts leading to successful communications in support of the Fairbanks Ranch Olympic event. Eighty hams participated in the communication system. The Santee Swap Meet has been moved to the Hollins Lake Recreation Area. Still the first Sat. of each month, at 0800. For details on Amateur Radio license exams, write to SANDARC — VEC, P O Box 5023, La Mesa, CA 92041. Volunteer examiners from throughout Calif. are needed. Traffic: KT6A 463, KU6D 113, KB6AI 82, N6GW 52, N6AT 28, WA6IIK 13, KM6I 10, KF6TF 9.

WEST GULF DIVISION

NORTHERN TEXAS: SM, Phil Clements, K5PC — Asst SM/ACC: NI5V. SEC: W5GPO. STM: AE5I. BM: W5QXK. PIO: N5FDL. OO/RFI: WB5JBP. SGL: W5UXP. Congrats to Terry, KA5RTU, your new Net Mgr. for the Texas Slow-Speed Net. N5DKW is leaving our section, and we are losing a fine worker and operator - a leader in NTS and ARES work. Good luck to you, Art, and keep in touch. The Amateur Auxiliary, the new enforcement back-up to the F.C.C. Field Operations Bureau, is off to a good start, with lots of interest. This program is headed in our Section by WB5JBP, our OO/RFI Coordinator. Two operators have already passed the exam, and have been accredited as "Volmon" Stations. Like the Volunteer Licensing program, this endeavor will require many hours of dedication by many operators to make the program a success and to keep our bands in an orderly manner. We are in full control of our destiny now, in both licensing and enforcement, and will have no one to blame but ourselves if the system does not work. We will need as many Official Observers in the field as we have Volunteer Examiners, if not more. This is an ARRL program . . . let me know of your interest. (See Aug. 1984 QST, page 11, for details). PSHR for Aug. KA5AZK KA5LQA N5BT KA5SPO KD5FR and AE5I. Traffic: KD5RC 295, N5BT 185, KA5AZK 155, KD5FR 117, AE5I 100, W5QU 56, KA5LQA 52, KA5SPO 33, W9OYL 21, NI5V 15, K5PC 11, N5FDL 7, WD5ICQ 7, N5GKF 6.

OKLAHOMA: SM, Ray Miller, W5RC — SM elect is NB5N: Congrats Dave! Thanks to new appointees: PIA: KE5EA WD5JCE WB5SZQ WA5ZNF WD5IFB. OBS: WA5IMO W5RB KC5OU N5AIP KA5FUU. NM: K5CXP KA5STC. DEC: KE5MT. EC: W5CEP WB5ECM KE5JE N5AGB WB5TTU KE5MU KY5J WA5ZAN W5ZDI WD5JME WD5JDI. ORS: K5GBN WD5JCE KI5P NG5G NG5O WB5SRX. Novice net OCWN operating on 3740 kHz at 9 PM T Th Sat Sn. Thanks to KA5STC NC5C KE5HZ N5CCV KC5OU and others. 3850 RCC going strong with WA5OGE W5GIQ K5JQH W5AHD W5AA W5ZKK KD5CP W5UCJ W5HIM W7LLP W5FW WA5JHB K5GBN W5MGZ KZ5F WA5FVJ W5KLH W5SFZ W5BBH and W5ETL are the regulars "gummin tha rag". Choctaw ARC working on providing ARRL numbered radiograms on cassette — contact WB5OHK. N5AFV had a FB report in the 10-10 News. More FREEWHEEL'ers were W7BNK W5LIL N5PS W5IER WB5RWS K5KW. GSP Hamfest great! Thanks to WD5GJN KB0HH WA5UTO WB0IXU and YL's. WB5RRR N5DUB and others getting into Packet Radio. Traffic: K5CXP 256, W5AS 224, W5RB 168, W5VXU 165, KB5EK 135, KI5P 128, KV5X 128, WB5OHK 96, WB5SRX 92, W5REC 87, WA5OUV 76, NG5G 69, WD5IFB 53, WA5ZOO 47, NO5W 45, NR5L 41, W5SUG 40, WB5LSW 36, K5GBN 34, WD5JCE 33, WA5OGC 31, K5CAY 26, W5VOR 26, KC5OU 21, WA5IMO 18, W5UYH 14, K5ENA 12, W5VLW 10, KA5FUU 7.

SOUTHERN TEXAS: SM, Arthur R. Ross, W5KR — STM: K5QEW. SEC: KA5KRI. ASM: N5TC. KS5V is Affiliated Club Coordinator (ACC) effective Sept. 1. Brazos Valley ARC earned designation as SSC with magnificent package of documents, professional in all respects. Austin ARC application for SSC is in the mill. OOs K5DL and WA2VJL are now full fledged members of the Amateur Auxiliary to the FCC FOB. WB5YUD sent a copy of Republic of the Rio Grande ARC Newsletter from Laredo; The Republic was established in 1840 and lasted one year; club will soon add a repeater dedicated to packet radio; announces a SWOT net at 9 P.M. Central Time on Tuesdays on 144.25 MHz USB. Hispanic ARS plans swap fest in Laredo soon, plenty of activity after a long sleep. WB5TIM upgraded to Advanced, is now KE5PG and congrats go out. AC5K has been active on mobile CW; activated 3 Texas counties and 4 Louisiana parishes for CW County Hunters Net. Austin ARC proudly announces a new op born to KB5SUR and wife KA4OJK, and another to WB5ZFG and spouse. COBS WB5FCO staying quite busy on Austin Armadillo Computer mailbox with 8 ARRL bulletins, 4 propagation forecasts and 1 CRRL bulletin. OO WA2VJL still trying for DX on a nearly dead 15M band. BARN (Beaumont ARC Newsletter) reports new Novices KA5UA KA5UJB KA5UJC LA5UKU; N5ERM upgraded to Advanced, is now KE5PJ. Nice going, fellers. Port Arthur ARC's Golden Triangle examining Committee will start first session in November. WB5ZHA represented Matagorda County ARC at the Hurricane Preparedness Conference in Palacios. The Golden Crescent ARC gave three Novice tests from its first class. W5HZ has his antennas back up from Alicia blow-down; recommends the TH7DX to anyone looking for a beam. WB5VFC learning to use an Apple computer. KN5Y planning trip to VP5 land. NQ5B getting ready for QSCAR 2-mtr and 70cm antennas ready for mounting. K5LTS has been SWLing RTTY with Commodore 64 and AEA's CP-1 interface. W5MPX and wife KA5NDV are growing Xmas trees, raising catfish, keeping bees and putting up a 60 ft tower for a 2-mtr beam. OBS S5KLV reports 4 ARRL bulletins, 4 DX bulletins, 2 CRRL bulletins, 4 propagation forecasts given 114 readings on 8 nets! CAND Mgr W5KLV reports 1027 msgs in 31 sessions with DRN5 represented 100% by STX stations WB5EPA WB5FQU KD5KQ N5EFG N5DFO WB5YDD and W5KLV. OBS N5DFO reports 4 ARRL bulletins, 2 CRRL bulletins, 3 DX bulletins, 3 propagation forecasts, 6 given 15 readings on 8 nets. DRN5 Mgr WB5YDD reports 951 msgs in 62 sessions; STX represented 100% by N5AMK W5KLV N5DFO WB5EPA WB5FQU W5CTZ KD5KQ W5URN N5EFG K5OWK KE5ER and WB5YDD. KA5HBS reports KA5UHP is new Novice in McAllen; blind ham KA5QHG upgraded to Technician and working on General — that's great! Hill Country ARC newsletter reports Kerrville has new repeater on 145.49 MHz-600 kHz. The Beam (Sun City ARC) reports AD W5OVH and her cookbook made headlines in the El Paso Times. Traffic: WB5YDD 522, W5CTZ 517, W5KLV 319, N5DFO 310, WB5EPA 222, KS5V 198, WB5FQU 111, WB5MMI 76, WD5GKH 22.

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Hamsoft — Send/Receive CW, RTTY, ASCII ★ Split Screen Display ★ Message Ports ★ Type-Ahead Buffer ★ Printer compatibility.

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Specifications

Input Filter — Four pole Switched Capacitance Filter with 170Hz Shift RTTY bandwidth of 260Hz nominal. Copies any shift.

Audio Input — Minimum level 5mvRMS. Input impedance is 600 ohms unbalanced. Accepts baudot or ASCII code up to 300 baud. Max input level is 12VRMS.

AFSK Output — Crystal controlled. Mark-2125Hz: Space-2295Hz (170 shift). Level 100mvpp (35mvRMS) standard. Optional 500mvpp (175mvRMS). Output impedance 600 ohm unbalanced.

FSK Output — Open Collector +40 VDC Max. Polarity can be reversed.

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Computer Connection — TTL Compatible. Inputs also RS232 level compatible.

Power Requirements — 11 to 15 VDC (12VDC nominal) 75ma

Construction — Precision Extruded Aluminum Alloy Case

Dimensions — 1.9"H x 5.9"W x 7"D

Weight — 1¾ lbs.

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(4) Closing date for Ham-Ads is the 20th of the second month preceding publication date. No cancellations or changes will be accepted after this closing date. Example: Ads received August 21 through September 20 will appear in November *QST*. If the 20th falls on a weekend or holiday, the Ham-Ad deadline is the previous working day.

(5) No Ham-Ad may use more than 100 words. No advertiser may use more than two ads in one issue. A last name or call must appear in each ad. Mention of lotteries, prize drawings, games of chance, etc. is not permitted in *QST* advertising.

(6) New "commercial" advertisers must submit a production sample of their product (which will be returned) and furnish a statement in writing that they will stand by and support all claims and specifications mentioned in their advertising before their ad can appear.

The publisher of *QST* will vouch for the integrity of advertisers who are obviously commercial in character, and for the grade or characters of their products and services. Individual advertisers are not subject to scrutiny.

Clubs/Hamfests

QCWA Quarter Century Wireless Association is an International nonprofit organization founded in 1947. You are eligible for membership if licensed 25 or more years ago, and presently licensed. It is not necessary to have been licensed the entire 25 years. Members receive QCWA publications and participate in QCWA activities. Come grow with us! Write QCWA, Inc., 1409 Cooper Drive, Irving, TX 75061.

PROFESSIONAL CW operators, retired or active, commercial, military, gov't., police etc. invited to join Society of Wireless Pioneers — W7GAQ/6 Box 530, Santa Rosa CA 95402.

IMRA-International Mission Radio Association Helps missionaries by supplying equipment and running a net for them daily except Sunday, 14.280 MHz, 1900-2000 GMT. Br. Bernard Frey, 1 Pryer Manor Rd., Larchmont, NY 10538.

THE Veteran Wireless Operators Association, a non-profit organization of communications people founded in 1925, invites your inquiries and application for membership. Write VWOA, Ed. F. Plauler, Jr., Secretary, 46 Murdock Street, Fords, NJ 08863.

JOIN the Old Timers Club, an international non-profit organization. If you operated a radio station, commercial, amateur or Armed Forces 40 or more years ago, and have an Amateur license at present you are eligible. Join the real pioneers of ham radio. Write O.O.T.C. Box AA, Mamaroneck, NY 10543 for details.

HAVE A-M capability? Join S.P.A.M. (Society for Promotion A-M) Membership is free. Write: F.A. Dunlap (S.P.A.M.), 14113 Stoneshire, Houston, TX 77060 (S.A.S.E. please).

FIND OUT what else you can hear on your general coverage transceiver or receiver. Complete information on major North American radio listening clubs. Send 25¢ and S.A.S.E. Association of North American Radio Clubs, 1500 Bunbury Drive, Whittier, CA 90601.

FOX-TANGO Newsletters — Since 1972, the prime source of modifications, improvements, and repair of Yaesu gear, free to Club members. Calendar-year dues still only $8 US, $9 Canada, $12 elsewhere. Includes five-year cumulative index by model numbers, or send $1 for index and sample Newsletter. Fox Tango Club, Box 15944, W. Palm Beach, FL 33416.

ATTENTION MORSE Telegraphers. Join Morse Telegraph Club. Meet old wire friends, swap experiences. Where and when do we meet? Contact John Holman, W3INV, 1 Beth Circle, Malvern, PA 19355. 215-644-2471.

FOR SALE: Large wall calendar with AMATEUR RADIO printed in top half. Excellent gift at $4 each, including USA mailing. Enclose self-addressed mailing label. W6LS, 2814 Empire, Burbank, CA 91504.

PLAN YOUR 1985 Summer Vacation in the beautiful Black Hills of South Dakota. The Black Hills Amateur Radio Club will sponsor the Dakota Division Convention July 5-7. This will also be the Club's 50th Anniversary. Would all former members please QSL with brief history, KXØU, Gene F. Bauer, 713 Blaine Ave., Rapid City, SD 57701.

ANNUAL CONNECTICUT Flea Market by SCARA will be held on Sunday, November 11th, 1984 at 9:00 AM at the Park-Rec Center on Linsley Street in North Haven, CT. Adm $1.50, tables $10 in advance, $12 at door. Refreshments served. Talk-in on 146.01/61. Contact Tony Vanacore, AK1Q, P.O. Box 81, North Haven, CT 06473 or call 203-239-5321 ext. 311 days, 203-484-4175 evenings.

QSL Cards/Rubber Stamps/Engraving

TRAVEL-PAK QSL Kit — Converts Post Cards, Photos to QSLs, Stamp brings circular. Samco, Box 203, Wynantskill, NY 12198.

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As founder and president of Amp Supply Co., I guarantee you'll be satisfied with our fabulous amateur radio products. I will only manufacture products I personally would use on the air. All Amp Supply Products now carry a full 2 years warranty against manufacturing defects or parts failure. (tubes are warranted by the original manufacturer) If you are dissatisfied write to me and I'll refund or replace your product within 10 days of purchase from Amp Supply Co. We want you to enjoy Ham Radio with Amp Supply Products.

"TURBO CHARGE YOUR STATION WITH AMP SUPPLY" 73 DENNY K8KXK

LA-1000A 1200 WATT AMPLIFIER

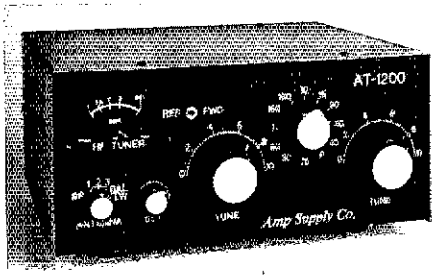
LA-1000A

The LA-1000A is a portable kilowatt now covering 160-15 meters. Typical drive requirement is 100 watts PEP yielding 1200 watts PEP SSB 800 watts CW. The compact linear uses four 6MJ6 tubes, has a tuned input and QSK built in and comes in an attractive gray-on-gray finish.

This is a super linear for all purposes, the LA-1000 excelled during the Heard Island DX pedition with over 30,000 contacts. The rugged design lends itself to continual use during contests and users are even running it on RTTY at 500 watts input.

LA-1000A **$449.50***

AT-1200 TUNER



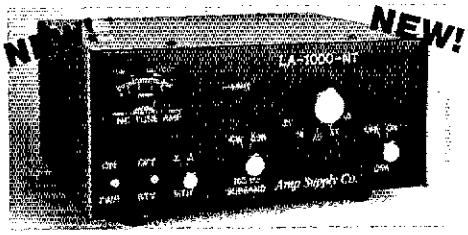
AT-1200

The AT-1200 antenna tuner is the perfect companion for the LA-1000A or any amplifier running up to 1200 watts input. It covers 1.8 to 30 MHz, has an antenna selector switch for 3 coax positions and 1 long wire or balanced feedline, and a built in SWR bridge and meter.

AT-1200 ..... **$189.50***

BL-1500 9:1 5 KW Balun **$29.50***

THE NEW NO TUNE — LA-1000-NT



More contacts, eliminate tune-up time, and less tune-up interference are yours with the NEW LA-1000-NT. The NO TUNE LA-1000 offers full coverage of the 160-15 meter amateur bands. A powerful 1200 watts PEP input and 800 watt DC input is the power rating of the LA-1000-NT. As with all Amp Supply Amplifiers, the NO TUNE LA-1000 features QSK, full break-in CW. Computerized CW and Keyboard Operators will love conversation-like full break-in (QSK) CW.

If you desire a compact kilowatt amplifier that needs no tuning and you have a transceiver capable of delivering 100 watts PEP—The LA-1000-NT is the perfect addition to your radio station!!

LA-1000NT No Tuneup **$529.50***

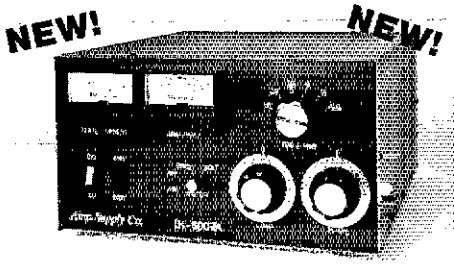
AIM-1™ *Major Antenna break through!*

The AIM-1 is an antenna impedance matching network for random, long wire or loop antennas. It provides continuous coverage from 500 KHz - 30 MHz, is completely *automatic*, no knobs to turn or coils to tap. Installation is simple; hook on wire antenna, ground, coax cable to station and balancing module at opposite end of wire. The antenna is ready for transmission from 1.8 - 30 MHz at up to 3KW PEP.

- SWR max 2:1, 1.5:1 average
- wire lengths should be 1/2 wave on lowest frequency for maximum efficiency.
- inverted V, inverted L, rombic, random wire or loop antennas
- weatherproof • 2 year warranty

AIM-1 ..... **$139.50***
with 130' antenna wire and insulators $149.50*
Stranded Ant. Wire $.08 ft.

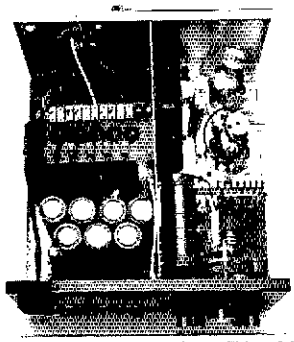
LK500ZA 2.5 KW AMPLIFIER



The all new Amp Supply LK-500ZA 2.5 KW Input Amplifier is the right amplifier, with the right features at the right price. The LK-500ZA comes completely assembled and covers 160-15 meters. Two Eimac 3-500Z triodes in grounded grid are featured with a dual cooling system, one for the power supply and the other cooling the 3-500's. There's only one 2.5 KW amplifier with a pair of 3-500Z tubes in the world that sells for under $900.00.

The Amp Supply LK-500Z!

- 2.5 KW SSB PEP Input: 1500 Output
- 1.5 KW Input CW :900 Output
- 1 KW SSTV, RTTY Input: 600 Output
- QSK Full Break-in CW
- 9" H x 15" W x 15" D
- 117/234 AC 50/60 Hz
- New Improved Bridge Power Supply with Computer Grade Electrolytics
- 1500 Watt Output with Hipersil Transformer



Interior view of LK-500ZA with "Peter Dahl" Hipersil Transformer

LK-500ZA

Wired and Tested **$889.00**
1500 Watt Output
All Mode with Hipersil Transformer . **$1099.50**

SAS-1 Sloper Antenna System 30, 40, 80, 160 Meters ..... **$ 99.50***
AEX-1 33' Self-supporting Vertical Antenna ..... **$ 89.50***
APC-1 Phasing Control System for verticals or dipoles **$109.50***
A-132-S Shielded Balanced feed line 5 KW PEP ..... **$.24 per foot**

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DISTINCTIVE QSL's — Largest selection, lowest prices, top quality photo and completely customized cards. Make your QSL's truly unique at the same cost as a standard card, and get a better return rate! Free samples, catalogue. Stamps appreciated. Stu, K2RPZ, Box 412, Rocky Point, NY 11778 516-744-6260.

FREE samples — stamp appreciated. Conner, 522 Notre Dame Ave., Chattanooga, TN 37412.

QSLs & rubber stamps. Top quality. QSL samples and stamp information 50c. Ebbert Graphics D-3, Box 70, Westerville, OH 43081.

QSL samples — 25¢ Samcards - 48 Monte Carlo Dr., Pittsburgh, PA 15239.

EMBROIDERED emblems, custom designed club pins, medallions, trophies, ribbons. Highest quality, fastest delivery, lowest prices anywhere. Free info: NDI, Box 6665 M, Marietta, GA 30065.

CADILLAC of QSLs — Completely different! Samples $1. (refundable) Mac's Shack, P.O. Box No. 43175, Seven Points, TX 75143.

QSLs — 1) Famous KØAAB custom collection. 2) Railroad employees and railfan's specials. 3) Front report styles. State your sample wants. 37¢ self addressed business size envelope required. Marv WØMGI, 2095 Prosperity Ave., St. Paul, MN 55109.

QSLs Samples 30c (stamps OK) Fred Leyden, W1NZJ, 454 Proctor Ave., Revere, MA 02151.

INTRODUCING: Beautiful natural full color photo QSL cards, made from your color negative or slide. From $285. for 3,000 cards minimum. Free samples, stamps appreciated. K2RPZ, Box 412, Dept. NC, Rocky Point, NY 11778 516-744-6260.

QSLS. Quality and fast service for 24 years. Include call for decal. Samples 50¢. Ray, K7HLR, Box 331, Clearfield, UT 84015.

NEW KID on block — for QSL free samples write Kings Grove Press, Box 9, Ellersiie, MD 21529. Also custom printing and SWL's. Stamp appreciated.

QSL's by W4TG: Prices from $16 per 1000. Send SASE to PO Box F, Gray, GA 31032.

BE SURPRISED - get a variety of cards - 100 for $8 or 200 for $13. Samples $1 refundable. All three colors, fast service, satisfaction guaranteed. Constantine, 1219 Ellington, Myrtle Beach, SC 29577.

FINEST custom QSLs, large cut catalog and samples $1 refundable on first order. Ritz Print Shop P.O. Box 45018, Westlake, OH 44145.

STAMP brings QSL catalog of new designs and samples, from $7 up. 22 years custom printing. WA6SOK, 4056 Acacia, Riverside, CA 92503.

NEW 3-D designs, including Space Shuttle, samples 50¢, 3-D QSL Co., P.O. Box D, Bondsville, MA 01009.

QSL's on woodgrain, glossy, and brightly colored card stocks. Samples 35¢, QOF Press, Box 8111, Eau Claire, WI 54702-8111.

QSL DISCOUNTS: $19.95 per 1000. White cards, black ink, one or two sides. 2-3 week delivery. S.A.S.E. for free samples. Jim's Printing Service, 2155 Young, Memphis, TN 38104.

PICTURE QSL cards of your shack, etc. from your photograph or black ink art work. 500 $22; 1000 $32.50. Send stamp for illustrated literature. Generous sample pack $1; half pound of samples $2. Custom printed cards, send specifications for estimate. Raum's, 4154 Fifth Street, Philadelphia, PA 19140. Phone: 1-215-228-5460.

RUBBER STAMPS: Name, Call and Address, $5.95 postpaid. Floyd Durand, W5YZC, P.O. Box 67, Westwego, LA 70094.

FULL COLOR QSL from your slide's $88.50 single thousand. Also B/W. Subject to discount. Samples. Picturecards, Box 5471, Amarillo, TX 79117 806-383-8347.

QSLs by K6MFE — "Customized" $24.50 per 1000. 7124 "C" Mohawk Trail, Yucca Valley, CA 92284.

COLORFUL QSL's — thirteen card colors, ten inks, Samples 50¢. Specialty Printing Box 361, Duquesne, PA 15110.

MAGNETIC CALLSIGNS ... 2 inches by 8 inches. Great gifts! Easy transfer from one car to another! Call letters or repeater frequency available in the following colors (on white background): Black, blue, red or green. Each sign $5.50. SIGN - ON, Dept. T, 1923 Edward Lane, Merrick, NY 11566.

NEW ... ECONOMY cards, 500 for $12.95. New styles. Write for free samples. QSLs by W4MPY, 705 Audubon Circle, Belvedere, SC 29841.

FREE, 100 Deluxe QSLs with first order of 100 or more. Samples 25 cents. Gazebo Press, Rt. 4, Box 4148, LaPlata, MD 20646.

ANTIQUE-VINTAGE-CLASSIC

WANTED: Radios, parts, books, magazines before 1928. W6ME 4178 Chasin Street, Oceanside, CA 92054.

WANTED: Early Hallicrafter "Skyriders" and "Super Skyriders" with "Silver" panels, "Skyrider Commercial," early transmitters — HT-1, HT-2, HT-8, etc., other Hallicrafter gear, parts, accessories, manuals. Chuck Dachis, WD5EOG, The Hallicrafter Collector, 4500 Russell, Austin, TX 78745.

WANTED; old microphones for my mic. museum. Also mic-related items. Write Bob Paquette, 107 E. National Ave., Milw. WI 53204.

MANUALS for most Ham gear made 1937/1972, plus Kenwood. Our 1984 catalog is $1, and required for ordering. Over 2,000 models listed. Hi-Manuals, Box D802, Council Bluffs, IA 51502-0802.

HALLICRAFTERS Service Manuals. Amateur and SWL. Write for prices. Specify Model Numbers desired. Ardco Electronics, P.O. Box 95, Dept. Q, Berwyn, IL 60402.

WANTED: PRE-1923 radio equipment. Tubes, books, mags-Pre 1940 T.V. any condition. Phil, Forest Hills Wireless Museum, 6761 Alderton, Flushing, NY 11374 212-896-3545.

SPY RADIOS WANTED! WW2 Historian purchases; Military Radios in Civilian Suitcases; Military Radios with prefix "SS," (example "SSTR-1"); AN/PRC-1,5,10,11; early electronic "Bugging" devices; Espionage/Cipher Equipment! Museum, Box 18521, Wichita, KS 67218, 316-684-6254.

WANTED: radios, magazines, horn speakers, pre 1930. W6THU, 1545 Raymond, Glendale, CA 91201. 818-242-8961.

MICROPHONES used in radio/TV broadcasting prior to 1960 wanted for archive. Write: James Steele, NAB, Box 39190, Washington, DC 20016.

WANTED: Old RCA, Western Electric, Cunningham, Genalex, tubes, speakers, amplifiers. Tannoy speaker, 713-728-4343, Maury Corb, 1122 Atwell, Houston, TX 77096.

WANTED: Early telegraph instruments for my collection. Keys, sounders, call boxes, registers, meters and related items including pre-1910 paper. Larry Nutting, WD6DTC, 5957 Yerba Buena, Santa Rosa, CA 95405.

SX-28-A or Hmind. Super-Pro (SP300) wanted. KA1LJZ Box 68, S.W. Harbor, ME 04679. 207-244-7102.

WANTED: 75A4, Johnson Desk-kW, other Johnson equipment. K4MOG, 184 Lake Somerset Drive, Marietta, GA 30064.

WANT OLD Handbooks, QST, CQ. KT7H, 5519 12th NE, Seattle, WA 98105.

16 QST's 1924 to 1929 $45. Includes 5 from 1925. Don Thomas, 1801 Oak Creek Drive, Dunedin, FL 33528.

FIRST EDITION "Radio Amateur's Handbook," 1926. Excellent condition. Best offer. Ted Ulmer, 1101 Lamplighter, Marco, FL 33937.

WANTED — HALLICRAFTERS VFO, HA-5. Will pay reasonable price. Must be good condition. Victor Stiles, 115-C King St., Murphy, NC 28906, 704-837-5672, KB4KTA.

WANTED: CROSLEY Pup. K4NBN "No Bad News".

STILL LOOKING for the following Collins gear: 75A-2A rcvr; 8R-1 Crystal Calibrator; 148C-1 NBFM Adaptor for 75A-2/3; Need complete 534A-1 Wiring Duct and Harness for SC-101 Station Control; Need 302C-1 Wattmeter. Want 353C-31 and 353C-15 Mechanical Filter Adaptors for 75A-1; Need a Crystal Gripper to complete a CP-1 Crystal Packet. Want set of Helipot Duodial turns counters for Tune and Load controls on KWS-1. All above items in good condition, please. Contact AC1Y c/o ARRL Hq. or 203-673-3662 eves until 10 PM.

SELL — HAMMARLUND HQ-150 mint cond with matching speaker $150. W9BFO John Warren, 2908 Jamison, Mt Vernon, IL 62864, 618-242-7189.

WANTED: NATIONAL NC-183 receiver manual or copy thereof. K5EIS, 726 Flamingo Way, Duncanville, TX 75116.

COLLECTORS: TECHNICAL Mechanical Corp. Model GPR-90 Communications Receiver and GSB-1 SSB Adapter. Make offer. N4BU, 813-686-5318.

NCX5MKII with mike, ps, set spare tubes. Will ship. $350 takes all. W2MDL, 212-527-3866.

SELL QST 1953 thru 1963. Some other issues. Best offer FOB origin. Also 1946 National Schools radio course. W6HBW, 714-528-9902.

QST, 1959 - present, $150. HR, complete, $150. RF Design, complete except V2N1, $40. U ship. Books, SASE. Meyer, 400-1736 N. River Rd., W. Lafayette, IN 47906.

CLASSIC HALLICRAFTERS and National: SX25 $99, S4OB $65, SX25 $125, SX28, S meter broken $99, HT4OK transmitter $45, National NC-183D, super receiver, like SX28, $125, Vintage Millen Wavemeters $12. These items excellent, no junk. Also 5/8w 2m base and 5/8 mobile w/magnetic mount $10 ea. Add shipping. Ed, N4DFX, Box 5247, Spartanburg, SC 29304. 803-583-3081.

QST COMPLETE bound from Dec. 1915 to Dec. 1975, rest loose to Sept. 1983. Full years, Single issues. SASE for list. Offers? Mrs. Marcy, 461 Third Avenue, Satellite Beach, FL 32937.

WANTED — 6th Edition of the ARRL Handbook. For sale, early (Vol 1) issues of QST and CQ magazines, early RCA VLF receiver, AR 8503 (15 - 600 Kc.) with preselector and power supply. ELC, 18 Mohawk Drive, Unionville, CT 06085.

QST 1940 thru 1975. 4 missing $75. QST 1951 thru 1975. 1960 thru 1964 complete in binders $50. W1IYN, Ernie Sealey, 46 River St., Marlboro, MA 01752.

SERIOUS COLLINS collectors: 1937 Collins transmitter, 30 FXC. 160-10 MHz, all coils, manual, schematics, complete, make offer. Joseph Nyitray, W8LNV, 3950 Drummond Rd., Toledo, OH 43613.

BUY/SWAP - Tom Swift, Radio/Wireless Boys/Girls Books. Charles King, Miner St., Middletown, CT 06457.

WANTED: OLD keys for my collection. Spark keys, Boston keys, pre-1940 bugs (Martin, Abemathy, D&K, Mecograph, etc.), Omnigraphs, miniature and unusual keys, cable keys, and pre-1900 landline gear (Camelbacks, Victors, Pocket Sets, etc.). K5RW, Neal McEwen, 1128 Midway, Richardson, TX 75081.

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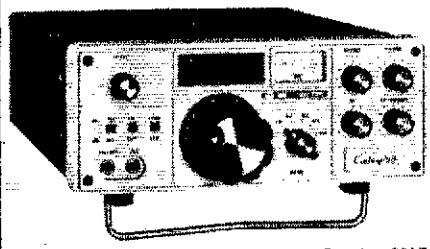
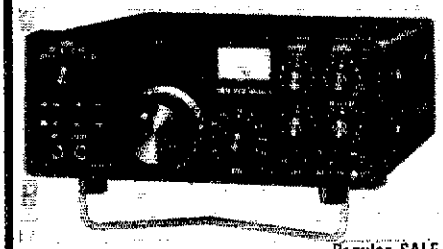
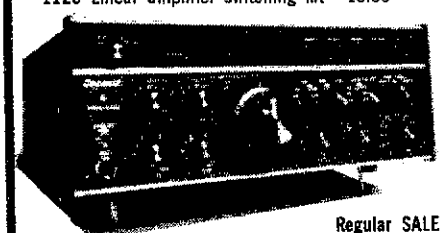


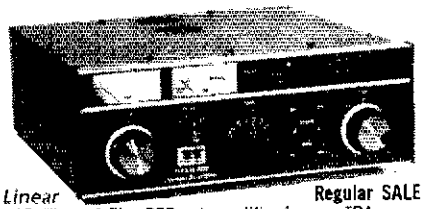
HF Equipment	Regular	SALE
579 Century/22 50w 6-band CW Xcvr	$389.00	359.95
979 5A power supply	89.00	
979/E 230v 5A power supply	99.00	
226 Crystal calibrator	29.00	
279 Mobile line filter/ckt breaker	TBA	
679 Internal keyer kit	27.00	
1179 DC circuit breaker	10.00	



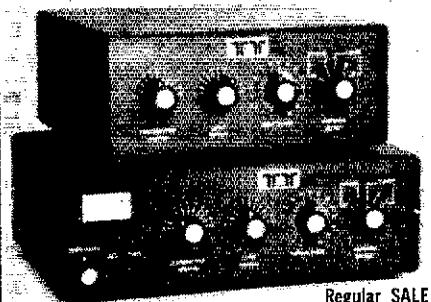
	Regular	SALE
525D Argosy II 10/100w digital Xcvr	599.00	529.95
225 9A power supply	129.00	119.95
217 500 Hz 8-pole CW filter	59.00	
218 1.8 KHz 8-pole SSB filter	59.00	
219 250 Hz 6-pole CW filter	59.00	
220 2.4 KHz 8-pole SSB filter	59.00	
222 Mobile mount	25.00	
223A Noise blanker	34.00	
224 Audio CW filter	34.00	
226 Crystal calibrator for plain 525	29.00	
700A Electret hand mic	29.95	
1125 Circuit breaker w/cable	18.00	
1126 Linear amplifier switching kit	15.00	



	Regular	SALE
560 Corsair 9-band digital Xcvr	1169.00	1029
260 Deluxe 18A ps w/spkr	199.00	179.95
263 Remote VFO	199.00	179.95
220 2.4 KHz 8-pole SSB filter	59.00	
282 250 Hz 6-pole CW filter	59.00	
285 500 Hz 6-pole CW filter	59.00	
288 1.8 KHz 8-pole SSB filter	59.00	
214 Electret desk microphone	45.00	
700C Electret hand mic w/plug	29.95	
1140 18/24.3A DC circuit breaker	10.00	



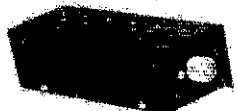
Linear	Regular	SALE
425 Titan 1.5kw PEP out amplifier/ps	TBA	



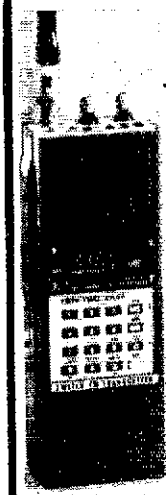
	Regular	SALE
227 1.8-30 MHz 200w antenna tuner	89.00	84.95
228 1.8-30 MHz 200w ant tuner/SWR	110.00	99.95

	Regular	SALE
229 1.8-30 MHz 2kw PEP tuner/SWR	279.00	249.95
4229 1.8-30 MHz 2kw PEP tuner kit	199.00	189.95

	Regular	SALE
214 Electret desk mic w/4-pin plug	45.00	
700A Electret hand mic, 3-cond ¼" plug	29.95	
700C Electret hand mic, 4-pin plug	29.95	
670 Single paddle keyer	39.00	
645 Dual paddle ultramatic keyer	85.00	79.95



209 300w dry dummy load	26.00	



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*We do not accept hand-helds, FM linears or kit-wired equipment.

VHF Equipment	Regular	SALE
2591 .3/2.5w 2m HT/batt/wall cgr/ TTP	319.00	279.95
2201 Sub-audible tone encoder	55.00	
2202 Protective case	9.75	
2425 30w amplifier	79.00	
2700 Speaker/mic	39.00	
2991 Extra 450 ma nicad battery	39.00	
2992 5 hour desk charger	TBA	
2993 12v adapter pack	22.00	
2510* SSB/CW Mode B satellite conv*	489.00	439.95
2510* Original model	469.00	399.95

*Not for use with 2591 hand-held

TEN-TEC Closeout

525 ARGOSY 10/100 Watt 6 band xcvr
*Regular $579 - **Closeout $399.95***

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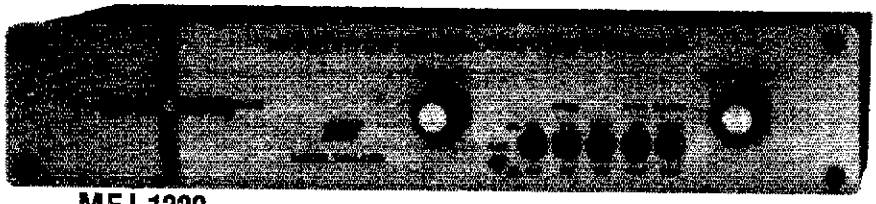
NEW FROM MFJ

MFJ'S MOST ADVANCED RTTY/ASCII/AMTOR/CW COMPUTER INTERFACE HAS FM, AM MODES, LED "SCOPE" TUNING ARRAY, RS-232 INTERFACE, VARIABLE SHIFT TUNING, 170/850 Hz TRANSMIT, TRUE MARK-SPACE DETECTION.



MFJ-1229
$179.95

FREE MFJ RTTY/ASCII/CW software for C-64/VIC-20. Complete package includes MFJ-1229, software on tape, cables for C-64/VIC-20.

Engineering, performance, value and features sets MFJ's most advanced RTTY/ASCII/AMTOR/CW computer interface apart from others.

FM (limiting) mode gives easy, trouble-free operation. Best for general use, off-shift copy, drifting signals, and moderate signal and QRM levels.

AM (non-limiting) mode gives superior performance under weak signal conditions or when there are strong nearby stations.

Crosshair mark-space LED tuning array simulates scope ellipse for easy, accurate tuning even under poor signal-to-noise conditions. Mark and space outputs for true scope tuning.

Transmits on both 170 Hz and 850 Hz shift.

Built-in RS-232 interface, no extra cost.

Variable shift tuning lets you copy any shift between 100 and 1000 Hz and any speed (5-100 WPM RTTY/CW and up to 300 baud ASCII). Push button for 170 Hz shift.

Sharp multi-pole mark and space filters give true mark-space detection. Ganged pots give space passband tuning with constant bandwidth. Factory adjusted trim pots for optimum filter performance.

Multi-pole active filters are used for pre-limiter, mark, space and post detection filtering. Has automatic threshold correction. This advanced design gives good copy under QRM, weak signals and selective fading.

Has front panel sensitivity control.

Normal/Reverse switch eliminates retuning while checking for inverted RTTY. Speaker jack. +250 VDC loop output.

Exar 2206 sine wave generator gives phase continuous AFSK tones. Standard 2125 Hz mark and 2295/2975 Hz space. Microphone lines: AFSK out, AFSK ground, PTT out and PTT ground.

FSK keying for transceivers with FSK input.

Has sharp 800 Hz CW filter, plus and minus CW keying and external CW key jack.

Kantronics software compatible socket.

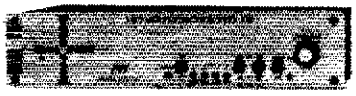
Exclusive TTL/RS-232 general purpose socket allows interfacing to nearly any personal computer with most appropriate software. Available TTL/RS-232 lines: RTTY demod out, CW demod out (TTL only), CW-ID in, RTTY in, PTT in, key in. All signal lines are buffered and can be inverted using an internal DIP switch.

Metal cabinet. Brushed aluminum front. 12½x 2½x6 inches. 18 VDC or 110 VAC with optional AC adapter, MFJ-1312, $9.95.

Plugs between rig and C-64, VIC-20, Apple, TRS-80C, Atari, TI-99 and other personal computers. Use MFJ, Kantronics, AEA and other RTTY/ASCII/AMTOR/CW software.

7-IN-1 RTTY OPERATING AID

MFJ-1221
$79.95



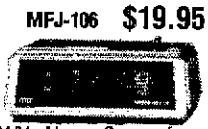
Indispensable. Improves any RTTY station.

1. **Crosshair LED "scope" Tuning Array.** Makes tuning quick and easy with dead-on accuracy. Tune for maximum vertical and horizontal display.
2. **Scope Adapter.** Mark/Space outputs for scope.
3. **Shift Indicator.** LEDs indicate 170, 425, 850 Hz shift. Especially useful for RTTY outside ham bands.
4. **Sharp Mark and Space Filters.** Greatly improves copy under crowded, fading and weak signal conditions. For 170, 425, 850 Hz shifts.
5. **Normal-Reverse Switch.** Check for inverted RTTY without changing sidebands and retuning.
6. **Output Level Control.** Adjust signal level into TU.
7. **Limiter.** Evens out signal variation for easier, smoother copy.

Plugs between receiver and TU. Mark is 2125 Hz and Space is 2295, 2550, or 2975 Hz. 10x2x6 inches. Uses floating 18 VDC or 110 VAC with AC adapter, MFJ-1312, $9.95.

24/12 HOUR CLOCK/ID TIMER

MFJ-106 **$19.95**



Switch to 24 hour UTC or 12 hour format! Battery backup. ID timer alerts every 9 minutes after reset. Red .6 in. LEDs. Synchronizable to WWV. Alarm, Snooze function. Minute, hour set switches. PM, alarm on indicators. Gray/Black cabinet. 5x2x3 in. 110 VAC, 60 Hz.

MFJ ELECTRONIC KEYER

MFJ-407
$69.95

MFJ-407 Deluxe Electronic Keyer sends iambic, automatic, semi-auto or manual. Use squeeze, single lever or straight key. Plus/minus keying. 8 to 50 WPM. Speed, weight, tone, volume controls. On/Off, Tune, Semi-auto switches. Speaker. RF proof. 7x2x6 inches. Uses 9 V battery, 6-9 VDC or 110 VAC with AC adapter, MFJ-1305, $9.95.

MFJ PORTABLE ANTENNA

MFJ's Portable Antenna lets you operate 40, 30, 20, 15, 10 meters from apartments, motels, camp sites, vacation spots, nearly any electrically clear location where space for a full size antenna is a problem.

A telescoping whip (extends to 54 in.) is mounted on self-standing 6x3x6 inch aluminum case. Built-in antenna tuner, field strenght meter, 50 feet RG-58 coax. Complete multi-band-portable antenna system that you can use nearly anywhere. Up to 300 watts PEP.

MFJ-1621
$79.95

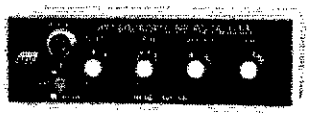
MFJ ANTENNA BRIDGE

MFJ-204
$79.95

MFJ Antenna Bridge. Trim your antenna for optimum performance quickly and easily. Read antenna resistance up to 500 ohms. Covers all hams bands below 30 MHz. Measure resonant frequency of antenna. Tells to lenghten or shorten antenna. Easy to use, connect antenna, set frequency, adjust bridge for meter null and read antenna resistance. Has frequency counter jack. Use as signal generator. Portable, self contained. 4x2x2 in. 9 V battery or 110 VAC with adapter, MFJ-1312, $9.95.

MICROPHONE EQUALIZER

MFJ-550
$49.95



Greatly improves transmitted SSB speech for maximum talk power. Evens out speech peaks and valleys due to voice, microphone and room characteristics that makes speech hard to understand. Produces cleaner, more intelligible speech on receiving end. Greatly improves mobile operation by reducing bassy peaks due to acoustic resonances. Plugs between mic and rig. 4 pin mic jack, shielded output cable. High, mid, low controls provide ±12 db boost or cut at 490, 1170, 2800 Hz. Mic gain, on/off/bypass switch. "On" LED. 7x2x6 inches. 9 V battery, 12 VDC or 110 VAC with adapter, MFJ-1312, $9.95.

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MFJ TUNERS

QUALITY TUNERS THAT DELIVER MORE PERFORMANCE, MORE FEATURES, MORE VALUE FOR YOUR MONEY.

MFJ-941D 300 WATT VERSA TUNER II

$99.95 (+$4) **MFJ's fastest selling tuner packs in plenty of new features. New styling!** Brushed aluminum front. All metal cabinet. **New SWR/Wattmeter!** More accurate. Switch selectable 300/30 watt ranges. Read forward/reflected power.

New antenna switch! Front panel mounted. Select 2 coax lines, direct or through tuner, random wire/balanced line or tuner bypass for dummy load.

New airwound inductor! Larger more efficient 12 position airwound inductor gives lower losses and more watts out. Run up to 300 watts RF power output.

Matches everything from 1.8 to 30 MHz: dipoles, inverted vee, random wires, verticals, mobile whips, beams, balanced and coax lines.

Built-in 4:1 balun for balanced lines. 1000 V capacitor spacing. Black. 11 x 3 x 7 inches. Works with all solid state or tube rigs. Easy to use anywhere.

MFJ-940B, $79.95, 300 watts, SWR/Wattmeter, antenna switch on rear. No balun. 8 x 2 x 6 in. eggshell white with walnut grained sides.
MFJ-945, $79.95, like MFJ-940B with balun, less antenna switch.
MDJ-944, $79.95, like MFJ-940B with balun, antenna switch on front panel, less SWR/Wattmeter.
Optional mobile bracket for 940B, 945, 944, $5.00.

MFJ-900 200 WATT VERSA TUNER

Matches coax, random wires 1.8-30 MHz. Handles up to 200 watts output; efficient airwound inductor gives more watts out. **$49.95** (+$4)
5x2x6 in. **Use any transceiver,** solid state or tube. Operate all bands with one antenna.
OTHER 200 WATT MODELS:
MFJ-901, $59.95, like 900 but includes 4:1 balun for use with balanced lines.
MFJ-16010, $39.95, for random wires only. Great for apartment, motel, camping, operation. Tunes 1.8-30 MHz.

MFJ-949B 300 WATT DELUXE VERSA TUNER II

$139.95 (+4) **MFJs best 300 watt Versa Tuner II. Matches everything** from 1.8 - 30 MHz, coax, randoms, balanced lines, up to 300W output, solid state or tubes.

Tunes out SWR on dipoles, vees, long wires, verticals, whips, beams, quads.

Built-in 4:1 balun. 300W, 50-ohm dummy load. SWR meter and 2 range wattmeter (300W and 30W).

6 position antenna switch on front panel, 12 position air-wound inductor; coax connectors, binding posts, black and beige case. 10 x 3 x 7 in.

MFJ-962 1.5 KW VERSA TUNER III

Run up to 1.5 KW PEP **$229.95** (+$10) and match any feedline continuously from 1.8 to 30 MHz; coax, balanced line or random wire. Built-in SWR/Wattmeter has 2000 and 200 watt ranges, forward and reflected power. 2% meter movement. **6 position** antenna switch handles 2 coax lines (direct or through tuner), wire and balanced lines. 4:1 balun 250 pf 6 KV variable capacitors. 12 position inductors. Ceramic rotary switch. All metal black cabinet and panel gives RFI protection, rigid construction and sleek styling. Flip stand tilts tuner for easy viewing. 5 x 14 x 14 inches.

MFJ-989 3 KW ROLLER INDUCTOR VERSA TUNER V

$329.95 (+$10) **Meet "Versa Tuner V". It has all the features you asked for,** including the new smaller size to match new smaller rigs - only 10 3/4"W x 4 1/2"H x 14 7/8"D.

Matches coax, balanced lines, random wires — 1.8 to 30 MHz. 3 KW PEP- the power rating you won't outgrow (250 pf-6KV caps).

Roller inductor with a 3-digit turns counter plus a spinner knob for precise inductance control to get that SWR down to minimum every time.

Built-in 300 watt, 50 ohm dummy load, built-in 4:1 ferrite balun.

Built-in 2% meter reads SWR plus forward and reflected power in 2 ranges (200 and 2000 watts). Meter light requires 12 VDC. Optional AC adapter MFJ-1312 is available for $9.95.

6-position antenna switch (2 coax lines, through tuner or direct, random/balanced line or dummy load). SO-239 connectors, ceramic feed-throughs, binding post grounds.

Deluxe aluminum low-profile cabinet with sub-chassis for RFI protection, black finish, black front panel with raised letters, tilt bail.

MFJ-981, $239.95. 3 KW, 18 position switched dual inductor. SWR/Wattmeter. 4:1 balun.

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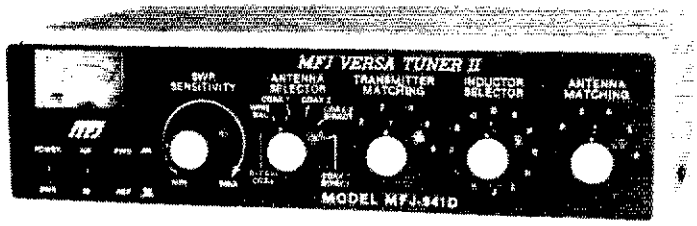
MFJ ACCESSORIES

300 WATT ANTENNA TUNER HAS SWR/WATTMETER, ANTENNA SWITCH, BALUN. MATCHES VIRTUALLY EVERYTHING FROM 1.8 TO 30 MHz.



$99.95 MFJ-941D

NEW FEATURES

MFJ's fastest selling tuner packs in plenty of new features!

- **New Styling!** Brushed aluminum front. All metal cabinet.
- **New SWR/Wattmeter!** More accurate. Switch selectable 300/30 watt ranges. Read forward/reflected power.
- **New Antenna Switch!** Front panel mounted. Select 2 coax lines, direct or through tuner, random wire/balanced line or tuner bypass for dummy load.
- **New airwound inductor!** Larger more efficient 12 position air-wound inductor gives lower losses and more watts out. Run up to 300 watts RF power output. Matches everything from 1.8 to 30 MHz: dipoles, inverted vee, random wires, verticals, mobile whips, beams, balanced and coax lines. Built-in 4:1 balun for balanced lines. 1000V capacitor spacing. Black. 11x3x7 inches. Works with all solid state or tube rigs. Easy to use, anywhere.

RTTY/ASCII/CW COMPUTER INTERFACE

MFJ-1224 **$99.95**

Free MFJ RTTY/ASCII/CW software on tape and cable for VIC-20 or C-64. Send and receive computerized RTTY/ASCII/CW with nearly any personal computer (VIC-20, Apple, TRS-80C, Atari, TI-99, Commodore 64, etc.). Use Kantronics or most other RTTY/CW software. Copies both mark and space, any shift (including 170, 425, 850 Hz) and any speed (5-100 WPM RTTY/CW, 300 baud ASCII). Sharp 8 pole active filter for CW and 170 Hz shift. Sends 170, 850 Hz shift. Normal/reverse switch eliminates retuning. Automatic noise limiter. Kantronics compatible socket plus exclusive general purpose socket. 8x1¼x6 in. 12-15 VDC or 110 VAC with adapter, MFJ-1312, $9.95.

RX NOISE BRIDGE

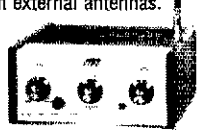
Maximize your antenna performance! **$59.95** MFJ-202B

Tells whether to shorten or lengthen antenna for minimum SWR. Measure resonant frequency, radiation resistance and reactance.

New Features: Individually calibrated resistance scale, expanded capacitance range (±150 pf). Built-in range extender for measurements beyond scale readings. 1-100 MHz. Comprehensive manual. Use 9 V battery. 2x4x4 in.

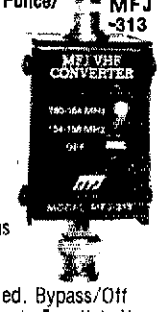
INDOOR TUNED ACTIVE ANTENNA

NEW! IMPROVED! with higher gain **"World Grabber" rivals or exceeds reception of outside long wires!** Unique **tuned** Active Antenna minimizes intermode, improves selectivity, reduces noise outside tuned band, even functions as preselector with external antennas. Covers 0.3-30 MHz. Tele scoping antenna. Tune, Band, Gain, On-off bypass controls. 6x2x6 in. Uses 9V battery, 9-18 VDC or 110 VAC with adapter, MFJ-1312, $9.95. **MFJ-1020A $79.95**



POLICE/FIRE/WEATHER 2 M HANDHELD CONVERTER

Turn your synthesized scanning 2 meter handheld into a hot Police/Fire/Weather band scanner! **$39.95** MFJ-313



144-148 MHz handhelds receive Police/Fire on 154-158 MHz with direct frequency readout. Hear NOAA maritime coastal plus more on 160-164 MHz. Converter mounts between handheld and rubber ducky. Feedthru allows simultaneous scanning of both 2 meters and Police/Fire bands. No missed calls. Crystal controlled. Bypass/Off switch allows transmitting (up to 5 watts). Use AAA battery. 2¼x1½x1½ in. BNC connectors.

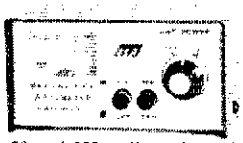
MFJ/BENCHER KEYER COMBO

MFJ-422 **$109.95**

The best of all CW worlds- a deluxe MFJ Keyer in a compact configuration that fits right on the Bencher iambic paddle! MFJ Keyer - small in size, big in features. Curtis 8044-B IC, adjustable weight and tone, front panel volume and speed controls (8-50 WPM). Built-in dot-dash memories. Speaker, sidetone, and push button selection of semi-automatic/tune or automatic modes. Solid state keying. Bencher paddle is fully adjustable; heavy steel base with non-skid feet. Uses 9 V battery or 110 VAC with optional adapter, MFJ-1305, $9.95.

VHF SWR/WATTMETER

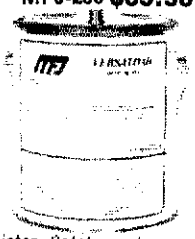
MFJ-812 **$29.95**



Low cost VHF SWR/Wattmeter! Read SWR (14 to 170 MHz) and forward/reflected power at 2 meters. Has 30 and 300 watts scales. Also read relative field strength. 4x2x3 in.

1 KW DUMMY LOAD

MFJ-250 **$39.95**



Tune up fast, extend life of finals, reduce QRM! Rated 1KW CW or 2KW PEP for 10 minutes. Half rating for 20 minutes, continuous at 200 W CW, 400 W PEP. VSWR under 1.2 to 30 MHz, 1.5 to 300 MHz. Oil contains no PCB. 50 ohm non-inductive resistor. Safety vent. Carrying handle. 7½x6¾ in.

24/12 HOUR CLOCK/ID TIMER

MFJ-106 **$19.95** *NEW*

Switch to 24 hour UTC or 12 hour format! Battery backup maintains time during power outage. ID timer alerts every 9 minutes after reset. Red LED .6 inch digits. Synchronizable with WWV. Alarm with snooze function. Minute set, hour set switches. Time set switch prevents mis-setting. Power out, alarm on indicators. Gray and black cabinet. 5x2x3 inches. 110 VAC, 60 Hz.

DUAL TUNABLE SSB/CW/RTTY FILTER

MFJ-752B **$99.95**

Dual filters give unmatched performance! The primary filter lets you peak, notch, low pass or high pass with extra steep skirts. Auxiliary filter gives 70 db notch, 40 Hz peak. Both filters tune from 300 to 3000 Hz with variable bandwidth from 40 Hz to nearly flat. Constant output as bandwidth is varied; linear frequency control. Switchable noise limiter for impulse noise. Simulated stereo sound for CW lets ears and mind reject QRM. Inputs for 2 rigs. Plugs into phone jack. Two watts for speaker. Off bypasses filter. 9-18 VDC or 110 VAC with optional adapter, MFJ-1312, $9.95.

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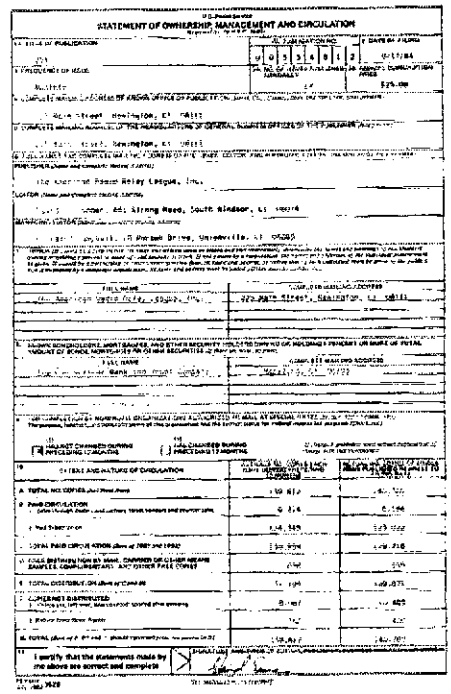

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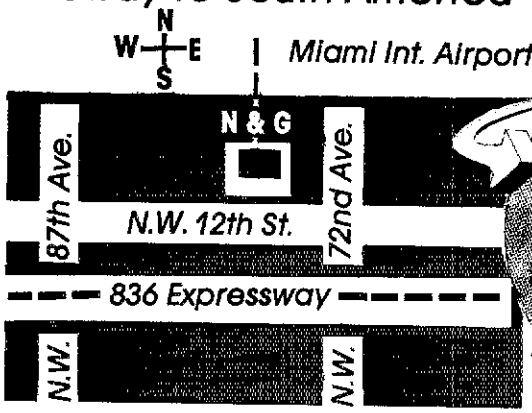

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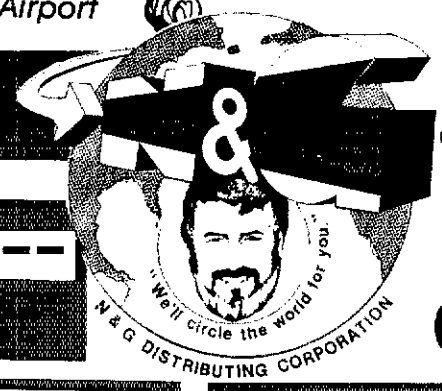

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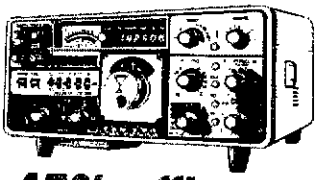

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IC-745 9-band Xcvr/.1-30 MHz Rcvr	$ 999.00	Call
PS-35 Internal power supply	160.00	144.95
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IC-271A 25w 2m FM/SSB/CW Xcvr	699.00	Call
IC-471A 10w 430-450 SSB/CW/FM Xcvr	799.00	Call
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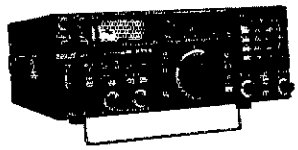

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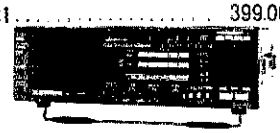

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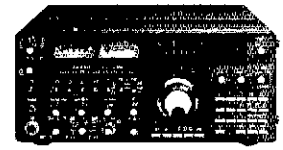

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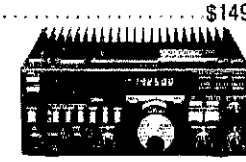

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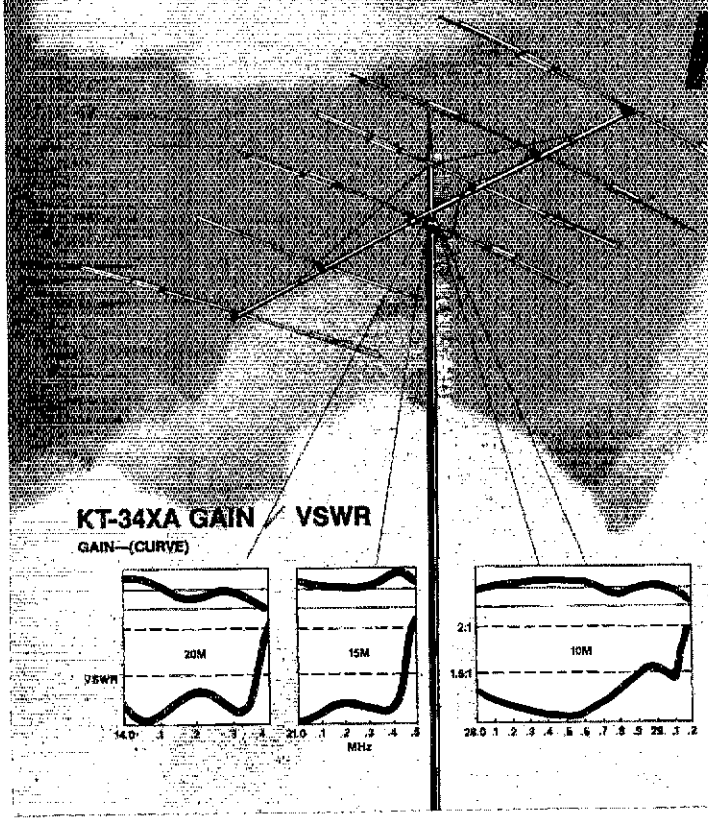

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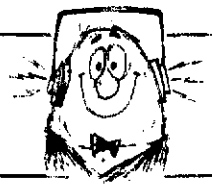

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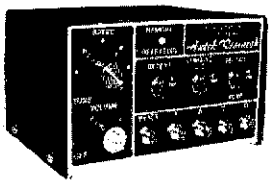

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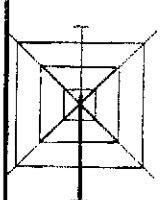

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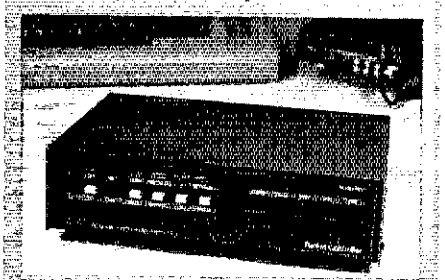

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WANTED: AVIATION rcvr, HW-101, DX-40, antenna tuner, 2-meters; WB7QBZ, 59771-2038.

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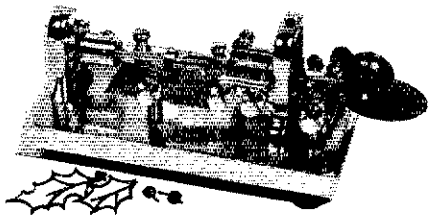

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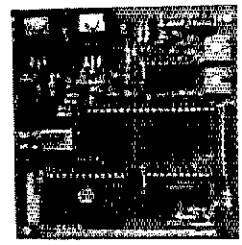

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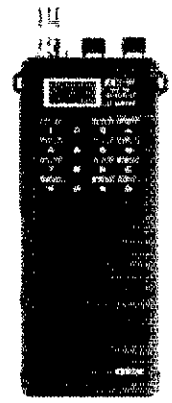

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KENWOOD TS-930S with auto antenna tuner, MC-60A desk mic. Both used less than 20 hours, $1200. KB1AD, 207-642-3213. RD 1, Box 484, West Buxton, ME 04093.

SWAN 350 Digital, with Electro-Voice 727 microphone - $300. Hallicrafter SX111 with manual - $100. Harold Gruen, 3340 Davis Road, Barrington, NJ 08007, 609-546-5696.

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SALE: HEATHKIT SA-2060 Antenna Tuner $195. Kantronics Interface with Hamsoft $90. Sony ICF-2001 Communications Receiver $140. All mint condition. UPS prepaid. Ron, W4VR, 10224 Wendover Drive, Vienna, VA 22180. Evenings 703-281-1081.

SELL: HEATHKIT SB-104 transceiver, SB-604 speaker, HP-1144 power supply, 400 cycle filter & noise blanker installed, manuals, good condition, $400. N8LS, Stuber, Amherst, OH 44001.

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HEATH SB102, CW filter, heavy duty power supply, desk mic, manual, $375. Swan 350D, new final, manual, $325. Both good condition with AFMars crystals. WD4NEG, Box 238, Tullahoma, TN 37388 615-455-0091.

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SALE: KWM-380 Ser. No. 2102 with MM-280 handheld mic. $2,550; 30L-1 (winged) $600; Epson Terminal Printer $200; Alpha 374 Bandpass linear amplifier $1,000; Drake TR7/DR-7 with mic and PST power supply $1,000; Yaesu Monitor Scope YO-101 $100; Kenwood MC-60 desk mic $45; Microlog ACT-1 with 12" Leedex video monitor scope $370; Waters #394 Dummy Load $50; HyGain RF550A wattmeter $35; Custom operating and control desk $300; Kenwood desk mic $25. William E. Trumbull, M.D., KD6RZ, 2021 Santa Monica Blvd., Santa Monica, CA 90404, 213-829-4469.

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DRAKE L4-B 2kW amplifier with 10 meters, mint condition with manual and original cartons, $850. I pay shipping in USA. KB4SS, 404-476-5644.

SELL COLLINS S/Line: 75S-1, 32S-1, 516F-2 ac supply, 312B-4 Station Control, Shure 444 mic. Perfect working, mint cond. Original owner, unmodified, manuals, cartons. $500. Neal Atkins, KC4NK, 5 Island Ave., Miami Beach, FL 33139, 305-532-8725.

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ALPHA OWNERS: New Elmac 8874's, $160. W9ZR, 1-414-434-2938.

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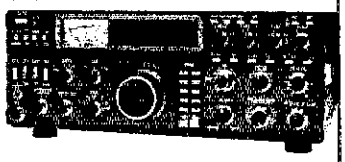

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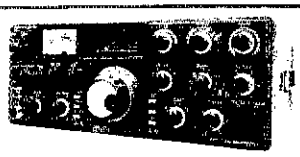

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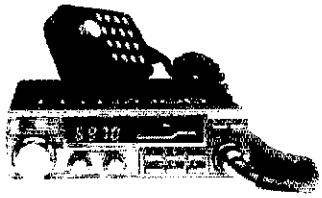

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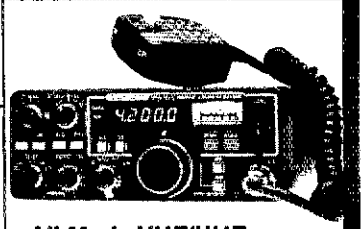

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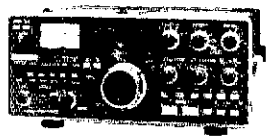

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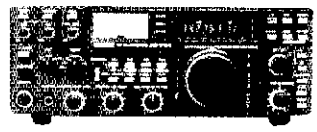

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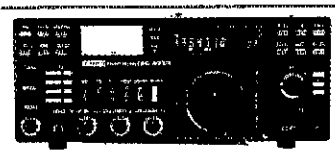

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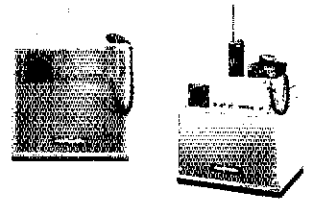

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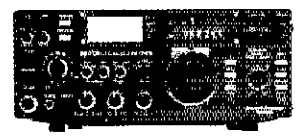

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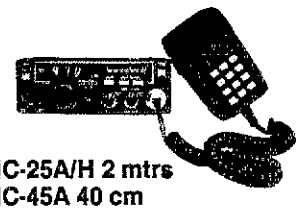

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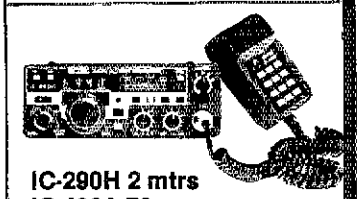

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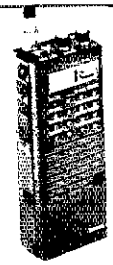

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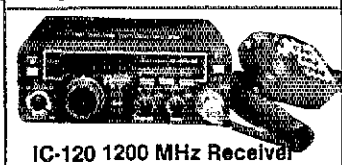

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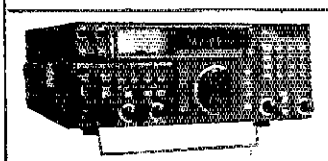

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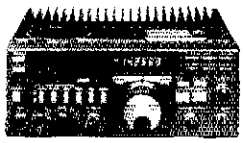

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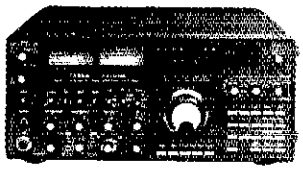

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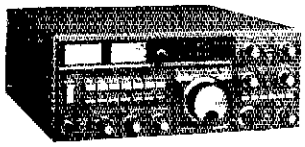

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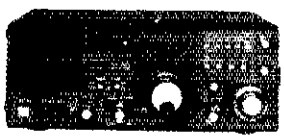

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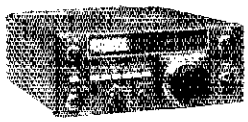

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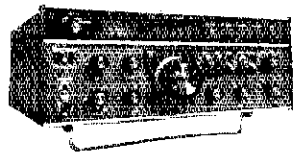

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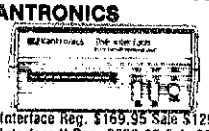

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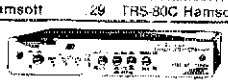

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B215	2M	Yes	2W	150W	20A	$259
B108	2M	Yes	10W	80W	10A	$159
B1016	2M	Yes	10W	160W	20A	$249
B3016	2M	Yes	30W	160W	17A	$199
C22	220	No	2W	20W	5A	$ 79
C108	220	Yes	10W	80W	10A	$179
C1012	220	Yes	10W	120W	20A	$259
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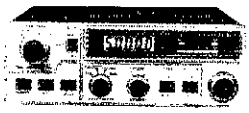

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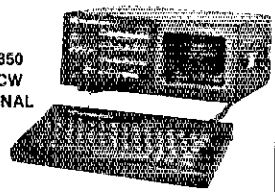

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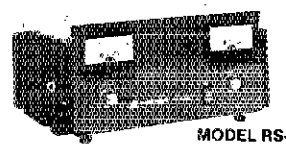
RS7A	5	7	49
RS12A	9	12	59
RS20A	16	20	89
RS20M	16	20	109
RS35A	25	35	135
RS35M	25	35	149
RS50A	37	50	159
RS50M	37	50	249



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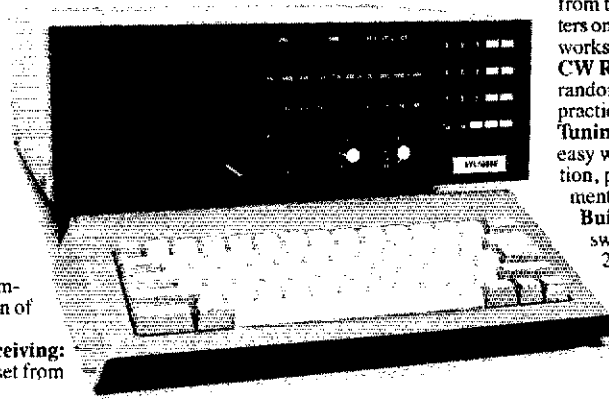
Automatic Sender/Receiver: Due to the most up to date computer technology, just a console and keyboard can accomplish complete automatic send/receive of Morse Code (CW), Baudot Code (RTTY), ASCII Code (RTTY) and new ARQ/FEC (AMTOR).
Code: Morse (CW includes Kana), Baudot (RTTY), ASCII (RTTY), JIS (RTTY), ARQ/FEC (AMTOR).
Characters: Alphabet, Figures, Symbols, Special Characters, Kana.
Built-in Monitor: 5" high resolution, delayed persistence green monitor – provides sharp clear image with no jiggle or jitter even under fluorescent lighting. Also has a provision for composite video signal output.
Time Clock: Displays Month, Date, Hour and Minute on the screen.
Time/Transmission/Receiving Feature: The built-in timer enables completely automatic TX/RX without operator's attendance.
Selcal (Selective Calling) System: With this feature, the unit only receives messages following a preset code. Built-in Demodulator for High Performance: Newly designed high speed RTTY demodulator has receiving capability of as fast as 300 Baud. Three-step shifts select either 170Hz, 425Hz or 850Hz shift with manual fine tune control of space channel for odd shifts. HIGH (Mark Frequency 2125Hz)/LOW (Mark Frequency 1275Hz) tone pair select. Mark only or Space only copy capability for selective fading. ARQ/FEC features incorporated.
Crystal Controlled AFSK Modulator: A transceiver without FSK function can transmit in RTTY mode by utilizing the high stability crystal-controlled modulator controlled by the computer.
Photocoupler CW, FSK Keyer built-in: Very high voltage, high current photocoupler keyer is provided for CW, FSK keying.
Convenient ASCII Key Arrangement: The keyboard layout is ASCII arrangement with function keys. Automatic insertion of LTR/FIG code makes operation a breeze.
Battery Back-up Memory: Data in the battery back-up memory, covering 72 characters x 7 channels and 24 characters x 8 channels, is retained even when the external power source is removed. Messages can be recalled from a keyboard instruction and some particular channels can be read out continuously. You can write messages into any channel while receiving.
Large Capacity Display Memory: Covers up to 1,280 characters. Screen Format contains 40 characters x 16 lines x 2 pages.
Screen Display Type-Ahead Buffer Memory: A 160-character buffer memory is displayed on the lower part of the screen. The characters move to the left erasing one by one as soon as they are transmitted. Messages can be written during the receiving state for transmission with battery back-up memory or SEND function.
Function Display System: Each function (mode, channel number, speed, etc.) is displayed on the screen.
Printer Interface: Centronics Para Compatible interface enables easy connection of a low-cost dot printer for hard copy.
Wide Range of Transmitting and Receiving: Morse Code transmitting speed can be set from the keyboard at any rate between 5-100 WPM (every word per minute). AUTOTRACK on receive. For communication in Baudot and ASCII Codes, rate is variable by a keyboard instruction between 12-300 Baud when using RTTY Modem and between 12-600 Baud when using TTL level. The variable speed feature makes the unit ideal for amateur, business and commercial use.
Pre-load Function: The buffer memory can store the messages written from the keyboard instead of sending them immediately. The stored messages can be sent with a keyboard command.
"RUB-OUT" Function: You can correct mistakes while writing messages in the buffer memory. Misspellings can also be erased while the information is still in the buffer memory.
Automatic CR/LF: While transmitting, CR/LF automatically sent every 64, 72 or 80 characters.
WORD MODE operation: Characters can be transmitted by word groupings, not every character, from the buffer memory with keyboard instruction.
LINE MODE operation: Characters can be transmitted by line groupings from the buffer memory.
WORD-WRAP-AROUND operation: In receive mode, WORD-WRAP-AROUND prevents the last word of the line from splitting in two and makes the screen easily read.
"ECHO" Function: With a keyboard instruction, received data can be read and sent out at the same time. This function enables a cassette tape recorder to be used as a back-up memory, and a system can be created just like telex which uses paper tape.
Cursor Control Function: Full cursor control (up/down, left/right) is available from the keyboard. Test Message Function: "RY" and "QBF" test messages can be repeated with this function.
MARK-AND-BREAK (SPACE-AND-BREAK) System: Either mark or space tone can be used to copy RTTY.
Variable CW weights: For CW transmission, weights (ratio of dot to dash) can be changed within the limits of 1:3-1:7.
Audio Monitor Circuit: A built-in audio monitor circuit with an automatic transmit/receive switch enables checking of the transmitting and receiving state. In receive mode, it is possible to check the output of the mark filter, the space filter and AGC amplifier prior to the filters.



CW Practice Function: The unit reads data from the hand key and displays the characters on the screen. CW keying output circuit works according to the key operation.
CW Random Generator: Output of CW random signal can be used as CW reading practice. **Bargraph LED Meter for Tuning:** Tuning of CW and RTTY is very easy with the bargraph LED meter. In addition, provision has been made for attachment of an oscilloscope to aid tuning.
Built-in AC/DC: Power supply is switchable as required; 100-120 VAC; 220-240 VAC/ 50/60Hz + 13.8VDC.
Color: Light grey with dark grey trim – matches most current transceivers. **Dimensions:** 363(W) x 121(H) x 351(D) mm: Terminal Unit.
Warranty: One Year Limited

Specifications Subject to Change

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**Dual Amtor: Commercial quality,* the EXL-5000E incorporates *two completely separate modems* to fully support the amateur Amtor codes and *all* of the CCIR recommendations 476-2 for commercial requirements.

SWAN 350D xcvr, 80-10, built-in PS and digital, 300W PEP $300 or best offer. KA1LBU, 207-943-7718.

COLLINS 75S-3 $225, 75S-3B $285, 32S-2 $235, 32S-3 $285, 516F-2 $120, 312B-4 $135, CP-1 $160, SM-2 $65, SM-3 $95. K5UR, 501-988-2527.

ROSS $$$ New November SPECIALS: If this month's special is not what you are looking for send Call letters, name & phone # for a personal price quote. Over 6,000 ham related items in stock. Blowout special on CW, RTTY, Amtor interfaces and software, - send for list. Kenwood TS-430 $689, Astron 20 amp power supply $88.95, Yaesu FT-208R $222, Special on communications receivers, Yaesu, Icom, Kenwood and on SSTV and other ham items - Call or write for details. All major lines stocked. Mention ad. Prices cash, FOB Preston. Closed Monday at 2:00 * Ross Distributing Company, 78 South State Street, Preston, ID 83263 208-852-0830.

CRYSTALS AND 203-A tubes. Build something! QRP oscillator. AM is coming back, try it (again). FT-243 crystals made here to your order. 160M $3.95, five $3.45 each. 80M $2.95, five $2.50 ea. 4001 to 8700 kilocycles covering 40M and multiplication to higher bands $2.25, five $1.95 ea. 30M 10100 - 10150 $2.95, five $2.70 ea. Sockets 50¢. "Crystals Since 1933." W0LPS. Airmail 30¢ per crystal. Stamp or long SASE for 1700 - 60,000 kilocycles, listings-circuits. Remember 50 years ago - 203-A's unused $14.95 plus $250 postage. C-W Crystals, Marshfield, MO 65706.

ROHN TOWERS - Wholesale direct to users. 23% to 34% discount from dealer price. All products available. Write or call for price list. Also we are wholesale distributors for Antenna Specialists, Regency, Hy-Gain. Hill Radio 2503 G.E. Road, P.O. Box 1405, Bloomington, IL 61701-0887, 309-663-2141.

LOGBOOK-V2 A complete log maintenance program consisting of seven modules to handle all phases of logging. Features multi-key and multi-level searching of thousands of records in seconds and full feature editing. Prints Station Logs, Contest Logs, Contest Dupe Sheets, QSL Cards, WAS Lists, DXCC Lists, 6-Band WAS lists. For TRS-80 Model I, Model III & Model IV. Price $39. Reviewed December 1983 QST. Supplied on 5¼" DOSPLUS formatted disk with complete documentation. Specify model/density of computer when ordering. WB8YUO, 6333 Willowdale Court, Columbus, OH 43229, 614-895-1130.

DRAKE TR4CW, RV4C, AC4 - $415 - Also Collins 30L1 - $400. W3IMU - 215-968-4122.

DIGITAL AUTOMATIC Displays for FT-101's, TS-520's (functional DG-5 replacement), Collins, Drake, Swan, Heath and others. Six 1/2" digits. Thirty-day money back trial. Two year warranty. Write for information. Grand Systems, P.O. Box 3377, Blaine, WA 98230. 604-530-4551.

DRAKE TR-4C incl Remote VFO, pwr, and spkr, $325. Squires SS-1V Bandscanner $85. SS-1R suitable for parts $50. 8 Quad Spreaders $50. N2AQN, 201-458-6613.

YAESU FT-101 E, AM-filter, mike, manual & carton and excellent; $350. ICOM 701, mike, supply, manual - perfect; $550. IC-720-A, likewise; $800. W8RH, 513-277-0409.

WANTED: COLLINS S-line filters, 30L-1, cabinet for KWM-2/30L-1. K5UR, 501-988-2527.

ROSS $$$ YOUR Ham Shopping Center - Hundreds of pieces of used gear in stock - thousands of new gear. Call or write for a personal price quote. Send for Christmas gift ideas book and other specials. All major lines stocked. Mention ad. Closed Monday at 2:00 *Ross Distributing Company, 78 South State Street, Preston, ID 83263, 208-852-0830.

SELLING COMPLETE station: Kenwood TS-830S, VFO-230, Mosley 402 2-element 40-meter beam, KLM 2-meter 16C antenna, Heathkit 5-position antenna switch, 6-meter linear, Tokyo 20U 430-450 UHF amp, Tek-Nik 24-hour clock, Clifford-Vista 50 amp p.s., Azden 2800 10-meter FM, Shure 444 mike, Yaesu FT-221 2-meter all-mode, YC-221 digital display for FT-221. WB7AWA.

FOR SALE: Kenwood TS900 5-band transceiver. Solid state with 3 tubes. Excellent with AC and spkr. $285. Vomax SBP-3 processor and AC, $243 value, $75. 614-335-5297. Jack Yeoman, W8VHY.

HEATHKIT HW-100 with HP-23C p.s. $125. Dave, WD6HFC, 303-641-1027.

DRAKE R4C, T4XC, NB4, MS4, AC4, 500 Hz. Filter, and extra crystals, Drake 7075 mike. $650. Frank Carter 6405-So. Prantice, Seattle, WA 98178. 206-723-5361.

FOR SALE: Kenwood 930S with A/T Serial #2128494, MC-60 microphone, SP-930 speaker. Mint $1200. Alpha 374 Auto Tune Bandpass Linear Amplifier. Excellent. $1100. WA6JIS, Andy, 707-996-1200.

JENNINGS UCSL-1000 Vacuum Variable Capacitors, 10 thru 1000 MMFD at 5000 KVA with gear drive train and mounting bracket, $59.50, HP608F late model signal generator, 10 MHz thru 455 MHz 19" panel with blue/gray cabinet $445, HP614 signal generator 900 MHz thru 2100 MHz $345, Tektronix L-30 Spectrum Analyzer plug-in 925 MHz thru 10.5 GHz $375, URM-25 signal generator 10 kHz thru 50 MHz $245. All lab tested excellent condition, VISA/MC phone 704-524-7519, Step Electronics Company, Highway 441, Otto, NC 28763.

ALPHA 374A Linear Amplifier. Mint. $1300. WA6JIS, Andy, 707-996-1200.

IC-730, LDA, FL-30, FL-45, HM-5, $550. EX-203, $25. HM-10, $25. Azden PCS-4000, $200. F.O.B. K1LEC, 802-886-8121.

DRAKE TR-5, used little, one-year-old, with FA-7 fan, and power supply. $475, or work a trade for your mobile 2-meter rig. KO8LF, 419-726-2467.

NCL-2000 OWNERS! We have acquired all remaining production parts and offer special Replacement Parts Kits at unusually low prices for limited time. SASE for price list. Maximilian Associates, 11 Plymouth Lane, Swampscott, MA 01907.

OWNER RETIRING - Must Sell - NH S9-plus QTH - 59 acres for antenna farm - elevation equals Francestown repeater; above Derry repeater - south slope Crotched Mountain for wide propagation window, solar exposure and view - spacious 4-room lodge, appliianced kitchen - separate pine-panelled bunkhouse with heated shop and double garage - excellent condition - paved access - privacy - one hour from Nashua or Manchester - "CW" Farr, W1WMK, Broker, Greenfield, NH 03047, 603-547-2053.

COLLINS KWM-2 transceiver, 516F-2 ac supply, PM-2 portable ac supply, MP-1 dc supply, CC-2 carrying case, 351D-2 mobile mount. Everything for $625. WB5SRB, 1-501-636-5387.

VHF AMATEURS: Drake TR-6 six meter SSB-CW transceiver, RV-6 remote VFO, AC-4 supply $495. TC-2 two meter transmitting converter $150. Yaesu FT-221R two-meter all mode transceiver w/Janel preamp. $250. Gonset Sidewinder two-meter SSB-AM-CW transceiver $65. Contact K2AWA, P.O. Box 568 Boro Hall, Jamaica, NY 11424. Phone 718-224-2448.

2-METER MULTIMODE station: ICOM IC-290A xcvr, Mirage B108 80W linear, Astron RS-20A 15-amp supply, all absolutely mint. $475 plus $15 shipping. K4MSG, 204 S. Harrison, Sterling, VA 22170. 703-435-2994.

20 MTR 3 EL monobander $50, 15 mtr 3 el monobander $35, BC221J with manual $15; Assorted mil/volt meters $3.50 ea. 3 @ $10. N2EG, 201-782-2762.

ICOM IC451A 430 MHz $550; IC451A 440 MHz $550; IC211 $325; RM2 $45; Venus SS2 sloscan $50; Regency digital flight scan $150. Want IC471H IC271H. Call Gene K3DSM 215-935-0362 mornings or evenings or write RD #1 Box 63A, Valley Hill Rd., Malvern, PA 19355.

NOVEMBER SPECIALS: AMP Supply LA-1000A 1200 watt amplifiers $379.95, AT-1200 tuners $169.95. Mini-Quads $135. UPS extra. Send stamp for flyer. Don, WB2RTW, Hart Eastern Communications, 1444 Darlington Drive, Derby, NY 14047.

KENWOOD TS-180-S solid state 10-160 meter 200 watt transceiver with 12 volt and 120 volt power supplies. CW and SSB filters, external speaker, microphone, $990. KT34XA KLM antenna with 13LMB two meter beam, $300. CDE Tailtwister rotor, $150. Heathkit HF dual wattmeter (2140), $50. Windspeed/direction indicator (1590), $40. Remote coax switch (1480), $90. M&M MSB-1 audio and notch filter, $58. Radio Shack TRS-80 Model 1 Level 2 computer, 48K, two disks, new keyboard, RS-232 board, cassette M-80 ham interface, voice box, dust covers, modem, many programs, desk, $480. Daisy Wheel Printer II, $600. 50' Rohn antenna tower, $250. KA5IFU 817-735-9383.

QRP SPECIAL: Heathkit HW-8, p.s. $100. Contact K2AWA, P.O. Box 568, Boro Hall, Jamaica, NY 11424. Phone 718-224-2448.

TEMPO-ONE TRANSCEIVER (black face), AC/One AC supply $300. WB5SRB, 1-501-636-5387.

TI-99/4A COMPUTER - peripheral expansion system $409, External disk drive $235, Panasonic 1090 printer $250. Parallel printer interface $90, extended basic $85. Swan 500 w/ac supply & mike - excellent $300. K2UOR, 124 Winding Ln., Avon, CT 06001, 203-673-2399.

CLOSEOUTS/OVERSTOCK SPECIALS: While they last, Drake TR-7/R-7 Filters $44.95, DX Engineering Speech Processors for Collins 32S-3 and Drake T4XC, Elmac 3-500Z and 8877, Hy-Gain Kit to convert 204BA 205BA $59.95 + truck, Yaesu FT-208R, Yaesu FRA-7700 Antenna Tuner for FRG-7700 Receiver $39.95. Ham Radio Outlet, 1-800-854-6046.

TEN-TEC CORSAIR with speaker power supply, electret mike. Purchased April, 2 hours use. Absolutely mint. Original boxes, manuals. $950. W3ALZ, 301-384-2969.

SELL: HEATH HW-101, PS23C $185. HW8/ps $100. Don, WD0AHO/9, 309-795-1206.

HW-8, p/s, $135. Yaesu filters: XF-90C (CW), XF-90B (AM), $25/pr. AA6EE, 619-789-3674.

COMPUTER/RTTY BUFFS: Sanyo DM-5109CX 9" green-screen monitor, metal cabinet (RF shielded). A super buy! $99.95 Free UPS. Ham Radio Outlet, 1-800-854-6046.

TRADE or sell Kenwood Twins T/R599D with matching speaker, DG-6 digital readout, MC-50 microphone, 2 meter receive converter. Want 6 meter FM/SSB transceiver. N3AR, Ron Schwendt, Box 149A, Sycamore Road, RD1, Douglassville, PA 19518.

DRAKE TC-6 trans converter, CC-1 console, SC-6 rec conv, CPS-1 conv p/s and SCC-1 calibrator $200. WA8MRT, 216-666-2914.

ICOM AT-500 automatic antenna tuner, new - $350, Henry Radio 2 KD-5 linear amplifier w/10M, mint - $675, Elmac 4CX3000A, socket, chimney, new - $795, Tektronix 1L10 and 1L30 spectrum analyzer plug-ins, mint - $450 ea. A. Emerald, 8956 Swallow, Fountain Valley, CA 92708, 714-962-5940.

WANT - HEATH IM-5258 HD Analyzer: Small Analog RF Telemetry Equipment/System. Charles King, Miner St., Middletown, CT 06457.

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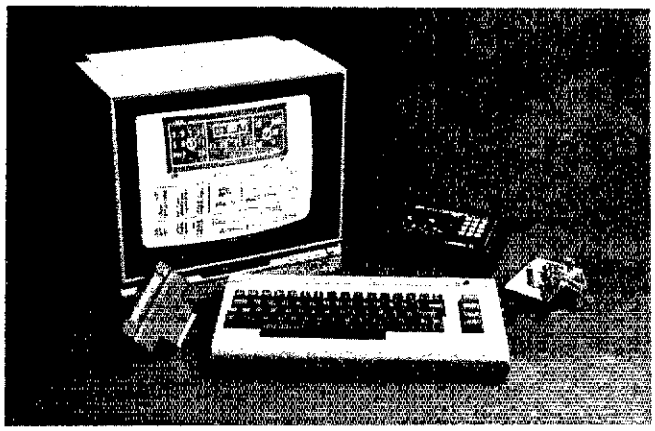

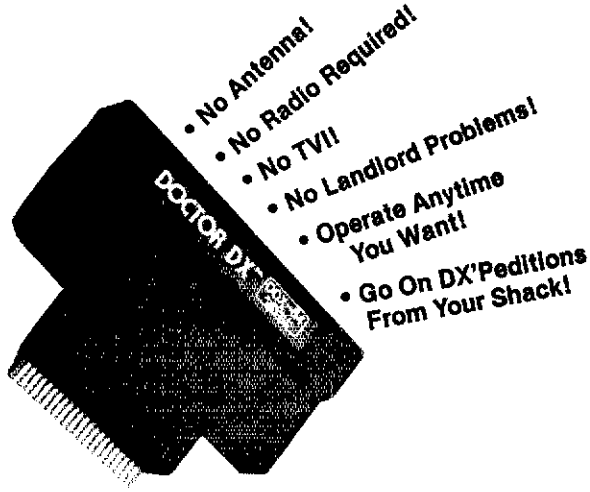

For the active CW operator, there is nothing more fun than operating with the "Doctor DX" CW DX simulator. For the person who has never liked CW, Doctor DX will show you what real fun is. Doctor DX has something for everyone from the aspiring Novice to the experienced Amateur Extra Class licensee. And you need no FCC license to operate Doctor DX!

With Doctor DX, all you need is a Commodore-64 computer, a key (or keyer), and a TV set. There is no need for an expensive transceiver, amplifier and antenna farm to enjoy the thrill of working "rare DX." No more TVI or dead bands! Doctor DX is more than the most sophisticated CW trainer ever developed, it is your DXpedition ticket to anywhere in the world at a very affordable price.

Doctor DX simulates real H.F. CW band conditions. All the stations you will work are generated by the computer. As you tune up and down the particular band you have selected, you will hear realistic sounding stations in contact with other stations (some within your skip zone). There is also the normal QRN and QRM one would expect to hear in the real world. All call letters heard are totally random (subject to the country's callsign assignment rules). The prefixes are weighted according to the Amateur Radio population density, with 304 possible countries represented. The speed of stations operating in the lower portion of the bands is much faster than those operating in the upper band segments. The "operators" are also more polished in the lower portion of the bands.

Radio propagation (programmed for each band) represents what you would expect to hear on a good propagation day at the peak of the sunspot cycle. The propagation follows the internal real-time clock that you set before beginning operation. All the simulated stations you hear (with proper prefixes) are at distances you would expect to hear for the time of day and band selected.

You can learn and enhance your CW operating skills with Doctor DX. Doctor DX will not reward bad habits. AEA even offers an awards program to owners of Doctor DX that work all zones, 100 countries, 5 band Dr DXCC, or Doctor DX Honor Roll.

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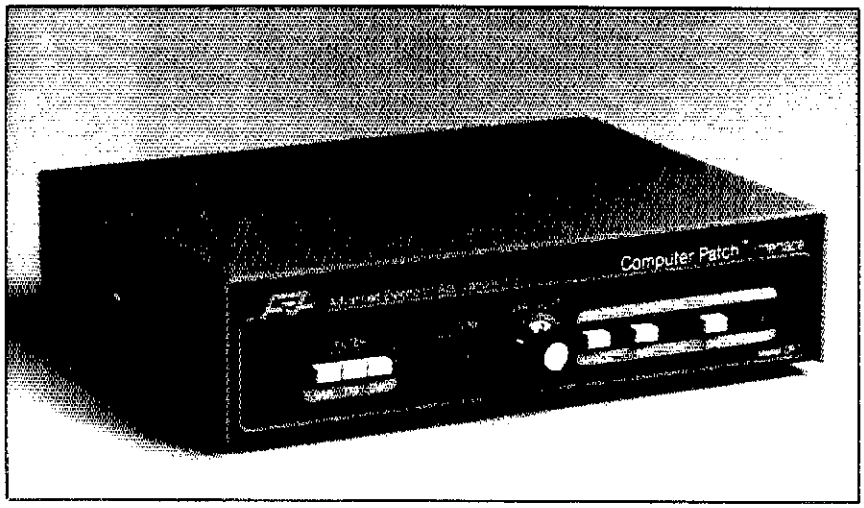

Production Expertise And Service Integrity Form The Foundation For Your Long-Term Satisfaction

The fact that the Computer Patch Interface unit by Advanced Electronic Applications, Inc. is known as the best value on the market is no accident. The CP-1 was designed by Al Chandler, K6RFK (PHD-E.E.), an active RTTY user since 1963.

Given a cost per unit budget for the CP-1, Al designed as much performance as possible into the Computer Patch, including a unique new tuning indicator, referred to by one of our customers as the "Dead Eye Dick" tuning indicator. This indicator is ideal for RTTY and CW, in that it is both fast to tune and (within 10 Hz) as accurate as scope tuning. It also performs under poor signal to noise conditions in which other indicators provide no useful data.

Al's variable shift tuning was designed to move the space filter center frequency from 2225 Hz to 3125 Hz without changing the bandwidth (by varying the Q of the filter). All this is accomplished using a precision ganged potentiometer to assure proper tracking of the multiple filter stages. We could have used a pot costing a tenth as much by simply using a two-pole filter design, but we feel the advantage of a sharper filter reduces the noise bandwidth significantly and allows the variable shift control to be used like passband tuning for extra elimination of adjacent channel interference.

Some manufacturers are concerned that amateurs might try calibrating their own equipment and, therefore, have used non-adjustable components, which results in sub-optimal performance. Although more costly, trimpots used in AEA equipment allow factory adjustment for performance to design specifications. Competently designed active filter circuits need not be adjusted after leaving the factory; however, for specialized use the owner can easily change filter parameters.

Mindful of the fact that many of our customers are new to RTTY, Al made the CP-1 tuning as forgiving as possible, while providing the most critical operator a piece of equipment in which he could be proud. Even old "pro's" are surprised at the poor signal conditions under which the CP-1 will still provide good copy.

You can now experience the BEST RTTY, CW, and AMTOR offered. Couple the CP-1 with our new AEASOFT™ software packages designed for the MARS, SWL, or amateur radio operator, and you will feel a pride reminiscent of what "made in U.S.A." brought in years gone by. Please do not hold the low price of the CP-1 against us. This is one case where you get much more than you pay for relative to any of the competitive units. For more information send for our FREE catalog. Better yet, see your favorite dealer.

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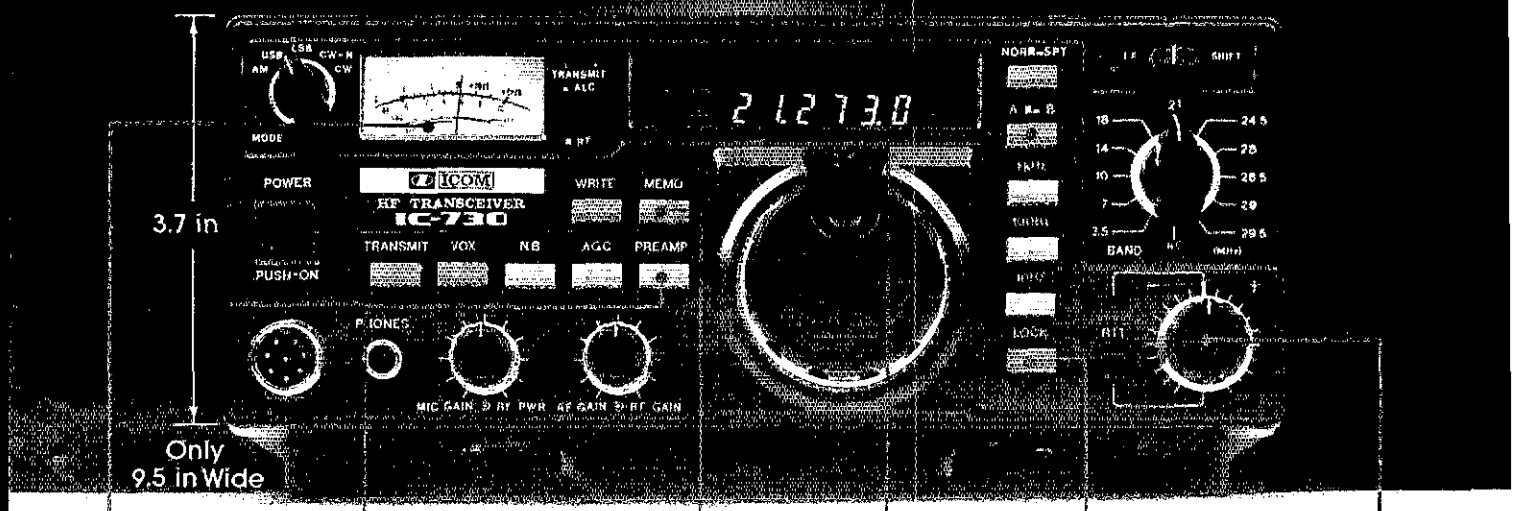
ICOM IC-730

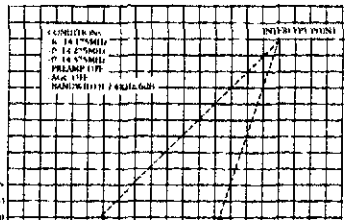
Proven, Reliable HF Compact Transceiver



BUILT-IN SWR BRIDGE | **BUILT-IN RECEIVE PREAMP** | **ONE MEMORY PER BAND** | **DUAL VFOs** | **TUNING KNOB LOCK** | **LARGE RIT TUNING KNOB**

ICOM's IC-730 go-anywhere HF all-band SSB/CW/AM transceiver, the best value on the market, has a proven record of high performance, ease of operation and durability. Compact in size, yet full-featured, the IC-730 has gained an uncomparable reputation.

Receiver Performance. Utilizing ICOM's DFM (Direct Feed Mixer), the IC-730 obtains a dynamic range of 100dB and an intercept point of 19.5dBm.



Superior front-end receiver performance, coupled with a switchable preamplifier and IF shift or passband tuning (optional), gives the IC-730 receiver flexibility yet allows it to be easy to operate.

Compact. The IC-730 is sized to be used mobile — either in a car, airplane or boat — to be carried in a suitcase, or to be used as a base station. Only 3.7 inches high by 9.5 inches wide by 10.8 inches deep, the IC-730 is a very compact package. Still the IC-730 sports a large tuning knob, large RIT knob, and large bandswitching knob to make mobile operation easy. The RIT control is conveniently located in the lower right corner to make access by touch easy while operating the unit mobile.

Convenience Features. The IC-730 has important features that make the unit easy to operate in a mobile environment. Two VFOs are easily accessed at the push of a button. Normal or split operation and three separate tuning rates for fast QSY or slow tuning are available. The dial lock deactivates the main tuning knob for rock-solid stability without the possibility of moving off frequency. One memory per band is provided to allow storage of net frequencies or favorite frequencies at the push of a button.

Full-Featured. The IC-730 has additional features which make it a joy to operate. A full 200W PEP input transmitter provides a powerful signal on SSB and CW (40W carrier power on AM). Eighty through 10-meter coverage is provided including the bands at 10, 18, and 24MHz. A speech processor is included as standard. Popular features such as digital readout, selectable AGC, VOX, SWR meter and noise blanker are also included as standard in the IC-730.

Complete. The IC-730 comes complete with a handheld microphone and power cord. The IC-730 is ready to use and ready to go when you are.

Affordable. Dollar-for-dollar, the ICOM 730 packs more punch and performance into a small package than ever thought possible.

Listen to IC-730s on the air and hear the sound of ICOM quality. The IC-730 is your best buy for a second rig for mobile portable operation or for your main HF station. See the IC-730 at your local ham equipment supplier today!

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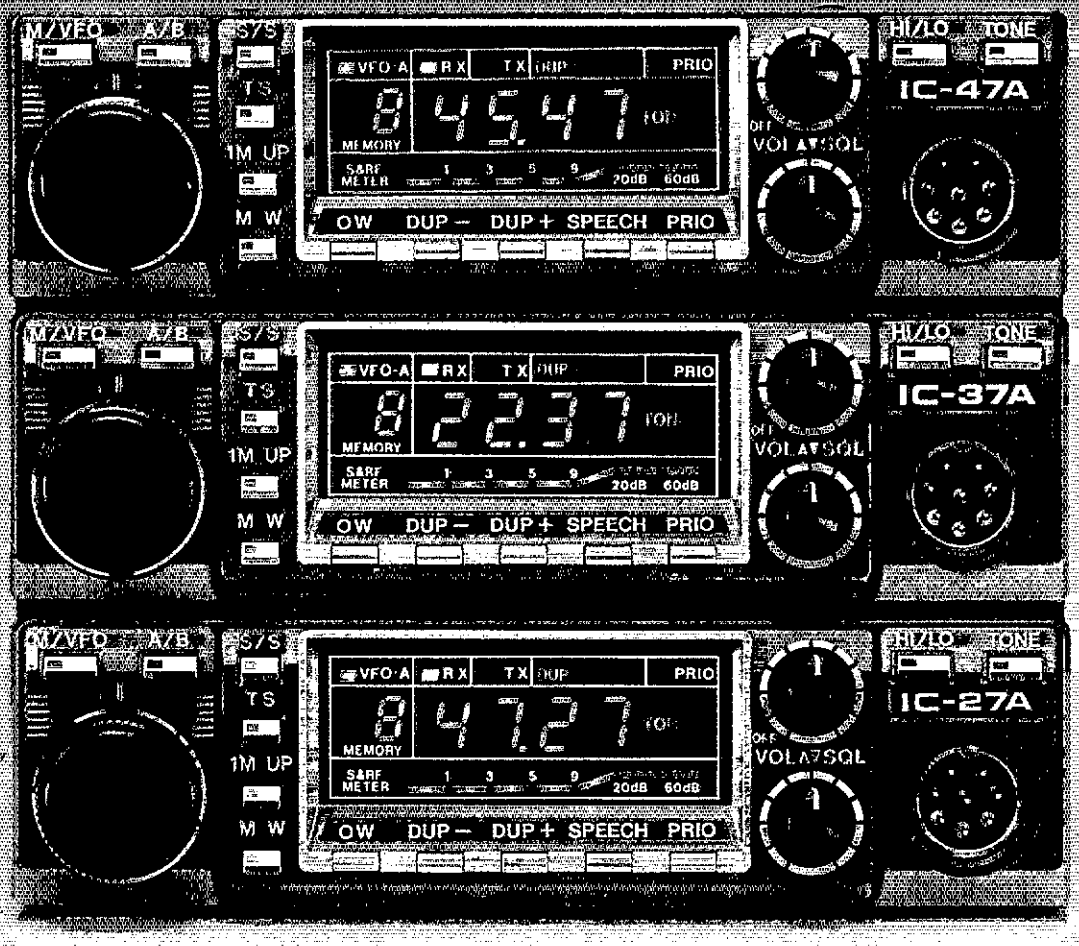


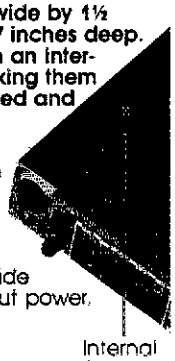
IC-47A
440MHz
25 Watts

IC-37A
220MHz
25 Watts

IC-27A
2 Meter
25 Watts

ICOM presents three ultra compact mobiles...the IC-27A 2-meter, the IC-37A 220MHz and the IC-47A 440MHz. The smallest mobiles available, the IC-27A/37A/47A series measure only 5½ inches wide by 1½ inches high by 7 inches deep. Yet, they contain an internal speaker making them fully self-contained and easy to mount.

25 Watts. In such an incredibly small package, the IC-27A/37A/47A are able to provide 25 watts of output power.



32 PL Frequencies. The IC-27A/37A/47A come complete with 32 PL frequencies ready to go. Each PL frequency may be selected by the main tuning knob and stored into memory for easy access along with frequency.

9 Memories. The IC-27A/37A/47A have 9 memories available to store receive frequency, transmit offset, offset direction, and PL tone. Memories are backed up by a lithium backup battery, which will store memories for up to seven years.

Speech Synthesizer. As an added plus, the IC-27A/37A/47A feature an optional speech synthesizer to verbally announce the receiver frequency of the transceiver through the simple push of a button. This allows the operator to hear which frequency he is operating on without looking at the transceiver.

Scanning. The IC-27A/37A/47A series has a scanning system which allows scanning of memories or scanning of the band.

Priority Scan. Priority may be selected to be either a memory channel or a VFO channel. By using sampling techniques, the operator can determine if a frequency which he wants to use is free or busy.

Microphone. Each IC-27A/37A/47A comes complete with a microphone with a 16-button pad for access to your favorite repeater or for dialing through an autopatch.

Stacking Mobile Mounts for the IC-27A/37A/47A make a small complete station for 1 to 3 bands. Each band is full featured and fully operational even when another band is in use.

The ICOM IC-27A/37A/47A provide superb performance in the mobile radio environment. See them at your local ICOM dealer.

ICOM

The World System

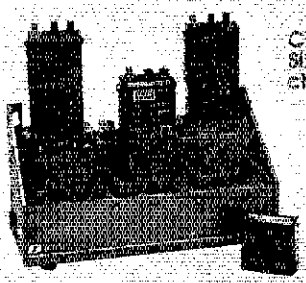
ICOM America, Inc., 2112-116th Ave NE, Bellevue, WA 98004 / 3331 Towerwood Drive, Suite 307, Dallas, TX 75234

ICOM Handhelds

Dollar-size and Dollar-wise

To meet your VHF and UHF communications needs, choose the ICOM 2-meter IC-02AT or the 440MHz IC-04AT full featured LCD readout handhelds. For exceptional features, quality built to last and a wide variety of interchangeable accessories, the IC-02AT and IC-04AT are optimum values.

Standard features include full frequency coverage, 140–149.995MHz and 440–449.995MHz with transmit frequencies covering U.S. MARS and CAP frequencies without modification, 10 memories, DTMF, duplex offset storage in memory (standard 600KHz plus four odd offsets), 32 keyboard selectable PL tones which store in memory, high/low power and internal lithium battery backup to maintain the memories for up to seven years. Slide-on battery packs with a battery lock, frequency lock and lamp on/off button provide operating convenience.



CM-60
Six-position
charger

Scanning systems are priority scan, memory scan and programmable band scan. Increments of 5, 10, 15, 20 or 25KHz are front panel selectable for band scan.

Keyboard entry with the 16-button pad allows easy access to all frequencies, duplex modes, memories, scanning, dial lock, PL tones, priority and DTMF.

An LCD readout indicates frequency, memory channel, transmitter output, dial indicator, offset direction, PL tone and scan functions plus Rx signal strength.

An aluminum case back provides superior heat sinking when the IC-02AT and IC-04AT are run at the standard three watt level or optional five watt level. Output power is determined by the battery pack used.

Accessories for the IC-02AT and IC-04AT include all accessories for the IC-2A series plus the new long-life IC-BP8 and high power (13.2 volt) IC-BP7 battery packs, HS-10 boom headset, HS-10SA VOX unit, HS-10SB PTT switchbox and CM-60 six-position charger.

One method of charging the IC-BP7 and IC-BP8 is by applying 13.8 volts through the tap connector of the transceiver. This allows operation of the transceiver with or without the battery connected.

See the IC-02AT and IC-04AT handhelds at your nearest ICOM dealer.

The IC-02AT and IC-04AT come standard with an IC-BP3 NiCd battery pack, flexible antenna, BC-25U wall charger, belt clip and wrist strap.

ICOM

The World System

ICOM America, Inc., 2112-116th Ave NE, Bellevue, WA 98004 / 3331 Towerwood Drive, Suite 307, Dallas, TX 75234

ICOM IC-471H

75 Watt 430-450MHz Base

ICOM presents the IC-471H 430-450MHz base station transceiver with a 75-watt transmitter and high dynamic range, low noise receiver. With FM, CW or SSB modes plus the most advanced 10Hz PLL system, the IC-471H has features which give you maximum UHF operation.

75 Watts. With 75 watts of power, the IC-471H provides the power required for simplex or repeater operation. Power is adjustable in all modes from 10 to 75 watts. This enables adjusting the drive level to a linear amplifier for higher power uses such as moonbounce.

Receiver. An extremely low-noise, professional-grade receiver and a high signal-to-noise ratio PLL which allows the IC-471's synthesizer to lock to 10Hz, provide receiver performance unparalleled by other UHF receivers. A mast-mounted preamp is switchable from the front panel and provides an easy-to-use option for weak signal work.

Mast-Mounted Preamplifier

32 Full-Function Memories. Each tunable memory holds frequency, offset, offset direction, mode and subaudible tone. Each parameter is selected by rotating the main tuning knob in conjunction with the other controls on the front panel.

Subaudible Tones. Included as a standard feature are 32 built-in subaudible tones which are easily selected by rotating the main tuning knob. PL tones may be stored into memory.

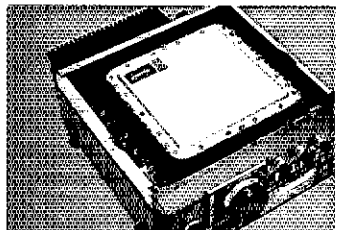
Size. Only 11¼ inches wide by 4⅜ inches high, the IC-471H is engineered for ease of operation.

Scanning. The IC-471H can scan its 32 memories sequentially or selectively by mode and by programmed sections of the band. Mode-S scan can be used to scan only memories with a particular mode.

Fluorescent Display. ICOM's high-visibility and easy-to-read display gives all the information necessary for logging a contact. Frequency, mode, duplex, offset direction, RIT frequency, memory channel number and PL tone can be displayed.

Other Standard Features. To facilitate the operation of the IC-471H, ICOM has incorporated a duplex check switch, all-mode squelch, receive audio tone control, S-meter, center meter, seven-year lithium battery memory backup, accessory connector and microphone.

Optional Features. IC-471H options are: AG-25 switchable mast-mounted preamplifier, UT-15 CTCSS encoder/decoder, CT-10 computer interface and EX-310 voice synthesizer. A variety of optional power supplies are available: the IC-PS30 base station supply, IC-PS15, and the internal IC-PS35.



IC-471H shown with internal power supply (IC-PS35)

The IC-471A. The 25-watt IC-471A is also available and has the same outstanding features as the IC-471H, plus an optional IC-PS25 internal power supply for portable operation.

Also available to complete your VHF/UHF base station, are its 2-meter companions, the 100-watt IC-271H and 25-watt IC-271A.

See the IC-471H and other ICOM equipment at your local authorized ICOM dealer.

ICOM

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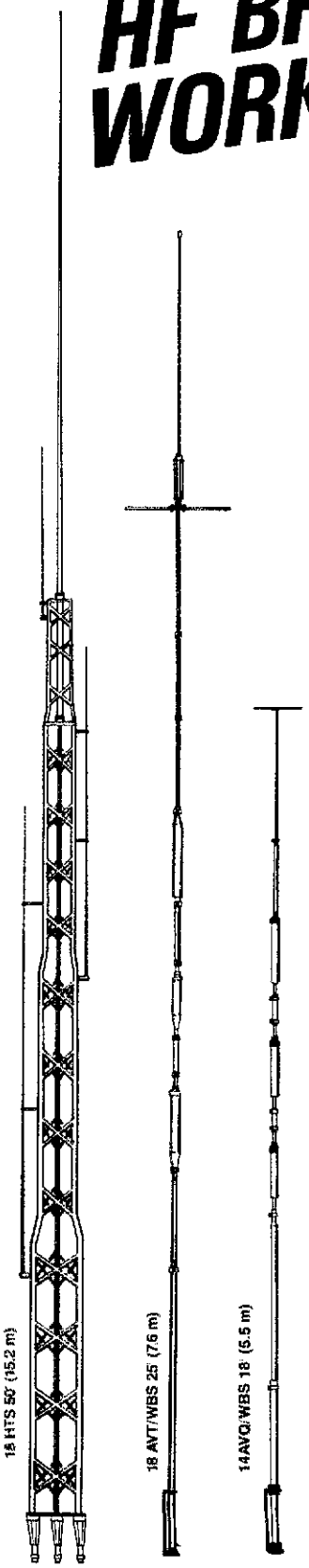
ICOM America, Inc., 2112-116th Ave NE, Bellevue, WA 98004 / 3331 Towerwood Drive, Suite 307, Dallas, TX 75234

hy-gain®

HF BROADBAND VERTICALS WORK THE WORLD

Hy-Gain broadband vertical antennas load the new auto-tune solid state rigs, require minimal space and provide low angle radiation without the expense or the problems of support structures.



18AVT/WBS (80-10 meters) The most successful vertical antenna of all and for good reasons. Broadband performance covers the 40, 20, 15 and 10 meter bands in their entirety. Automatic 5 band switching is accomplished by mechanically superior, highly efficient factory tuned Hy-Q traps with large coils for consistent performance at 2:1 or lower VSWR on 40-10 meter band edges; bandwidth on 80 meters is approximately 40 kHz with VSWR below 2:1. A factory tuned matching network for 50 ohms impedance is dc grounded for lightning protection and reduced precipitation static. The mechanical integrity of this antenna is so stable that performance does not change with the weather. The 18AVT withstands winds to 80 mph (128 km/h) without guying. All stainless steel hardware is included.

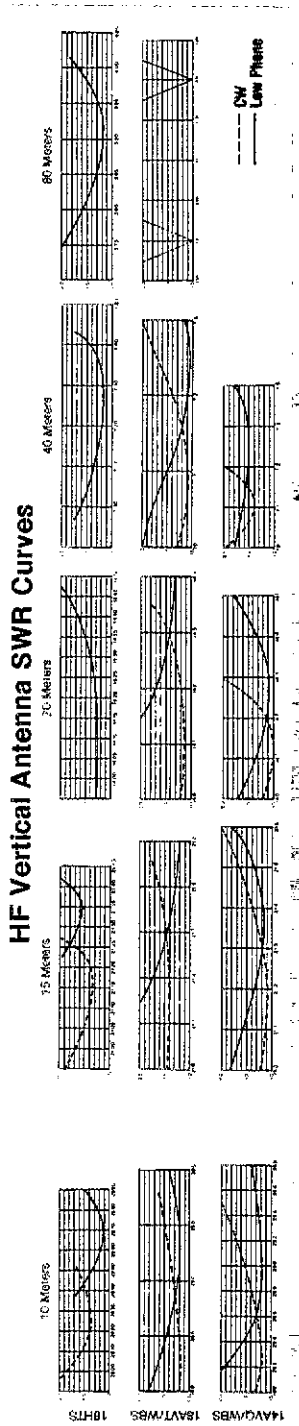
14AVQ/WBS (40-10 meters) Offers very similar construction and the same excellent broadband performance as 18AVT over the entire 40, 20, 15 and 10 meter bands; automatic band switching with mechanically superior large-coil Hy-Q traps and very low angle radiation pattern. The smaller, low visibility size also makes the 14AVQ very suitable for roof mounting. The optional 14RMQ roof mounting kit includes base plate, mast and radial/guy wires. All antenna hardware is stainless steel.

18 HTS (80-10 meters. 160 meters with optional loading coil) The superb reliability of the 18 HTS is manifest in installations now over 20 years old. And, with the improvements we made over the years, the 18HTS is now better than ever. Automatic band selection is achieved through a unique stub decoupling system which effectively isolates various sections of the antenna so that an electrical ¼ wavelength (or odd multiple ¼ wavelength) exists on all bands. For example, outstanding broadband performance on 20, 15 and 10 meters is achieved with an extended ¾ wave collinear. On 80 meters bandwidth is approximately 250 kHz at 2:1 VSWR. With the optional base loading coil exceptional performance is also provided at 160 meters. The galvanized tower requires no guying and withstands winds to 100 mph (160 km/h). A special hinged base allows complete assembly at ground level and permits easy raising and lowering. Includes stainless steel hardware.

Other Hy-Gain vertical multiband antennas are available though not shown here. The 12AVQS (20, 15, 10 meter) is similar to 18AVT above but with VSWR of 1.5:1 or less on all bands. The 18VS (80-10 meter) comes with a base loading coil and may be installed on a short mast driven into the ground. All include stainless steel hardware.

PHASE FOR GAIN

Any two identical Hy-Gain verticals can be phased for excellent gain and directivity. A great system for beam performance on 40, 80 and 160 meters or for 10, 15 and 20 meters where space is limited. Send for our free technical report "Phased Verticals".



Hy-Gain Verticals that work the world at better Amateur Dealers.

TELEX® hy-gain®

TELEX COMMUNICATIONS, INC.

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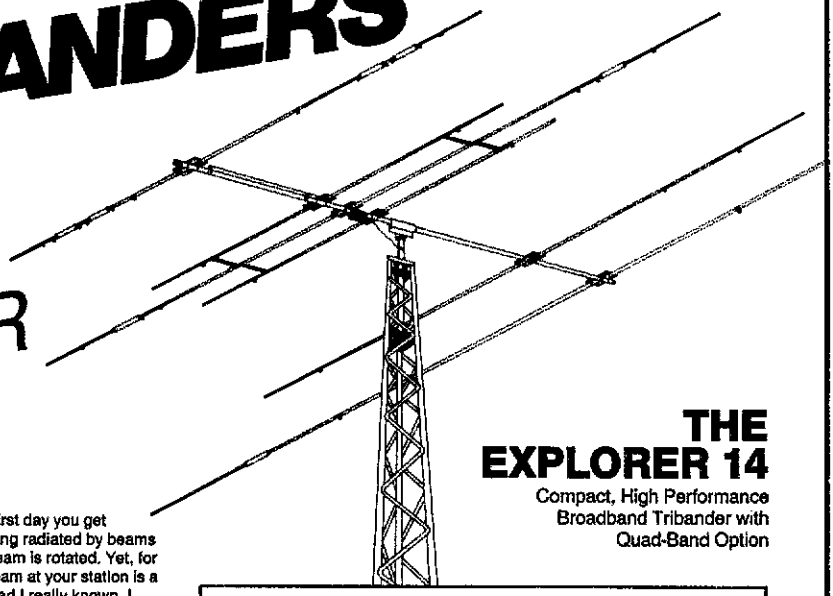
Europe: Le Bonaparte–Office 711, Centre Affaires Paris-Nord, 93153 Le Blanc-Mesnil, France.

hy-gain®

BROADBANDERS

MAXIMIZE THE POTENTIAL OF YOUR HAM GEAR



There is nothing like a beam!

You hear about the importance of the antenna system from the first day you get involved in amateur radio. You hear the big signals on the air being radiated by beams and you hear those same signals virtually disappear when the beam is rotated. Yet, for whatever the reason, getting on the air for the first time with a beam at your station is a down-right exhilarating experience. The universal reaction is "Had I really known, I would have installed a beam years ago".

The gain of a beam multiplies the effective radiated power of your transmitter just like an amplifier. More importantly, it amplifies the signal from the station being beamed. Off the sides and back of the antenna, the effective radiated power of those kilowatts on/near your frequency are reduced to manageable QRP levels.

A well-designed beam is by far the best performance buy you can make and it doesn't use any electricity. Further, if you buy a good one, it will last longer than some of the electronics gear in your shack. In terms of cost per hour of enjoyment, a beam antenna is among the least expensive major station components.

As sunspot cycle 21 winds down over the next few years the priority for a good beam shifts from "great to have" to "essential!" To maximize your station capability on the high bands choose one of these super broadband arrays.

THE EXPLORER 14

The same compact size as the well-known TH3Mk3 it replaces. The driven element uses an open sleeve dipole which is a concept that we call PARA-SLEEVE (Patent Pending). The para-sleeve design achieves the broadband performance objective. The forward gain and front to back ratio is very impressive, especially when compared with other antenna designs in the same size class. 43 lbs. (19.5 kg) of superb performance on a 14 ft. (4.3 m) boom. Turning radius 17 ft. (5.3 m) and 7.5 sq. ft. (.69 m²) of surface area. The EX 14 is the ideal choice where space is limited. Great for roof mount or on smaller towers. Optional QK7-10 kit adds your choice of either 30 or 40 meters to the driven element.

FIVE ELEMENT THUNDERBIRD TH5Mk2

Broadbanding is achieved with our unique dual driven element system. Five elements on the 19 foot boom (5.8 m), with four active elements on each of the three bands. 72 lbs. (32 kg) of rugged antenna with 7.4 sq. ft. (.68 m²) of surface area. Turning radius is a manageable 18.4 ft. (5.6 m).

SEVEN ELEMENT THUNDERBIRD TH7DX

This is a broadband successor to the legendary TH6DXX. Five active elements on 10 meters and four elements on both 15-20 meters. The TH7DX represents the ultimate in high-performance arrays whether you're comparing other large tribander's or stacked monobander's. 76 lbs. (35 kg) with a surface area of 9.4 sq. ft. (.87 m), a 24 ft. (7.3 m) boom and a turning radius of 20 ft. (6.1 m). If you own a TH6DXX, a conversion kit is available which includes the second driven element, the completely new matching system, a full set of stainless steel hardware, and of course, step by step instructions. After conversion, your TH6DXX is a TH7DX, exactly.

FEATURES COMMON TO EX 14, TH5Mk2, and TH7DX:

- Separate Hy-Q traps for each frequency. Factory assembled and individually resonated to insure uniform performance.
- Handles maximum legal power with a respectable margin of safety.
- Unique broadband beta match assures efficient energy transfer and places the entire antenna structure at dc ground.
- BN 86 balun supplied as standard.
- Top quality stainless steel hardware supplied at no added cost.
- Super strong, taper swaged 6063-T832 thick-wall aluminum tubing used throughout.
- Unique Hy-Gain die cast aluminum boom to mast bracket. Accepts mast diameters up to 2½" (63 mm).
- Twist and slip proof die formed heavy gauge aluminum element to boom brackets.
- All tubing deburred and cleaned for ease of assembly.
- Only one set of dimensions for complete coverage of all three bands below 2:1 SWR.
- Designed to survive winds of 100 mph (160 km/hr).

THE EXPLORER 14

Compact, High Performance Broadband Tribander with Quad-Band Option

The value of a Directional Antenna was one of my early "discoveries". Over the years, I have built or bought numerous Quads and Yagis. I have never been so impressed as I am with my TH7DX. I enjoy QRP but now have a problem convincing folks that I am only running 5 watts! The TH7DX is a superb antenna, both from a performance and a structural point of view.

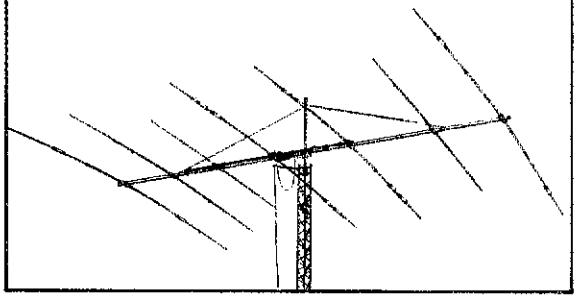
Congratulations!

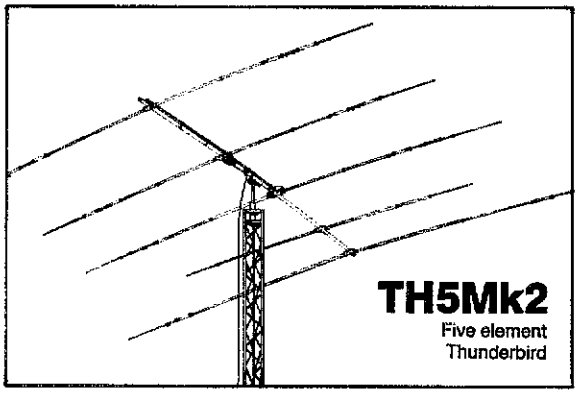
Jack Falker
W8KR

(W8KR has worked all countries but two!)

TH7DX

Seven element Thunderbird





TH5Mk2

Five element Thunderbird

TELEX® hy-gain®

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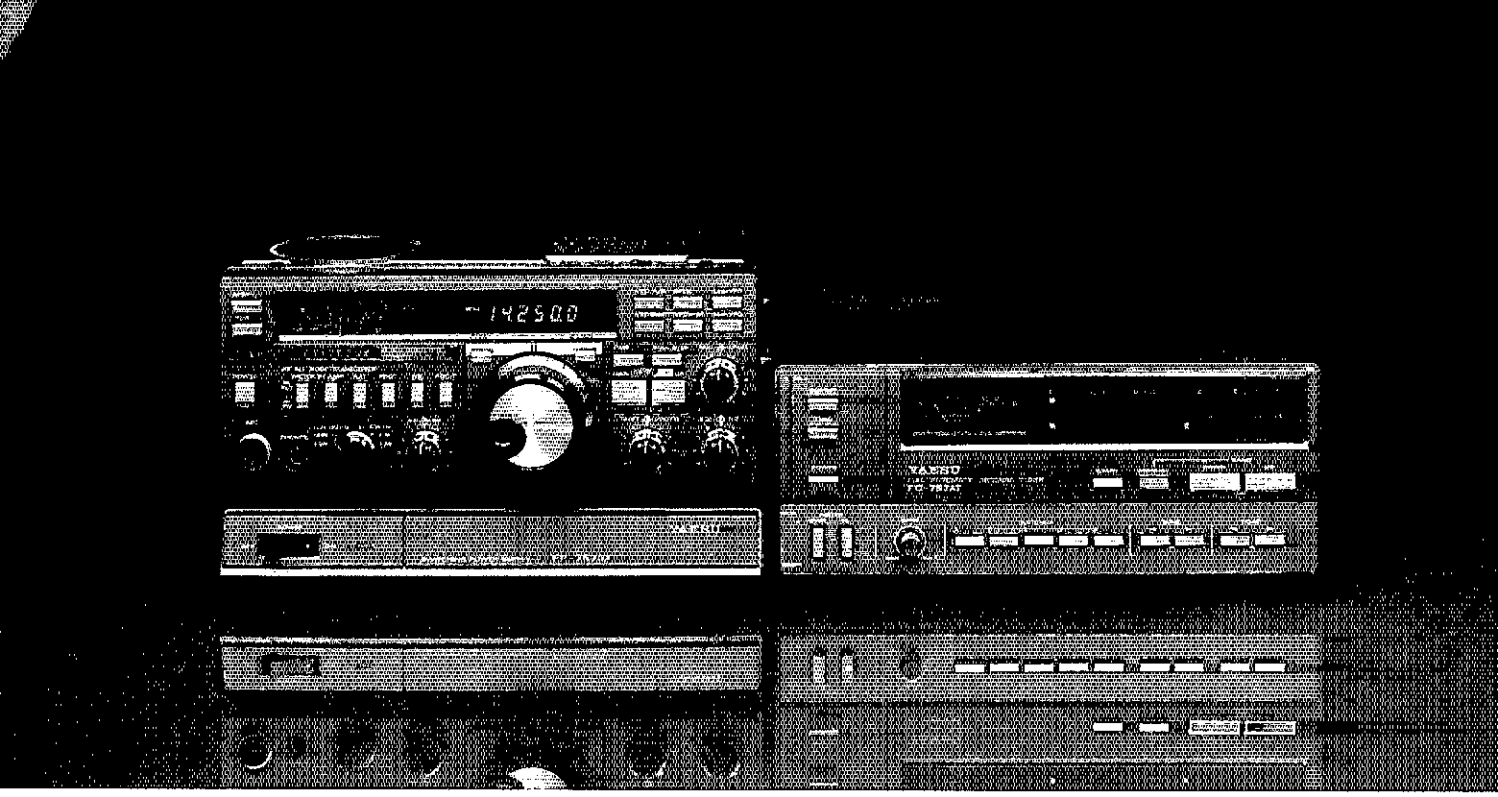


Yaesu HF radios rely on state

Some people feel the name that goes on a radio is more important than what goes into it.

At Yaesu, we let our technology speak for itself: a unique blend of engineering know-how and user suggestions that make our HF products superior.

But don't take our word for it. Take a look at our transceivers and make up your own mind.

The economical FT-757GX. A mobile transceiver that might never leave your shack.

You told us what you wanted in an HF rig that operates both in the car and at home. We've answered with the FT-757GX: a compact 12-volt transceiver with all the extras built in. Features you'd normally pay a lot more for.

As standard equipment you get AM and FM modes, electronic keyer with dot-dash memory, 600-Hz CW filter, noise blanker, AF speech processor and 25-kHz marker generator. All at no extra charge.

The FT-757GX's high-performance general coverage receiver lets you listen from 500 kHz up to 30 MHz. The transmitter covers 10 to 160 meters, including the new WARC bands. Dual VFOs and single-button VFO/memory swap make split-frequency operation easier than ever before.

Use the 8 memories to store your favorite frequencies on any of the bands. Then touch a button to jump to any programmed frequency without worrying about a bandswitch.

For base-station use, the space-saving FP-757GX flatpack power supply shown in the photo is ideal. With this supply, the rig delivers 100 watts output on sideband, FM and CW.

In addition, a massive heatsink permits continuous RTTY operation at full power output for up to 30 minutes. Full power for long periods does require the use of the FP-757HD heavy-duty supply.

To the right of the transceiver is the FC-757AT, a fully-automatic antenna tuner designed especially for the FT-757GX. This optional tuner stores in its memory the antenna selection and matching network settings for each band. When you operate that band again, the tuner automatically recalls the matching network settings and chooses the proper antenna.

With an optional interface unit, you can control VFO frequency and memory functions via your personal computer.

Contact your Yaesu dealer regarding MARS operation for both transceivers.

f-the-art, not state-of-mind.

The FT-980.
The cleanest signal on the air.
We know that the quality of the signal you put out is a reflection on you.

So when we designed the FT-980, we took clean output seriously. So seriously in fact, that you won't find a cleaner transmitter on the market.

Featuring a conservatively designed final amplifier that loafs at a fraction of its rated power output, the FT-980 cuts distortion levels to new lows. So you get a signal you can really be proud of.

We designed the FT-980 with complete operating flexibility in mind. But not at the expense of fundamental performance.

You can set and forget about 50% of the front panel controls.

Store your favorite frequencies and operating mode independently in each of the 12 memory channels. Review the contents of any memory location, without disturbing the QSO in progress, by using the checking function.

Going from one programmed frequency to another is simple and fast. Just touch a button to recall any channel.

You'll find the FT-980 tolerant of imperfect antennas. There's essentially no power turn-down with an SWR of 2:1 and just 25% turn-down at 3:1.

There's lots of flexibility built into the triple-conversion receiver. For one thing, there are separate front ends for ham and general coverage reception. So ham band operation is not compromised.

Multiple levels of IF filtering assure outstanding rejection of unwanted signals close to your operating frequency. And armchair copy under really brutal conditions.

The FT-980 comes ready to hook up to your personal computer. You can control operating mode, IF passband, frequency, and memory functions from a remote location. A variety of computer interfaces are available. See your Yaesu dealer for details.

State your mind.
When you visit your dealer, tell him you want the latest in HF technology. A radio built by Yaesu.

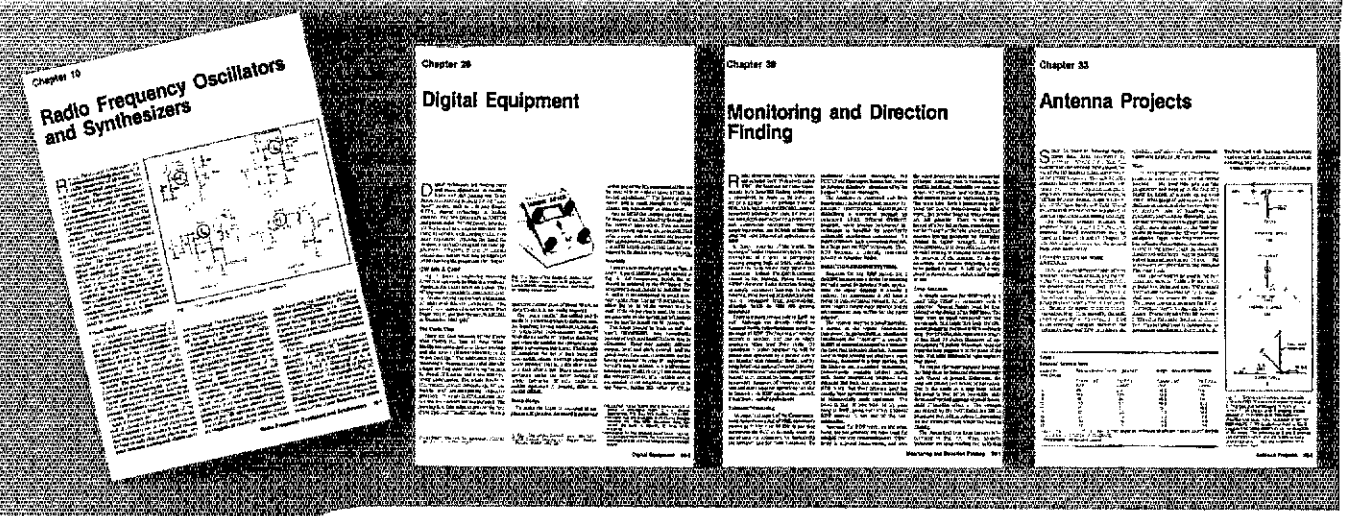
YAESU

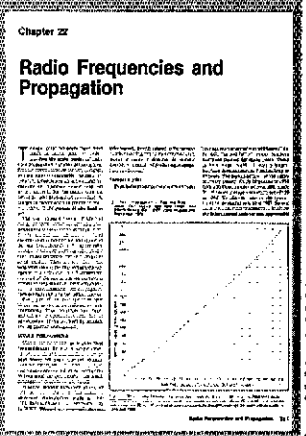
Yaesu Electronics Corporation
6851 Walthall Way, Paramount, CA 90723
(213) 633-4007

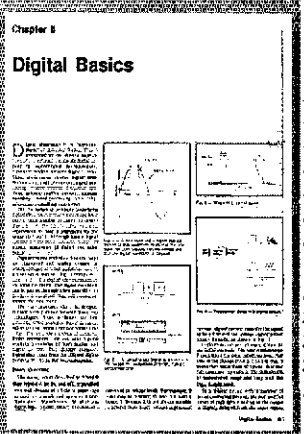
Yaesu Cincinnati Service Center
9070 Gold Park Drive, Hamilton, OH 45011
(513) 874-3100.

Prices and specifications subject to change without notice.

One of the most significant announcements in many years concerning an Amateur Radio publication follows on the next pages.....







COMPARE!

1985

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3. Radio Design Techniques and Language
4. Solid State Fundamentals
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21. VHF and UHF Antennas
22. Operating a Station
23. Vacuum Tubes and Semiconductors (Tables)

648 PAGES

The *1985 Handbook* will be available in November. Paperbound prices are $15.00 in the U.S., $16.00 in Canada and elsewhere. Cloth prices are $22.50 in the U.S. and $24.00 elsewhere. Prices in U.S. funds. Foreign remittance should be in the form of an international money order or a check drawn on a bank account in the U.S.

Photo credit: The photograph at the beginning of this section is of XE2FU operated by The Texas DX Society during the ARRL DX Test. Photo by K5RC and AA5Y.

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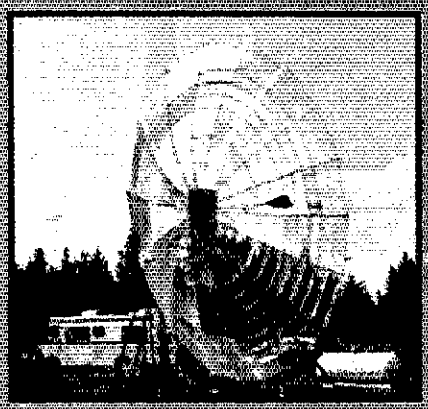
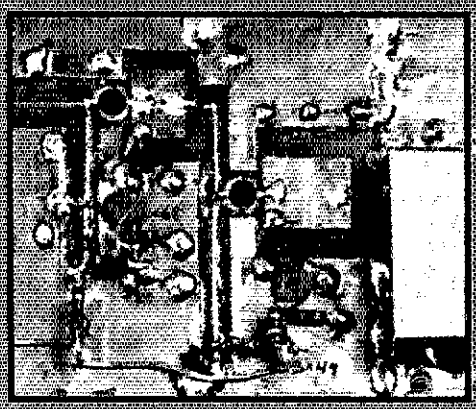
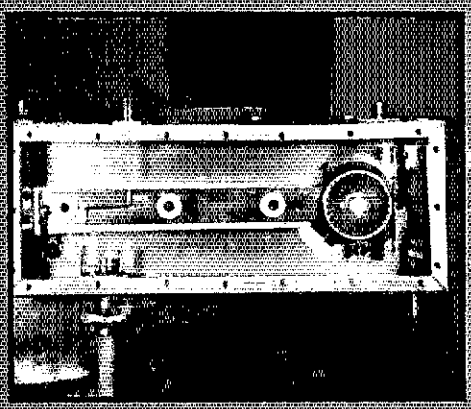
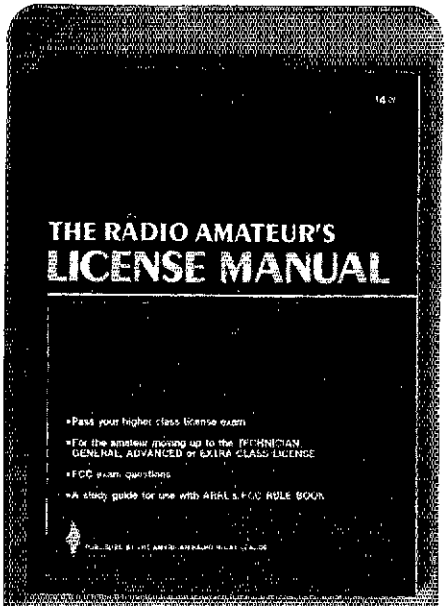
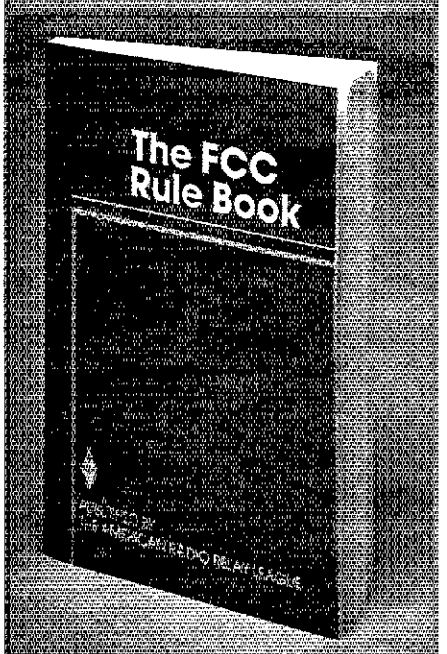
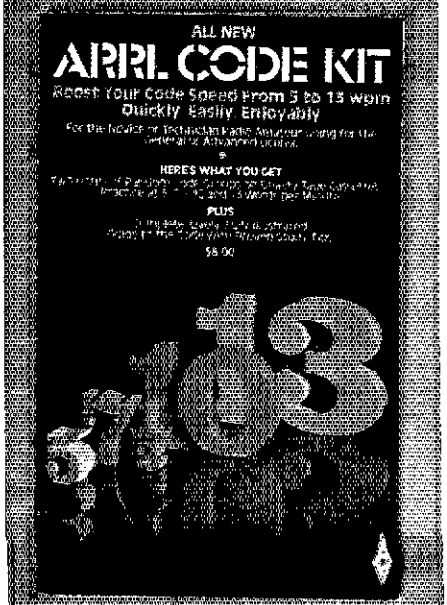




THE ARRL 1985 HANDBOOK

FOR THE RADIO AMATEUR





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1 THE RADIO AMATEUR'S LICENSE MANUAL

A change in format! Whether you plan to take an FCC supervised exam or one administered by volunteers, you'll find the material needed to pass the technical and operating portions with ease. Covers the Technician, General, Advanced and Extra Class exams, and includes sample study questions and answers. Also included in this latest edition is the pool of questions released to the public by the FCC for use by volunteers. The big change is that the regulatory material is now covered separately in the *FCC Rule Book* so that the most up-to-date material can be presented.

2 THE FCC RULE BOOK

Contains complete FCC rules with explanations in the popular "Washington Mailbox" format adapted from *QST*. Covers FCC rulemaking, the Communications Act of 1934, and international regulations. Chapters include topics on technical standards, basic and specialized operating practices, "Thou Shalt Nots", and Part 97 — The Amateur Radio Service Rules.

3 THE ARRL CODE KIT

Boost your code speed from 5 to 13 words-per-minute quickly and enjoyably. Two C-60 cassettes provide practice at 5, 7½, 10 and 13 wpm. The booklet included in the package is packed with proven suggestions and hints for increasing your ability to copy the code. If you have already mastered 13 wpm, we have a separate C-60 cassette available with practice at 15 and 20 wpm.

License Manual: $4.00
2nd Edition of the FCC Rule Book: $3.00
The ARRL Code Kit: $8.00 **15/20 wpm cassette** $5.00

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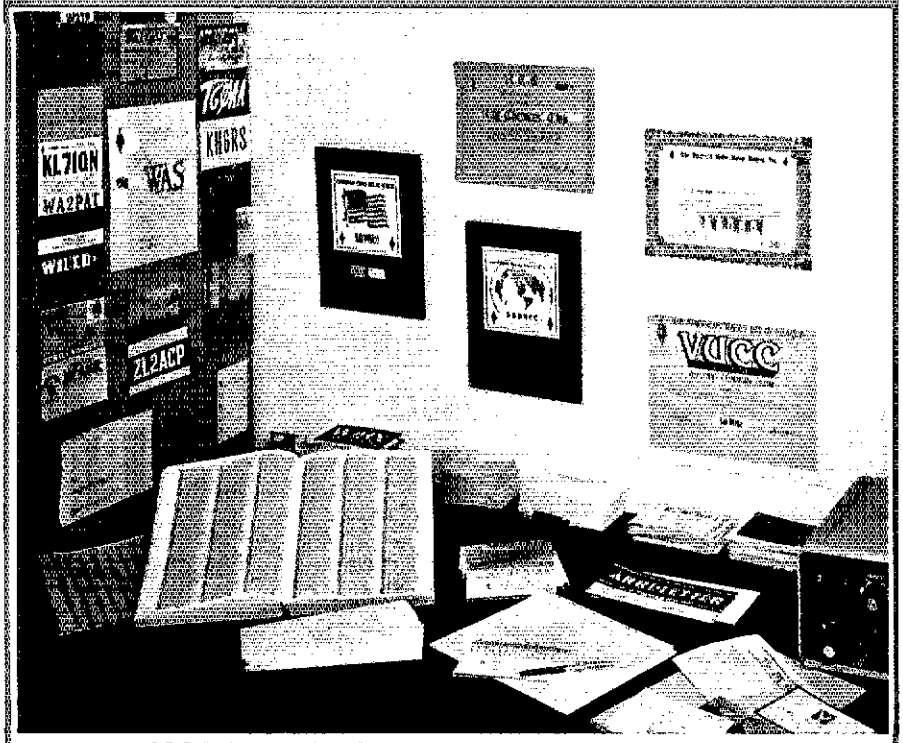

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Whether you are *DXCC Honor Roll* bound or just beginning to collect QSL cards for the WAS award, you'll find the addresses you need quickly and easily. There are over 453,000 listings of U.S. Amateur Radio licensees listed alphabetically in callsign order. The section covering club stations is the most accurate to be found. Only $15.75 in the U.S. and $19.75 in Canada and elsewhere.

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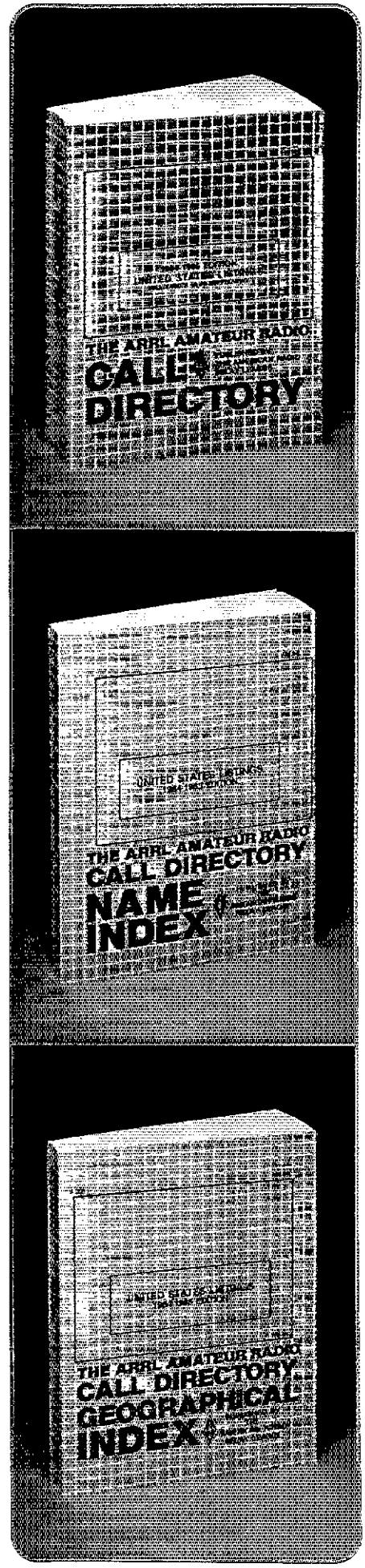
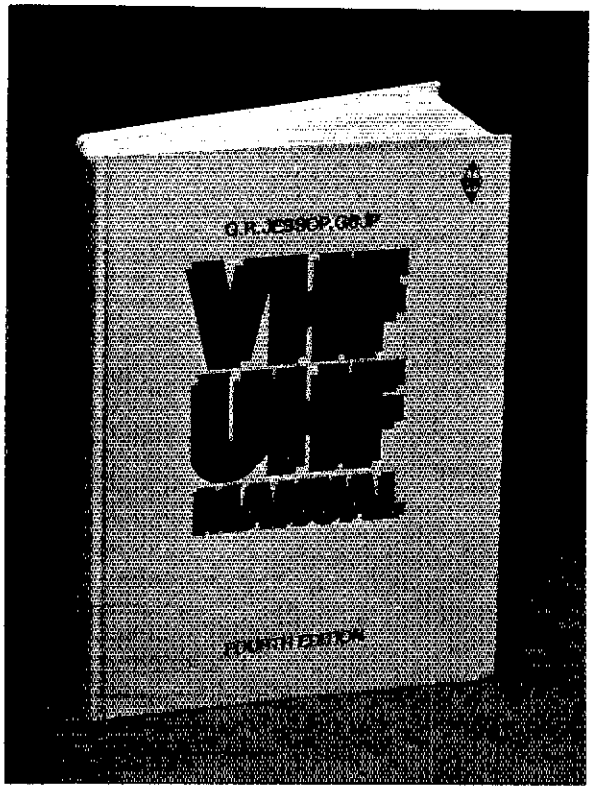
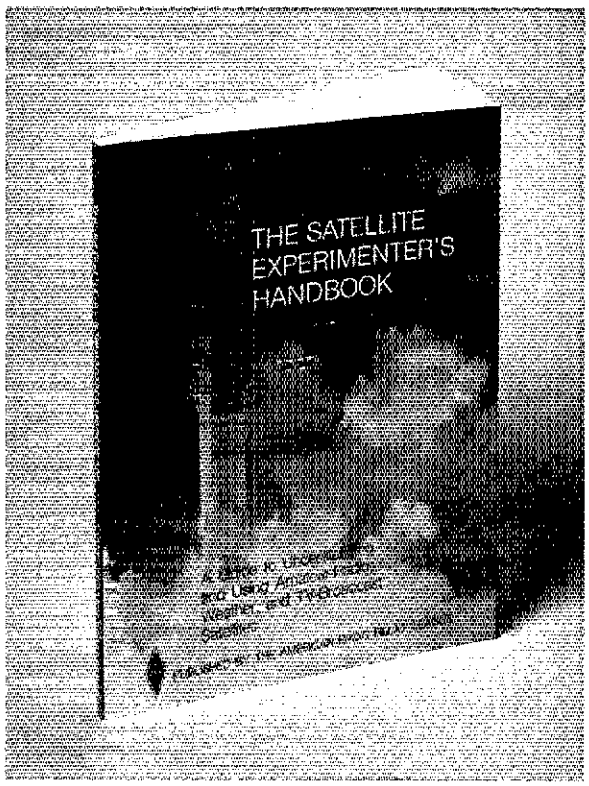




VHF-UHF Manual by G. R. Jessop, G6JP. You will find the new fourth edition of ***VHF-UHF Manual*** jam-packed with practical theory and construction projects for the region above 30 MHz to 24 GHz. The microwave chapter has been expanded to 83 pages; and includes information on: converters, cavity amplifiers, Gunn diodes, waveguides, directional couplers, and antennas. Receivers and transmitters are covered in 181 pages. The balance of the 512-page book contains chapters on propagation, tuned circuits, space communications, filters, test equipment, antennas, and a handy data section. (Since this is a British publication, there is little coverage of the 6-meter band, but many of the 4-meter band projects can be adapted by the experienced amateur for use on 6-meters.) Copyright 1983 Hardbound $17.50

Under one cover, here is all you need to communicate through or pick up the signals from orbiting satellites. Whether your interest is in Amateur Radio, weather or TV-broadcast spacecraft, you'll find what you looking for in ***The Satellite Experimenter's Handbook.***

Since the first OSCAR (Orbiting Satellite Carrying Amateur Radio) was launched in 1961, thousands of ham radio operators, scientists, educators and satellite enthusiasts from around the world have used these "birds" for pleasure, education and experimentation. You can join them! And if you're already into satellite communications, you'll find a wealth of practical information on all aspects of these spacecraft—from satellite design to ground-station equipment and antennas. You'll find ***The Satellite Experimenter's Handbook*** to be indispensable. $10 U.S., $11 in Canada and Elsewhere. ARRL 225 Main St., Newington, CT 06111.



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BOOKS

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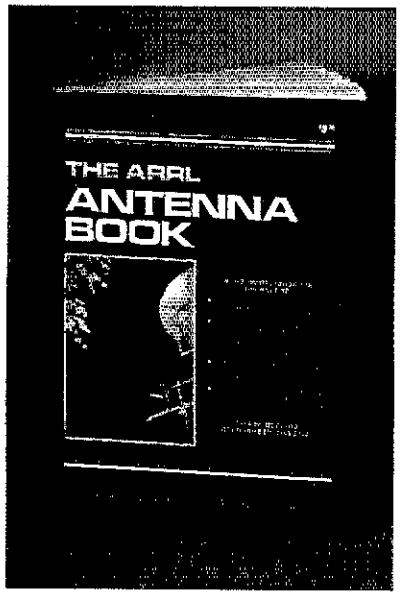
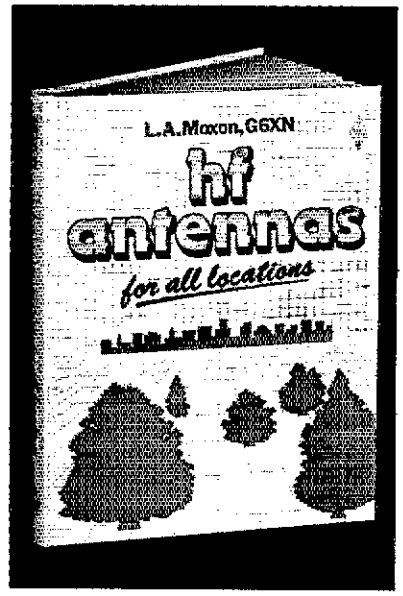
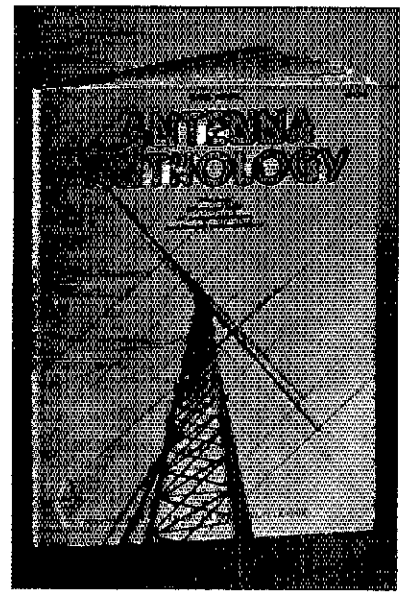


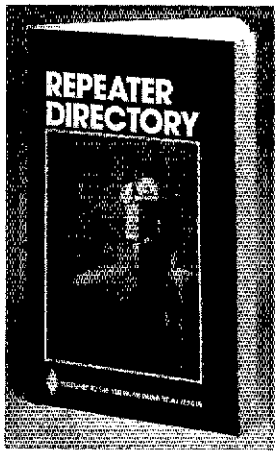




THE ARRL ANTENNA BOOK The best and most up-to-date antenna information around. The just revised 14th Edition contains in its 328 pages propagation, transmission line and antenna fundamentals. You can update your present antenna system with practical construction details of antennas for all amateur bands - 160 meters through microwaves. There are also antennas described for mobile and restricted space use. Tells how to use the Smith chart for making antenna calculations and covers test equipment for antenna and transmission line measurements. Over 600,000 copies of previous editions sold. Paperbound. Copyright 1982. **$8.00** in the U.S., **$8.50** elsewhere.

HF ANTENNAS FOR ALL LOCATIONS by L.A. Moxon, G6XN. An RSGB publication. Contains 264 pages of practical antenna information. This book is concerned primarily with small wire arrays, although construction information is also given on a small number of aluminum antennas. Chapters include: Taking a New Look at hf Antennas; Waves and Fields; Gains and Losses; Feeding the Antenna; Close-spaced beams; Arrays, Long Wires, and Ground Reflections; Multiband Antennas, Bandwidth; Antenna Design for Reception; the Antenna and its Environment; Single-element Antennas; Horizontal Beams; Verticle Beams; Large Arrays; Invisible Antennas; Mobile and Portable Antennas; What Kind of Antenna: Making the Antenna Work; Antenna Construction and Erection. Copyright 1982, 1st Edition, Hardbound **$12.00.**

ANTENNA ANTHOLOGY The best *QST* hf antenna articles and theory presentations. Verticals: 2 and 4 band verticals for the novice, Cheapie GP, High Performance system for 20, 40 and 80, other loaded systems. Yagis: Short antennas, and The Log-Yag Array. Quads: Wire quads for 80 and 40, 2-Element Quad for the Novice, Miscellaneous Antennas: Loops, Delta-loops, Antennas for travel trailers and campers, plus matching devices and antenna test accessories. Copyright 1978, 148 pages. **$4.00** U.S., **$4.50** elsewhere.



REPEATER DIRECTORY

If you use repeaters... you will need the latest copy of the ARRL REPEATER DIRECTORY. For your operating convenience repeaters are listed by frequency and by state. Available at your local ARRL dealer or order direct from Headquarters.

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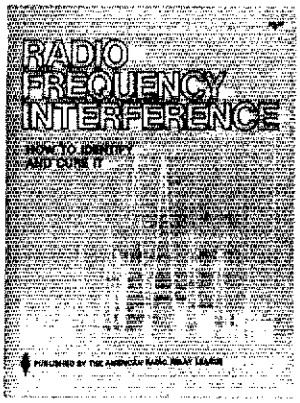

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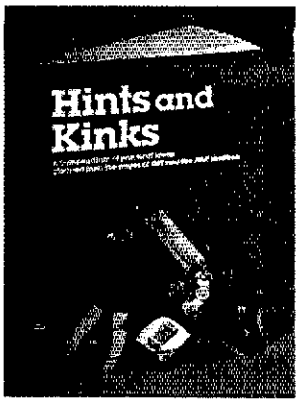
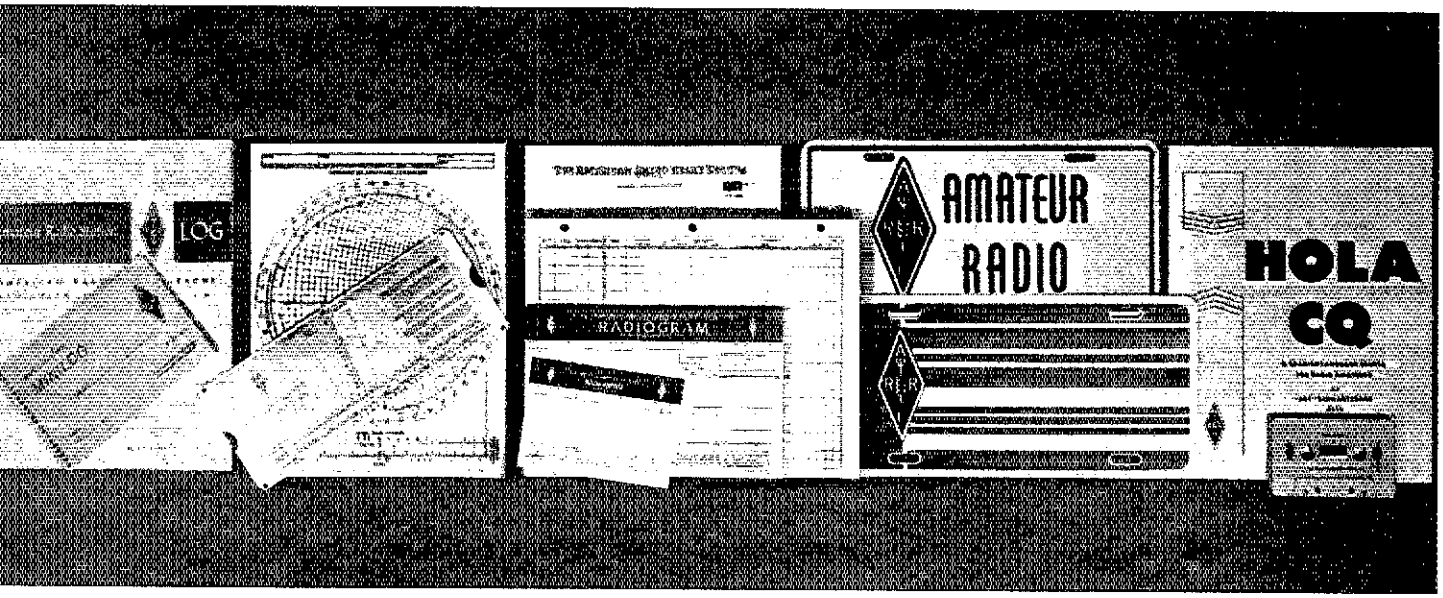


The recently published 3rd Edition of **RADIO FREQUENCY INTERFERENCE** tells how to identify and resolve such problems caused by electrical devices and power lines. Covers CATVI; tells how to determine if your transmitter is at fault; lists cures for RFI problems in home entertainment devices and gives addresses of manufacturers who will provide assistance. Tells the role of the FCC; provides an extensive bibliography. Copyright 1984, 64 pages **$3.00** U.S. **$3.50** elsewhere.

HINTS & KINKS One of the most popular columns in *QST* is "Hints and Kinks". Every so often during the past 50 years we have collected the best of the gimmicks, gadgets and small construction projects presented in the column and published them in an anthology. The 11th Edition of *Hints and Kinks* is the latest in the series (past editions are out of print.) **$4.00** U.S. and **$4.50** elsewhere.



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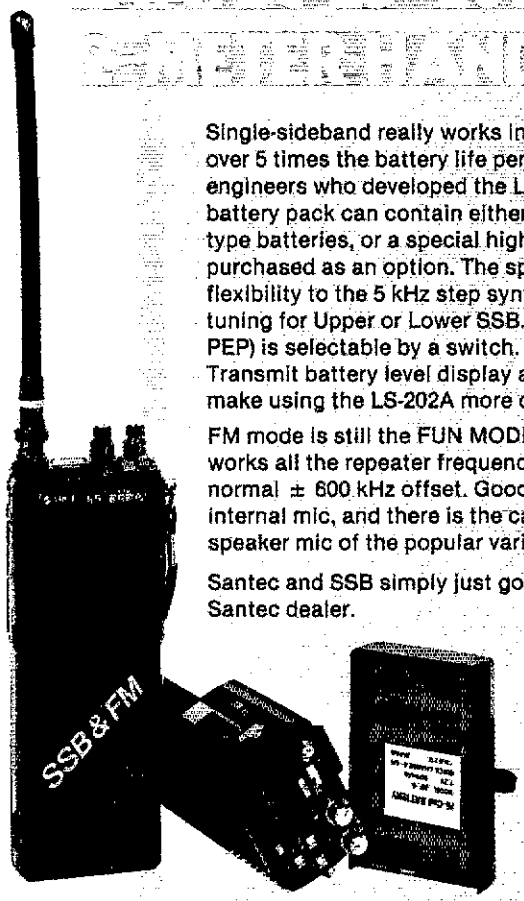

Single-sideband really works in nonrepeater situations and has over 5 times the battery life per battery charge according to the engineers who developed the LS-202A. The slide-on, locking battery pack can contain either Ni-Cd 'AA' cells or 'AA' alkaline-type batteries, or a special higher voltage Ni-Cd pack can be purchased as an option. The special VXO and RIT circuits add flexibility to the 5 kHz step synthesizer to provide continuous tuning for Upper or Lower SSB. High (2.5 W PEP) or Low (0.5 W PEP) is selectable by a switch. Lighted receive 'S-Meter' with Transmit battery level display and thumb-wheel switch lighting make using the LS-202A more comfortable.

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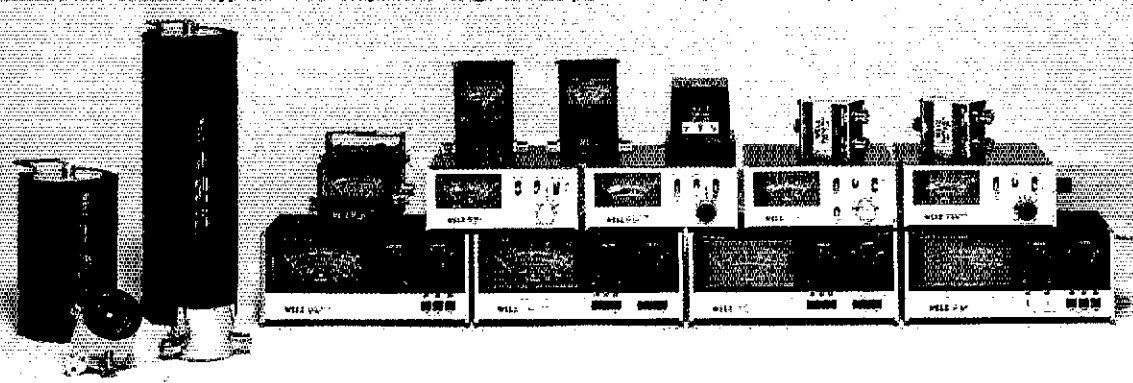

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KDK

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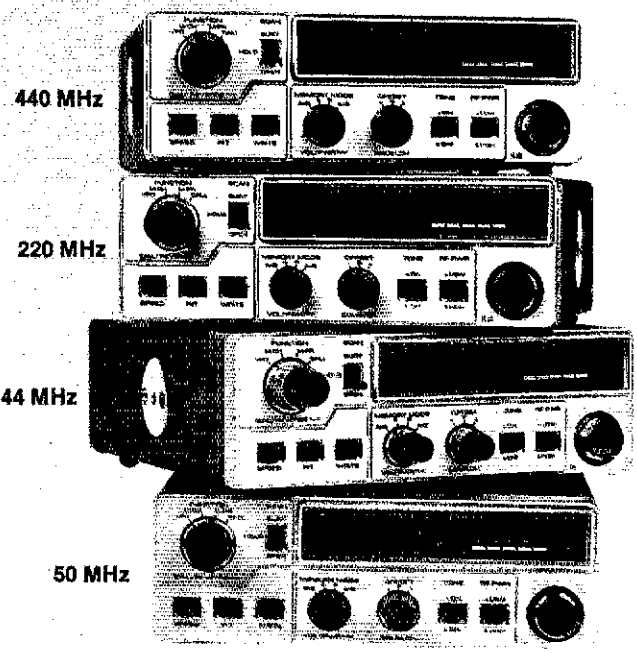

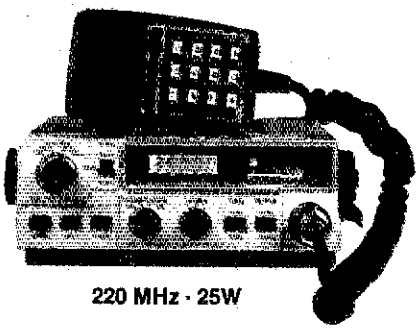

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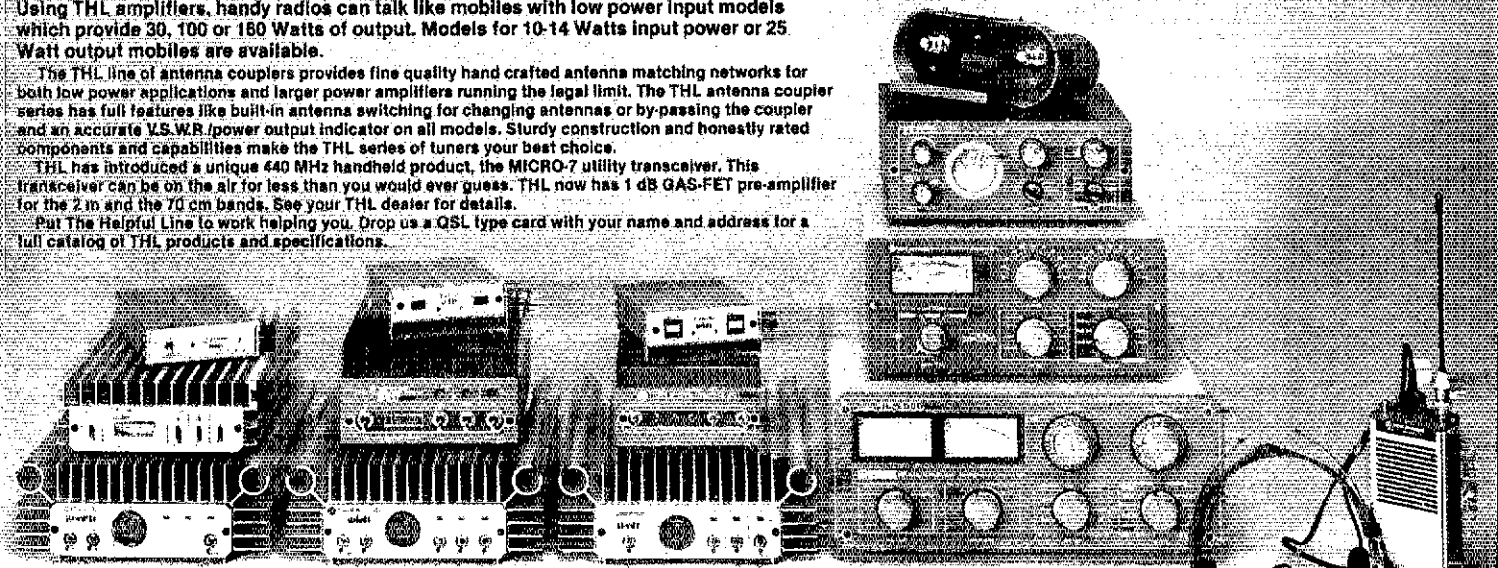

Bottom row: HL-160V25 25W in 150W out 2m • HL-160V - 3 or 10W in for 160W out 2m • HL-90U 10W in 90W out UHF • HC-2000 2KW antenna tuner • Second Row: HL-110 3 or 10W in 100W out 2m • HL-82V 10 in 80W out 2m • HL-45U 10W in 45W out UHF • HC-400 200W antenna tuner and VSWR Power Meter • Third Row: HL-30V economy HT amp 3W in 30W out 2m • HL-32V 3W in 15 or 30W out 2m SSB or FM portables • HL-20U .2 or 3W in 20W out UHF • HC-200 the Economy-With-Quality HF antenna tuner. An HRA2 GAS-FET preamp sits atop the HC-200 • Also shown is the MICRO-7 Utility UHF transceiver and headset.

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25G ..... per section 46.00
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55G ..... per section ..... CALL
FK2548AG3 FOLD OVER 48 ft. TOWER KIT Includes:....Hardware, 4 sections 25G, 1 25AG-3 Peaked top section, universal Eave Bracket, 15" House Bracket, M200H 10 ft. Mast, GB25G Guy Bracket and AS25G Access. Shelf....prepaid shipping 949.00
TOWER....4 sect. 25G & 25AG top sect 269.95
BE SURE TO CALL FOR OTHER ROHN PACKAGES AND INFORMATION ON ROHN PRODUCTS
¼" E.H.S. GUY CABLE Rohn U.S. 1000 ft... 250.00
3/16" E.H.S. CABLE 210.00
¼" GUY CABLE 6100# 7x7 strand ..... 15¢/ft
3/16" GUY CABLE 3700# 7x7 strand ..... 12¢/ft
PREMAX GROUND RODS - HEAVY COOPER PLATING 3/8, 1/2, 5/8, 3/4 inch diameter, 3 to 8 ft. in length ..... CALL
GENUINE ROHN ACCESSORIES ..... CALL
Alliance HD-73 ..... 99.95
U110 ..... 59.95

CLOSEOUT CORNER-SOME GOOD DEALS IN HERE
We plan to feature things we "found" in our warehouse. If you ever saw the warehouse you would understand! This month's "FINDS" are:
AEA MT-1 Morse Trainer 25.00
AEA MT-1P as above with nicad battery 50.00
AEA KT-1 Keyer/Trainer 25.00
DRAKE P-75 Power Supply 100.00
DRAKE 550 Code Reader 300.00
DRAKE TR7/R7 RX Cable 20.00
DRAKE MN 75 ..... 125.00
ICOM Acessories for 701 & 720 ..... CALL
YAESU ACCESSORIES for older rigs ..... CALL
NOTE — QUANTITIES ARE VERY LIMITED

ANTENNA CLOSEOUT CORNER!!!! LOOK AT THIS
These items are in addition to the equipment in our regular CLOSEOUT CORNER. Cleaning out the warehouse we "DISCOVERED" some old and/or obsolete ANTENNAS. Everything we "discover" will be offered at a price that is at least 20% below our cost.... EXAMPLES -
CUSHCRAFT ASQ-6 ..... 20.00
ATS-1 Turnstile 20.00
FINCO Amateur antennas 20.00
HYGAIN 204BA 250.00
TELREX some various antennas ..... CALL
As you might expect, QUANTITIES ARE LIMITED and subject to stock ..... Be sure and CALL SOON

AMPHENOL
831T coax tee 4.00
PL259 831SP silverplate 1.25
UG176 reducer RG8X/RG59 ..... .30
4400 N Male-SO239 ..... 6.00
2900 BNC Male-SO239 ..... 4.00
8261 N Male 3.00
Other Amphenol products in STOCK — CALL

USED GEAR — YOU BET! CALL FOR UP TO THE MINUTE ITEMS AND PRICES. 90 DAY WARRANTY, SALES PRICE REFUNDED WITHIN TWO WEEKS, SIX MONTH FULL TRADE IN TOWARDS NEW GEAR.

COMPUTER BOOKS...20% DISCOUNT ON STOCK ITEMS ..... CALL WITH TITLE & PUBLISHER

NEW!!! NEW!!! NEW!!! NEW!!! NEW!!!
How about a good log program for the shack? This is a good one for the COMMODORE 64...DISK BASED and pretty fast. DXCC, WAS, WAZ into and multi level sorts 39.95

RTTY SALE!!!

We are having a RTTY SALE, look for our other ad in this issue for details. There are some VERY HOT DEALS listed ..... LOOK AND CALL

We keep a tremendous inventory of items to make antennas including WIRE, COAX and CONNECTORS. BE SURE TO CALL US.

Madison Electronics Supply has been in business as a leading Electronic Supply Firm for many years. Our Staff is composed of active HAMS and most of us are active SWLers. We can help you get more enjoyment from your hobby.

DON'S CORNER

There is a series of products everyone should look into: HEIL SOUND. We have used and really enjoy these fine products from Bob Heil. The mic elements can turn your rig into a dream machine. It gives a lot more punch to your audio. The Headset/Boom Mic set-up is the best we have ever used, comfortable and light in weight. The SS-2 powered speaker allows you to copy signals much easier. It gives you a lot of CLEAN AUDIO. Give these items a try, you will enjoy them. 73 till next month.

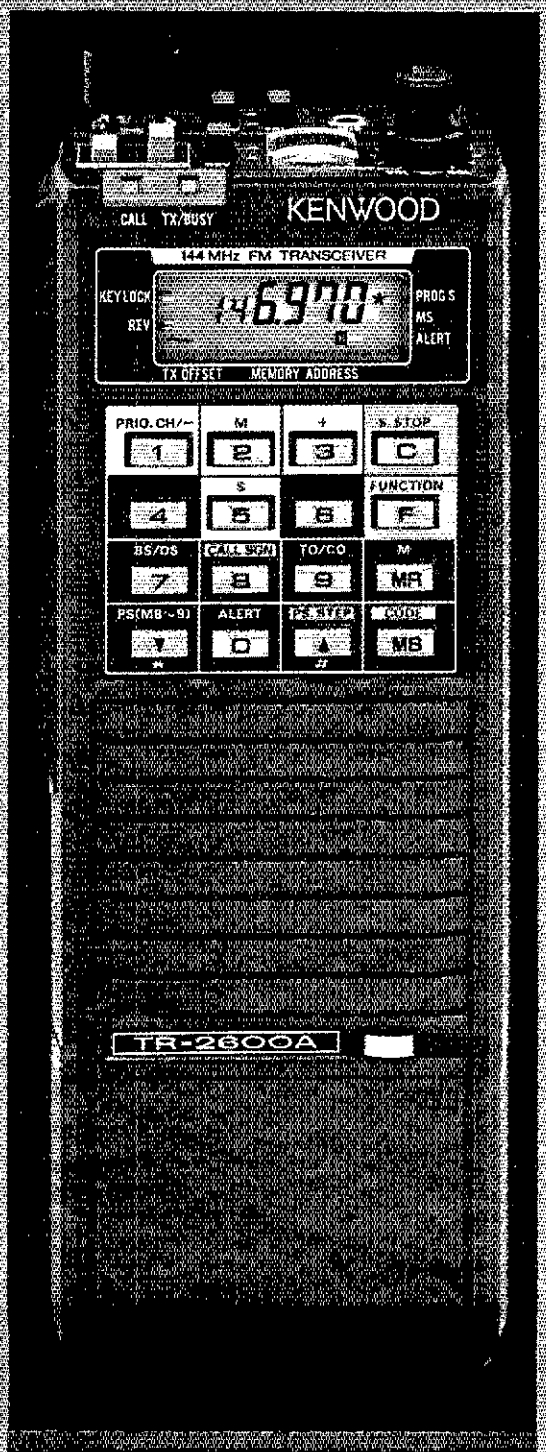
KENWOOD

the excellence in amateur radio

Digital Code Squelch...

TR-2600A

Kenwood's TR-2600A introduces DCS (Digital Code Squelch) circuitry, a signaling concept developed by Kenwood. DCS allows each station to have its own "private call" code or to respond to a "group call" or "common call" code. There are 100,000 different 5-digit ASCII code combinations possible. You can program in call signs up to 6 digits in the ASCII code. When operating in the DCS mode, this information can then be automatically transmitted each time the transmit key is depressed. This revolutionary feature is only the beginning! The TR-2600A also sports a high impact plastic case that is extra rugged and scuff-resistant. The molded-in color adds to the attractive appearance. The large L.C.D. display is easy to read in direct sunlight or in the dark with a convenient lamp switch. It displays transmit/receive frequencies, memory-channels, and five arrow indicators for "F-LOCK" frequency lock, "REV" repeater reverse, "PROG-S" programmed scan, "MS" memory scan, "ALERT S" alert scan. A star indicates "MEMORY LOCK-OUT" is activated, and repeater offset indicated by "+, –, S and M". The TR-2600A has 10 memories, nine for simplex or transmit with frequency offset ±600 kHz and one (memory 0) for non-standard split frequencies. Memory scan and programmable band scan have the added convenience of "Time operated Resume" that stops on busy channel and holds for approximately 5 seconds, then resumes scanning, or "Carrier Operated Resume" that stops on busy channel and resumes when signal ceases. Memory scan scans only those memories in which data is stored, and memory lock-out allows you to skip selected memory channels without loss of data previously stored! Manual Scanning UP/DOWN in 5-kHz steps and programmable automatic band scan are also useful features. The TR-2600A has a built-in "S" meter on the top panel which also indicates battery level when in transmit mode. Extended frequency coverage: 142.000-148.995 MHz allows transmit capability in 5-kHz steps for simplex or repeater operation on most MARS and CAP frequencies. Receive frequency coverage includes 140.000-159.995 MHz.



These features only tell part of the story. The TR-2600A also has keyboard frequency selection, built-in 16-key autopatch encoder, "TX-STOP" switch, HI (2.5)/LOW (300 mw) power switch, REV switch, "SLIDE-LOC" battery pack, high efficiency speaker, BNC antenna terminal, and all of this in an extremely compact and lightweight package!

Kenwood's TR-2600A, with D.C.S., leads the way in high technology handheld transceivers!

Optional accessories:

- TU-35S built-in programmable sub-tone encoder
- ST-2 Base Stand
- MS-1 Mobile Stand
- PB-26 Ni-Cd Battery
- DC-26 DC-DC Converter
- HMC-1 Headset with VOX
- SMC-30 Speaker Microphone
- LH-3 Deluxe Leather Case
- SC-9 Soft Case
- BT-3 AA Manganese/Alkaline Battery Case
- EB-3 External C Manganese/Alkaline Battery Case
- RA-3, 5 Telescoping Antenna
- CD-10 Call Sign Display

More information on the TR-2600A is available from authorized dealers of Trio-Kenwood Communications, 1111 West Walnut Street, Compton, CA 90220.

Specifications and prices are subject to change without notice or obligation.

KENWOOD

pacesetter in amateur radio

TM-211A DCS...a new turn in 2 meters/70 cm.

TM-211A/411A

The TM-211A 2 meter and the TM-411A 70 cm mobiles combine ultra compact size with the added feature of a 7 position adjustable front panel, allowing you maximum flexibility in both home and automotive installations! These compact transceivers also feature Kenwood's innovative DCS (Digital Code Squelch) circuit, that allows you to program your transceiver to respond only to transmissions from stations whose radios transmit a pre-selected digital code. Both radios deliver 25 big watts of R.F. power on HI and 5 watts (approximately) on LO power. Dual digital VFO's, built-in, highly visible yellow LED display, five memories plus COMM Channel add to this impressive array of features. The TM-211A and TM-411A each boast high performance receive and transmit specifications and an external high quality speaker that provides unsurpassed sound quality. Mounting flexibility is also a feature. Yes, all these features, plus priority watch, memory and programmable band scan, microphone test function, audible "beeper" for operation confirmation, repeater offset switch and reverse switch. The TM-211A and TM-411A offer you the best in 2 meters and 70 cm operations!

Optional accessories:

- CD-10 Call Sign Display
- PS-430 D.C. Power Supply
- KPS-7A Power Supply
- MC-55 Mobile Microphone with Time-Out Timer
- MA-4000 Dual Band Mobile Antenna with Duplexer
- SW-100A/B SWR/Power meters
- PG-3A Noise Filter

More information on these products is available from authorized dealers of Trio-Kenwood Communications, 1111 West Walnut Street, Compton, CA 90220.

CD-10/DCS

The optional CD-10 helps maximize your use of Kenwood's revolutionary new signalling concept, DCS (Digital Code Squelch). DCS uses digital code information to open squelch on a receiver that has been programmed to accept the specific code being transmitted. Up to 100,000 different 5-digit codes are possible, allowing each station to have its own "private call" code or to respond to a "group call" or "common call" code. Program your call sign (up to 6 digits) in the ASCII code and it is automatically transmitted when the transmit key is depressed. The CD-10 stores the calling station's call sign in its memory for future reference, and it is also displayed on the L.C.D. readout. The CD-10 can store call sign data of up to 20 stations, allowing you to quickly check for calls if you have been absent from your station, and review your contacts for logging purposes. The DCS/call sign data transmission system uses mark and space frequencies within the normal speech band width (compatible w/most repeaters).

TM-201A/401A

The extremely popular TM-201A 2 meter FM (25 watts, 142.000 to 149.000 MHz) and the TM-401A 70 cm FM (10 watts, 440-450 MHz) ultra compact mobile transceivers are also available.

Specifications and prices are subject to change without notice or obligation.

KENWOOD

the essence of amateur radio

TS-711A

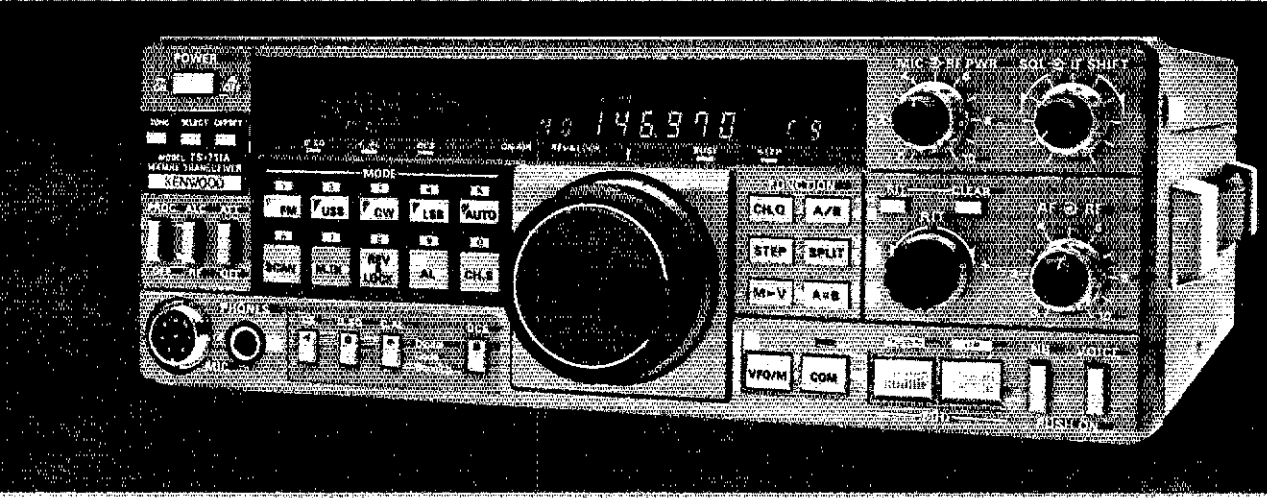
TS-711A Multi-function all-mode 2 m transceiver.

The TS-711A 2 m all-mode transceiver is the perfect base station unit. It features Kenwood's innovative D.C.S. circuitry that allows your TS-711A to respond only to signals that include a pre-selected digital code. The system recognizes 100,000 different 5-digit codes, making it possible for each station to have its own "private call," "group call," or "common call" code. Built-in dual digital VFO's provide commercial-grade frequency stability through the use of a TCXO (temperature Compensated Crystal Oscillator). The new fluorescent multi-function display shows frequency, RIT shift, VFO A/B, SPLIT, ALERT, repeater offset, digital code, call sign code, and memory channel. 40 multi-function memories store frequency, mode, repeater offset, and tone. It has programmable scan, memory scan, and mode scan. The Auto-mode function automatically selects the correct mode for the frequency being used. When a mode key is depressed, an audible "beeper" announces mode identification in international Morse Code.

The TS-711A has all-mode squelch, noise blanker, speech processor (SSB, FM), IF shift, RF power control, alert, and a 5-minute channel Quick-Step tuning that varies tuning characteristics from conventional VFO feel, to stepping action when CH/Q switch is depressed.

Optional accessories:

• CD-10 Call Sign Display • TU-5 CTCSS Tone Unit • VS-1 Voice Synthesizer • MC-60A Deluxe Desk Mic • MC-80 Desk Mic • MC-85 Desk Mic • SP-430 External Speakers • MB-430 Mobile Mount • PG-2J DC Cable



TS-670

TS-670 All-mode "Quad Bander"

The TS-670 "Quad Bander" is a unique all-mode transceiver that covers the 6 meter, VHF band and the 10, 15 and 40 meter HF bands. FM operation may be added with the optional FM-430. Key features include dual digital VFO's, 80 memory channels, memory scan and programmable band scan. Direct keyboard frequency selection allows you to enter a frequency to either VFO or to a memory channel using the 10-button key pad on the front panel. The 2-color fluorescent tube display indicates frequency to the nearest 100 Hz (10 Hz modifiable) and includes LED indicators that signal the specific functions in use. The optional GC-10 general coverage receiver unit allows continuous tuning from 500 kHz to 30 MHz. The VS-1 voice synthesizer unit is another popular option available. All this plus IF shift, all-mode squelch, CW semi-break-in with side tone, narrow/wide filter selection, noise blanker, and RF attenuator make the TS-670 "Quad Bander" the next transceiver you should own!

Optional accessories:

• GC-10 General Coverage Unit, 500 kHz to 30 MHz • VS-1 Voice Synthesizer • FM-430 FM Unit • YK-88C 500 Hz CW Filter • YK-88CN 270 Hz CW Filter • YK-88A 6 kHz AM Filter • PS-430 DC Power Supply • KPS-7A DC Power Supply • MC-60A Deluxe Desk Mic • MC-80 Desk Mic • MC-85 Multi-Function Desk Mic • VOX-4 VOX Unit

More information on the TS-711A and TS-670 is available from authorized dealers of Kenwood Communications, 1111 West Walnut Street, Compton, CA 90220.

Specifications and prices are subject to change without notice or obligation.

KENWOOD

pacesetter in amateur radio

R-11 portable receiver

R-11

Kenwood's R-11 is the perfect "go anywhere" portable receiver. It covers the standard AM and FM Broadcast bands, plus nine additional short wave bands. The R-11's selectivity is greatly enhanced by the use of double-conversion on short wave frequencies above 8.95-MHz. High sensitivity coupled with a dual antenna system (telescopic and ferrite core) allow it to reach out and bring in those distant stations from all over the world.

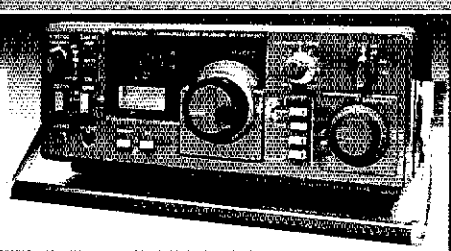
Simplicity of operation is enhanced by a band-spread type tuning control. Electronic band switching, with LED band indicator along with a tuning meter to indicate received signal strength, combine to provide you with superior listening capability. Safety Hold-Release switch prevents accidental station loss. Large front mounted speaker provides excellent sound quality. Tone switch adjusts for high, low and voice transmission.

Optional HS-7 micro-head phones allow for private listening pleasure.

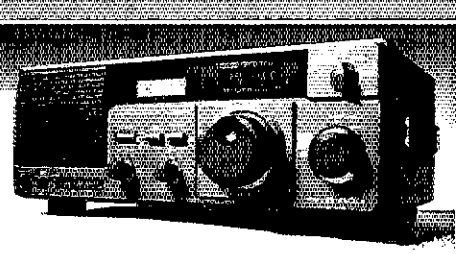
All this along with a record output jack, external antenna terminal and a rugged and attractive carrying case make the R-11 portable receiver the perfect travel companion!

More information on the Kenwood receivers is available from authorized dealers of Trio-Kenwood Communications, 1111 West Walnut Street, Compton, CA 90220.

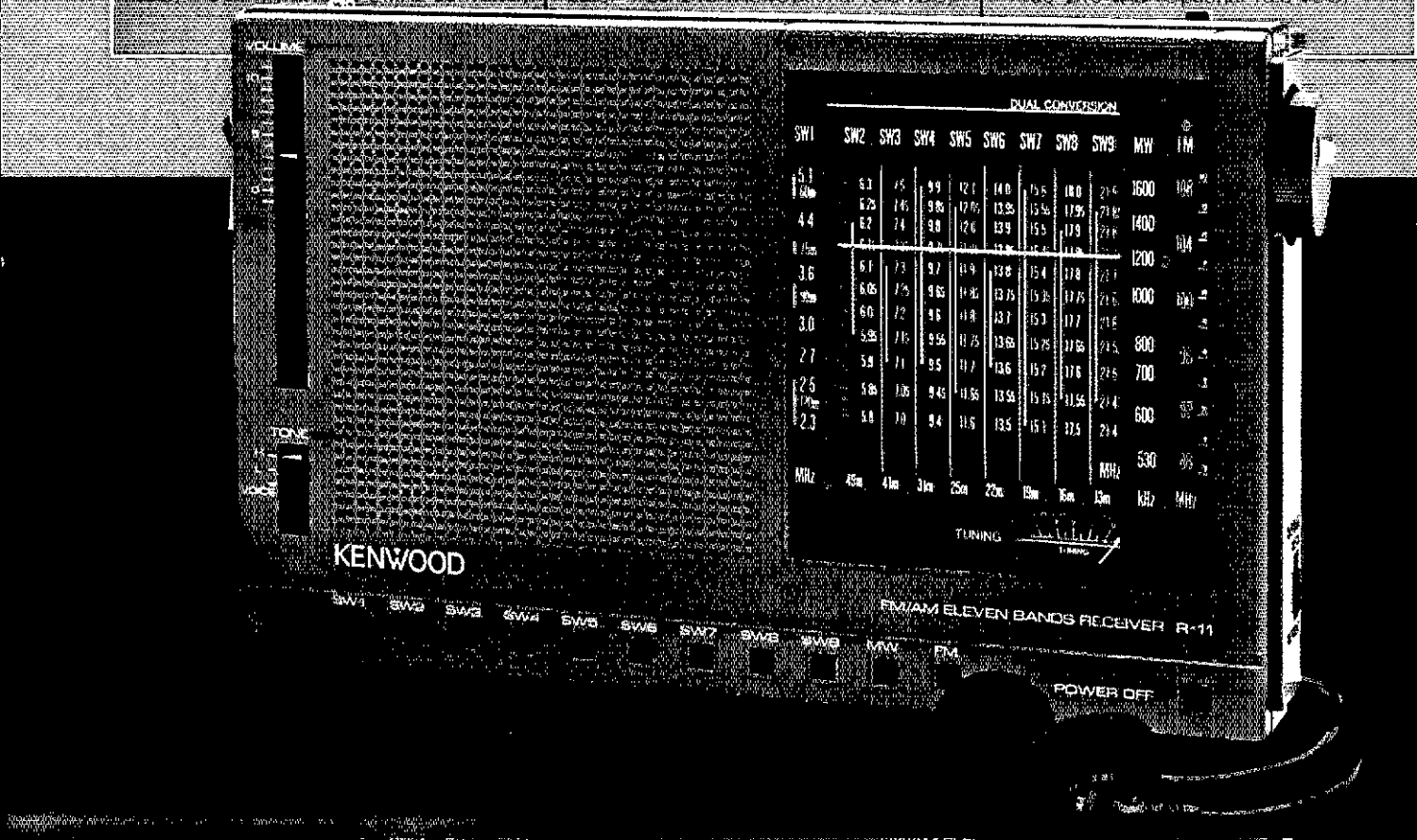
R-2000 Top-of-the-line general coverage receiver • 150 kHz to 30 MHz • ten memories • Dual 24-hr clock with timer • Scanning • 100-240 VAC (Opt. 13.8 VDC) • Opt. VHF (118-174 MHz converter)



R-1000 High performance receiver • 200 kHz - 30 MHz • digital display/clock/timer • 3 IF filters • PLL UP conversion • noise blanker • RF step attenuator • 120-240 VAC (Optional 13.8 VDC)



R-600 General coverage receiver • 150 kHz - 30 MHz • digital display • 2 IF filters • PLL UP conversion • noise blanker • RF attenuator • front speaker • 100-240 VAC (Optional 13.8 VDC)



KENWOOD

excellence in amateur radio

Pocket-size performers!

TH-21AT/41AT

Kenwood's advanced electronic technology brings you a new standard in pocket/handheld transceivers! The TH-21AT/41AT features a high impact molded case and is designed to deliver convenient, reliable performance in a package so small, it will slip into your shirt pocket! It measures only 57 (2.24) W x 120 (4.72) H x 28 (1.1) D mm (inch) and only weighs 260 g (0.57 lb) with batteries. In typical Kenwood fashion these transceivers provide superior transmit and receive performance.

Both the 2 meter and 70 cm versions deliver one watt R.F. output on HI power and 150 mW low, for really extended battery life! Functional design includes three digit thumb-wheel switch for easy frequency selection along with a built-in 5 kHz UP-Shift switch and repeater offset switch. (±600 kHz or simplex, 2m version and ±5 MHz or simplex 70 cm version).

Both the 2 meter and 70 cm pocket/handheld transceivers are available in standard or 16-key autopatch DTMF encoder versions. Kenwood thread-loc antenna connector is also provided.

See your authorized Kenwood dealer and take home a pocket full of 2 m or 70 cm performance today!

Optional accessories:

- HMC-1 headset with VOX
- SMC-40 speaker microphone
- PB-21 Ni-Cd 180 mAH battery
- DC-21 DC power supply
- BT-2 battery case
- EB-2 external C manganese/alkaline battery case
- SC-3 soft case for TH-21A/41A
- SC-8T soft case for TH-21AT/41AT
- TTT-6 programmable sub-tone unit
- AJ-3 thread-loc to BNC female adapter

More information available from authorized dealers or Trio-Kenwood Communications, 511 West Walnut Street, Compton, CA 90220.

TH-21A/41A
Standard versions.

TH-21AT/41AT Subject to FCC approval. Specifications and prices are subject to change without notice or obligation.

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Houston, Texas 77010
Call for Quotes
713-658-0268

RTTY SALE!!!

MADISON has several RTTY systems on sale this month. If you don't see what you want, give us a call. We may have it on SALE.

AEA PACKAGE SPECIALS
This package allows full MORSE, BAUDOT RTTY, ASCII RTTY and AMTOR operations.

AEA CP-1	retail	239.95
AEA TI-1	retail	119.95
AEA MBA-TOR software	retail	119.95
5 ft. BELDEN mic cable	retail	5.00
MIC Connector, 4 or 8 pin	retail	4.95
	TOTAL	$489.80
SPECIAL SALE PRICE	**379.95**	**YOU SAVE $$$$**

This package has all of the software features included above, but in a self-contained unit. The interface is a little less sophisticated.

AEA MAP-64/2 TU and software	retail	239.95
AEA TI-1 tuning indicator	retail	119.95
AC-1 12 volt PS	retail	19.95
One 4 or 8 Pin MIC Connector		4.95
	TOTAL	$384.80
SPECIAL SALE PRICE	**259.95**	**YOU SAVE $$$$**

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ALL AEA ITEMS IN STOCK!!! SALE PRICES.....CALL

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We have the entire KANTRONICS product line in stock at special prices this month..... CALL
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TOTAL $219.90
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KANTRONICS "CHALLENGER" terminal unit. A NEW PRODUCT from Kantronics. retail..... 99.95
SALE DEAL - BUY the CHALLENGER at retail and get the software at a 25% DISCOUNT.

CHECK THIS OUT
KANTRONICS INTERFACE] [..... 239.95
KANTRONICS INTERFACE..... 119.95
These are our regular "DEAL" prices, but we will include the KANTRONICS SOFTWARE of your choice at a 20% DISCOUNT. TALK ABOUT A DEAL!!!

GOSH, I almost forgot about MFJ..... CALL for your **SPECIAL PRICES ON MFJ.**

AEA PACKET. The new AEA PKT-1 PACKET SYSTEM All the features of the TAPR and VADCG systems and then some..... retail 599.95
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AEA AMT-1 Terminal unit and software that works from any computer with a RS232 port, or any ASCII terminal. MORSE, BAUDOT, ASCII and AMTOR. With CW board and terminal software for the C-64 or VIC-20..retail..600.00
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HAL HAL HAL HAL HAL HAL HAL
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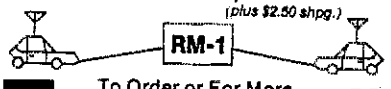

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2- " "	80, 40M	40 ft. "	$ 38 "
9-BAND SPACE-SAVER DIPOLE	160 thru 10M in 40 ft.		call/write
3- " "	NO TRAP DIPOLE - 160, 80, 40M	113 ft. long	$ 58 ppd
2- " "	" " - 80, 40M	66 ft. "	$ 49 "
2- " "	BROAD-BAND DIPOLE - 80, 40M 90 to 130 ft.	"	$ 48 "

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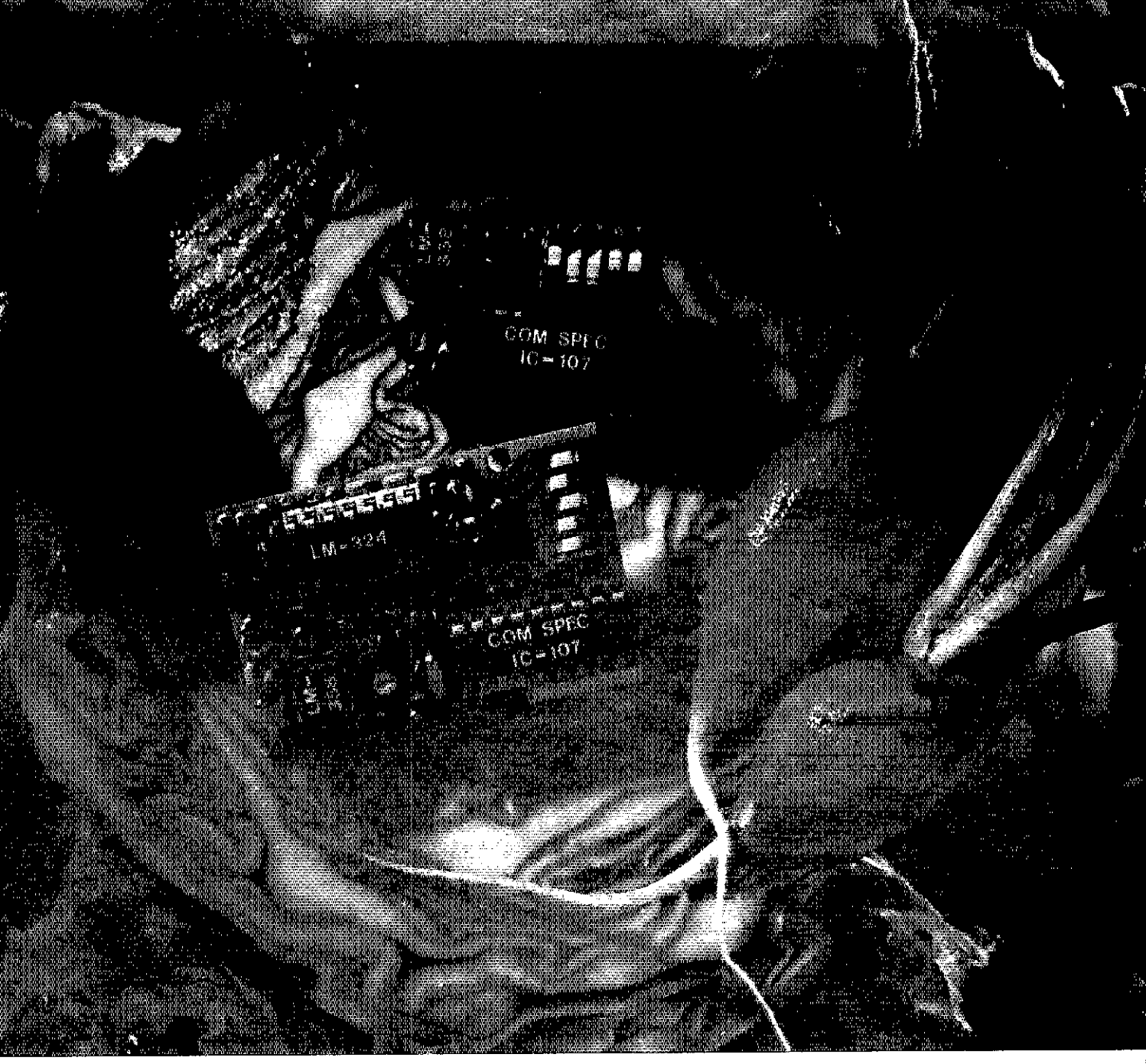

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(800) 854-0547 / California: (714) 998-3021

SS-32 **$29.95**, TS-32 **$59.95**

ADVERTISING DEPARTMENT STAFF

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Sandy Gerli, AC1Y, Deputy Adv. Mgr.
Jo-Ann H. Arel, Advertising Assistant

203-667-2494 is a direct line, and will be answered only by Advertising Department personnel

Index of Advertisers

ANTENNA/TOWER SALE!

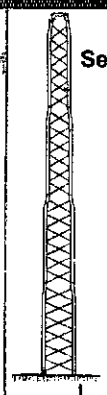
hy-gain CRANKUP SALE!

All Models Shipped Factory Direct—Freight Paid*!

Check These Features:
- All steel construction
- Hot dip galvanized after fabrication
- Complete with base and rotor plate
- Totally self-supporting—no guys needed

Model	Height	Load	Sale Price
HG37SS	37 ft.	9 sq. ft.	$ 719
HG52SS	52 ft.	9 sq. ft.	$1049
HG54HD	54 ft.	16 sq. ft.	$1629
HG70HD	70 ft.	16 sq. ft.	$2599

Masts—Thrust Bearings—Other Accessories Available—Call! Prices Shown Are Your Total Delivered Price In Continental U.S.A.!



ROHN Self Supporting Towers On SALE!

FREIGHT PREPAID

- All Steel Construction—Rugged
- Galvanized Finish—Long Life
- Totally Free Standing—No Guy Wires
- America's Best Tower Buy—Compare Save $
- Complete With Base and Rotor Plate
- In Stock Now—Fast Delivery

Model	Height	Ant. Load*	Weight	Delivered Price*
HBX40	40 ft	10 sq ft	164	$319
HBX48	48 ft	10 sq ft	303	$399
HBX56	56 ft	10 sq ft	385	$489
HDBX40	40 ft	18 sq ft	281	$379
HDBX48	48 ft	18 sq ft	363	$469

*Your Total Delivered Price Anywhere In Continental 48 States. Antenna Load Based on 70 MPH Wind.

Tri-Ex®

These rugged crankup towers now available from Texas Towers! All models available On Sale for tremendous savings to you!

To save on freight costs, all towers are shipped directly from the Tri-Ex factory to you!

Check these features:
- **All steel construction**
- **Hot dip galvanized after fabrication**
- **Complete with base and rotor plate**
- **Totally self-supporting—no guys needed**

Model	Height Up	Down	Wind Load	List	Sale
W36	36.0 ft	20.5 ft	9.0 sq ft	$694	$579
WT51	51.0 ft	20.5 ft	9.0 sq ft	$1154	$999
LM354	54.0 ft	21.0 ft	16 sq ft	$2010	$1599
LM470D (Motorized)	70.0 ft	22.0 ft	16 sq ft	$4195	$2999
DX86 (Motorized)	86.0 ft	23.0 ft	25 sq ft	$7200	Call

BUTTERNUT ELECTRONICS CO.

- Designed to operate on all Amateur Bands at "FULL" Legal Power Input.
- Automatic Band Switching (80/10 meters).
- Automatic Band Switching (160/10 meters) with optional model TBR-160 HD.
- IN STOCK for IMMEDIATE DELIVERY & LOOK at very SPECIAL PRICES . . .
- New Model HF6V $129.00
- New Model TBR-160HD (High Power 160 meter Base Resonator) $49.00.

Model RMK-11 (roof mount kit with multiband radial kit $39.00. Model STR-2 (Stub Tuned Radial Kit) $29.00.

Delivery Anywhere In The Continental USA At No Additional Cost. (Free Shipping On Butternut Accessories Also When Purchased With Antenna.)

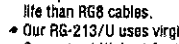
RG-213U

$.29/ft $279/1000 ft
Up to 600 ft via UPS

- RG-213/U—95% Bare Copper Shield
- Mil-Spec Non-contaminating Jacket for longer life than RG8 cables.
- Our RG-213/U uses virgin materials.
- Guaranteed Highest Quality!

RG-8X

$.19/ft $179/1000 ft



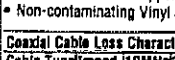
- RG8X—95% Bare Copper Shield
- Low Loss Foam Dielectric
- Non-contaminating Vinyl Jacket

Coaxial Cable Loss Characteristics (DB/100 ft)

Cable Type	Imped.	10MHz	30MHz	150MHz	450MHz
RG-213/U	50	.6	.9	2.3	5.2
RGBX	50	.8	1.2	3.5	6.8
RG-58/U	52	1.4	1.9	6.0	12.5
½" Alum	50	.3	.5	1.2	2.2
½" Heliax	50	.2	.4	.9	1.6
¾" Heliax	50	.1	.2	.5	.9

HARDLINE/HELIAX™

Lowest Loss for VHF/UHF!



½" Alum. w/poly Jacket . . . . . $.79/ft
½" LDF4-50 Andrew Heliax™ . . . $1.69/ft
⅞" LDF5-50 Andrew Heliax™ . . . $3.99/ft
select connectors below.

HARDLINE & HELIAX™ CONNECTORS

Cable Type	UHF FML	UHF MALE	N FML	N MALE
½" Alum	$19	$19	$19	$25
½" Heliax™	$22	$22	$22	$22
⅞" Heliax™	$49	$49	$49	$49

AMPHENOL CONNECTORS

Silver PL259 . . $1.25 UG23D N Female . $2.95
UG21B N Male . . $2.95

ANTENNA WIRE & ACCESSORIES

14 Ga. Stranded Copperweld . . . . $.10/ft
450 Ohm H.D. Line . . . . . $.16/ft
18 Ga. Copper coated steel wire ¼ mile long . . . $30
H.D. End Insulators $2/ea
Van Gorden 1:1 Balun $11
Van Gorden Center Insulator $6

HUSTLER

68TV 80-10 mtr Vert $129
4BTV 40-10 mtr Vert $89 5BTV 80-10 mtr Vert $109
G6-144B 2-mtr Base $89 G7-144 2-mtr Base . $119

Mobile Resonators	10m	15m	20m	40m	75m
400W Standard	$12	$12	$15	$18	$22
2KW Super	$18	$20	$22	$26	$36

Bumper Mounts - Springs - Folding Masts in Stock!

CUSHCRAFT

MULTI-BAND HF ANTENNAS

A3 3-el Tribander $219 A4 4-el Tribander . . $269
R3 20/15/10mtr Vert $279 A743/A744 40mtr Kit . $75

HF MONO-BAND ANTENNAS

10-3CD	$ 95	10-4CD	$109
15-3CD	$119	15-4CD	$129
20-3CD	$199	20-4CD	$279
40-2CD	$289	D40	$149

VHF/UHF BEAMS

A50-5	$ 79	617B	$199
214B	$ 79	3219	$ 95
220B	$ 95	4248	$ 79

OSCAR/TWIST ANTENNAS

A144-10T	$ 52	A144-20T	$ 75
A147-20T	$ 63	416TB	$ 59
A147MB	$ 29	PS4	$ 69

VHF/UHF FM ANTENNAS

A147-4	$ 29	A147-11	$ 49
214FB	$ 79	226FB	$219
A449-6	$ 29	ARX2B	$ 39

HY-GAIN

Discoverer 2-el 40-mtr Beam $319
Discoverer 3-el Conversion Kit $199
Explorer-14 . . . . . $309
QK710 30/40 mtr. Add-On-Kit $79
V2S 2-mtr Base Vertical $49
TH5MK2S Broad Band 5-el Triband Beam . . . $389
TH7DXS 7-el Triband Beam $439
TH3JRS 3-el Triband Beam $189
TH2MK3S 2-el Triband Beam $179
205BAS 5-el 20-mtr Beam $349
155BAS 5-el 15-mtr Beam $199
105BAS 5-el 10-mtr Beam $129
204BAS 4-el 20-mtr Beam $259
64BS 4-el 6-mtr Beam $69
66BS 6-el 6-mtr Beam $135
18HTS 80-10 mtr Hy-Tower Vertical $439
LC-160 160-mtr Coil Kit for 18HTS $45
214BS 14-el 2-mtr Beam $49
2BDQ 80/40 mtr Trap Dipole $69
5BDQ 80-10 mtr Trap Dipole $129
BN86 80-10 mtr KW Balun W/Coax Seal $22

MOSLEY

Pro37 7-el Triband Beam $469
CL-33 6-el Triband Beam $279
TA-33 3-el Triband Beam $249
TA-33JR 3-el Triband Beam $189
TA40KR 40 mtr Kit for TA33 . . . . . $119

MINI-PRODUCTS HQ-1

LIST $182.50 SALE $159

- Wing Span - 11 ft
- Wind Area - 1.5 sq ft
- Boom - 54 in. long
- 1200W P.E.P. Input

ALPHA DELTA COMMUNICATIONS

Transi-Trap™ Surge Protectors—In Stock Now!

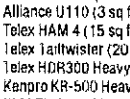
Model LT 200W UHF Type . $19
Model HT 2KW UHF Type . $29
Model LT/N 200W N Type . $39
Model HT/N 2KW N Type . $44
Model R-T 200W Deluxe . . $29
Model HV 2KW Deluxe . . . $32

KLM

KT34A 4-el Broad Band Triband Beam $339
KT34XA 6-el Broad Band Triband Beam $489
80m-1 80-mtr Rotatable Dipole $595
40m-1 40-mtr Rotatable Dipole $179
40m-2 2-el 40-mtr Beam $309
40m-3 3-el 40-mtr Beam $459
40m-4 4-el 40-mtr Beam $649
2m-13LBA 13-el 2-mtr Beam $79
2m-14C 14-el 2-mtr Satellite Antenna $89
2m-16LBX NEW-16-el 2-mtr Beam $99
2m-22C NEW-22-el 2-mtr Satellite Antenna . . . $119
432-30LBX NEW-30-el-432 MHz Antenna $99
435-18C 435 MHz Satellite Antenna W/CS-2 . . $119
432-16LB 16-el 432 MHz Beam $69

ROTORS & CABLES

Alliance HD73 (10.7 sq ft rating) $99
Alliance U110 (3 sq ft rating) $49
Telex HAM 4 (15 sq ft rating) $219
Telex Tailtwister (20 sq ft rating) $269
Telex HDR300 Heavy Duty (25 sq ft rating) $519
Kenpro KR-500 Heavy duty elevation rotor $189
KLM EL-3000 Moon Tracker Elevation Rotator . . $349



Standard 8 cond cable $.19/ft (vinyl jacket 2-#18 & 6-#22 ga)
Heavy Duty 8 Cond cable $.36/ft (vinyl jacket 2-#16 & 6-#18 ga)

SOUTH RIVER ROOF TRIPODS

HDT-3 3 ft Tripod . . . $19 HDT-5 5 ft Tripod . . . $29
HDT-10 10 ft Tripod . $49 HDT-15 15 ft Tripod . $69
Heavy Duty Tripods include mtg hdw-UPS Shippable

ROHN GUYED TOWERS

10 ft Stack Sections

20G $37.50 25G $46.50
45G $107.50 55G $127.50

All 20G, 25G, 45G and 55G Accessories In Stock at Discount Prices - CALL!

Foldover Towers

Model	Height	Ant Load*	Price
FK2548	48 ft	15.4 sq ft	$ 829
FK2558	58 ft	13.3 sq ft	$ 899
FK2568	68 ft	11.7 sq ft	$ 959
FK4544	44 ft	34.8 sq ft	$1159
FK4554	54 ft	29.1 sq ft	$1259
FK4564	64 ft	28.4 sq ft	$1359
25G Foldover Double Guy Kit			$199
45G Foldover Double Guy Kit			$229

*Above antenna loads for 70 MPH winds and Guys at Hinge & Apex.

TOWER/GUY HARDWARE

3/16" EHS Guywire (3990 lb rating) . . . $.13/ft
1/4" EHS Guywire (6000 lb rating) . . . $.16/ft
5/32" 7 × 7 Aircraft Cable (2700 lb rating) . . . $.12/ft
3/16" CCM Cable Clamp (3/16" or 5/32" Cable) . . . $.35
1/4" CCM Cable Clamp (1/4" Cable) . . . $.45
1/4" TH Thimble (fits all sizes) . . . $.30
3/8EE (3/8" Eye & Eye Turnbuckle) . . . $5.95
3/8"EJ (3/8" Eye & Jaw Turnbuckle) . . . $6.95
1/2"EE (1/2" Eye & Eye Turnbuckle) . . . $8.95
1/2"EJ (1/2" Eye & Jaw Turnbuckle) . . . $9.95
3/16" Preformed Guy Grip . . . $1.99
1/4" Preformed Guy Grip . . . $2.49
6" Diam - 4 ft Long Earth Screw Anchor . . . $12.95
500D Guy Insulator (5/32" or 3/16" Cable) . . . $1.39
502 Guy Insulator (1/4" Cable) . . . $2.49
5/8" Diam - 8 ft Copper Clad Ground Rod . . . $12.95

PHILLYSTRAN GUY CABLE

HPTG2100 Guy Cable (2100 lb rating) . . . $.29/ft
HPTG4000 Guy Cable (4000 lb rating) . . . $.43/ft
HPTG6700 Guy Cable (6700 lb rating) . . . $.69/ft
9901LD Cable End (for 2100/4000 cable) . . . $6.95
9902LD Cable End (for 6700 cable) . . . $7.95
Socketfast Potting Compound (does 6-8 ends) . . . $12.95

GALVANIZED STEEL MASTS

Heavy Duty Steel Masts 2 in OD - Galvanized Finish

Length	5 FT	10 FT	15 FT	20 FT
.12 in Wall	$25	$49	$59	$79
.18 in Wall	$39	$69	$99	$129
.25 in Wall	$69	$129	$189	$249

TEXAS TOWERS

VISA MasterCard

Div. of Texas RF Distributors Inc.
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Telephone (214) 422-7306

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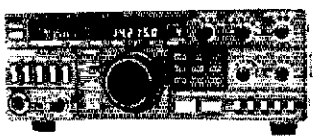
Sat: 9am - 1pm

MISSOURI RADIO CENTER

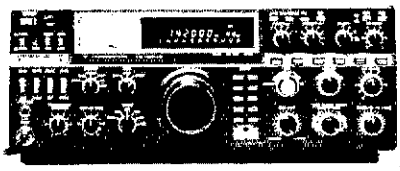
KENWOOD



TS-430S Most Advanced, Compact HF Transceiver

- General Coverage Receiver
- USB/LSB/CW/AM/Optional FM • 10Hz Dual Step Digital VFO • Eight Memories w/Lithium Back-up • Memory and Band Scan

KENWOOD



TS-930S Top of the Line HF Transceiver

- General Coverage Receiver • Superior Dynamic Range • All Solid State—28 VDC Final • QSK CW • Optional Automatic Antenna Tuner • Dual VFO w/8 Memories • Dual Mode Noise Blanker

KENWOOD

TR-7950/7930

- Large LCD Readout • 21 Multi-Function Memory • Lithium Back-up • Automatic Offset • Built-in Encoder • Memory or Band Scan

KENWOOD

TR-2600 NEW!

2.5W/300 mW (Switchable) 2 Meter Handheld Transceiver

- LCD Readout • Ten Memories w/Lithium Back-up • Band and Memory Scan • Built-in Sub-tone Encoder

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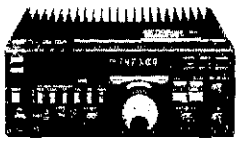


FT-757 GX

Compact General-Coverage Receiver

- General-Coverage Receiver
- USB/LSB/CW/AM/FM • Dual VFOs
- Memory/Band Scan • Speech Processor • CW Filter and CW Keyer included

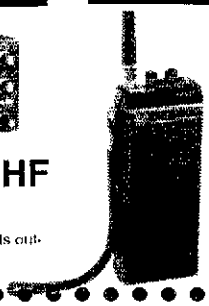
YAESU

FT-726R VHF/UHF

All Mode Tri-Band Transceiver

- 50-54 Mhz • 144-148 Mhz • 10 watts output on all bands • 430-450 Mhz

YAESU



FT203R

New* Yaesu FT203R

- Compct VHF Handy Talkie • S-Meter • Small Light Weight

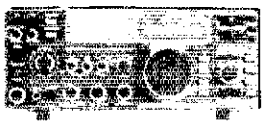
YAESU

FT980

CAT SYSTEM—ComputerAided Transceiv

- Wide Dynamic Range • General Coverage • Low Noise Front End • 10 Hz Digital Readout • All Mode Transceive—CW/SSB/AM/FM/FSK

ICOM



IC-745 HF Base

All ham band HF transceiver, 16 memories, 100KHz to 30 MHz general coverage receiver, and adjustable noise blanker and AGC

ICOM

IC-27A Compact Mobile

A breakthrough in 2-meter mobile communications! Most compact on the market (5½" x 1⅝" Hx7" D), contains internal speaker for easy mounting, 25 watts, 32 PL frequencies, 9 memories scanning and touchtone mic

ICOM

IC-02AT

The IC-02AT 2-meter LCD readout handheld features 10 memories, 32 PL tones, scanning, keyboard frequency entry, dual lock, 3W std., 5W opt. DTMF.

ICOM

IC-R71A General Coverage Receiver

The IC-R71A 100KHz - 30 MHz superior-grade general coverage receiver features keyboard frequency entry, 32 memories, SSB/AM/RTTY/CW, selectable AGC and noise blanker, and wireless remote controller (optional).

CALL FOR SPECIAL SALE PRICES

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- ASTRON
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- BENCHER
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- CES
- COMM SPEC
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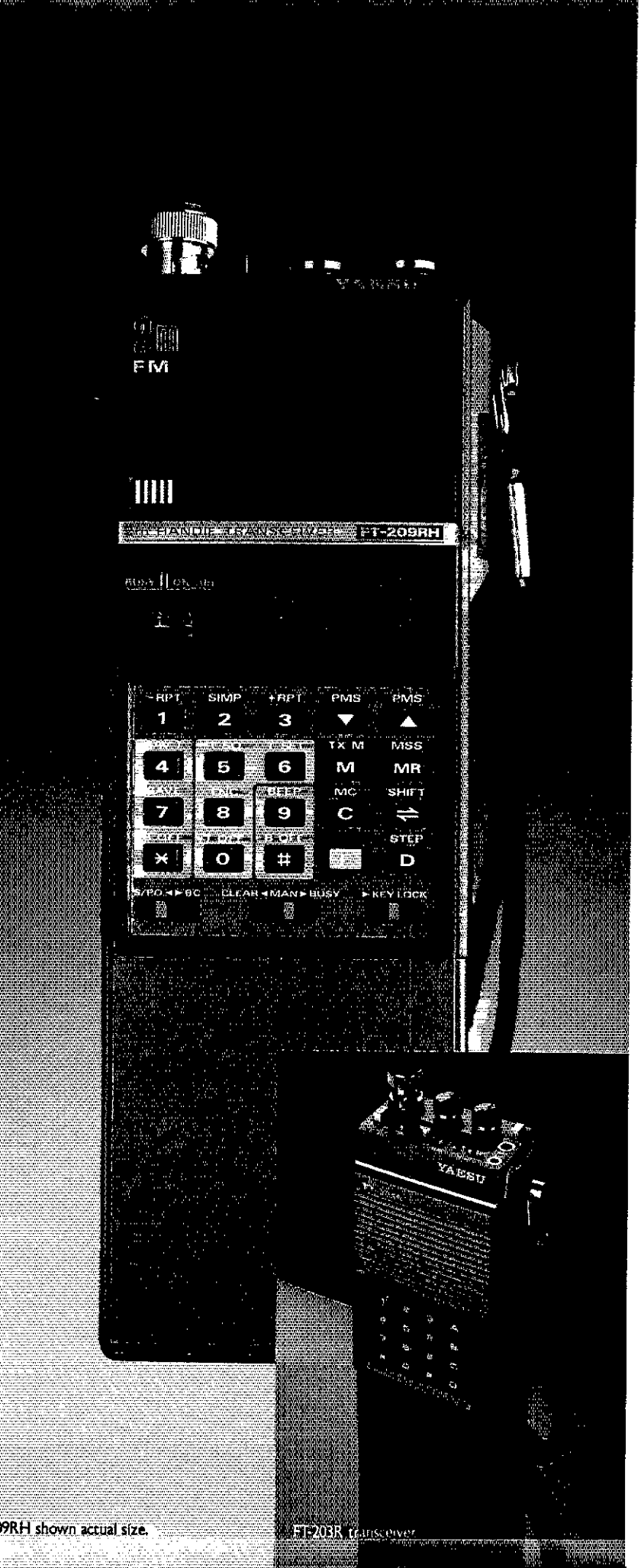


9RH shown actual size.

FT-203R transceiver

The Yaesu FT-209RH. 5 watts that your batteries can live with.

Have the power you need when you need it with Yaesu's new 5-watt, 2-meter handheld. Power to get out in situations where ordinary HTs just won't make it.

We designed our HT with a unique user-programmable Power Saver that puts the rig to "sleep" while you're monitoring and "wakes it up" when the squelch breaks. So you can listen for hours and still have plenty of power to hit those hard-to-reach repeaters when you need to.

With the FT-209RH there's no need to fiddle with knobs when you change from one memory channel to another. That's because you can independently store everything you need in each of the ten memories: receive frequency, standard or non-standard offset, even tone encode/decode with an optional module. And then recall any channel at the touch of a button.

It's easy to hear what's happening on your favorite repeaters or simplex frequencies. Just touch a button and scan all memory channels, or selected ones. Or all frequencies between any two adjacent memories. Use the priority feature to return automatically to your special frequency when it becomes active.

Bring up controlled-access machines with the optional plug-in subaudible tone encoder/decoder, independently programmed from the keyboard for each channel. Listen for tone-encoded signals on selected channels—without having to hear a bunch of chatter—by enabling the decode function.

The FT-209RH, which covers 10 MHz for CAP and MARS use, comes complete with a 500-mAh battery, charger and soft case.

For those who want a basic radio without the bells and whistles, consider the compact, lightweight FT-203R. This economical HT features 2.5 watts of power and an optional DTMF keypad. Most all the accessories for the 209 work with the 203, including an optional VOX headset that gives you hands-free operation that's perfect for public service events.

So when you visit your dealer, let him know you won't settle for anything but the best. A radio built by Yaesu.

YAESU

Yaesu Electronics Corporation
6851 Walthall Way, Paramount, CA 90723
(213) 633-4007.

Yaesu Cincinnati Service Center
9070 Gold Park Drive, Hamilton, OH 45011
(513) 874-3100.

Prices and specifications subject to change without notice.

KENWOOD

pacesetter in amateur radio

TS-430S "Digital DX-terity!"

TS-430S

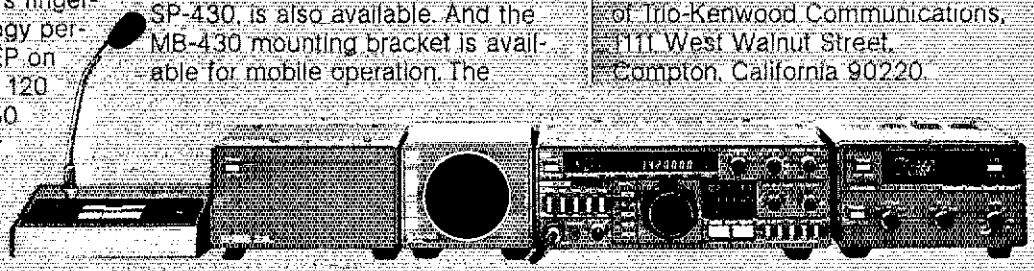
Digital DX-terity...that outstanding attribute built into every KENWOOD TS-430S that lets you QSY from band to band, frequency to frequency, and from mode to mode with the speed and ease that will give you a dominant position in DX operations.

KENWOOD'S TS-430S, a revolutionary, ultra-compact, HF transceiver has already won the hearts of radio Amateurs the world over. It covers 160-10 meters, including the new WARC bands (easily modified for HF MARS). Its high dynamic range receiver tunes from 150 kHz-30 MHz. It utilizes an innovative UP conversion PLL circuit for superior frequency stability and accuracy. Two digital VFO's allow fast split-frequency operations. A choice of USB, LSB, CW, or AM, with FM optional, are at the operators fingertips. All Solid-state technology permits inputs of 250 watts PEP on SSB, 200 watts DC on CW, 120 watts on FM (optional), or 60 watts on AM. Final amplifier protection circuits and a cooling fan are built-in.

Eight memories store frequency, mode, and band data, with Lithium battery memory back-up. Memory scan and programmable automatic band scan help speed up operations. An IF shift circuit, a tuneable notch filter, and a Narrow-Wide switch for IF filter selection help eliminate QRM. It has a built-in speech processor. A fluorescent tube digital display makes tuning easy and fast. An all-mode squelch circuit, a noise blanker, and an RF attenuator control help clean up the signal. And there's a VOX circuit, plus semi-break-in, with side-tone. All-in-all, it just could be that the expression "Digital DX-terity" is a bit of an understatement.

TS-430S Optional Accessories: In typical KENWOOD fashion, there are plenty of optional accessories for this great HF transceiver. There is a special power supply, the PS-430. An external speaker, the SP-430, is also available. And the MB-430 mounting bracket is available for mobile operation. The AT-250 automatic antenna tuner was designed primarily with the TS-430S in mind, and for those who prefer to "roll their own," the AT-130 antenna tuner is available. The FM-430 FM unit is available for FM operations. The YK-88C (500 Hz) or YK-88CN (270 Hz) CW filters, the YK-88SN SSB filter, and the YK-88A AM filter may be easily installed for serious DX-ing. An MC-60A deluxe desk microphone, MC-80 and MC-85 communications microphones, an MC-42S mobile hand mic., and an MC-55 8-pin mobile microphone, are available, depending on your requirements. TL-922A linear amplifier (not for CW QSK), SM-220 station monitor, PC-1A phone patch, SW-2000 SWR/power meter 160 ~ 6 meter, SW100A SWR/power/volt meter 160-2m, HS-4, HS-5, HS-6, HS-7 headphones, are also available.

More information on the TS-430S is available from authorized dealers of Trio-Kenwood Communications, 1111 West Walnut Street, Compton, California 90220.



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