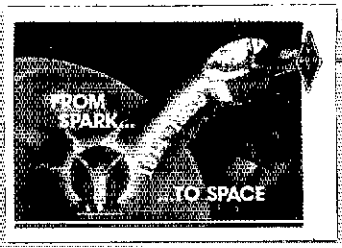
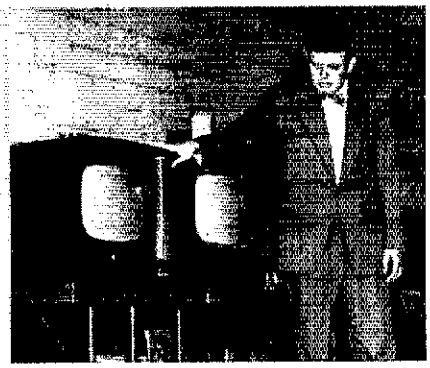
QST

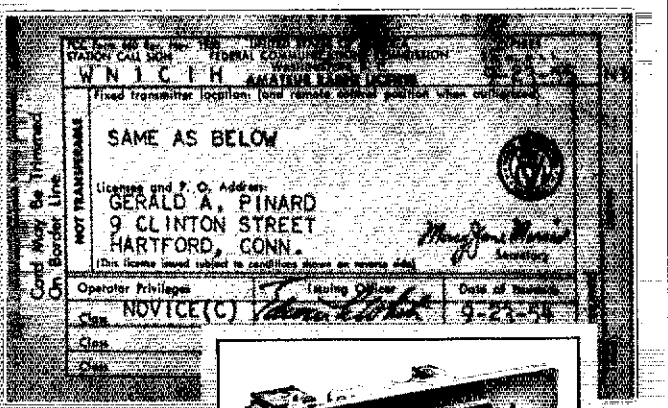
July 1989 $3.00

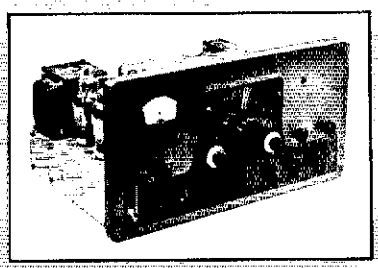


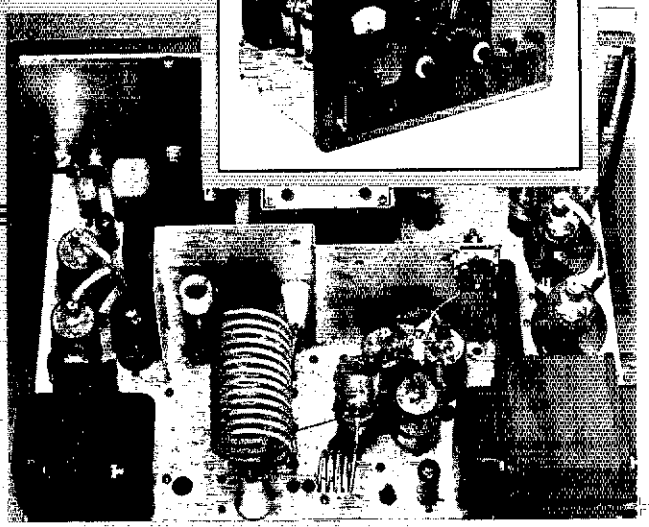
devoted entirely to Amateur Radio

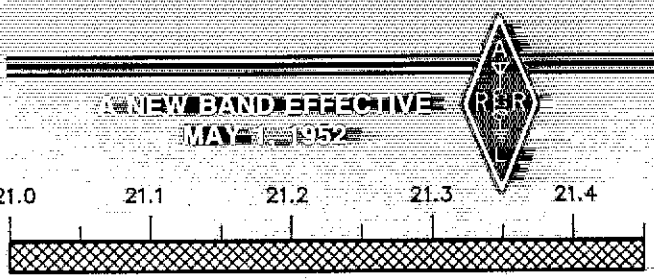
THE '50s











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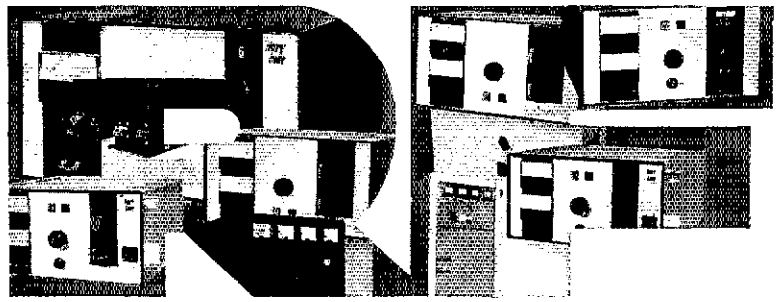

should be our middle name

We're aiming this message at the thousands of amateurs who are also electronics engineers. . . . because we may have just what you are looking for.

We started building amplifiers for amateur use more than 25 years ago. We know that we build the broadest line in the world and we also believe they're the best. A lot of people must agree with us because 40,000 of our amplifiers are in use throughout the world. And because we are so versatile and quality conscious, hundreds of our amplifiers, both stock and custom designed, are being used by commercial, industrial and military users worldwide. They are key components in scores of high tech systems used in a broad range of applications.

Thousands of Henry amplifiers are still used for communications. . .amateur, commercial, MARS, military, short wave broadcast, FM broadcast, VHF link, domestic, foreign. . .Henry amplifiers go everywhere for diverse services. HF point-to-point, VHF, UHF, SSB, AM, FM, RTTY, packet, meteor burst, digital, marine shore station. Are you beginning to get the idea? If you need a special purpose vacuum tube amplifier for a specific frequency from 2 MHz to 500 MHz at power levels up to 10,000 watts, we invite your inquiry.

But communications is only the beginning. Think about plasma generation, sputtering and etching, thin film deposition, laser excitation, nuclear magnetic resonance (NMR), photo-emissions and mass spectrometry, scientific research, industrial production. . .Henry equipment is used in all of these applications. We have always been customer driven and still are.

Recent projects include:

10,000 watt 41 MHz Meteor Burst U.S. Air Force
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2,000 watts 110 to 150 MHz United Technology
3,000 watts 300 MHz NMR
4,000 watts 145 MHz VHF Point-to-Point — Indonesia
1,000 watts 300 MHz Cancer Hyperthermia
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New 220 MHz

220: FM for All!

Kenwood brings you a wide range of 220 MHz gear designed for every need. Choose from two types of mobile and two types of HT. The TH-315A is a full-featured HT covering 220–225 MHz. Ten memory channels and 2.5 watts of power. (5 W with PB-1 or 12 V DC.) Uses the same accessories as the TH-215A for 2 meters or TH-415A 440 MHz. For truly "pocket portability," choose the TH-31BT, a thumb-wheel programmable, 1 watt unit. For mobile use, select the TM-321A or TM-3530A.

The TM-321A is the 25 W, 220 MHz, 14-memory version of the super popular, super compact TM-221A. The 25-watt TM-3530A has 23 memories, a 15 telephone number memory and auto dialer. Direct keyboard frequency entry and front panel DTMF pad enhances operating convenience. Novice to Amateur Extra, these transceivers will put everyone on the air "Kenwood Style"!

TH-315A
Full-featured HT

TM-321A
Compact mobile transceiver

TH-31BT/31A
Pocket-held HT

New

TM-3530A
Full-featured mobile transceiver

The TM-321A comes with 16-key DTMF mic.
A complete line of accessories is available for all models.

Complete service manuals are available for all Kenwood transceivers and most accessories
Specifications and prices are subject to change without notice or obligation.

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THE BEST OF BOTH WORLDS.

The pacesetting IC-R9000 truly reflects ICOM's long-term commitment to excellence. This single-cabinet receiver covers both local area VHF/UHF and worldwide MF/HF bands. It's a natural first choice for elaborate communications centers, professional service facilities and serious home setups alike. Test-tune ICOM's IC-R9000 and experience a totally new dimension in top-of-the-line receiver performance!

Complete Communications Receiver. Covers 100KHz to 1999.8MHz, all modes, all frequencies! The general coverage IC-R9000 receiver uses 11 separate bandpass filters in the 100KHz to 30MHz range and precise-tuned bandpass filters with low noise GaAsFETs in VHF and upper frequency bands. Exceptionally high sensitivity, intermod immunity and frequency stability in all ranges.

Multi-Function Five Inch CRT. Displays frequencies, modes, memory contents, operator-entered notes and function menus. Features a subdisplay area for printed modes such as RTTY, SITOR and PACKET (external T.U. required).

Spectrum Scope. Indicates all signal activities within a +/-25, 50 or 100KHz range of your tuned frequency. It's ideal for spotting random signals that pass unnoticed with ordinary monitoring receivers.

1000 Multi-Function Memories. Store frequencies, modes, and tuning steps. Includes an editor for moving contents between memories, plus an on-screen notepad for all memory locations.

Eight Scanning Modes. Includes programmable limits, automatic frequency and time-mark storage of scanned signals, full, restricted or mode-selected memory scanning, priority channel watch, voice-sense scanning and scanning a selectable width around your tuned frequency. Absolutely the last word in full spectrum monitoring.

Professional Quality Throughout. The revolutionary IC-R9000 features IF Shift, IF Notch, a fully adjustable noise blanker, and more. The Direct Digital Synthesizer assures the widest dynamic range, lowest noise and rapid scanning. Designed for dependable long-term performance. Backed by a full one-year warranty at any one of ICOM's four North American Service Centers!

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OUR COVER

This month's cover features the fabulous '50s with Lew McCoy, W1ICP, and his traveling TVI tours; another classic Phil "Gil" Gildersleeve, W1CJD, cover; the new Novice license; the new 15-meter band; and the Johnson Valiant, which incorporated five 6146s, a cooperative tube design of RCA and the ARRL.

CONTENTS

July 1989
Volume LXXIII Number 7

TECHNICAL

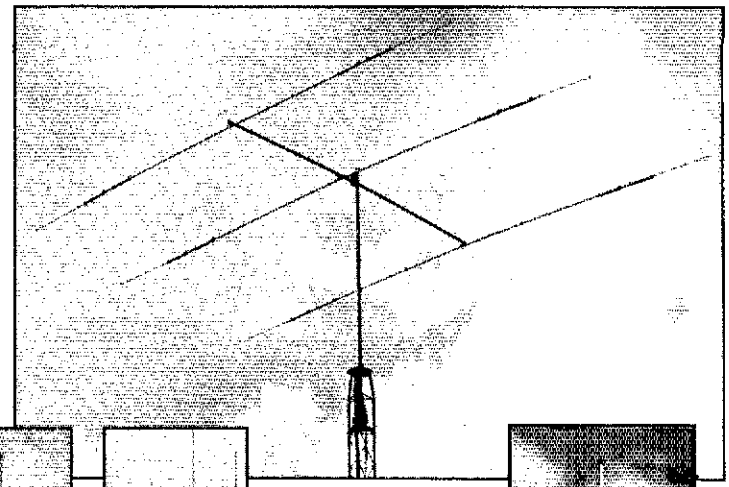
NEWS AND FEATURES

OPERATING

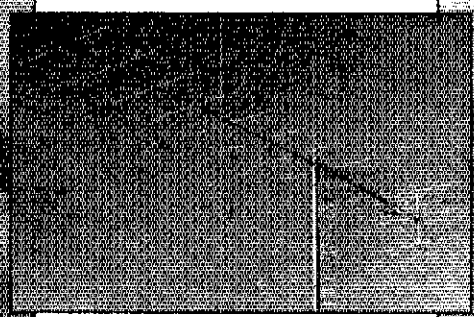
DEPARTMENTS

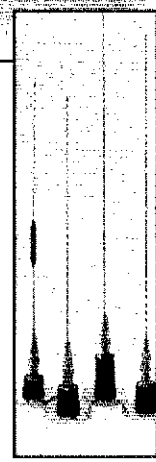
Tuned To The New World Of Amateur Radio

From Novice to Extra Class Cushcraft has the antenna you need.



Cushcraft offers high performance antennas to make every phase of your ham radio activity more satisfying. We have been creating innovative and exciting new products for more than 35 years. Call or write for a free copy of our full line antenna and accessory catalog or see your local dealer.

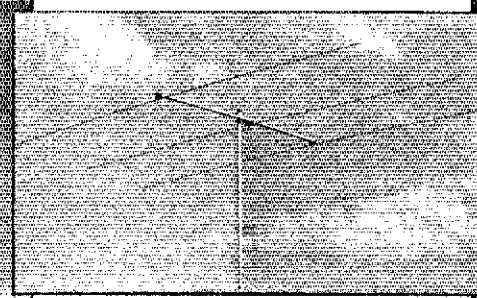




HF TRIBAND BEAM. A3. The most popular compact 10,15, 20 meter beam. *A4S.* A high performance 18' long wideband beam with all stainless steel hardware. 40 meter add on kits for each

NEW ***CUSHCRAFT/SIGNALS.*** magnetic mount mobile for 10 meters. An ideal companion to the new 10 meter multi mode rigs. Model CS28M.

AP8 VERTICAL. Covering 10,12, 15, 17, 20, 30, 40, 80 Meters. Great choice for Novice to Extra class.

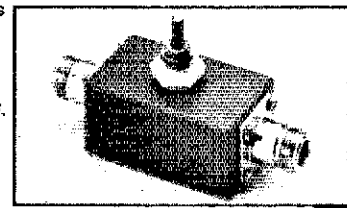


BOOMERS. The contest winners and distance record holders. Computer enhanced design for better gain, pattern and strength. VHF and UHF models for SSB, FM and other activities.

RINGO RANGER II. Still the world's favorite 2 meter, 70 cm or 220 MHz omni antenna, with more gain. A must for your FM or packet station.

FAST ACTION GAS TUBE LIGHTNING ARRESTERS. Protect your valuable radio equipment. High and low power models with SO-239 or N connectors.

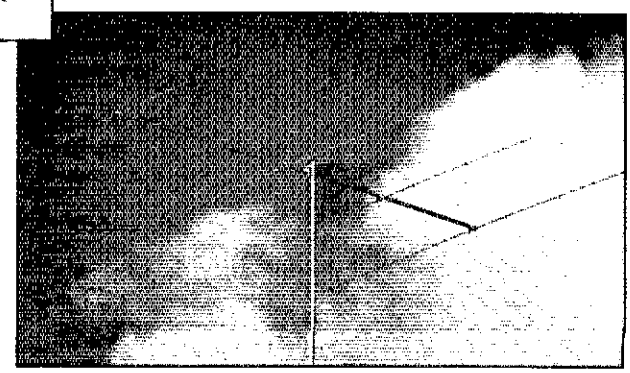
NEW ***10, 18, 24 MHz ROTATABLE DIPOLE.*** Mounts easily on the same mast as your tribander or other antennas. Bi-directional pattern gives excellent performance. Model D3W.



NEW ***NEW 10 METER 3 ELEMENT*** for the novice, technician or any ham who wants more gain with a good front to back ratio. Model TEN-3

NEW ***R5 HALFWAVE 10, 12, 15, 17, 20 METER VERTICAL.*** Amazing DX performance in a small space without ground radials. Includes a solid state broadband impedance matching network. Model R5.

SKYWALKER MONOBAND. 10, 12, 15 and 20 meter Yagis for more contacts, less waiting and a better signal. Preferred by contesters and DX-Peditions.



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NOW! 70 cm

All Mode Mobility!

TR-751A/851A

Compact all mode transceivers

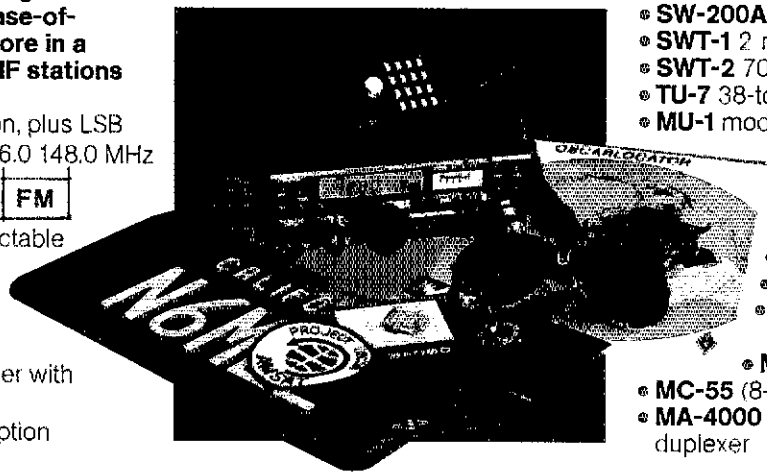
It's the "New Sound" on the 2 meter band—Kenwood's TR-751A! Automatic mode selection, versatile scanning functions, illuminated multi-function LCD and status lights all contribute to the rig's ease-of-operation. All this and more in a compact package for VHF stations on-the-go!

- Automatic mode selection, plus LSB

144.0 144.1 144.5 145.8 146.0 148.0 MHz

CW	USB	FM	USB	FM

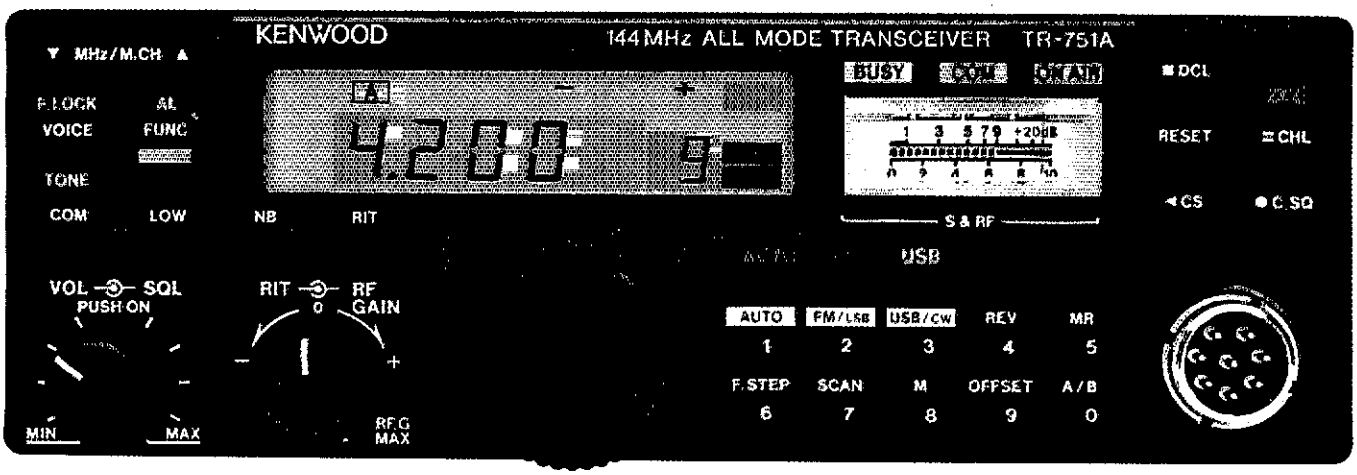
- Optional front panel-selectable 38-tone CTCSS encoder
- Frequency range 142-149 MHz (modifiable to cover 141-151 MHz)
- High performance receiver with GaAs FET front end
- VS-1 voice synthesizer option
- 25 watts high/5 watts adjustable low
- Programmable scanning—memory, band, or mode scan with "COM" channel and priority alert
- 10 memory channels for frequency, mode, CTCSS tone, offset. Two channels for odd splits.
- All mode squelch, noise blanker, and RIT
- Easy-to-read analog S & RF meter



- Dual digital VFOs
- Semi break-in CW with side tone
- MC-48 16-key DTMF hand microphone and microphone hook included
- Frequency lock, offset, reverse switches
- Digital Channel Link (DCL) option

Optional accessories:

- **CD-10** call sign display
- **PS-430, PS-30** DC power supplies
- **SW-100A/B** SWR/power meter
- **SW-200A/B** SWR/power meter
- **SWT-1** 2 m antenna tuner
- **SWT-2** 70 cm antenna tuner
- **TU-7** 38-tone CTCSS encoder
- **MU-1** modem unit for DCL system
- **VS-1** voice synthesizer
- **MB-10** extra mobile mount
- **SP-40, SP-50B** mobile speakers
- **PG-2N** extra DC cable
- **PG-3B** DC line noise filter
- **MC-60A, MC-80, MC-85** deluxe base station mics.
- **MC-43S** UP/DOWN mic.
- **MC-55** (8-pin) mobile mic.
- **MA-4000** dual band antenna with duplexer



Actual size front panel

TR-851A

70 cm SSB/CW/FM transceiver

The same winning features are yours on 70 cm with the TR-851A!

- Covers 430-439.999 MHz
- 25 W high power/5 W adjustable low
- MC-43S UP/DWN mic. and mic. hook included

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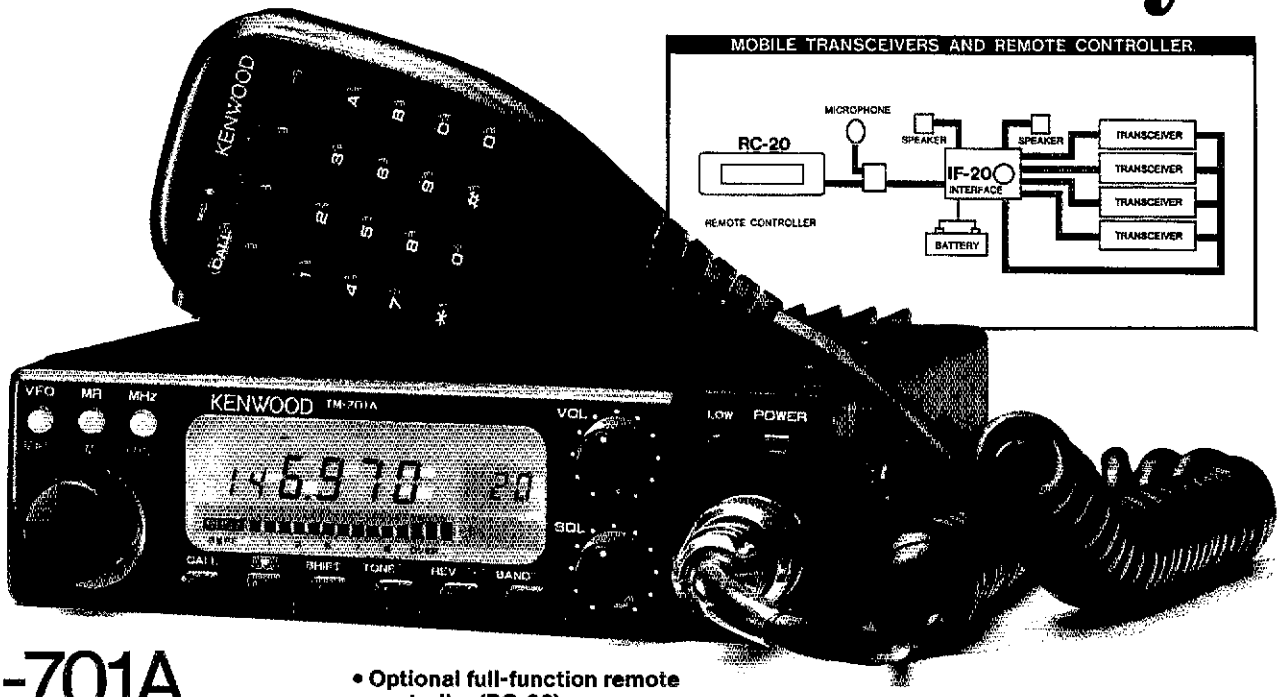
Affordable Breakthrough!

Dual Band Afford-ability!



TM-701A

Dual Bander

The TM-701A combines two radios into one compact package. You get 25 watts on 2 meters and 70cm, 20 memory channels, tone encoder built-in, multiple scanning, auto repeater offset selection on 2 meters, and a host of additional features!

- **20 multi-function memory channels.** 20 memory channels allow storage of frequency, repeater offset, CTCSS frequency, frequency step, and Tone On/Off status, CTCSS and REV, providing quick and easy access during mobile operation.
- **25W on 2m and 70cm.**
- **Selectable full duplex-cross band (Telephone style) operation.**
- **Easy-to-operate front panel layout.**
- **Multi-function DTMF mic. supplied.** Controls are provided on the microphone for CALL (Call Channel), VFO, MR (Memory Call or to change the memory channel) and a programmable function key. The programmable key can be used to control one of the following functions on the radio: MHz, T. ALT, TONE, REV, BAND, or LOW power.
- **Easy-to-operate illuminated keys.** A functionally designed control panel with individually backlit keys increases the convenience and ease of operation during night-time use.
- **Optional full-function remote controller (RC-20).** A full-function remote controller using the Kenwood bus line may be easily connected to the TM-701A and mounted in any convenient location. The new controller is capable of operating all front panel functions.
- **Built-in dual digital VFO's.**
  a) Frequency step selection (5, 10, 15, 20, 12.5, 25kHz)
  b) Programmable VFO
  The user friendly programmable VFOs allow the operator to select and program variable tuning ranges in 1 MHz band increments.
- **Programmable call channel function.** The call channel key allows instant recall of your most commonly used frequency data.
- **Programmable tone encoder built-in.**
- **Tone alert system—for true quiet monitoring.** When activated this function will cause a distinct beeper tone to be emitted from the transceiver for approximately 10 seconds to signal the presence of an incoming signal.
- **Easy-to-operate multi-mode scanning.**
  a) VFO scan
  Band scan, Programmable band scan.
  b) Memory scan plus programmable memory channel lock-out
  c) Dual scan
  Dual call channel scan
  Dual memory scan
  Dual VFO scan
  d) Scan stop modes
  Time operated scan (TO)
  Carrier operated scan (CO)
  e) Scan direction
  f) Alert
  When the AL switch is depressed memory channel 1 is scanned for activity at approximately 5 second intervals.
- **MHz switch.**
- **Lock function.**
- **Repeater reverse switch.**

Optional Accessories

- **RC-20** Full-function remote controller
- **RC-10** Multi-function remote controller
- **IF-20** Interface unit handset • **MC-44** Multi-function hand mic. • **MC-44DM** Multi-function hand mic. with auto-patch • **MC-48B** 16-key DTMF hand mic. • **MC-55** 8-pin mobile mic. • **MC-60A/80/85** Desk-top mics. • **MA-700** Dual band (2m/70cm) mobile antenna (mount not supplied) • **SP-41** Compact mobile speaker • **SP-50B** Mobile speaker • **PS-430** Power supply • **PS-50** Heavy-duty power supply • **MB-201** Mobile mount • **PG-2N** Power cable • **PG-3B** DC line noise filter • **PG-4H** Interface connecting cable • **PG-4J** Extension cable kit • **TSU-6** CTCSS unit

Specifications and prices subject to change without notice or obligation.
Complete service manuals are available for all Kenwood transceivers and most accessories.

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Eastern Pennsylvania — Kay C. Craigie, KC3LM, 5 Faggs Manor Ln, Paoli, PA 19301 (215-993-9623)
Maryland-DC — Kenneth Cohen, NI3F, 7403 Hickory Hog Cir, Columbia, MD 21045 (301-381-7883)
Southern New Jersey — Richard Baier, WA2HEB, 1226 Audubon Dr, Toms River 08753 (201-270-9292)
Western New York — William Thompson, W2MTA, RD 1—Rock Rd, Newark Valley 13811 (607-642-8930)
Western Pennsylvania — Otto Schuler, K3SMB, 3732 Colby St, Pittsburgh 15214 (412-231-6890)

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Indiana — Bruce Woodward, W9UMH, 6208 Bramshaw Rd, Indianapolis 46220 (317-251-5606)
Wisconsin — Richard R. Regent, K9GDF, 5003 South 26th St, Milwaukee 53221 (414-282-0312)

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North Dakota — Roger "Bill" Kurtti, WCØM, Rural Route—Box 34, Rock Lake 58365 (701-266-5646)
South Dakota — Roland Cory, WØYMB, 1010 7th St, W, Mobridge 57601 (605-845-2400)

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Louisiana — John M. Wondergem, K5KR, 600 Smith Dr, Metairie 70005 (504-837-1485)
Mississippi — Vessen "Butch" Magee, KF5DE, 2120 Belvedere Dr, Jackson 39205 (601-373-4325)
Tennessee — Harry Simpson, W4MI, 1830 Macaulay Ave, Memphis 38127 (901-357-8148)

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Ohio — John P. Haungs, WA8STX, 10615 Thornview Dr, Evendale 45241 (513-563-7373)

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NYC-Long Island — Walter M. Wenzel, KA2RGI, 373 Fifteenth St, West Babylon 11704 (516-957-5726)
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Missouri — Bill McGrannahan, KØORB, 4826 Jarboe, Kansas City, 64112-1335
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Eastern Massachusetts — Barry Porter, KB1PA, 47 Erin Rd, Stoughton 02072 (617-341-2639)
Maine — Clyde E. Bonesteel, Jr, WA2ERT, PO Box 14, Birch Harbor 04613 (207-963-7192)
New Hampshire — William Burden, WB1BRE, 11 Briand, Nashua 03063 (603-889-9322)
Rhode Island — William Foss, KA1JXH, 70 Mayfair Rd, Cumberland 02864 (401-334-3058)
Vermont — Jonathan Maguire, N1CQE, RFD 1 Box 7500, Poker Hill Rd, Underhill 05489 (802-899-4045)
Western Massachusetts — William C. Voedisch, W1UD, 240 Main St, Leominster 01453 (617-534-6256)

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Idaho — Don Clower, KA7T, 5103 W. Cherry Ln, Meridian 83642 (208-888-7020)
Montana — A. F. "Pete" Peters, KF7R, Rte 38, Box 2017, Livingston 59047 (406-222-2601)
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San Joaquin Valley — James Wakefield, AH6CO, 2215 North Winery, Fresno, CA 93703
Santa Clara Valley — Glenn Thomas, WB6W, 554 Simas Dr, Milpitas, CA 95035 (408-263-9450)

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South Carolina — Charles E. Moeller, N4FVU, 116 Willow Winds Dr, Columbia 29210-4454 (803-772-1186)
Virginia — Claude Feigley, W3ATQ, 135 The Maine, Williamsburg, 23185
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New Mexico — Joe Knight, W5PDY, 10408 Snow Heights Blvd, NE, Albuquerque 87112 (505-299-4581)
Utah — Richard Fisher, NS7K, 1510 Celia Way, Layton, 84041
Wyoming — James E. Raisler, N7GVV, 1102 East 9th St, Gillette 82716 (307-686-0794)

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Georgia — Edmund J. Kosobucki, K4JNL, 5525 Perry Ave, Columbus 31909 (404-322-2856)
Northern Florida — Royal V. Mackey, N4ADI, 161 Shell Point W, Maitland 32751 (407-644-5905)
Southern Florida — Richard D. Hill, WA4PFK, 12380 NW 30 St, Sunrise 33323 (305-572-3172)
Puerto Rico — Alberto L. Valldejuli, WP4CSG, V-11 19th St, Berwind Estates, Rio Piedras 00924
Virgin Islands — Ronald Hall, Sr, KP2N, PO Box 3987, St Thomas 00803 (809-774-4740)

Southwestern Division
Arizona — James E. Swafford, W7FF, 5906 W Miramar Dr, Tucson 85715 (602-298-7793)
Los Angeles — Phineas J. Icenbice, Jr, W6BF, 19323 Halsted St, Northridge, CA 91324 (818-349-3186)
Orange — Joe H. Brown, W6UBQ, 5444 La Sierra, Riverside, CA 92505 (714-687-8394)
San Diego — Arthur R. Smith, W6INI, 4515 Melisa Way, San Diego, CA 92117 (619-273-1120)
Santa Barbara — Thomas I. Geiger, W2KVA, 428 E Grant St, Santa Maria, CA 93454 (805-866-1359)

West Gulf Division
North Texas — W. W. "Dan" Dansby, W5URI, 5805 Walla Ave, Fort Worth 76133 (817-292-5019)
Oklahoma — Joseph Lynch, N6CL, PO Box 73, Oklahoma City 73101 (405-528-6625)
South Texas — Arthur R. Ross, W5KR, 132 Sally La, Brownsville 78521 (512-831-4458)
West Texas — Amelia "Milly" Wise, W5OVH, 8516 Mt Scott, El Paso 79904 (915-751-4160)

"It Seems to Us . . ."

May Flowers on M Street

If an extraterrestrial visitor had landed on M Street in the District of Columbia in early May, and if the aforementioned e.t. had stuck around to watch the month's goings-on at the FCC, he'd have phoned home to report that Amateur Radio was one of the major preoccupations of the agency. May was not exactly a typical month at the Friendly Candy Company.

For one thing, it's not typical for the Chief Engineer to be summoned before a Congressional oversight committee to try and defend an allocations decision. Not typical at all. But that's what happened on May 11, as you'll read beginning on page 44. Congress should be, and is, very reluctant to substitute its judgment for that of an agency with presumed expertise in its field; but when the expertise turns out to be a facade reminiscent of a Potemkin village, then Congress *must* take an interest. Thanks to West Virginia's Congressman Bob Wise, it is now a matter of public record that whatever spectrum allocations expertise the FCC might possess was not applied to Docket 87-14. Should it come to that, the hearing record has strengthened the basis for a possible court appeal of the Commission's action in reallocating 220-222 MHz. But if the FCC sees this as a good time to mend fences, maybe it won't come to that.

It also has not been typical to hear of the FCC taking enforcement action based on the observations of the volunteer Amateur Auxiliary. But it happened in the State of Washington, breathing renewed vigor into a corps of dedicated volunteers, some of whom had begun to wonder if they were wasting their time. Whether done by volunteers or by FCC professionals, monitoring for enforcement purposes demands a high standard of performance; it's reassuring to see that this standard can be met by the Amateur Auxiliary, and when warranted, the FCC *will* act to curb observed violations.

We wish it were less typical for the League to have filed a petition for reconsideration and motion for stay of a rules revision, but unfortunately all too many months are so marked. In this case it was the inexplicable relaxation of Part 15 restrictions on nonlicensed RF emitters that triggered the League's action, and unless the Commission takes uncharacteristically prompt and favorable action on the motion for stay (that is, for postponement of the effective date of the rules changes) we'll probably have gone to court to seek an injunction by the time you read these words.

Back to the atypical—in this case, practically the unprecedented. On May 31, FCC adopted a top-to-bottom rewrite of the Part 97 rules that govern Amateur Radio. This was a mammoth undertaking for a depleted FCC staff even to attempt, which meant that it deserved to be taken seriously by the League and the amateur community generally. And it was. At this writing we haven't seen the actual document, so we can't swear there aren't some zingers in it somewhere; but early indications are that the Private Radio Bureau (PRB) staff who handled the rewrite were commendably responsive to public input. A rewrite of this magnitude is a lot like tiptoeing through a minefield, as the grizzled veterans of past campaigns can attest. Especially gratifying was the degree to which mutual respect, acceptance, and trust were enhanced between PRB and ARRL officials and staff in the course of the rewrite proceeding—an atmosphere which we earnestly hope will once again mark our relations with the Commission generally.

Coming on top of all this, the word that PRB-3 (privatization of amateur call sign assignments) was being terminated without action came almost as an anticlimax. We share the disappointment of those amateurs who would like to obtain or reobtain a specific call sign, and we still think the FCC could manage such a system itself in a way that would enrich the Treasury. But we can readily understand the Commission's belief that a privately managed system, even one managed by the League, would still leave the FCC with a burden of responsibility for administrative oversight that it presently lacks the resources to shoulder. We'll continue to try and find a way club-station licensing can be resumed, something that's especially important if we're to take full advantage of the renewed interest in school and youth-group clubs that is taking hold across the country.

May was by no means a typical month for Amateur Radio at the FCC. Not all of May's flowers bloomed just the way we might wish. But in a number of ways, we could use a few more months like May.—*David Sumner, K1ZZ*

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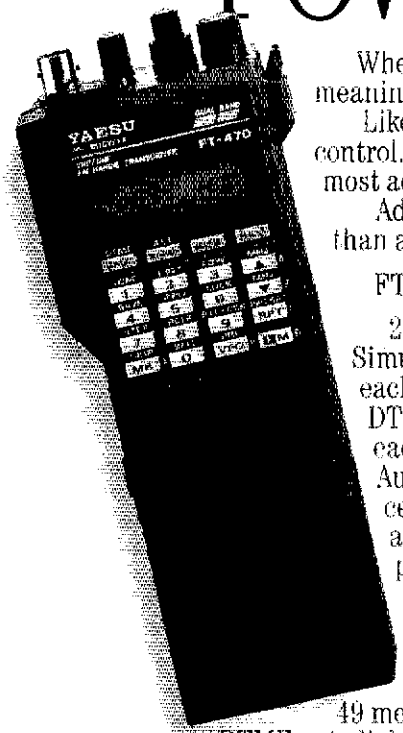

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Added up, it's no wonder amateurs choose Yaesu HTs more than any others.

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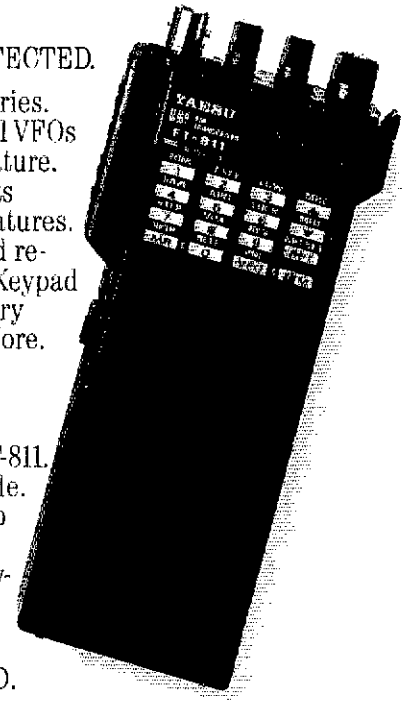

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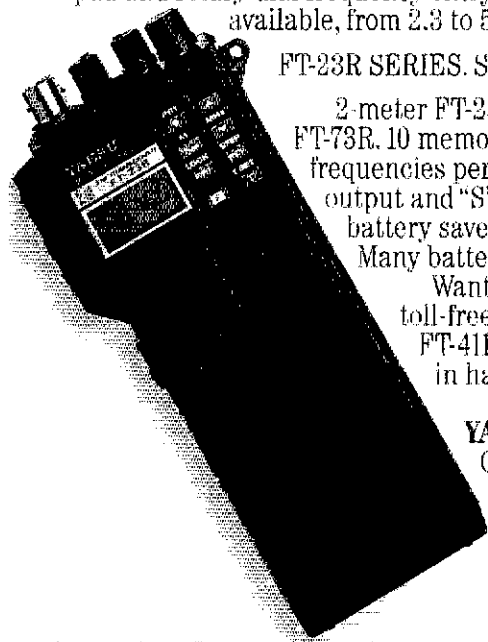

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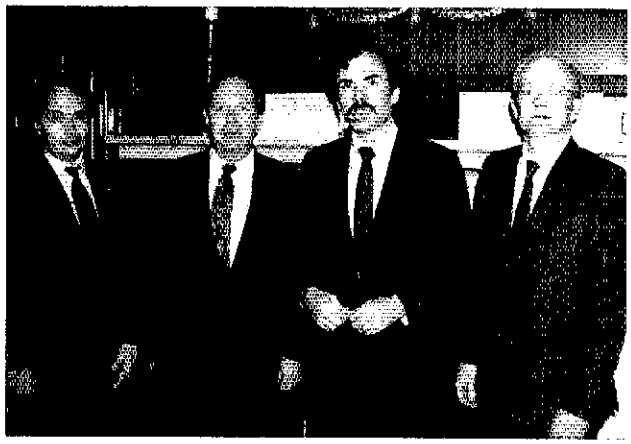
UP FRONT in QST

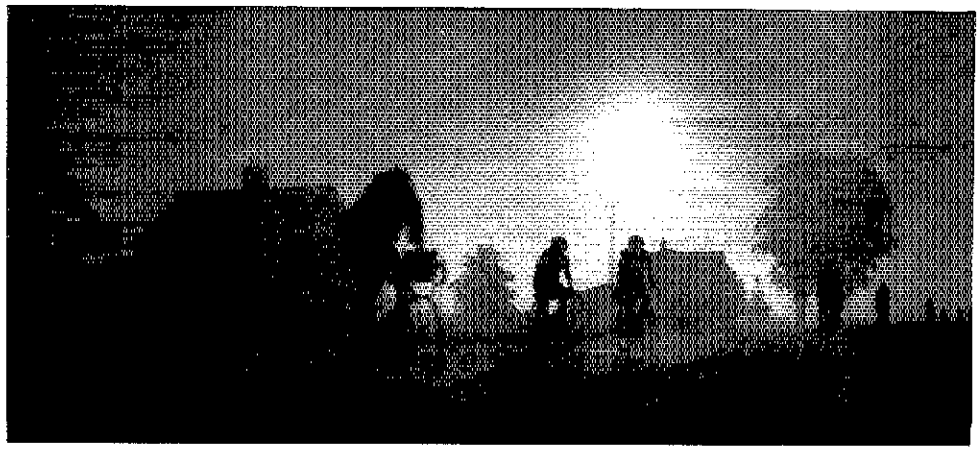


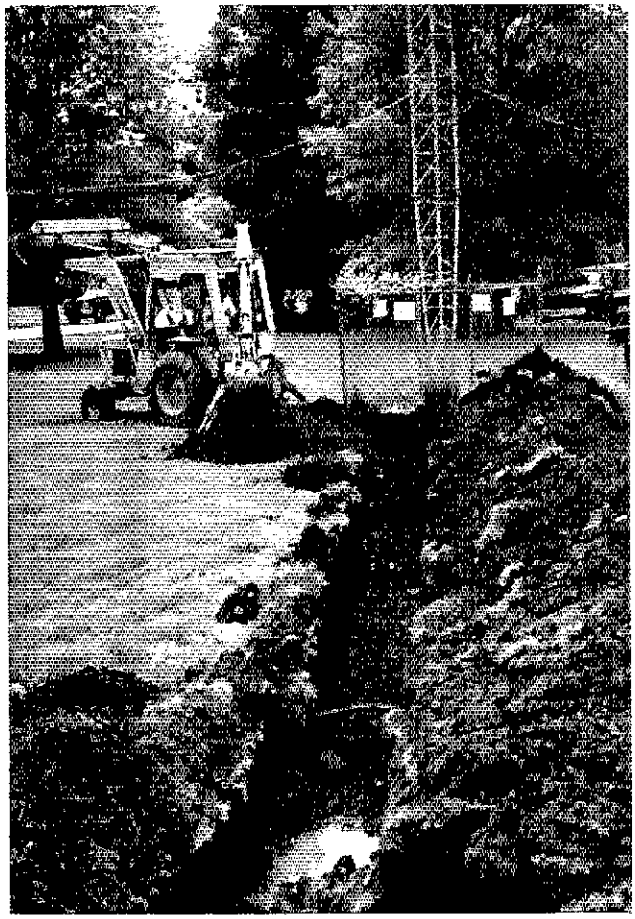
220 hearing: The Government Information, Justice and Agriculture Subcommittee of the House Committee on Government Operations held an oversight hearing on May 11 to look into the FCC handling of the 220-MHz reallocation decision. ARRL representatives, along with a witness speaking on behalf of the Department of Defense, objected to the procedures followed by the FCC in deciding to terminate access by amateurs to 220-222 MHz. The Subcommittee will review the record of the hearing to determine if further action is appropriate. See the story on the hearing on page 44. (l-r) Chairman of the Los Angeles County Emergency Public Information Group Richard Rudman, W6TIA; West Virginia Section Manager Karl Thompson, K8KT; Subcommittee Chairman, Rep Robert E. Wise, Jr; ARRL EVP David Sumner, K1ZZ.

Message # what?: The Ramapo Mountain Amateur Radio Club announced that message #50,000 has been handled by the club's packet-bulletin-board system, WA2SNA-1. The system utilizes three ports and handles about 200 monthly calls with about 2500 connects. Here, Emil VanDevelde, WA2UPK, system operater, is at the console at the PBBS station keyboard. The club is already looking forward to message #100,000. (*photo WA2S*)

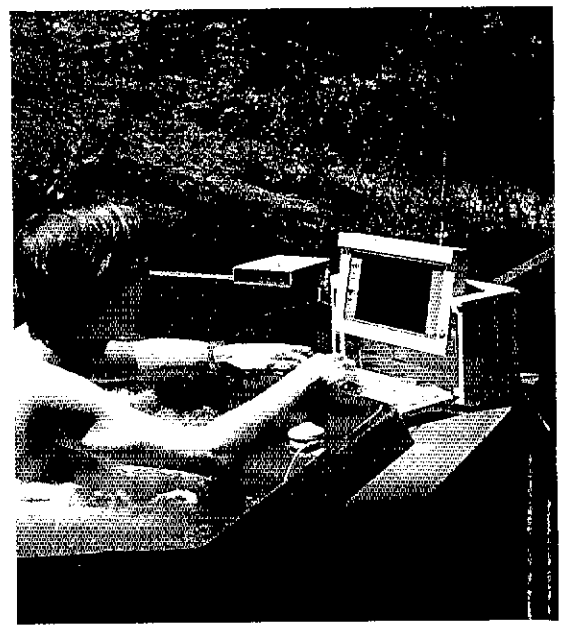
OSCAR demo: During orbit 631 of OSCAR 13, 11-year-old Ashley Marx, KC4IRV (2nd from r), used her 2-meter hand-held transceiver to talk to G3RUH in Cambridge, England. The QSO was made during her science class at the Stokes School in Nashville, Tennessee. The demonstration was accomplished via the WB4NTM repeater linked to the KG6EX gateway. (*photo KG6EX*)

Iowan cooperation: More than 7500 bicyclists and 2500 support personnel participated in the Des Moines *Register's* Annual Great Bike Ride Across Iowa (RAGBRAI). In the true spirit of cooperation, more than 80 hams from 10 clubs handled 343 messages and 600 special-event contacts over the eight-day trek. The story on this annual event begins on page 51. (*photo Des Moines* Register)

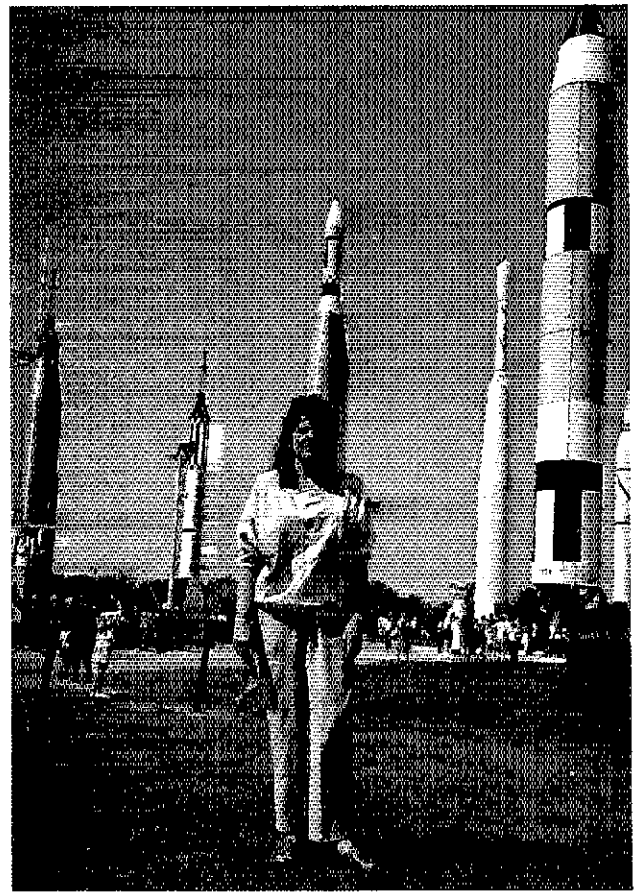




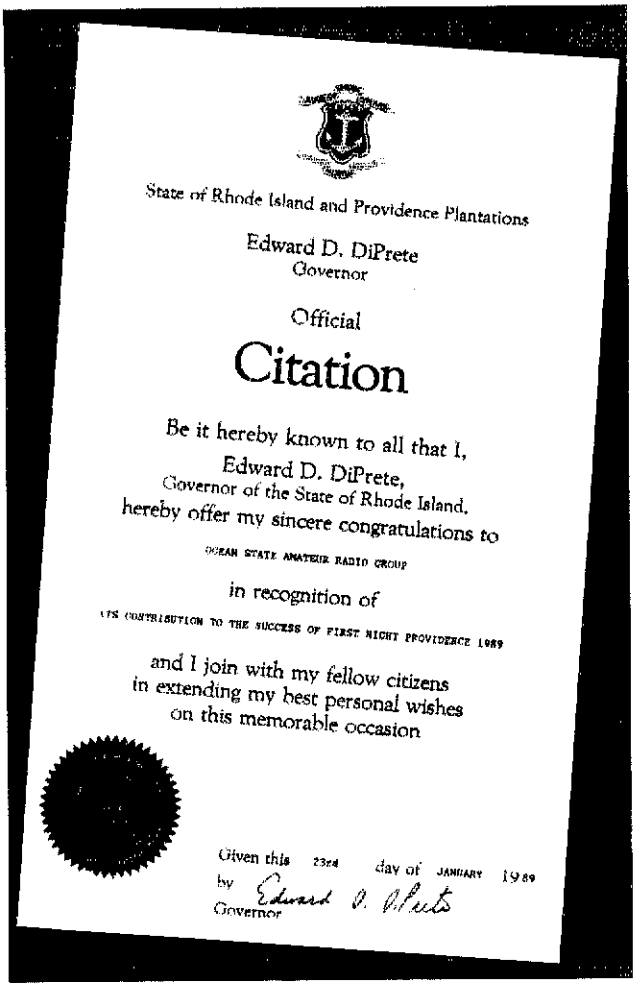
W1AW trenches: A backhoe digs a trench to an existing W1AW tower to allow installation of conduit and Hardline. Other renovation activity these past few weeks included interior painting and installation of staircases, a furnace and an alarm system. For more renovation photos, see page 30. (*photo KC1MP*)



Packet "California style": Phil Karn, KA9Q, is a devoted member of the ARRL Digital Committee—so devoted he even took a packet station to this vacation retreat near Lake Tahoe. Phil is a long-time AMSAT member and won this year's Dayton Amateur Radio Association Specific Achievement Award. Rest assured that he had enough sense not to plug in any of the equipment; this photo was done just for fun. (*photo N6BIS*).



Among rockets: Carole Perry, WB2MGP, stands in the Rocket Garden during a tour of Kennedy Space Center as part of the Educators' Magellan Launch Conference April 25-28. Even though the launch was delayed, Carole said the the four days were exciting and informative, packed with seminars and tours. She received a myriad of educational and resource material for use in the classroom. She noted that all the other teachers were impressed by the way Amateur Radio became such a valuable source of information for the group. Carole added, "You can't help but be impressed and feel an enormous sense of pride in what has been accomplished, and in what the future holds." Carole was one of the 1987 ARRL Professional Instructors of the Year. Her class made a SSTV contact with Tony England, WØORE, in 1985 and has been in regular contact with Johnson Space Center hams on the 10-meter CQ All-Schools Net.



State of Rhode Island and Providence Plantations

Edward D. DiPrete
Governor

Official

Citation

Be it hereby known to all that I,
Edward D. DiPrete,
Governor of the State of Rhode Island,
hereby offer my sincere congratulations to

OCEAN STATE AMATEUR RADIO GROUP

in recognition of

ITS CONTRIBUTION TO THE SUCCESS OF FIRST NIGHT PROVIDENCE 1989

and I join with my fellow citizens
in extending my best personal wishes
on this memorable occasion

Given this 23rd day of JANUARY 1989
by Edward D. DiPrete
Governor

A welcome citation: The Ocean State Amateur Radio Group, of Cranston, Rhode Island, was commended by Governor Edward DiPrete for providing communications for the Rhode Island First Night Celebration. *US Air* magazine carried a story, which included mention of OSARG, on the event. OSARG utilized a 2-meter simplex link and a 220-MHz repeater, which allowed Novices to take part in this public-service event. *(citation courtesy K1CVP)*

Keep those contacts rollin': The South Dakota Centennial Wagon Train left Elk Point, South Dakota on May 10 with 137 wagons—the second wagon in line being devoted to ham radio. Various Amateur Radio clubs along the way will provide operators through September 4. The Wagon Train will travel 1781 miles and visit every county seat in the eastern part of the state. According to South Dakota SM Roland Cory, WØYMB, some of these counties have no hams located in them! Are you taking note county hunters? For details on how to contact the Wagon Train and receive a QSL, check out the Special Events column on page 95. *(photo KØGDS)*

Want a Place in Up Front?

Have a news item of an interesting twist concerning Amateur Radio, with a good color photograph? It just may be the ticket for inclusion in a future edition of Up Front. Here are some hints to improve your chances of getting that item in print.

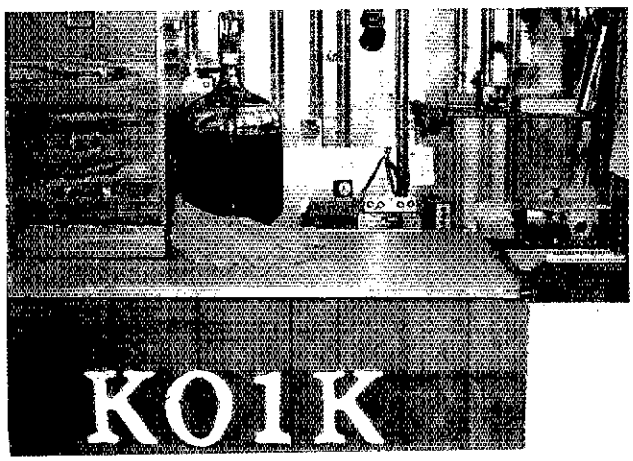
1) Be sure the item is of interest to most hams.

2) Amateur-Radio-in-action shots are preferred over staged stand-up awards presentations; ie, we'd prefer to have a photograph of a ham doing what he got the award for, rather than a shot of the ham receiving the award.

3) Photographs must be in color. Transparencies reproduce best, and print enlargements should be at least 4 × 6. No Polaroids™, please.

4) Include all pertinent information and identify everyone in the photograph. Don't forget to include a photo credit.

5) Send all material to ARRL, Up Front Editor, 225 Main St, Newington, CT 06111.



Home brewing lives: As Eric Jamaieson, KO1K, of Farmington, Connecticut, demonstrates in this photo, home brewing is *not* dead. Eric says his home brew is quite legal, even though it is more than a "full gallon." His five-gallon project used two bushels of grapes and champagne yeast. Eric reports that the wine is actually a very light blush white; the depth of the carboy causes it to look dark red. The wine is bottled and aging nicely under the counter, along with Eric's *QST* collection! *(photo courtesy KO1K)*

League Lines

At press time, HQ received word of two important FCC actions. On May 31, ***FCC announced the completion of its major revision and reorganization of Part 97,*** the rules and regulations governing the Amateur Radio Service. The actual Report and Order has not been released as this issue goes to press; details will appear in August *QST.*

On June 1, ***FCC announced that it will not initiate a special call-sign system*** administered in the private sector, as proposed in PRB-3. See this month's Happenings column for more information.

The ARRL Board of Directors meets in the Hartford area July 21-22. There's still time before the Board meeting to contact your Division Director (see page 8) to express your views on code-free licensing and other important issues facing Amateur Radio.

The rededication of the Hiram Percy Maxim Memorial Station, W1AW, will be held July 20 at 3 PM EDT. The ribbon cutting will be witnessed by ARRL Officers, Directors, staff and Newington town officials. Design Group One Architects, M & L Building Company and the Harris Corporation will have representatives at the gala event. The guest of honor will be Hiram Hamilton Maxim, son of HPM. If you're in town, drop by and tour the new facilities.

ARRL representatives testified May 11 before the Government Information, Justice and Agriculture Subcommittee of the House Committee on Government Operations. The ARRL panel objected to the procedures followed by the FCC in deciding to terminate access by amateurs to 220-222 MHz. The complete story appears on page 44 of this issue.

The 4th IARU HF World Championship is July 8-9 from 1200 UTC Saturday until 1200 UTC Sunday.

HQ is looking for good photos of clubs in action for the Club Spectrum column. Send your club photos to the attention of Rick Palm, K1CE, Field Service Manager, ARRL HQ.

The ARRL's 75th anniversary slogan, "From Spark... To Space," must have sounded very familiar to the members of the Saskatoon Amateur Radio Club, VE5AA! In 1968, in connection with the Canadian Centennial, the club published a history of Amateur Radio under the title, "from spark to space." It was a great title then, and it's a great slogan today! A tip of the ARRL cap goes to VE5AA for beating us to it by 20 years.

For some time, ***W1AW bulletin transmissions have become increasingly difficult for some listeners to copy*** on 20 and 40 meters. There is much teleprinter operation on and very near 14.070 MHz and both phone and teleprinter operation on 7.080 MHz. Therefore, effective August 1, W1AW will move, on a trial basis, to 14.047.5 MHz on 20 meters and to 7.047.5 MHz on 40 meters. We hope these changes will make the W1AW CW transmissions more readily available to our listeners. There will also be a slight change in the W1AW voice bulletin schedule. The voice transmissions will be sent 15 minutes later than at present. The new times will be 0145 and 0445 UTC which is 9:45 PM and 12:45 AM Eastern Daylight Time. We ask our regular listeners to please drop us a line and let us know how you find these changes.

Effective June 1, 1989, the cost of the Five Band Worked All States (WAS) plaque became $25.00. This reflects the increase in the price of recently ordered plaques.

Ken Cameron, KB5AWB, has been assigned as a pilot on Space Shuttle mission STS-37, two flights after the scheduled March mission of Ron Parise, WA4SIR. Ken has stated that he is interested in operating amateur gear while aboard the shuttle and the SAREX Working Group is currently putting together the paperwork to make that happen.

AMSAT President Doug Loughmiller, KO5I, reports that ***the scheduled Microsat/UOSAT launch date is November 9, 1989.***

Bart J. Jahnke, KB9NM, is the new ARRL/VEC manager. Bart, formerly *ARRL Repeater Directory* editor, replaces Jim Clary, WB9IHH.

New ARRL book: *Antenna Impedance Matching* shows in detail how to use the Smith Chart™ to develop matching networks. Written by Wilfred N. Caron, this 224-page hardcover book is a must for amateur and professional antenna designers. The cover price is $15, and copies should be available from your local dealer or ARRL HQ now.

A Clean, Low-Cost Microwave Local Oscillator

This versatile local oscillator provides a clean, crystal-controlled 7-dBm output in the 2.1 to 2.3 GHz range, and requires no RF adjustment!

By Richard L. Campbell, KK7B
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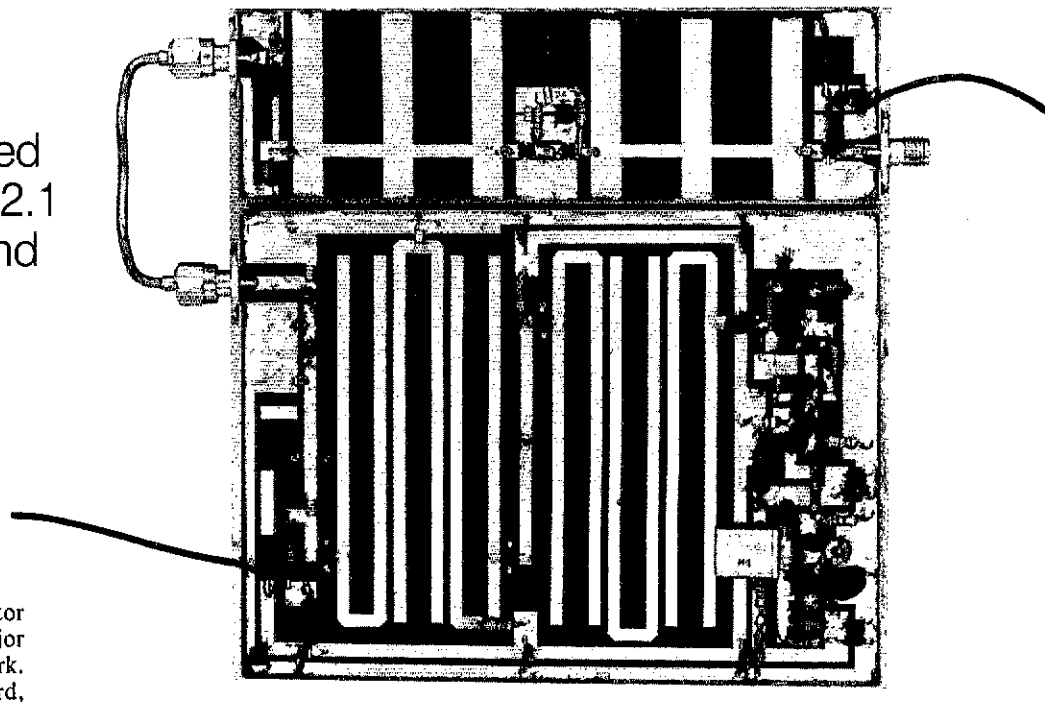


The complete microwave LO is built on two PC boards. The larger (bottom) board provides a signal anywhere from 540 to 580 MHz, depending on the crystal frequency. The smaller board is a ×4 multiplier that provides an output from 2160 to 2320 MHz, depending on input frequency. Used separately or together, these boards have a wide variety of UHF and microwave applications.

Obtaining a suitable local oscillator (LO) has traditionally been a major obstacle in amateur microwave work. This article describes a straightforward, inexpensive, easily constructed microwave LO. The oscillator may be combined with a simple low-noise preamp[1], an image filter[2] and an off-the-shelf doubly balanced mixer to build a complete high-performance receiving converter for OSCAR Mode S. This LO can also be used as a building block in a transverter for the 2304- or 3456-MHz bands.

All of the critical microwave circuitry in this LO is readily taken care of by a pair of fiberglass-epoxy (G-10) PC boards. The remaining parts include noncritical chip capacitors for interstage coupling and bypassing, standard ¼- and ½-W bias resistors, inexpensive, plastic-cased monolithic-microwave integrated-circuit (MMIC) amplifiers, a pair of 99-cent diodes, a few hand-wound inductors, disc-ceramic capacitors, and a 90-MHz, 5th-overtone crystal oscillator. PC board manufacturing tolerances, component varia-

[1]Notes appear on page 21.

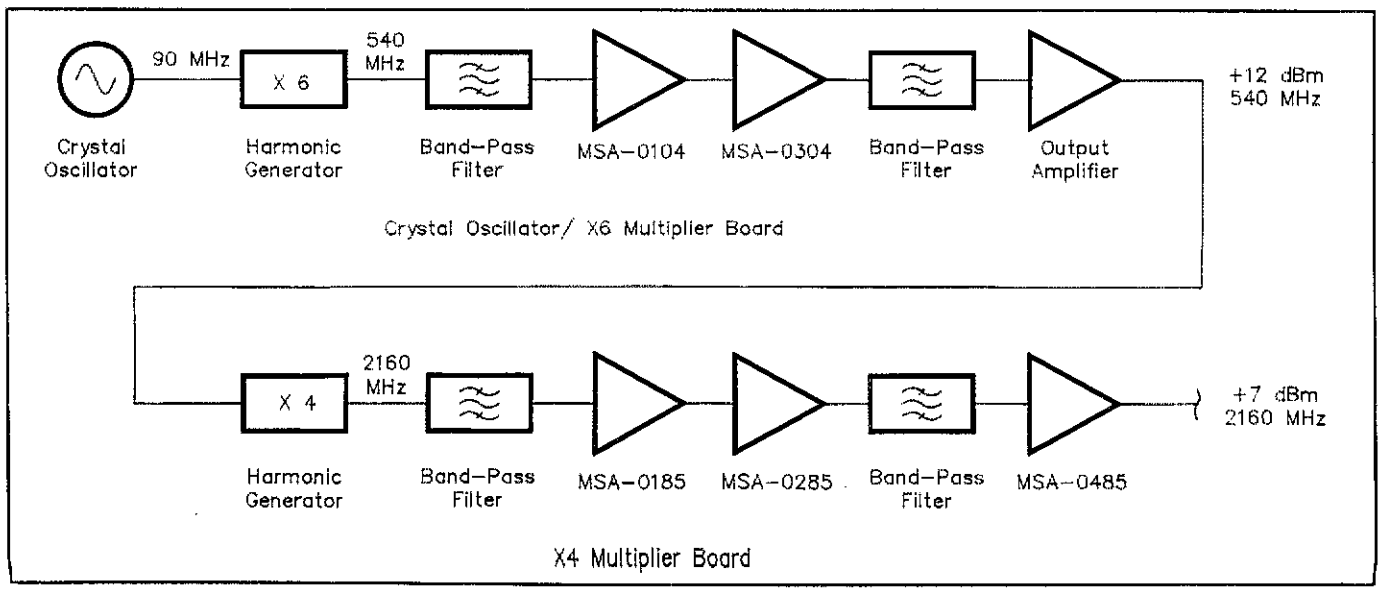


Fig 1—Block diagram of the 2160-MHz LO.

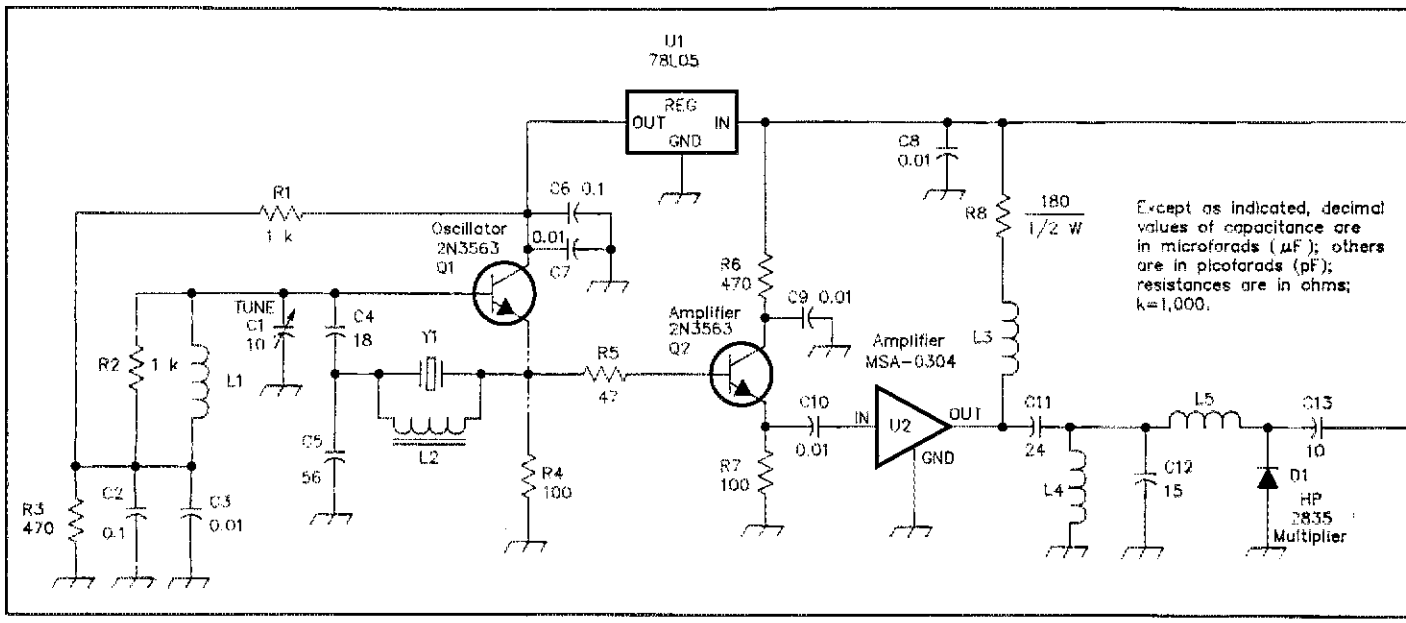


Fig 2—Schematic diagram of the crystal oscillator/×6 multiplier board. Resistors are ¼-W carbon-film types unless otherwise indicated. Capacitors are 50- or 100-V disc-ceramic types unless otherwise noted.

C1—8- to 10-pF trimmer capacitor. Ceramic-piston trimmer preferred; standard ceramic trimmer acceptable.
D1—Schottky diode; Hewlett-Packard 2835, 2800, 2811 or equivalent. See text.
J1—SMA female chassis-mount connector preferred. See text.
FL1, FL2—Band-pass filters printed on PC board.
L1, L3, L4, L5, L6—8 turns no. 28 enam wire, 0.1-inch ID, closely wound.
L2—10 turns no. 32 enam wire on T-25-6 toroid core, or 0.33 μH miniature RF choke.
L7, L8—3 turns no. 28 enam wire, 0.0625-inch ID, spaced 1 wire diam.
Q1, Q2—2N3563, MPS3563, 2N5179 or equivalent. See text.
R11—If U5 is an MSA-0404, use 120-Ω, ½-W resistor. If U5 is an MSA-1104, use a 100-Ω, ½-W resistor. See text.
U1—5-V, 100-mA, 3-terminal regulator.
U2—MSA-0304 MMIC preferred. MSA-0404, MSA-0385, MSA-0485, MAR-3 or MAR-4 also usable. See text.
U3—MSA-0104 MMIC preferred. MSA-0185, MSA-0685, MAR-1 or MAR-6 also usable. See text.
U4—MSA-0304 MMIC preferred. MSA-0285, MSA-0385, and MAR-2 also usable. See text.
U5—For +12 dBm out, use MSA-0404. For +16 dBm out, use MSA-1104. See text.
Y1—90-MHz, 5th-overtone, series-resonant crystal.

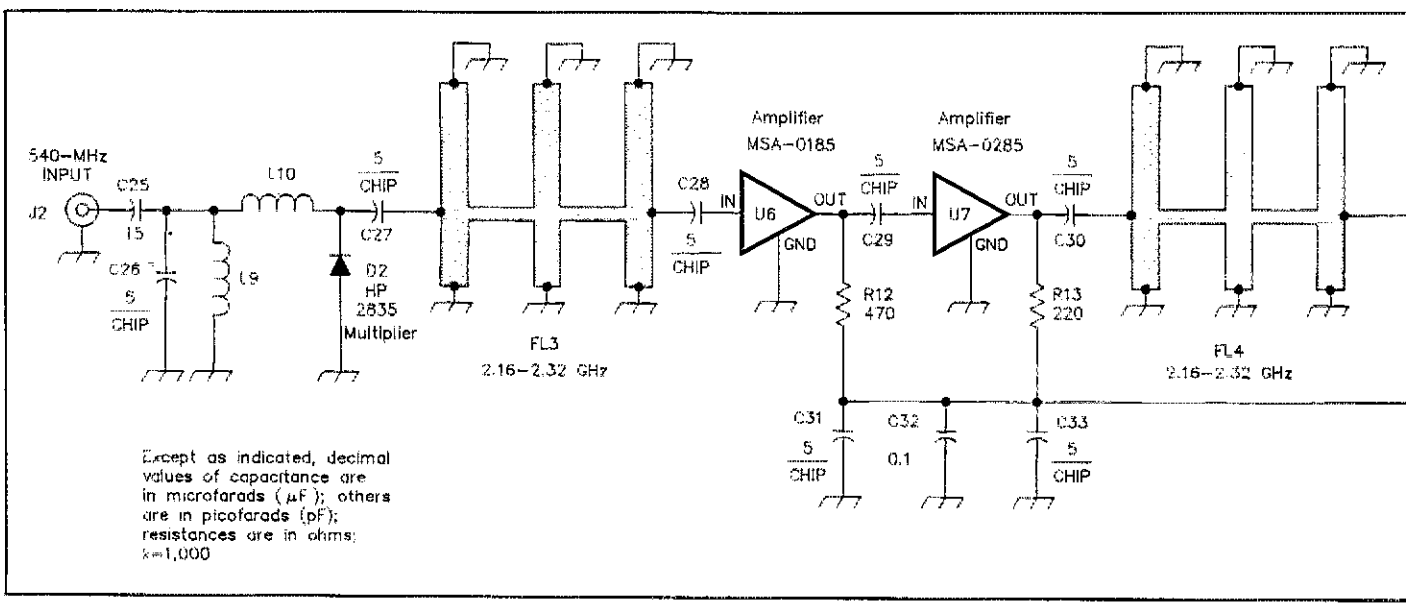
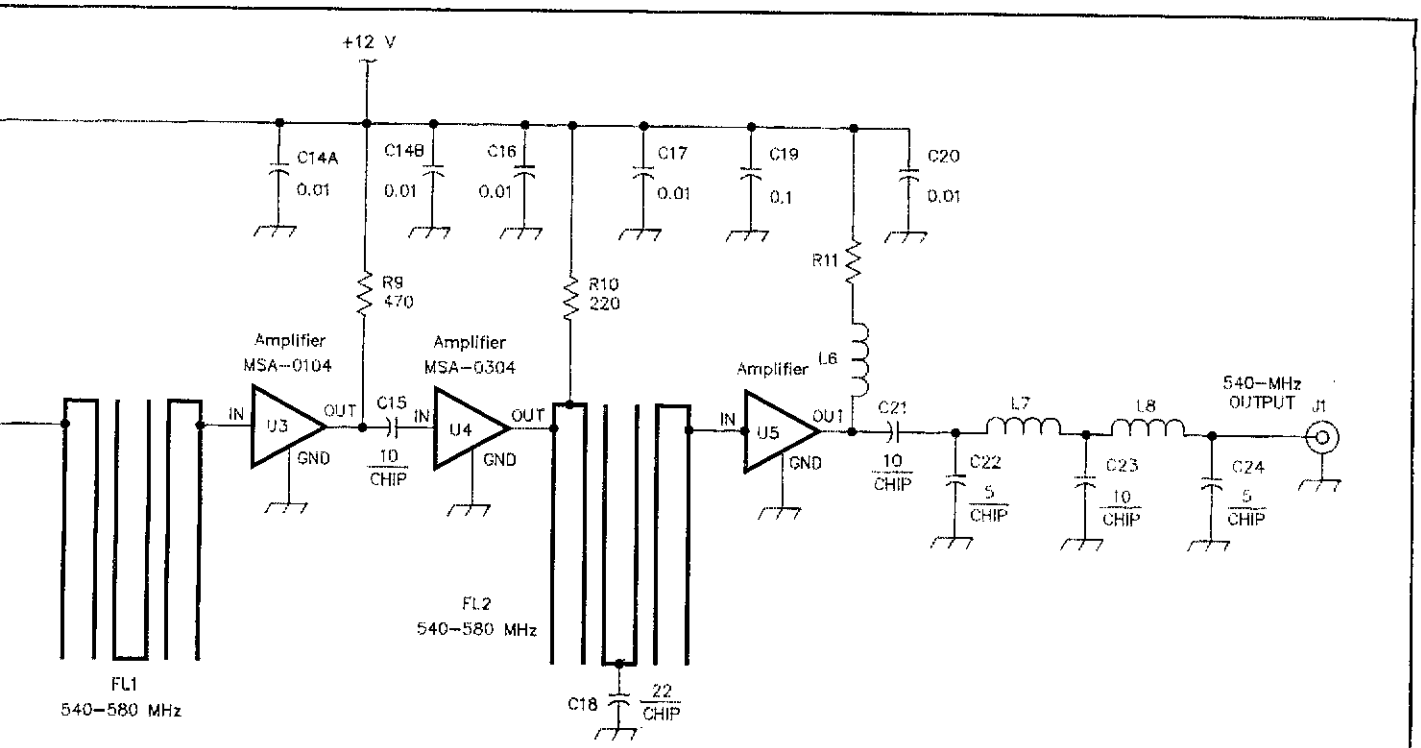


Fig 3—Schematic diagram of the ×4 multiplier board. Resistors are ¼-W carbon-film types unless otherwise indicated. Capacitors are 50- or 100-V disc-ceramic types unless otherwise noted.

D2—Schottky diode; Hewlett-Packard 2835, 2800, 2811 or equivalent. See text.
J2, J3—SMA female chassis-mount connector preferred. See text.
FL3, FL4—Band-pass filters printed on PC board.
L9—3 turns no. 28 enam wire, 0.0625-inch ID, spaced 1 wire diam.
L10—Inductor printed on PC board.
U6—MSA-0185 or MAR-1 MMIC preferred. See text.
U7—MSA-0285 or MAR-2 MMIC preferred. See text.
U8—MSA-0485 or MAR-4 MMIC preferred. See text.

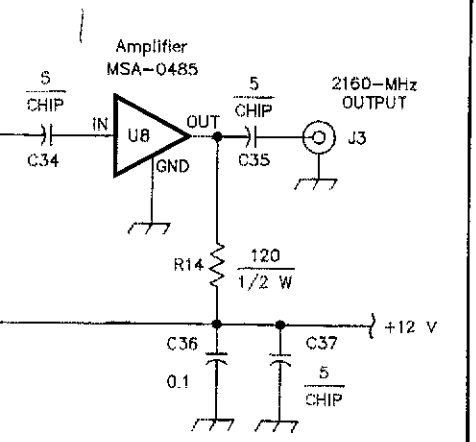


tions, and construction tolerances have all been allowed for in the design. There are no RF tuning adjustments except for the 90-MHz oscillator tank circuit.

Design Goals

This project began with a list of design goals:

1) No tuning adjustments should be required.



2) All frequency-sensitive elements are printed on G-10 board.

3) Use inexpensive, readily available components.

4) Offer sufficient output to drive a standard-level mixer.

5) Use a single 12-V power supply.

6) All spurious outputs are more than 40 dB down.

7) Have electrical, mechanical and thermal stability consistent with portable CW operation on mountaintops in bad weather.

These goals have been met, with one minor exception: The 90-MHz crystal oscillator tank circuit must be tuned to make the oscillator start reliably. This adjustment can be made by listening for the crystal-oscillator output on an FM-broadcast radio. The electrical, mechanical and thermal stability are impressive. One of these LOs was still operating after an airline baggage-handling event left the aluminum transverter case so badly bent that the top had to be removed with a hammer!

System Description

The complete microwave LO, shown in block-diagram form in Fig 1, consists of two PC boards: a crystal oscillator and times 6 ($\times 6$) multiplier board; and a $\times 4$ multiplier board. The crystal oscillator/$\times 6$ multiplier board can generate any frequency between 540 and 580 MHz; simply choose the appropriate crystal. The output level depends on the device chosen for the output amplifier. An Avantek MSA-0404 is used for the output amplifier in the version described here. (See this article's Amplifiers section for more details.)

The $\times 4$ multiplier board can be used for any output frequency between 2140 and 2360 MHz. The harmonic-generator components are sufficiently broadly tuned that the board works equally well as a $\times 3$ or $\times 5$ multiplier. Any input level between +7 and +13 dBm is fine, and inputs as low as 0 dBm may be used, at reduced output levels.

These two boards can be used independently—in fact, they were developed for two separate projects. The 540- to 580-MHz board was developed at the suggestion of Jim Davey, WA8NLC, who wanted a simple 552-MHz driver for his single-board 3456-MHz transverter.[3] The 2140- to 2360-MHz multiplier board was developed as part of a no-tune 2304-MHz transverter that was described in the *Proceedings of Microwave Update '88*.[4]

The local-oscillator system shown in Fig 1 has four functional blocks: the 5th-overtone crystal oscillator; the Schottky-diode harmonic generators; the printed band-pass filters; and the MMIC amplifiers. Each of these blocks is described in the following sections. A schematic of the crystal oscillator/$\times 6$ multiplier board is shown in Fig 2, and Fig 3 shows a schematic of the $\times 4$ multiplier board.

Crystal Oscillator

The crystal oscillator generates the signal that is subsequently multiplied into the microwave region. In this design, the 90-MHz crystal-oscillator signal is multiplied by 24 to produce the final output signal (2160 MHz). Any long-term drift or "warblies" on the 90-MHz oscillator will be 24 times worse at the output frequency. Common crystal-oscillator circuits that work well in a 144-MHz, or even 432-MHz, receiving converter may be unacceptable when the output frequency is multiplied into the microwave region.

The Butler emitter-follower circuit shown here was originally suggested to me by Al Ward, WB5LUA, and modified to the present circuit by Jim Davey, WA8NLC. (I don't waste much time arguing with those two—when they express an opinion, they generally turn out to be right.) This oscillator will free-run on the tank-circuit frequency if the crystal and its shunt inductor (L2) are replaced with a 47-Ω resistor. This characteristic is especially

useful if you want the tank circuit to operate at another frequency. After initially testing the prototype oscillator with inexpensive 2N5770 transistors, I tried replacing them with some 20-year-old pullout 2N3563s, some MPS3563s, a pair of 2N5179s that I found on the floor under the bench, and some new AT-42085 microwave transistors from Avantek. All of these devices worked in this circuit. I also discovered that the value of R1, which sets the operating points of Q1 and Q2, can be varied to change the power output. A 1-kΩ resistor was fine for all the transistors except the AT-42085s. The output power from the AT-42085s was about +6 dBm—a little too much drive for the MSA-0304 buffer (U2).

The LO shown in the photo on the title page varies slightly from the schematic in Fig 2. The photo shows a Zener-diode regulator in Q1's collector circuit. When this board is used in a setup with a battery supply, the difference in voltage when switching from receive to transmit may be enough to cause an observable frequency shift. This problem is eliminated by using a 3-terminal, 5-V regulator (U1), as shown in Fig 2.

Harmonic Generator

Harmonic generation is easy—or, at least, *not* generating harmonics is very difficult. Solid-state power amplifiers must be low-pass filtered to get rid of the harmonics generated by the nonlinear characteristics of the transistors. In fact, if you do anything to a sine wave—clip it, drive a class-C amplifier with it, half-wave rectify it—anything that distorts its perfectly sinusoidal shape, the resultant signal will contain harmonics.

Harmonic generation is difficult only if you want to do it with high efficiency. High efficiency in microwave-LO harmonic-generator stages was important in the 1960s and 70s because amplifying a low-level microwave signal to the +7 dBm level required for many diode-ring mixers was expensive. Back then, tuning up efficient multipliers that used expensive step-recovery or varactor diodes required hours in front of a spectrum analyzer tweaking a handful of $5 piston trimmers to within a half turn of oblivion. And you had to do it all again if the drive level, load or temperature changed.

Now that unconditionally stable, broadband MMIC amplifiers are available for less than a dollar, multiplier efficiency is a minor consideration. By taking advantage of readily available modern components, we can build a broadband multiplier—with no RF-tuning adjustments—that is unconditionally stable with variations in temperature, load and drive level.

The harmonic generator shown in Fig 4 is just a half-wave rectifier with a simple low-pass filter (L1) feeding in the fundamental, and a simple high-pass filter (C3) picking off the harmonics. A half-wave rectifier based on an ideal diode generates only odd harmonics. A Schottky diode (D1 of Fig 4) has an offset voltage of a few hundred millivolts, so the conduction angle is less than 180 degrees. Odd and even harmonic levels are approximately

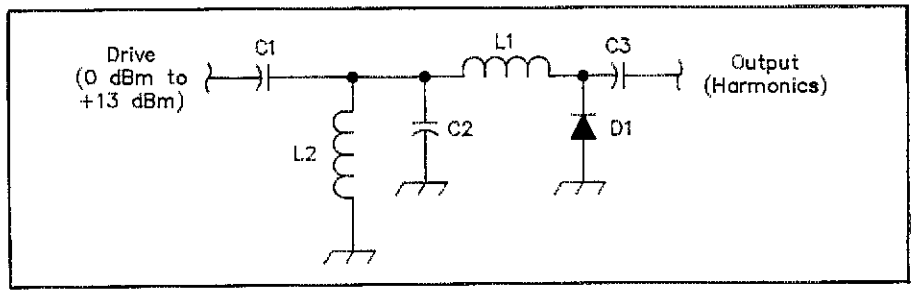


Fig 4—Schematic diagram of the basic harmonic generator used on both boards. See text for discussion.

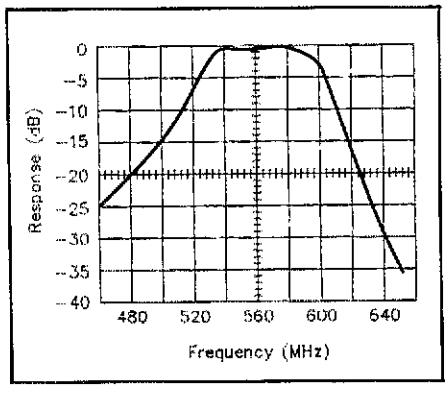


Fig 5—Frequency response of the 540- to 580-MHz hairpin filters printed on the crystal oscillator/×6 multiplier board.

equal for drive levels up to about +10 dBm. This basic harmonic generator is used on both boards. For higher drive levels, a bias circuit with a trimmer potentiometer is recommended.[5]

Other diodes will work in this circuit. Schottky diodes like the HP-2800 and HP-2811 are suitable. A silicon switching diode like the 1N4148 works fine, and even provides more output than the specified Schottky diode, but it has one major disadvantage: It may oscillate! If you don't believe this, compare the circuit of Fig 4 with that of a parametric amplifier circuit in an early VHF manual. Better yet, connect the input of a 1N4148 multiplier to a signal generator and the output to a spectrum analyzer and try it. At some combination of input frequency and drive level, the output noise floor will rise considerably, and the output spectrum will contain many discrete output signals—typically, subharmonics of the drive signal modulating the desired output. This circuit needs to operate reliably from a motorcycle battery on a mountaintop in a rainstorm, so the use of switching diodes is discouraged.

Filters

The filter selects the desired harmonic output from the harmonic generator. In the past, amateur-built frequency multipliers usually were limited to multiplication factors of 2 or 3, because of the difficulty of tuning to the correct harmonic. With fixed-tuned filters having steep skirts and flat tops, it is easy to build multipliers of much higher order. The theory behind hairpin filters (FL1 and FL2 in the 540- to 580-MHz board) and off-center-tapped half-wave filters (FL3 and FL4 in the ×4 multiplier board) is covered in the amateur and professional literature.[6-9] Only the practical aspects are mentioned here.

The primary design goals for these filters were low cost and reproducibility without tuning adjustments. To achieve the first goal, I've specified G-10 board. As a result, the filters are more lossy than equivalent designs on a more expensive substrate, such as Teflon® -fiberglass. The loss for each of the three-element sections used here is about 3 dB. Because a 10-dB-gain MMIC capable of compensating for this loss costs only about $1, and because better substrates may cost $100 a square foot, G-10 is an attractive trade-off.

To achieve reproducibility without tuning adjustments, the filters are made broadband (with lots of low-Q resonators), rather than narrowband (with only a few high-Q resonators). The resulting passband characteristic, shown in Fig 5, looks more like that of an SSB filter in an HF rig than something out of an LO chain! This filter characteristic is fundamentally different from a single-tuned circuit that must be tuned exactly on frequency—a signal anywhere in the 40-MHz-wide passband (540 to 580 MHz) passes through, but the undesired 5th and 7th harmonics 90 MHz above and below the passband are greatly attenuated by the steep filter skirts.

There are two major advantages to using flat-passband filters in a crystal-controlled LO. One is that the frequency may be moved anywhere in the passband by simply changing the crystal. The other is that allowance for manufacturing tolerances and variations in circuit-board material can be designed in *before the circuit is built*, rather than having to be tuned out afterward. For example, if the PC-board manufacturer is a little sloppy and the production boards are 1% smaller than the prototype, the passband will be 5 MHz higher. The desired signal will still get through, and the undesired signals will still be attenuated.

Even a change in circuit-board material from G-10 to its fire-retardant variant, FR-4 (which has a slightly different dielectric constant), results only in a well-behaved upward shift in the passband. The FR-4 boards provide a few decibels more output at 576 MHz, and the G-10 boards are a few decibels better at 540 MHz. The passband shape is the same for both G-10 and FR-4 materials.

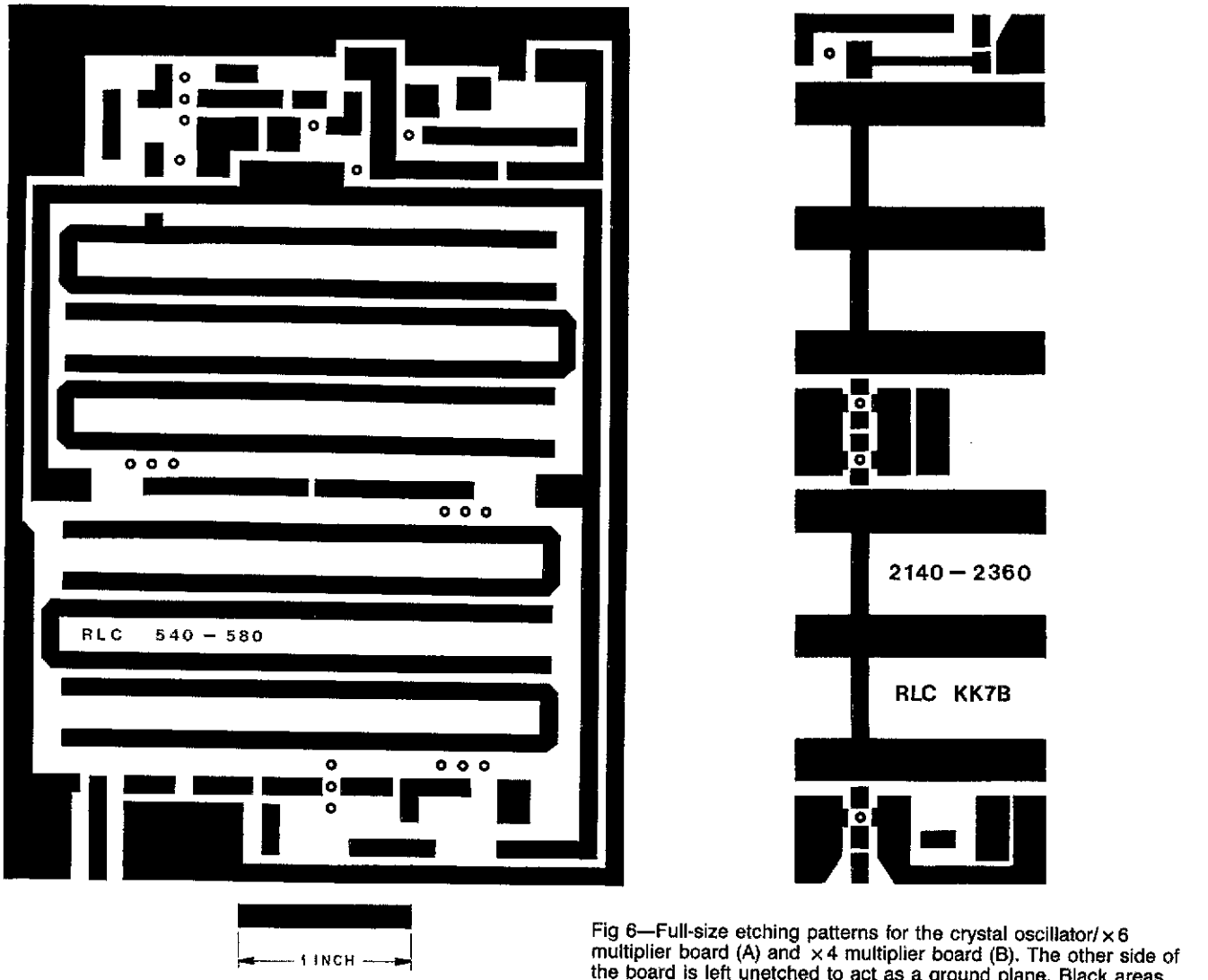


Fig 6—Full-size etching patterns for the crystal oscillator/×6 multiplier board (A) and ×4 multiplier board (B). The other side of the board is left unetched to act as a ground plane. Black areas represent unetched copper.

In an attempt to discover how tolerant the 540- to 580-MHz hairpin filters are, I reduced the length of several hairpin resonators by one millimeter. The output dropped about 2 dB, worst case, and the spurious outputs remained acceptably low. I also sprayed a complete 2160-MHz LO with a thick coat of clear Krylon®, and could not detect any change in the module's output.

These filters work better than double-tuned circuits; require no tuning; are tolerant of manufacturing, device and construction variations; allow a range of frequencies to be generated from a single board layout; and cost no more than the PC-board material required to make them.

Amplifiers

The MMIC amplifiers serve two important functions: They raise the level of the desired harmonic, and they provide broadband, 50-Ω interstage terminations. Many suitable amplifiers are available, and substitutions require only a little care concerning output level. The MMICs most popular with hams are available from Avantek and Mini-Circuits Labs. The Avantek line has part numbers starting with MSA-; the MSA-0404 is an example. Mini-Circuits parts numbers start with MAR-; the MAR-4 is an example. The devices used here were chosen because they were closest to the top of the pile of parts on my workbench.

Drive to D1 should be about +10 dBm—an MSA-0304 or '0404 works well for U2. The desired harmonic coming out of FL1 is at about −17 dBm, so a device with a 50-Ω input and more than 10 dB of gain is useful for U3. The MSA-0104, MSA-0185, MSA-0685 and MAR-6 are good choices.

The second interstage amplifier, U4, must deliver about +10 dBm and provide a 50-Ω load for FL2. MSA-0304, MSA-0285 and MAR-3 devices have all been used in this stage. The final stage, U5, may be omitted if +6 dBm is enough output. If U5 is not used, also omit R11, L6, C20 and C21. A good plan, however, is to use a high-power device that will not saturate, and then add a resistive attenuator to reduce the output to the desired level. An MSA-0404 will provide +12 dBm output, and an MSA-1104 works well for +16 dBm out.

It's not really necessary to operate any of these amplifiers linearly, but the output stage should be kept at or below its 1-dB compression point, or the spurious outputs will rise to an unacceptable level. MMIC selection is left up to the builder. Just about anything will work—and who knows what will be available next year for 49 cents? If you'd rather not think about which parts to use, just use those specified in the schematics. If you use devices different from those specified, be sure to use an appropriate bias resistor, as specified in the manufacturers' data sheets.

Construction

Full-size etching patterns for the crystal oscillator/×6 multiplier and ×4 multiplier PC boards are shown in Fig 6. Both boards are etched on 0.062-inch-thick, double-clad, G-10 PC board material. All components are surface mounted on the etched side; the other side is unetched and acts a ground plane. The components necessary to complete this project are available from several suppliers, and etched PC boards and complete parts kits are available as well.[10]

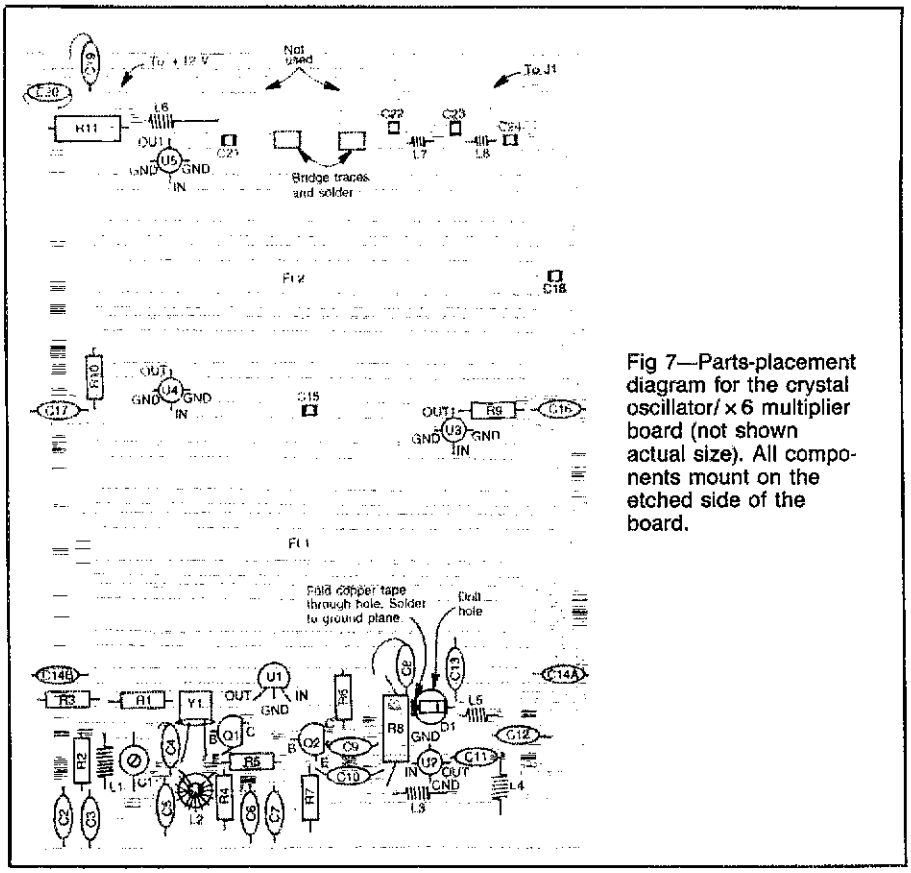


Fig 7—Parts-placement diagram for the crystal oscillator/×6 multiplier board (not shown actual size). All components mount on the etched side of the board.

The first construction step for the crystal oscillator/×6 multiplier board shown in Fig 7 is to drill the component holes and file the edges flat. The filter elements need not be grounded, so the exact size of the board is not critical. The edges of the upper and lower ground foils must be connected all the way around the board, though. A plated-through hole or shorting wire every half inch or so works fine. Copper tape wrapped the whole length of each edge and soldered top and bottom also works well. The method I recommend is to solder brass or tin walls all the way around the circuit board, making sure to solder to both the top and bottom of the circuit board. This results in a nice, rigid box with solderable shield walls suitable for mounting feedthrough capacitors and the output connector.

The next step is to add the bridges across the unused breaks on the crystal oscillator/×6 multiplier circuit board (between C21 and C22), and a piece of copper tape to short the cold end of multiplier diode D1 to the ground plane. The MMIC ground leads are bent at right angles to the device body, passed through holes drilled in the board, and soldered directly to the ground plane. The 5-V regulator's ground lead also goes through the board and is soldered to the ground plane. I usually put the chip capacitors on first, followed by the inductors, resistors, disc-ceramic capacitors, diode, transistors, 5-V regulator IC and MMICs, in that order. The crystal can be installed as shown on the parts-placement diagram by sticking it to the board with a small piece of double-sided foam tape.

I prefer to use SMA end-launch connectors, even at the output of the crystal oscillator/×6 multiplier board, because they are small and easy to use. (I also use an SMA connector at the output of the ×4 multiplier board because it's an excellent microwave connector. By standardizing on connectors, I don't have to keep switching adapters on my power meter.)

After you've carefully checked all your mounted components against the parts-placement diagram, you can apply 12 V to the board. Tune C1 until you hear the 90-MHz signal in a nearby FM broadcast radio. Then turn the power supply on and off a few times to make sure the oscillator starts reliably. The crystal oscillator/×6 multiplier board is now complete.

The filter topology on the ×4 multiplier board (Fig 8) differs from that of the ungrounded hairpins on the crystal oscillator/×6 multiplier board. The width of the ×4 multiplier board determines the resonant frequency of the shorted half-wave filter elements. The correct length for all the half-wave resonators is obtained by cutting the circuit board precisely to the width shown in the drawing, and then soldering the board's brass wall to the ground plane on the bottom, and to the end of each resonator on the top of the circuit board. Plated-through holes, ground wires and copper tape wrapped around the board edges *will not work* with this layout.

I obtain the correct board dimensions by scribing a line on the top of the circuit board at exactly the correct place. Then I cut the board slightly oversize. Next, I lay a large, flat file on my workbench and work the circuit board back and forth until the board edge is filed to the scribed line. This results in a nice square edge as shown in Fig 8. Only the width of the ×4 multiplier board is critical. Because FL3 and FL4 form a band-pass filter with a flat passband response, *construction* errors of up to about 0.032 inch do not significantly affect the output level at 2160 MHz.

After soldering the side and end walls to the ×4 multiplier board, add copper tape to ground the MMICs and multiplier diode as shown in Fig 8. Then add the chip capacitors, disc-ceramic capacitors, inductor, diode, MMICs, bias resistors and SMA connectors. No adjustments need be made to the ×4 multiplier board.

Performance

Fig 9 shows the output spectrum of the crystal oscillator/×6 multiplier on G-10 board with a 90-MHz crystal and an MSA-0404 output device. The plot is from dc to 1 GHz. The largest spur, at 450 MHz, is 70 dB below the +12-dBm, 540-MHz output. The 360-MHz and 630-MHz spurs are just barely visible at about 75 dB below the 540-MHz output. The harmonics at 1.08 GHz and 1.62 GHz (not shown) are more than 55 dB below the 540-MHz output, and are not measurable because of the limited dynamic range of this spectrum analyzer. This is a *clean* LO!

Different crystal frequencies result in different spurious-output levels. Worst-case spurious outputs are about −45 dB for any output between 540 and 580 MHz.

Once the board is built and tested, frequency stability can be enhanced considerably by thermally insulating the crystal oscillator. I usually tape a small piece of sponge packing foam over the oscillator and then package the entire system in a box to keep rain and cold mountain breezes out.

Fig 10 shows the output spectrum of the ×4 multiplier board driven with the signal shown in Fig 9. The plot covers dc to 3.7 GHz. The largest spur, at 2.70 GHz, is 45 dB below the +8-dBm, 2.16-GHz output. The lower frequency spurs, at 0.54, 1.08 and 1.62 GHz, are more than 50 dB down. The second harmonic, at 4.320 GHz (not shown), is only about 25 dB down. However, harmonic spurs are not too important on LO outputs, since the mixer generates harmonics of the LO signal anyway. If the output of the ×4 multiplier board is used to drive an antenna or another multiplier stage, then a filter (as described in reference 5) may be added.

A word about LO drive level is in order here. Many engineers, both amateur and mercenary, agonize because they have a +7-dBm mixer and only +6 dBm of LO drive. It's true that 1-mW (0 dBm) is probably not enough drive for a 5-mW (+7 dBm) mixer, and that 100 mW (+20 dBm) is too much—but there is some latitude. A few decibels either way won't make any measurable difference in most systems. If you really don't want to get on the air, having only +5 dBm drive for your +7 dBm mixer is as good an excuse as any. But the guy down the street

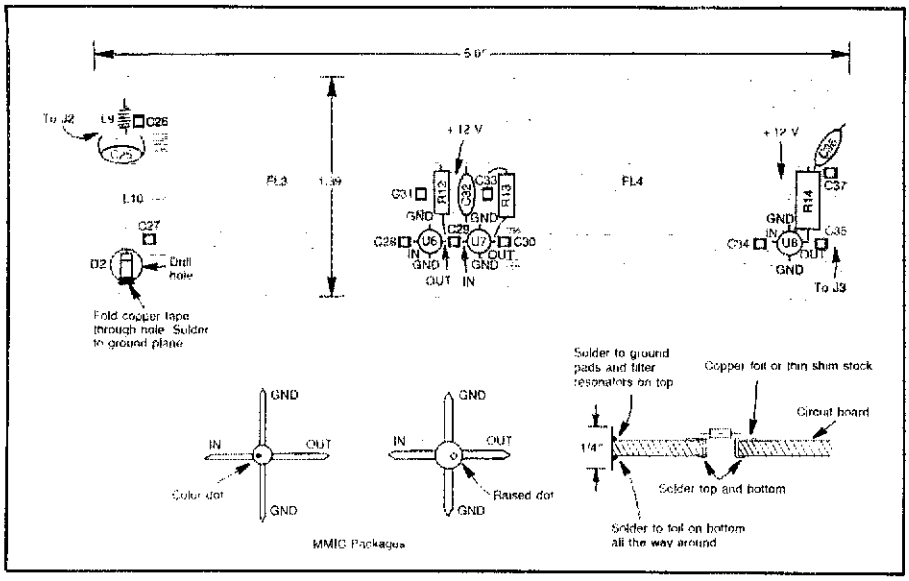


Fig 8—Parts-placement diagram for the ×4 multiplier board (not shown actual size). All components mount on the etched side of the board.

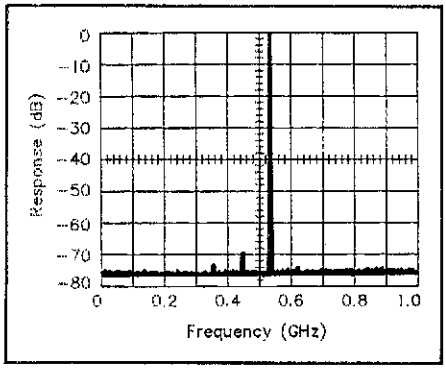


Fig 9—Output spectrum of the crystal oscillator/×6 multiplier board. The desired signal is +12 dBm at 540 MHz.

with 10 countries worked via moonbounce is probably running +3 dBm into the RF port of an unknown surplus mixer.

Applications

These two boards have been used for a surprising number of applications. I use the 2160-MHz LO described here in a pair of 2304-MHz transverters with 144-MHz IFs, and in a 3456-MHz transverter with a 1296-MHz IF. Simply change the crystal to 96 MHz, and you have a low-power CW transmitter for 2304 MHz. A 94-MHz crystal will provide a 2256-MHz LO for OSCAR Mode S. The ×4 multiplier board may be used with a suitably modified 70-cm FM exciter to generate 2304-MHz FM (460.8 × 5 = 2304 MHz).

The crystal oscillator/×6 multiplier board is even more versatile. With a 96-MHz crystal providing 576-MHz output, it serves as the LO for my single-board 1296-MHz transverter. It may be used with a ×4 multiplier for 2304-MHz CW output, a ×6 multiplier for 3456-MHz output, a ×10 multiplier for 5760-MHz output or a ×18 multiplier for 10.368-GHz output. If an untuned Schottky diode multiplier is used, it will provide useful signal levels for receiver and filter alignment on the calling frequencies of all the amateur bands from 2.3 through 10 GHz. With a 92-MHz crystal and an MSA-1104 providing +16 dBm at 552 MHz, it can serve as the LO board for the WA8NLC single-board 3456-MHz transverter described in June 1989 *QST*.

Acknowledgments

This work would not have been possible without the forum for amateur microwave technology exchange provided by Don Hilliard, WØPW, in the form of the Microwave Update Conferences. The speakers and attendees at Microwave Updates '85 through '88 provided much of the basic information and all of my motivation for pursuing this work. In particular, I thank Al Ward, WB5LUA, for the wealth of information on MMICs he has made available to the amateur community, and Jim Davey, WA8NLC, for bringing us hairpin filters and encouraging me to keep pushing the state of the art.

Notes

[1]A. Ward, "Simple Low-Noise Microwave Preamplifiers," *QST*, May 1989, pp 31-36.

[2]R. Campbell, "2.3 GHz Transverters," *Proceedings of Microwave Update '88* (Newington: ARRL, 1988), pp 9-32. This book is available from ARRL for $12 (plus $2.50 postage and handling, or $3.50 for insured parcel post or UPS) or from your local dealer.

[3]J. Davey, "A No-Tune Transverter for 3456 MHz," *QST*, Jun 1989, pp 21-26.

[4]See note 2.

[5]R. Campbell, "A Clean Microwave Local Oscillator," published in Proceedings of the 1296 and 2304 Conference, Estes Park, CO, Sep 1985. Reprinted in *Proceedings of the 21st Conference of the Central States VHF Society* (Newington: ARRL, 1987), pp 51-57. This book is available from ARRL for $10 (plus $2.50 postage and handling, or $3.50 for insured parcel post or UPS) or from your local dealer.

[6]J. Wong, "Microstrip Tapped-Line Filter Design," *IEEE Transactions on Microwave Theory and Techniques*, Vol MTT-27, No. 1, Jan 1979, pp 45-51.

[7]G. Beebe, "Analysis of a Class of Microstrip Bandpass Filters," MSEE thesis, Michigan Technological University, Feb 1988.

[8]J. Davey, "Microstrip Bandpass Filters," *Proceedings of Microwave Update '87* (Newington: ARRL, 1987), pp 42-53. This book is available from ARRL for $10 (plus $2.50 postage and handling, or $3.50 for insured parcel post or UPS) or from your local dealer.

[9]J. Davey, "Microwave Filter Update," *Proceedings of Microwave Update '88*, pp 1-8. See note 2.

[10]Most of the parts for this project are available from Microwave Components of Michigan, PO Box 1697, Taylor, MI 48180, tel 313-753-4581. Etched PC boards and parts kits are available from Down East Microwave, Box 2310, RR1, Troy, ME 04987, tel 207-948-3741.

Rick Campbell, KK7B, earned a BS in physics from Seattle Pacific University in 1975, an MSEE from the University of Washington in 1981 and a PhD from the University of Washington in 1984. He is a faculty member at Michigan Technological University in Houghton, Michigan. His research specialty is microwave propagation and scattering in random media, and he teaches electromagnetics and wave propagation courses. Rick was first licensed as WN8VAZ in 1966 and has been active on VHF and microwaves since 1971. His primary interest in Amateur Radio is VHF contesting on the bands above 420 MHz. He has operated portable stations in June VHF contests from New Jersey, western Washington and central Ohio. He is active on SSB and CW on the bands from 144 MHz through 3456 MHz from grid square EN57 in Michigan's Upper Peninsula.

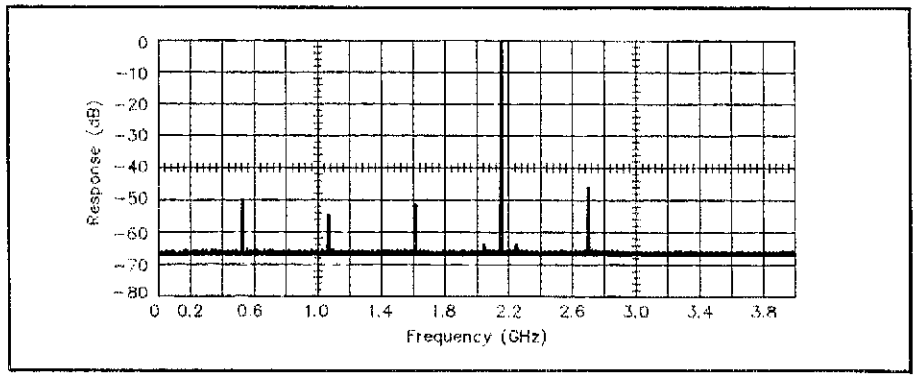
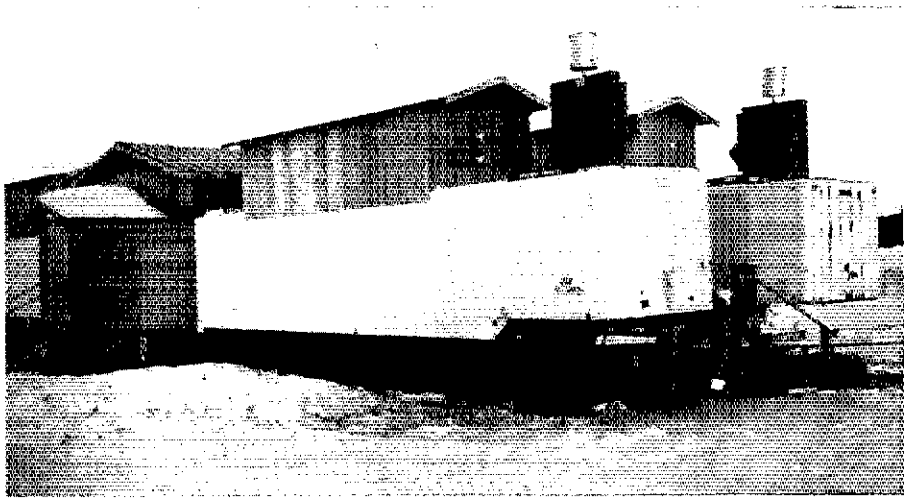


Fig 10—Output spectrum of the ×4 multiplier board. The desired signal is +8 dBm at 2160 MHz.

Stimulating the Ionosphere in Alaska

Located just outside of the arctic circle, UCLA's ionospheric research observatory doesn't just observe—it *modifies* the ionosphere by transmitting a 60-megawatt signal straight up!

By L. Van Prooyen, K8KWD
8330 Myers Lk NE
Rockford, MI 49341



Front view of UCLA's High Power Auroral Stimulation (HIPAS) Observatory transmitter building. Each trailer contains two of the Observatory's eight 125-kW transmitters, which, transmitting via an 18-dBi-gain antenna array, produce a 60-MW (EIRP) circularly polarized signal capable of making measurable changes in the ionosphere. The heat exchangers (radiators) on the trailer roofs are part of the vapor-phase system used to cool the transmitters' final-amplifier tubes *(all photos by K8KWD).*

When, in 1987, I was invited to design a computerized antenna phasing and monitoring system for UCLA's newly operational High Power Auroral Stimulation (HIPAS) Observatory, I *had* to go—even if I didn't have the time—because Alaska is one of those places to which I've always wanted to go. Located just outside the arctic circle near Fairbanks, Alaska, the HIPAS facility is a place worth seeing should you be in the neighborhood. With high-power transmitters, shortwave receivers, antennas, all kinds of computers and electronic gadgets, HIPAS resembles the biggest Field Day installation I've ever seen—complete with two 1500-horsepower electrical generators that burn 100 gallons of fuel per hour!

The HIPAS Observatory, an extension of the University of California at Los Angeles (UCLA) Plasma Physics Lab, was established to study nonlinear effects caused by irradiation (heating) of the auroral plasma (ionosphere) by radio emissions. The Observatory seeks to gain a better understanding of the nature of the ionosphere through field experiments and—at UCLA—lab simulations and theoretical studies of the auroral ionosphere.

Transmitting with an effective isotropic radiated power (EIRP) of over 60 megawatts (MW), the HIPAS facility has operated on 3349, 4530, 4905 and, most recently, 2850 kHz. The HIPAS transmitting system serves as an ionospheric probe that is capable of modifying the ionosphere to a limited extent. By analyzing radio signals—the ionospheric echoes of its own probe, satellite-beacon signals passing through the probed ionospheric region, or signals generated by the ionosphere itself in response to heating by the probe—the HIPAS Observatory serves as a valuable tool for the study of ionospheric physics by scientists and students.

HIPAS is located at Fairbanks because of the proximity of the site to the arctic circle—where auroral effects regularly occur and where the earth's magnetic lines of force are nearly perpendicular to the

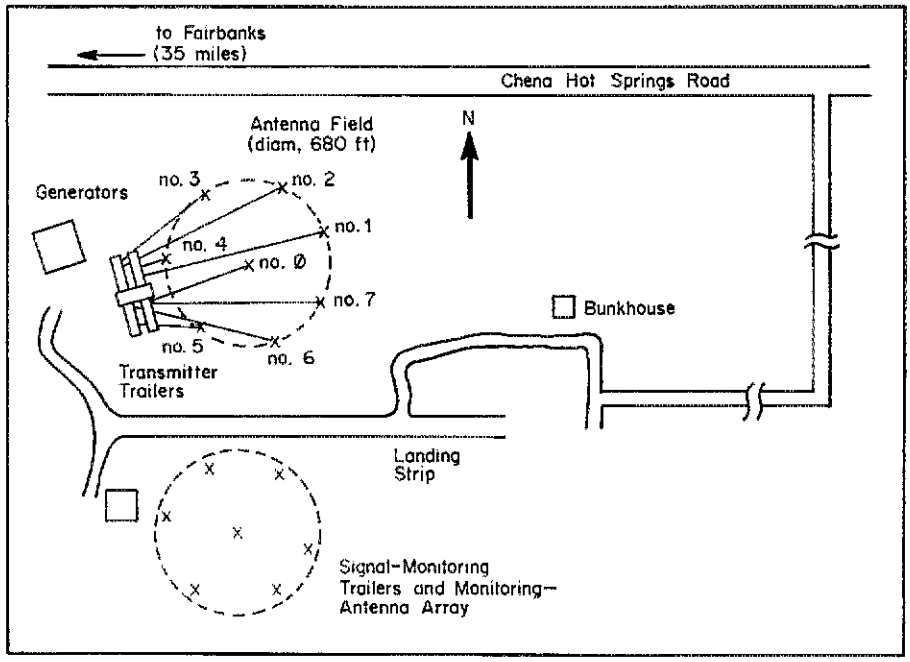
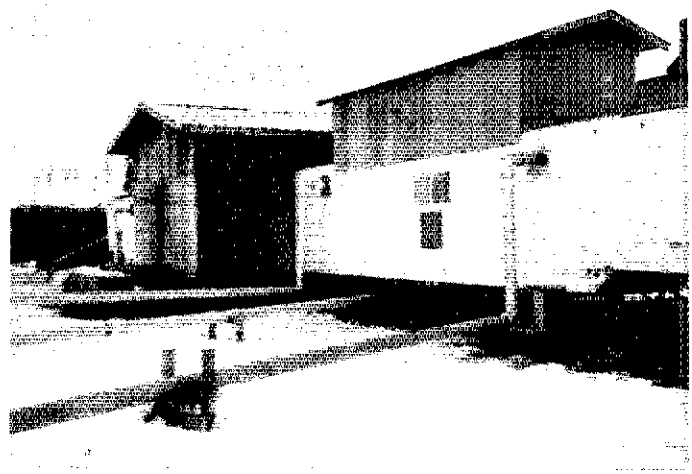


Fig 1—"Ionosphere's-eye" view of the HIPAS Observatory site near Fairbanks, Alaska. The powerful signal produced by the transmitting array (upper circle), in conjunction with special receivers fed by the site's receiving-antenna array (lower circle), allows 3-D ionospheric mapping by means of RF holography.

earth's surface. (The HIPAS site was used by the University of Alaska [U of A] for propagation studies dating back to World War II; remnants of antenna arrays, parabolic dishes and related equipment can be found all about the area.) The HIPAS facility, which started as a joint venture with the U of A's Geophysical Institute, was built using mostly surplus and custom equipment by UCLA faculty and students under the guidance of Observatory Director Dr. Alfred Wong. The facility is now maintained and operated by UCLA's Plasma Physics Lab.



Rear view of the HIPAS transmitter building. Each of those 8-inch-diameter coaxial transmission lines carries 125 kW during transmitter operation.

A 2-Meter Hand-Held—or a Shotgun?

I arrived at HIPAS in October 1987—a little late in the season for Alaskan travel, but the weather that fall was unusually mild by Alaskan standards. I settled in at the bunkhouse, a dormitory-like structure that provides the site's living accommodations and "all the comforts of home." (See Fig 1 for a plan view of the Observatory site.) Rare periods of free time at the bunkhouse are consumed by video games and tournaments on the two computers installed there. Spectacular auroral displays occurred on my first night at the Observatory, so I went outside with camera in hand and photographed the Alaskan aurora. (One of the Observatory's activities is studying the aurora's spectral lines when the probe is transmitting; that night, Observatory hands were busy setting up and calibrating a spectral telescope.)

The following afternoon, with the sun shining and Fahrenheit temperatures in the high 30s, I decided to take a short hike to explore the countryside. Alaska is beautiful, and with such fine weather, I wanted to get in as much sightseeing as possible. Armed with my hand-held 2-meter transceiver—with which I could hit a couple of Fairbanks repeaters quite well from the HIPAS site—I set out. After wandering for an hour or so, I came upon a river and started walking downstream toward a dense thicket. As I approached, I heard the thrashing of what sounded like a large animal. At first, I was excited: Maybe it was a moose! But when the noisemaker didn't materialize—and after realizing that I wasn't prepared for unpleasant surprises—it occurred to me that the noise could have been made by a grizzly bear! I decided it was time to head back. On returning to the HIPAS site, I related my experiences to one of the Alaskan staff members who, spotting my radio, said, "You don't take a radio with you on a hike around here, you take a *shotgun*!" From that point on, I limited my sightseeing expeditions to automobile trips.

The Penn State Campaign

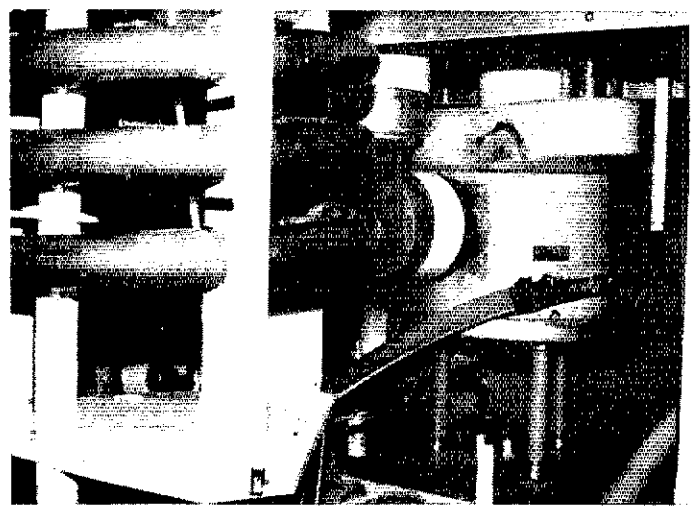
Deciding to limit my sightseeing wasn't that much of a burden, though. From a ham's point of view, the real action was back at the site, especially because the weather was changing to the snow and cold that typify Alaskan Octobers.

I had arrived at the start of a major campaign by a group from Penn State's electrical engineering department. (In Observatory jargon, a *campaign* is an intensive transmitter-operating schedule combined with monitoring at the site and at various remote posts.) The Penn State campaign, which sought to observe ELF (extremely low frequency) reradiation by the ionosphere, consisted of a six-day schedule of four hours of transmitter operation per day, with each day's operation starting four hours later than that of the previous day. For this campaign, the HIPAS transmitters were tuned to 2850 kHz and modulated at frequencies between 100 and 1500 Hz. The Penn State team used a computer to control probe modulation and—via telephone and modem—the receivers at Penn State's monitoring site at the U of A campus in downtown Fairbanks.[1]

From a radio standpoint, preparation for a campaign is as interesting the campaign itself. For instance, the Penn State campaign required that the HIPAS probe be retuned from 3349 to 2850 kHz. This meant resetting taps on, and retuning, eight transmitters' output networks; lengthening, retuning and phasing the probe antennas; adjusting matching networks; and a *lot* of debugging. In a system that combines the output of eight 125-kW transmitters in phase, there is no margin for error: Small discrepancies in tuning and phasing can produce big sparks!

Strange things can happen to hardware exposed to the climate of northern Alaska, which may subject outdoor equipment to temperatures near −40 °F for days on end. For example, bolts holding transmission-line flanges together may suddenly snap off. Such effects must be carefully guarded against by inspection and maintenance because system reliability is paramount if the data gathered during a campaign is to be meaningful. (Surprisingly, electronic equipment is not much bothered by Alaskan cold; the low humidity that accompanies the cold is probably the

[1]Notes appear on p 26.



Part of the output network (the coil at left) and the 4CV100,000C final-amplifier tube (right) of the HIPAS Observatory's transmitter no. 5.

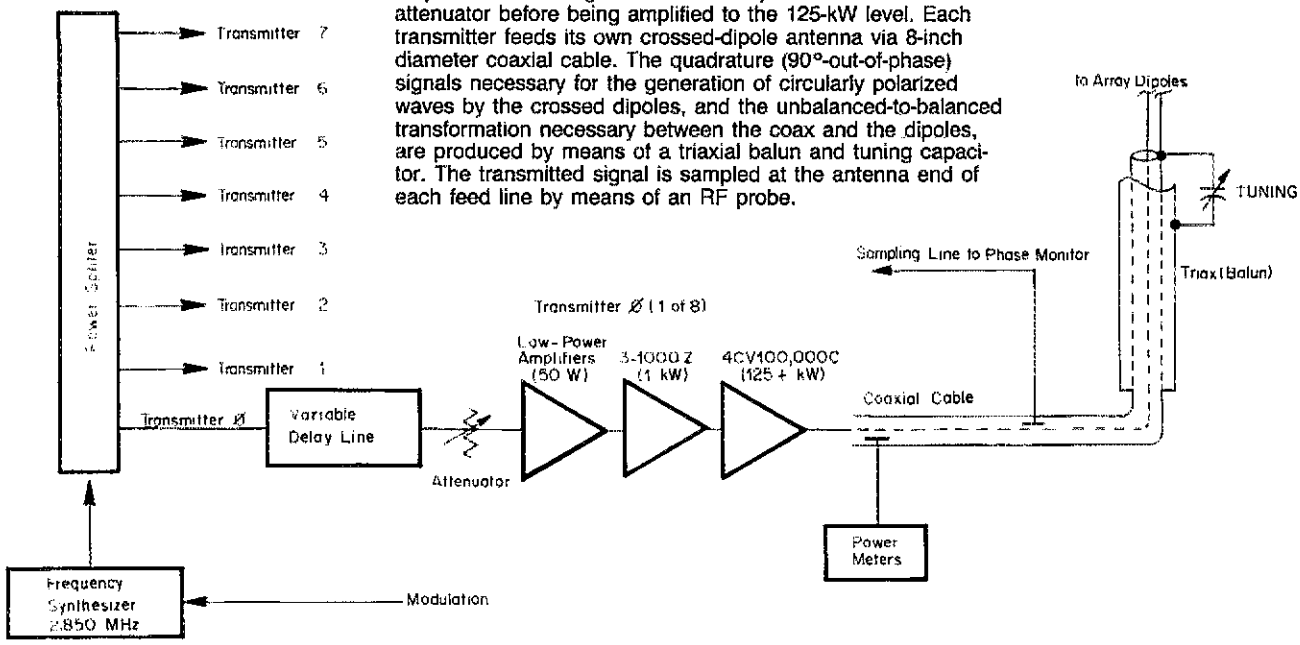


Fig 2—The HIPAS Observatory's 60-MW main-probe signal is generated by a pulse-modulated frequency synthesizer, which feeds an eight-way power splitter. Each of the splitters' eight outputs is fed through a variable delay line and a variable attenuator before being amplified to the 125-kW level. Each transmitter feeds its own crossed-dipole antenna via 8-inch diameter coaxial cable. The quadrature (90°-out-of-phase) signals necessary for the generation of circularly polarized waves by the crossed dipoles, and the unbalanced-to-balanced transformation necessary between the coax and the dipoles, are produced by means of a triaxial balun and tuning capacitor. The transmitted signal is sampled at the antenna end of each feed line by means of an RF probe.

reason for this.) Equipment reliability was not a problem during the Penn State campaign.

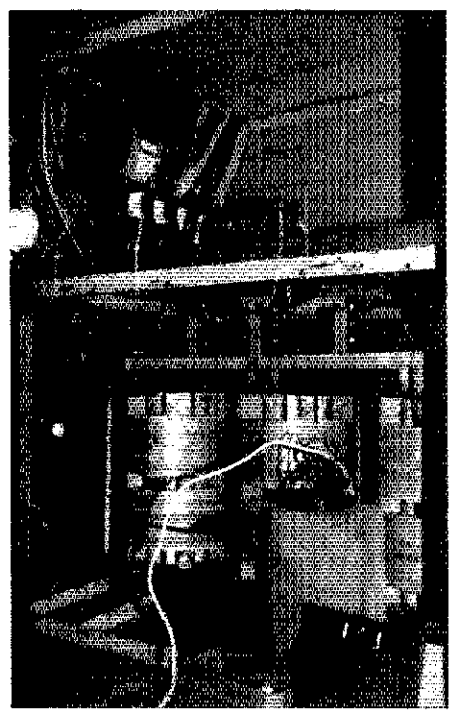
The Ionospheric Probe

The HIPAS ionospheric probe consists of eight 125-kW transmitters (Fig 2), each of which is connected to one crossed-dipole antenna in the probe array. The transmitters were originally built by the US Department of Commerce for use in HF propagation studies at a site in Colorado.[2] They were obtained surplus by UCLA and extensively modified for use at HIPAS.

The transmitters are driven by a pulse-modulated frequency synthesizer, the output of which is split into eight drive signals. Each drive signal passes through a variable attenuator and a variable delay line. Four stages of amplification follow, the last two of which are the driver and final amplifier. The driver is a grounded-grid 3-1000Z. The final amplifier consists of a 4CV100,000C—a vapor-phase-cooled tetrode.[3] The 4CV100,000C operates in class C and is coupled to 50-Ω coaxial feed line via a pi matching network.

The feed line between each 125-kW transmitter and its crossed-dipole pair consists of 8-inch-diameter outer conductor (irrigation pipe) and an inner conductor made of 3-inch-diameter pipe. The inner and outer conductors are kept concentric by means of Teflon® spacers. During transmitter operation, the line is pressurized with dry air at a pressure of 1 to 2 lbs/in^2.

The antenna end of each feed line contains an RF sampling probe; the energy provided by the eight RF samplers is routed to the probe control room via eight RG-8 runs of equal length. The signal samples are used by Observatory researchers as referents in adjusting the phase and amplitude of each antenna's energy to their proper values.



Interior view of one of the HIPAS transmitters' power supplies. This supply delivers 15 kV dc at 12 A.

The transmitters are housed in an *H*-shaped structure, with two transmitters in each leg of the *H*. (Each of the *H* legs is actually a semitrailer; this allowed the transmitters to be assembled in Los Angeles and transported to the site intact.) The cross-member of the *H*, which houses the probe control room, was built on site. The antenna feed and RF-sampling lines radiate from the transmitters to the antenna array.

The probe antenna array consists of seven crossed-dipole antennas arranged in a circular pattern 680 feet in diameter; the eighth crossed-dipole pair is positioned at the center of the circle. The array's on-axis gain is 18 dBi. The array can be electrically steered—up to 30° from vertical and 360° in azimuth—and produces a circularly polarized signal. Either of two circular-polarization modes is possible with the HIPAS-probe array. Operating in the *X* mode, the array produces a left circularly polarized signal, the electric field of which rotates in the same direction as ionospheric electrons. Operated in the *O* mode, the array produces a right circularly polarized signal.

Each of the array's dipoles is center-fed and 93 feet long (Fig 3). One dipole in each crossed-dipole pair (the north-south dipole) is aligned with the horizontal component of the earth's magnetic field. Because the array was originally designed to operate at 4905 kHz, end-loading straps had to be added to the dipoles for operation at 2850 kHz. Each dipole pair is supported approximately 45 feet above the ground by five towers; the entire array is underlaid

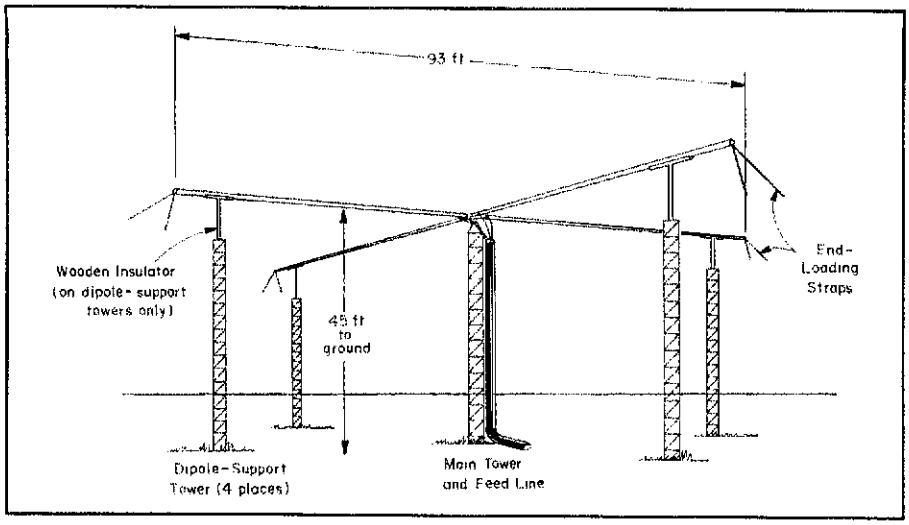


Fig 3—One of eight crossed-dipole antennas used in the main-probe transmitting array. Fed 90° out of phase, the dipoles generate a circularly polarized signal. The loading straps lower the antennas' resonant frequency from 4905 to 2850 kHz (see text).

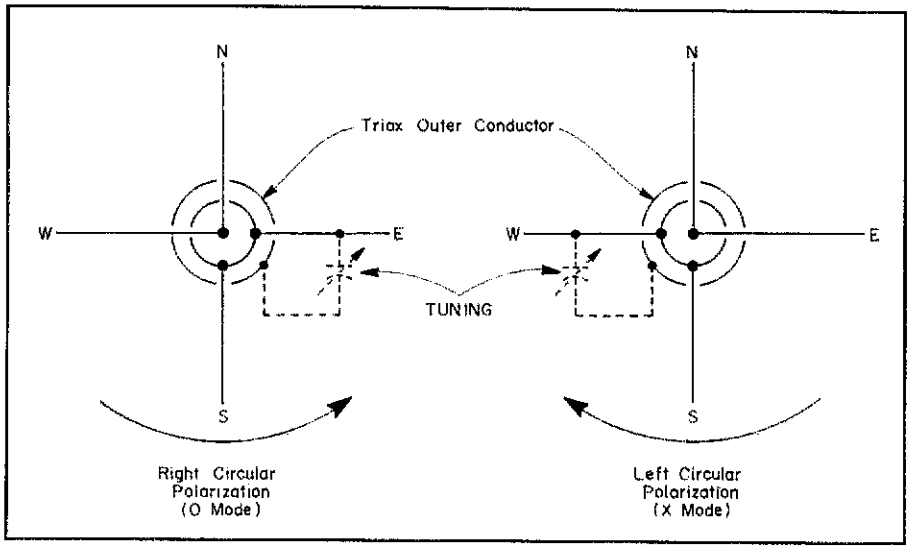


Fig 4—The HIPAS probe array's crossed-dipole antennas can be connected for two circular-polarization modes as shown here. The rotation directions indicated by the arrows are correct for a viewer standing on the ground and looking through the antenna into the sky.

with a chicken-wire ground plane to enhance vertical radiation.

A triaxial balun connects each dipole pair to its feed line as shown in Figs 2 and 4; Fig 4 also shows how the dipole-balun connections differ for the array's two circular-polarization modes. At each antenna, the east-west dipole is adjusted to exhibit an impedance of 50 $-j50\ \Omega$; the north-south dipole, 50 $+j50\ \Omega$. Connected in parallel, the dipoles present a resistive 50-Ω load to the feed line—and the 90° phase difference between the dipole currents results in circular polarization.

Signal Monitoring and Diagnostics

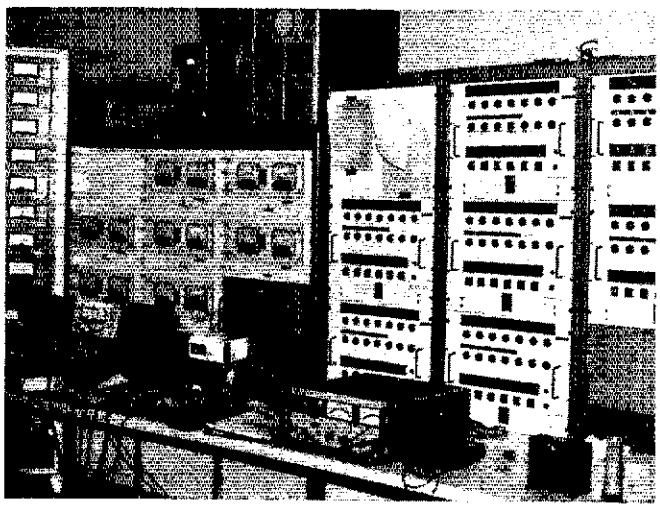
Satellite Interferometry

The HIPAS Observatory uses a satellite interferometer (SATIN) as one means of measuring ionospheric changes. SATIN uses signals from satellites—usually HILAT or POLARBEAR—that pass over the observatory site. These satellites contain beacons that transmit phase-coherent signals at 137.676 and 413.028 MHz—a 1:3 frequency ratio. Because signals passing through the ionosphere are subject to phase shift that varies with frequency and ionospheric density in a predictable way, determination of the relative phase difference between the received 137- and 413-MHz beacon signals allows reliable measurement of the density of the ionosphere.

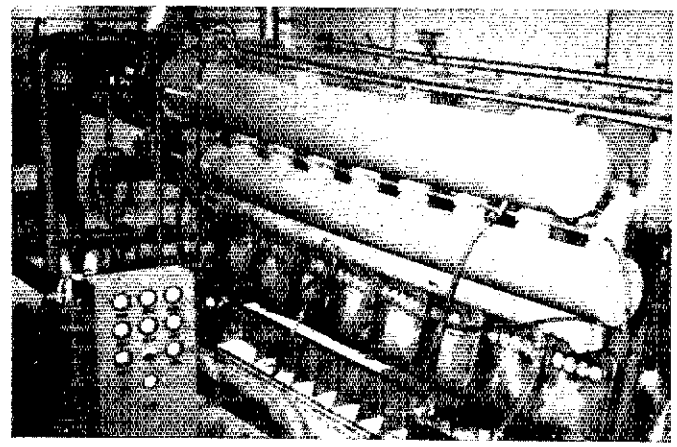
The SATIN receiving system uses two low-noise (GaAsFET) preamps (one for 137 MHz; the other, for 413 MHz), a spectrum analyzer and frequency synthesizer (as a phase reference). The 137-MHz antenna consists of a five-element turnstile array; the 413-MHz antenna is a helix based on an *ARRL Handbook* design.

Ionospheric Mapping

The energy emitted by the Observatory's 60-MW MF/HF probe does more than heat the ionosphere; it provides raw material for



View of the HIPAS Observatory's main control room.



Side view of "Jumbo," one of the 1500-horsepower diesel generators that power the Observatory's eight 125-kW transmitters. Jumbo generates three-phase, 4.8-kV ac, is almost two stories tall and burns 50 gallons of fuel per hour.

the ionosphere; it provides raw material for ionospheric mapping. The probe's ionospheric echoes are detected by eight phase-coherent receivers designed and built by UCLA. Each receiver is fed by one of eight inverted-V antennas arranged in a pattern similar to that used for the transmitting-antenna array. Used in conjunction with a PC-based data-acquisition system, this receiving setup allows Observatory researchers to map the ionosphere by means of *RF holography*. Propagation variations due to ionospheric-density changes show up as phase changes in the signals detected by the eight receivers. This phase data is fed to a computer that, taking into account the effects of the geometry of the receiving-antenna array, produces a three-dimensional picture of the ionosphere's profile. When used during operation of HIPAS's main probe, this system provides a continuous map of the ionospheric changes caused by the probe.

Ionosondes and Radar

Other monitoring and diagnostic equipment at the HIPAS Observatory includes two digital ionosondes that cover 1.6 to 6 MHz, and a radar that operates in the vicinity of 50 MHz. (The Observatory also had a 420-MHz radar until that system's 50-foot dish was wiped out by an ice storm.) The 6-meter radar is capable of 60 kW peak output and uses an antenna array consisting of four five-element Yagis. This system was not fully operational during my stay at the Observatory, but was expected to go on line soon. The Observatory staff planned to evaluate the radar's performance with the help of moonbounce: The closely quantifiable loss of the EME path serves as a useful piece of radar "test equipment."

Acknowledgments

I thank Dr. Wong and his staff at UCLA for the accommodations they provided in making this trip possible. I also acknowledge the contributions of Dr. Ralph Wuerker and Dr. Mike McCarrick of the HIPAS staff, whose help in answering my many questions made this article possible.

For those who want more information about UCLA's HIPAS Observatory, and the activities of the UCLA Plasma Physics Lab, I've included a short bibliography of articles and papers that describe the Observatory's technical features and activities in greater detail.

Summary

This article attempts to present a general description of the HIPAS Observatory's technical features and experimental activities from a ham's perspective. Many years ago, I read a report in *QST* about Cornell's Arecibo Ionospheric Observatory[4]—a report which, I believe, provided me with the inspiration to do some of the more unusual things I've done in life. I hope that this article will serve as similar inspiration for others.

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A. Ferraro, H. Lee, T. Collins, M. Baker, D. Werner, F. Zain and P. Li, "Measurements of Extremely Low Frequency Signals from Modulation of the Polar Electrojet Above Fairbanks, Alaska," *IEEE Trans on Antennas and Propagation*, Jun 1989, pp 802-805.

Notes

[1]Penn State's monitoring site listened for ionospheric reradiation of the HIPAS-transmitter modulation at *audio* frequencies—audio energy in electromagnetic, not acoustic, form.—*Ed.*

[2]V. Frank, R. Fenwick and O. Villard, "Communicating at VHF via Artificial Radio Aurora," *QST*, Nov 1974, pp 27-31, 34.

[3]Vapor-phase cooling of a tube involves the conversion of water into vapor (steam) by anode heat. The steam produced passes through a *heat exchanger*, which cools the steam and returns the water to its liquid form for recirculation to the tube.

[4]D. DeMaw, "The Story of El Radar," *QST*, Sep 1965, pp 24-27.

New Books

40 YEARS OF HF MOBILEERING

By Don Johnson, W6AAQ. Published by the author (Esparto, CA 95627, tel 916-787-3905). First edition, 1988. Soft-cover, 8 × 10-5/8 inches, 115 pages including index, $10 (delivered in the US).

Reviewed by Doug DeMaw, W1FB

This book is an earthy and fascinating volume about mobile antennas, gadgets and operation. It is a compendium, or scrapbook, of pertinent articles from *QST* and other amateur journals, plus reproductions of magazine ads and tidbits from the author's personal notes. The best way I can describe this publication is to call it a crazy quilt of HF mobile data! I get the impression that a considerable amount of the text has been freshly generated by the author for inclusion in this book. He used a two-column format with right-hand justification for the printed matter. Large, easy-to-read computer type stands out well on the book's heavy, white paper. Those with tired eyes should have no trouble reading this book.

Johnson covers such subjects as loading coils, tuning and pruning, and instrumentation for mobile-antenna adjustment. He also discusses, in great detail, automatic tuning of mobile antennas. A reprint of W6AAQ's original article, "Mobile Antenna Matching—Automatically," from October 1983 *QST*, is included, along with a long, freshly prepared update.

A particularly interesting chapter for me is the one that treats the troubles of mobile operation. This section has broad coverage of the common problems associated with HF-equipment installation, antenna efficiency and the maladies we often encounter with mobile setups.

A nice hints and kinks section is included in the book, along with a section on mobile power supplies. The list of topics goes on and on. This book should appeal to new hams, nostalgia buffs and those who are dedicated to HF-mobile operation. All hams will find Johnson's material interesting to read—even those with little or no motivation to try HF-mobile operation.

QEX: THE ARRL EXPERIMENTER'S EXCHANGE AND AMSAT SATELLITE JOURNAL

The July issue of *QEX* includes:

• "Impedance Bridge" by David L. Hanning, KD4FY. Bridge the gap between traditional mechanical RF impedance bridge circuits and varactor tuning diodes, in a new easy-to-build direct-reading RF impedance bridge.

• "Practical Spread-Spectrum: Clock Recovery with the Synchronous Oscillator" by André Kesteloot, N4ICK. The Synchronous Oscillator (SO), an interesting, simple circuit which can be used for lock recovery. This article describes its principle, practicality, ease of use and performance.

• "Nonlinear Applications using the Avantek MMICs", by Al Ward, WB5LUA, and Marcus Wagner, N5GEJ. Covered are special applications of the Avantek MSF-86 and MSF-88 series of MMIC mixers.

• "Correspondence," some thoughts on practical standards for HF packet.

• "Components" by Mark Forbes, KC9C. Reader survey continues: More places to by components in small quantity.

QEX is edited by Paul Rinaldo, W4RI, and is published monthly. The special subscription rate for ARRL/AMSAT member is $10 for 12 issues; for nonmembers, $20. There are additional postage surcharges for mailing outside the US; write to HQ for details.

Interference Standards Revisited

Here's a brief look at the history of, and recent progress in, RFI standards-making.

By Howard L. Lester, W2ODC
PO Box 6
Alplaus, NY 12008

Neither life nor interference get any easier as time goes by. Early hams raised Navy tempers with their strong spark signals in the midst of Navy radio traffic. Post-World War I regulators attempted to solve this problem by banishing Amateur Radio operations to the "useless" wavelengths below 200 meters (frequencies above 1500 kHz).

Then came broadcast radio, and with it came broadcast interference (BCI). Ham life became still more difficult. Reducing interference usually involved putting *wave traps* (filters) at the affected receiver. Broadcast radios with external antennas helped make the job possible; so did the sharply tuned input circuits on broadcast radios of late 1920s and early 1930s. No FCC amateur exam was complete without a question on how to use series- and parallel-tuned wave traps for eliminating BCI.

A new problem, born of 1930s depression ingenuity, came with the flood of ac/dc radios. Selling for less than $10, these radios appeared in almost every kitchen. For many families, these radios brought *Amos and Andy* and the *A&P Gypsies* home for the first time. For hams, these entertainment fixtures brought grief in the form of nearly insoluble BCI. Because these radios had transformerless power supplies, harmonic-ridden local oscillators and poor front-end RF selectivity, all manner of BCI occurred. The old antenna-wave-trap solution didn't work on radios with internal antennas! Much of the interference came through the power lines. Quiet hours were imposed on some unlucky hams; others carefully avoided frequencies that caused radios to generate spurious responses on the frequencies of popular AM broadcast stations.

Another gremlin surfaced in the late 1930s: interference to audio amplifiers by unwanted RF detection. My introduction to this came as I sat in the church choir one Sunday morning. Booming over the speakers of the newfangled electronic organ came the familiar Irish brogue of Kelly the cop. Kelly was talking over his new police car radio, a 31-MHz AM job.

Hams, and consequently ham-generated BCI, were silenced by World War II. With the close of hostilities, FM radio obscured BCI. The new, battery-powered transistor radios of the 1950s helped, too. Radios using tuned, high-Q ferrite loopstick antennas reduced front-end overload problems, and there were fewer problems from the ac power lines.

At the same time, a real monster appeared: television interference (TVI). Television had two general characteristics that made solving TVI problems difficult; several of these TV characteristics still plague us today. For starters, most early TV reception was weak-signal work; almost *everyone* was in a fringe area. Another snag: the 6-MHz width of TV channels allows many combinations of MF/HF ham-band harmonics to fall on TV frequencies. Some TV receivers used intermediate frequencies (IFs) within a ham band (TV sound IFs were near 21.25 MHz in the late '40s and early '50s); some modern TV IFs are close to ham bands (45 MHz—quite close to our 6-meter band). Color TV brought another problem: The color-TV subcarrier (3579.545 kHz) falls in the 80-meter ham band.

The second major stumbling block in solving TVI problems was poor TVI immunity: Very low undesired-signal levels produced annoying interference on TV pictures. Intensive work by a large industry task force[1] in the early 1950s showed that undesired on-channel signals had to be less than one ten-thousandth (−40 dB) of the desired TV signal to allow interference-free reception. More recent industry/FCC tests conducted as part of a UHF TV/land-mobile sharing study indicates that, for interference-free reception at modern levels of picture quality, required rejection of undesired signals must be closer to 50 dB.[2]

In the late 1940s and early 1950s, many city-dwelling hams were forced to either go off the air or severely restrict their operations. Even today, high-power 6-meter operation in areas with nearby channel 2 (54 to 60 MHz) TV stations is a daring proposition.

Pioneering work done at ARRL Headquarters and the *QST* articles by Phil Rand, W1DBM, pointed the way to curing the TVI in the late 1940s and early 1950s. Ham rigs needed to be shielded and their signals filtered to bottle up harmonics. Thousands of open-rack home-built rigs, along with my own, were relegated to the junk pile or left to stand unused in a corner of the basement because of the difficulty involved in cleaning them up.

Just as they had to do then, today's TV receivers (and other consumer-electronics devices) must coexist with RF signals outside the parts of the spectrum that they use: they must be compatible. This issue of electromagnetic compatibility (EMC) is one that designers of electronic equipment must consider.

CB Radio

Dealing with a few hundred thousand technically qualified hams is one thing, but handling the problems associated with the unleashing of 10 million CB transmitters into the hands of Joe and Jane Public is another. When the CB boom first got underway, illegal, harmonic-ridden CB amplifiers were only part of the problem. Many TV receivers generated harmonics internally when 27-MHz signals from legal CB rigs were picked up on TV-antenna leads.

Reactions to the initial CB interference problems were immediate and strong. Under the sponsorship of the FCC, a Personal User Radio Advisory Committee[3] was formed to find methods of dealing with spectrum jamming, illegal operation and interference. ARRL was represented on this committee. The FCC subsequently adopted very strict technical standards for CB transceivers; these standards had the unfortunate side effect of putting many CB-radio manufacturers out of business.

The Electronic Industries Association (EIA)

The standard-developing body for the electronics industry was known, in the 1930s, as the Radio Manufacturers Association (RMA). Later, it was the Radio and Television Manufacturers Association (RTMA). The standard-setting body these days is the Electronic Industries Association (EIA). Most hams will immediately recognize some of the standards work of RMA, RTMA and EIA, such as the standard values of resistance and capacitance in 5% steps (10, 11, 12, 13, 15 and so on) and 10% steps (10, 12, 15, 18, 22, 27, and so on). Perhaps their best-known standards are those for data transmission, known formerly as RS-232-C, and, in the most recent form, as EIA-232-D.

With CB radios everywhere, the EIA Television Receiver Engineering Committee

[1]Notes appear on p 30.

(known as R-4) wrestled, in the late 1970s, with the creation of a new standard for overload immunity of TV receivers against legal 27-MHz CB signals. Engineers from all the big-name manufacturers were involved: RCA, Zenith, Sylvania, Sony, Panasonic, GE, Magnavox, North American Philips and others participated.

Data was taken for then-current production-model TV receivers. This information was then presented to the manufacturers in the blind, although each company was told which data applied to their own receivers. The haunting question: Was it possible to make a TV receiver that had the required immunity, and that consumers could afford? The engineers determined that, by stretching the available technology, TV receivers *could* be made to provide interference-free reception in the presence of CB signals as strong as 0.25 V at 300-Ω TV-antenna terminals.[4] The resulting standard was adopted by the leading TV manufacturers. This standard was published by the American National Standards Institute (ANSI) and EIA in 1988 as ANSI/EIA-544-1988.[5]

The Goldwater Bill

During this study period the FCC maintained that it had no jurisdiction over RF immunity of receivers or any consumer electronic devices that did not emit RF. (Part 15 of the FCC regulations does, however, set maximum levels for incidental local-oscillator radiation in receivers.) Consumers tend to think that their TV and radio receivers are totally approved by FCC when they see the Part 15 notice on the back of the set. (There are so many different labels on equipment these days that designers need to use ingenuity to avoid confusion of set-adjustment labels and regulatory labels!)

Barry Goldwater, K7UGA, then a US Senator, sponsored a bill in the US Senate to mandate that, among other things, the FCC set standards for RF interference immunity for consumer TV receivers and other electronics. Popularly known in the Senate as the Goldwater Bill, and cosponsored by Congressman Timothy Wirth, it became Public Law 97-259 in 1982.[6]

The FCC, particularly the engineering staff, was then faced with the sobering task of setting minimum levels for RF immunity, determining methods of measurement, and enforcing new rules and regulations. The FCC called on The Institute of Electrical and Electronic Engineers (IEEE) to set up an oversight committee, and for American industry to voluntarily set—and comply with—immunity standards.

The IEEE oversight committee, known as the C63 Ad Hoc Committee, is chaired by Don Heirman of AT&T Bell Laboratories. Committee members include internationally known engineers from academia and industry, consultants, the EIA Vice President of Consumer Electronics, and ARRL and FCC representatives. For industry, the EIA Engineering Committee on Electromagnetic Compatibility for Consumer Electronics, known as R-2, was charged with setting RF-immunity standards and demonstrating their adoption and effectiveness.

These committees took the needs of hams into consideration in their work. In fact, several of the people involved, other than ARRL representatives, have been hams. Vice President Eb Tingley, of the EIA Consumer Electronics Group, is K4FKX. The Chairman of EIA Committee R-2 was Gil Hermerling, W9UYE, of RCA Television Receiver EMC Engineering.

For some time, I had been grumbling and urging prompt action by the Committee, and the EIA got me involved. The R-2 Committee, over the course of five years, completed the bulk of its work on TVI and has been folded back into the R-4 TV Receiver Engineering Committee. The last report to the oversight ("watchdog") C63 Ad Hoc Committee reported on the two new standards for RF immunity.

A survey taken during the summer of 1987 showed that 90% of European, Japanese and North American (but not Korean or Taiwanese) TV manufacturers already met or exceeded these immunity standards. Most hams find that their neighbors' and their own recent-vintage TV sets are TVI-free. Many hams can work DX or check into their favorite nets while keeping an eye on a ball game on TV, right in the shack. Most hams even find outboard high-pass filters unnecessary on those nearby late-model TV receivers. But the fight will never be completely over.

What are these new standards? How were they developed? What do (and what don't) they say? Where are we headed?

Setting RF-Immunity Standards

The first task was to set RF immunity levels, then devise repeatable, standard methods to measure these levels. Any ham who has tried to make repeatable RF-field or antenna-gain measurements has an idea what problems are involved in this process.

Interfering RF signals can sneak into a TV receiver in three ways: (1) The TV antenna; (2) direct pickup by wiring inside the TV set (the TV set is immersed in the RF field, and voltages are induced in every internal conductor); (3) conduction (pickup of RF by any external wires connected to the TV set, including the ac power cord, external speaker wiring and, especially, if coaxial feed line is used, by the feed-line shield). The standards developed by EIA addressed these three entry paths.

The top priority for the committees was determining the the maximum magnitude of an RF field in a residence in which consumer electronic equipment is expected to function without interference. Considerable guidance came from studies done at the Canadian Department of Communications (DOC). Using analysis and field measurements in urban areas, the DOC proposed three levels of immunity: 30 V/meter for medical devices used in life-threatening emergencies; 10 V/meter for industrial electronics, such as factory machinery control; and 1 V/meter for consumer entertainment devices. The highest RF levels in home environments came from the FM broadcast, amateur, and CB-radio services.

For interfering signals entering the TV receiver via the antenna terminals, 0.25 V at 300 Ω was made the immunity goal for the spectrum between 0.5 and 30 MHz, not just the CB band. The ANSI/EIA-544-1958 standard includes these values.[7] Note that the maximum level of tolerated interference is for "just perceptible" interference to either picture or sound. "Just perceptible" interference levels were found to be quite repeatable in different laboratories.

Production and measurement of RF fields in which an entire TV set can be immersed is a true engineering challenge. Myron (Mike) Crawford of the Boulder, Colorado, labs of the National Bureau of Standards (NBS—now National Institute of Science and Technology), came up with a solution to this problem. Dubbed the Crawford Cell, it consists of a square section of waveguide divided in two by a plate, or septum. See Figs 1 and 2.

Each end of the waveguide cell is tapered to match 50-Ω coaxial cables. One end of the cell is driven with an RF signal generator, and the other end is terminated in a dummy load. The unit under test is placed in the cell on an insulating stand. The picture on a TV set inside the cell can be observed through a window in the side of the cell. A microphone inside the cell picks up any audible interference. The Crawford Cell has a well-defined, calibrated RF field that is similar to a radiated field in free space. Because it is completely enclosed, the test cell doesn't radiate interference.

Another way to produce a plane wave to simulate far-field RF is with an pair of parallel metal sheets that form a slab-type transmission line. Known as a Jackie Line, this test setup is popular in Europe. Although they are easy to fabricate, Jackie Lines have leakage fields that can cause measurement difficulties, and they radiate potentially interference-producing RF fields unless operated in a large shielded room. After several years of discussion in the international EMC body, The International Electrotechnical Commission's International Special Committee on Radio Interference (CISPR), a consensus was reached that either the Crawford Cell

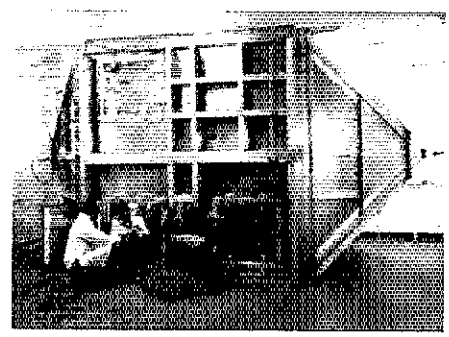


Fig 1—In this photograph, two engineers work with a 3 × 3 × 6-meter Crawford Cell at the National Institute of Science and Technology, Boulder, Colorado.

Fig 2—This Crawford Cell, considerably smaller that that shown in Fig 1, is also used at the National Institute of Science and Technology in Boulder.

or the Jackie Line could be used for testing.

Immunity tests were made on several color TV receivers using Crawford Cells at RCA and North American Philips. Comparative sample tests were made at Zenith with a Jackie Line. From EIA-sponsored tests and engineering studies at the principal manufacturers, the R-2 Committee decided that, by really stretching the available technology, immunity in the presence of a 1-V/meter RF field should be possible for a completely new model design. A goal of 2-V/meter immunity from ham- and CB-band frequencies was also established. The result is EIA interim standard IS-16.

As new-model TV receivers and VCRs are designed, IS-16 requirements are being applied. There's a twist for VCRs: On playback, the frequency range over which this standard applies is 0.5 to 7 MHz.[8]

With a four-year model-engineering cycle, you might think that after two years, about half of currently marketed TV receivers would meet these new immunity standards. Last year's EIA survey, as reported to the C63 (IEEE) Watchdog Committee, showed 90% compliance (among those produced by participating manufacturers [those in the US, Japan and Europe])—not bad!

Cleanup Items

Two items were passed from EIA EMC Committee R-2 to EIA TV Receiver Engineering Committee R-4. One of these is the design of an automatic method of detecting the picture-interference threshold, which is being developed by North American Philips under a grant from EIA. Present visual methods are repeatable and acceptable when done by highly trained engineers and technicians, but are not economical for routine factory testing. Initial reports have been issued to EIA on this work.

A second cleanup item is finding an acceptable test method for conducted interference. Under an EIA grant, the Boulder labs of the National Institute of Science and Technology constructed test units to be connected at a TV receiver's antenna jack. Using a signal generator connected to the test unit, measured RF currents can be injected along the coax shield into the TV receiver. These currents are then compared to those measured for a TV set and antenna immersed in measured RF fields. The test setups are considered typical of a home TV installation with an outside antenna and coaxial feed line.

Measured currents are compared to expected values from analysis using conventional antenna theory. Variations of over 6 dB were typical, and resulted from factors not easily controlled, such as the capacitance of a particular TV chassis and cabinet to ground. In measurements taken in France and Switzerland, CISPR representatives claimed a 20-dB discrepancy with the US results, but their data showed variations on the order of 18 dB. Although these tests provided useful guidelines, standards need better reproducibility.

One of the most interesting tidbits gleaned from the European work is their finding that, with modern TV construction, interference-signal conduction via coaxial-cable shields (or parallel [common-mode] currents on 300-Ω parallel-conductor lines) may be the key entry point for interfering signals. Looking at it from the ham's viewpoint, with current TV sets, many cases of TVI can be fixed with shield breakers at the receiver, or at cable-converter coax inputs. This method is shown in the TVI booklets available from the ARRL, EIA, and FCC. I've used pairs of 75- to 300-Ω and 300- to 75-Ω transformers to cure several recent, stubborn, cases of TVI. Satisfactory devices are available at Radio Shack. If you're going to use this method, assemble the transformers and use an ohmmeter to ensure that there's no dc connection between the input and output connections.[9]

Looking Back, Looking Ahead

Peaceful coexistence between consumer entertainment equipment and neighborhood radio transmitters is a continuous challenge. Initial standards have been set and are working for TV, VCR and radio receivers. The EIA R-2 Committee did not specifically address other consumer electronics, such as telephones or audio products.

One potential difficulty stems from changing world markets and manufacturers. In the last two years, two of the US companies supplying substantial engineering contributions to the EIA work no longer manufacture television receivers. Another potential trouble spot is financial difficulties. Almost all significant manufacturers of consumer TV and radio receivers in the US are under offshore ownership. Manufacturers in parts of the Far East, such as Korea and Taiwan, did not participate in the formulation of the voluntary EMC standards.

This de facto industry standard now exists for all consumer electronics: *There shall be no perceptible effect on operation of electronics in the home for RF fields of at least 1 V/meter in any ham or CB band, and 10 dB lower anywhere else in the spectrum between 0.5 and 30 MHz.*

RFI and ARRL

ARRL has long been aware of its responsibility to keep abreast of interference problems and current technology. To facilitate this, ARRL established an RFI Task Group nearly two decades ago; this group has reported regularly to the Board ever since. The RFI Task Group represents the Amateur Radio community by participating on two of the accredited Standards Committees: C63 Task Group 1-11.1, *Radio Interference Limits for Appliances;* and C63 *Ad-Hoc Committee on Public Law 97-259.* In addition, ARRL has periodic contact with the National Cable Television Association (NCTA) regarding Amateur Radio-related interference problems.

Other ongoing activities of the RFI Task Group include the review of articles for League publications and documents produced by CISPR; Amateur Radio interference cases; and the cooperative use of local interference committees to assist the FCC. ARRL President Larry Price, W4RA, has assigned the following people as members of the ARRL RFI Task Group: Vice Directors Bruce Meyer, WØHZR, and Howard Huntington, K9KM, and the undersigned, as Chairman.—*Hugh Turnbull, W3ABC, ARRL Atlantic Division Director*

Notes

[1]This task force, known as Television Allocations Study Organization (TASO), set requirements used for over 30 years by the FCC and industry.

[2]B. Jones, *Subjective Assessment of Protection Ratios for UHF Broadcast Signals* (CBS Technology Center, Apr 23, 1986).

[3]*Final Report: Personal User Advisory Committee*, John B. Johnston, chairman, Apr 1977.

[4]In terms of decibels with respect to a milliwatt (dBmW), this is −7.

[5]Copies of ANSI/EIA 544-1988 are available from EIA, 2001 Eye St, Washington, DC 20006.

[6]For more information, see W. Dale Clift, "'RFI Bill' Becomes Law; Amateur Radio Benefits!," *QST*, Nov 1982, pp 11-13.

[7]In Europe, work toward compliance with much tighter standards is now underway. In the future, manufacturers producing equipment destined for the US market should benefit from this work.

[8]Having these standards in place does not mean that blanket compliance to them will necessarily occur overnight. In the past, some manufacturer-implemented TVI fixes were as simple as changing components in tuned circuits. With current technology, even simple changes cannot be applied to current-production devices because of the high-level integration used in modern circuits. In many cases, an entire four-year model-engineering cycle is required to implement design changes that will ensure compliance with any new standard.—*Ed*

[9]Also see J. Rafferty, "300-Ω Filter in 75-Ω TV Coax Cures Shield-Conducted TVI," Hints and Kinks, *QST*, Mar 1989, p 41.

References

The following sources contain information on RFI matters, and are recommended reading.

B. Hale, ed., *The 1989 ARRL Handbook* (Newington: ARRL, 1988), Chapter 40.

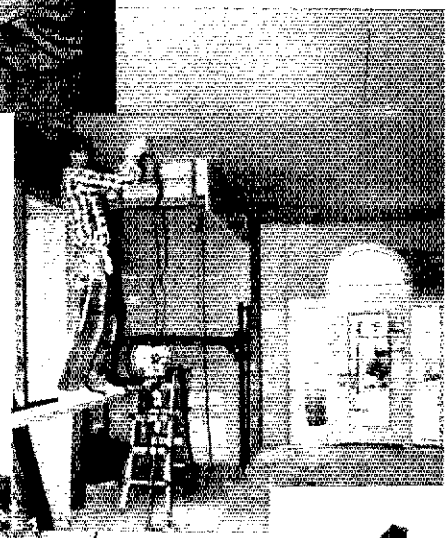
C. Hutchinson, ed., *Radio Frequency Interference: How to Identify and Cure It* (Newington: ARRL, 1986).

CISPR Specifications for Radio Interference Measuring Apparatus and Measuring Methods, IEC/CISPR Publication 16, 1987.

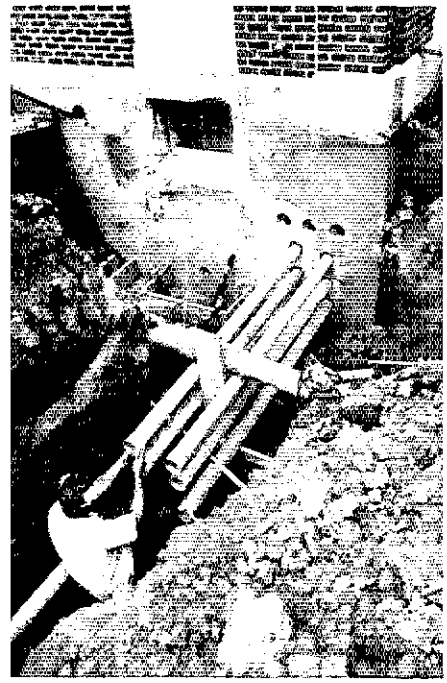
Maxim Memorial Station W1AW Renovation Update

Work on the renovation is proceeding on schedule, enough so that a rededication ceremony has been scheduled for July 20 (see League Lines this issue). All members are cordially invited to attend. The following photographs offer a glimpse of the work that took place in the month of May.

A worker affixes drywall to the ceiling of the first floor. *(photos KC1MP)*



League officials meet with representatives of M & L Building and Design Group One Architects on a weekly basis to review and plan construction. (l-r) Robert Bach, M & L Building; HQ Building Manager Greg Kwasowski; M & L Construction Supervisor Steve Knowlton; David Wert and James Brownsmith, Design Group One; W1AW Renovation Project Manager John Lindholm, W1XX.



This conduit will house the Hardline to the antenna farm.

As the renovation progresses, it's apparent that W1AW is *the* flagship station of Amateur Radio, offering code practice, bulletins and visitor operation.

A concrete worker bores holes in the existing foundation for new antenna lead routing.

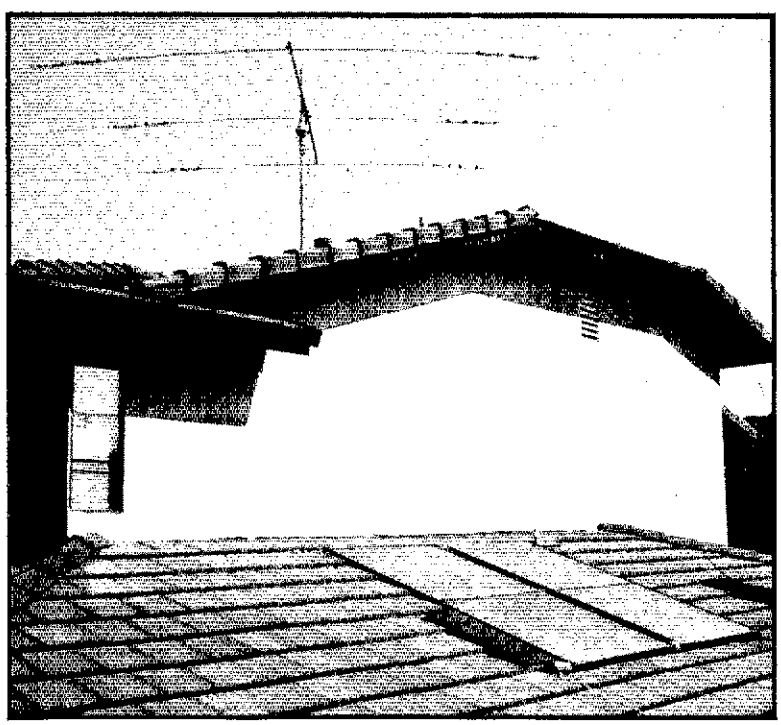
Operate Your Station With Power from the Sun!

Here's a report on this *hot* technology, with the information you'll need to design your own solar-powered station.

By Peter Berg, KG6JA
PO Box 4207
Carlsbad, CA 92008

I'm not a dyed-in-the-wool ham radio operator when it comes to RF—I'm more of a tinkerer in electronics. Although I have held a license since 1954, I have, until recently, derived more satisfaction from designing receivers and transmitters—and getting them to work—than from operating them on the air.

With the sunspot cycle starting upward again, I finally broke down, put savings in pocket, drove to the ham store and purchased a new dc-operated transceiver. Because I did not have a sufficiently large (20-A) power supply for this radio, and because I was in a hurry to try out the new rig, I borrowed the storage battery from my motor home. This battery has a 55 ampere-hour (Ah) capacity, can be deep discharged, and appeared to be plenty large for this application. It has operated the rig for over a year, without trouble.



Solar panels (lower right) and a tribander decorate the rooftops at KG6JA.

I recently read up on developments in alternative energy sources such as wind, motion (water) and sun that supply energy to power an entire household. It occurred to me that the use of solar energy to charge a battery capable of powering my ham station would be an interesting and affordable experiment. Much to my surprise, I found that technology in the manufacture of solar electric cells has moved far enough forward that you don't have to live in space, in Florida or in California to benefit from solar energy! Solar-cell efficiency is such that solar cells can provide sufficient energy to be usable in areas of the country where sunshine is less abundant than in the Sunbelt, In fact, these cells even provide electricity on cloudy days.[1]

Capturing Energy from the Sun

The electric effects of light on certain materials have been known since long before the invention of the transistor. Materials such as cadmium sulfide and selenium exhibit altered electrical behavior when they are exposed to light. Early in the development of transistors, it was discovered that transistors not encapsulated in lightproof housings were sensitive to light. The reason for this is that photons striking a base-emitter junction cause the movement of electron-hole pairs in the junction—just as injecting a forward base-emitter current does. An increase in collector current is the result. This discovery was later put to good use in the development of the translation of light energy to electromotive force, *photovoltaic conversion*, often called PV called *PV conversion*.

A solar cell is a very simple semiconductor. Solar cells are, in fact, large-area semiconductor diodes. A cross-section of a solar cell is shown in Fig 1. Simply explained, when the photons contained in light rays bombard the barrier of this semiconductor, hole-electron pairs inside this P-N junction are freed, resulting in a forward bias of the junction, just as in phototransistors. This forward-biased junction can deliver current into a load. Because the exposed area of a solar cell can be quite large, the forward current proced can be substantial. It follows that the output current of a photocell is directly proportional to the rate of photon bombardment, and thus to the exposed area of the photocell.

Types of Solar Cells

Originally, solar cells were made by cutting slices of grown silicon-crystal rod and subjecting them to doping and metallization processes. These solar cells are called *monocrystalline* cells because each unit consists of only one crystal plate. The shape of these cells is the same as that of the silicon rod from which they are cut: round. A slice of this material with an area of 2 inches can be made into one photocell, but a slice of this size could also be used to

[1]Notes appear on page 34.

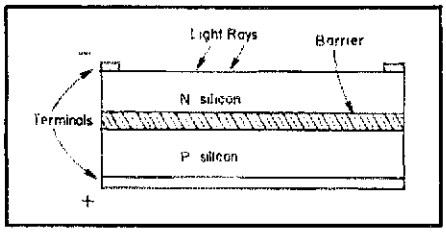


Fig 1—Cross section of a PV solar cell.

produce upwards of a thousand transistors! The cost of these early solar cells was way beyond the means of common folk, and could only be justified for use in space research and other highly critical applications.

Techniques for the manufacture of two other types of PV cells have been developed since monocrystalline cells were first produced. The newer cells are *polycrystalline cells* and *amorphous cells*. Polycrystalline cells are typically manufactured as rectangular blocks of seemingly randomly arranged silicon crystals from which the cell plates are cut. These cells can be recognized by their shape and their random pattern and colorful surface. Polycrystalline cells are less expensive to manufacture than monocrystalline cells.

In the mid 1970s, researchers began to experiment with the manufacture of PV cells by depositing a thin film of doped silicon on an economical but stable substrate, such as glass. In 1975, these efforts paid off, and today the result, amorphous cells, are used in the production of calculators, watches, security systems, automatic gate openers, electric fences, wireless freeway telephones, battery chargers in automobiles and recreational vehicles, and, of course, in ham radio. At first, amorphous solar cells were not very efficient and exhibited rapid degradation with time. Most of these problems have since been solved, and reliable amorphous PV panels are available from many manufacturers. These panels come in several forms: mounted on thin glass, framed, and even mounted on flexible substrates, such as steel.

Amorphous cells are relatively inexpensive to manufacture. They do not, however, spell the end of crystalline cells: Crystalline cells still offer the highest efficiency. The best shopping comparison you can make when purchasing PV solar panels is to compare power output per dollar, and then select a vendor who offers a good warranty and good customer service.

Solar-Cell Specifications

Depending on construction, each cell has an open-circuit output, when exposed to the sun, of 0.6 to 0.8 V. (You may have expected this, because each cell is the electrical equivalent of a forward-biased silicon diode.) This output voltage drops somewhat

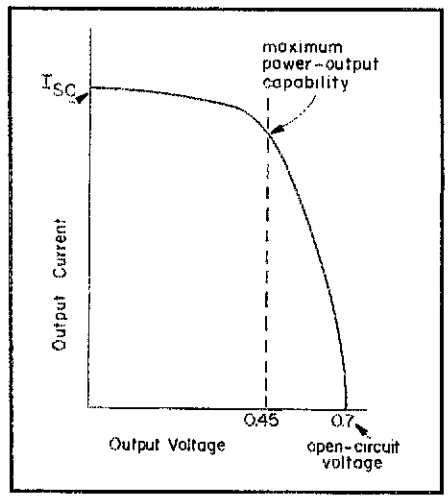


Fig 2—This load curve for a PV solar cell shows that maximum power delivery from a solar cell occurs at approximately 0.45 V output. I_{SC} is the short-circuit current.

when current is drawn from a solar cell. Fig 2 shows the typical voltage v current relationship of a solar cell. This is called the cell's *load curve*. Open-circuit voltage is approximately 0.7, and output voltage at optimum load is nominally 0.45. Output current is maximum with shorted output terminals. This maximum current is called the short-circuit current, or I_{SC}, and is dependent on the cell type and size. Because a cell's output current remains relatively constant under varying load conditions, it can be considered to be a constant-current source. The point on the load curve where maximum power can be drawn from the cell is indicated in Fig 2.

Just like batteries, solar cells may be operated in series to increase output voltage, and/or in parallel to increase output-current capability. Several manufacturers supply arrays or panels with a number of cells in a series-parallel hookup to be used, for example, for battery charging.

Techniques have been developed for the construction of amorphous cells whereby the cells are manufactured in series by cutting metal layers that have been vapor deposited on the amorphous silicon mass. This cutting is done with a laser. Cell width in such panels may be up to several feet, and the output-current capability of these relatively economical panels is excellent.

PV-cell efficiency varies: Monocrystalline cells have efficiencies up to 15%; polycrystalline cells, 10 to 12%; amorphous cells, 6.5 to over 10%, depending on the manufacturing process.[2]

The output power of solar arrays or panels is specified in watts. Typically, the listed wattage is measured at full exposure to sunlight, at a nominal potential of 7 V for a 6-V system, 14 V for a 12-V system, and so on. You can calculate the maximum current that can be expected from a PV panel by dividing the specified output power by the panel voltage.

The cost of solar panels has decreased significantly in recent years. Basically, you can expect to pay anywhere from about $8 to $15 per watt, depending on quantity, size, construction and efficiency of the panel.

Storing Solar Energy

Because the sun doesn't shine 24 hours per day at any location in the US, some means of storing collected energy must be used. Batteries are commonly used for this purpose. Battery capacity is generally expressed in ampere hours (Ah) or milliampere hours (mAh). This rating is simply the product of discharge current and discharge time in hours. For example, a fully charged 500-mAh NiCd battery of good quality can deliver a discharge current of 100 mA for a period of 5 hours, or 200 mA for 2½ hours, before recharging is required.[3] Three types of rechargeable batteries are commonly used:

- Nickel-cadmium (NiCd) batteries: NiCds are mostly used in relatively low-energy applications such as hand-held transceivers, scanners, etc. The development of consumer electronics has contributed to the rapidly increasing availability (and somewhat-less-rapidly decreasing cost) of NiCds. Major advantages of NiCds: They are hermetically sealed, operate in any position and have a good service life (several hundred charge/discharge cycles), if they are properly maintained.
- Gelled-electrolyte lead-acid batteries: These hermetically sealed batteries are available in capacities from below 1 Ah to more than 50 Ah. They are ideal for supplying energy to a ham radio station, but their cost (for capacities above 10 Ah) is rather high. For portable and QRP stations, though, this type of battery is difficult to beat. The cells can be operated in any position, but should be charged in an upright position. If properly maintained (no deep discharges—cell-polarity reversal is possible under these conditions—and they are stored in a fully charged state), gel cells last a long time (500 or so cycles). I operate a small 10-W portable CW station from a 12-V, 6.5-Ah gel battery with good success.
- Other lead-acid batteries: These are available in the standard automotive version, in the marine/RV deep-discharge versions and in the golf-cart variety. Differences: Automotive batteries usually fail following several deep-discharge cycles (because of the thin plate and insulation materials used in their construction), resulting in premature internal short circuits. Golf-cart and marine/RV batteries have thicker plates with more rigid insulation between them, so these batteries can withstand deeper discharges without plate deformation and internal failure. Deep-discharge batteries provide the best value in a ham station. Some of these batteries require attention (the electrolyte level must

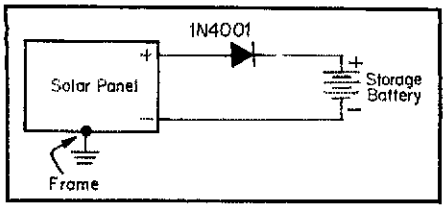


Fig 3—Basic solar-panel-to-battery connection. The series diode in the panel's output line keeps the battery from discharging into the panel.

be maintained), and they last longest when kept charged. Because these batteries use a wet electrolyte (water), and most of them are not hermetically sealed, they must be kept upright.

A Typical Application

Here's a practical example of how to calculate power requirements for a PV-powered ham radio station. The first thing to do is define the power demand. Assume that you use a 100-W rig. (We'll also assume that 100 W is the peak power consumption, and occurs only during CW operation and SSB voice peaks when a 13.6-V nominal supply [a fully charged battery] is provided.)

The most reliable way to calculate realistic power requirements is to determine the power used over a longer period of time—say, a week or a month. Because most of us have more or less recurring weekly habits, we'll take one week as the base period. (You can substitute your own numbers to adapt these calculations for your rig, under your operating circumstances.) Assume that the rig is turned on five days of the week for two hours on each of these five days. Of each two-hour period, 1½ hours is spent listening, and transmitting takes the remaining half hour. Assume that the current consumption of the transceiver during receive is 2 A; during the 100-W peaks on transmit, current drawn is 20 A. The owner's manual for your rig should give the maximum dc current drain. The average current consumption during SSB transmitting is only about 4 A. Therefore, we need a battery that can supply a peak current of at least 20 A and an average current of 4 A. Now calculate the total energy consumed in ampere hours over a one-week period:

Receiving: 2 A × 2½ hours/day × 5 days = 25 Ah.
Transmitting: 4 A × ½ hours/day × 5 days = 10 Ah.

The total energy used per week is 25 + 10 = 35 Ah, or per day (average) is 35 ÷ 7 = 5 Ah. If we had a perfect system, all we would need to do is supply 35 Ah per week (5 Ah per day) to the battery. In practice, imperfections in battery construction cause some loss (self discharge), for which the charging system must compensate, as you'll see.

Next, calculate the minimum battery capacity required for this application. The system should be designed so that sufficient energy is available to run the equipment for two consecutive sunless days (this is rather arbitrary—some locations are worse than others in this regard). Because these sunless days could be days on which you want to operate, and because it's not a good idea to discharge a battery to less than 50% of its capacity (for maximum battery life), this battery must have a capacity of at least 2 (days) × 5 (Ah) ÷ 0.5 (for the 50% charge capacity left after 2 days without sunshine) = 20 Ah. If your location is likely to be without sunshine for as much as an entire week, the battery requirement is 7 × 5 ÷ 0.5 = 70 Ah. Add about 10% to this number to compensate for self discharge and other losses. (Typically, this means you'll buy the next-larger-size battery than the initial calculations indicated.)

What does it take to keep this battery sufficiently charged? Here again, some rules of thumb help in the calculations.

First, estimate the average number of hours of sunshine per year in your area. This information can be found in an almanac. As a guide, average annual sun exposure is approximately 3200 hours per year in the Sunbelt, less elsewhere (down to about 1920 hours per year in the far northern parts of the US).

Your PV solar panel will most likely be mounted in a fixed position, but should be at an optimum angle with respect to the earth. This varies from about 30° in the summer up to about 60° in the dead of winter. Fixed-mounted solar panels cannot pick up maximum energy from the sun, for obvious reasons. Of course, you could build some kind of solar-tracking mechanism to circumvent this obstacle, but that's beyond the scope of this article (and beyond the ambition of most people I know). If you need to collect more solar energy, it is much easier to simply add another solar panel! In practice, you can only count on panel exposure for about 70% of the total sunlit time, which is anywhere between 1340 and 2240 hours per year (between 26 and 43 hours per week), depending on where you live.

The remaining system planning is easy. Our earlier calculations showed that the solar cells must replenish 35 Ah per week, plus 10% to compensate for losses, or about 38.5 Ah of battery capacity. With solar energy available in the Sunbelt for 43 hours per week, the required charge current is 38.5 Ah ÷ 43 hours of sunshine = 0.9 A. In the northern part of the US, this is 38.5 Ah ÷ 25.8 hours = 1.5 A. Now, find a PV panel that can deliver this current under load.

In the 12-V system described here, the PV panel operates, with a fully charged battery, at about 13.6 V, plus the voltage drop of a series diode. The basic hookup is shown in Fig 3. With a fully loaded panel voltage of 14, a panel rated at 21 W (14 V × 1.5 A) is required in northern climes. In practice, this power can be obtained from good-quality solar panels with a surface area as small as 5 square feet. If you live in the Sunbelt, you need only 12.6 W (14 V × 0.9 A) of PV energy.

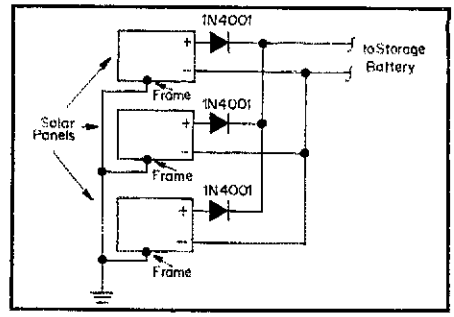


Fig 4—Connecting panels in parallel is a good way to increase output current from a solar-panel array. A diode is connected in series with each panel to protect the panels from the battery and from the other panels.

Using this basic method, you can calculate the electrical and mechanical dimensions of almost any solar installation; just substitute your power needs into the equations shown here. The sidebar, "Calculating Solar-Cell and Storage-Battery Needs," conveniently shows the required calculations in tabular form.

Some Practical Hints

PV panels can be wired in series to provide increased output voltage. If the total output of the cell array exceeds 20 V, wire shunt diodes across each PV cell. Similarly, PV panels can be wired in parallel to yield increased output-current capability. In this case, use a series diode for each panel, as shown in Fig 4.

When hooking up PV panels to a storage battery, always use a series diode to prevent discharge of the battery into the panels. A Schottky diode can be used in applications where it is important to maintain the lowest voltage drop (and minimum loss) of charge current.

If you live in an area where battery overcharging may occur, take precautions to prevent battery overcharging and related gas discharge inside the battery. Several manufacturers supply simple charge regulators that serve this purpose by disconnecting the PV panel from the battery when the battery is fully charged. Some of these chargers allow charging to resume when the battery has reached a measurable level of discharge. Note: These values are only valid for lead-acid batteries; an entirely different set of charge criteria exists for NiCds.[4]

Installing Solar Panels

If you plan to permanently install PV

Calculating Solar-Cell and Storage-Battery Needs

Calculation of PV solar-cell and storage-battery requirements is easy using this form. See the text for additional information.

Solar Cell

1) Current drain during receive:† _____ A
2) Number of hours of receiver operation per week: _____ h
3) Product of lines 1 and 2: _____ Ah
4) Peak current drain during transmit:† _____ A
5) Number of hours of transmitter operation per week: _____ h
6) Product of lines 4 and 5: _____ Ah
7) Total weekly power requirement (sum of lines 3 and 6): _____ Ah
8) Number of hours of sunshine per week (see text): _____ h
9) Required solar-panel current (line 7 ÷ line 8): _____ A

The solar panel you select should have at least as much current capability as shown in line 9.

Storage Battery

10) Maximum number of days of operation without sunlight: _____
11) Daily power requirement (line 7 ÷ 7): _____ Ah
12) Stored-energy requirement (product of lines 10 and 11): _____ Ah
13) Maximum stored-energy requirement (line 12 × 2.2) _____ Ah

The battery you select should have a capacity at least as large as the total storage requirement found in line 13, or the numerical current capacity of the battery (in Ah) should be at least twice as large the numerical value found in line 4, whichever is larger.

†This value is usually given in the instruction manual for your transceiver.

panels, consider mounting them at ground level on a simple wooden or metal frame, or mounting them on the roof. Roof mounting is more appropriate if you have a roof that slopes at the correct angle (30 to 60°—see the title photo), and in the right direction (anywhere between a little east of south and southwest is acceptable). The easiest way to mount panels permanently is with a silicone adhesive, such as RTV. First, mount series diodes on the back of each panel. Attach color-coded wires to the panels' negative terminal or wire, and to the cathodes of the diodes. If you're using more than one panel, wire them in parallel so that you only need to run one set of leads from the panels to the battery. Secure the wires and diodes with small strips of tape and apply a blob of silicone adhesive to each diode and solder joint.

If the solar panels are going to be located in an area where they might be subjected to lightning, it is especially important to ground the metal frames of the solar panels. Use separate wire for this ground—*do not* combine the panel-frame ground with one of the power leads!

After you have determined where the panels will be positioned, lay them upside down and squeeze a bead of silicone adhesive onto the back of each panel frame. Turn each panel over, lay it on the roof, and tape it down until the adhesive has dried. If you want to go the extra mile, you can mount the panels on blocks so that air can circulate under the panel. PV solar panels, when cool, have slightly higher output than hot panels.

Methods of securing solar panels to wooden or metal frames vary with frame designs; panels may lay in the frame, or you may elect to use brackets and/or bolts. The advantage of a frame mount (as opposed to a more permanent mounting scheme, such as adhesive), is that you can adjust the angle of the panels with respect to the ground, so that you can align the panels for maximum efficiency.

Notes

[1]I use *provide* rather than *generate* to describe the process by which solar energy is transformed into electrical energy. Of course, the energy is generated by the sun; solar cells convert photon energy into electrical energy, and thus *provide* electricity.

[2]For reference, maximum theoretical PV-energy-transfer efficiency is in the 22 to 25% bracket. The optimum has not been reached, but it is pretty well approached (to within an order of magnitude).

[3]Ampere-hour battery ratings are not absolute: You generally cannot, for instance, use a battery with a rating of 2 Ah to supply 10 A for 0.2 h (2 Ah ÷ 10 A), or even 4 A for ½ h. Materials used in battery construction are not made to withstand the heat generated during such extreme operation.—*Ed.*

[4]I intend to describe a simple charge regulator for lead-acid batteries in a future article. Drop me an SASE for more information about charge regulators.

Peter Berg was first licensed in the Netherlands in 1954, and held the call sign PAØMOB. He emigrated to the US in 1967. Several years later he obtained the call KA6FPT, and in 1981 earned his Advanced class license and acquired his present call sign. Peter runs his own company, which specializes in computer-based work stations for the aerospace industry. In addition, he operates a small mail-order business through which he supplies solar panels to industrial and commercial users. More information is available from Peter for a no. 10 SASE.

New Books

ALL ABOUT VHF AMATEUR RADIO

By Bill Orr, W6SAI. Published by Radio Publications, Inc, Lake Bluff, IL 60044. First edition, 1988. Softcover, 6 × 9 inches, 163 pages, $11.95 (plus $2 shipping and handling).

Reviewed by Doug DeMaw, W1FB

Plain language, minimum mathematics and down-to-earth explanations of Amateur Radio subjects provide a proven formula for success among writers who wish to reach those at all levels of the ham-radio avocation. Bill Orr has recognized the need for straight talk in his newest book, *All About VHF Amateur Radio*. His book tells you *how to* rather than *why it happens*. Practical circuits are used wherever they can complement the text discussion. In a like manner, line drawings with dimensions in English units are provided. You need not have a BSEE to glean knowledge from this book.

This book contains 10 chapters, an index and some descriptive material about other books by Bill Orr. The chapter titles are: VHF Propagation; The VHF Bands—an Overview; The VHF Repeater and How it Works for You; VHF Moonbounce Communication; and Amateur Satellite Communication. The remaining chapters are: Almost Everything About Coaxial Lines; VHF Vertical and Mobile Antennas You Can Build; VHF Beam Antennas You Can Build; VHF Interference and How You Can Suppress It; and VHF Roundup.

This volume is not dedicated to the design or construction of VHF and UHF transmitting and receiving equipment. Rather, it deals with the principles of operation, signal propagation, building effective antennas and attaching coaxial-cable connectors. Nearly all of the book's many diagrams are pictorials rather than schematics. There is a generous sprinkling of good-quality photographs in the book.

I found the text worthwhile for personal updating on some of the developments for exotic modes of communications, as I have not kept abreast of developments in some facets of VHF and UHF operation. This book should be excellent for newcomers to Amateur Radio, since the essential procedures are provided in capsule form. For those who do not aspire to VHF/UHF achievements, the book provides light, interesting reading. I consider *All About VHF Amateur Radio* a fine addition to the ham library.

Product Review

Conducted By James W. Healy, NJ2L
Assistant Technical Editor

MFJ-1278 Multi-Mode Data Controller

Reviewed by Jeff Kilgore, KC1MK

With the ever-increasing popularity of digital modes such as packet radio and AMTOR, more and more multimode communications processors are showing up on the market. (In this review, I'll use MCP to refer to this category of devices.) MCPs offer a variety of modes; many have AMTOR, ASCII and Baudot RTTY, facsimile (FAX), and slow-scan television (SSTV) capabilities. This is a mixed blessing for you if you're ready to test the waters of digital operation; choosing the MCP that will serve you best can be a bewildering process indeed.

MFJ Enterprises has thrown their hat into the many-mode-communications-processor ring with their introduction of the MFJ-1278 Multi-Mode Data Controller, which offers HF and VHF packet radio, AMTOR, ASCII and Baudot RTTY, CW, SSTV and FAX operation. This variety of operating modes is enough to keep you occupied for some time!

To get you on the air in a hurry, MFJ offers three Starter Packs for the '1278. These packages are available for use with IBM® PC, Apple® Macintosh and Commodore 64™, C128 and VIC 20™ computers. Each Starter Pack contains terminal software, a '1278-to-computer cable and instructions.

Table 1

MFJ-1278 Multi-Mode Data Controller, serial no. 03010256

Power requirements: 12 V dc at 500 mA.

Terminal/computer interface: RS-232-C interface with DB25 connector; 8-pin TTL serial port.

Data rates: 300, 1200, 2400, 4800 and 9600 bauds.

Radio interfaces: 5-pin DIN connectors (two). Each provides connections for audio output, audio input, push-to-talk (PTT), ground and squelch input (use of the squelch input is optional).

Setup

Connecting the '1278 to most modern equipment is not difficult. A cable for connection to the radio, complete with an installed MCP-end connector, is supplied with the '1278. You must connect the other end of this cable to your rig's audio output, transmit-audio input and PTT lines. There are several ways to make these connections, depending on your preferences and on the radio you are using.

Many radios provide one rear-panel jack where all these connections are made. This provides an element of convenience; you only need to plug in one cable to connect the radio to the '1278. Many rigs also have jacks for AFSK input and output, which leaves you to supply the PTT connection elsewhere (either through a rear-panel jack or via the rig's front-panel microphone connector). Making the connection at the microphone jack has the disadvantage of requiring that you exchange the microphone and MCP cables when you switch between voice and MCP operation.

Once the MCP is connected to the radio, you'll need to connect the MCP to your computer. I used the optional Macintosh Starter Pack, which comes with a cable for this. Unfortunately, the Macintosh Starter Pack is supplied with a DB25 connector to match current-generation Macintoshes, so I had to replace the DB25 with a DB9 connector to match my older computer.

Operation

Operation of the '1278 is relatively straightforward as multimode communications processors go. That is, if you've never used an MCP before, some reading of the manuals and a little practice on your part are required before MCP operation becomes second nature. Even so, you'll have fun learning by doing.

The '1278 has two modes: command and converse. Changing modes and operating parameters on the MCP is done in the command mode, and operating is performed in the converse mode. Toggling between the two is a simple matter—CTRL C places the unit in the command mode, which is signified by a CMD: prompt. In command mode, select the desired mode and any operating parameters you want to change, type K to place the unit in the converse mode, and you're ready to talk via the bit stream.

Note: Although the '1278 operates on text-only modes (such as packet radio and AMTOR) with any terminal (or a computer running terminal-emulation software), use of the '1278's SSTV and FAX modes requires specialized software. Software contained in the optional Starter Packs (discussed later) provides FAX and SSTV video-graphics capability. The '1278 allows you to print directly to an Epson® -compatible printer in the FAX and SSTV modes.

The '1278 is a versatile unit; its CW operation is a reflection of this. In addition to receiving CW with the '1278, you can transmit CW from the keyboard at any speed from 5 through 99 WPM, or use the '1278 as an iambic keyer. That's right—you can connect your keyer paddles to the '1278 and have at it.

Unfortunately, like other units that offer CW reception, the '1278 doesn't do very well in this mode (more on this later). The '1278 also serves as a memory keyer—something contesters should appreciate (more on this, too, later).

Front-panel LEDs provide you with information on MCP status. A yellow LED, DCD, aids in setting the THRESHOLD control. A green LED, PTT, and red LEDs, STA, CON and PWR, fill out the picture. A 20-segment LED indicator, TUNE, operates on all modes and shares front-panel space with the other indicators and controls.

My Impressions

As I said earlier, the '1278 is relatively easy to hook up and operate. I had a few difficulties that are worth mentioning, however.

The first problem I had was getting the unit to receive properly—not just on one mode, but on *all* modes. The '1278 required more audio drive than that available from either the ACC 2 or the AFSK OUT jacks on my Kenwood TS-440S. Only when signals were more than 40 dB over S9, as indicated on the '440's S meter, did the DCD light come on—even with

the '1278's THRESHOLD control set to maximum sensitivity. I had to resort to getting a signal directly at the '440's speaker leads! This crude approach works, but is inconvenient. And, altering the setting of the '440's AF-gain control necessitates adjustment of the '1278's THRESHOLD control. This is a minor, but annoying, inconvenience.

After getting the unit set up to receive properly, it was time to transmit. I had another minor problem doing this: RF somehow got into the '1278. I reasoned that this was most likely occurring because of the extra cable I had attached to the '440's speaker to get sufficient audio for the '1278. Wrapping a few turns of this speaker-to-'1278 cable around a ferrite core took care of the problem.

HF-Packet-Radio Operation

The '1278's HF-packet-radio performance is best described as adequate. I made plenty of contacts, but under weak-signal or noisy conditions, it was rough going. It's hard to fault the '1278 too much for this, however, because the same problem exists in many other MCPs that use PLL modems on HF. Many PLL-modem MCPs don't work well with varying-amplitude signals. Multipath and selective fading also add their deleterious effects. Nonetheless, the '1278 provided hours of HF-packet-radio enjoyment.

The same problems that beset the '1278 during HF-packet-radio operation also affects the unit during HF AMTOR, ASCII and Baudot RTTY operation. Again, this is not an indictment of the '1278 in particular; many current MCPs perform likewise. I did little HF-RTTY operating, but I did listen around quite a bit, and copy was good enough—under the right conditions—to have some fun on RTTY.

VHF-Packet-Radio Operation

The '1278 was a real pleasure to use in VHF packet-radio operation. The '1278 performed flawlessly in this mode. If VHF packet radio is your thing, the '1278 is a fine unit for you. One of the '1278's nice features is its ability to be connected to two radios simultaneously. This avoids the hassle of connecting and disconnecting cables when switching between HF and VHF operation. In addition, either of the '1278's radio ports can be set up for HF or VHF (300 or 1200 bauds, respectively) packet-radio operation, so you could, for example, connect a 2-meter rig to one port and a 220-MHz rig to the other. If you're into multiband VHF/UHF packet-radio operation, this is a real plus. The '1278 can even be set up as a gateway between two bands.[1]

CW Operation

Operating the '1278 on CW left me with mixed emotions. As with some other current MCPs that offer CW operation, receiving CW on the '1278 is like having teeth pulled—in lots of little pieces. Even with strong signals, what is displayed on the screen bears little resemblance to what's actually being sent. Although the '1278 does a passable job of decoding machine-sent code when signals are strong and in the clear, this CW-reception facility is of little practical use under real-world conditions. Furthermore, tuning CW signals to the center of the '1278's passband places these signals outside the passband of the 500-Hz CW filter in my TS-440S; I had to adjust the '440's IF SHIFT control to compensate for this. The human ear and brain are still the best thing going for copying CW signals.

Sending CW with the '1278 is another matter. As a CW keyboard, the '1278 performs flawlessly. Using the '1278, I made CW contacts at speeds from 5 to 18 WPM, with no problems. I didn't try using paddles with the '1278, but based on the '1278's keyboard-generated keying, I believe that this feature should work well. The '1278's memory-keyer functions also work well, though I made little use of them after trying them out.

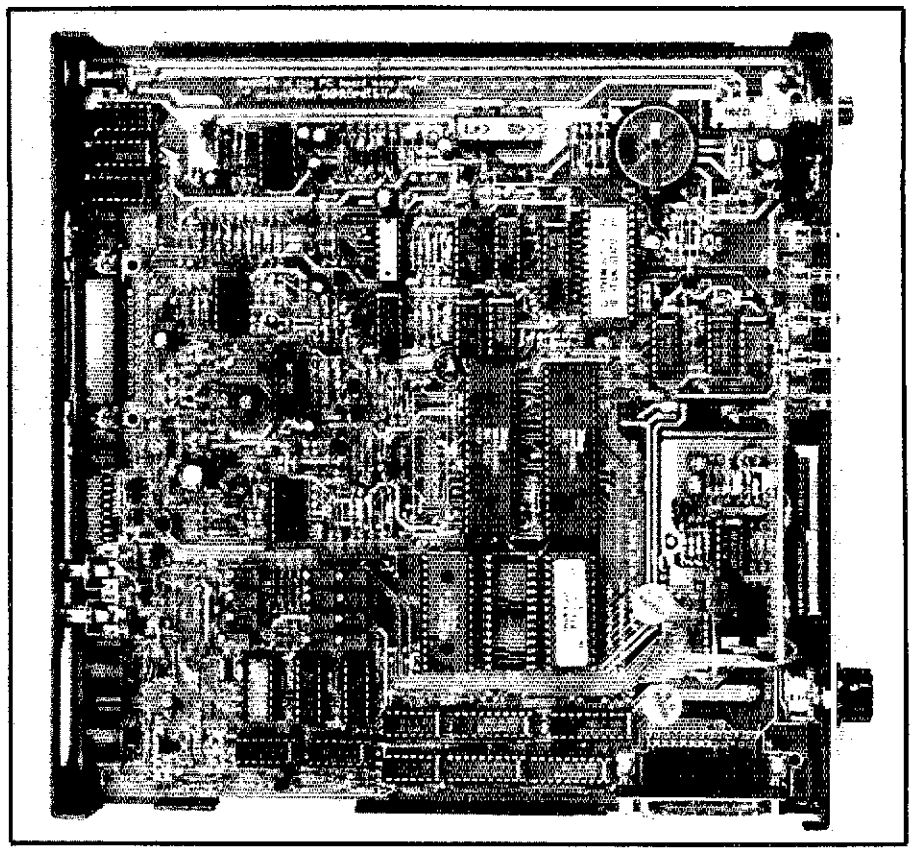


Fig 1—This photo of the main PC board inside the MFJ-1278's enclosure gives nary a hint at the numerous operating modes that the '1278 provides.

FAX and SSTV

In these two areas, the '1278 simply doesn't perform well enough to satisfy anything more than a short-term curiosity. The '1278's major problem in this area is that, although FAX and SSTV are generally transmitted in many shades of gray, the '1278 displays them on the computer screen in only two shades: black and white. Therefore, most of the picture detail is lost, even under ideal conditions.

I also found it impossible to get FAX and SSTV pictures to line up properly, both on the screen and the printer. The pictures were angled to varying degrees. The '1278's manual states that you can adjust the image angle with a trimmer capacitor on the '1278's PC board, but I was unable to make the pictures line up properly by adjusting this control.

The incoming synchronization pulses (used to line up frames) are often missed by the '1278, resulting in FAX pictures that are skewed to the left or right. When I tried SSTV operation, the '1278 almost never caught the incoming sync pulse; the few times the '1278 did start itself, it seemed to key on noise bursts. It is possible to start frame reception manually, but I was unable to receive SSTV pictures accurately using this method. SSTV pictures also appeared in odd sizes on my monitor; many pictures filled only 15% or so of the screen! Another staffer had no better luck than I with FAX and SSTV reception using the '1278. Although they may be the fault of the software and not the '1278 itself, these operational bugs are hardly conducive to hours of enjoyment!

Although I was disappointed with the FAX and SSTV performance of the '1278, none of the current multimode communications processors that I've seen perform well enough for serious FAX or SSTV work.

Software

The software included in the '1278's

[1]For more information on gateway operation, see Larry Wolfgang's review of the Kantronics KAM™ in June 1989 *QST*, beginning on p 39.

Macintosh Starter Pack performed well with one exception: After leaving the program, the cursor locked up and couldn't be moved with the mouse. I had to reboot the computer to regain cursor control. This may be an incompatibility problem with older Macintoshes (mine has the original 64 kbytes of ROM).

The Manuals

The '1278's documentation (two manuals for the '1278, plus another for the Starter Pack) provides most of what you need to get going, but the information included is not as accurate or as easy to find as I would like.

The main manual is basically a TAPR TNC 2 manual with some changes made to account for the differences between the TNC 2 and the '1278. This manual covers only packet-radio operation, and covers it well, with some exceptions. For example, the manual says to type BUFFER plus the message number to load a message into the CW memory keyer, but the actual command is BUF, followed by the message number. There is an example of the correct usage on the next page, but errors like this can be a real headache as you try to learn about a new piece of equipment—particularly one that's as command-intensive as a multimode communications processor.

The main manual is indexed, but information I looked for was often not indexed. A better index would have been very helpful when I was learning to use the '1278.

The supplemental manual, which covers all modes other than packet radio, is only 58 pages long. This manual contains much information, but is noticeably less comprehensive than the main manual. Furthermore, there is no index at all, making it much more difficult to find desired information.

Summary

The MFJ-1278 represents a good value for the money, particularly for those who want to concentrate on VHF packet-radio operation and dabble in other modes. The '1278's FAX and SSTV modes are disappointing curiosities, but performance is acceptable in HF packet radio, AMTOR, ASCII and Baudot RTTY operation. Furthermore, although I feel it's poor at copying CW, the '1278's combination of a CW keyboard and a memory keyer could be of real benefit to many amateurs.

Price class: MFJ-1278, $250; Starter Packs, $25 each. Manufacturer: MFJ Enterprises, Box 494, Mississippi State, MS 39762, tel 601-323-5869.

ALINCO DR-110T 2-METER FM TRANSCEIVER

Reviewed by Kirk Kleinschmidt, NTØZ

If you're in the market for a small, feature-packed 2-meter FM rig that does the job but isn't burdened with too many fancy features, Alinco's new DR-110T may be for you. The '110's small size and 45-W output make it ideal for cost-conscious hams who want the best of today's technology without having to pay for a lot of seldom-used extras.

As for its structural integrity, the '110 is a rugged, solid-feeling radio. A look "under the hood" revealed a neatly laid-out, compartmented chassis and circuits using surface-mount technology.

Features and Controls

The '110 is not a stripped-down, bare-bones rig; it simply has an unintimidating, uncomplicated look about it. Here is a rig that I can relate to. (My last 2-meter FM rig had only a 12-position, rotary channel-selector switch and an AF-gain control!)

The DR-110T features selectable power output (5 or 45 W), a built-in, dual-tone multifrequency (DTMF) encoder/decoder, dual-conversion receiver circuitry, memories, scanning, variable-rate tuning, a microphone with built-in tone pad and up/down tuning keys, and an audio section with plenty of output power (more than 2 watts), among other things. Unlike many current-generation VHF FM rigs, the '110 does not have receiver coverage outside the 2-meter ham band.

Starting with the front panel, here's a rundown of the '110's controls and connectors: tuning knob; VOLume and SQUELch controls; High/Low-power switch; on/off button; microphone connector; Function/Memory write switch; MHz key (used in conjunction with the tuning knob to rapidly move up and down the band); VFO/Memory channel key (the second function of this key, CH.SP, is to select the tuning rate); REVerse shift/display LOCK key; SHIFT key (selects repeater offset); TONE/BEEP key (selects CTCSS tone and enables/disables key-actuation-acknowledgment beep); PRIority key (selects desired priority scanning frequency); SCAN/SKIP key (initiates/stops scanning and designates memory channels to be skipped during memory-scan operation); and the CALL/CALL Write key (designates an often-used frequency). Also on the front panel is the multifunction liquid crystal display (LCD).

The rear panel is dominated by the final amplifier's heat sink. Also present are the power cable and connector, the antenna connector and an external-speaker jack.

The heat sink measures approximately 1.5 × 3.75 × 1.5-inches—not excessively large for a 45-W rig! In fact, the '110 becomes extremely warm after lengthy transmissions (more than 5 minutes). No such heat problems occur during prolonged low-power transmissions.

Using the DR-110T

The DR-110T's manual is a lot like the rig itself—simple and to the point. The manual's 15 pages tell you everything you need to know about the '110's operation and hookup, without a lot of extra or unnecessary information. There's no schematic diagram, but the figures are excellent and easy to understand. Getting the '110 on the air is a snap. Simply connect the antenna, the microphone and a power supply, and you're ready to go.

The rig has variable-rate tuning. A press of the F key, which operates the second functions of many front-panel keys, and then a push of the CH.SP key enables selection of the VFO increment. In this mode, the tuning knob is used to select increments of 5, 10, 12.5, 15, 20 or 25 kHz. Pressing the F key again returns the rig to normal operation.

The rig can now be tuned up and down the band using the newly selected tuning increment. For large frequency excursions, where spinning the tuning knob is impractical, a press of the MHz key allows the tuning knob to operate in 1-MHz steps, facilitating quick frequency changes. Another press of the MHz key returns the rig to normal VFO operation. The '110's tuning knob is conveniently located in the upper-left portion of the front panel; many other small mobile rigs don't have such appropriately placed tuning controls.

The '110 has two built-in repeater shifts: +600 and −600 kHz. It also has the ability to store the transmit and receive frequencies for one nonstandard-offset repeater. Pressing the REVerse key swaps the transmit and receive frequencies, whether in VFO or memory mode.

An often-used simplex or repeater frequency can be programmed into the C (call)

Table 2

Alinco Electronics DR-110T 2-Meter FM Transceiver, serial no. 0000568

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Frequency coverage: 144 to 147.995 MHz.	As specified.
Mode of operation: FM.	As specified.
Frequency display: Not specified.	5-digit LCD, light digits on dark background
Frequency resolution: 2.5 kHz.	As specified.
Frequency accuracy: Not specified.	Indicated frequency, 146.000 MHz; measured frequency 146.0001 MHz.
Power requirements: Receiving, 500 mA; transmit high power, 9.5 A; transmit low power, 4.0 A.	Maximum audio output, 660 mA, transmit high power, 8.25 A; transmit low power, 3 A.
Transmitter	*Transmitter Dynamic Testing*
Power output: Low, approx 5 W; high, 45 W.	Low, 4.7 W; high, 46.5 W.
Spurious signal and harmonic suppression: better than 60 dB.	–74 dBc, See Fig 2.
Receiver	*Receiver Dynamic Testing*
Type: Dual conversion; first IF, 10.7 MHz; second IF, 455 kHz.	
Receiver sensitivity: Better than 0.16 μV for 12-dB SINAD.	0.10 μV for 12-dB SINAD 0.27 μV for 20-dB quieting
Squelch sensitivity: Not specified.	0.01 μV to 0.10 μV.
Receiver audio output: Approx 2 W at 10% distortion (8-Ω load).	2.31 W at 2% total harmonic distortion (THD) with an 8-Ω load.
Color: Black.	
Size (W × H × D): 5.5 × 2.0 × 6.75 inches.	
Weight: 2.64 lb.	

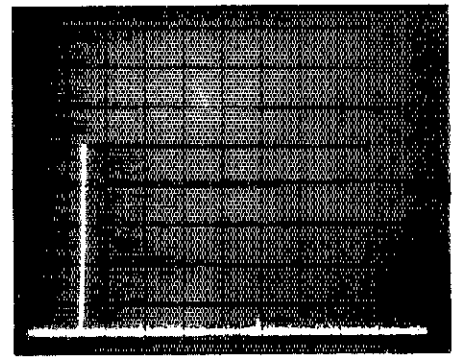


Fig 2—Worst-case spectral display of the Alinco DR-110T. Horizontal divisions are each 100 MHz; vertical divisions are each 10 dB. Output power is approximately 46.5 W at 146 MHz. For this photo, the fundamental was attenuated by 30 dB by means of notch cavities to prevent spectrum-analyzer overload. All harmonics and spurious emissions are at least 74 dB below peak fundamental output (–74 dBc). The DR-110T complies with current FCC specifications for spectral purity.

memory. This frequency, once stored, is available at the touch of the CALL key.

Programming the ten regular memories is done by dialing in the desired frequency with the tuning knob, selecting the appropriate repeater offset and CTCSS tone, if desired, and then pressing the F key. Next, cycle through the available memories (displayed on the LCD). When the desired memory position is located, a press of the MW (memory write) key stores the frequency, offset and CTCSS-tone information in that memory.

The A and B memories are used to store the upper and lower frequency limits for the rig's programmable-scanning feature. Memory D is used to store an independent frequency for a nonstandard-offset repeater.

The power supplied to the DR-110T's memories and microprocessor is backed up by a lithium battery. Estimated battery life is five years. All memory information can be erased by holding in the F and VFO/M keys while momentarily turning off the power switch. (The only time you'd probably need to do this is when replacing the backup battery.)

The '110 can scan any segment of the 2-meter band by entering the upper- and lower-frequency limits into the A and B memories, activating the squelch, and pressing the SCAN key. In this mode, the rig scans upward in frequency until it encounters a signal strong enough to break the squelch. When the signal drops, the rig waits a few seconds and resumes scanning. Scanning can be stopped manually by pressing the microphone PTT switch or the SCAN key.

To activate memory scanning, you must first put the rig in the memory-recall mode, activate the squelch and press the SCAN key. The rig then scans through all programmed memory channels, stopping if it encounters a signal strong enough to break the squelch. You can terminate scanning the same way as in the band-scan mode.

For tone-squelch operation, the '110 can access 37 CTCSS-tone frequencies. Tone selection is done by pressing the VFO/M key to select VFO Mode, and then pressing the TONE key. The CTCSS-tone frequencies are then displayed on the LCD. Rotating the VFO knob or pressing the up/down keys on the microphone cycles through the available tone frequencies. Pressing the PTT switch returns the receiver frequency to the LCD. When selected, the subaudible tone will be transmitted whenever the PTT switch is pressed.

The tone-squelch function keeps the '110 quiet until the proper tone frequency is received. This function is activated by pressing the TONE key. When this is done, ENC (encode) will appear on the display. Another press of the TONE key causes DEC (decode) to appear on the display. In this mode, the '110 will remain squelched until the proper tone in received—just make sure that all of the stations you want to communicate with use the same tone frequency! To disable the tone squelch, press the TONE key again. ENC and DEC will disappear from the display.

Operating Impressions

The DR-110T is a capable 2-meter FM rig. With it, I made many QSOs from my home station and my car (using a Hustler 5/8-wave, mag-mount vertical antenna).

The '110's selectable power output is a nice feature, and its 45-W output makes hitting faraway repeaters easy. The rig got good marks on its transmitted audio quality, and receiver audio sounds okay, although it's a bit muddy. The '110's receiver has enough audio output to overcome road noise and most other distractions. This radio has a top-mounted internal speaker that directs the received audio upward into the passenger compartment, instead of downward, into the carpeting, like too many other mobile rigs.

Learning to use the DR-110T wasn't as easy as I thought it would be. Some of the programming sequences aren't as intuitively obvious as those found on other comparable rigs. The rig is by no means difficult to operate; I simply had to refer to the manual frequently while I was getting acquainted with the rig.

Reading the LCD is easy under all ambient-light conditions; reading the markings on the nine function keys located along the bottom of the front panel is not so easy, however. The light-yellow and -blue markings are difficult to read under even the best of conditions, and tend to disappear during mobile operation.

As shown in Fig 2, the '110's spectral purity is excellent. The rig clearly surpasses the FCC's –60-dBc spectral-purity requirement for 144-MHz transmitters in this power-output class.

Minor inconveniences aside, the DR-110T is a solid-performing rig. For those who want a back-to-basics rig with few fancy features, the '110 packs a lot of performance into a reasonably priced package.

Price class: DR-110T, $360. Manufacturer: Alinco Electronics, 20705 S Western Ave, Suite 104, Torrance, CA 90501, tel 213-618-8616.

Hints and Kinks

Conducted By David Newkirk, AK7M
Assistant Technical Editor

ISOLATED-PAD DRILLS STILL AVAILABLE

☐ The easiest way to rework or to fabricate a single- or double-sided PC board *mechanically* is to use a specially made tool—an *isolated-pad* drill bit—such as those made by the Stahler Co, 5521 Big Oak Dr, San Jose, CA 95129. These bits are available in three ODs; the approximate sizes are 0.109, 0.150 and 0.2225 inch. Used by itself, the isolated-pad bit removes a ring of copper from the board, creating an isolated foil pad. Used in conjunction with a no. 60 or 61 bit, the tool creates an isolated pad with a component-lead hole at its center (see Fig 1).—*Paul Atkins, K2OZ, 56 Ormsay St, Park Ridge, NJ 07656*

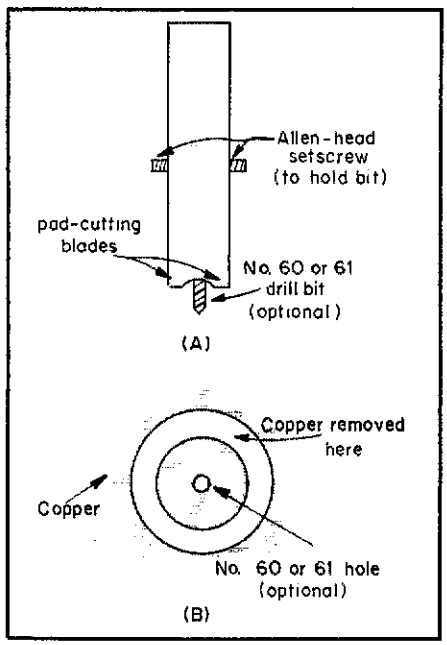


Fig 1—Isolated-pad drill bits (A) create isolated pads in circuit-board foil by removing a ring of foil (B). Isolated-pad construction has previously appeared in *QST*; for example, see Alfred F. Stahler, W6AGX, "Isolated-Pad Circuit-Board Construction," Gimmicks and Gadgets, *QST*, May 1973, p 44. Vector also makes isolated-pad drills; the Vector 138 C is an example.

MORE ON AMPLIFIER TR-RELAY SWITCHING INVERSION

☐ In January 1989 *QST* (pp 37-38), Wilbur Fulton, W2SE, described a means of controlling a Heath® SB-200 amplifier with his Drake TR-5 transceiver. I built Mr Fulton's circuit because I wanted to drive *my* SB-200 with a solid-state rig—a Kenwood TS-940S—and didn't want to damage the 940's amplifier-control transistor.

When I switched on the SB-200 after installing the modification, I immediately heard relay chatter in the SB-200 without even turning the TS-940S on. Troubleshooting did not uncover a wiring or assembly fault, and what I did to solve my problem may prove helpful to other hams who encounter similar relay chatter.

A slight, built-in resistance in the line from J1 (and inside the TS-940S) is enough to cause a voltage drop large enough to trigger Q1 in the W2SE circuit. Merely swapping Q1's 3.3-kΩ base resistor and 22-kΩ emitter resistor raises the stage's input impedance enough to overcome this problem. Now, my modified-SB-200/TS-940S combination works nicely.—*A. F. Constable, N6QNS, 20201 Parthenia St, Canoga Park, CA 91306*

A SWITCH BOX FOR VOICE OR PACKET RADIO

☐ Have you joined the ranks of VHF packeteers? Unless you have a VHF transceiver dedicated to packet-radio operation, you've probably discovered that switching between voice and packet operation is inconvenient because of the different audio feeds necessary for these modes. The simple switch box shown in Fig 2 can allow you to enjoy both modes with a minimum of bother.

J1 must be the same as the connector on the transceiver mic; P1 must mate with the transceiver's microphone connector. I used a male DB9 connector (Radio Shack® no. 276-1537) at P2, TNC. In my installation, J2, AUDIO IN, carries audio obtained from the transceiver's external speaker jack, and J3 carries audio to the external speaker when voice operation is selected. I used a three-pole, double-throw push-button switch at S1; a rotary switch would work fine, too.

Because the switch-box components aren't heavy, I mounted my switch box to the side of the TNC with one of the TNC's cover-mounting screws. With the TNC serving as ballast, the switch box doesn't move when I push S1.

Most recent MF/HF transceivers include rear-panel connections for PTT, AFSK input and audio output. Such auxiliary audio I/O connections need not be disturbed for voice operation. MF/HF transceivers without separate audio I/O connections suitable for digital communications can benefit from the addition of a switch box like that described here.—*Robert L. Dingle, KA4LAU, 657 Dell Ridge Dr, Dayton, OH 45429*

MAKE YOUR HOUSE ANTENNA-READY

☐ If you're constructing a house or remodeling the house you have, consider a simple addition that can make installing antennas—especially attic antennas—easier. Run a length of 2-inch-ID plastic pipe inside a wall from the attic to the basement (or crawl space). Install the pipe so its attic end passes through the top plate; the bottom end of the pipe should pass

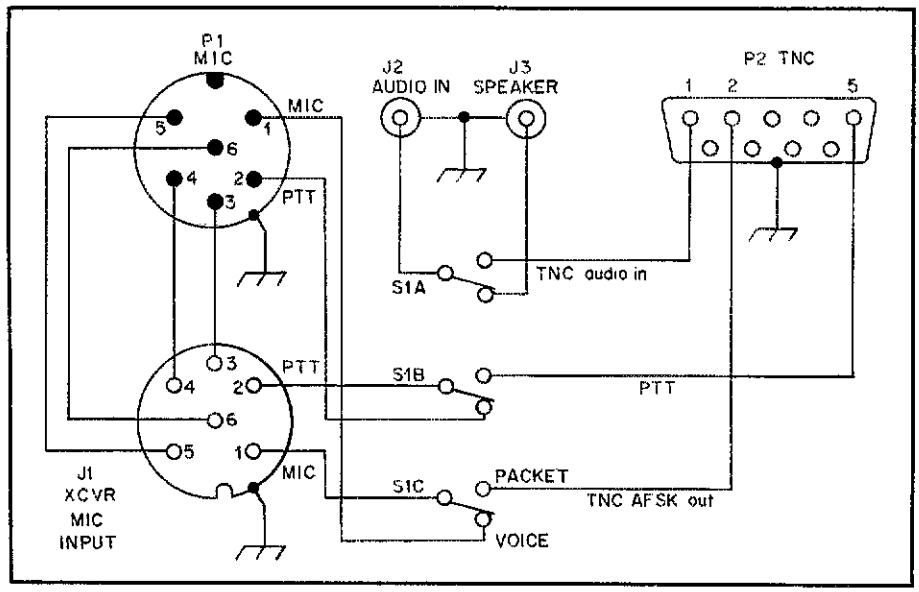


Fig 2—Robert Dingle built this circuit to allow easy switching between voice and packet-radio operation with his VHF transceiver. J1 and P1 complement the mic connectors used on the transceiver; your installation may require connectors of a different type, and pin-number assignments may differ from those shown here. Any microphone-connector lines not affected by packet/voice switch (pins 3, 4 and 6 in this case) should be carried from J1 to P1 to preserve the functions they support. S1 can be a slide or rotary switch. The connector types used at J2, J3 and P2, and the pin assignment at P2, are uncritical and can vary with the connectors available.

through a hole in the soleplate. Use this pipe as a conduit to carry feed lines between your basement operating position and the attic.—*Charles E. Cohn, KK4CS, 6311 Mark Trail, Austell, GA 30001-5126*

IMMUNIZING THE ICOM IC-730 AGAINST HIGH KEY-CONTACT RESISTANCE

☐ The IC-730 is a great no-frills HF transceiver, but it does have one weakness that's important to us old-timers who still insist on using bugs [semiautomatic speed keys —AK7M] for CW work. Because the IC-730's keying-circuit voltage is very low, the rig's RF circuitry is sensitive to the resistance of the closed keying circuit. Reports of missing dots and irregular keying had me burnishing my bug's contacts every other day—or so it seemed—even though the transceiver's sidetone followed my keying faithfully.

An article in July 1982 *QST*[1] addresses the problem of IC-730 keying but doesn't really help the bug user. My good friend Marv Juze, W6FGD, came to my rescue by pointing out that he had cured the same problem by keying his IC-730 with a reed relay. Since implementing this suggestion as shown in Fig 3, I've had no trouble keying my IC-730 properly (any irregularities may be attributed to my Lake Erie swing!). I've since learned that other locals have enjoyed the same success in keying their IC-730s, so it seems worthwhile to spread the word.—*"Uncle Vern" Howard, W6ERS, 733 Plymouth Wy, Burlingame, CA 94010*

[1]D. McClure, "Keying Improvements to the ICOM IC-730," *QST*, Jul 1982, pp 23-27.

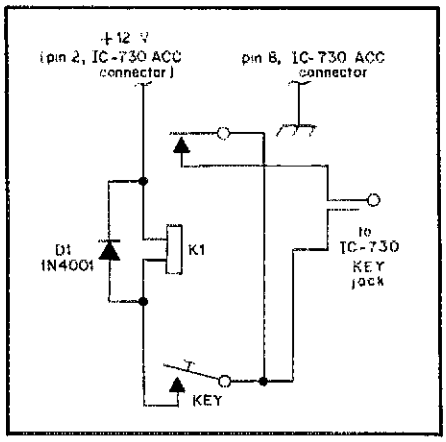


Fig 3—W6ERS overcame the effects of key-contact-resistance-related keying errors by installing a keying relay (K1) between his semiautomatic key and and ICOM IC-730 transceiver. A Radio Shack no. 275-233 12-V reed relay is suitable. Vern didn't mention adding D1 (to clamp the transient that occurs when the key opens and K1's magnetic field collapses), but Hints and Kinks recommends it.

CHARACTERIZING DIODES AT LOW APPLIED VOLTAGES

☐ For many years, the *ARRL Handbook* has featured a diode probe suitable for measuring RF voltages down to the millivolt level. The accuracy and sensitivity of such probes has been the subject of prior investigations in Hints and Kinks;[2] generally, however, it's safe to say that the sensitivity of such probes is determined by the junction-barrier voltage of the probe diode. The lower the junction-barrier voltage, the higher the probe sensitivity.

From the standpoint of RF probe sensitivity, germanium diodes are better than silicon diodes for the *Handbook* RF probe because the barrier voltage of a germanium PN junction (about 0.3) is lower than that of its silicon counterpart (0.7). Because junction-barrier voltage may vary from unit to unit among diodes of a given type, it's worthwhile to grade prospective probe diodes in terms of barrier voltage. Diodes intended to be used in RF probes should be tested at an applied voltage much lower than the junction-barrier voltage. This is so because low-level RF measurements depend on the occurrence of diode conduction at applied voltages in the millivolt region. (*Some* forward current flows through a diode at applied voltages somewhat below the junction-barrier level; how much current flows at a given applied voltage varies from diode to diode.) Fig 4 shows a simple means of characterizing diodes at applied voltages of this magnitude.

To characterize a diode at a forward current of 0.1 μA (for example), set the voltmeter (in my case, an FETVOM) to read 10 mV at full scale, install a 100-kΩ resistor at R_{SH}, and adjust the power supply to indicate 10 mV on the voltmeter. (According to Ohm's Law [I = E ÷ R], the diode current is 0.1 μA [0.01 V divided by 100 kΩ].) To find the forward voltage

[2]See S. Mann, "Match Your RF Probe to Your Meter," Hints and Kinks, *QST*, May 1985, pp 44-45, and G. Hardman, F. Swan and J. Kronvich, "RF Probes Revisited," Hints and Kinks, *QST*, Mar 1986, pp 47-48. The three pieces that constitute "RF Probes Revisited" also appear on pp 7-7 and 7-8 of the 12th (current) edition of *Hints and Kinks for the Radio Amateur*, available from your dealer and ARRL HQ.

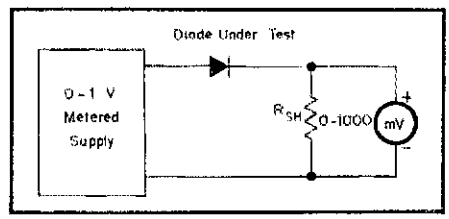


Fig 4—George Klaus characterizes diodes below their junction-barrier potential with this setup. The power supply must be capable of stable, voltage-metered output from 0 to 1 V or so. See text.

Table 1
Two Diodes Compared

Forward Current (μA)	Test Voltage (mV) 1N270	1N914	R_{SH} (Ω)
1000	380	814	10
100	202	625	100
10	122	538	1 k
1	60	470	10 k
0.1	15	405	100 k
0.01	1.2	340	1 M
0.001	0	271	open
0.0001	0	235	open

at which the diode conducts the calculated current, subtract the voltage drop across R_{SH} (10 mV in this case) from the voltage indicated on the power-supply voltmeter. Table 1 lists the results of tests on one 1N914 (silicon) diode and one 1N270 (germanium) diode. Similar comparisons among germanium diodes can be made to find the best diode for an RF probe, or to match diodes for special purposes.—*George H. Klaus, W2CJN, 140 Mill Dam Rd, Box T, Centerport, NY 11721-0619*

SOLVING GROUND-FAULT-CIRCUIT-INTERRUPTER RFI

☐ Here's an interference conundrum: My 35-watt CW transceiver tripped the ground-fault circuit interrupter (GFCI) at my house's service entrance panel. My half-wavelength, 7-MHz dipole is mounted at one end of the house; the GFCI, at the opposite end of the house, protects two bathrooms and three outdoor outlets. The transceiver, which has a three-wire power cord, is also grounded via a rod at the back of the house. The shield of the antenna feed line (RG-8) is also grounded where it enters the house.

The SWR on the dipole feed line was lower than 1.5:1 when the GFCI tripped. With a 50-Ω dummy antenna installed in place of the dipole, the GFCI did not trip. On the strength of this dummy-load test, I first assumed that RF energy was being radiated directly into the GFCI. But before undertaking the difficult job of shielding the GFCI, I tried running the transceiver on an isolation transformer instead of plugging it directly into the ac mains. *This cured the problem.*[3] The isolation transformer was a bit bulky, however, so I replaced it

[3]An isolation transformer is a transformer intended for use between the ac mains and a device containing a "transformerless" power supply. Usually, isolation transformers do not transform one voltage to another; instead, they provide current limiting and isolate the powered device from the mains by breaking the direct wire connection between the mains and the powered device. Apparently, Warren's installation of an isolation transformer cured this case of mains-conducted GFCI because of the inefficiency of the isolation transformer at HF—especially its inefficiency in transmitting *common-mode* HF energy.—*AK7M*

with a Radio Shack ac interference filter (no. 15-1111). The filter seems to suppress the interference as well as the isolation transformer did.

My tentative conclusion: Under conditions of other than a near-perfect match between the RF load and feed line, enough reflected RF energy was getting back through the house wiring to the service panel to cause the GFCI to trip. Although I've solved the problem, I have not done much work on determining the exact mechanism of RF interaction with the GFCI circuit. I hope that *QST* readers with experience in solving ground-fault-circuit-interrupter RFI will respond with their views and experiences. Why did this problem come up? Is there a better solution?—*Warren Jochem, WB2IPF/4, 1118 Braenar Ct, Cary, NC 27511*

CURING THERMAL DRIFT IN THE HEATHKIT HW-99 TRANSCEIVER

☐ I am a new ham, and my station includes an HW-99 transceiver. As noted in *QST*'s review of the HW-99,[4] this transceiver has a frequency-stability problem. This bothered me because I like to go on the air at the spur of the moment: I don't always have time to let the transceiver warm up for an hour!

I looked into the problem and realized that the can holding the parts that control the HW-99's frequency is awfully close to the pilot lamp—and that lamp gets quite hot. Removing the pilot lamp solved the drift problem. I thought I'd share this hint with you in case other readers who've encountered this HW-99 stability problem might like to try a simple solution.—*Nancy Kott, KB8FAY, PO Box 47, Hadley, MI 48440-0047*

QUIETING EQUIPMENT FANS—REVISITED

☐ Mort Slavin's "Quieting Equipment Fans by Series Wiring" (*QST*, May 1988, p 41) touches on a subject of interest to many radio amateurs because "bargain" fans purchased by hams at flea markets may run too fast, or too loudly, to be useful. Mr. Slavin's method requires the presence of two fans; how can *one* fan be slowed effectively?

Fan noise is related to the physical design and integrity of the fan in addition to its rate of rotation. Vibration from worn-out bearings—quite common in used or surplus fans—can cause considerable noise if it is conducted to the enclosure (if any) in which the fan and associated equipment are housed. If the enclosure happens to resonate at the fan's vibration frequency, this noise can be severe. Slowing a fan makes the fan run quieter by reducing blade turbulence and lowering the frequency of the fan's vibration(s).

Continuous operation of a fan below its design speed may be harmful to the fan in the long run, however. This is so because the fan is designed to cool itself in addition to the equipment associated with it. Slowed, a fan may be undercooled by its own air flow and run hot, especially at high ambient air temperatures.

An appropriate compromise to the conflicting problems of fan noise and insufficient fan cooling is to link fan speed and air temperature. The simplest means of achieving this is a resistor in series with the fan, *with a thermostat in parallel with the resistor.* Choose a thermostat that (1) operates at the desired temperature; (2) closes with rising temperature; and (3) is capable of switching the fan power supply. Properly installed, such a thermostat will allow the fan to run at full speed to cool itself and its associated equipment above its trigger temperature; at air temperatures lower than this, the thermostat will open to allow the series resistor to slow (and quiet) the fan.

A series resistor is an inefficient means of slowing a cooling fan, however, because it dissipates power as heat. An ac-rated *capacitor* of sufficient reactance to slow the fan to the desired speed—*and* capable of safely handling the fan current—is a better solution. Fig 5 shows how a fan-slowing capacitor can be applied in conjunction with a thermostat.

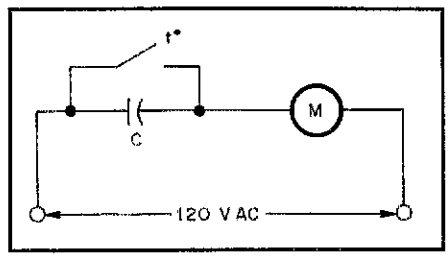


Fig 5—Joachim Wollweber suggests using a series capacitor, C, instead of a resistor to slow and quiet ac powered fans. A thermostatic switch can be added to achieve a workable compromise between fan noise, fan life and equipment cooling; see text.

The capacitance required depends upon the characteristics and power consumption of the fan motor. Insufficient capacitance will keep the motor from starting; too much capacitance will allow the motor to reach its normal (noisy) speed. The proper value can be determined by installing insufficient capacitance to start the fan. Increase the value of this capacitance until the fan starts. [Safety first: Be sure to disconnect the fan circuit from the ac supply before adjusting the slowing capacitance.—*AK7M*]

Once you have determined the value of the fan-slowing capacitor, experiment to find the best location for the thermostat. Positioning the thermostat as closely as possible to the heat source should allow the thermostat to respond quickly to temperature variations at the heat source. A thermostat that actuates at a temperature somewhat lower than the target temperature may be of use in achieving this aim.—*Joachim Wollweber, DF5PY, Schillerplatz 18 A, 6500 Mainz, West Germany*

A SUBSTITUTE FOR SPADE BOLTS

☐ Unable to find a source of spade bolts, I devised the fastener shown at Fig 6. It works well, but I'm still on the lookout for a small-quantity source of spade bolts!—*William L. Fleming, WA9VPU, 5315 Wiley Ave, Indianapolis, IN 46226*

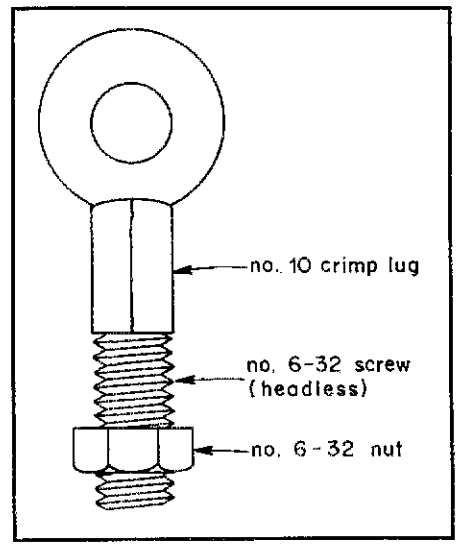


Fig 6—Bill Fleming uses a no. 10 crimp lug and a headless no. 6-32 screw in place of a spade lug. The nut secures the lug to the mounted surface; not shown is the hardware necessary to secure the crimp lug to the mounted object.

Strays

I would like to get in touch with...

☐ any ham who is also a member of the Fraternal Order of Police. Please give your lodge number, location and whether you're a police officer or an associate member. Richard Silverman, K8NKB, 15216, W 9 Mile Rd, Oak Park, MI 48237.

[4]C. and E. Holsopple, "Heath HW-99 Novice CW Transceiver," Product Review, *QST*, Mar 1986, pp 43-45

Technical Correspondence

Conducted By Paul K. Pagel, N1FB
Associate Technical Editor

HIGH-POWER OPERATION WITH THE TANDEM MATCH DIRECTIONAL COUPLER

☐ In January 1987 *QST*, John Grebenkemper, K16WX, described a wattmeter that he calls the Tandem Match.[1] In April 1988 *QST*, Zack Lau, KH6CP, described a directional-coupler circuit based on the same principle as Grebenkemper's circuit—that he uses in a QRP transceiver.[2] The main advantage of Lau's circuit is a very low parts count.

This directional-coupler circuit has several advantages over the more-common Bruene directional coupler:[3] It is simpler to build, requires fewer parts and is self-balancing. Also, compensating/balancing capacitors are not needed at the input and output of the coupler. (These capacitors are required in the Bruene circuit to achieve deep nulls for accurate 50-Ω reflected-power measurement.)

In his article, Grebenkemper also described a complex log-antilog amplifier for use with the directional-coupler circuit to provide good measurement accuracy. I wanted to get away from this complex circuit, but still retain reasonable measurement accuracy over the 1- to 1500-W range. I was also willing to forfeit the SWR-computation feature.

The coupler described by Zack Lau uses ferrite toroids. Therein lies a major problem: This coupler works great at low power levels; but with high power, the ferrite toroids heat excessively, causing erratic meter readings and the potential for burned parts.

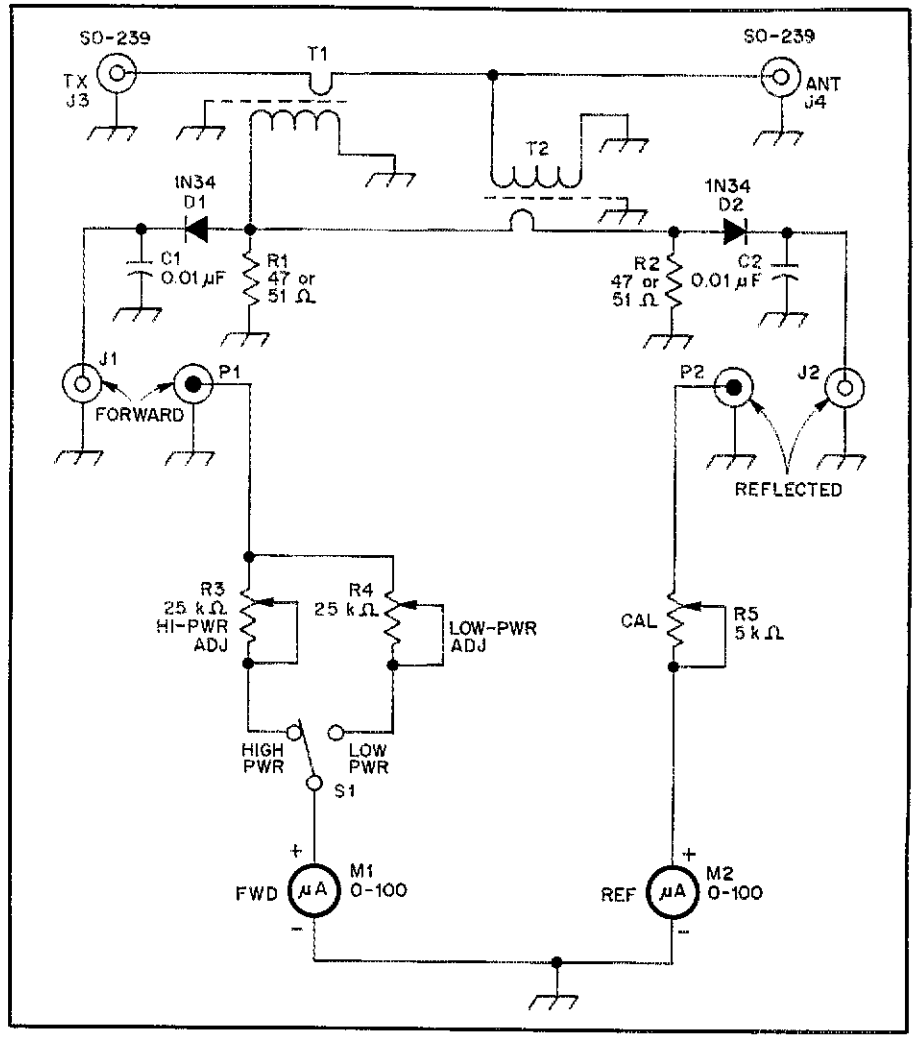


Fig 1—Schematic diagram of the high-power directional coupler. D1 and D2 are germanium diodes (1N34 or equiv). R1 and R2 are 47- or 51-Ω, ½-W resistors. C1 and C2 have 500-V ratings. The secondary windings of T1 and T2 each consist of 40 turns of no. 26 to 30 enameled wire on T-68-2 powdered-iron toroid cores. If the coupler is built into an existing antenna tuner, T1's primary can be part of the tuner's coaxial output line. The remotely located meters (M1 and M2) are connected to the coupler box at J1 and J2 via P1 and P2.

The Revised Design

To solve the problems caused by using ferrite toroids at high power levels, I used powdered-iron toroids for the pickup transformers in my version of Zack Lau's basic circuit. The number of turns of wire on the powdered-iron toroid is increased to compensate for the lower permeability of the powdered iron. Increasing the number of secondary turns on these transformers ensures that the windings have a high enough impedance to operate properly on 160 and 80 meters, and do not short circuit the high-power signal path.

I decided to use two meters, one for forward power and one for reflected power, each using the same scales. For this purpose, I bought two 100-µA meters[4] with scales that were already calibrated for 0 to 150 W and 0 to 1500 W. See Fig 1. The outputs from germanium (1N34) detector diodes D1 and D2 provide fairly accurate meter readings, particularly if the meter is calibrated to coincide with the transmitter power output (using R3, R4 and R5) at midscale meter readings. If the winding sense of the turns of the toroidal transformers is reversed, the meter readings are also reversed (the forward-power meter becomes the reflected-power meter, and vice versa).

Construction

Fig 2 shows the physical layout of the coupler. The pickup unit is mounted in a 3.5 × 3.5 × 4-inch box, and the meters, PC-mount potentiometers and HIGH/LOW power switch are mounted in a separate box or a compartment in an antenna tuner. Parts for this project are available from the suppliers listed in Table 1.

The pickup transformers are wound on T-68-2 powdered-iron toroid cores. The secondary windings consist of 40 turns (per core) of no. 26 to 30 enameled wire. Spread the turns evenly around each core. The transformers are each mounted on short sections of RG-8 coaxial cable, which act as the primary windings of the transformers. The RG-8 leads use electrostatic Faraday shields that are grounded at one end only. (The shield is simply the copper braid of the coax, appropriately trimmed to suit this need). The shield is wrapped with fiberglass tape.[5] An excellent alternative to fiberglass tape—with even higher

Table 1

Parts Suppliers

Amidon Associates, 12033 Otsego St, North Hollywood, CA 91607 (toroid cores, fiberglass tape).

Fair Radio Sales, PO Box 1105, Lima, OH 45802 (meters).

Palomar Engineers, PO Box 455, Escondido, CA 92025 (toroid cores).

Radio Shack® stores (misc parts).

RADIOKIT, PO Box 973, Pelham, NH 03076 (misc parts, toroid cores).

Surplus Sales of Nebraska, 1315 Jones St, Omaha, NE 68102 (0-150/1500-W-scale meters, A&M model no. 255-138, approx $10 each).

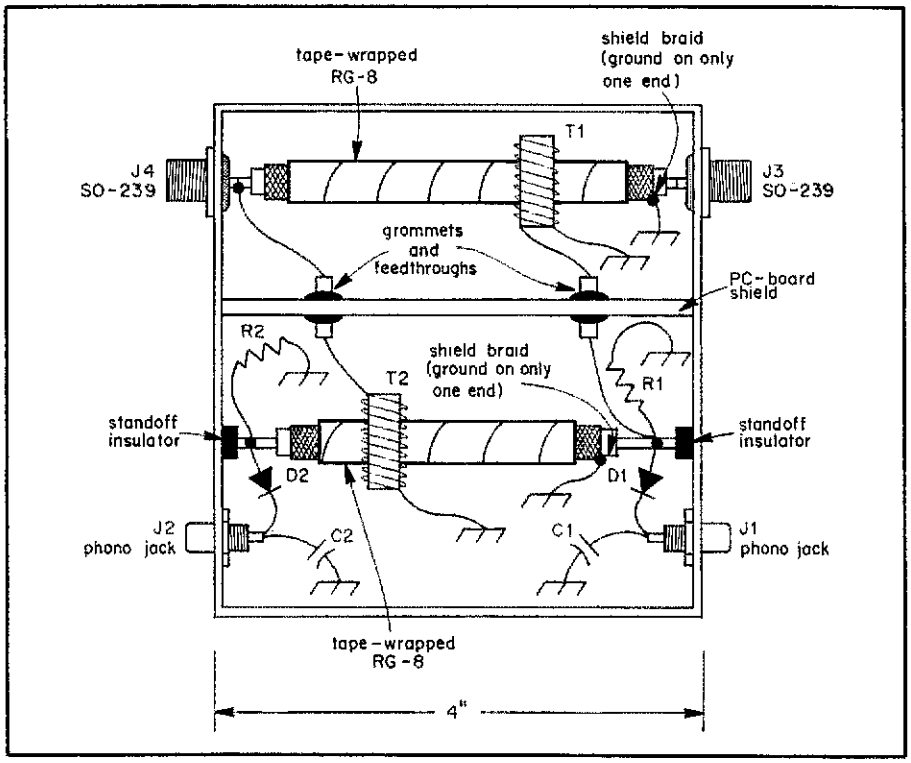


Fig 2—Directional-coupler construction details. Grommets or standoff insulators can be used to route the secondary windings of T1 and T2 through the PC-board shield. A 3.5 × 3.5 × 4-inch box serves as the enclosure.

RF voltage-breakdown characteristics—is ordinary plumber's Teflon® pipe tape, available at most hardware stores.

By using no. 26 to 30 wire on the cores, the cores slip over the tape-wrapped RG-8 lines. With no. 26 wire on the toroids, a single layer of tape (slightly more with Teflon tape) over the Faraday shield provides an extremely snug fit for the core. Use care in fitting the cores onto the RG-8 assemblies. See Fig 2 for guidance.

The primary winding for T1 is a 3½-inch length of RG-8. This lead carries the high-power RF from the input to the output of the pickup box. The RG-8 is stripped of its outer insulation and part of its shield braid. A section is cut out of the cable dielectric to expose the inner conductor where one end of T2's multiturn winding is connected. This connection can be made at J4, if it is convenient to do so.

A length of the shield braid is left on the coax. Solder a ground lug to one end of a short piece of tinned no. 22 copper wire. Then, wrap the other end of this wire around the braid of the coax, and solder the connection. The Faraday shield formed by the remaining braid is then wrapped with a layer of fiberglass or Teflon tape, and the toroid core, T1, is slipped over it. The ends are then soldered to coaxial jacks J3 and J4. If the coupler is mounted in an existing antenna tuner, T1's primary can be the output coaxial cable in the tuner, and you don't need to add jacks at J3 and J4.

Mount a PC-board shield in the center of the box between T1 and T2 to minimize coupling between the transformers. T2 is mounted similarly to T1. T2's primary is made of a piece of RG-8 suspended at each end by standoff insulators. T2's core is mounted over a tape-wrapped electrostatic shield that is grounded at one end. After the toroids are mounted on the RG-8 sections, they can be coated with polystyrene Q-dope, or a spot or two of RTV sealant to hold the windings in place on the core and to hold the cores to the RG-8 primary windings.

Tune Up and Operation

The coupler has excellent directionality. The meters can be calibrated for various power levels by using an RF ammeter in series with a 50-Ω dummy load. Calculate I^2R for each power level, and mark the meter faces accordingly. R3, R4 and R5 can be used to adjust the meter readings within the ranges. Nonlinearities in the diodes are thus taken into account, and the signal-processing amplifier circuit of the January 1987 article is not needed for relatively accurate power readings.

The coupler circuit and physical configuration are reliable. Start the tune-up process using about 10 W, adjust the antenna tuner for a 1:1 SWR (no reflected power), and increase power while adjusting the tuner to maintain minimum reflected power. I made up a tune-up chart for each of my antennas to make initial tune up easy, quick and safe.

I built the circuit described here into several antenna tuners with good success. I tested the bridge on 160 meters at 1.5-kW output, and it worked well. On the 80- through 10-meter bands, I used between 1.2- and 1.5-kW output, and the circuit worked fine. I could easily tune the antenna for a 1:1 SWR using the null indication provided.

The wattmeter's null readings that corresponded to amplifier-tuning settings for a 50-Ω output, as confirmed by a 50-Ω dummy load, were in close agreement. Checks with a Palomar noise bridge and a Heath® Antenna Scope also verified these findings. This circuit should handle more than 1.5 kW, *as long as the SWR on the feed line through the wattmeter is kept at or near 1:1.*

The only problem I encountered occurred on one occasion when the antenna tuner was not coupled to a load. Naturally, the SWR was extremely high, and the output transformer's secondary winding opened like a fuse when transmitter power was applied. This happened because of the excessively high voltage coupled into T2's secondary winding from the primary line. This damage was easily and quickly repaired.—*Frank Van Zant, KL7IBA, 2424 Virgo Dr, Colorado Springs, CO 80906*

Notes

[1]J. Grebenkemper, "The Tandem Match: An Accurate Directional Wattmeter," *QST*, Jan 1987, pp 18-26.

[2]C. Hutchinson and Z. Lau, "Improving the HW-9 Transceiver," *QST*, Apr 1988, pp 27-29.

[3]W. Bruene, "An Inside Picture of Directional Wattmeters," *QST*, Apr 1959.

[4]I purchased them from Surplus Sales of Nebraska; see Table 1.

[5]Available from Amidon Associates; see Table 1.

Note: All correspondence addressed to this column should bear the name, call sign and complete address of the sender. Please include a daytime telephone number at which you may be reached if necessary.

ARRL Pleads Case for 220 MHz at Congressional Hearing

It's far from over . . . a government oversight hearing gives the fight a tremendous shot in the arm.

By ARRL Staff

ARRL representatives testified in a three-hour hearing of the Government Information, Justice and Agriculture Subcommittee of the House Committee on Government Operations on May 11. Appearing in a room packed with amateurs and press, the ARRL panel and a witness speaking on behalf of the Secretary of Defense objected to the procedures followed by the FCC in deciding to terminate access by radio amateurs to the frequencies between 220 and 222 MHz (FCC General Docket 87-14).

In his opening statement, Subcommittee Chairman Bob Wise of West Virginia noted that Amateur Radio operators provide a much-needed service. He observed, "Much is made nowadays of the lack of 'volunteerism' in our country, and a call has been made for our citizens to renew their commitment to making our country a place where 'a thousand points of light' focus each other's attention on how we can help one another in times of emergency and need. If we consistently frustrate those who are willing to give of themselves, their time and their resources in the form of vital public services—especially when this is done without compensation—how can we hope to increase this volunteerism?"

ARRL West Virginia Section Manager Karl Thompson, K8KT, led the testimony by stressing the volunteer nature of Amateur Radio emergency communications and particularly its significance in his state. He underlined the importance of the threatened band segment to repeater linking and packet-radio development.

ARRL Executive Vice President David Sumner, K1ZZ, testified that the process used by the FCC in deciding to reallocate the bottom two MHz of the 220-MHz band to Land Mobile use had failed to take into account the comments of individual amateurs. These comments had documented the band segment's importance to public-service and experimental communication, and the great cost to amateurs and to the public if these operations had to be moved elsewhere or abandoned for lack of frequency space. He cited alternatives to the reallocation which had not been adequately considered in the proceeding.

Chairman of the Los Angeles County Emergency Public Information Advisory Group Richard Rudman, W6TIA, described the crowded conditions in Southern California in the entire 220-MHz band and the tremendous impact the FCC decision has had on packet-radio development. He stressed the importance of Amateur Radio in emergency planning for such major catastrophes as earthquakes.

FCC Chief Engineer Dr Thomas P. Stanley made a prepared statement next. Dr Stanley spoke of the need for narrowband land mobile systems in the 220-MHz spectrum, stating that the FCC had been presented with petitions seeking to implement the international allocation for the Mobile Service in the band in order to develop spectrum efficient technology. The Chief Engineer went on to say that "current narrowband technology allows up to five communication channels to occupy the same spectrum taken up by one channel today." He continued with a explanation of the background of 87-14 and the basis for the allocation decision. He said the Commission carefully weighed the impact of its action on the amateur service, noting the aspects of public service and contributions to the field of radio science. He added that growth in the Amateur Service

The hearing turned out to be a big production, complete with TV cameras, a full press table and approximately 75 people in the audience. *(photos Cameron Communications)*

Subcommittee Chairman Bob Wise (center), a Democrat from West Virginia, presided over the hearing. His opening statement was extremely supportive of Amateur Radio and its role in emergency communications. Rep Wise's father was WA8AYP. Subcommittee Staff Director Lee Godown and Counsel Audrey Bashkin flank Mr Wise.

Opening Statement of Chairman Bob Wise

This morning the subcommittee meets to review the August, 1988 Federal Communications Commission decision to terminate the access of amateur (or "ham") radio licenses to the 220-222 megahertz frequency band.

Our particular interest this morning is in the process the FCC followed in their rule making action. While we need to support the continuing advance of technology and what this will mean for the betterment of radio communication in the years to come, we need to make sure that we do not take giant steps forward only to trip over our own feet in the process. We need to make certain that the allocation of radio frequencies is done in such a manner so as to foster efficiency. We also need to make sure that all parties that might be impacted by these orders have a chance to be heard, and that the finite resource that is the radio frequency spectrum is well managed.

Today we want to investigate why the FCC feels that this band is underutilized by amateurs, and why this action will not impact our nation's emergency communications system negatively. Why is this the most appropriate band for reallocation to Land Mobile Service? Why was there no mention in the FCC's Report and Order of the 5000 comments of ham operators in opposition to this move? Was compromise considered? These are only some of the questions we need answers to this morning.

Much is made nowadays of the lack of "volunteerism" in our country, and a call has been made for our citizens to renew their commitment to making our country a place where "a thousand points of light" focus each other's attention on how we can help one another in times of emergency and need. If we consistently frustrate those who are willing to give of themselves, their time and their resources in the form of vital public services—especially when this is done without compensation—how can we hope to increase this volunteerism?

My father, who was a ham radio operator himself, taught me that Amateur Radio operators provide a much needed service to our country. They are there, day and night, to respond to all sorts of emergencies—natural and otherwise—and keep assistance flowing to those in need. There are 440,000 radio amateurs in our country—3200 in my own state of West Virginia alone.

We will hear this morning from the American Radio Relay League, the FCC itself, the Department of Defense/National Communications System, and the United Parcel Service. These witnesses are interested in this issue from a variety of viewpoints, and it is our hope that we will gain some sense of whether or not this action will help—or hurt—radio communications.

West Virginia Section Manager Karl Thompson, K8KT (right), led off ARRL panel testimony by focusing on the volunteer nature of amateur emergency communications. The components of a portable packet station were on display near the microphones, and he described how one worked in basic terms. Richard Rudman, W6TIA (left), chairman of the Los Angeles County Emergency Public Information Advisory Group, concentrated on the importance of Amateur Radio in emergency planning, on how crowded the entire 220-MHz band was in Southern California and on the need for the 220-222 MHz segment to support high-speed intercity packet links. League witnesses, along with Washington Area Coordinator Perry Williams, W1UED, and League Counsel Chris Imlay, N3AKD, spent the day before the hearing preparing their presentations with the help of Congressional relations consultants John Chwat and Rob Weigend.

ARRL EVP David Sumner, K1ZZ (right), concentrated on the damage done to the volunteer sector by FCC errors in procedure and judgment. He discussed the significance of the band as an international primary allocation. He stated that the FCC had relied on information from the *Repeater Directory*, ignored explanations of what the ARRL's material meant, overstated the efficiency of narrowband modes and had not cited a single comment from an individual in its Report and Order. West Virginia SM Karl Thompson, K8KT (left), listens to the testimony.

had been stable and the amateur bands between 28 and 1300 MHz provided hams with 128.7 MHz of spectrum, and the Commission concluded that the loss of 2 MHz should have little impact.

Rep Wise then established that two out of the three petitions the FCC used as the basis for starting this proceeding didn't request 220-222 MHz, and one specifically requested that amateurs not be affected. He established that the FCC had no monitoring surveys for the 220 band, and they had not relied on a survey they did have, of the 800-MHz Land Mobile allocation, which showed two-thirds of the channels unoccupied.

In responding to questions about why the FCC relied on the *Repeater Directory*, Dr Stanley said repeatedly that it was the "best evidence" of "physical facilities" [actual stations] and was forced to concede that in the largest urban areas there is a congestion problem in the band, but added "additional efficiencies could be implemented." He acknowledged that if he were a ham, he would be unhappy too, since there had been a long-standing "com-

Opening Statement of Congresswoman Louise M. Slaughter

Mr. Chairman, thank you for the opportunity to examine the Federal Communication Commission's decision to reallocate the 220-222 megahertz range from a shared use by amateur, radiolocation, fixed and mobile services to exclusive use by Land Mobile Service.

Under the Communications Act of 1934, the FCC was created

"to make available, so far as possible, to all the people of the United States a rapid, efficient, nationwide, and worldwide wire and radio communication service with adequate facilities at reasonable charges for the purpose of national defense, [and] for the purpose of promoting safety of life and property . . ."

Today's hearing is to explore whether the Commission has fulfilled its mission in making this reallocation decision.

Today's witnesses and their positions reflect the increasingly difficult problems the Commission will face as communications technology advances and more and more demands are made for access to the electromagnetic spectrum.

One of the stated purposes of federal regulation is to promote the safety of life and property. I am very pleased to have this opportunity to thank representatives of ham radio operators for the invaluable services they provide in emergencies of all kinds. I have worked closely with the western New York members of the Relay League and have seen firsthand their extraordinary service to the public. We must ensure that hams can continue to perform this vital function.

Protecting the national defense is another explicit charge to the Commission and I believe that the Defense Department's concerns about damage to the National Communications System, amateur technological innovation, and its own radar and radiolocation programs should have been given considerable weight in the FCC's deliberation.

These concerns must be weighed against the demands of developing technologies and their ability to allow American companies to remain on the cutting edge and maintain their competitiveness. Today's innovative technologies could not have been anticipated when frequency allocation decisions were made 40, 30, or even 10 years ago. Unless the United States is willing to risk being left behind in this communications revolution, the FCC will continue to be faced by enormously difficult decisions between competing interest groups which all have legitimate claims on this national resource.

As these decisions become increasingly difficult, it is essential that they be made in a fair and unbiased manner. All parties must be treated equally and their arguments given careful consideration. Mr. Chairman, thank you for your leadership in calling today's hearing so that we can learn more about how this decision was made and ensure that all interests received a fair hearing.

fortable relationship" with radar and that under the circumstances, "secondary status was a good thing to have." Dr Stanley also said that the value of the band to amateurs would be "substantially reduced" by going from 5 MHz secondary to 3 MHz primary. When asked what guarantees amateurs had that the band would not be further reduced in the future, Dr Stanley said he "would want to give amateurs fairly strong assurance" of that. Chairman Wise then drew an analogy to treaties with Indians: "If you move to that reservation, you'll never have to move again."

When asked what it would cost to move a repeater to a new frequency pair, FCC Branch Chief Julius Knapp said it would be "about $20 for new crystals." This remark set off some murmuring in the audience. Chairman Wise established through questioning that Knapp was not an amateur and had no experience in changing frequencies of repeaters. He then produced a comment filed from an individual stating it would cost from $900 to $1100—one of thousands of individual comments that had not been addressed in the Commission's Report and Order, and apparently had not been considered.

Chairman Wise then asked Dr Stanley why the FCC gave UPS months to file late, then would not grant a request from an individual for additional time to comment on the UPS filing. Dr Stanley said that despite the denial of the extension of time, the FCC had not turned away a single piece of information submitted. Chairman Wise asked how amateurs could know that; Dr Stanley said amateurs must have known, because the comments kept coming in.

United Parcel Service Strategic Planning Manager Gene Hughes delivered a statement citing UPS's 55,000 delivery vans, 10,000 trailer trucks, 12 million packages delivered per day and their business plan to overcome a lack of computerized routing. He said the reason they had not participated in the proceeding earlier was that they did not know about it; they had developed their telecommunications requirement in late 1987. In response to a question about what it would cost UPS if the FCC reversed its decision, Hughes said there would be some cost of a change to a new band, but the cost would be minimal to an adjacent band. He said UPS had spent $20 million buying companies to get access to the technology they needed, another $3 million on narrow-band technology, and it was costing them $100,000 a month while the proceeding continued. In response to a question, he said that the FCC did not solicit a filing from UPS. He said UPS had no plans to sell its technology to others, but that they might do so if no one else did.

The final witness was Dr Dennis Bodson, Assistant Manager, Standards and Technology, National Communications System (NCS), who appeared on behalf of the Secretary of Defense. Dr Bodson said that the Department of Defense had the right to represent itself in FCC proceedings and had chosen to exercise that right in this proceeding. He also put a copy of the ARRL/NCS Memorandum of Understanding into the record. He chided the FCC for not dealing with the substance of the DOD/NCS filing in its Report and Order.

In his comments about possible alternatives, ARRL EVP Sumner had pointed to the map showing the relatively small impact of the Inland Waterways Communications System (WATERCOM) and said that "amateurs would be glad to have to have use" of 216-220 MHz. In response to a question, Dr Bodson said as long as such an allocation was secondary, he could see no basis for an objection from the Department of Defense.

Other members of the Subcommittee present for all or part of the hearing were Reps Glenn English (D-OK 6th), Edolphus Towns (D-NY 11th), Louise M. Slaughter (D-NY 30th), and Al McCandless (R-CA 37th).

Following the hearing, David Sumner commented: "In a number of ways, the FCC responses to the Subcommittee's questions contrast sharply with what was said last August when the Report and Order was adopted. Until now, the Commission did not seem to understand the great impact its decision would have on Amateur Radio. Now that this is clearly established in the public record, perhaps it's not too late for the Commission to have a change of heart. We deeply appreciate the efforts of the Subcommittee, and particularly Chairman Bob Wise, which led to this hearing."

The ARRL, the Secretary of Defense, and some 550 Amateur Radio clubs and individual licensees have filed petitions for reconsideration with the FCC. Action on these petitions is pending.

The Subcommittee will be reviewing the record of the hearing to determine if further action is appropriate.

The Case for Code

By Rick Booth, KM1G
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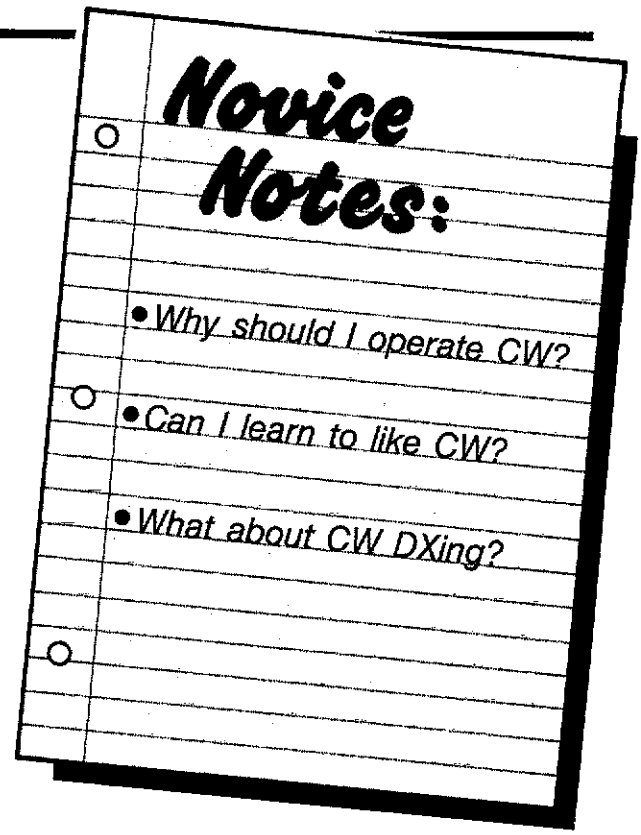


In case you've been asleep lately, 10 meters hasn't. It's been hot, and you can expect it to get hotter. That's big news, since Novices now enjoy 10-meter SSB along with their HF code privileges. The advent of HF phone for Novices might tempt you to leave CW.

Think About It

Whether you're good at code or not, whether you like it or not, you might want to ponder that decision for a minute. At least for the few minutes it will take you to read these words—*especially* if you're a person of modest means.

You've probably heard signals on 10 that knock your headphones off. Don't forget, the same conditions that open 10 make 15 and 20 jump, too. That's something you'll want to think about before letting your CW skills get rusty. My own experience may illustrate.

I've had a tower and beam. Someday I may move back to Connecticut, where the tower and beam are (I hope) still waiting. But in the meantime, I'm running wire antennas, and working DX lately made me think back about five years to when I'd just passed my General.

Like countless hams before me in the days before Volunteer Examiners, I took my General class test in the FCC offices on Varick Street in Manhattan. I couldn't wait for the train to get home so I could jump on the phone bands with my new privileges. Time of day made me pick 75 meters, where I made a few contacts, then went happily to bed dreaming of the times to come when I'd work CW only when I *wanted* to.

Not the End of CW

Alas, life on the bands isn't always what we expect. In that respect, ham radio mirrors the life at large of which it is a part. I didn't know it yet, but my CW days were far from over. In fact, events I couldn't foresee were to put me on the road to higher speed. It was a road that eventually led to Extra Class.

Our bedroom was directly under the radio shack. That virtually wiped out early morning or late-night SSB. Headphones don't dampen an *outgoing* voice, and mine is pretty healthy. Besides, whispers don't modulate well. With but a few words from my mouth, the family's need for sleep was made *abundantly* clear. Faced with their superior claim, I did the only thing I could.

Shut down? No way! I went back to CW—scratching pen and clicking keyer raised nary a protest in the quiet hours. I settled for what sideband operation I could, during reasonable hours. That was instructive. Naturally, my prime time proved the same as every other ham's in my time zone.

At the time I was an avid DXer, so I naturally tended to hunt on the higher bands—20, 15 and 10. The timing of my upgrade was such that after but a few weeks, 10 began to open only sporadically, neither often nor broad enough to claim the bulk of my attention. When it's open—as it has been lately—it's *gangbusters*, clear signals and wonderful DX on hardly any power or antenna. Don't forget, our Citizens Band neighbor at 27 MHz claims

Why Morse Code?

Late last year, HQ received reports that Morse code would no longer be a requirement for the Maritime Service, and that set off an interesting chain of events.

Aside from the debate as to whether or not we should have a codeless license, what is CW and why do we use it when there are other methods of communication which are much faster? There are many other modes out there in radioland—why do so many amateurs choose to use CW? Why have we had such a love affair with Morse code for so many years? Nobody can answer this question better than Bruce Vaughan, NR5Q, did in his letter in the Correspondence column of January 1989 *QST*. His letter is reprinted here.

"Almost 150 years ago, Daguerre, a French experimenter, introduced photography to an astonished world. The following day, a newspaper carried the following headline: 'From Today, Painting Is Dead.' Somehow, painting managed to survive. It survived because painting was, and is, an art. Not the most modern way of capturing a scene on paper or canvas and not the most accurate way, but to many, the most beautiful way.

"CW is also an art. Practiced and loved by many, many thousands, CW will survive. To me, there are few pleasures in the world that compare to a good, snappy CW QSO. Occasionally, when someone compliments me on having a "good fist," I feel proud. Recently, when a VK told me 'your bug is music to my ears; I could listen to it all day,' I felt very honored.

"Small pleasures, perhaps, and certainly not for everyone, just as all modes are not for me. I love DXing, rag chewing, building and CW. I have little interest in RTTY, 2-meter FM, packet and so on, but how glad I am that we have these wonderful and varied means of communications. I will fight to the end to preserve each and every one of them."—*Bruce Vaughan, NR5Q, Springdale, Arkansas*

His letter says it all!—*John Hennessee, KJ4KB, ARRL HQ*

its share of "DXers" at certain points of the sunspot cycle, too, even with legal (5 W) power. (The power may be legal, but CB DXing isn't.)

When 10 went away, I cruised 15 and 20. My fortunes changed. A new pattern developed. Tuning the phone subbands, I'd look endlessly for an opening. Nothing doing. Either there was no clear spot, or the tiny gaps between QSOs were unusable due to QRM. I shrugged. No room? No problem. My finger got good at rolling the VFO on my Kenwood TS-820S, ever downward toward the CW bands. After all, hadn't I done the same thing when the family was asleep? I didn't realize it at the time, but enforced CW made my code get better. And better. Stumbling on the occasional band riot means either big DX or major contest—I dived right in. So what? So my CW eventually crept up to Extra Class speed.

There's Always Room for CW

And no matter how open the bands, how jumping the sideband segment, I never failed to find a place to call CQ on CW. Sometimes, it was a little hairy. With 10 and 15 closed much of the time, it was inevitable that the overflow found itself on 20. But that made it all the better, not worse. Give me a barn of manure, and I'll find that pony.

I found something else. DXers use the verb "hunt," and I found that when I hunted, my "kill ratio" was higher on CW, far higher than on phone. So obvious was the difference, I noticed it right away; so extreme, I determined to find the reason. It didn't take long. Brute force has more sway on phone.

Think about it. Know what a *pileup* is? Think of a football fumble, only with hundreds of players. They all want that loose ball, that rare DX station. Now, with sideband, many stations all transmitting in the same space at the same time can cause mush. Listen sometime, and you'll know. But CW is different. Many transmissions can occupy a small space. Several can occupy the *passband*, the operator-selected listening spot, of a modern transceiver. And yet the experienced operator can still read *each one*. Not every time, mind you, but often enough. It's a difference in rhythm, a difference in tone. The best operators can copy more than one transmission at a time, believe it or not, at least enough to get the gist.

Think about something else. Good sideband signals occupy 2.5 to 3 kHz; CW, much, much less, a mere pinprick in the ether. Even if they tried, two CW operators would have a terrible time transmitting on *exactly* the same frequency without special pains. And if they weren't *exactly* on one another, a receiving station could often make one or another out.

What does all this mean? If you run wire antennas and no amplifier, it means a lot. It means that on CW your station can compete head-to-head with anybody and still win. Often. The difference is *you*.

Not everyone is cut out for CW. A lot of us say we can't wait to upgrade so we can get away from it, leave it behind, escape. But to escape indicates we have someplace to escape to, an alternative. And for some of us, those of us limited by circumstances beyond our control, there just might not be another place, at least on the low bands where other countries await.

Next time you're on 10, listen down a little, between 28.1 and 28.2.

Who knows, you just might like what you hear.

Exam Info

QUESTIONS COMMONLY ASKED

The ARRL/VEC receives numerous phone calls and correspondence from individuals and VEs asking a variety of questions. The following are some of the more common ones with their answers.

1. If I have a Technician Class license (or CSCE) dated before 3/21/87, what element(s) must I pass to upgrade my license to the General Class?

If your Technician Class license is dated before 3/21/87, you need only pass Element 1B (13 WPM Morse code) to obtain your General class license. You are automatically given credit for Element 3B.

2. I upgraded my license at an exam session four weeks ago, and I have not received my upgraded license from the FCC. When should I call the VEC or the FCC to see what happened to my 610 form?

Unless your 610 form was being held because a current license photocopy was not attached, license processing normally takes 6 to 8 weeks. Also, the FCC processes licenses in weekly batches, so if you and a friend upgraded at the same session, and your friend received an upgraded license from the FCC but you didn't, chances are yours will be processed in the next weekly batch.

3. If I attend a session conducted by a VE team and pass Elements 2 and 3A, but do not pass Element 1A (5 WPM Morse code), may two VEs issue my 5 WPM Code Test?

No. The license you will be eligible for upon passing Element 1A will be the Technician class. Three VEs must administer examinations for a Technician class license.

4. When I upgraded to Technician class, I had not received my Novice license from the FCC—and I did not check the box (2E) on my Form 610 for a call-sign change. Is it too late to change my call?

No. You still have the opportunity to change your call. When you submit to the VEC a copy of your Novice license (or higher) also include a signed note requesting that the "Change Call Sign" box (2E) be marked. For further information on this, please contact Gerrie at the ARRL/VEC—extension 284.

5. My VE accreditation has expired. What must I do to renew my accreditation so that I may participate in VE sessions?

You will need to inform the ARRL/VEC that you are still active and wish to have your accreditation renewed. Contact the ARRL/VEC and ask for Maria at extension 286. Maria will be able to assist you in getting your accreditation up-to-date so that you can again participate in VE sessions.

6. I will be attending an exam session tomorrow to take elements for the Extra Class license. What will happen to my Extra Class Form 610 while I'm waiting for my Advanced class license to arrive? This question may apply to Novice, Technician and General class licensees as well)

Your Extra Class Form 610 will be held by the VEC until you receive your Advanced class license. As soon as you receive your Advanced class license, sign it, photocopy it and send the photocopy to the ARRL/VEC department, attention GW. As soon as we at the VEC receive your license, we'll get your Extra Class Form 610 in the mail to the FCC for processing.

(continued on page 79)

4U1UN...That Wild First Night

A tribute and farewell to Mister UN Radio, HB9RS.

By John G. Troster, W6ISQ
82 Belbrook Way
Atherton, CA 94025

It is exciting to operate from a rare DX country. But it is the dream of all DXers to participate in the first operation from a brand-new DXCC country, a once-in-a-lifetime opportunity.

It was with great enthusiasm, therefore, that I accepted an invitation from my old friend Max to be an operator at 4U1UN when it was put on the air for the first time. It was exciting to be sure, but as it turned out, rather bizarre.

Max, of course, is Dr Maximilian C. DeHenseler, HB9RS, Chief Cartographer of the United Nations, who was president of the United Nations Radio Club. If you have talked to 4U1UN in the last 10 years, you probably talked to Max, particularly if it was *other than* a contest, since Max generally prefers to chat rather than make contest QSOs (see accompanying sidebar on recent contest activities from 4U1UN). And if you found Max on a Saturday or Sunday morning, probably his devoted wife, Renata, was sitting right alongside him, too, reading a book or the newspaper. But that's getting ahead of the story.

A Little Background

The first United Nations Amateur Radio operation was in May 1948 from K2UN at Lake Success, New York, the original location of the United Nations headquarters. That station was on the air only a short time.

After the United Nations moved to its present well-known address on the East River in midtown Manhattan, K2UN was reactivated in October 1976, located on the third floor of the Church Center for the United Nations, across First Avenue from the Secretariat Building (but still UN territory).

However, there was still no official approval for the station from the Secretary General of the United Nations to operate as an amateur station under the UN flag and sanction. K2UN was just another FCC-licensed station in New York, albeit with an interesting call, operated by members of the UN Radio Club.

So, Max went to work. Through his efforts, the Secretary General approved the operation of a specifically designated UN amateur station using the call 4U1UN in early 1978. It was to be located on the 40th floor (top floor) of the UN Secretariat Building. And it was Max's one-man drive and determination that finally established 4U1UN as a separate DXCC country, similar to that granted by the ARRL to 4U1ITU, the amateur station at the headquarters of the International Telecommunication Union in Geneva, Switzerland.

That First Night

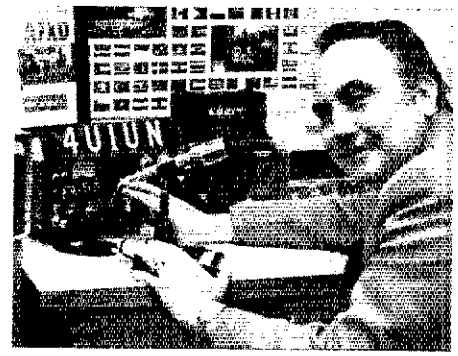
So it was that a group of us gathered on the top floor of the UN building on February 4, 1978, for that first new-country operation from the United Nations. That was the beginning of the phone weekend of the ARRL DX Contest. Max thought that would be a great time to introduce 4U1UN to the world.

The equipment was all hooked up and in operating order in the UN employees recreation room on the 40th floor. This large room was shared with the art club, the exercise club, the ballet club and others...most especially a club we would soon meet.

About 6 PM local (2300 UTC), one hour before the contest started, Max suggested we have a little supper. Down we went to the UN cafeteria, talking about the exciting feeling of putting a "new one" on the air.

At 2350, we went back to the 40th floor. As we approached the recreation room we heard strange loud bangs and yelps and thuds—something like a 20-meter phone pileup. What was going on here?

Oh, oh! Standing within a foot of our operating table was a short, stocky, scowling gentleman dressed in a shaggy white uniform with a black belt around his middle. It was the UN karate class instructor, along with 20 or so students jabbing and pounding each other to the floor. And Mr Black Belt showed no inclination to allow us to approach our equipment, which he appeared to be guarding.



Mister United Nations Radio, Max DeHenseler, HB9RS.

What do you do when a black belt karate instructor is conducting class almost on top of your equipment? You wait! So we waited. About 0045 UTC, Mr Black Belt finally moved and we scampered across the karate mats to get on the air, 45 minutes late.

Of course, Max was given the honor of

4U1UN—The Station

Security at the UN is tight, and any visitor must have a UN employee *constantly* accompanying him or her. Naturally, this is often a difficult, if not impossible, responsibility for the UN Radio Club members to handle. Therefore, requests to operate 4U1UN cannot always be accommodated. However, thanks to the organizational efforts of HB9RS and other able UN staff members, I am fortunate to have had the privilege of operating from 4U1UN on three occasions.

The first was during the VHF WPX (prefix) Contest, sponsored by *CQ* magazine, in July of 1987. Several of us took along all the necessary equipment and antennas for a multioperator, multitransmitter effort on the 50- through 2304-MHz amateur bands for the weekend, and we made just under 1000 QSOs in the contest.

Later that year, I operated from 4U1UN during *CQ*'s CW Worldwide DX Contest. I had a great time in the contest, using the relatively modest complement of equipment and antennas at the station, which at that time consisted of Kenwood TS-940S and TS-830S transceivers and a TL-922A amplifier. One of the very early Henry floor-model amplifiers was also present, although not in use.

The antenna situation at that time was also very unpretentious: a multiband trap vertical for 80-10 meters and an open-wire-fed dipole for 80 meters. In fact, the antennas at 4U1UN must be regularly replaced because of the difficulty in withstanding the rigors of a New York City winter atop the lofty United Nations building!

The third foray I made to 4U1UN was for the 1988 ARRL June VHF QSO Party. This was another group effort, with a lot of gear and antennas brought to the UN especially for this effort. Another top score resulted. At that time, the UN radio club members had added a three-element Cushcraft 10-meter beam to the antenna farm. I suspect that's about the biggest permanent directional antenna they felt comfortable installing, if anything atop the UN building can be considered permanent, that is!—*Rus Healy, NJ2L*

being the first operator to speak from the new country. And away we went, taking turns for the first half-hour or so before settling into sustained contest operation.

There was a lot of explaining to do on the air. The stations we worked asked us all kinds of questions like, "What was that call again?" "Where are you located?" "Never heard of 4U1UN." "You say it is a new multiplier?" "You count as New York?" "You in Geneva?" and so on. It appeared that not everyone had gotten the word that the ARRL had approved 4U1UN as a new country. Indeed, we doubted that many of those stations realized that they were among the *first* to work a brand-new country. But we were having fun with the whole event, despite the fact that many of those we worked thought we were a pirate!

About 11 PM (0400 UTC), I decided to pack it in so I would be able to return first thing in the morning to relieve the all-night operators. So I left.

United Nations Radio Club members present at the first night of 4U1UN operation toasting in the new DXCC country (left to right): Walter Strysko, W2ZUB; Gerard Doherty, W2UYX; Max, HB9RS; Renata, Max's XYL; Larry Kettlewell, W3HHG (kneeling); and Vincent Sullivan, K2FC. (W6ISQ not pictured.) *(photo courtesy HB9RS)*

The Next Day

Next morning about 7 AM, I took the elevator up to the 37th floor and walked up the last three flights to the big recreation room. I opened the door and...nothing. No lights, no noise, no people—nothing. There was the operating table, but there was nothing on it—no rigs, no wires, not even a scrap of paper. I must be dreaming, I thought. Those old ghost stories flashed through my mind, the ones where people vanish without a trace. Or the kind of tale that turned out to be a complete hallucination or fantasy all along. But there was a radio station here last night. I knew it! I reassured myself that I had been on the air, and there were other people there too...I think!

In a sweat I sprinted back down to the first floor and called Max's home. Renata answered and told me Max was at K2UN. Well, at least I'm still sane, I reassured myself. Or is that where we really were last night? For some reason (I guess I was still in shock), I didn't ask "why" or any other obvious question. "Thanks Renata" was all I managed, and I took off across First Avenue, to the third floor of the UN Church Center, where (as mentioned previously) radio station K2UN had been located in the mid-70s.

I opened the door of the large closet which was K2UN's home. There was Max, operating the contest: "4U1UN, QRZed?"

"Max," I asked, "what happened? Last night, 40th floor, ARRL contest..."

"You're 5 and 9, 4 Uniform 1 United Nations."

"What happened to all the equipment?"

"Oh, that?" said Max, as if nothing had happened.

"Yeah, that...those kilopounds of radios on the 40th floor across the street—they're all gone!"

"Well," Max began, "we operated until about 1 AM when three UN security guards suddenly appeared. It seems that since early evening our "brand-new country" radio station had completely destroyed the security system of the United Nations headquarters. They shut us down."

"But all that equipment...?"

"After the operators left," Max continued, "I decided it was too bad that our new country was going to be shut down on its first night. So, Renata and I moved the equipment over here."

What Max was really saying was that, in the middle of the night, he and Renata carried load after load of heavy radio gear, cables and all the peripherals down those three flights of stairs, then down 37 floors on the elevator, out of the building and 200 yards across icy First Avenue, to the building where K2UN had been located. Then up to the third floor and finally hooking all the pieces back together again, all this in the dead of a bitterly cold February night in New York City.

"QRZed contest," said Max.

You now have some idea of Max's determination and dedication, the same kind of determination that culminated in 4U1UN being approved by the UN Secretary General in the first place.

4U1UN Continues Operation

Since that night, 4U1UN has been very active on the bands for over a decade. You can find it on the air particularly during the major DX contests, under the direction of present station manager Dave Rosen, K2GM.

Incidentally, the reason that 4U1UN interfered with the UN security system was that the triband vertical was put up in the dark, right next to the VHF antenna used by the security police. Better spacing solved the problem and brought about a peaceful coexistence from then on to the present, with 4U1UN resuming its operation from the UN employees recreation room on the 40th floor of the Secretariat Building.

The UN station still operates from a sheltered corner of the recreation room, with one significant addition: the 4U1UN/B 20-meter beacon is housed at the other end of the room. 4U1UN/B is the first beacon to key in the 10-minute cycle of beacon stations in the Northern California DX Foundation's worldwide beacon net operating on 14.1 MHz.

Max Retires

Max served as president of the UN Radio Club for most of the past 10 years. He is now president emeritus.

Max is an avid collector of Hallicrafters equipment, having amassed one of the most complete collections in the world. He has all but a few of the sets ever manufactured by Hallicrafters. He has also just completed a book on Hallicrafters gear which will be published by the Antique Wireless Association.

When Max retires in July 1989, he will return to Montreaux, Switzerland, where he will assume duties as director of the Swiss Radio and TV Museum "Audiorama." You may be sure all those Hallicrafters rigs will be on display! Oh yes, all the sets in his collection were in working order the last time they were turned on.

The Audiorama will have an on-site amateur station with the call HB9M. Max says the "M" is for Museum or Montreaux. But we know it really stands for *Max*!

So, when you hear 4U1UN on the air this month, break in and say, "Hello, Max ...thanks for 4U1UN." Chances are Max will be at the mike or close by. You might also send 88 to Renata, who will probably be there, right next to him, reading the paper.

Good luck, 73, and see you both from HB9M soon, and thanks, Max and Renata.

Riding the RAGBRAI

Where do 7500 bicyclists turn when they want to call home? To Amateur Radio, of course!

By Chris Charron, WBØRSW
3841 Amherst
Des Moines, IA 50313

For the past 16 years my employer, the *Des Moines Register,* has sponsored an annual bicycle trek across Iowa. Riders begin on a Sunday by dipping their rear wheel in the Missouri River on Iowa's western border. The following Saturday they finish by rolling into the Mighty Mississippi, on the state's eastern border.

Getting there is a tale of seven days of steady pedaling and constant partying. For Iowa hams, the 1988 RAGBRAI (The *Register's* Annual Great Bike Ride Across Iowa) was a week of public service and good press for Amateur Radio.

A handful of cyclers inaugurated this event in 1972. Today, RAGBRAI is a rolling city on wheels with more than 7500 riders and their support crews. Traversing back roads, the RAGBRAI navigates some of Iowa's most scenic rural areas, offering small towns a rare opportunity to profit from tourist dollars, along with a challenge to supply the facilities such a horde of athletes needs.

Humble Beginnings

Like many plans, ours had humble beginnings. The children of a friend, Don Schmidt, WØANZ, were going to ride the 1988 RAGBRAI, held July 24-30, and asked Dad to drive their camper. I agreed to tag along. We would operate HF in the evenings along the 433-mile route. Then someone suggested we handle messages for the riders. "Should be no problem," I recall saying. Famous last words!

Most RAGBRAI stops are in small towns with a shortage of pay phones—overloaded circuits make for long waits. We hoped to give the riders the option of sending messages by Amateur Radio. That way, when riders became separated from their group, they could send a message ahead or behind to friends or family, as well as send messages home (to all 50 states).

I was a novice at third-party message handling, so I went straight to the top for advice, calling our ARRL Section Manager, Wade Walstrom, WØEJ. I expected a quick, polite answer and a "have a nice day." Our first conversation lasted over an hour, ending with a fully endorsed ARRL Section activity that would involve at least seven local radio clubs.

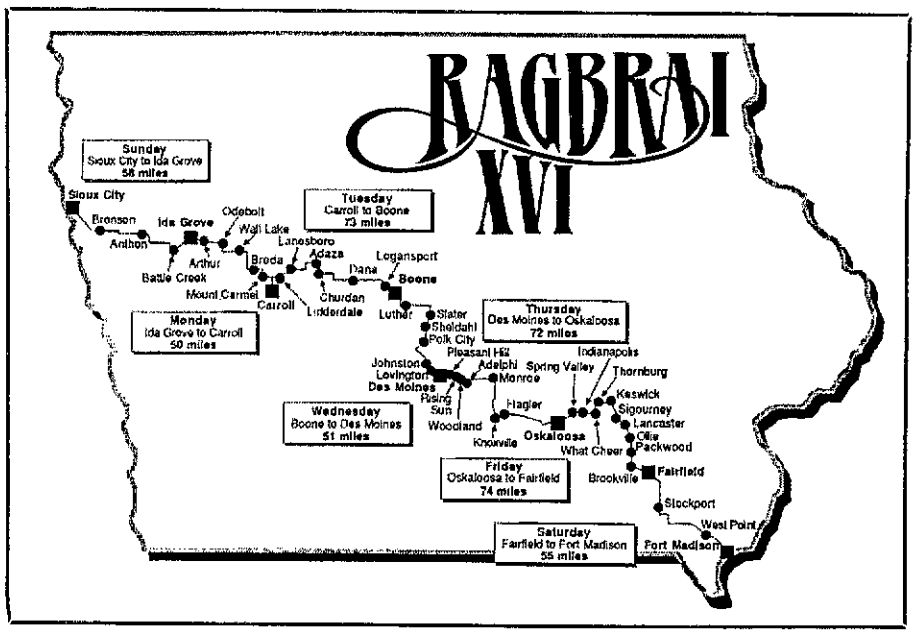
I think our Section Manager has a future in politics—or in sports—because when I hung up I was ready to "win one for the Gipper." Wade added Steve White, NUØP, our ARRL Affiliated Club Coordinator and Tom Gorden, WEØM, our Public Information Officer, to the team. The three of us lined up contact people at each layover. Our plan was amazingly well received by the different Amateur Radio clubs along the route, the clubs assuming staffing responsibilities.

We decided our roving ham shack should be self-contained, with all the necessary equipment for each stop. Since permission had been given to incorporate the ham station into each of the information centers, we wanted the RAGBRAI organizers to know what to expect each night.

By this time we had outgrown Don's camper and needed a second support vehicle; Todd McLarty, NØJEG, offered the use of his van. The plan now included a special-event station and a 2-meter talk-in station for both the local hams supporting our efforts and for the 35 or so ham-cyclists.

"Wireless radio" this was not—the RAGBRAI route this year was 433 miles, and I suspect we had at least that much in coax, jumpers, power cords and antenna wire.

Before undertaking this operation I had my doubts about the state of our hobby—



Iowa hams helped bicyclists stay in touch over the 433-mile route of RAGBRAI XVI.

At Fort Madison, the final stop: (l-r) organizers KAØYAP and KØKWU; Iowa Governor (and rider) Terry Branstad; and the author. *(KØKWU photo)*

was the *esprit de corps* still there? Well, most of "our" gear was loaned by hams who wanted to help. We turned down many offers but in the end still took more equipment than was realistic. At any rate, we seemed ready for anything.

The Ride Begins

We left Des Moines with two HF radios, a mobile HF station, two multiband verticals, a pair of 2-meter stations, a UHF station, a packet station and tons of associated gear. So we had the equipment and generally prime spots to operate from, but as I drove into Sioux City I wondered whether or not The Bodies would be there. Here's what happened:

• Day One. Loren, WBØYOW, and the Sooland Amateur Radio Association were waiting with bated breath for us to arrive (I was running late, as usual). The temperature the week of RAGBRAI ran in the high 90s, and after a summer of drought, the banks of the Missouri River were dusty and dry. The Sioux City gang supplied 15 operators that first day, operating HF, packet, 2 meters and answering questions from the gathering crowd.

N5JTG in Louisiana told us on 10 meters that we were his 49th state—where was Idaho? Sure enough, the next station worked was from Idaho and N5JTG, still on frequency, was able to complete his WAS.

Commercial power failed at the park, but we were able to substitute our generator with just a few minutes of down time. The power failure left a TV crew there for a remote report on RAGBRAI high and dry, and an offer to use our generator netted a plug for Amateur Radio on local TV.

• Day Two found us in Ida Grove. Since there are no hams nearby, we had called on the Denison Repeater Association. Wayne, NØAHP, arranged to have hams come from the surrounding area. Because the closest repeater and packet bulletin board were 45 miles away, TV masts were used to put beams at 30 feet, enabling us to handle traffic on 2-meter FM and packet.

At most sites space was at a premium, with 7500 riders and another 2500 support people around, so we limited HF to the mobile antennas. Radio traffic was picking up, and much of our time was spent explaining the wonders of Amateur Radio. This day our operation was cut short by an unexpected, but much needed, rain storm, making race organizers jumpy with so many people camping in close quarters. Storm information was relayed from Denison, which helped relieve the organizers' worries.

• Day Three, Carroll. Monday's storm seemed to break the weather a little and gave us a beautiful day on which to operate and dry out the tents. John, WDØHPT, of Carroll, organized the local hams. Again we concentrated on message handling the Denison BBS and on 2-meter FM.

• Day Four, Boone. Bob, KØCY, had promised a good turnout of the locals, and he didn't let us down. Our normal schedule was to start operating when we pulled in and tear down around dusk. The Boone gang had things covered, so I headed 50 miles home to Des Moines for a much needed break. The next morning, I found out that the night-owl shift had handled traffic well past 1 AM.

• Day Five: If this is Wednesday, we must be in Des Moines. Jim, KAØVSL, had the Des Moines Radio Amateur Association there in force, with the station set up on the Iowa State Capitol lawn. From this highly visible spot, the DMRAA handled quite a few messages and gave Amateur Radio front-row exposure.

• Day Six, Oskaloosa. Steve, WAØDKC, and the Mahaska Amateur Radio Club not only helped our efforts, they also provided support communications for a number of local agencies who asked for help. More than half of the MARC took the day off from work to assist (and you thought only new DXCC countries made hams do this!). It took 40 feet of mast, but we were able to use a packet-radio node 50 miles away to dump traffic to a bulletin board 100 miles away—not bad for 10 W.

In Oskaloosa, a cycling group inquired about the condition of a friend who had crashed during the day. They had no idea of where he had been taken. With a couple of calls, the MARC located the rider and relayed his status to his relieved friends.

• Day Seven, Fairfield. Dave, KØHYH helped line up the Fairfield gang, a small but energetic club. NØFIB came to the rescue by turning his antenna our way to give us a packet outlet for our traffic.

• Day Eight, Fort Madison and the home stretch. Rick, KAØYAP, had promised a good turnout by the Fort Madison club, and he didn't lie. This is an interesting group with a mixture of old-timers and new hams. Our setup on the bank of the Mississippi was less than ideal—as far as public access was concerned—so the Fort Madison guys, message pads in hand, stalked the crowd for "customers."

RAGBRAI rider WØANZ at the Boone message center. A "Free Messages Home" sign brought in more "customers." *(KØCY photo)*

Wrapping It Up

Iowa Governor Terry Branstad, who rode the entire route with his oldest son, stopped by to check out the operation. The special-event station unfortunately had to remain idle for most of the trip, so we had a couple of the locals put the station on the air from their homes. They made a number of contacts, including one to Germany via AMSAT-OSCAR 13.

All told more than 80 operators from 10 radio clubs handled 343 messages and made 600 special-event contacts. This, coupled with those 7500 riders and 2500 support people over eight days and 433 miles, made RAGBRAI seem like a Field Day that never ends.

One thing I learned on this trip was that ham radio is alive and well. I never imagined the help and support that we eventually were to receive.

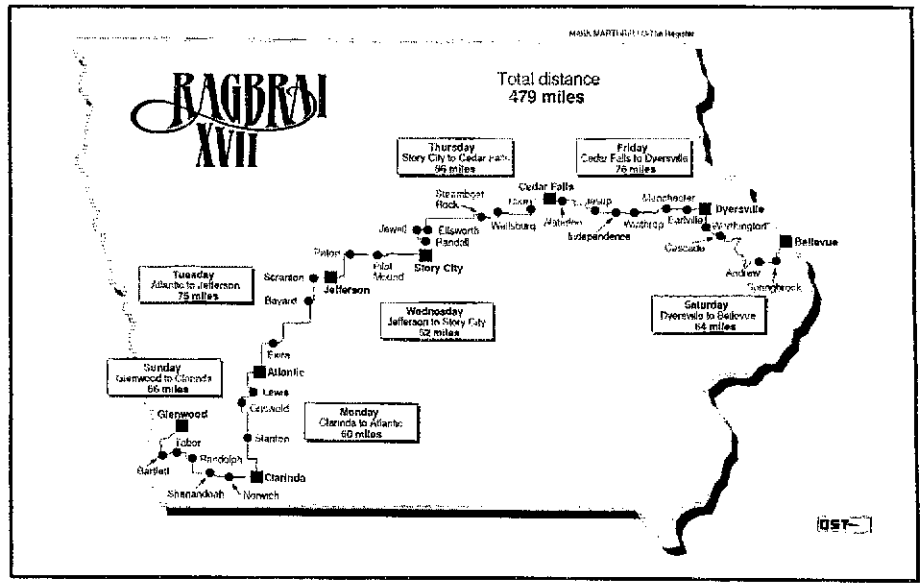
Second, there are the different levels of community awareness of their local radio club. Some clubs are virtually unknown, while others seem to be involved in everything.

Maybe most important, the biggest contributions often can come from the smallest club or group. I had never met most of the people who helped out. They had no reason to do so, except for our common interest in Amateur Radio. Not only did those local hams help with radio duties, but offers of showers, warm food and a place to stay were made in each town. I think this says a lot for our hobby.

Finally, thanks to Wade and our Section leadership for helping keep us on the right path, and to the SYSOPs of the many BBSs that took our traffic. An added benefit was that quite a few hams were exposed to packet radio for the first time, in part due to Mike, NFØN, a packet guru who happened to be on the ride and managed to stop by and lend a hand when he could.

Editor's note: For information about the ARRL Field Organization and the name of your Section Manager, see page 8 of any *QST*.

A RAGBRAI participant completes his ride across Iowa by dipping the front wheel of his bicycle in the Mississippi River.



This year's RAGBRAI covers a different route. Volunteers are still needed to help out. Contact the author if you'll be in the area July 23-29.

New Books

SATELITES

By Carlos A. Huertas, LU4ENQ. Published by Editorial Hispano Americana SA (HASA), Buenos Aires, Argentina. First edition, 1988. Softcover, 6 × 9 inches, 464 pages, $19.64 (US).

Reviewed by Chuck Hutchinson, K8CH

The first section of this Spanish-language book deals with getting started in satellite operation. This 70-page section covers the basics of theory and practice. Here, you'll find information on satellite launching, orbits, stabilization, tracking, frequencies used and other phenomena related to Amateur Radio satellites.

The book's second (and largest) section covers the history and characteristics of Amateur Radio satellites, starting with OSCAR I and going through Phase 3C (now known as AO-13). This section includes data on the Soviet amateur satellites as well. Huertas tells you how to operate through the satellites that were active at the time he wrote the book (March 1987), gives modem circuits and tells of the 1984 AZ5ZA DXpedition to the South Orkney Islands.

The book's final section (78 pages) is devoted to antennas and preamplifiers for the 29- through 2400-MHz amateur-satellite bands. In the appendices, you'll find information on RS-10 and RS-11, G3RUH's PSK demodulator for FO-12, and the table of contents.

Huertas's writing style is brief but descriptive. The book's 170 diagrams were made using a computer and plotter, and the results are pleasing. Unfortunately, I can't say the same for the photos; they are not of high quality. If you can read and understand Spanish and you have an interest in satellites, you're bound to find this book interesting. Huertas is the editor of the Argentinian AMSAT Bulletin and is an international leader in the amateur-satellite program.

Oh, and yes, the title is spelled correctly—it's in Spanish, of course!

This is Our Last Hope... Please Help Our Kid!

Hams rally to get a badly needed medical device to a child in the Soviet Union.

By Byron Robertson, WQ7M, 4U1VIC, ex-WA7SBG
Edited By Bill Legge, NT1R, ex-WB1EWA, and Jim Gorman, N1FVH

Peter Topal, UB4EY, with son Maxim and daughter Victoria.

While routinely opening the direct QSLs that we received at 4U1VIC in mid-August of 1988, I found an urgent plea for help from a father in the Soviet Union. The child of a Soviet ham had only two months to live unless he could obtain a badly needed medical device which is unavailable in the Soviet Union.

The Soviet ham, Peter Topal, UB4EY, in a neatly handwritten letter, said, "The matter I trouble you is our family facing a big disaster. Our kid, six, has his brain-feeding system broken. We were in clinic in Kiev and surgeons told us the Denver valve is badly needed (within two months) to restore the system function. The valve is produced in the US, but I don't know the manufacturer. To order this thing via Soviet organization is a long way. You see, the matter of life. And the only way out is to rely upon ham's generosity. Dear Byron, I thank you in advance and hope you will do something. This is my last hope."

I was stunned. In all my years as a ham radio operator, I had never received a QSL like this. I did not know what to do, but I knew I had to do something. A fellow human being was in trouble, and it seemed that Amateur Radio offered the only fast solution. I had to find a way to bridge cultural, language and medical differences across fragile airways in a race against time. Fortunately, as Peter must have guessed, I was in a good place to try. But to save his youngster's life, we had to have the valve in Peter's hands by October 15.

I am one of the several operators of 4U1VIC at the United Nations Headquarters located in Vienna, Austria. I currently work for the International Atomic Energy Agency, which is one of the specialized agencies at the United Nations. The agency's mission is to accelerate and enlarge the contributions of atomic energy to peace, health and prosperity throughout the world, while ensuring that it is not used to further any military purpose. Peter may have written to me because I work at the United Nations, and he thought that the UN could help him.

My home QTH is the state of Washington. I received my first ticket in 1970. I joined the Vienna International Amateur Radio Club to stay active while living in Vienna and to get the chance to operate a popular DX station. We make about 15,000 contacts per year. It is a rather light-hearted operation, where we try to give hams all over the world the chance to work a rare station. In the process, we try to keep the United Nations spirit alive by one-on-one contacts and descriptions of what we do. Most of our QSOs quickly become pileups. Peter Topal was in one of those pileups on July 27. We exchanged signal reports and call signs, and I thought no more about it...until I received his letter three weeks later. He was just one of the many Soviets we work during every pileup.

After discussing the situation with Jim Gorman, N1FVH, a fellow ham at the UN, we decided to contact the Samantha Smith Center in Jim's home state of Maine. The center is named after a little girl from Maine who received an invitation to visit the Soviet Union after she wrote to the Secretary General asking why they wanted to conquer the world. Samantha died in a 1985 plane crash. The center, formed as a legacy to Samantha, hopes to further the understanding between the United States and the Soviet Union. Jim said he knew of the Samantha Smith Center, and that they wanted to help Soviet children learn more about the US.

Not knowing how to contact the center, we wrote to the *Kennebec Journal*, a newspaper with statewide distribution, and asked them to forward Peter's request to the center. Steve Cartwright, a reporter for the *Journal*, looked into the situation and took immediate action.

He contacted Jane Smith, Samantha's mother, to see if the center could help in this situation. Mrs Smith said, "If anyone were to follow up on this (appeal for help), the thing to do is get in touch with medical people." She said she was aware of some Soviet shortages in medical care.

Acting on this information, Steve wrote an article for his newspaper, describing Peter's plight. The article was reprinted by the Guy Gannett News Service and distributed nationwide. In the article, Steve explained that the Denver valve is a shunt used to drain fluid from the brain into the stomach and intestinal area where it is absorbed by the body

Steve contacted Ernie Bracy, W1BFA, a ham radio operator in nearby Readfield, Maine, to learn how hams could help in this situation. Ernie explained that many times hams had banded together for worthy causes to help people all over the world. Ernie, who regularly talks with Soviet hams, provided information to 4U1VIC on a regular basis as progress was being made to help Peter. Bill Legge, NT1R, read the story in the *Portland* (ME) *Press Herald* and decided to do something about helping the boy. He called everyone who might be able to help find a valve or the name of its manufacturer. The people he contacted were anxious to help with donations if needed, but we still had to find out where to obtain a shunt valve. The purchasing agent at the local medical center provided the necessary information.

A call to Helen Powell at Denver Biomaterials in Evergreen, Colorado revealed that a Denver shunt had been sent to the Soviet Union the day before. This was initiated by Ray Morris, KL7C, a long-time Alaskan ham, and Dr Stanley Ray, KE7BQ, a surgeon in Seattle, Washington.

Ray found out about the boy's problem from Mike Pshonney, UB5EID, a friend of the boy's father whom he had been corresponding with and meeting on the airwaves.

The Codman & Shurtleff division of Johnson & Johnson, parent company of

Denver Biomaterials, with the help of Helen Powell, Shirley Freeman and Bill Floyd, agreed to donate a valve. The shunt was airmailed to the Ukrainian city of Dniepropetrovsk. When Bill told us the good news, everyone in the 4U1VIC shack was ecstatic. We all shook hands and slapped each other on the back.

Bill, NT1R, began to mobilize ham radio operators in both the US and the USSR to help track the progress of the shipment. Difficulties began to arise immediately. It was September 12, about one month since the initial request. We only had another month to get the valve to Peter in time to save his young child.

Peter had given us a post office box as his address. Bill found out that Johnson & Johnson must have a street address to ship the device. This was easier said than done. No one had been able to get Peter back on the air again to ask him for his address. Several letters were written requesting a schedule with no response.

If this problem were in the United States, we would just call on the telephone and ask for his street address. It is not so easy in the Soviet Union. As we found out later, Peter did not have a home telephone. The post office box that he had provided in his appeal for help was the box number of his ham radio club. There was no way to reestablish contact with Peter other than through ham radio.

At this point Ed, NT2X, stepped in and carried the ball. Ed speaks fluent Russian and has many ham radio contacts near Peter's home. When Bill called Ed, he was in QSO with Valentin, UC2AA. When Ed told Valentin what he had just heard, UC2AA went to work to get the address. After much help from the Soviet hams, the address was relayed to Ed, and the package was on its way.

The valve was shipped from Randolph, Massachusetts to Moscow via Brussels. It arrived in Brussels safely and disappeared somewhere in the Soviet system in Moscow. Peter, who had been told that the part was coming, went to Moscow to try to find it, but was unsuccessful. Time was running out. It was September 20.

Bill contacted Johnson & Johnson again and asked if they would donate a second valve. We held our breath; days passed as propagation problems disrupted schedules and delayed messages. Yes, they would! Unfortunately, the good news was tempered by discouraging news as well.

After considerable effort, Ed, NT2X, working through various Soviet hams, was able to contact Peter. He called Bill to get on the rig with them. Bill asked the questions, and Ed translated. They were able to find out that the boys name was Maxim, he was six years old and weighed 30 kilos. This was important in determining the proper size of the shunt valve. Peter reported that Maxim had lost most of his sight and would not last much longer without an operation. Every day counted.

Thanks To My Friends

Dniepropetrovsk
October 27, 1988

Dear ARRL:

Last year, my family had a problem. My little son Maxim suffered from excess fluid on the brain. The device he needed was not in stock here in the USSR. I appealed to US hams to help us find this unit for my ailing son. My request was sent to Byron Robertson, WQ7M, who works for the United Nations in Vienna, Austria and operates 4U1VIC.

At the same time, a friend of mine, Mike, UB5EID, forwarded my request to Raymond Morris, KL7C, in Anchorage, Alaska. These messages were acted upon immediately. Ray called Dr E. Stanley Ray, KE7BQ, in Seattle, and Stan located the manufacturer of the device.

After Byron contact East Coast hams, Don Button, AJ1T, and Bill Legge, NT1R, raised their effort seeking the way to resolve the problem. They arranged schedules on 20 and 15 meters between KL7C, KL7HFM, NL7DU, NT2X and Soviet hams to provide the experts with detailed medical conditions of the boy and inform us about shipping the device. The ARRL must also be given credit for their assistance.

I don't know all the hams involved in helping me, so I'd like to express my gratitude for their generosity and compassion. All my ham friends here have had the chance to become convinced of the real fraternity between hams. Now, Maxim is out and about. Doctors said, with the fluid pressure lowered, his sight would improve. We feel happy. Thanks a lot for all you have done, my friends.

Best of luck and DX, 73,
Peter Topal, UB4EY

Denver Biomaterials kindly agreed to send a second valve. This time, Bill had Johnson & Johnson send the part to me at the United Nations. It arrived October 1, just after a Soviet delegation from the Ukraine had left. They had agreed to hand carry it to Dniepropetrovsk if it arrived while they were still here. Next, we contacted a Soviet film crew making a movie about the aftermath of Chernobyl. They said that they would take it, but they were not going to leave for a week.

Finally, we found a Soviet diplomat who was leaving for Moscow, and he agreed to take it with him. His wife, a doctor, understood the urgency of the situation. Armed with the telephone number of Peter's neighbor and his street address provided by Ed, the diplomat called Peter's neighbor from Moscow to tell him that the valve was in Moscow and was ready for him to pick up. The date was October 10, almost two months since Peter's letter requesting help. Were we too late?

For the next three weeks, skeds were held nearly every day between 4U1VIC and NT1R in Maine. We relayed what little new information we had.

As the days passed with no news from Peter, we became concerned. We were afraid our worst fears had become reality. Why else would repeated calls to Moscow go unanswered? Why didn't Peter make any of the scheduled radio contacts? If his child had died, ham radio was certainly the last thing on his mind.

Finally on November 2, Bill told us that during the CQ World-Wide DX Contest, UB5EID relayed that Peter had received the part. Further, he said the valve had been surgically implanted in the child, and his recovery was progressing normally.

With that news, the shack at 4U1VIC really lit up! It was the culimination of weeks of work by many people, most of whom don't even know each other.

As of June 1, Maxim's condition has continued to improve, but his eyesight is still not normal. He needs additional medical treatment to recover his sight. The hams involved are continuing their efforts to aid Maxim. We also learned that the original shunt was found and used for treatment of another Russian child.

It is a rare privilege to be able to help another human being in such a serious situation. The feeling of accomplishment is very gratifying. Through ham radio a life had been saved.

In addition to the hams mentioned above, the following hams deserve much recognition and thanks for their efforts: W1HZE, UW3DS, UW3AX and UZ3AWR.

Most importantly, special thanks goes to the Johnson & Johnson Company, who graciously donated the medical parts that enabled this story to have a happy ending. When people work together to help other people, amazing things can happen. QST

(l-r) Jim Gorman, N1FVH, and author Byron Robertson, WQ7M, at the 4U1VIC shack.

Escape to Paradise

W5HTX decides he can't take it anymore.

By Bruce Vaughan, NR5Q
PO Box 203
Springdale, AR 72765

Tex pulled the battered brown Stetson lower on his forehead to shield his eyes from the blazing noonday sun. As he gazed across the Arizona desert and through shimmering heat waves, he watched two dust devils waltzing toward Black Mesa, only to dissipate as others formed.

Though not a philosopher, he could see a relationship between man and the dust devils. We spring into life, become caught up in a dizzy whirl of activity, then die quickly, our substance becoming part of the earth again. Thinking of it this way somehow made death seem a logical and less dreadful conclusion to life.

In the distance, standing out in bold relief against a rust-red butte, he could see a hogan with a small corral nearby. Looking to the side, he could see a sheep dog working his flock, and though unseen, Tex knew from experience that a predator would not be far away. Instinctively his right hand dropped to the holster at his side, then he realized this was "big country"—no place for short-range hardware.

His thoughts returned to his home and family; he was beginning to feel guilty about running out on Mary and the kids. He hoped she would understand.

It wasn't that he had an unhappy home life, or that business at the hardware store was slow. He supposed it was just that trapped feeling that finally forced his decision. Every day the past year had been more difficult than the day before; it had to end. He now had decided on the place, the time and the way to put an end to his problems and frustrations.

Tex loved this country and had for 40 of his 52 years. He remembered coming here on a camping trip with his father. It was hard to believe that it was almost 40 years ago. He could remember every detail.

Would he be able to complete his plan and leave all this behind when the time came, or would he lose his nerve at the last moment, he asked himself. "I really don't have a choice," he thought, "I have planned this carefully. I will do what I must do when the time is up." Once committed to a course, Tex was well known for sticking with it.

"Guess I'll camp here tonight, the sun will soon be down," Tex said to himself, "I want to find the perfect spot, and I'll need daylight for that."

The sun was not fully up when he broke camp the following morning. Passing near Mexican Water Trading Post about noon, he did not stop. "I have plenty of supplies to do me," mused Tex, "there is more than enough."

Riding along he thought of his wife and kids. Would they be okay? Would they miss him? Would they understand the reason he had chosen this way of escape? These questions and others kept crossing his mind.

The country changed from flat desert to deep canyons and majestic rock formations. He knew Fort Defiance was not too far east of here.

Then, there it was! This is where it would happen.

He looked around. "Bet I can see 50 miles in every direction," said Tex, "and one of those trees should serve my purpose very well."

"I'm in no hurry now," he thought, "I think I'll have a bite to eat and a real cup of coffee before I do my rope trick."

Gathering up a few pieces of dead pinon pine, he soon had a nice campfire going. He placed the old coffee pot on the fire and raked some coals away. He then buried a couple of large potatoes in the hot ashes. "Nothing quite as tasty as a potato baked this way," he thought. "Baked potatoes, a can of beans and a cup of coffee brewed on a campfire are good enough for a king."

The sunset covered the area in a red-gold blanket of light, and though far from dark, the brighter stars were plainly visible in the cobalt-blue sky. In the distance, he could hear a lone coyote starting its nightly serenade.

Tex poured the leftover coffee on the fire and stood for a moment savoring each moment of this time and place. "Guess this is as near heaven as I'll ever get," he said aloud. "I better get on with it while I still can see what I'm doing."

He took the rope, and with ease, tossed it over a branch of the tree leaving both ends dangling. "That limb don't look strong enough," said Tex. "That one over there looks strong enough to hold up an elephant." Again a rope was tossed over a limb.

"Well, this is it," he thought as he pulled the ropes tight raising the trap dipole. Reaching down, he picked up the PL-259, blew the dust out of it and connected it to the SO-239 on the side of the large motor home.

Stepping inside, he removed the handheld and holster from his belt, tossed them in a chair and opened a can of soda. Before sitting down at the rig, he hit a switch bringing the 6.5-kW generator to life.

"What a life," thought Tex, "and what a family to understand my need for two weeks of solitary hamming."

Turning on the Corsair and kW linear, he reached for the Bencher. CQ CQ CQ DE W5HTX W5HTX W5HTX K. . .

Yes, tonight Tex was in paradise.

• *At the Foundation*

The Spirit in Every Ham

Reflections on that special essence that enables hams to do the good they do.

By Mary E. Schetgen, N7IAL
Secretary
The ARRL Foundation, Inc.

Our beloved Amateur Radio is a voluntary pursuit. No one forces us to become hams, and for some, no force keeps them from it! It's been said we are compulsive communicators, and the label is apt when describing Amateur Radio operators. What compels us to reach across the airwaves to tap a stranger on the shoulder and introduce ourselves and our interests? Are we more gregarious than most, more outgoing, more inclined to connect with another soul for the simple *joy* of communicating? What makes someone who submits to testing to *qualify* for the *privilege* to talk long distances over the amateur airwaves different from anyone able to dial a telephone?

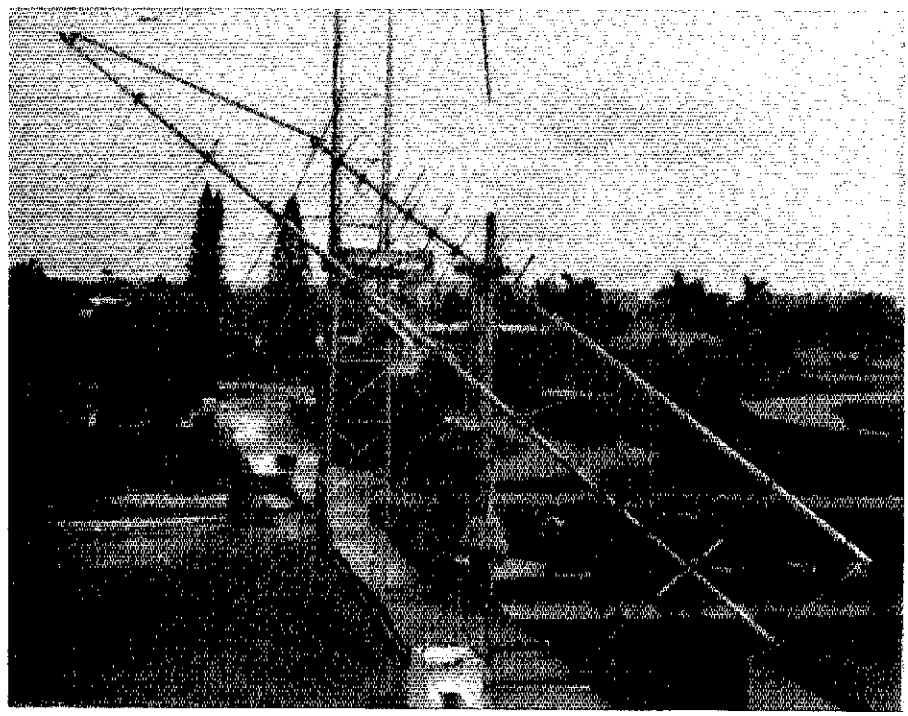
One difference is certainly willingness. By being willing to get and stay licensed and operate, hams show an extraordinary desire to "be available" to others via the ham bands. Unlike a telephone call where you almost always know whom you intend to reach, the very nature of calling CQ is always an adventure! Unless it's a scheduled QSO, you never know who will respond to your call. Being open to strangers, willing to talk and listen, is a natural consequence of experiencing unexpected and delightful encounters via the airwaves. Many shy folk come alive at the key or mike, developing confidence and naturalness with strangers that benefits other areas of their lives. Scratch the surface of many hams and you'll usually find a good talker who has cultivated the even-more-highly prized art of being a good listener. No wonder life-long friendships develop in hamming circles. No wonder our rich heritage includes veneration for many well-loved Silent Keys. The willingness to be open to others is part of that special ham essence.

Generosity is also a quality indigenous to hams. Hams give liberally of time, effort and funds to help not just one another, but also to help the communities in which they live. Public service by hams is so commonplace one might be tempted to minimize the generous spirit that fuels these kinds of efforts, but, of course, that would be a mistake. From walkathons and emergency disaster communications to Elmering the kid down the block or underwriting a local school's electronics experiment, hams know how to *act upon* the desire to help others. The works of your Foundation are made possible by this wonderful reality and every ham should share in the satisfaction of that fact. You make it possible through your generosity. It's part of the ham essence.

How does willingness and generosity add up to the special essence or spirit in every ham? By being open and giving, hams are *dynamic*. Many Amateur Radio operators are the movers and shakers in business, industry, communications (naturally!) and the arts. Even the ordinary ham-in-the-street is hardly ordinary. He or she has that dynamism that is a recognized quality in all good communicators. That dynamism is appreciated. Hams can't hide their light under a bushel. Nonhams probably know you are special before they even know you're a ham. You can help effect good public perception of the good that hams do by continuing to be a willing and generous representative of Amateur Radio through public-service efforts and your support of the ARRL Foundation. Happily, we hear from many of you. Thanks for being moved by the spirit!

FLORIDA PHYSICS STUDENTS ARE BEAMING AT OSCAR 13

Suppose you had a club station at your school capable of hearing Amateur Radio transmissions sent via OSCAR 13. Your station also had the necessary antenna array and other essential equipment, much of it generously donated by the local Amateur Radio clubs in your area. It's a pretty nice setup, alright, and the students are excited about it—but alas, they would like to do more than listen... they'd like to transmit via satellite. What you would need is a transmitter—exactly the situa-



Chaminade-Madonna (FL) physics students got the antenna array and rotator up for receive-only satellite communications months before they were able to transmit. With a Victor C. Clark Youth Incentive Program grant, they were able to purchase a 70-centimeter satellite transmitting unit and are now happily conducting two-way contacts. You can help other school clubs by sending in a donation to the Victor C. Clark Youth Incentive Program Fund. *(Photo courtesy of KA4B)*

tion of the physics students of Chaminade-Madonna College Preparatory Radio Club of Hollywood, Florida.

With a $500 grant from the Victor C. Clark Youth Incentive Program, the school club was able to purchase the 70-centimeter uplink equipment necessary to beam the students' signals up to OSCAR. Brother Lester Dwyer, SM, KA4B, coordinated the students' efforts to setup the station and now the 11th- and 12th-grade students are happily tracking OSCAR's position and learning the fine points of satellite communications firsthand.

HOW TO BE COOL WHEN IT'S HOT

Everybody knows it's cool to be first . . . first in the pool, first in line at a rock concert, first-place in a contest. You could be first at the Foundation. You could be the first senior at your high school to apply for a scholarship from the ARRL Foundation for the 1990-91 academic season by sending for our scholarship application package. All you have to do is drop a simple postcard or QSL in the mail—nothing fancy—and we'll send you all the details. Think it's too early to write? Nonsense. Early planning to meet college expenses is *really* cool . . . so write today to: *The ARRL Foundation, 225 Main Street, Newington, CT 06111.*

Contributor's Corner

We wish to thank the following for their generous contributions to:

The Bill Bennett, W7PHO Scholarship Fund
G. T. Sparrow, K7KTD

The Victor C. Clark Youth Incentive Fund
Chester Lech, W2DPR
(in memory of his son, Bradford D. Lech, WB2AYD)
Tom Frenaye, K1KI

The Goldwater Scholarship Fund
Chicago Amateur Radio Club (IL)
Honeywell Amateur Radio Club (AZ)
(in memory of Ken Rodrigues, W7KCM)

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As received and acknowledged during the month of **April.**

THE ARRL FOUNDATION, INC.

"for the advancement of amateur radio"

Heinrich Hertz—One Hundred Years Later

Does the name Heinrich Hertz ring a bell? It should—he was the first to demonstrate the existence of radio waves.

By Win Wagener, W6VQD
185-D Towne Rd
Sequim, WA 98382

Do you sometimes stop and think about everything man has done with radio waves since they were demonstrated by Heinrich Hertz 100 years ago? Take a moment to imagine today's world without radio waves!

The Foundation is Laid

In 1864, Clerk Maxwell, a mathematician, theorized that energy could be transported through space at a finite velocity by electric and magnetic fields at right angles to each other. He offered a series of mathematical field equations to explain his theory, but did not actually prove the existence of the resulting radiated waves.

Hertz, a professor of physics at the University of Bonn, did prove their existence in the years 1886-1888. He had to invent ways to generate and detect these waves, an antenna system, a transmission line, a parabolic reflector and a means to show polarity and refraction. Hertz did all this creative work, and in doing so proved that UHF electromagnetic waves behaved in a manner similar to the behavior of light waves.

The Setup

His generator was a spark gap in the center of a dipole antenna; the detector was a spark gap in a loop antenna. He measured the nodes of a standing wave on a transmission line to calculate wavelength. By calculating the L and C of his capacity-load transmitting antenna, and thus the approximate frequency, he proved, as Maxwell had predicted, that the velocity of propagation was the product of wavelength and frequency and was the same as for light waves.

With his reflector, he showed that the radiated waves could be beamed, just as light waves could. With a screen of parallel wires, he demonstrated polarization, and with boxes of dielectric material, he demonstrated that UHF radio waves could be refracted like light waves.

Hertz died in 1894, at the age 37. One wonders what else he would have accomplished had he lived a normal life span.

Happenings

Conducted By John C. Hennessee, KJ4KB
Regulatory Information Editor

League Members to Choose Board Representatives

There is a lot happening in Amateur Radio. ARRL is moving forward on several critical Amateur Radio issues, and more loom before us. You, as an ARRL Full member, determine the course ARRL will follow into the uncharted waters of the 1990s.

As the sole national-level general Amateur Radio organization, ARRL effectively represents the US ham population. League policy is set by the ARRL Board of Directors, acting together. Where does the Board get that authority? From you who elect them. Our Directors and Vice Directors are volunteers, who serve two-year terms once you nominate and elect them. The Directors are your "senators," who assert your collective will through the HQ staff and the nationwide volunteer organization that is ARRL.

This year, ARRL Full members (that is, licensed amateur members of all categories—Life, Youth, Senior, Family or Annual) in the Atlantic, Dakota, Delta, Great Lakes, Midwest, Pacific and Southeastern Divisions select their Directors and Vice Directors for the 1990-91 term. If one of these is your Division, read on to see how you can have your say in the future of ARRL.

ARRL Divisions

The policies of the League are established by 15 Directors, who are elected to the Board on a geographical basis to represent their Divisions and constituents (see page 8 of any *QST* for a list of the Divisions, Directors and Vice-Directors). These 15 Directors serve for two-year terms, with seven or eight standing for election in alternate years. Just as in national or state politics, ARRL voters/members have the privilege and responsibility either to decide they like the actions of their incumbent representatives and support them actively for reelection or to decide that other representatives could do a better job and work for the election of those persons. Vice Directors, who succeed to Director in the event of a midterm vacancy and serve as Director at any Board meeting which the Director is unable to attend, are elected at the same time.

Call for Nominations

Nominations are now open for Director and Vice Director in the Atlantic, Dakota, Delta, Great Lakes, Midwest, Pacific and Southeastern Divisions for the two-year term beginning January 1, 1990. From now until August 20 at noon, the Secretary will accept nominating petitions signed by 10 or more Full members of a division, naming a Full member of that division as a candidate for director or vice director.

Each candidate will be provided with election procedures information and a questionnaire that will allow the Election Committee to determine the eligibility of a candidate in accordance with the Articles of Association and Bylaws. The questionnaire will require each candidate to furnish information as to his/her occupation and other business activity, age, license class and membership status, under affirmation. A statement of not more than 300 words setting forth the candidate's qualifications and a recent photo may also be sent. This statement and photo will be included with the ballot mailed to members and will be reprinted without content editing; if the statement as submitted exceeds 300 words, the first 300 words will be used. The statement must be relevant, truthful and not misleading (as determined by the Election Committee). The candidate must also submit an accompanying signed statement certifying that the information is true to the best of the candidate's knowledge and belief. Any willful violation of this statement will be grounds for disqualification by the Election Committee. The Committee will meet soon after the nomination deadline to complete its examination of nomination papers, affidavits and 300-word statements, so candidates should make sure their information form arrives at Headquarters as early as possible and in any event no later than August 20. (It is in the candidate's best interest, obviously, to get the nomination in early. If there is to be a mid-August nomination for some unavoidable reason, the candidate information, 300-word statement and photo should accompany the nominating petition.)

The nominee must hold at least a Technician-class amateur license, must be at least 21 years of age and must have been licensed and a Full member of the League for a continuous term of at least four years immediately prior to the election. No person is eligible whose business connections are of such nature that he or she could gain financially through the shaping of the affairs of the League by the Board or by the improper exploitation of his or her office for the furtherance of his or her own aims or those of his or her employer. The primary test of eligibility is the candidate's freedom from commercial or governmental connections of such nature that his or her influence in the affairs of the League could be used for his or her private benefit. The idea behind these rules is to ensure that candidates: (1) possess a lasting interest in Amateur Radio and the League, (2) have the legal capacity to make decisions for ARRL and (3) are free from conflicts of interest.

Balloting Will Follow

Whenever there is more than one candidate for either office, ballots will be sent to all Full members of the League in that Division who were in good standing as of September 10. (You must be a licensed radio amateur to be a Full member.) The ballots will be mailed not later than October 1 and, to be valid, must be received at HQ by noon on Monday, November 20. A group of nominators can name a candidate for Director or Vice Director, or both, but there are no "slates" as such—each candidate appears on the ballot in alphabetical order. If a person is nominated for both Director and Vice Director, the nomination for Director will stand and that for Vice Director will be void. A person nominated for both offices does have the option, however, of declining the higher nomination and running for Vice Director if he or she wishes. Since all the powers of the Director are transferred to the Vice Director in the event of the Director's death, resignation, recall, removal outside the division or inability to serve, careful selection of candidates for Vice Director is just as important as for Director.

Nominating Form

The following form for nomination is suggested; it may be copied onto any paper, or a form may be obtained from Headquarters upon request:

Election Committee
The American Radio Relay League
225 Main St, Newington, CT 06111

We, the undersigned, Full members of ARRL residing in the . . . Division, hereby nominate. . . of. . . as a candidate for Director; and we also nominate. . . of. . . as a candidate for Vice Director from this division for the 1990-1991 term.
(Signature...Call...City...ZIP...Date...)

Nominees, or indeed any member, may obtain a copy of the Articles of Association and By-Laws, along with a pamphlet outlining the duties and responsibilities of elected League officials.

Absentee Ballots

All ARRL members who are licensed by FCC but are temporarily residing outside the US are eligible for Full membership. Those members overseas who arrange to be listed as Full members in an appropriate

Division prior to September 10 will be able to vote this year where elections are being held. Members with APO and FPO addresses should take special note of this provision; in the absence of information received to the contrary, ballots will be sent to them based on their postal address.

Even within the US, Full members temporarily living outside the ARRL Division they consider home may have voting privileges by notifying the Secretary prior to September 10 giving their current *QST* address and the reason that another division is considered home. If your home is in the Atlantic, Dakota, Delta, Great Lakes, Midwest, Pacific or Southeastern Divisions, but your *QST* goes elsewhere, please let the ARRL Secretary know, as soon as possible, but no later than September 10, so you can receive a ballot from your home division.

The Incumbents

These persons presently hold the offices of Director and Vice Director, respectively, in the divisions conducting elections this year;

Atlantic—Hugh A. Turnbull, W3ABC, and James M. Mozley, W2BCH.

Dakota—Howard Mark, WØOZC, and Bruce L. Meyer, WØHZR.

Delta—Joel M. Harrison Sr, WB5IGF, and Joseph A. Butler, K5OS.

Great Lakes—Leonard M. Nathanson, W8RC, and Allan L. Severson, AB8P

Midwest—Paul Grauer, WØFIR, and L. C. "Chuck" Miller, WAØKUH.

Pacific—Rodney J. Stafford, KB6ZV, and Charles P. McConnell, W6DPD.

Southeastern—Frank M. Butler Jr, W4RH, and Evelyn Gauzens, W4WYR.

Petitions need 10 or more signatures of Full members and are due at Headquarters by noon August 20. If there *is only* one eligible candidate for an office, he or she will be declared elected by the Election Committee; otherwise, ballots will be mailed not later than October 1 to Full members of record September 10. To be valid, ballots must reach Headquarters before noon November 20. The new term will begin at noon January 1, 1990.

For the Board of Directors:
May 19, 1989
David Sumner, K1ZZ
Secretary

ARRL FILES FOR RECONSIDERATION; MOVES FOR STAY IN FCC GENERAL DOCKET 87-389

ARRL has filed a Petition for Reconsideration and Motion for Stay in FCC General Docket 87-389, the Part 15 revision. Part 15 devices include garage door openers, for example. The League Petition for Reconsideration establishes that the Commission erred in not responding in a reasoned manner to the comments of the ARRL and to those of over 200 amateurs; that the Commission's "absence of complaints" rationale for relaxing restrictions on Part 15 devices is fundamentally flawed; and that the Commission was arbitrary in excluding Part 15 devices from some bands allocated for services involving safety of life or for services that utilize very low received signal levels without excluding them also from the amateur bands (which have these same characteristics). ARRL's call for the Commission, on reconsideration, is to include the amateur bands among the restricted bands; to not increase permitted RF emissions for non-licensed radiators over their former levels; and to require that information on a manufacturer's responsibility to resolve RFI problems be included in the owner's or user's manual for home electronic equipment.

According to our Petition for Reconsideration, "[The FCC], without any empirical data, assumed erroneously that a particular level of RF emission was appropriate, in the face of significant record evidence that its assumption was in error. It failed to adequately consider the League's engineering data, and ignored the hundreds of amateur comments discussing the interference potential to Part 15 devices. Neither did it [FCC] consider its own records of interference complaints, which demonstrate a far more serious level of interference than is assumed in the [proposed rules.] In fact, the levels of permitted energy in the present rules are in some instances hundreds of times as high as those which would cause harmful interference to the Amateur Radio Service."

The League went on to say that the FCC did not adequately consider the specific geographic problems associated with co-channel operation with amateur operation in residential areas since this is where most Part 15 devices are operated. "By failing to place amateur bands in the restricted band, and by authorizing high-powered Part 15 devices on amateur bands above 902 MHz, the Commission has assigned large numbers of amateurs and millions of American consumers an interference burden that they can not and should not be expected to accept. The action is done... at the expense of good spectrum planning, and without the benefit of any field testing..."

The League Petition for Reconsideration concluded by stating that the FCC had failed to permit the consumer to help himself or herself with respect to RFI resolution. "By failing to require manufacturers to incorporate RFI resolution information in the owners manual of the product, the Commission has ignored the instructions of Congress..."

In the Motion for Stay, the League establishes that irreparable harm will occur if the new rules are allowed to go into effect as scheduled on June 23, since it would be virtually impossible to remove from service the Part 15 equipment that would then be permitted into the marketplace. The ARRL has requested a Stay of the effective date pending administrative and judicial appeal.

FCC DECLINES TO INITIATE A SPECIAL AMATEUR CALL SIGN SYSTEM

FCC announced June 1 that it will not initiate a special call-sign system in the Amateur Radio Service, as proposed in PRB-3. According to an FCC news release, "After carefully considering the comments, the Commission concluded that a special call sign program—even one administered by the private sector—would require the diversion of significant agency resources that are essential to the timely and efficient processing of applications for new and upgraded amateur licenses. Under these circumstances, the FCC concluded that a special call sign system is not in the public interest. Accordingly, it terminated this proceeding."

In response to requests from ARRL and three other interested parties, FCC issued a Public Notice in February 1987 seeking comments and proposals for a special call-sign system administered by a Special Call Sign Coordinator (SCSC) in the private sector. The Public Notice called for FCC to continue to perform the actual station licensing function, including assignment of an official call sign. Upon request of an individual licensee, an SCSC could issue one or more special supplemental call signs that could be used in lieu of the FCC-issued call sign. ARRL and 11 other individuals, groups and companies had petitioned the FCC to become SCSCs.

NATIONAL REPEATER DATA BASE ALIVE AND WELL

Through the efforts of Willem "Van" Van Aller, K3CZ, Gary Hendrickson, W3DTN, Larry D'Anna, WA3KOK, Bob Weber and others of The Middle Atlantic FM and Repeater Council (TMARC), the National Repeater Data Base is up and running. A special forum was held at the Dayton HamVention® for the purpose of introducing the on-line availability of the National Repeater Data Base to potential participating coordinators. The data base may be used to access news and message-type mailboxes, as well as uploading and downloading coordination information files.

One of the major concerns in the field is that some coordinators do not want their neighboring coordinators viewing their data without permission. This concern is addressed in the program: Each coordinator must have separate passwords for uploading and downloading data. The only way a coordinator can access the information for another area is by obtaining the password from the coordinator for that area.

WASHINGTON STATE AMATEUR FINED FOR CAUSING MALICIOUS INTERFERENCE

Working closely with the Amateur Auxiliary, the FCC was able to issue a Notice of Apparent Liability and subsequently a Notice of Forfeiture to Billie E. Prell, N7FAQ, of Pasco, Washington. The action against Prell was triggered by numerous complaints from other radio amateurs who stated that Mr. Prell was transmitting radio signals on the frequency of 146.04 MHz for the sole purpose of disrupting the communications already in progress on that frequency. The intentional jamming signals were directly observed and identified by members of the Amateur Auxiliary's Local Interference Committee (LIC). The LIC forwarded the pertinent information to the local FCC Field Office for investigation and enforcement action. Section 97.125 of the Commission's rules prohibit the causing of malicious interference. Malicious interference subjects the licensee to a monetary forfeiture or fine of up to $1000. [Transcript of FCC Field Office news release, Bellevue, Washington news release]

AMATEUR ORDERED TO SHOW CAUSE

An FCC Order to Show Cause and Suspension Order released May 9, 1989 reports that Jerry E. Gastil pleaded guilty and was convicted in Federal court of an offense of interference with Federal radio communications in violation of Title 18 of the United States Code, Section 1362 on February 22, 1989. The conviction establishes that Gastil willfully and maliciously caused radio interference to the Federal Bureau of Investigation (FBI) between April 1 and 10, 1987 in violation of Sections 97.125 and 13.62 of FCC Rules.

The Commission stated, "it appears Gastil lacks the requisite character qualifications to be a Commission licensee in the private radio services or to hold an operator license." The Commission went on to say "malicious interference in any radio service is a very serious matter. It is the most serious violation found in the Amateur Radio Service, warranting the most stringent penalty." According to the FCC, Gastil's conviction for interfering with US Government communications was deemed clearly relevant to evaluating the likelihood that he will comply with the Communications Act and with the Commission's Rules as an operator or as a licensee in the Land Mobile and Amateur Radio Service.

FCC has ordered Gastil to show cause within 30 days of receipt of the Order why his station licenses for his Specialized Mobile Radio System stations and club station licenses W6JAM and K6KQC should not be revoked. His General Class Radiotelephone Operator license has been suspended. Gastil's Amateur Extra Class operator's license has been suspended and his station license for K6DYD revoked.

FCC DENIES INDIVIDUAL SPECIAL-EVENT CALL-SIGN REQUEST

In a recent letter to an amateur denying a request for authorization to use a the numerals "89" in the call sign of a special-event station, FCC's Private Radio Bureau Chief Ralph Haller said the following:

"I regret that your request can not be granted. Your request is, in effect, a request for a special call sign and issuance of those call signs was discontinued over 11 years ago because the processing of such requests delayed processing of other applications. There was one exception made for an amateur station operating in connection with the 1987 Pan American Games. Unfortunately, that authorization has brought about an increase in the number of requests for special-event calls, all of which had to be denied. For this reason, we do not anticipate that any future exceptions will be made."

AMATEUR RADIO AT THE 1989 SCOUT JAMBOREE

Amateur Radio operators will showcase their hobby at the 1989 National Boy Scout Jamboree between August 2nd and 8th. Hams will use the Boy Scouts of America's amateur call sign of K2BSA to demonstrate Amateur Radio at Fort A. P. Hill, Virginia, to more than 34,000 Scouts and leaders. Hams will teach radio skills to Scouts and provide for them a shortwave-listening post. In addition, traffic-handling services will be provided to Jamboree participants.

K2BSA will be active for the entire Jamboree period, on all bands and modes. You can earn a special QSL card for contacting K2BSA on the air. Frequencies include CW: 3.590, 7.030, 14.070, 21.140, 28.190, and SSB: 3.740, 3.940, 7.090 (outside US), 7.290 (in US), 14.290, 28.350 and 28.990.

SECTION MANAGER ELECTION NOTICE

To all ARRL members in the Alabama, Alaska, Delaware, East Bay, Kansas, Michigan, New Mexico, Santa Barbara, Tennessee and Western Massachusetts Sections: You are hereby solicited for nominating petitions pursuant 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 (FSD-129) are available on request from ARRL Headquarters but are not required. The following is suggested:

(Place and date)

Field Services Manager, ARRL 225 Main Street, 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).

Any candidate for the office of Section Manager 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 4:00 PM Eastern Daylight Time September 8, 1989. Whenever more than one member is nominated in a single Section, ballots will be mailed from Headquarters on or before October 1, 1989. Returns will be counted November 21, 1989. SMs elected as a result of the above procedure will take office January 1, 1990.

If only one valid petition is received for a Section, that nominee shall be declared elected without opposition for a two-year term beginning January 1, 1990.

If no petitions are received for a Section by the specified closing date, such Section will be resolicited in January 1990 *QST*. An SM elected through the resolicitation will serve a term of 18 months.

Vacancies in any SM office between elections are filled by the Field Services Manager.

You are urged to take the initiative and file a nomination petition immediately.

Richard K. Palm, K1CE
Field Services Manager

FCC-ISSUED CALL SIGNS UPDATE

The following is a list of the FCC's most recently issued call signs as of May 1.

District	*Group "A" Extra*	*Group "B" Advanced*	*Group "C" Tech/Gen*	*Group "D" Novice*
Ø	WSØV	KFØCM	NØKNK	KBØEMA
1	NW1G	KC1OP	N1GMN	KA1TSK
2	WO2R	KE2MQ	N2JHX	KB2HSC
3	NU3S	KD3MP	N3HAL	KA3UOE
4	AB4OB	KM4RL	N4VPB	KC4KJB
5	AA5LJ	KG5TR	N5OHX	KB5JHA
6	AA6NP	KJ6TE	N6UYS	KC6DIF
7	WZ7P	KF7TH	N7MQX	KB7HQE
8	WR8Y	KE8YQ	N8KSK	KB8HCS
9	WG9X	KE9PX	N9IJZ	KB9CPT
Guam	KH2K	AH2CE	KH2DS	WH2AMA
Hawaii	**	AH6JT	NH6SW	WH6CDB
Alaska	**	AL7LD	NL7RF	WL7BUV
Virgin Islands	NP2E	KP2BO	NP2DB	WP2AGQ
Puerto Rico	**	KP4QD	WP4VG	WP4IIP

**indicates all 2 × 1 calls have been issued in these areas.

Correspondence

Conducted By John Hennessee, KJ4KB
Regulatory Information Editor

IN SUPPORT OF A CODELESS VHF/UHF LICENSE

☐ I'm writing in support of an entry-level codeless VHF/UHF license. Once we attract these codeless hams to Amateur Radio, it is our responsibility to help them upgrade. While not all may be interested in upgrading, I believe a considerable number would be, especially if we encourage them and expose them to the other fun aspects of ham radio at club meetings, Field Day and through their reading of *QST*.

I believe that a codeless license will help our hobby grow, act as a springboard for people who want to get into HF hamming, help reduce the possibility for future VHF spectrum grabs and help us to present a new and dynamic face to Amateur Radio to attract the next generation of hams.—*Dale Gaudier, N4REE, Dunwoody, Georgia*

I do not advocate dropping the CW requirement for HF bands. Given the current international regulations, I doubt that it would ever become reality. I do advocate an entry-level, codeless license with limited privileges on the VHF/UHF bands. Upgrading beyond this entry-class codeless license would require demonstrating a proficiency in CW operation as required today. For now, I'll cast my yes vote for a codeless license class.—*Jim DiTucci, N2IXD, Rochester, New York*

☐ Just because there is a license which does not require proficiency in the Morse code doesn't mean that Morse code will not be used any more! It does not sound the death knell of the code! If the code is as great as these folks maintain, then people will use it. It's as simple as that. Let it stand upon its own merits.—*John E. Vercellino, WB9OVV, Downers Grove, Illinois*

☐ With reference to Correspondence March 1989, I take issue with KBØBSR's comment that "...those who would benefit from a codeless license would most probably be those who won't stick with ham radio for too long." I have a United Kingdom no-code license, I am a keen home-brewer and operator and my call is now 8½ years old. There are still many codeless calls in excess of 15-20 years old!

To conclude, a properly controlled, codeless license can help introduce people into our hobby who may initially find CW too daunting. Compulsory CW can discourage those with much technical expertise from joining our ranks, only because of the dits and dahs!—*Jon Carp, GM8XFT, Shetland, Scotland*

☐ I would like to let you know how strange the question of a codeless license sounds on this side of the ocean. One of your members, W9RS, proposed that you wait five years before drawing conclusions on the adoption of a codeless license by Canada. This experiment has already been done many times! Here in France (and in many other European countries like the United Kingdom, West Germany and others), we have a codeless license with privileges only on the VHF/UHF frequencies, and we've had one for many years. Nothing awful has happened to our bands. Many new hams have joined our ranks, [as a result of a codeless license] especially technical people, and I can tell you that many of them are building their own equipment and experimenting—perhaps more than full-licensed hams! I do not want to stick my nose in when it's none of my business, but keeping our hobby alive throughout the world very much depends on keeping it alive in the US.—*Jean-Michel Quetin, F6ADT, Le Plessis-Robinson, France*

A CODELESS LICENSE IS NO GOOD

☐ Amateur Radio is a hobby and not a profession. Those who support the concept that CW is obsolete are in a sense correct. However, I do not believe this is a valid reason to eliminate the requirements for obtaining a ham license.

It is hard for me to believe that learning the code creates a hardship for those willing to get involved with Amateur Radio. This is a small price for entry into this hobby of ours. One cannot ever fully appreciate and enjoy the hobby without experiencing communications via CW.

A true hobbyist is one who at least once in his or her lifetime constructs their own radio equipment. I have constructed many rigs before and after World War II. I am sure there are still those aspiring youngsters who are constrained by a limited budget and who could find a simple CW rig within their means—the other modes to come later. Encouraging the entry into ham radio (at least in the HF bands) via CW as a first step, I believe, will be of significant value to the new ham and to our hobby.—*George A. Lucchi, W6NVN, Phoenix, Arizona*

☐ CW is not a silly hazing phase designed to keep out the riff-raff. I've heard others claim it was. It is not. It's primary importance, probably, is that it is a common language—an acquired language skill which binds the whole world together and enables amateurs of all nations and many languages to communicate.

I hope and trust that the ultimate decision within the amateur community will be to leave the codeless license with the no-license group now cluttering our long-lost 27-MHz band.—*Thomas H. Cash, Jr, K4ZQX, Chattanooga, Tennessee*

SOLUTIONS...

☐ Each month I read the growing debate regarding code/no-code in *QST*. Each side has valid points in my opinion. Proponents of the code side feel if they learned it, why shouldn't everyone else? No-code proponents want more hams as quickly and as easily as possible. Both sides, however, do not give the one thing needed—solutions. Instead of complaining, why not find a middle ground? Here are a few possible courses of action:

1) Issue a license for codeless operation with limited privileges. Make it valid for only 1 to 2 years, non-renewable. If a new ham likes our hobby that much, he will have to work to receive permanent use of the bands.

2) Initiate a massive upgrade program. Too many of us do not upgrade. Tough to do? Probably, but it will generate more interest in our hobby.

3) Finally, I understand at least one-half of all Novice licenses are never used, and probably at least that many people in the *Callbook* never get on the air. Any idea why? Me neither, but someone should try to find out.—*Jeff Rahmel, KA8ZAW, Napoleon, Ohio*

☐ This letter pertains to everyone's complaint of ham radio dying. Everyone wants to get new people on the air, but I haven't seen a thing done! I am an 18-year-old computer science major, and I just took and passed my Novice exam one week ago.

My interest in ham radio sprung up one day when I was at a friend's station and was listening to a ham speak to Russia. I say speak, but it wasn't voice that he was using...it was Morse code. That is what attracted me. I have been interested in telecommunications since 1980 when I opened the Army outpost BBS in Brooklyn, New York running on an Atari 800 computer. I had the time of my life! I still use my modem daily. When I saw someone speaking to someone else around the world at no cost by ham radio, I immediately said, "I want to be a ham."

In order to get more people into ham radio, more people have to know about it. Maybe getting small articles in newspapers, magazines or other media forms other than ham radio-related media will get more people interested. How about people going to colleges and high schools giving lectures on ham radio. Public awareness is the only way people learn about things!—*Matthew Horbund, Tempe, Arizona*

How's DX?

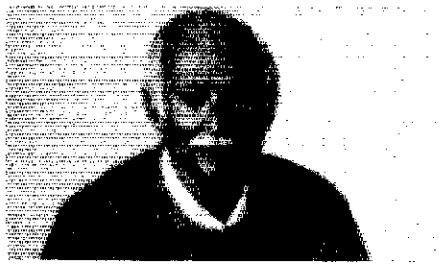
Conducted By Ellen White, W1YL/4
19620 SW 234 St, Homestead, FL 33031

A Visit to Madeira, CT3-Land

In November 1988, W8TP of Columbus, Ohio spent a week vacationing on Madeira Island. The Amateur Radio highlight of his visit was a meeting in Funchal with CT3BA, CD Communications Director for the Island.

Madeira, an autonomous part of Portugal, lies at 32 degrees, 38 minutes North latitude and 16 degrees, 55 minutes West longitude from Greenwich. The island was uninhabited when discovered by Portuguese sailors in 1419. The scenic volcanic island is roughly 35 miles long and 14 miles wide, with a surface area of about 308 square miles. Its name means "woods," from the heavily forested, extremely hilly terrain. The hills and valleys account for serious communications problems. Madeira has three 2-meter repeaters, with another repeater on the nearby island of Porto Santo serving as a UHF link, permitting intercommunication on Madeira, where line-of-sight contacts are impossible because of the mountainous terrain.

CT3BA (Luis Caissotti Rosa, Servico Regional de Proteccao Civil, Quinta Magnolia, Rua Dr Pita 10, Funchal, P9000, Madeira, telephone 63115 and 64715) maintains his ham shack at his office, but he is so busy that he has little time to operate. Madeira's CD headquarters also houses the Madeira Amateur Radio beacon on 14.1 MHz (identical to that described in December 1988 *QST*, page 60). The beacon operates at 6, 26 and 46 minutes past each hour. It is a busy place on the grounds of the former British country club. W8TP reports a wonderful visit with Luis and a thoroughly enjoyable CT3 holiday enjoying Madeira's spectacularly scenic views of mountains and seacoast.



CT3BA, Madeira's CD Communications Director. *(Thanks, W8TP)*

QSL MANAGERING

There has been quite an uproar in the Amateur Radio press in recent months concerning controversial QSL practices. LA5HE's Commandments for QSL Managers (this column, August 1988 *QST*) capsuled what most active DX-type hams feel to be a responsible way in which to handle cards. Let's take a look at what a 20-year QSL manager has to say, from that highly regarded radio amateur WA3HUP.

"I've enjoyed helping out DX stations, as well as those in need of cards. I've made many wonderful friends throughout the world. Now, something has come up which is very disturbing to me. The policy of requiring one SASE for each card is ridiculous. I, for one, am very much against this policy. Green stamps which I've received have helped in this work, but I've also had to dig into my own pocket, as I'm sure other managers have done. If a stateside station works the same station on five bands and sends cards to the US manager requiring one envelope per card the cost would be $2.50. Should that same station QSL via an overseas manager with the same requirement, the cost would be $11.75 (postage one-way $2.25, 2 IRCs for each card at $.95 each!). If you're able to buy IRCs for $.50 each, the cost would be $7.25. Can you imagine the cost for a DX station QSLing to those managers? Now, I ask you, is this fair?

"Some managers will not accept cards via the bureau. I can't believe this. It is so wrong, and I personally do not condone this practice. The bureaus were organized to help the hams save a little money. Postage rates are so high. You may have to wait longer for a card, but then there are times when we wait a long time for a card from a manager for one reason or another.

"Amateur Radio isn't a business. Come on, be a bit more compassionate and help where you can. I for one will always accept more than one card for a single envelope, providing it doesn't exceed the postage on the envelope. I will always accept cards coming via the bureau. I answer them all, including SWL cards. This has always been my policy and the way I'll continue to operate. I might add that it takes 2 IRCs for direct air mail. (Many DX stations have sent only 1 IRC.)

"If I've angered some managers I'm sorry. Think back to when you started, and let's all be friends please. If you were just starting out now, I'm sure you would agree with me."

NIGERIA

Cal KH6HSS/5NØ, updates 5N activity: Sego, 5NØSKO, is the Lagos-area manager and is active 40-10 phone/CW; Yemi, 5N2KRC/Ø, runs 10 watts 40-10 phone; Tidy, 5NØELT, is active 40-10 CW; Jerry, 5NØBRJ, is the Lagos-area treasurer; Kunle, 5NØOBA, is the Secretary General of the Nigerian Amateur Radio Society (NARS); NARS runs a 0700Z Sunday net on 7065 LSB with 5NØOBA as net control; the NARS 2-meter repeater in Lagos operates on 145.675/145.075. If you're having difficulty working a Nigerian station, keep an ear out for Georgio, 5N9GM, in Kaduna who is active on several DX nets; Bernd, 5NØMRD (DK3LQ) is active 20-10 phone; G3GJQ/5NØ is an avid contester; KH6HSS/5NØ is on 10 CW around 28.033, and hangs out on other bands 27, 33, or 37 up from the bottom of the band.

W8TP and XYL doing some serious holidaying on CT3. *(Thanks, W8TP)*

ECI

Earlier this year, JA2NQG/JH1LKH (accompanied by JA7HMZ) visited Pohnpei (formerly Ponape) in the Eastern Carolines. During his stay, Mine operated his station KC6MS Feb 27-Mar 5, resulting in 4000 two-ways, all on CW. In mid-March he keyed JA2NQG/JD1 on Ogasawara to the tune of 2500 code contacts. (In past trips Mine operated VK9LS and VK9NQ, idyllic Norfolk and Lord Howe Islands.) All requests via Minekazu Sugiyama, Box 5, Ninomiya, 259-01 Japan.

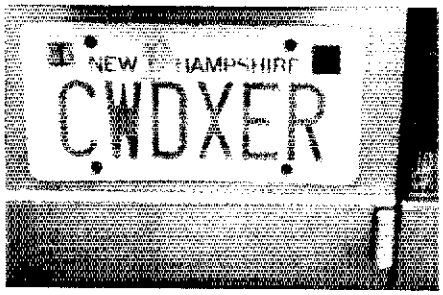
US/USSR

On the heels of the successful US/SU joint US/Soviet operation to Ayon Island, K7ZR announces that the Zilan DX Club (Kazan branch) has invited six Western Washington DX Club members for a 10-day trip down the Volga, starting July 5, visiting UA4P (Kazan), UA4L (Ulianov), UA4C (Saratov), UA4H (Kuibishev) and UA4A (Volgograd). Hoping to operate UA4/ plus their own calls are: K7UDG, K7ZR, WA7WXA, WR7Q, KE7V and K7RA.

AWARDS

The Luxembourg Independency Award commemorates the independence of the Grand Duchy (according to the Treaty of London, April 19, 1839). The award counts for 1989 contacts, totaling 150 points: each LX is worth 20 points for non-EU stations (10 points for EU); each club-station (LX/RL or LX15/L) contact counts 30 points for non-EU (15 points for EU). Work stations only once per band, independent of mode (no band/mode restrictions). Application fee 10 IRCs or $6 US. Before July 31, 1990, forward fee, plus certified list, to the Reseau Luxembourgeois des Amateurs d'Ondes Cortes, Awards Manager, Box 1352, L-1013, Luxembourg. (Include a return address label.)

The Guernsey Bailiwick Award, for working the islands of Guernsey (consisting of 10 small parishes), Alderney, Sark and Herm. *Bronze Award:* Contact GU stations in six of the Guernsey parishes, plus club stations GU3HFN or GU8NIS (7 QSOs). *Silver Award:* GU stations in eight of the parishes, plus one contact with either Alderney or Sark, plus either of the mentioned club stations (10 QSOs). *Gold Award:* GU stations in all 10 parishes, one each with



Telling it the way it is, snapped by K1KI at the 1988 New England DXCC dinner (owner unknown).

Alderney and Sark, and either club station, for a total of 13 QSOs. Note: contacts with mobiles/portables count as long as the confirmation states which parish was activated. All Guernsey stations must be members of the Guernsey Amateur Radio Society. Various endorsements available. A list of contacts certified by two members of your national society is required, accompanied by 8 IRCs or $4 US. Details and a list of club members available from Phil Horsepool, GUØJCI, Awards Manager, Box 100, Guernsey, Channel Islands.

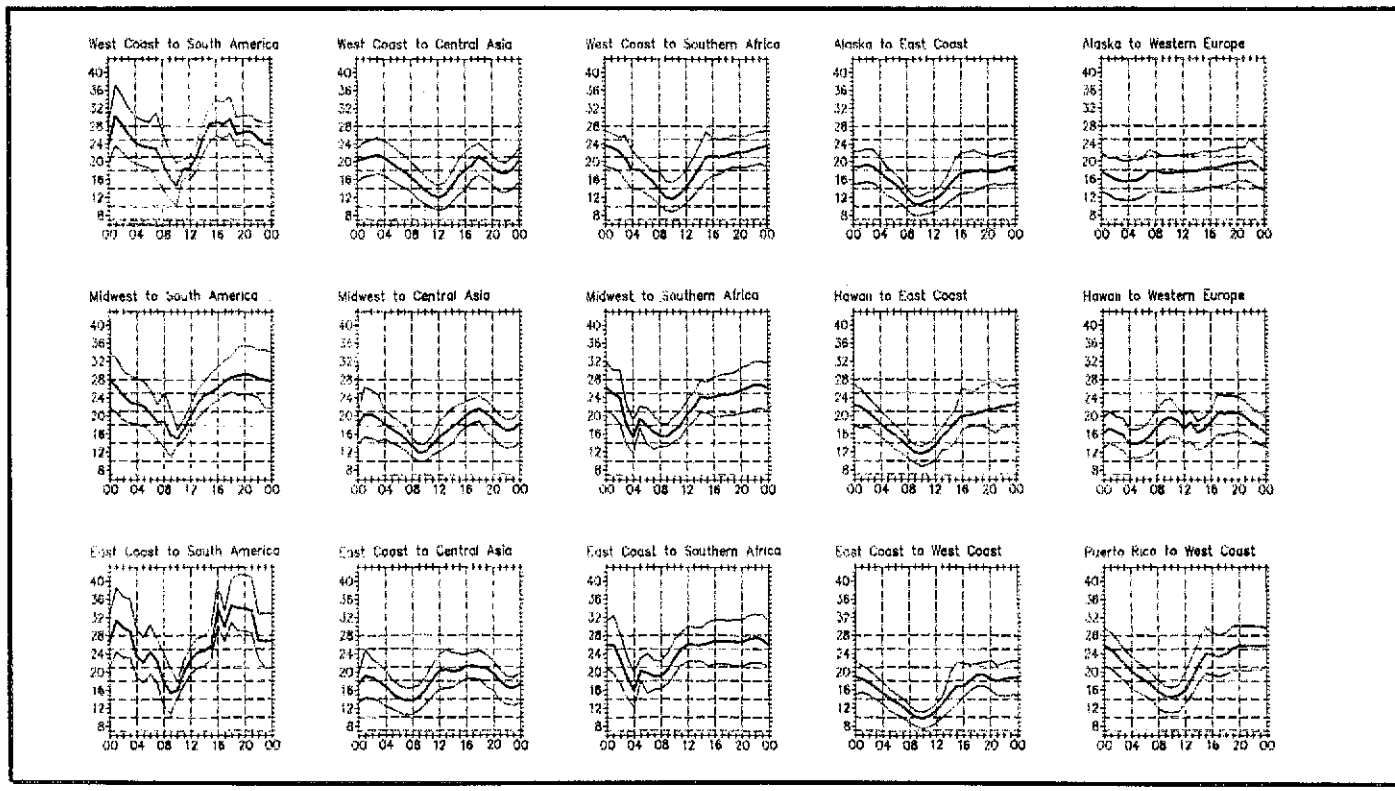
5NØOBA *(Thanks KH6HSS/5NØ)*

RUSSIAN ROUNDUP

NT2X furnishes helpful tidbits from time to time. RA9YD is willing to help his counterparts in other countries obtain *any* Soviet QSL, returning via airmail. Enclose 3 IRCs, please, to Valery Tyulyapin, PO Box 2353, Barnaul 656057, USSR. 4K1GAG: UQ2GAG has all the logs. Two IRCs to PO Box 50, Riga 226010 USSR. 4K1CEY: UW1ZC has the logs. Box 70, Kola, Murmanskaya Oblast, 184360 USSR. 4K1J, operated by Slava, UA1BJ, reports over 4000 cards are already out, more on the way. RB7GG manages the following rare ones direct for W/VE stations: UAØKK, UAØZZ, RD6DZ, UJ8XA, EO5BGH, RVØYF; Box 73, Herson, 325000 USSR. 4K1A, 4K1HK, 4K1ANO (1980-87) via Toiva Lamitainen, Box 459, Moscow, 127349 USSR. UAØKBZ (op at UZØKWC) has over 25,000 manager calls/routes on file (going back 20 or more years). He is willing to trade info, and inquires if anyone knows the whereabouts of the DX logs once held by the now-deceased legendary W2CTN. Check with Serge at Box 485, Cape Schmidt, Magadan Region, 686830, USSR. UA9YAB is willing to become a manager for any NA station or club and help facilitate QSL exchanges. Alex has logs for UK9ZAA, UA9ZAA, UK9YBD/U9Z, UZ9YWA/U9Z, UYZ9ZWA/U9Z. Write (IRCs, please) Alex Vedernikov, Box 83, Biysk, Altaisky Krai, 659393, USSR. A parting tip from the editor: Avoid sending personal letters, reply coupons and photos via Box 88. All incoming correspondence is considered their business property and once envelopes are opened, IRCs are removed and letters/photos discarded. Use the now-personal direct route if you're mailing something other than just a QSL. (W1RAN appends a note advising that you leave the call letters off the addresses of envelopes going directly to a Russian QTH.)

5NØSKO *(Thanks KH6HSS/5NØ)*

5NØELT with 5NØBRJ *(Thanks KH6HSS/5NØ)*



When are the bands open? These charts predict this month's average propagation predictions for high-frequency circuits between the US and various overseas points. One chart showing 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 the lowest curve (optimum traffic frequency, or FOT). The horizontal axis shows Coordinated

CIRCUIT

☐ **W6QD:** Herb Becker, a genuine DXCC progenitor, passed on in mid-March.

☐ **W1DX:** Cheers for By Goodman, Technical Excellence Award winner at the 1989 Dayton Hamvention, one of the pioneers who helped develop the ARRL DXCC program.

☐ **VK2BCH:** Bing's sixth DXpedition to the Pacific: May 14-Jun 7 in Rarotonga, ZK1XV; Jun 8-15 Apia, Western Samoa, 5W1GY; Jun 16-Jul 7, Pago Pago, American Samoa, VK2BCH/KH8; ? Tokelaus; Jul 8-Aug 8, Rotuma Island via Suva, awaiting 3D2 call. Bing plans to operate 160-6 meters, no split. He'll take a list, but only to assist with the European pileups. Cards direct only to Bing Crosby, VK2BCH, Box 344, Forster, NSW 2428, Australia, with postage assistance.

☐ **Routings: XE2GCK** (1988 CQ WW, CW) via AA6EE. **ZD8IAN**, go via the bureau and not through G4ZAO. **3B8DA** badly needs your SAE plus postage for return airmail or direct. Go via Alex Mootoo, 39 Brown Sequard Avenue, Vacoas, Mauritius. Note, Alex collects stamps. Thanks W9AZP. **C3ØDSA** goes via Pentti Lareva, Tenavankatu 34, SF-15170 Lahti, Finland.

☐ **Palmyra:** W8ZCQ notes that uninhabited Palmyra will go to the highest bidder if Hawaii doesn't buy the 600 acres of land with an 8,000-acre reef-protected atoll, lying 960 miles south of Honolulu. Any takers?

☐ **XF4L:** The April Revilla Gigedo 8-day operation netted close to 48k contacts, averaging about 260 contacts/hour during some 184 hours of operating. The objective of meeting high EU demand was achieved. Additionally, the group established Amateur Radio on a permanent basis by training the island's commander, Fernando Quijana Garrido. QSLs/donations to Jarmo J. Jaakola, OH2BN, Kiiletie 5-C-30, 00710 Helsinki, Finland.

☐ **ZYØFX:** Bill, W9VA, operated this station on Fernando de Noronha during ARRL's February DX Contest at the station of the only resident ham, Andre PYØFF. Bill notes that he had dinner with that old CW pro Rolf, PY1RO, when passing through Rio. Rolf's 60-meter tower (meters, yes!) supports a directional array that puts an awesome top-band signal everywhere. W9VA handles cards for PY1ZFS/Ø, PYØFF, ZYØFX. QST

QSL Corner

Administered By Joanna Hushin, KA1IFO

Here is some information for those of you who would like to QSL a QSL manager or 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.

ED5WWC	(EA5FCS)	V21AJ	(WB2TSL)
EL2JM	(KA5ZMK)	VP2SL	(HB9SL)
EL2MR	(WA8LKS)	V29A	(W4FRU)
HV3SJ	(IØDUD)	V29OA	(W7KNT)
D68J	(AK1E)	ZK1XI	(SM7PKK)
JY3ZH	(DJ9ZB)	ZS3Z	(ZS6BCR)
J73EH	(WA4WIP)	ZV5A	(PY5EG)
OA4SS	(KB6J)	5B4WW	(5B4TI)
PA6CC	(PA3BAG)	5V7DX	(DK9KX)
PJ8JP	(AB1U)	5W1HM	(JH4IFF)
PYØFF	(W9VA)	5W1HV	(JL3UIX)
SU1EE	(WA9INK)	5Z4BI	Bill Nesbitt, PO Box 149222, Coral Gables, FL 33114
SU1EK	(W2QUV)		
SVØEK	(N1DSC)		
S79T	(JI3ERV)		
TG9GI	(IØWDX)		
TZ6FIC	(FE6CRS/F6CRS)	9H1HBS	(N5APW)
T32AF	(K7EHI)	9Q5NW	(AL7EL)

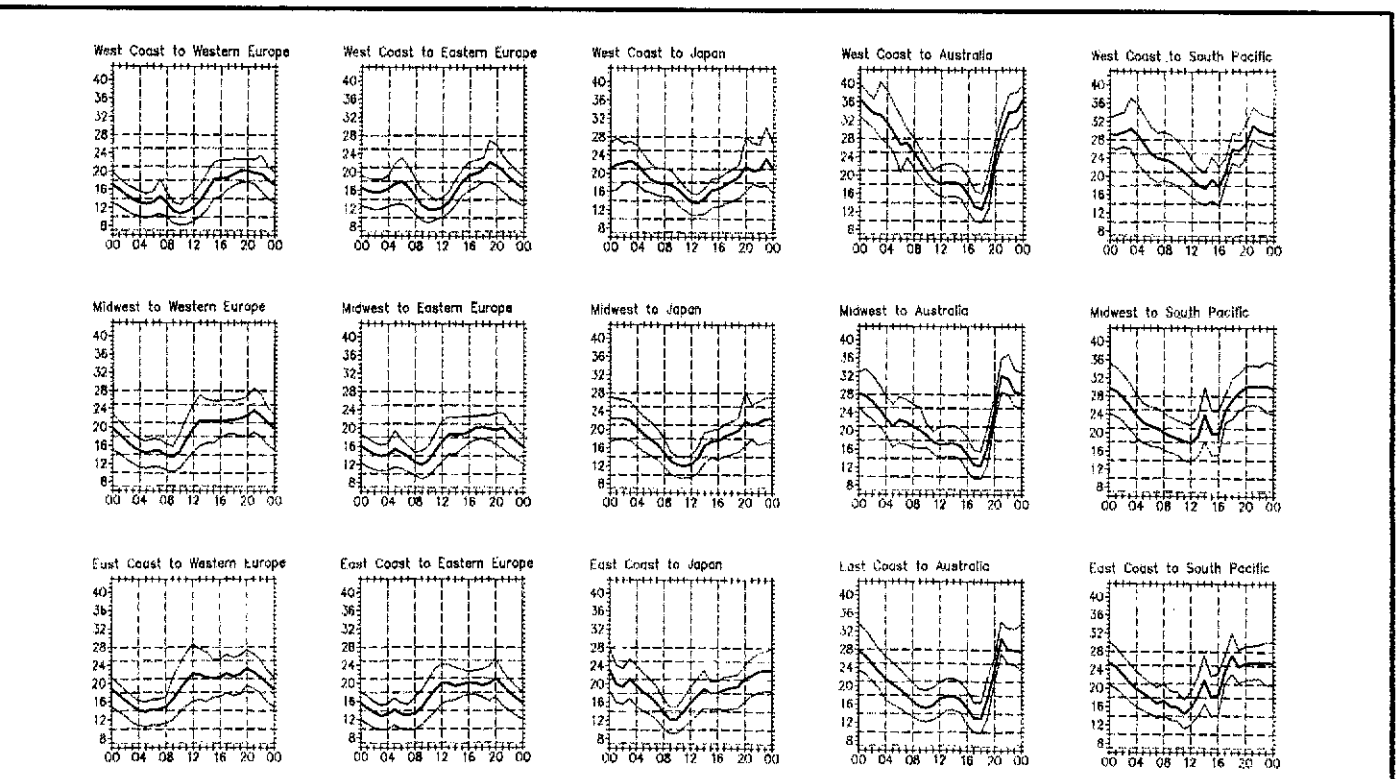
QSL MANAGER VOLUNTEERS

N6TIB

SPECIAL NOTES:

ZD8 QSL-Bureau
PO Box 4127
Ascension A.A.F.
Patrick A.F.B.
Florida FL 32925-0127

☐ QSL Corner, June 1989 *QST* page contains information and addresses for the ARRL Incoming Bureau. QSL Corner, March 1989 *QST*, page 68 contains information on the operations of the ARRL Outgoing Service. For additional information on bureau operations (Incoming and Outgoing), send a self-addressed, stamped envelope to ARRL QSL Bureau, 225 Main St, Newington, CT 06111. QST



Universal Time (UTC); the vertical axis, frequency in MHz. See April 1983 *QST*, pp 63-64, for a more-detailed explanation. The 3rd edition of *The ARRL Operating Manual* contains similar charts for a range of sunspot numbers and times of the year. Data provided by the Institute for Telecommunication Sciences, Boulder, Colorado. These predictions, for July 16 to August 15, 1989, assume a sunspot number of 181, which corresponds to a 2800-MHz solar flux of 179.

DX Century Club Awards

Administered By Don Search, W3AZD

The ARRL DXCC is awarded to amateurs who submit written confirmation for contacts with 100 or more countries on the official DXCC Countries List. You may endorse your award in 25-country increments through 250, 10-country increments through 300, and 5-country increments above 300. The Satellite, 160 Meter, and 80 Meter DXCC awards are endorsable in 10-country increments through 200, and 5-country increments above 200. The totals shown below are exact credits given to DXCC members from March 1 to March 31, 1989. An SASE *will bring you the* rules and applications forms for participation in the DXCC program. Send $1.00 to request the ARRL DXCC Countries List.

New Members

Mixed

CP5AA/110	HA3MU/103	JI3PMI/104	OZ1HUE/171	K1RAW/327	NO2R/309	W4APQ/301	N5MIV/119	K8GSR/136
DL3HAA/113	HA8DE/104	JK3SYT/104	RB9GG/311	K1ZZJ/104	W2ØØNY/102	W4YCZ/103	AA6BR/128	KA8MVV/232
DL8NCG/110	HA8KCK/150	JR3ANG/314	SK6LU/154	KA1MPF/109	W2KGE/100	WA4F/123	KW6N/314	KC8WS/100
DL9ZAL/190	HB9AFM/336	JA4JIF/110	VE7NK/109	NR1Q/109	W2WCE/106	WA4QYK/128	KZ6N/127	N8HTT/265
FD1LMI/107	IK8FUN/125	JA5BLB/318	XE2GAT/100	W1WTG/112	WB2UEZ/126	WB4BMM/183	N6SKF/101	K9SD/315
F6ISP/118	IK8HEO/114	JA7YYL/107	Y37OJ/112	W1ZE/329	KI4FW/273	WD4BTF/291	W6HIB/106	NE9Z/287
GIØAIQ/103	JJ1ZXE/103	JE8BKW/204	YU3CF/106	K2MWU/107	N4IVR/101	AA5AX/207	WV6N/239	NJ9R/135
GM3ULP/102	JK1PKE/105	LA4BQ/122	4X6JS/180	K2RS/109	N4ONQ/111	AA5CO/111	K7YQI/181	WB9CPV/125
GW4VBV/114	JP1NWZ/205	LU1BDF/4X/108	K1DD/235	KE2AG/102	N4PNI/100	AA5IL/108	W7LNE/108	WØRAP/133
HA1XR/225	JE3MYG/264							

Phone

CP1FF/102	JP1NWZ/144	LU1BDF/4X/108	YBØAY/104	5T5CK/150	WA4QYK/128	N6BNN/115	W7RH/121	KA9OTD/161
FD1LMI/107	JA2IVK/286	OZ8VR/206	YBØHZL/110	W1IDP/158	WB4BMM/156	NR6S/100	K8GSR/136	NE9Z/276
HA1XR/141	JI3PMI/104	OZ9SN/104	YC1DOA/108	NX2F/103	AA5AX/206	W6IKH/103	KA8MVV/146	NJ9R/129
HB9ATM/223	JR3ANG/273	PP5SZ/269	YC1RED/125	WA2UUK/256	N5HRG/174	W6WBY/202	KA8YSW/110	WA9GCB/128
HP8AHF/126	JA4JIF/110	SK6LU/154	YCØLOG/169	KD3IC/102	N5MIV/117	WD6FPU/105	WB8JDV/108	WA9RDV/124
HP8BSZ/103	JA5BLB/314	VE3MNI/104	3XØHAB/106	N4BQD/287	WA5OLT/104	KD7PA/103	WB8WWK/106	WBØYEA/100
IK1CJO/124	JE8BKW/167	VE4UD/101	4X6JS/161	WA4PZD/100	KB6KTV/134	KF7GH/100	K9SD/260	WDØFQA/110

CW

DF5TS/105	GØEHO/106	JS1MAY/110	VE1BBL/105	K3TEJ/105	KK4VN/102	W6HIB/105	K8SUS/106	W9IAL/102
DK8XB/103	HA1XR/201	JE3MYG/161	YC3HCM/220	K3YL/175	N4MPQ/106	W7LNE/100	KA8MVV/216	WA9GCB/122
DK9PZ/104	IK8HVH/104	JR3ANG/190	K1GVW/132	W3ELJ/100	WB4BMM/101	W7MB/210	K9EC/104	KAØEBP/103
DL3HAA/106	JM1BDB/188	JX5DW/114	WA2C/114	KI4FW/126	AA6GM/104	W7RH/106	NE9Z/216	NØJO/129
FE1JUD/121	JR1DTD/107	SM6AOU/300						

RTTY

DJ7BU/102	IT9ZGY/111	KD2YG/102						

160 Meters

JA4LXY/104

80 Meters

SM6CST/146	NR1R/162	NY2E/104	KZ3H/133					

10 Meters

G4GEE/130	SM6LIF/236	VE4DQ/103	K2EEK/106	K4PXO/101	KB5DUP/126	W6PLX/102	KØHOW/186	NØISL/100
HB9BMZ/106	SM6MSG/130	K1YDG/101	KZ3H/151	NX4B/108	W6KBB/126	WD9DZV/109	KBØBQB/100	NØIWT/101
SM6CST/183	SM6NJK/102	NR1R/212	K4CXY/162	WD4FZO/105				

5BDXCC

K6SVL	K9IL	AA5BK	RT5UY	I2TZK	KL7U	K4ADN	HA1XR	IK4ALM
OK3SVL	N4DRC	PT7CB	WCØY	WØYDB	KI4FW	JH1OXV	NIØG	KA2DIV
N5CID	WS5O							

Endorsements

Mixed

AL7HX/153	HB9NU/320	SM5BBS/157	W1CYB/291	KE3R/250	N4GE/315	KF5AL/278	KB7VD/290	WB8Y/224
CT4YN/299	I1GMF/223	SM5FBL/127	W1KDD/252	N3CJW/224	N4KVF/158	KX5W/260	KV7L/204	K9ALP/309
CX2CS/307	IK2GNW/273	SM6GOR/197	W1LF/150	NM3C/254	N4NPV/194	N5GGO/292	KY7M/292	K9APW/223
DF2UA/159	IN3RZY/311	SM7BRO/223	W1OU/308	W3CRH/275	N4VG/314	NT5V/237	NB7N/158	K9ZXG/290
DFØAFZ/281	I4CJW/213	SM7DMT/199	W1PNR/316	W3KH/315	W4EJH/313	W5EFA/320	NK7L/289	KC9C/188
DJ2XP/256	I5EFO/306	SMØMC/319	W1VH/314	W3ZBF/271	W4JKC/275	W5TCX/255	NW7O/301	KD9OT/241
DJ3FW/307	I7OYT/275	SMØRSM/181	W1ZR/153	WB3CQN/314	W4WAW/159	WA5HOD/302	NZ7K/315	KM9G/254
DJ6DU/304	IØZUT/278	VE2DWH/250	AE2L/173	WB3DNA/314	WA4BEC/313	WA5LQN/151	W7FPT/291	KR9S/261
DJ9KH/311	JG1OUT/287	VE2GHZ/262	K2OWE/310	WB3EVL/181	WA4CCP/280	WS5O/276	W7PFZ/300	NA9Q/315
DL1CP/254	JL1ARF/271	VE3BTQ/170	K2POF/263	AA4HX/200	WA4GKR/308	WX5L/312	W7QN/279	NF9Q/310
DL1PM/348	JM1GYQ/204	VE3OMM/131	K2SD/273	AA4TV/262	WA4MOQ/260	AF6S/309	W7RH/216	W9GSB/304
DL3MAA/194	JM1MGP/294	VE4UD/126	KA2OOG/261	AA4ZW/137	WA4SAC/181	K6ASI/271	WA7GCS/150	W9JEK/205
DL4ZBI/140	JA2CXK/301	VE6XV/258	KB2CV/304	AK4H/270	WA4SSI/279	K6BAG/273	WB7UUE/200	W9LJR/292
DL6OL/285	JH2RMU/191	YV1AVO/157	N2BSA/204	K4AVC/289	WA4UCI/175	K6FM/315	WC7F/128	W9MP/290
DL7HT/301	JA3UCO/217	ZL2ASM/299	N2ZZ/180	K4CEB/311	WA4VEK/286	K6LRN/251	AB8Y/315	W9POC/224
DL8HAZ/209	JR3TOE/152	4Z4AB/304	NB2P/319	K4JAG/290	WB4CVH/150	K6SMF/320	K8SUS/179	WA9GCB/199
G3DCC/125	JA4XH/261	AA1M/292	NY2E/300	K4LR/316	WB4MRH/150	K6TMB/295	K8ZTT/311	WA9LDZ/176
G3FKH/272	JA5NG/306	AK1E/284	W2BWC/165	K4NST/154	WB4PUD/311	K6TWU/321	KB8ZW/300	WA9YYY/201
G3LCS/172	JA6CBG/235	K1ECK/127	W2JGR/317	KA4LRM/251	WB4VMH/159	KA6LDN/127	KC8MK/270	ACØA/305
G3RTE/313	JA6RIL/303	K1GVW/204	W2MT/325	KC4DY/311	WD4AFY/255	KI6BU/261	KC8NU/260	KEØY/246
G3SJH/327	JA8TRT/228	K1IU/316	W2PA/184	KD4OM/225	WJ4T/303	N6IXX/126	KC8XH/202	NØIN/248
G4FEU/311	KP4BJD/318	KA1CSL/180	WA2CBU/299	KE4UC/260	AA5DX/258	W6DU/283	KD8SY/206	NEØP/151
G4VZQ/201	LA1PBA/200	KA1RRL/203	WA2VZQ/157	KI4M/315	K5CSK/314	W6NNV/344	KT8W/225	NIØG/283
GM4KLO/250	LA4DCA/277	KB1ER/254	WA2WIP/150	KJ4BK/313	K5FNR/275	W6YFW/269	KW8T/315	NTØH/151
HA5AM/301	LU6DHR/308	KC1EL/204	WB2EBS/149	KJ4VH/240	K5GKC/288	WA6TJM/250	N8ZA/335	NXØI/292
HA6KQD/127	OE3EVA/319	N1CIX/270	WB2GYS/206	KK4YA/129	K5NV/297	WB6OTB/275	NX8J/305	NZØR/231
HB9AFI/314	ON5SY/320	N1CQ/263	WC2B/200	KV4F/315	K5OLJ/229	WB6ZUC/322	W8DN/270	WØFF/320
HB9CBA/267	OZ1LGF/280	N1IR/249	K3MD/227	KX4H/289	K5WA/212	WR6O/201	W8NJC/325	WØJLC/307
HB9DJC/156	PS7ER/239	NE1T/204	K3RY/150	N4CRI/296	KE5AX/308	K7LJ/285	WA8SEG/208	WØRRY/320
HB9EU/344	PY2DBU/300	NQ1W/278	KB3OQ/310	N4DAZ/310	KE5RM/200	K7NW/247	WA8SJX/150	WEØQ/201

Phone

AL7HX/153	I0ZUT/206	SM6CST/312	K2EWB/291	KF4NO/297	WA4GKR/304	WX5X/226	W7DSZ/312	K9BIL/310
CT1CNI/185	JA1DM/337	SM6CTQ/319	K2MFY/303	KI4FW/262	WA4OBO/309	K6ASI/270	W7JNC/326	K9EL/296
DF4PL/305	JA1WSK/319	SM0MC/310	KB2CV/300	KI4SR/258	WA4PLR/310	K6BAG/210	W7TE/315	K9HQM/314
DJ9KH/304	JL1ARF/260	VE2GHZ/262	KB2ZP/312	KJ4VH/202	WA4PPS/284	K6EXO/334	WA7KNK/316	K9JF/296
DK2BI/327	JM1MGP/288	VE3BTQ/157	N2AMI/306	KK4YA/125	WA4UNZ/272	K6MA/322	WA7QQI/126	K9MK/306
DL2AW/318	JA2CXK/299	VE3ICR/304	N2LT/294	KQ4O/314	WA4VEK/285	K6RK/312	WB7CLU/315	KA9VRA/175
DL2DBH/132	JA2KVD/313	VE4OX/331	N2ZZ/160	N4AVB/314	WB4MRH/151	K6RN/311	WC7F/128	KC9C/130
DL3MAA/169	JA3CSZ/314	VE6XV/248	NY2E/300	N4AVV/313	WD4AFY/225	K6SMF/319	AB8Y/294	KC9SF/226
DL3RK/336	JA3JOR/319	VE7AHA/314	W2IOT/333	N4BVP/249	WD4JMC/250	K6TMB/289	K8CS/209	KD9OT/241
DL8CM/315	JA3LUK/314	VK2AGA/229	WA2FCW/250	N4BYU/307	WJ4T/277	KF6EN/229	K8EK/200	KD9RD/236
EA1FP/200	JR3TOE/152	VS6CT/295	WA2IZN/315	N4CRI/290	K5CTG/307	KI6BU/260	K8GG/305	KR9R/282
EA8AKN/295	JA4XH/224	WP4AFA/201	WA2JUN/311	N4EDT/246	K5GKC/284	N6JV/237	K8ONV/337	KR9S/248
EI7DJ/128	JA5FDJ/302	YB0BOK/189	WA2MOE/308	N4JA/321	K5ZH/296	NS6B/313	K8SUS/125	NC9I/177
G3OPL/224	JA5NG/290	YV1AVO/138	WB2KPE/307	N4MZL/180	KA5WOO/250	W6BJI/325	K8YVI/260	W9DE/314
G3UAS/274	JA6CBG/228	ZL1ALE/316	WB2QMU/319	N4ONI/282	KB5CX/154	W6DU/273	K8ZTT/302	W9DOR/302
G3VIE/320	JA6CNL/307	4Z4AB/274	K3AYK/153	N4QF/312	KC5UO/306	W6EBR/153	K8ZZU/311	W9HJ/324
G3YJI/318	JA6RIL/290	5N8ZHN/205	K3CI/236	N4VG/314	KV5E/310	W6OMR/319	KA8DZT/209	W9WM/262
G4GED/280	JA7FS/276	AK1E/279	K3RT/282	NE4A/313	N5FW/315	W6SN/315	KB8ZW/297	WA9BDX/200
G4NXG/232	JA7ZF/322	K1ECK/127	K3RV/293	NF4U/315	N5GGO/292	W6YFW/265	KC8NY/300	WA9LOZ/149
G4VZQ/201	JE7JZT/208	KA1ERN/206	KD3CR/151	NN4Q/315	N5ITG/252	WB6RSE/301	KC8XH/201	WE9R/176
HA5AM/256	JA8AWH/300	KA1UJ/150	W3ICQ/313	W4APQ/301	N5JR/311	WD6EKR/292	KD8KX/260	AC0A/305
HB9BGN/308	KH6JEB/303	KT1N/314	WB3EVU/177	W4BQY/331	NE5P/306	WR6O/157	KD8SY/206	K0GSV/315
HB9NU/320	LA4HW/314	N1CIX/253	WB3IHQ/146	W4CVX/202	NK5Y/301	K7EG/286	KN8COQ/270	K0IFL/308
I2EOW/300	LU1JDL/353	W1AX/340	AA4TV/258	W4DZZ/296	NT5C/271	K7EHI/290	NX8J/290	KE0Y/192
I2HHE/313	OK1VK/317	W1BAL/272	AA4VK/314	W4JZ/307	W5CRP/273	K7GEX/314	W8JQ/322	N0IGU/125
I2TZK/297	PA0LOU/321	W1CYB/290	AA4ZK/244	W4RKN/252	W5EFA/319	K7NW/243	W8QBG/323	N0I/281
IN3FDC/231	PY5OC/286	W1KID/311	K4BVQ/337	W4UNP/312	W5LDH/310	KB7VD/290	W8QWI/305	W0FF/304
I5EFO/302	SM3DXC/309	W1KKG/160	K4CXY/315	W4ZPQ/127	W5TNZ/225	KB7YX/271	W8UVZ/310	W0GOQ/286
I6MRD/224	SM4EMO/299	W1MGP/259	K4KST/283	WA4ACL/223	W5UJO/260	KY7M/271	WD8Y/311	W0JLC/244
I7OYT/275	SM5BBS/157	W1PNR/316	K4LR/312	WA4BEC/312	W5UP/312	NB7N/154	WE8Q/175	W0PSH/271
I8IYW/249	SM5VS/326	W1YRC/305	K4SFI/124	WA4DPU/312	WA5BBR/290	NK7L/289	K9ALP/288	W0RRY/301
IK8GCS/290	SM6AOU/307	K2AGJ/322	KB4FQ/313	WA4DRU/312	WB5SSD/309	NK7Y/279	K9APW/220	WB0HAD/316
IK8HVH/130	SM6CKU/319	K2CM/327	KC4DY/310	WA4FHQ/310	WO5G/161	NX7K/311		

CW

DJ2XP/205	IT9VDQ/291	JA3JOR/287	SM6GOR/192	K2AGJ/302	KV4F/291	AF6S/298	KY7M/269	W8JBI/300
DL1CP/214	IT9ZGY/279	JE3LWB/290	SM0CCE/291	K2MFY/279	N4CC/250	K6DT/307	N7MC/281	WB8RJX/297
DL2AW/281	I0ZUT/250	JA6CNL/268	SM0GMG/294	K2SD/144	N4CRI/251	K6MA/287	N7US/289	K9ALP/262
DL6QW/296	IK0FWI/202	JA8TRT/217	SM0RSM/167	K2SHZ/290	NE4A/267	K6RK/289	NX7K/224	K9BWQ/303
DL7HT/260	JA1AAT/227	LA4DCA/265	SP5EWY/302	N2LT/285	NN4Q/302	K6TMB/214	W7IUV/310	K9EL/267
DL7NB/278	JA1BN/305	LA9XG/282	VE3BX/309	NY2E/254	W4BQY/277	K6TS/252	W7KS/226	K9GX/302
DL8CM/307	JA1HGY/300	OE3EVA/268	VE3HO/280	W2FCR/126	W4DZZ/256	K6WD/272	W7KSK/178	K9IL/282
EA4MY/309	JA1QXY/303	OH2BAD/290	VE3OMM/126	W2FXA/290	W4NUS/279	N6JV/310	W7TE/293	KC9C/134
EA5YN/187	JA1UQP/310	OK1VK/290	VE7AHA/285	W2LZX/306	WA4DPU/296	NS6B/151	AB8Y/275	KM9G/236
F6BEE/276	JG1OUT/208	PY2RO/280	VE7DX/265	KZ3B/232	WB4ZBI/225	W6DU/329	K8IFF/299	W9DH/290
F6GID/231	JL1ARF/140	PY5AKW/200	VE7WO/296	W3EVW/310	K5NW/306	W6JTI/225	K8NA/305	WA9YYY/180
G4SSH/202	JM1MGP/207	SM3DXC/292	4Z4DX/302	AA4DO/250	KA5W/300	W6SN/272	K8ZTT/279	KE0Y/203
HA5AM/126	JA2AAQ/310	SM4CTT/250	K1JA/309	AA4NG/153	N5CID/284	W6UY/286	KA8HOK/136	NI0G/253
HB9CSA/230	JA2KVD/277	SM4EMO/261	K1VKO/274	K4CEF/292	N5FW/307	WB6IYS/125	KD8WP/176	NX0I/207
HB9DJC/155	JH2RMU/188	SM5DAC/238	W1KSZ/293	K4CXY/299	NE5P/280	K7NW/140	NX8J/229	NZ0R/176
I2XIP/299	JA3CMD/293	SM6DYK/304	W1YY/302	KJ4VH/182	NT5G/250	K7ZR/306	W8CY/284	W0JLC/290

RTTY

W1AX/151	W2FCR/176	W3DJZ/241	K5KR/182	W5ZPA/191				

160 Meters

DL1RK/155	AA1K/213	W1FZ/126	W2PN/150	N4SU/203	W4VQ/112	W7OEV/116	K9GX/139	W0CD/182
4X4NJ/175	K1MM/194	W2FP/151	N4KG/182	W4FX/164	WA4VDE/121	W8UVZ/163	K0GVB/122	

80 Meters

VE7AHA/183	VE7SV/223	K1MEM/262	K1MM/271	K3UA/203	W3MFW/302	W8UVZ/225		

10 Meters

DL3RK/249	VE7AHA/161	N1CIX/150	N4KG/301	K5AQ/240	WB5SKQ/273	N6JV/226	NX7K/186	W8UVZ/254
JA3CMD/254	4Z4DX/269	K2POF/140	N4VZ/277	W5LLU/223	K6MA/189	WA6BYA/150	K8TGC/135	KS9R/250
SM3DXC/220	K1MEM/281	K3UA/236	NE4A/148	W5TZN/125	K6YRA/297	N7US/194	KB8DAE/150	W0IKD/156
SM0AJU/298	K1MM/291	AA4TV/198	W4VQ/276					

Strays

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I would like to get in touch with...

☐ hams who have myasthenia gravis. Sam Yoshikawa, N6ENO, 934 Mullen Ave, Los Angeles, CA 90019.

☐ anyone who has info about the Skytec company and/or converting the Collins S-line and 75-A4 to solid state. Gene Ledger, K1RQS, 256 Middle Branch Rd, New Boston, NH 03070.

☐ anyone to help me locate a Vid-Com mail storage operation program on tape for a VIC 20 mailbox operation. Paul Bourassa, VE2JN, 30 Papineau St, St Luc, PQ J0J 2A0 Canada.

☐ anyone who knows who manufactured a 2-meter mast-mounted preamp with the model number 146-OS. Jerry Newton, N6TPV, Rte 1 Box 262, Woodland, CA 95695.

☐ anyone who has incorporated a weight control into the Yaesu "Keyer Unit A" as used with the FT-980 tranceiver. This model employs the Texas Instruments TMS1751C IC. Edward Swynar, VE3CUI, 48 Evergreen Dr, Whitby, ON L1N 6N6 Canada.

DXCC Honor Roll

Administered By Don Search, W3AZD

The DXCC Honor Roll is comprised of those call signs that have been credited with at least 311 of the 320 current countries on the DXCC list. Total DXCC credits earned, including deleted countries, are shown after each call sign. The large, boldface numbers indicate total DXCC credits, excluding deleted countries.

Mixed

320

DJ2BW/362
DL1BO/361
DL1PM/348
DL3RK/362
DL3ZI/353
DL6EN/360
DL7FT/346
DL8NU/341
DL9OH/356
F8RU/339
F9RM/354
G3AAE/364
G3FKM/362
G3FXB/362
G3KMA/348
GM3ITN/353
GW3AHN/364
I2KMG/345
IT9AUA/326
JA1BK/352
JA1BRK/348
JA4ZA/346
LA9CE/340
LU6DJX/369
OH2QQ/357
OK1MP/350
OZ3Y/359
PAØLOU/357
PT7YS/355
PY2PE/346
SM7ANB/355
SMØAJU/357
SP7HT/342
U5WF/359
4X4FQ/352
W1AX/367
W1AXA/361
W1FZ/363
W1GKK/371
W1HX/365
W1JR/361
W1OO/344
W1UU/351
K2FB/352
K2FL/361
K2MUB/343
K2PXX/349
K2TQC/352
W2AG/365
W2AGW/369
W2AYJ/363
W2BOK/361
W2BXA/369
W2FXA/357
W2JVU/366
W2LV/364
W2NC/345
W2OKM/363
W2QM/360
W2SSC/361
W2UE/360
W2YY/353
WA2DIG/354
W3CWG/361
W3DJZ/351
W3EVW/365
K4CEB/339
K4DJ/342
K4EZ/361
K4ID/347
K4IKR/343
K4LNM/359
K4RPK/353
K4XO/338
N4SU/366
W4AIT/368
W4BFR/353
W4BQY/367
W4EX/369
W4JVU/343
W4OO/355
W4UG/347
W4VQ/349
W4YJ/365
K5FJ/357
K5YY/343
NY5F/353
W5AQ/356
W5IO/363
W5QK/356
K6EV/351
K6JG/345
K6KII/357
K6OJ/367
K6RF/353
K6RN/353
K6RQ/356
K6WR/350
K6YRA/345
K6ZO/369
W6BZE/365
W6CF/346
W6EUF/344
W6ISQ/352
W6KG/356
W6KNH/340
W6KTE/347
W6QNM/354
W6REH/351
W6RJ/348
W6YA/350
W6ZM/355
W6ZO/366
WA6OET/345
W7CG/361
W7CMO/355
W7DX/353
W7GN/361
W7MB/369
W7OF/362
K8DYZ/345
K8ONV/353
W8BKP/358
W8JBI/363
W8JQ/345
W8LKH/364
W8PHZ/360
W8RT/363
K9RJ/342
W9CH/352
W9DWQ/358
W9DY/357
W9JUV/363
W9RCJ/356
W9ZM/368
WØBW/366
WØMLY/366
WØPGI/361

319

DJ1XP/340
DJ5AI/335
DJ7CY/344
DJ7ZG/345
DL1JW/356
DL1KB/364
DL6QW/340
DL7HU/353
F3AT/355
G4CP/365
HB9MX/354
HB9PL/353
HB9TL/360
I1ZL/356
I8AA/342
IT9ZGY/359
JA1MIN/341
JA1MJ/342
JA2JW/354
JA2XW/344
JA3DY/352
JA8ADQ/342
LU5DO/358
OE1ER/366
OH2BH/346
OH2BZ/345
OH2LA/356
OH2NB/366
OH2QV/349
OH4NS/345
OK1ADM/349
OK3MM/358
ON4DM/360
PY1HX/357
SM3BIZ/361
SM3CXS/339
SM5CZY/347
SM7ASN/339
VE3WW/341
VE7IG/339
VE7SV/343
ZL1AV/345
ZS6LW/357
4X4DK/362
4X4JU/359
4X4NJ/338
K1DRN/342
K1RM/339
W1AFF/350
W1CKA/354
W1DGJ/349
W1HH/355
W1HZ/362
W1NU/358
W1YRC/338
K2BK/358
K2BS/345
K2BZT/361
K2JMY/346
K2LWR/358
W2BHM/357
W2FG/341
W2GC/358
W2GKZ/346
W2GW/362
W2HZ/340
W2LPE/361
W2MJ/354
W2TQC/357
W2VJN/347
K3GL/362
W3GH/359
W3MP/366
K4DY/340
K4MZU/342
K4PDV/361
K4YYL/344
N4KG/339
N4MM/340
W4BAA/359
W4BRE/342
W4DR/360
W4DRK/349
W4FPW/336
W4FX/355
W4GTS/340
W4IF/355
W4MGN/352
W4NL/339
W4QM/351
W4ZD/354
K5AAD/347
K5LIL/341
K5UC/365
W5GJ/351
W5KGX/360
W5RDA/350
WA5IEV/338
WF5E/350
K6GA/352
K6LGF/356
K6MA/348
K6QH/344
KI6T/358
N6AV/345
N6FX/351
W6BA/363
W6BS/361
W6EE/365
W6EL/349
W6ET/356
W6GMF/352
W6KH/357
W6ONZ/355
W6QL/342
W6RKP/359
W6RT/361
WA6GFE/343
K7ABV/342
K7KG/341
N7EB/356
NS7J/346
W7CB/338
W7IR/363
W7JFO/338
W7KH/367
K8EJ/343
K8OHG/348
W8AH/360
W8DCH/341
W8KPL/360
W8OK/355
W8QFR/338
W8RSW/345
W8ZCQ/357
K9AB/357
K9MM/338
K9RA/337
N9AB/336
W9DQ/341
W9FKC/363
W9GIL/361
W9GRF/351
W9GU/354
W9KNI/350
W9YSX/357
KØBUR/340
NAØY/355
WØAIH/359
WØCM/361
WØELA/367

318

DJ5DA/344
DJ6RX/339
DJ8FW/328
DL7EN/359
DL8CM/351
DL8FL/335
F5II/338
G3HTA/339
G3LQP/335
GM3BQA/341
HB9AHA/339
HB9DX/350
HB9MQ/360
I7WL/337
I7ZPB/349
I0AMU/361
JA1AAT/338
JA1BLC/339
JA1BN/349
JA1BWA/344
JA1DM/357
JA1JRK/336
JA1UQP/336
JA2AAQ/338
JA3APL/337
JA8ZO/339
LA3XI/329
LU4DMG/358
OH3SR/337
PY1APS/339
PY4OD/353
SM5API/340
SM5AQB/341
SM5BBC/338
SM5CAK/339
SM5DQC/333
SM6AQU/347
SM6CST/333
SM6CVX/336
SM6DHU/337
SM7DMN/328
SM7EXE/335
SP6RT/339
UB5WE/331
VE3BX/341
VE3HD/356
VE7WO/354
YU1AB/326
ZL1AMO/338
ZL1ARY/343
ZL1HY/367
ZS6RM/355
4Z4DX/326
K1DFC/338
K1JO/334
K1YZW/341
N1XX/343
W1AA/356
W1AB/348
W1BIH/366
W1DK/361
W1GX/340
W1MIJ/350
W1NG/335
W1OT/335
W1SD/349
K2CL/338
K2SHZ/354
W2FP/337
W2GK/344
W2HTI/359
W2PN/344
W2QHH/363
W2VUF/341
K3MO/356
W3AP/334
W3VT/363
K4AIM/353
K4CIA/343
K4FJ/345
K4RA/332
K4SM/361
N4WW/339
N4ZC/340
W4EEE/359
W4NKI/341
W4SSU/350
WA4FFW/336
WA4WIP/342
K5DX/359
K5PP/318
K5UR/337
N5AR/346
W5EJT/348
W5NUT/356
W5TO/342
K6DC/361
K6PU/345
N6EA/353
N6UC/336
W6BSY/359
W6FSJ/359
W6GR/341
W6HYG/355
W6KUT/362
W6MUR/355
W6PN/346
W6SN/356
W6SQP/359
W6YB/344
W6YK/360
W6ZKM/339
K7NN/334
N7NG/341
N7RO/333
W7DY/342
W7QK/356
K8IFF/337
K8MFO/340
W8BF/364
W8CFG/335
W8CT/346
W8MPW/361
W8PR/345
W8QY/356
W8RCM/338
W8YA/335
W8ZD/349
W8ZET/349
K9CJK/343
K9ECE/352
K9JF/335
N9AF/339
N9ZN/349
W9AQ/343
W9NA/353
W9SFR/358
W9TKD/352
W9ZR/335
WA9NUQ/340
KØGVB/336
WØCD/336
WØCJZ/346
WØUD/339
WØZV/352

317

CU2AK/336
DJ5JH/337
DJ5LA/343
DJ6TK/335
DJ8CR/337
DJ9RQ/326
DJØJJ/330
DK3FD/328
DK5PR/330
DL1HH/351
DL3BK/354
DL7HZ/348
DL7NB/330
EA1BC/352
F5LQ/332
F9IE/338
G3IOR/351
G3JEC/339
G3RUX/333
G3UML/340
G3ZAY/330
GI3IVJ/356
HB9AAA/336
HB9IK/345
I1APQ/332
I1RBJ/338
IV3PRK/336
I4MKN/335
I5ARS/347
I5FLN/333
I8KDB/355
JA1ADN/348
JA1FHK/338
JA1HGY/333
JA1IFP/337
JA3BQE/332
JA4AFT/334
JA8MS/333
KH6CD/364
LA8LF/345
OE1LO/346
OE3WWB/332
OE6RT/337
OH2BC/343
OH2BGD/333
OH2LU/333
OH5UQ/342
OK1MG/343
ON4IZ/347
ON4UN/338
OZ1LO/339
OZ3PZ/330
OZ6MI/336
PAØTAU/344
PT2BW/332
PY1HQ/357
PY7ZZ/329
SM2EKM/332
SM5BHW/339
SM6AFH/337
SM6CKS/338
SM6CTQ/328
SM6VR/342
SMØBFJ/332
UA3CT/351
VE3GMT/336
VE3MJ/340
VE3NE/339
VE3SR/359
VE3WT/344
VE3XN/336
VE4OX/345
VE5RU/354
VE7BD/331
YO3AC/335
YS1RRD/329
YU1HA/344
ZL1AAS/332
ZL3IS/355
ZL4BO/350
K1BW/332
KA1QY/355
NR1R/325
W1JZ/336
W1KG/328
W1OHA/344
W1SP/351
W1UN/334
W1WY/354
K2CM/335
K2UR/342
K2VV/331
KM2V/332
W2BMK/353
W2CP/347
W2FZY/355
W2JB/328
W2PPG/337
W2RS/330
W2SAW/358
W2SUA/337
W2XN/356
WB2YQH/334
K3AV/348
K3II/356
K3TUP/333
N3II/329
W3GG/334
W3LB/334
W3XM/341
AA4MM/337
AA4S/332
AE4X/354
K4BBF/336
K4BVQ/350
K4HJE/336
K4ISV/340
K4JC/347
K4KC/343
K4KQ/360
K4MG/331
K4MQG/346
K4XG/336
K4YR/360
KR4M/331
N4CC/331
N4SA/332
W4AUH/336
W4AVY/353
W4HR/353
W4NNH/355
W4QQN/343
W4YV/336
K5RC/339
W5MUG/338
W5OB/352
K6DT/344
K6IR/331
K6OZL/335
W6BJH/331
W6BVM/356
W6ERS/347
W6FW/347
W6GC/332
W6LQC/333
W6PHF/347
W6PT/359
W6TZD/362
W6YO/340
W7AQB/354
W7CSW/348
W7OM/338
W7RV/339
W7TE/330
K8DR/353
K8FF/347
K8IP/339
K8KAE/336
K8NN/326
KD8VM/359
W8CNL/336
W8CUT/349
W8DA/351
W8DMD/363
W8GKM/335
W8GT/365
W8KR/339
W8YGR/346
WB8EUN/334
K9KA/336
W9DE/332
W9HJ/351
W9KQD/340
W9TKV/357
W9WY/334
KØIEA/332
NØRR/330
WØLWG/353
WØQGI/358
WAØOAH/336

316

DJ2TI/328
DJ4PI/335
DJ8NK/330
DJØKQ/342
DK1YK/328
DK9FB/330
DL2AW/324
DL7AA/362
DL7AP/354
F2BS/343
F2VX/330
G2FSP/353
G3GIQ/342
G3HCT/352
G3JAG/336
G3KDB/332
G3RCA/322
I3EVK/338
I7HH/332
I8YRK/338
IT9TAI/357
JA1ELY/328
JA1EOD/335
JA1FNA/329
JA1GV/339
JA1MCU/337
JH1QOJ/326
JK1OPL/329
JR1AIB/323
JA2JSF/327
JA3BG/340
JA3CMD/325
JA3EMU/329
JA3MNP/328
JA6BSM/331
JA8CDT/328
KH6IJ/360
KV4FZ/335
OE1FT/351
OE6MKG/327
OH2BAD/335
OH2BCV/330
OH2KI/331
OK1TA/335
ON4QJ/344
ON5KL/333
OZ8BZ/333
PP5UG/338
PY2BKO/341
PY2FR/335
SM1CXE/342
SM6AEK/340
SM6CWK/338
SMØKV/356
SP9PT/334
UA1CK/346
VE1AL/325
VE1KG/336
VE7GI/364
VK4QM/364
VK6HD/335
XE1AE/350
YU1EXY/333
ZL1AJU/348
K1RAW/327
W1FJ/344
W1GG/339
W1GL/330
W1JBW/339
W1RLQ/348
K2LE/341
K2YLM/341
KM2P/333
KY2Q/341
N2SS/334
W2SM/328
W2TP/350
AF3E/329
K3KG/330
K3KP/341
K3NL/334
K3NN/328
K3UA/324
W3AFM/354
W3BTX/329
W3EYF/347
W3GRS/353
W3LPL/335
WA3HUP/336
AA4CJ/329
AB4D/335
AB4H/331
K4CEF/334
K4KG/344
K4MPE/340
KE4I/333
N4EA/337
N4KE/328
N4UH/338
N4WB/330
N4WF/335
N4XO/348
W4BBP/347
W4EEU/342
W4FLA/330
W4GD/361
W4JD/332
W4OEL/338
W4OM/362
W4WV/352
W4XR/334
W4YN/343
WB4OSS/334
K5AQ/336
K5GH/330
K5OS/333
N5EA/332
N5NW/342
N5RR/335
W5AL/360
W5HE/342
W5IZ/340
W5LCI/351
W5SJ/336
W5UN/355
AA6G/323
K6EXO/340
K6LM/321
K6SVL/331
KD6PY/328
N6AR/345
N6CW/338
N6GM/345
N6MG/328
W6JRY/331
W6KPC/341
W6MI/341
W6OMR/333
W6RGG/341
W6TC/330
W6US/329
WA6WZO/323
K7QXB/328
W7BGH/350
W7EKM/330
W7LFA/335
W7ORH/333
K8FL/342
K8LJG/328
K8PYD/332
K8ZR/326
N8AA/337
W8EVZ/343
W8ILC/338
W8NGO/357
W8QWI/338
K9GM/334
W9BM/352
W9BW/345
W9NGA/327
W9RF/334
W9SS/330
W9WM/346
KØBS/333
WØAX/362
WØDU/363
WØGKL/352
WØPAH/337

315

CX4CR/326
DJ2AA/347
DJ2YA/345
DJ7CX/341
DL1CF/344
DL1DC/352
DL1RB/323
DL3OH/336
DL6MK/345
DL8UP/325
DL9NC/332
EA3NC/335
EA4MY/325
F5VU/330
F9GL/347
G3ALI/333
G5RP/341
G5VT/359
HB9AHL/325
HB9AQW/328
HB9RX/332
I2LAG/333
I2PJA/325
I2ZZZ/329
I8DUD/322
I8JIX/334
JA1IBX/339
JA1OCA/333
JH1GZE/326
JH1IFS/328
JA2ADH/335
JA2AH/333
JA2AN/334
JA2BHG/335
JA3AQ/333
JA3GM/328
JA3HZT/327
JA4CQS/325
JA6VA/332
JA7JH/330
JA8JL/336
JA9AA/345
KP4RK/350
LA1KI/339
LA5UF/331
LA8CJ/323
LA9GV/319
OE2EGL/336
OH2VB/335
OH2XF/346
ON6BC/322
ON8XA/335
OZ5EV/324
PP5YC/325
PY1DH/348
PY2TM/324
PY5ATL/330
RT5UN/330
SM3DXC/323
SM4CTT/323
SM5BCO/347
SM5FC/333
SM6DYK/321
SM6EOC/331
SM7BIP/332
SMØCCE/354
SMØCCM/323
T77C/319
VE1YX/323
VE3GS/334
VE3ST/348
VK3YL/351
YU2DX/335
YU2TW/325
YU2YM/325
YU3EY/333
YV5ANF/345
Z24JS/337

ZS6YQ/349
9Y4VU/325
K1BV/333
K1HZ/323
K1KI/328
K1MEM/327
K1NJE/332
W1BL/323
W1DA/328
W1GME/350
W1LQQ/336
W1QJR/349
K2AGJ/331
K2AGZ/336
K2BT/334
K2ON/319
K2UU/328
N2AP/329
W2AX/355
W2CR/357
W2IRV/355
W2LZX/323
W2MZV/340
W2PSU/328
W2SY/333
W2VYX/339
W2ZZ/335
AD3Z/325
K3FN/322
K3HPG/333
N3UN/322
W3AC/341
W3EKN/338
K4AUL/335
K4PI/324
K4RD/325
K4UTE/333
K4XI/327
N4JJ/325
N4OM/322
N4PN/326
N4RA/330
N4VZ/324
NE4R/323
W4AXR/354
W4EO/354
W4FDA/336
W4OWJ/345
W4PZV/334
W4RIM/331
W4WG/332
WA4DRU/331
WA4QBX/330
WB4HOK/320
WB4NDX/325
WB4QNP/328
WB4TDH/323
WR4K/329
K5JM/326
K5KLA/325
K5KR/324
K5KX/331
K5YCP/329
N5UR/327
W5DL/351
W5GO/353
W5MMK/361
W5RA/333
W5UP/331
W5YU/338
K6EC/354
K6JAD/327
K6LQA/332
K6OJO/330
K6UD/325
K6ZM/346
N6AW/332
N6JV/326
W6HFL/345
W6HT/329
W6MUM/340
W6MZ/333
W6UY/330
WA6FIT/324
WA6TLA/325
AA7A/321
N7US/326
W7IUV/321
W7IYW/328
W7JYZ/348
W7XA/329
WA7BEV/333
K8CH/333

K8NA/324
K8NW/321
K8RA/328
KJ8G/323
KN8Z/333
W8AD/332
W8ARH/343
W8TA/332
K9AWK/337
K9BWQ/328
K9FN/328
K9PPY/332
K9QVB/321
K9XJ/328
W9DH/343
W9FD/353
W9HB/354
W9HLY/347
W9LT/347
W9RKP/356
W9RXJ/329
W9RY/328
W9VA/325
W9ZRX/333
AJ0X/336
K0ALL/327
K0CD/349
W0DEI/351
W0HBH/382
W0IZ/332
W0JMZ/326
W0LYI/334
W0RI/342
W0SD/334
W0SR/326
WA0IDK/320

314

DJ3NW/324
DK3KD/321
DK3PO/333
DK3SF/324
DL6KG/335
DL7BK/348
EA3NA/330
EI8H/325
F2GL/325
FY7AN/320
G2DMR/335
G2FYT/349
G4DYO/320
HB9AMO/327
HB9BGN/319
HB9MO/352
I2VGU/325
I2XIP/318
I2ZGC/321
IN3DEI/319
JA1JAN/332
JA1JWP/321
JA1NRH/321
JA1OYY/323
JA1WSK/325
JH1ARJ/326
JH1EDB/323
JA2AIR/335
JA2APA/322
JA3FYC/325
JA3LUK/325
JA4FWM/324
JA4LXY/324
JA5EN/331
JA5IU/325
JA6GXP/323
JA7AD/350
JA7FS/331
JA7GLB/324
JA7IL/323
JA7ZF/327
JA8EAT/326
JA8FKO/321
JA8XJF/323
LA1K/346
LA5HE/350
OK1ACT/332
OK1VK/328
OK2RZ/332
ON5NT/327
OZ3PO/340
OZ4RT/346
OZ7JZ/331
OZ7YY/326
PY2BW/330

PY5WD/322
SM3EVR/321
SM4DHF/328
SM7BYP/320
SP2AJO/329
SP6BZ/332
SV1ADG/314
SV1IW/318
UA2AO/342
VE3CVZ/326
VE3LGQ/344
VE7DX/320
VK5WO/343
YO3JU/334
YS1O/353
YU7BCD/342
YV5AIP/348
K1HMO/319
K1NA/338
K1ST/321
K1UO/321
W1BR/332
W1EOA/332
W1GDQ/330
W1KGH/336
W1RED/326
KZ2I/325
N2DT/320
W2AZX/345
W2GA/329
W2GLF/352
W2HAZ/331
W2LL/346
W2MIG/325
W2PD/325
WA2CBB/335
K3ND/326
K3ZR/330
N3ED/332
W3ACE/323
W3PVZ/335
AA4AR/319
K4GJD/326
K4II/340
K4SMX/327
K4XP/321
K4ZYU/329
KA4S/322
W4CPZ/333
W4CZU/322
W4DHZ/349
W4OTX/332
W4PTH/327
W4VPD/354
W4WD/336
WA4CXZ/322
WA4JTI/323
K5JW/333
K5VNJ/321
K5VT/324
N5DX/337
N5UD/325
W5DOZ/319
W5GEL/354
W5IR/334
W5MQ/332
W5NW/356
W5ZPA/320
K6CBL/324
K6JR/334
K6KA/334
K6PZ/331
K6RK/326
K6XJ/328
K6XP/332
K6XW/342
N6AHU/319
N6DX/345
N6MU/329
NS6C/324
W6DN/329
W6EJJ/336
W6FET/336
W6JZU/329
W6KYT/336
W6TWZ/346
W6TXL/345
W6UQQ/351
W6XP/330
W6YMV/344
WA6OGW/323
K7EG/321
K7ZR/332

KA7AUH/319
W7ADS/357
W7BKR/325
W7CNL/326
W7ETZ/330
W7OEV/337
W7UZA/330
AC8K/327
K8RWL/331
K8ST/328
W8BE/337
W8GS/322
W8UVZ/326
WA8PYL/328
AB9O/314
K9BG/322
K9IW/318
K9KU/326
K9UWA/323
K9VAL/319
W9AZP/344
W9LNQ/339
W9RN/328
K0BLT/338
N0AT/320
W0BL/334
W0HZ/343

313

DJ5VQ/340
DJ6KH/327
DK3GI/330
DK8NG/320
DL3ZA/336
DL7CW/337
F2IU/336
F6BEE/320
F6BKI/321
F6CKH/324
G3MCS/329
HB9AIJ/330
HB9KB/351
HB9QR/344
HB0LL/330
I1RB/343
I1SBU/320
I2DEZ/332
I2LLD/324
I3VRV/327
I4EAT/320
I5UA/352
IK7CBN/323
JA1CJF/331
JA1CRR/335
JA1GTF/329
JA1QXY/326
JA1VN/324
JA1WTI/326
JF1PJK/325
JH1HLQ/323
JR1FYS/321
JA2KVD/322
JA3AAW/335
JA3ART/330
JA3CSZ/320
JA5AQC/319
JA5FDJ/320
JA6CNL/327
JA7ARD/323
JA7BJS/321
JA7HZ/326
JA7PL/323
JA8IXM/322
JA9BJ/332
JA0CWZ/320
KH6CF/322
OE1UZ/335
OH6RA/340
OK2DB/325
OZ7OP/331
PY2ELV/331
SM4EAC/331
SM4EMO/320
SM5BFC/321
SM6CAS/334
SM7QY/355
SM0DJZ/320
SM0GMG/319
SP5EWY/322
SV1DO/320
UA9VB/344
UP1BZZ/320
UQ2MU/320

UW0MF/321
VE3BWY/350
YS1GMV/321
YU1AM/328
YU3AW/320
YV5BZ/346
YV5CWO/325
K1CC/325
K1SA/318
N1GL/337
W1DQH/337
W1NHJ/343
W1PM/352
W1WLW/337
K2LGJ/336
K2LQ/323
K2UFM/327
K2UO/320
KK2I/318
N2JV/317
N2KW/320
W2BAI/328
WA2IZN/318
WB2BNJ/324
WB2QMU/324
N3US/321
W3SO/330
W3YX/326
W3ZN/329
AA4V/325
K4IR/332
K4LSP/326
K4LTA/335
K4PVZ/325
K4SE/319
K4TO/328
K4XH/328
K4XL/343
KN4B/321
N4AVB/317
N4SR/326
N4TO/338
N4WJ/328
NF4U/321
W4ORT/334
W4XJ/341
W4XQ/332
W4YKH/328
WA4LOF/317
WA4VDE/318
WB4RUA/320
K5BLV/320
K5LM/329
K5LP/325
N5AN/325
N5AU/328
N5FW/322
N5JR/318
N5OK/324
NE5P/317
W5FFW/353
W5KFN/325
W5MMD/357
W5QOU/341
W5VT/330
W5ZWX/330
WB5SKQ/317
WB5SSD/318
K6AAW/326
K6CH/356
K6LEB/341
K6WD/325
K6XT/326
KJ6V/337
N6ET/332
NS6B/317
W6AE/330
W6RFX/324
W6XI/331
K7RLS/324
K7SP/322
N7MC/321
W7DQ/324
W7KR/342
W7KSG/331
KG8V/329
K9AJ/324
K9EL/318
K9HMB/321
K9IL/323
K9MK/318
K9NB/321
K9RF/327

K9VQK/329
W9FR/327
W9GW/331
W9HK/348
W9IU/352
W9OA/337
W9XX/318
WA9WJE/329
WB9YXY/318
K0WWX/330
W0BN/342
W0PT/342
W0WW/340
W0YK/319

312

DJ4AX/336
DJ5MC/320
DK1FW/327
DK2BI/329
DL7SY/318
F6BFH/324
F6DHB/317
F6EXV/317
G3VIE/325
G3YJI/320
HB9AOA/319
I2VDX/321
IT9JLA/321
JA1MDK/322
JE1MGE/321
JH1EIG/330
JH1OJU/319
JA2BAY/321
JA2BL/335
JA2JKV/330
JA2MGE/323
JA3JOR/322
JE3LWB/315
JR3IIR/318
JA4BJO/338
JA5PUL/319
JA6GRX/320
JA7DRM/322
JA7MA/331
JH7DNO/316
JR7TEQ/318
JA8DNZ/321
JA8KB/327
JA0GZZ/321
LA7JO/321
OH2BDP/326
ON4PA/348
ON5KD/329
OZ9PP/325
PY2CQ/338
PY2SO/338
SM3RL/328
SM5BRW/325
SM6CKU/330
SP5BAK/320
UA6JD/325
VE1AST/320
VE3HO/320
VE3ICR/317
VE4SK/329
VE6VM/322
VE6WQ/319
YV5BBU/334
YV5DFI/327
ZL2HP/346
ZL4LZ/320
9H4G/324
K1JA/324
K1MM/322
K1SF/316
K1TN/324
K1VKO/317
KT1N/317
W1ELR/348
W1JJ/318
W1ODY/329
W1RR/323
W1TRC/321
W1YY/326
WB1DQC/316
K2OEA/350
KR2Q/329
N2LM/334
W2IOT/335
W2IYX/323
W2LNB/340
W2TA/323

W9TY/319
WB9EBO/327
AB0X/319
K0KTP/320
K0ZZ/320
KY0A/325
N0EL/327
WB0HAD/318

311

CE3GN/320
DK6NP/318
DL4FF/323
DL7EG/331
F6BWJ/317
F9YZ/330
G3MXJ/329
GI3OQR/339
HK3DDD/317
I2JR/320
IV3TQE/315
JA1GO/323
JA1HYF/327
JA1OND/322
JA1RLV/321
JA1SYY/317
JA1ZZ/335
JR1EBE/317
JA2HNP/330
JA2KLT/327
JA3RWJ/320
JA6EYD/322
JA6HUG/316
JA8AWH/322
JA8BIO/325
JA8BMK/322
JA8HQI/319
JA9CXA/324
JA9YBA/323
JA0SC/320
JH3CXL/317
OH2BLD/315
OH2EE/315
OH3TQ/326
OH8SR/326
ON5FU/319
ON7EM/315
OZ1CTK/316
OZ8SS/347
PT7WA/319
SM5AZU/339
SM6CMU/322
SP6AEG/315
SP9AI/325
TF3SV/330
TG9NX/317
UA6JW/327
UB5UAT/317
UR2AR/347
VE3II/319
VE7AHA/319
YU2CBM/321
4X4FU/330
AA1K/318
K1IK/320
K1VJH/316
W1AM/326
W1HSB/315
W1XS/315
W1ZE/329
WA1URV/315
K2KGB/329
K2MFY/324
K2OF/328
K2XA/324
KB2ZP/316
N2KA/319
N2LT/326
N2MF/317
W2CC/324
W2FCR/322
W2QXA/320
W2UI/336
WA2MNM/315
WA2VUY/315
WB2KPE/315
WB2NYM/328
WB2OHD/315
K3KA/316
K3RT/317
K3SGE/329
KE3A/315

W3GOH/315
W3TV/343
W3UJJ/315
W3XX/329
WA3WIP/315
AA4M/317
AA4VK/317
K4CXY/318
K4EEK/329
K4EWG/330
K4IBP/316
K4KJZ/315
K4KUZ/316
K4ZKZ/335
KB4IL/313
N4DW/326
N4HH/319
N4NO/330
N4NX/319
NE4A/324
NN4Q/316
W4DZZ/317
W4YA/329
WA4OBO/316
WA4TLI/323
WA4WPN/315
WB4OSN/317
AD5N/342
K5FA/326
K5JUC/316
K5QY/315
K5RE/316
K5RJ/326
KA5W/315
W5CWQ/321
W5DJ/333
W5JC/341
W5JG/316
W5XJ/328
WB5WQG/316
N6OC/317
N6RJ/325
W6BJI/328
W6BYH/337
W6HX/359
W6MJP/330
W6SWM/314
W6YHT/328
WA6DUG/332
WB6APX/326
WO6G/344
K7AA/331
K7BR/325
K7LAY/319
K7UR/326
K7ZBV/315
W7FP/320
W7HR/319
W7LLC/346
W7NCO/332
WB7CLU/316
K8DB/313
K8ZO/315
W8EWS/359
WD8Y/316
K9BIL/314
K9HQM/319
K9QXY/317
KB9OC/323
KD9E/321
KS9Z/315
KW9K/316
W9AMM/327
W9EB/341
W9HZ/342
W9KB/329
W9TKR/331
WA9USE/317
WB9OQU/315
K0AB/338
K0GSV/326
K0IFL/330
K0YRX/328
KF0H/320
KW0A/327
N0XA/316
W0BTD/349
W0MYN/329
W0OQK/334
W0TRF/321
W0VX/319
WB0NHD/316

Phone

320

CT1BH/337
DJ2BW/355
DL6EN/358
DL9OH/356
F8RU/339
F9RM/354
GW3AHN/361
OZ3Y/352
PY2PE/346

U5WF/343
W1FZ/357
W1HX/357
K2FL/352
W2BXA/367
W2FGD/345
W2LV/355
W2OKM/361
W2YY/348
W3CWG/359
W3DJZ/350
W4EX/367

W4PDL/354
W4UG/346
W4YJ/362
K5YY/341
W5IO/362
K6WR/350
W6EUF/343
W6GVM/366
W6KNH/340
W6REH/347
W6ZM/350
W7CMO/347

W7DX/350
W7GN/351
K8DYZ/345
W8JBI/352
W9WHM/362
W9ZM/356
W0MLY/357
W0PGI/351

319

EA4JL/338
HB9TL/359

I2KMG/342
I4LCK/336
I8AA/342
I0ZV/350
JA1BK/349
ON4DH/359
ON4DM/360
PT7YS/354
SM0AJU/346
TI2HP/366
VE3MR/346
VE3WW/341

ZS6LW/356
4X4DK/362
4X4JU/355
K1DRN/342
K1FX/338
W1AFF/350
W1DGJ/349
K2BZT/354
K2JMY/346
KS2I/343
W3AZD/347
W3DHM/358

W3EVW/350
W3GH/353
K4JRB/347
W4BRE/340
W4DR/356
W4JVU/342
W4LMX/354
K5UC/359
W5KGX/356
W5UAW/340
K6YRA/344
W6KTE/346

W6RKP/353
W7JFO/338
W8AH/360
W9DC/338
W9DWQ/347
K0BUR/337
NA0Y/349
W0BW/359
W0CM/361

318

DJ7ZG/344

DL1KB/355
DL7FT/344
DL7HU/350
EA4DO/339
F2MO/346
F5II/338
F6AOI/335
G3FKM/356
G3NLY/341
G3TJW/334
I4ZSQ/337
I0AMU/361

JA1BRK/340
JA1MIN/340
JA4ZA/342
JA8ADQ/337
LA1ZI/332
LA3XI/329
LU4DMG/358
OK1ADM/343
OK1MP/343
OZ3SK/348
PY2ED/336
SM3BIZ/359
VK5MS/362
VK6RU/365
YV1KZ/336
YV5AJK/350
ZL1HY/366
ZP5CF/359
ZS6RM/351
W1AA/356
W1CKA/345
W1MMV/359
W1SD/343
W2HTI/358
W2HZ/339
W2QWS/347
W2YYL/348
W3JK/341
K4AIM/353
K4YYL/341
W4DPS/337
W4EEE/359
W4MGN/343
W4NKI/341
W4SKO/357
W4UWC/345
WA4WIP/342
K5DX/354
W5SZ/341
WA5IEV/337
K6JG/340
K6LGF/352
N6UC/336
W6BAF/353
W6EL/346
W6GR/340
W6HYG/351
W6KUT/347
W6ZKM/339
W7UPF/339
K8CFU/350
W8BF/364
W8GMF/347
W8GZ/366
W8ZET/349
K9ECE/351
W9BEK/346
W9JT/342
W9NZM/347
W9RNX/358
W9YSX/356
W0CSZ/346
W0YDB/334

317

DJ9RQ/326
DJ9ZB/331
DJ0UJ/330
DL8FL/333
G3JEC/339
G3KMA/334
G3UML/340
G3ZBA/333
GM3BQA/340
HB9AAA/336
I1APQ/332
I1RBJ/338
IV3PRK/336
I5FLN/333
I6FLD/348
I8KDB/355
I8SAT/326
JA2JW/342
JA2XW/334
JA3APL/335
LU9DAH/353
OA4OS/336
OE1LO/343
OE3WWB/332
OH3SR/336
ON4SZ/355
ON4UN/338
OZ3PZ/330
PA0HBO/357
PY1APS/336
PY3BXW/336
PY4TK/357
PY5GA/334
SM5BHW/336
SM5CZY/346
SM5DQC/332
SM6CKS/338
UB5WE/330
VE2WY/346
VE3GMT/336
VE3MJ/340
VE3NE/338
VE3QA/356
VE3WT/344
VE5RU/353
VE7WO/338
VO1CU/327
YS1RRD/329
ZL1AAS/332
ZL1ARY/336
ZL1AV/333
ZL3NS/342
NR1R/325
W1GKK/354
W1JR/347
W1JWX/340
W1ONK/357
W1SP/350
K2TQC/329
KM2V/331
W2FP/333
W2GK/342
W3GG/332
W3MP/342
AA4MM/337
K4BBF/336
K4HJE/336
K4JC/343
K4PDV/345
K4XO/334
N4KG/327
K5UR/334
W5LZW/349
K6CCY/346
K6IR/331
KI6T/349
W6ARJ/336
W6BSY/353
W6ISQ/342
W6LQC/333
WA6AHF/335
K8IFF/336
K8NN/326
KD8VM/358
W8CUO/346
K9AB/339
K9MM/336
W9GU/334
W9TKD/341
WA9NUQ/339
K0EPE/339

316

CT1FL/335
DJ8NK/330
DK2BL/333
F2BS/341
F3DJ/349
F5JA/329
F9IE/336
G3SJH/327
I2YBC/326
I5TDJ/344
I7HH/332
I8YRK/338
IT9ZGY/345
JA1ADN/340
JA1BN/337
JA1BWA/333
JA1JAN/332
JA1JRK/333
JA1UQP/334
JA2AAQ/336
JA3BQE/330
ON5KL/329
PT2BW/329
PY2FR/334
PY7ZZ/324
SM6CVX/332
UA1CK/346
VE3XN/335
XE1AE/350
K1RAW/327
W1ICU/335
W1JFG/356
W1SEB/335
K2BS/342
NO2U/332
W2FG/337
W2FXA/338
W2SUA/335
W2TP/347
W3XM/340
K4FJ/337
K4IKR/338
K4KC/341
K4MG/330
K4MQG/341
K4PQV/332
N4MM/335
N4WF/335
N4WW/333
W4EPZ/338
W4VQ/329
WA4MMO/328
K5OVC/334
W5JWM/351
K6GA/335
K6SVL/331
W6CCB/333
W6FW/345
W6KON/332
W6KPC/340
WA6WZO/323
K7NN/332
N7RO/330
W7LFA/335
W8CFG/332
W8GKM/334
W8JTD/336
W8KST/338
K9LKA/337
N9AF/336
W9SFR/347
W9SS/330
W9ZR/331
K0BS/333
N0RR/326
W0GKL/351
W0SFU/341
WA0OAH/335

315

DJ1XP/328
DK9KX/321
DL1HH/339
DL4YAH/317
EA2HX/344
EA4JF/331
F2VX/328
F5VU/330
F9MD/342
G3RCA/321
G5VT/359
HB9AHA/334
IX1BGJ/331
I2LAG/333
I2LPA/330
I2PJA/324
I3EVK/336
I8JN/328
IT9GAI/336
I0DUD/322
I0JX/334
I0MPF/323
JA1ELY/326
JH1IFS/328
JA2ADH/335
JA3CMD/323
JA4AFT/331
JA6BSM/329
KH6BB/338
KH6OR/350
LA8CJ/322
LA9GV/319
LU1BR/328
OE2EGL/336
ON8XA/335
OZ5EV/324
PP5UG/337
PY2PC/338
PY2TM/319
SM5BCO/347
SM5FC/333
VE1YX/323
VE3BX/330
VE3GS/334
VK4QM/349
VK6HD/333
VK6LK/331
YV5ANF/345
ZL3QN/332
ZS6BBP/337
K1LHT/332
W1DNZ/330
W1NG/327
KM2P/331
N2SS/333
W2GKZ/341
W2MPK/330
W3AP/325
K4CEF/328
K4HEF/359
K4XG/330
KE4I/331
N4CC/327
W4BFR/332
WB4NDX/325
K5AQ/333
K5GH/329
K5OS/332
K5YCP/329
W5RRK/334
W5YU/338
K6DT/327
K6JAD/327
W6HFL/345
W6KOE/333
W6RGG/338
K7IRO/326
W7EKM/329
W7EPA/341
W7JYZ/348
W7QK/338
K8DR/338
K8LJG/327
K8PYD/330
W8CNL/331
W8JXM/335
W8PR/333
WB8EUN/331
K9BWQ/328
K9KA/333
W9BW/338
W9DNE/335
W9HPS/342
W9RXJ/329
AJ0X/336
W0GAA/343
W0QGI/346

314

DJ2TI/323
DJ4PT/331
DK3HL/324
DK9KD/321
DL6KG/333
DL7NB/323
DL8NU/336
EA4LH/333
G4DYO/320
G5AFA/331
GI3IVJ/351
I1GEA/329
I1TBE/325
I2PHN/332
I2VGU/325
I2ZGC/321
IN3DEI/319
I8ACB/321
I0OLK/333
JA1AAT/334
JA1EOD/333
JA1FNA/326
JA1OCA/330
JA1OYY/323
JH1GZE/325
JA3MNP/326
JA7GLB/324
JA7IL/323
JA7JH/329
KV4FZ/331
LA8LF/340
LU2AH/321
OH2LU/320
ON5NT/327
VE7WJ/325
YO3JU/334
YV5AIP/348
ZS6YQ/347
6W1DY/332
9Y4VU/324
K1CMI/324
K1MEM/322
K1UO/321
W1LQQ/329
K2UU/327
W2GLF/352
W2LZX/320
W2RGU/330
W2VO/328
W2XN/349
KB3PJ/327
N3UN/319
W3ACE/322
K4GJD/326
W4AVY/335
W4BBL/335
W4OM/354
W4OTX/332
W4QAW/333
W5HE/337
W5MQ/332
K6JR/334
K6OJO/329
K6XJ/328
N6AR/337
N6AW/331
NS6C/324
W6AXH/326
W6GTL/326
W6PT/343
W6XP/330
W6YMV/343
KE7LU/336
N7US/325
NS7J/322
W7BKR/325
K8NW/320
K8ZR/324
KJ8G/321
KN8Z/332
W8EVZ/340
W8ILC/333
K9FN/326
W9KQD/325
W9LA/334
K0CD/331
W0JMZ/325
W0LYI/332

313

CT1RM/323
CT1XK/321
DJ2YI/352
DJ5LA/338
DJ6VM/329
DK2WH/316
DK8MZ/318
DL1JW/340
DL6QW/324
EA1IY/328
EA3AOC/318
EA3NC/328
EA3TT/320
EA8JJ/331
EA8LD/317
F6AJA/328
F9GL/341
G3ZAY/326
I1BSN/317
I1FNX/318
I1HAG/320
I1RB/343
I1YG/327
I2SLA/328
I2WTY/316
I5UA/352
I7SCA/336
IK7CBN/323
I8KNT/318
I8LEL/324
IT9JT/334
IT9KZW/321
JA1IBX/335
JR1AIB/320
JA2AH/330
JA2APA/321
JA4FWM/323
JA7HZ/326
JA8XJF/322
LA7ZO/322
LU3YL/W4/322
OE2GKL/327
OH2BAD/329
OZ7OP/331
PP5YC/322
PY2DSC/330
PY5WD/318
SM4CTT/319
SM4EAC/331
SM6VR/332
UA3CT/330
VE4BJ/323
YS1GMV/321
YS1O/345
YV5AXQ/340
YV5CWO/325
ZS6JM/354
K1NJE/330
K1ST/318
W1DO/332
K2GPL/327
W2GBC/336
W2MIG/324
W2SY/329
WB2BNJ/324
K3BCG/324
W3AC/338
W3FWD/343
AA4AR/318
AE4X/332
K4MEZ/326
K4PI/319
K4SM/348
N4ZC/331
W4EEU/337
W4NYN/341
W4PZV/332
W4SSU/342
WA4CXZ/321
WA4JTI/321
K5KR/322
WB5SKQ/317
K6EV/342
N6AHU/318
N6NA/342
W6YB/334
WA6OET/333
WA6RTA/329
W7ADS/352
W7DQ/324
W7KR/341
K8NA/322
W8COG/329
W8RT/341
W8VHY/332
WD8MGQ/317
K9HMB/320
K9VAL/318
W0CD/329
W0SR/323

312

DK3SF/321
DK6XR/319
DL7FP/325
DL9DY/332
EA1QF/317
F6BFH/324
F6CKH/323
G3MCS/328
I1CAW/323
I1UW/326
I2BVG/322
I3ADI/326
I3VRV/326
I4BAC/325
I5KKW/316
I5MPN/317
JA1IFP/325
JA1JWP/317
JR1FYS/318
JA2BAY/321
JA3DY/325
JA5AQC/316
JA5IU/323
PA0KB/321
PY2CYK/335
SM6AEK/332
UA2AO/338
VE3SR/340
VE7DX/317
YV5BBU/334
YV5DFI/327
ZL1AMN/325
ZL1BKX/328
ZL4LZ/320
4Z4DX/319
9H4G/324
K1MM/319
W1BIH/342
W1K8Z/316
WB1DQC/316
K2UFM/326
K2UO/319
K2YIY/323
W2IJB/317
W2IYX/323
W2PSU/325
K3UA/319
W3NV/327
K4LSP/325
KD4S/317
W4BAA/330
W4ELB/329
W4FRU/312
WA4VDE/317
WB4LFM/322
WB4UBD/316
K5UKN/327
KB5GL/316
NY5F/344
W5GC/344
W5JJA/342
W5LZZ/335
W5SJ/332
W5UYD/327
K6AXC/324
K6EC/333
K6LM/317
K6PU/329
N6CR/320
W6BCQ/328
W6CN/318
W6HXW/323
W6UY/327
WA6OGW/321
AA7A/317
K7ABV/319
KA7AUH/317
W7OM/330
W7YR/320
K8SQE/324
KC8CY/317
KU8I/321
K9GX/318
K9HDZ/321
K9IKP/321
K9QVB/317
KU9I/321
W9DH/334
W9DMH/319
W9LQ/333
W9RY/325
K0KTP/320
N0AT/318
W0IZ/317

311

CE3GN/320
DF1DB/316
DJ2YA/336
DJ6FN/321
EA8ZO/316
F6DLM/316
HK3DDD/317
I1JS/318
I2AT/333
I2JR/320
IV3TQE/315
I5PAC/332
I7IVL/316
IC8EGO/317
JA1MCU/326
JE1MGE/320
JF1PJK/322
JH1EDB/319
JA2JSF/320
JA5PUL/318
JA6GXP/320
JA7ARD/321
JA7MA/330
JA8IXM/319
JA8ZO/328
LA7JO/320
LU3AJW/318
OA4JR/328
OH2BZ/328
OK1TA/325
ON6MY/316
PA0LEG/315
PY2BU/325
SM2EKM/326
SM5AZU/336
SM5CAK/325
SM6CAS/331
SM6EOC/326
SM7BYP/316
TG9NX/317
TI2CC/323
UW4NH/323
UW0MF/319
VE3EJ/318
VE3HO/319
VK5WO/337
XE1J/325
W1TRC/320
W1VKQ/317
WA1URV/315
K2SHE/327
N2KW/316
W2CC/324
W2FCR/322
WA2VUY/315
K3RX/320
W3FDP/324
W3RX/330
WA3ATP/331
WA3IKK/330
AA4KT/316
K4DJ/327
K4SE/317
K4XH/326
KE4RX/315
W4TDW/339
W4WMQ/318
WB4QNP/322
K5OA/324
K5RE/316
K5VNJ/318
KA5W/315
W5LQN/317
W5RNG/337
WD5DBV/316
K6RF/335
N6OC/317
W6GO/323
W6ORD/316
K7OXB/321
K7SP/320
K7UT/323
K7ZBV/315
W7FP/320
W7OEV/330
WA7DRP/323
WA7UVO/318
K8ZO/315
KB8DB/313
W8BE/321
W8CY/316
WA8AJI/337
AB9O/311
K9BJ/316
K9DXO/322
K9FYZ/320
K9IW/315
KS9Z/315
W9XX/316
K0ALL/323
K0IUC/320
W0MYN/329
W0QLX/326
WB0NHD/316

CW

316

DJ2BW/322
W9KNI/324

315

DL1PM/319
SM0AJU/321
K2FL/320
K2TQC/319
K3FN/320
K4PI/321
K6GA/322
K8MFO/320
N0RR/320

314

DL6EN/320
G3KMA/318
JA1BK/318
JA3FYC/319
PY2TM/318
K1MEM/318
K4XO/318
N4WW/322
W4VQ/309
WA6TLA/319
W8AH/320
K9MM/320
W9DWQ/319

313

DL8AN/318
JA1ELY/319
JH3CXL/317
OZ7BW/318
W2FP/318
K5UR/319
K8DYZ/316
K9QVB/317
W9ZM/318

312

I2KMG/313
LA8CJ/315
SM3EVR/318
W1NG/316
K2UO/316
N5JR/316
WB6RSE/316
K8NW/315
K8WW/316
W8UVZ/316
W9ZR/316

311

JA3BQE/317
JA6BSM/317
SM6CST/314
TG9NX/314
K1MM/315
N2KW/315
W3AP/315
N4MM/315

310

F3AT/315
JA1BWA/316
JA1IFP/314
ON5NT/315
OZ3Y/315
PY7ZZ/312
SM5BHW/316
W1DA/316
W1FZ/314
W1JR/314
N4RJ/316
W5ZPA/313
AA6AA/312
NS7J/311
W8RT/316
K9AJ/315

309

JA1JRK/317
JR1FYS/313
JA3DY/313
JA8EAT/314
SM6CTQ/312
NR1R/313
N4KG/312
N4VZ/313
K6JG/314
AA7A/313
K8ZH/313
W0BW/313
W0WP/314

308

DL9YX/311
JH1IFS/311
JA3GM/312
OZ1CTK/312
OZ1LO/314
VE3CKF/312
YU2TW/313
W1GL/312
W2MIG/312
W2SM/311
K3UA/312
AA4KT/312
K4SE/312
K5KLA/313
K5VT/313
W6PT/315
WB6ZUC/312
W9XX/312
W0SR/313

307

JA1FNA/310
JA1GTF/313
JA1JWP/311
JE1JKL/312
JA3CSZ/310
LA3XI/310
OK1MP/310
AA1K/311
K4KUZ/311
K5AQ/310
K5KR/310
K6LM/309
W8QWI/310
W8RSW/312
AB9E/311
K9IW/310
W0IZ/311

Conducted By Luck Hurder, KY1T
Deputy Manager, Field Services Department, ARRL

Operation Hospitality

By Graham Hicks, W4PJS

Tucked up in the shoulder of a great scenic valley in northeast Oregon is the little town of La Grande. It is a beautiful community of about 12,000 kind and generous folks who take a great deal of pride in their hometown.

La Grande is situated halfway between two mountain passes on Interstate 84. These passes, picturesque as they may be, can turn into killers when winter weather systems, sweeping inland from the coast and the Willamette Valley, slam into them with 70 and 80 mi/h winds and dump a couple of yards of snow on the roads. Most of the locals know when and how to travel in these conditions, but several times a year, on average, sunbelters who don't, and semi-trailer drivers trying to make a deadline, underestimate the conditions on these passes. When the state highway division closes the passes down temporarily for safety reasons or for snow clearance, up to a thousand people can find themselves stranded overnight.

Well, we thought, that's no way to run a blizzard. There must be some way to prepare ourselves for this kind of emergency so that the unfortunate travelers who are forced to spend an unscheduled night in La Grande know we care. Enter the Amateur Radio Service.

We realized that it would not take a large, complicated setup to make things considerably easier. It would have to be done with volunteers, since state and local law units are busy at these times with more pressing duties. We got together with County Emergency Management Director Dennis Spray and offered to set up some procedures. The plan, using Amateur Radio operators, would essentially coordinate the local relief agencies already involved, and reach out a little further to make contact with our guests before they had an opportunity to become frustrated.

A meeting was arranged in the courthouse conference room about a week after an ugly December storm. We invited representatives from the state highway department, state and local law enforcement, the Emergency Management office, local Ministerial Association, the American Red Cross and the Salvation Army.

About a dozen attended this first meeting, and the level of enthusiasm was high. We briefed them on the general idea of the plan, emphasizing its public-service nature and public-relations benefits to the community. In an exceptionally high spirit of cooperation among agencies, several suggestions were offered to simplify and streamline the procedure. When that meeting was over, we knew we had the essence of a scheme that could not only bring relief to our surprise guests, but could also enhance working relationships among many of the citizens of La Grande. With a promise to flesh out the plan within a few days, we scheduled a final meeting two weeks later.

At the final meeting, two suggestions were made to the overall operation. Once they were incorporated, it received unanimous support. We decided to call it "Operation Hospitality." These are its fundamental concepts:

1) When road or weather conditions reach the point at which it appears that highway closure will likely be required, the highway division office notifies the County Emergency Management office, which executes a telephone tree to alert all organizations involved, including the hams who have volunteered to participate.

2) An Emergency Operations Center (EOC) is established at the Salvation Army Corps building.

3) Local Amateur Radio operators are phoned and alerted to the emergency. The W4PJS repeater, with autopatch, is dedicated to emergency traffic. Acting net controls assign operators with hand-held transceivers to various positions where communications are required.

4) The county's search and rescue team is alerted.

5) Local broadcast radio stations are notified to broadcast their pre-positioned public service announcements.

6) When the highway is actually barricaded at a local off-ramp, members of the SAR team, with at least one amateur and his hand-held, station themselves at the barricade. They direct drivers to a safe area and briefly explain the reason for the road closure. While motels still have space available, they help direct drivers to them, utilizing a special map provided by the local Chamber of Commerce. When motels reach capacity, EOC notifies the roadblock through the repeater and specifies which church or other hosting facility is opening to accept the overflow of travelers. The special maps also show these locations, as well as restaurants and service stations in the community.

7) One amateur with a hand-held is positioned at a church which is currently accepting travelers. This allows those travelers to be kept abreast of road conditions and the highway department's forecast for reopening the passes, since the church telephones may be kept busy with calls to relatives.

8) EOC telephones local families who have indicated their willingness to host travelers in their homes and directs them to the current hosting facility to meet and pick up their prospective guests.

9) EOC remains in close touch with the state highway office throughout the emergency. As soon as they are notified that the road is reopened, word is passed by phone to local broadcasting stations and via 2 meters to each church or other hosting facility.

Operation Hospitality plans were published and distributed to all potential users about mid-February 1989. Weather had begun to improve, and we figured our efforts to be prepared for another blow were like

Dr James "Judge" Hicks, WA5LTL, points out locations of motels using a special emergency map donated by the Chamber of Commerce. *(photos WA7TSJ)*

Barbara Hicks, KB7DRI, uses the W4PJS repeater to coordinate the delivery of extra food supplies to the First Baptist Church. The church hosted 109 weary travelers overnight.

taking an umbrella to the ball game—it's almost a guarantee of no rain. But on March 4, a weather front gathered strength off the Pacific Northwest coast and came screaming eastward, leaving in its path up to a foot of snow. The next day, several dozen drivers pulled to the side of the interstate at Ladd Canyon, fifteen miles to the southeast, hoping to wait out the zero visibility caused by high winds blowing snow across the road. That could have been a deadly mistake. By the time highway road crews and machinery arrived, their cars were so deeply embedded in drifts that they could not move an inch. Snow plows could not operate to clear the roads, since they would have blown several more feet of the cold white stuff on top of the already immobilized vehicles. The highway department declared the road closed and alerted local authorities to activate Operation Hospitality.

The telephone tree was activated about 2 PM. Since it was still daylight, we decided we would give the highway department another hour or two to see whether the roads might reopen without having to swing into full operation. By 3:30, it was clear that the motels were going to fill up rapidly, so we put all facets of the plan into operation. KB7DRI took a 2-meter unit to the Salvation Army building and, along with Capt and Mrs Alan Fones, the Corps officers, established the Emergency Operations Center.

I quickly found that I could not handle the stream of trucks and autos coming off the freeway by myself, so I called on the autopatch to WA5LTL for assistance. He arrived shortly with flashlight and clipboards for our maps, and together, we were able to stop and brief all vehicles, directing those who desired help to the Baptist church. With N7JPO at the church, we were able to keep track of numbers arriving. When they began to run short of food, coffee and hot chocolate, he alerted the EOC, and Salvation Army officers quickly located and delivered emergency supplies.

About 6 PM, the highway department closed the interstate at Pendleton, 50 miles to the west, which shut off the flow of traffic to La Grande. By 8:30, the last few vehicles still on the road had trickled in, and we were able to close down the roadblock position and essentially wrap up the operation, at least from the Amateur Radio standpoint.

A visit to the fellowship hall at the Baptist church proved that matters were well under control. Spirits were good, and most travelers expressed their gratitude to the church committee.

Later, in a written critique of the operation, the church committee chairman conceded that, had they read the Oplan (operations plan) more carefully when it was distributed, they would have been better prepared to deal with a real-time situation. Nevertheless, they said it was a major improvement over the disorganization of previous efforts.

It was particularly gratifying to experience the participation and enthusiasm of the state highway division. So many times when we attempt to use volunteers to assist in a public emergency, we find a "Do what you want but don't get in our way" attitude. Mr Terry Helman, district office manager for the Oregon Highway Division, not only attended both organizational meetings, but welcomed the plan as a way to relieve his people of some not-so-happy duties. Further, he initiated a press release to the state highway department headquarters in Salem, who in turn disseminated it to radio and television stations throughout Oregon. Several called us for an interview on the project. Word also came via Lt Gerald Hayes of the Oregon State Police that a counterpart of his in central Washington state had requested a copy of our Oplan for his community to review. Our own daily newspaper, *The Observer*, supported the formation of Operation Hospitality with several stories and a very positive editorial. Their associate editor, Mel Coulter, WA7TSJ, took the photos accompanying this article.

Of all the things we learned when we put our plan into effect, perhaps the most important was that one percent of the organized planning can make a thousand percent difference in handling an emergency situation. We know Operation Hospitality works, and though it may lie dormant on several dozen shelves about town for many months to come, it is clear that when nature's fury shuts us down again, we will be ready!

Maybe the Medium is the Message?

By David Wiesen, K2VX

I'm convinced that in the days of spark, most hams liked the Frankensteinian green light and the smell of ozone more than the content of the traffic they handled. In the days of CW, AM and tubes, we all loved the smell of the dust burning, phenolic heating and the crash of distant static in the same way. The same is still true today, because if all we wanted to do was communicate, well, there's always Ma Bell and her imitators.

Packet is no worse (or better). There is nothing wrong with packeteers being more interested in the equipment than the mission. In fact, the equipment is more the mission than the traffic. It is this duality which is what ham radio is all about.

However, this change of perspective does not change once you use the equipment in the public service of traffic handling. You have an obligation to ensure that there is enough "ultimate terminal" capacity to deliver the messages that come on the wings of NTS and packet. The two shouldn't even be separated. It should all be one system with packet being another mode.

I think that we ought to start thinking in terms of building our "ultimate terminals." You know what those are, right? Aside from the existing traffic people, they're the Novices on 220, the folks who operate solely on 2 meters and the new recruits that we get from everywhere!

Long ago, ARRL recognized the importance of deliveries (and originations) when the credit toward BPL required only 100 deliveries plus originations. In other words, one delivery was worth five relays.

I guess I've just reinvented the wheel. [Maybe, Dave, but that old wheel just keeps-a-turning!—*Ed.*]

Field Organization Reports
April 1989

ARRL Section Emergency Coordinator Reports

Twenty-seven SEC reports were received, denoting a total ARES membership of 17,839. Sections reporting were: GA, IA, KS, KY, LAX, MDC, MN, NFL, NH, NM, NV, OH, OK, OR, ORG, PAC, SD, SDG, UT, RI, VA, WI, WMA, WNY, WPA, WV, WWA.

Transcontinental Corps

Area	Successful Functions	% Successful	TCC Function Traffic	Total Traffic
Cycle Two				
TCC Eastern	105	87.50	451	888
TCC Central				
TCC Pacific	96	80.00	312	597
Summary	201	83.75	763	1485
Cycle Three				
TCC Eastern	60	100.0	31	62
Cycle Four				
TCC Eastern	109	90.83	443	895
TCC Central	67	90.50	287	601
TCC Pacific	99	82.50	411	791
Summary	275	87.94	1141	2287
March 1989				
Cycle 3				
TCC Eastern	60	96.77	44	88
Cycle 4				
TCC Eastern	111	89.52	500	1012

TCC Roster

TCC Eastern Area, Cycle 2: KW1U, Director. K1EIC WA1FCD KT1Q W1QYY WA1TBY WA2FJJ W2FR NN2H WB2MNA W2MTA WA2SPL KA2UBD N2XJ N3AZW N3EMD NC3V WA3YLO AA4AT WD4FTK N4GHI NJ4L WB4PNY N4SS W8PMJ NJ8S KA8WNO WB8YDZ VE3ORN

TCC Eastern Area, Cycle 3: KN1K, Director. KY1T WA2SPL N3EMD W3JKX W3OKN AA4AT N8JPR K8TPF KA8WNO

TCC Eastern Area, Cycle 4: KB1AF W1CE W1EFW W1NJM W1QYY KA1MDM KY1T KW1U W1WCG W2FR W2GKZ NQ2H W2LWB W2RQ WA2SPL N2XJ N3FM W3GL WB3GZU W3PQ KQ3T NC3V WD4FTK N4GHI W4SOQ N4SS W4UQ K4WJR K4ZK W8BO W8PMJ N8XX VE3FAS VE3GSQ

TCC Central Area, Cycle 4: K5GM, Director. WB5J KM5L K4MXQ WZ5N WR5O N5TC K5TL W5TNT KB5W W9CBE WB9UYU AI0O KS0U

TCC Pacific Area, Cycle 2: ND5T, Director. N1CWP ND5T W5JOV K6UYK WF6O VE6CHK W7AMM VE7EIL KF7R W7TGU W7IGC N0HFZ N0IA WA0YNP

TCC Pacific Area, Cycle 4: K0DJ, Director. N2IC ND5T W5QVK K6LL W6EOT W6VZT K7GXZ KA7CPT KN7B NN7H NR7E W7EP W7GHT W7VSE K0DJ K0EZ K0TER KC0D KJ0G N0HFZ

National Traffic System

Net	Sess	Tfc	Avg	Rate	% Rep	% Rep to Area
Cycle Two						
Area Nets						
EAN	30	804	26.8	.761	93.3	
CAN	30	500	16.66	.403	98.6	
PAN*	52	235	4.52	.451	86.6	
Region Nets						
1RN	60	384	6.40	.513	85.5	
2RN	30	107	3.57	.360	90.0	
3RN						
4RN	60	470	7.83	.350	75.0	
RN5	60	445	7.42	.414	79.6	100.0
RN6	60	123	2.05	.253		100.0
RN7	60	307	5.10	.361	85.2	100.0
8RN	60	251	4.18	.266	97.2	
9RN	60	268	4.47	.288	93.8	96.0
TEN	60	310	5.16	.249	83.3	100.0
TWN	50	172	34.40	.377	81.2	100.0
ECN						
Cycle Three						
Area Net						
EAN	30	185	6.17	.436	81.4	
Region Net						
1RN	30	80	2.66	.248	93.3	90.0
2RN	30	89	2.96	.325	97.3	80.0
3RN	27	52	1.93	.213	92.6	96.6
4RN						66.6
8RN						96.6
ECN						73.3
Cycle Four						
Area Nets						
EAN	30	995	33.17	1.197	98.5	
CAN	30	779	25.97	1.198	97.0	
PAN	30	616	20.53	.796	98.3	
Region Nets						
1RN	60	449	7.48	.516	98.3	100.0
2RN	48	208	4.33	.476	76.7	96.6
3RN	60	208	3.47	.339	98.8	96.6
4RN	60	509	8.48	.364	100.0	100.0
RN5	60	488	8.13	.620	83.5	100.0
RN6	60	267	4.45	.451	96.7	100.0
RN7	60	313	5.21	.524	92.8	98.3
8RN	60	252	4.20	.284	93.0	96.6
9RN	60	385	6.42	.430	93.0	97.0
TEN	60	298	4.96	.477	78.8	100.0
TWN	56	267	4.77	.449	98.4	98.3
ECN						100.0
ARN	30	95	3.16	.100	100.0	100.0

*PAN operates both cycles one and two.

ARRL Section Traffic Managers reporting: AL, AR, AZ, CT, DE, EMA, ENY, GA, IA, IL, IN, KS, MDC, ME, MI, MN, MO, MT, NC, NFL, NNJ, NTX, OH, OK, OR, ORG, SB, SC, SD, SCV, SDG, SFL, STX, UT, VA, VT, WI, WMA, WNY, WPA, WWA, WTX, WV.

Public Service Honor Roll

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; (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 qualify for the Public Service Honor Roll 12 consecutive months, or 18 months out of a 24-month period, upon sending written notification to ARRL Public Service Branch, will be awarded a special PSHR certificate from HQ. This certificate is a one-time award, ie, it is not issued more than once.

451
KC9CJ
172
WB2OWO
162
WD8V
147
KA7AID
146
KA8BBY
139
NR9K
137
WA2SPL
125
WB0FVV
W7TVA
123
W9YCV
WB6DOB
W2QNL
N4GHI
122
WB4DVZ
119
WA4QXT
117
KA3DLY
116
WA9W
115
WA9VND
WB2EAG
114
KJ4VT
113
W2MTA
112
WX4H
K4IWW
111
N4EXQ
N5MEA
110
W2RRX
109
WF6O
WB7WOW
KA1NXT
108
KI6ZH
107
AG9G
WB2ZJF
WA4PFK
KW1U
WG7H
N2EIA
106
N9BDL
105
WA4JDH
K5UPN
N2XJ
K4ZK
N1CPX
104
W4PIM
KI4YV
103
KF5BL
102
KA2KJF
K8TVG
W7VSE
101
KT1Q
W9CBE
WB8SYA
N3EMD
NO3M
KB9LT
WB2QMP
KD8HB
K4NLK
WT7A
100
W4ANK
WB4KSG
99
WA0HTN
WB4WII
98
W7GHT
KI4QH
ND2S
WB2VUK
97
KC4BHX
K2VX
W4JLS
N4KFU
N0FOO
K3JL
W7LNE
96
W4CKS
N4MEJ
WD8KQC
KT9I
WA1TBY
95
WD5GKH
KA0PDM
94
AA4AT
WB1HIH
91
W0OYH
KF5RD
90
W3FA
89
N6NLW
WB4ZTR
WX7A
K2ZVI
88
WA1JVV
N8FPN
WD4VMX
K4BGZ
KD7ME
87
W5YQZ
W5CTZ
86
WA4EIC
W9DM
KC3Y
85
NW8M
KA0ARP
84
W7LBK
N1FLO
KA7EEE
83
K5MXQ
W6VOM
KB1AF
K0ERM
KV7F
N3EGF
82
WA0TFC
KA1GEP
80
N8HSC
NN2H
79
ND0N
KQ3T
78
N8JPR
KA2QOO
WA2FJJ
77
W4QAT
N5KCL
N4AVJ
KA0KPY
N2HIF
76
K4MTX
WA4RUE
N0IYE
N0DPF
KC2HJ
75
WB8YPG
KI4W
KA0UEQ
N7BGW
74
AC5Z
KJ4NK
KA1IFC
73
KC1KI
KA8WNO
WA4TXT
KA4FZI
K3RXK
72
K8CQF
WB4WQL
KA2INE
KE2JX
N3DRM
K2YAI
NJ3V
71
WA8DHB
NY8W
N3AZW
KA7SYG
W3YVQ
W1PEX
70
WB5J
WB5YDD
N4KSO
N4ORZ
N2IYA/T
W2YGW
69
W4RWB
WB7WVD
KA2UBD
68
KD8KU
N8FWA
KA1S
KB4WT
WB6QZX
KA4HHE
KG2D
KJ3E
W1KK
67
NS9Q
WD4COL
WA4YYQ
KJ9J
66
N2IKR/T
W2FR
65
WA3UNX
KB2BNW
WB2FTX
N8CEI
WD8KBW
WD4KBW
NO0A
64
N1DHT
WB8R
KI4BR
ND0N
NC3V
63
KA9FVX
K4ZUY
KK4FV
KC4ESG/T
KA4MTX
KA1RVN/T
62
WB9CPY
N4RHV
KD0YL
KA2ZNZ/T
KA2ABA/T
K3GHH
61
WB0ZNY
WB8KWC
WB1BTJ
60
WA4RNP
W0OUD
N2DXP
K8JDI
WB4ZNB
N4SMB
WB0WNJ
W9UMH
WS7U
N1FNN
KB2EPU
WB2NVR
57
N5NZH/T
N4MMM/T
KA1QFV/T
46
N1GFM/T
45
N2DIY/T
42
N4TJT/T
N2EVG/T
40
KA6HJK/T

The following stations qualified for PSHR during the month of March 1989 but were not listed in last month's column: WX7A, N8HKX.

Brass Pounders League

The BPL is open to all amateurs in the United States, Canada and US 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 the standard ARRL form.

Call	Orig	Rcvd	Sent	Dlvd	Total
W3CUL	732	806	1401	102	3041
WB9YPY	0	1221	100	766	2087
WB0TAX	0	816	816	0	1632
W4TJM	765	0	765	0	1530
WA2SPL	22	610	597	36	1265
WA9VND	5	618	556	26	1205
W3VR	297	269	410	22	998
KC9CJ	7	546	54	382	989
KA1IFC	8	566	378	24	976
WB1BTJ	2	222	503	2	729
WA9W	16	367	333	9	725
NR9K	180	144	235	50	709
WB0WNJ	215	90	399	1	705
WA4JDH	7	331	347	4	689
WX4H	7	328	328	3	666
K5UPN	3	307	256	4	570
WB2QMP	243	270	41	0	561
KF5BL	9	255	283	14	561
WF6O	7	254	265	13	539
N3AZW	4	258	260	12	534
WB2OWO	57	198	207	71	533
K1UGM	0	259	259	0	518
N2DXP	26	257	231	0	514
WG9J	12	279	187	31	509

BPL for 100 or more originations plus deliveries

W0FIR 105

Independent Nets

Net Name	Sess	Tfc	Check-Ins
Amateur Radio Transmitting Society	25	282	392
Central Gulf Coast Hurricane Net	30	91	3304
Clearing House Net	30	255	226
Empire Slow Speed Net	30	73	397
Great Lakes Emergency Traffic Net	30	54	1072
IMRA	29	759	1605
Mission Trail Net	30	133	887
NYSPTEN	30	62	401
West Coast Slow Speed Net	30	78	414
20 Meter ISSB Net	25	328	705
75 Meter Interstate SB Net	30	193	1109
7290 Traffic Net	45	413	3140

The World Above 50 MHz

Conducted By Bill Tynan, W3XO
Send reports to HCR 5 PO Box 574-334,
Tierra Linda Ranch, Kerrville, TX 78028
or call 512-257-1296 to record late-breaking information.

The 6-Meter DX Window—Yes or No—It's Time for a Vote

The May 1988 column called for a one-year trial of a suggestion that had been made several years earlier by a group of south Florida 6-meter operators. The matter was brought up at that time because of numerous complaints that, especially during contests—the June VHF QSO Party in particular—stations actively working the contest, but not particularly attempting to work outside of the US and Canada, were making it all but impossible for others to hear weak DX signals. Those making the complaints wondered why contest rules could not be changed to specify that contest contacts be made in a portion of the band not normally used by DX stations, leaving the area around 50.110 clear for those chasing DX. Feeling that it would be difficult to convince those who run contests that they should establish rules that reflect something other than customary practice during noncontest periods, this conductor proposed that the "DX window," originally suggested by the south Florida group, be established on a one-year trial basis. Following this group's specific frequency limits, 50.100 to 50.125 would be used, by US and Canadian stations, exclusively for working, or attempting to work, DX. DX, for want of an unambiguous definition, was defined as any station outside of the contiguous 48 US states and the lower-tier Canadian provinces.

As anticipated, the DX window proposal was, and continues to be, controversial. The majority of those who wrote in response to the editorials which preceded the May call for the experimental trial period supported the idea—although many expressed detailed differing proposals of their own. Some urged a wider window, while others insisted that no US or Canadian stations should transmit within it, but should employ split-frequency operation to leave the segment completely clear for use by DX stations. This would mean, of course, that DX stations would also have to employ split frequency. This would present a problem, as many of them have older rigs without split-frequency capability. It has been pointed out that this same limitation applies to some of us as well.

Comments in the same vein were expressed at the various conferences at which the DX window was brought up. A show of hands indicated support, but, again, there were almost as many suggestions for "improvements" as there were people in attendance. Despite this general expression of support among those voicing a direct opinion, my listening on the band indicates only limited compliance. I often hear people who have been some of its most vehement supporters conversing with their friends between 50.100 and 50.125. This seems particularly prevalent during F2 openings when backscatter propagation is especially good. This, of all times, is when we should make it easiest, for those in parts of the country not as favored with DX openings as some other areas, to pick up new countries—either via direct or backscatter paths. The same goes for periods when sporadic E is present along with F2 or TE.

Naturally, there are those who are opposed to any change and stand on their rights to operate anywhere in the band they please, as long as they abide by FCC rules. They are certainly correct in contending that such action is within their "rights." Only friendly persuasion by other operators can ever succeed in convincing them to do otherwise. But I have seen little evidence of such friendly persuasion. All too often, when there have been exchanges regarding operation in the DX window, the persuasion has not sounded particularly friendly.

Although observation of the DX window has been far from perfect, many have noted that domestic QSOs on the low end are fewer in number than they used to be and that more use is being made of the 50.125 to 50.200 portion of the band. A few cite this improvement and urge that the subject not be brought up again.

However, I promised a one-year evaluation followed by a specific recommendation based on the results of that evaluation. I feel obligated to follow through with that plan. In addition, my listening suggests that many who express support for the DX window believe that its purpose is to get the riffraff out of the low end of the band so that they can have their own private preserve. If that is the case, this conductor cannot continue to support a DX window. I have always believed that if the DX window is to succeed at all, it must be observed by everyone and at all times—not merely when the band appears open for DX at that particular location.

Since the one-year trial period is now up, it's time for a decision. A vote by 6-meter operators seems the appropriate way to reach that decision. In order to keep the results manageable, not containing as many alternative suggestions as there are replies, the questions and their corresponding answers must be kept simple and specific. Please use a postcard. It will save money on stamps and facilitate my sorting of responses. Please also ask your friends who are on 6 meters but who may not read this column to vote also. If you wish, you may collect a number of cards and mail them in one envelope, but please—only one person's response per card and one card per person. Let's not stuff the ballot box!

Here are the questions. Please include the corresponding letter too, so that your answers can easily be matched to the question, and limit your responses to those presented. If you wish to elaborate or make further suggestions, please use a separate card or sheet of paper.

1) Do you believe that there should be a portion of the 6-meter band used by US and southern Canadian stations only for working, or attempting to work, stations outside of the 48 contiguous US states or the lower-tier of Canada; eg, VE1 through VE7?
Yes No

2) If your answer to Question 1 is yes, do you believe that a DX window should apply at all times or only when an individual operator believes that the band might be open for DX?
a. At all times
b. Only when an individual believes that propagation to DX areas is possible.

3) If your answer to Question 1 is yes, should the DX window be:
a. 50.100 to 50.125 *
b. 50.100 to 50.120 **
c. 50.100 to 50.150 ***
d. 50.080 to 50.100 (For CW only by US licensees)
e. 50.200 to 50.250 ****

(Response should be in the form "3 a")
Note: These are some, but not all, of the alternative suggestions that have been made.

*Implies a new general calling frequency of 50.125, replacing 50.110.
**Implies a new general calling frequency of 50.120, replacing 50.110.
***Implies a new general calling frequency of 50.150, replacing 50.110.
****The current calling frequency of 50.110 would probably be retained, with DX calling done either there or within the DX window.

4) If the responses indicate major support among 6-meter operators for a full-time DX window, will you honor it by refraining from engaging in QSOs with US and lower-tier Canadian stations, whether or not you think that propagation to DX areas is possible at the time? (Applies to US and lower-tier Canadians only)
Yes No

5) If the answer to Question 4 is yes, will you also try, in a friendly manner, to persuade others to observe a DX window if it is implemented?
Yes No

6) Are you now on 6 meters, or have you been on the band in the past 10 years?
Yes No

7) If the answer to Question 6 is yes, how long have you been on (or were you on) 6 meters?
(years _____, months _____)

8) How many DXCC countries have you worked on 6 meters?

9) Do you think that a DX window should apply to lower-tier Canadians or only to US stations.
Yes No

10) What is your call? (Optional. You need not answer this question, but please provide your US or Canadian call area, or country/prefix if outside continental US or lower-tier Canadian provinces.)

Please send postcards to the address at the top of this column by July 20. I will try very hard to publish the results, along with recommendations based on them, in the October column—just in time for the fall F2 season.

ON THE BANDS

6 Meters—This is being written during early May, when 6-meter conditions are in a state of flux. F2, which has been king, at least in some parts of the country, particularly in the South and West, is beginning to give way to the summer sporadic-E season. Such transitional conditions can be very productive for those who have not been experiencing the exciting conditions some of the rest of us have been privy to. Although F2 conditions are not as consistent as they were during March and early April, nevertheless they are there. When they occur in conjunction with sporadic E, sections of the country which have been in the "black hole" all of a sudden are able to partake of some juicy DX morsels. But, in most instances, operators doing so must be ready to take advantage of fleeting openings and must often be in a position to copy very weak signals. Naturally, the existence of QRM from locals and/or E_s-range stations can make hearing weak DX stations all but impossible. The accounts that follow are illustrative of how E_s and other propagation modes can team up to provide DX for those who may have been on the outside looking in for many months.

While south Florida and the Caribbean continued to clean up in the south Pacific, 6-meter devotees in most of the rest of the country had to be content with witnessing their success vicariously via 28.885. The West Coast, as well as Texas, New Mexico and Arizona, got a few fairly good openings to South America and the south Pacific, but generally these weren't as numerous as a month earlier. But Friday seemed to be the lucky day for 6-meter operators generally, largely through E_s link-up. The afternoon of Friday, April 28th produced some of the strongest signals this conductor has heard so far from New Zealand, with ZL3TIC S9 or above on 51 MHz. In addition to ZL3TIC, ZLØAAH, alias K9AKS, and ZL4LV (the first ZL4 for W3XO/5) were worked. The ZLs put in an appearance here about 2100Z, followed by the LUs 45 minutes later—a reversal of the usual pattern. As thunderstorms were nearby, everything was then disconnected even though the band was still open. But a telephone call from W5OZI broke the reverie, to inform me that he had just worked FOØAG. Of course, the cables were reconnected for a short CW QSO with that station, which reached 589. On returning at 0100Z April 29, a CQ on 50.125 brought a response from NØICB EM28. That was followed in quick succession by contacts with CX8BE and CX4HS. Stations in Kansas, Colorado and Wyoming were in via E_s over the next hour, and I was pleased to hear many of them working the South American stations, presumably via TE propagation, which was taking place in my part of Texas, and the E_s path from here to their area. At 0223Z, I had a QSO with LU9MA, an old-timer from Cycles 18 and 19. Then, at 0243, I worked LU8MBL, who was S7. At 0252 and 0305, I had QSOs with WB5JAR/Ø and W2CRS/Ø, respectively, both transplants to Colorado. At 0321, my adrenalin rose sharply with the appearance of CE3BFZ sporting a good 57 signal. Pedro was worked for a new country in short order. South Americans stations were not the only DX snagged that evening by those who have been biding their time for the past several months. VK3OT was worked by several Øs as well as by W4CKD/8 in Ohio. This contact apparently represented the greatest distance ever worked by either station on 6 meters. W4CKD commented that he managed to complete the QSO despite considerable QRM from single-hop E_s stations.

If Friday April 28-29 was good, Friday May 5-6 was absolutely stupendous. I can't possibly hope to report all that everyone worked that day, so I will attempt my usual thumbnail sketch.

The first signal I heard upon checking the band about 2100Z was that of this column's first conductor, W1HDQ/4, in Florida. Unfortunately, Ed was in QSO with a VE3 and faded out before I had a chance to say hello. A few minutes later, several 9s and a 4 were worked before I quit for dinner. But at 0010Z May 6, off-tuned SSB brought me back to the rig. It turned out to be a solid 55 signal from VK3OT. A quick QSO ensued to let Steve know that he was getting beyond the West Coast. That was followed a few minutes later by a double-hop contact with W3EP/1 in Connecticut. Believe it or not, FN31 was a new grid for me—that is from Texas! At 0210, a CW contact with CO2KK was very welcome. I understand that a number of other US stations, including many East Coasters, were also successful with CO2KK that evening. As an example, KA3BTD Waldorf, MD near Washington reports that he worked Arnie at 0024Z and that his brother KA3PQS, as well as his brother's wife KA3RUR and their 14-year-old son, KA3RXW, were all able to add Cuba to their worked list. It was particularly gratifying to work CO2KK and know that others had done so also, as I had been associated with a group of US and Canadian hams which was able to obtain an SB-110 and get it sent to him. With W4OO handling the QSLing, I am certain all who work CO2KK will be able to receive cards without difficulty. Shortly after contacting CO2KK, I worked 8R1AH. Like the Cuban station, Atsi was gracing the logs of many North American stations that evening. W4CKD is handling the cards for this station. Use the 1989 *Callbook* address only. CX8BE was heard a few minutes later, but I didn't call him, as I had worked him before and wanted to give those who hadn't a chance to pick up a new country.

Apparently, one of these was KA7WOZ in Wyoming. Richard says that the E_s link-up allowed him to he work CX8BE and LU8YYO at 0209 and 0231Z, respectively. He added that these contacts not only represented new countries, but his best DX in that direction.

Friday, May 5-6 was also a memorable evening for N5JHV in southern New Mexico. At 0035, Dave worked VK3OT and at 0055 3D2AG for a new country. He notes that the contact, although completed, was made difficult by a couple of Øs QSOing on 50.110. A few minutes later, with his beam still to the west, N5JHV heard a ZS he thought was signing ZS6UN. When he put the beam to the normal ZS direction, the signal disappeared and reappeared again when the beam was returned to the west. Dave says that W5FF heard the station also. Can anyone shed any light on this one?

2 Meters—Many have speculated on the existence of 2-meter E-skip during the big 6-meter opening of May 5-6. WA5IYX's FM-broadcast monitoring showed signals up to 108 MHz, so Pat felt that 2-meter propagation was a distinct possibility. I have not yet heard of any 2-meter openings that evening, but 2 days earlier W2MGF/4 Sunset Beach, NC says that 2 meters was open. After working several Caribbean stations on 6 meters, Rich asked KP4A to try 144. They worked immediately, at 2048Z May 3, with 59 signals. This was followed, 3 minutes later, by a contact with KP4EKG, also with 59 reports being exchanged. See the section that follows for a most intriguing sequel to this contact. K1FJM/4 near Miami confirms this same opening. Pete notes working KP4EIT, KP4A and KP4EKG, plus KV4FZ for country number 7 on 2 meters. Pete adds that KV4FZ was running 10 W to a ¼-wave vertical. These contacts all took place between 2255 and 2330Z on the 3rd.

SPORADIC E ON 70 CM?

Following their 2-meter E_s contact May 3, KP4EKG asked W2MGF/4 Sunset Beach, NC to look for him on 432.1. Rich heard nothing from the KP4, but when he went back to 2 meters, he learned that KP4EKG had heard him at S1. Could this have been the first known instance of sporadic E on 70 cm? Or was the overwater path between them, the same path that has produced a number of good tropo openings over the years, at work again? The time was 2050Z, not usually thought of as an auspicious time for tropo, but who knows? It's interesting to speculate anyway.

Conducted By Bob Atkins, KA1GT
103 Division Ave, Millington, NJ 07946

Calling Frequencies

The calling frequencies on the higher microwave bands are located 100 kHz above the frequency in each band that is a multiple of 1152 MHz. This arrangement allows a common 1152-MHz LO (and any appropriate multiplier chain) and a 144-MHz IF to be used for several bands.[1] The calling frequencies are thus 1296.1, 2304.1, 3456.1, 5760.1 and 10368.1 MHz. (The 902-MHz band was not available to amateurs when this calling-frequency standard was developed; 903.1 MHz was added to the calling-frequency list when we got the band.)

In a recent recommendation by the ARRL VHF/UHF Advisory Committee (VUAC) concerning revised band plans for the 13- and 33-cm bands, new calling frequencies for these bands were proposed. The change would move the present 33-cm calling frequency from 903.1 to 903.2 MHz. The proposed 13-cm calling frequency is 2304.2 MHz. The reasoning behind this proposal is to give protection to weak-signal operations (especially EME)—that take place just above 903.0 and 2304.0 MHz—from spurious emissions (LO phase noise, splatter and so forth) generated by high-power stations operating on the calling frequencies.

A number of groups, including The Central States VHF Society and The North Texas Microwave Society, have voiced objection to this plan; if the VUAC's proposal is adopted, the IFs of almost all amateur microwave receivers will be tuned to the 144-MHz calling frequency (144.2 MHz) when the transverter-based microwave rigs are tuned to the microwave calling frequencies. Under the proposed plan, IF leakage would be a big problem because a relatively large number of stations run high power on 144.2 MHz.

The only way to avoid this problem is to replace the LO crystals in all existing amateur microwave transverters that use a 144-MHz IF—a change that would probably affect more than 90% of all amateur microwave stations—to use an IF other than 144.2 MHz when tuned to the proposed microwave calling frequencies.

Arguments for and against the change have been raised. It would be nice to give weak-signal operators more immunity from interference, but it is highly undesirable to subject microwave operators to 144-MHz IF leakage or require them to modify their equipment.

If you feel strongly about this issue, write to your ARRL VUAC representative and make your views known. (VUAC members are listed in *The ARRL Repeater Directory*; you can also find your VUAC rep by calling ARRL HQ.) The band plans are for the benefit of all who use the bands, so speak out now, or your views can't be taken into consideration in the final decision.

[1]This scheme dates from the days when high-power frequency multipliers were the only way to generate reasonable amounts of energy on the amateur microwave bands.

Microwave Circuitry

Most of the microwave equipment being developed these days, even by amateurs, uses microstrip circuitry. A good example is Al Ward's series of microwave preamplifiers for the 2.3- through 10-GHz bands (May 1989 *QST*, pp 31-36, 75). Until a few years ago, 10 GHz was exclusively the province of waveguide and associated plumbing! As microstrip circuits are developed for higher-frequency use, the need to use high-quality microwave components increases. Let's take a closer look at two of the most critical components—circuit boards and capacitors—and see why making component substitutions can be a risky business.

Circuit-Board Materials

If you've seen articles describing microwave microstripline designs, you have also undoubtedly noticed that Teflon®-based circuit-board material is nearly always called for. The reason for this lies in a property known as the *dissipation factor* of the dielectric material used to make the board. Dissipation factor is a measure of the power lost in a microstrip transmission line by interaction with the dielectric material. The lower the dissipation factor, the less power is lost.

Common, glass-epoxy G-10 circuit board has a low dissipation factor at VHF/UHF, but it is not suitable for demanding uses at frequencies much above 1 GHz. At frequencies above 1 GHz, a different dielectric material must be used; the most commonly used and widely available low-loss materials use Teflon. Pure Teflon, or more commonly, a Teflon/glass-cloth laminate, is used. These materials have dielectric constants (represented by the Greek letter ϵ) in the range of 2.0 to 2.6 (compared to about 5 for G-10 glass-epoxy boards), and dissipation factors between 0.001 and 0.002 at frequencies from 1 GHz to 10 GHz. (Each 0.001 increase in dissipation factor results in an additional 0.027-dB-per-wavelength loss on a microstrip transmission line.)

Also usable as dielectrics are ceramic materials such as alumina (aluminum oxide). Ceramics have high dielectric constants—usually around 10—and low dissipation factors, but they are rather brittle and difficult to work with. Alternatives include a series of ceramic-filled Teflon dielectrics that also have high dielectric constants (6 to 10), but are more flexible and thus less prone to breakage.

The dielectric constant of the substrate determines the physical size of the microstrip elements. Element size is proportional to the square root of the substrate material's dielectric constant. Thus, circuits etched on high-dielectric-constant boards are physically smaller than those etched on boards with low dielectric constants. For example, using 1/32-inch-thick board, a 50-Ω stripline on an $\epsilon = 2.5$ board is about 0.9 inch wide, whereas on a board having a dielectric constant of 10, a 50-Ω stripline is only 0.3 inch wide. This can be an advantage if small size is important; it can also reduce microstrip radiation losses. On the negative side, greater dimensional accuracy of the etched microstrip elements is required on high-ϵ boards.

Teflon/glass laminates are by far the most commonly used circuit-board materials in above-1-GHz applications. These laminates are quite expensive to buy new: expect to pay on the order of 50 cents per square inch for small quantities of board stock. These materials can sometimes be found at flea markets for considerably less, though. Teflon-dielectric boards can be recognized by their slightly greater flexibility than G-10 board, and their smoother-feeling dielectric material. The quickest way to characterize the board is to measure the capacitance between the two copper-laminated surfaces. The dielectric constant of the substrate can then be calculated by

$$\epsilon = (C \times t) \div (0.224 \times A) \qquad \text{(Eq 1)}$$

where

ϵ = dielectric constant
C = capacitance in pF
t = dielectric thickness (inches)
A = circuit-board area (sq inches)

Next month: microwave capacitors.

Microwave Update 1989

This year, The North Texas Microwave Society will host the Microwave Update conference. In previous years, this conference has been held in Estes Park, Colorado; this year, the site will be the Flagship Inn in Arlington, Texas. The conference will be held October 5th through the 8th. Technical sessions will be conducted on Friday and Saturday, and a tour of the surplus outlets in the Dallas/Fort Worth area is planned for Thursday. Noise-figure measurement for 902-MHz-and-up receiving equipment will also be performed at the conference.

Topics scheduled for technical presentations include laser communications, microwave propagation, dish feeds, high-power tube amplifiers for 2.3 GHz, microwave EME, no-tune transverters for the 902-MHz and 2.3-GHz bands, solid-state power amplifiers, 24- and 47-GHz operation and much more.

For more information, contact Al Ward, WB5LUA, Rt 9, Box 132, McKinney, TX 75069. I'm sure Al would appreciate an SASE with your request.

On Line

Conducted By Stan Horzepa, WA1LOU
75 Kreger Dr, Wolcott, CT 06716-2702
CompuServe ID no. 70645,247

More Ham Software Here!

Apple® II

APR

APR is a packet-radio terminal-emulation program that features the WA7MBL YAPP binary-file-transfer protocol. Recently, a new version of APR (Version 1.2) was released and, besides fixing some problems that were present in the previous version, the following features were added: terminal emulation with split-screen; text file uploading; session logging; ability to connect a printer; state-of-options display; ability to change baud rate from within the program; YAPP uploading and downloading for 8-bit file transfers; TNC-220 and KPC-2 support; 40- or 80-column screen control; SSC, Apple IIgs and IIc modem port support; VIDEX 80 support for Apple II+ users; and Apple II+, IIe, IIc and IIgs support. 5½-inch disk: $5, 3½-inch disk: $6 (specify Apple ProDOS or MS-DOS format), Paolo Viviani, I1VVP, C So Brunelleschi 36, I-10141 Torino, Italy.

Apple Macintosh®

MFJ-1287

MFJ has released a new terminal-emulation program, compatible with the MFJ-1278, that includes the ability to print weather FAX pictures on the computer's display. The program includes an interface cable for connecting the computer to the controller. $19.95, MFJ Enterprises, Inc, PO Box 494, Mississippi State, MS 39762.

WeFaxWorks

Kantronics has released *WeFaxWorks*, a program that permits reception of weather maps and charts when used in conjunction with a Kantronics data controller. The program features simple signal synchronization that is accomplished by pointing the computer's mouse at the synchronization mark and clicking the mouse once. This causes the received and displayed signal to be aligned with the left edge of the computer's screen. Each picture is saved in a buffer as it is being received; once the user exits the receive mode, the captured picture may be displayed with a scroll bar that allows the user to scroll up or down through the picture. Printing is accomplished by saving screens in MacPaint® format and using a paint program to touch-up and print the picture. $39.95, Kantronics, Inc, 1202 E 23rd St, Lawrence, KS 66046.

Commodore C-64®

Super Net and *Quick Search*

Super Net was written by Scott Cundiff, N5ASD, for use by net-control stations. By entering a call-sign suffix, the computer displays the full call sign, name and location of the station. In addition, the program has an on-screen clock, a check-in log, a printer option, update and add functions and a "save-and-replace" option. *Quick Search* is another N5ASD program and offers a different approach to net controlling than does Super Net. The net-control station never has to press a return to initiate a call-sign search; simply keyboarding one character does the trick. Both programs: $8, or $5 with a formatted blank disk and self-addressed stamped disk-mailer, Scott Cundiff, N5ASD, 108 Northside Dr, Vivian, LA 71082.

IBM PC® (and Compatible Computers)

MINIPROP Version 3

Version 3 of Shel Shallon's propagation prediction program predicts both MUF and signal strength. It uses a method of searching through several ionospheric modes to find the combination of E and F hops that yields the strongest received signal at each half-hour on each of seven frequencies selected by the user. The resulting ionopheric mode configuration, radiation angle and mode availability are presented for each frequency and half-hour. A "DX compass" feature determines which bands are open in 12 compass directions from the user's QTH. Version 3 supports optional 8087, 80287 and 80387 math coprocessors to greatly speed up the prediction process. MINIPROP also includes an atlas that provides latitudes and longitudes for more than 350 locations, including all DXCC countries. A beam-heading chart from the user's location to all locations contained in the atlas is also provided. $49.95, W6EL Software, 11058 Queensland St, Los Angeles, CA 90034-3029.

QSO Tutor

This "tutor" is a study aid for the Amateur Radio exams (Novice through Extra Class) which creates randomly generated tests based on the entire question pool and analyzes the results, showing areas requiring additional study. The program will work with the entire question pool, selected areas of the pool or automatic selection of questions in the user's weak areas. $29.95 per license class, QSO Software, 208 Partridge Way, Kennett Square, PA 19348.

The Amateur Radio Operating System

The Amateur Radio Operating System or "ARS" is a computer database manager for QSO information written by Ron Stange, WA4PYF. The program is structured modularly so that you need purchase only those modules you intend to use. The ARS base module performs automatic logging of all QSOs on any eight bands and six different modes. QSO data that is recorded by the program includes call sign, date, time, band, mode, name and QSL sent/received data. This data may be summarized for tracking Worked All States and Worked All VE awards. The foreign/DX module is intended for the DXer and features a country "Quikchek" which provides a single keystroke status of your needs for the country of the call sign entered. Summaries for DXCC and Worked All Europe awards are also provided. The QSL-printer module scans the user's selected log files for contacts that are marked for QSLing. When found, the module prints a QSL and indicates in the log that a card has been sent. A contest manager module is also available. Base module: $39.95, contest-manager module: $19.95, foreign/DX and QSL-printer modules: $15.95 each, Fundamental Services, 1546 Peaceful Ln N, Clearwater, FL 34616.

Yagi Optimizer

Yagi Optimizer, or simply "YO," automatically optimizes Yagi-Uda antenna arrays for maximum forward gain, best pattern and minimum SWR. YO offers a complete Yagi design package including models for matching networks, element tapering, element-to-boom mounting plates, frequency scaling and taper scaling. The program will plot radiation patterns at the central design frequency and at the band edges on your screen during optimization. Three simultaneous plots are updated continuously as optimization proceeds, allowing the user to check the performance of the antenna at a glance. The user may invoke a high-resolution plotting program to view the antenna patterns in several different formats and to directly compare the plots of the two Yagis using a special plot comparison feature. YO has been designed to work alone or in conjunction with *MN*, the general-purpose antenna-analysis program that is also available from K6STI (see On Line, May 1988 *QST*). $90, Brian Beezley, K6STI, 507½ Taylor St, Vista, CA 92084.

HELP WANTED...

☐ Finding a packet-radio terminal-emulation program and TNC-interfacing information for a Commodore Plus 4® computer. Fred Jones, WA4SWF, 511 Lackey Ave, Louisa, KY 41230.

☐ Finding a CW and RTTY program for a Northstar® Advantage computer that is interfaced to an MFJ-1229 terminal unit. Bill Nohrn, W5UNB, 8820 James NE, Albuquerque, NM 87111. (I can convert almost any CP/M program to run on the Northstar and I can convert from MS-DOS BASIC files to CP/M if the files will run on a compatible BASIC.)

Conducted By
Vern "Rip" Riportella, WA2LQQ
PO Box 177, Warwick, NY 10990

A Switch In Satellite Directions—Part 2

Last month,[2] I began this discussion by asking why, if given a choice of low or high satellite orbits, one would choose the lower orbit? Wouldn't the higher orbit—with its vastly greater coverage—be the natural choice? As we began to discover last month, the real answer may be counterintuitive. This month, I'll develop the rationale for choosing low orbits for some applications.

Low orbits have their pros and cons. On the plus side, with a given launcher you can put a much bigger satellite at an altitude of 250 miles (shuttle altitude) than at 22,000 miles (geosynchronous satellite altitude). It's as simple as this: Given a fixed amount of propellant, the less distance you have to push the spacecraft's mass up against earth's gravity, the more mass you can place in the lower orbit.[3]

Also on the plus side for LEOs is path loss. It is well known that military imaging reconnaissance satellites often dip as low as 100 miles or lower to zoom in on an interesting feature. Similarly, a radio-communications satellite benefits from the lower path loss between satellite and earth station when in LEO.

On the negative side, very low LEOs mean shorter orbital lifetimes unless some form of station keeping is performed with rockets, or other motive power. And, as mentioned earlier, the coverage zone (or footprint) is smaller with LEOs than with higher orbits.

But let's look at path losses again because it's in that area where some real insight is possible. Let's compare the path losses of a really low earth orbit, say 250 miles, with a geosync bird that has a slant range from your QTH of, say, 25,000 miles. The ratio of distances is 100:1. Because radio-wave energy decreases as the square of the distance increases, if comparable effective radiated power were used on both satellites, the one at 250 miles would be $100 \times 100 = 10{,}000$ times stronger on the ground than the one at 25,000 miles. In terms of power ratios, that's 40 dB. Anyone who's tried to squeeze an extra decibel or two out of a VHF beam will appreciate that 40 dB is a hefty ratio indeed! It's no wonder then, that UO-9, at an altitude of about 270 miles, can easily be heard on a 2-m hand-held transceiver while AO-13 (at 22,000 miles altitude when at apogee) usually requires a large beam and preamp to be heard.

"Engineering" concerns itself with recognizing the resources available, determining the interrelationships, prioritizing requirements and establishing reasonable trade-offs among resources and requirements. And, if the main requirement of a satellite communications system is to keep the power requirements of both the satellite and the earth station as low as possible, then LEO is likely the preferred solution. An important trade-off is footprint size. With smaller footprints, fewer and fewer users can be in real-time communication. But let's trade real-time communication for store-and-dump packet-radio communication in return for the reduced path loss the LEO yields.

With the proliferation of packet-radio equipment within the Amateur Radio community, using LEO satellites in non-real-time, digital store-and-dump modes makes sense. The satellite flies over, announcing its presence to all listening on the frequency. Those having messages to upload do so at random on one of the uplink channels. The message is stored in the spacecraft's computer memory until the destination addressee announces his presence. Then, the previously stored message is downlinked to the addressee. This type of mailbox service can effectively blanket the earth in a few hours if a wise choice of LEO is made.

Most important though, is that in return for the small footprint that has driven us towards a non-real-time communications regime, we have accrued the promised low path loss. In fact, with proper choice of frequencies, power, modulation and coding, the satellite can effectively communicate with very primitive earth stations without using gain antennas on either the spacecraft or on the ground. This can have profound consequences on realizing special missions where portability and low cost are key design drivers. Complete packet satellite stations including transceiver, radio modem and portable computer can be toted in an attaché case of moderate proportions. Imagine setting up your terminal on the shores of Lake Tanganyika on the hood of your Land Rover and sending/receiving E-mail from home!

The question now arises as to exactly what type of orbit should be chosen for the packet store-and-dump satellite. If global coverage is a requirement, as it likely is, it's clear the LEO must be polar. That's because polar LEOs cover every square inch of earth several times per day. (See Fig 2). How many times per day you see the satellite depends on your latitude. The closer you are to one of the poles, the more frequently your QTH is included in the satellite's footprint on a given day. Conversely, if you reside near the equator, the coverage time per day for a polar LEO is least.

Now, suppose we required speedier message delivery between arbitrarily located message originators and message destinations. Placing an identical satellite in a similar orbit but spaced, say, half an orbit behind (or ahead) would work. But what about a different orbital plane? Suppose one or more satellites were in polar orbits and one or more were in equatorial (low inclination) orbits. Equatorial stations would then see 12 to 15 passes per day from the equatorial birds in addition to the 5 to 7 per day from the polar birds.

Then, these questions arise: If you have a message to send via satellite and a choice of routes (carrier satellites) to transport it for you, how do you decide which satellite to use? What's the optimum routing? Is there a way to determine optimum routing a priori?

Now, consider the general approach of uplinking the message to the first satellite that comes into view, then letting the satellite take care of the routing, including the possibility of cross satellite links to get the message on board a satellite that will pass over the destination address in the minimum length of time. Better yet, to keep the RF link burden on the satellite low (crosslinks are very difficult), how about using the facility of an earth station to downlink messages and then upload them on the appropriate "carrier" birds? This would be kind of a mail sorting house, a distribution center, if you will.

Imagine a combination of polar and equatorial satellites and well-placed terrestrial relay stations. An earth station near Thule, Greenland, sees portions of virtually every polar orbit. Another site in Quito, Ecuador, would see portions of every orbit of equatorial birds. A data link between Thule and Quito—combined with

For more information on getting started on OSCAR and information on AMSAT membership and membership benefits, call AMSAT at 301-589-6062 or write: AMSAT, PO Box 27, Washington, DC 20044. Please include a business-size SASE.

[2]Notes appear on page 79.

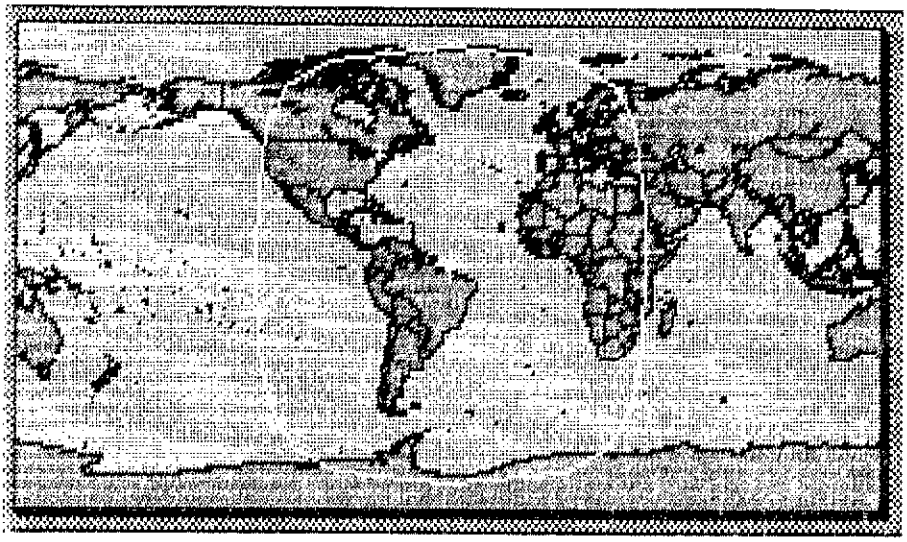


Fig 3—As shown here, a satellite at geosynchronous altitude has very broad coverage. But the cost of the broad coverage is increased path loss and the need for attitude maintenance warranted by the use of highly directional spacecraft antennas. The SatelLife public-service satellite (destined for launch in 1992 and positioned over northeast Brazil) will have the footprint depicted here.

appropriate networking intelligence—could form the brains of a highly effective network for routing traffic between stations. What about other combinations of space and earth segments?

It's well known in engineering space-communications systems that the link budget is shared between the space segment (satellite) and the earth segment (earth station). For example, to improve the performance of an uplink by 6 dB, one can increase the power of the uplink transmitter four-fold (6 dB), or increase the gain of the receive antenna by 6 dB or some combination, say, doubling uplink power (increase uplink by 3 dB) and increasing receive antenna gain on the satellite by 3 dB.

How link-performance budgets are established is also strongly affected by the user population. If, for example, there are to be 10,000 earth terminals working into a single satellite, it is often less expensive to place more link budget burden on the space segment. After all, if 3 dB more signal is needed, it may be less costly to obtain most of it through improvements on a single spacecraft than on 10,000 terminals!

It is just this premise that allows direct-broadcast satellites (DBSs) to beam 12-GHz TV signals to European homes employing dishes with diameters as small as 1 meter or less. The link burden is obtained on the space segment through its radiation of copious amounts of power (more than 100,000 watts EIRP). Similar feats might be achieved using large, powerful satellites to transmit to the small packet terminals described earlier.

Thus, a message picked up by a LEO could be dropped off at a convenient way station to be uplinked to a powerful geosynchronous satellite that could then blanket every station in its footprint, which might cover 30% of the earth's surface (see Fig 3). This would reduce message delivery time by half, on average, since message latency would depend only on pickup delay; not on delivery delays. The downlink would be accomplished in real time. Such a linking of LEOs for uplinks and LEO/GEO for downlink would seem to offer new options in speeding message delivery, especially to equatorial regions where polar LEO coverage is most difficult.

The choice of orbits is critical. This fundamental decision aligns and constrains hundreds of design choices. Through a combination of LEO and GEO orbits, it appears that packet-radio satellite-networking can provide unexpectedly high levels of responsiveness and throughput.

Notes

[2]V. Riportella, "A Switch In Satellite Directions—Part 1," Amateur Satellite Communications, *QST*, Jun 1989, pp 86-87.

[3]A typical large launcher, such as the Ariane 4, can place over 9,200 pounds in geosync transfer orbit, but a whopping 17,600 pounds in LEO.

Exam Info

(continued from page 48)

7. I am the team liaison for a session. Three weeks ago a candidate passed the Novice test and the 610 was sent to the FCC for processing. That candidate has now passed Element 3A for the Technician license but has not yet received the Novice license from the FCC. Should I issue to the candidate two CSCEs, one for element credit and a second for element and upgrade credit, or do I just issue one CSCE indicating Element 3A credit and upgrade to Technician?

Your candidate has not yet received the license from the FCC, and therefore is not upgrading an existing license. You must issue two CSCEs for the candidate, one giving credit for Element 3A (the signed Form 610—as submitted to the FCC for the Novice license—gives the candidate credit for Elements 1A and 2), and the second CSCE indicating element credit and upgrade to the Technician license. The first CSCE indicating element credit is given to the candidate at the session. The second CSCE indicating element credit and upgrade to Technician Class license is returned to the VEC. The VEC will hold this CSCE until the photocopy of the candidate's *signed* Novice license is received at the VEC. Upon receipt of this license photocopy, the VEC will mail the candidate a CSCE indicating element credit and upgrade to Technician. *If you do not have an Amateur Radio license and plan to take your Novice and Technician examinations within a short time frame (within 3 to 4 weeks of each other) we highly recommend that you take both your Novice and Technician exam elements at a registered VE session.* If you take both your Novice and Technician exam elements at a VE session, the delay will only be that for processing one application—about 7 to 10 weeks. If you choose to take these examination elements separately, the processing time from no license to receiving a Technician (or higher) license could take 16 weeks at a minimum.

8. What will be accepted as proper identification at a examination session?

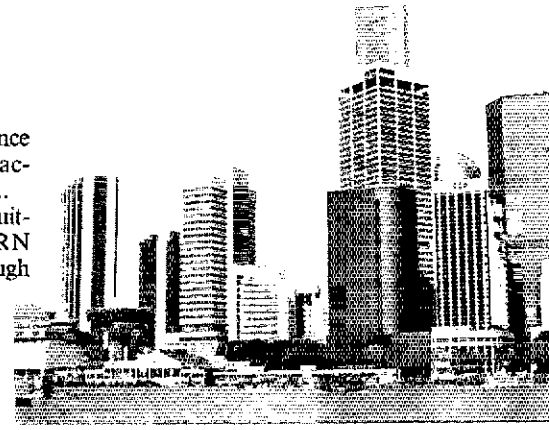
The standard acceptable identification is a drivers' license with photograph or a photo ID. If a candidate does not have a drivers' license with photograph or a photo ID, two of the following are required:

- Nonphoto ID/drivers' license. Some states still have have them;
- Birth certificate. Embossed, or affixed with the municipality seal;
- Minor's work permit or school report card;
- Utility bills, bank statements or other business correspondence with the addressee's name on it; or,
- A postmarked envelope addressed to the person—as his/her name and address appears on the 610 form.—*Bart J. Jahnke, KB9NM, Manager, ARRL/VEC*

IARU News

Conducted By Richard L. Baldwin, W1RU
HC 60, Box 60, Waldoboro, ME 04572

Asia Telecom '89—and the IARU



Over the past two decades, the IARU has grown from strength to strength. Three strong and viable regional organizations that aid IARU in its worldwide objective of representing the interests of the Amateur and Amateur-Satellite Services have emerged. The regional organizations focus on the interests of the national societies in their own region. The national societies in turn look after the interests of their members—individual amateurs.

Over the past two decades, the IARU has developed a close rapport with the ITU so that today IARU, together with its regional organizations, supports and participates in ITU functions wherever and whenever it is feasible to do so.

Some of the more high-profile events in which IARU participates are the ITU Exhibitions.

A series of ITU Telecom exhibitions has been held in Geneva for a number of years, and IARU has exhibited the best of Amateur Radio in these biennial events. Telecom exhibitions went regional in 1985 when Asia Telecom '85 was held in Singapore during May of that year. That event was adjudged such a success that the ITU, in collaboration with Singapore Telecoms, resolved to host a second exhibition.

Asia Telecom '89 was the result; it took place in Singapore February 20-25 this year. Once again, IARU, together with IARU Region III and the national Singapore society SARTS, mounted a modest exhibition and presented Amateur Radio to the delegates and visitors.

The ITU and Singapore Telecoms made it possible for IARU to participate at minimal cost, and the help and assistance of these two organizations is acknowledged and greatly appreciated.

Other societies assisted by loaning suitable exhibit material—the CERN Amateur Radio Club in Geneva, through the assistance of Jaap den Herder, PAØYJ/F6FYI, kindly lent some beautiful posters. JARL sent a full-scale model of the amateur satellite JAS-1 with explanatory diagrams. In addition, a member of the JARL staff, Mr Jay Oka, JA1TRC/KH2J, came to Singapore to help man the exhibit.

SARTS members also played their part in manning the stand and by lending a 144-MHz packet-radio setup. It was hoped to have 9V1ITU operate on 2 meters through a local digipeater onto HF, but conditions inside the exhibit hall frustrated this attempt.

Important visitors to the exhibit included senior Telecom officials from Singapore, Brunei, China and Malaysia, as well as other Region III countries. Mr Richard E. Butler, Secretary-General of the ITU, along with Mr Jean Jipguep, Deputy Secretary-General, and Mr Werner Wolther, Executive Director of the ITU Telecom Exhibit, also visited the IARU stand.

Of course, many amateurs, both overseas and local, were visitors. Some of the places represented by these visitors included Australia, Canada, England, Finland, Greece, Hong Kong, India, Indonesia, Israel, Japan, Papua New Guinea, Sweden and the US. Naturally, there were quite a number from Singapore and nearby Malaysia.

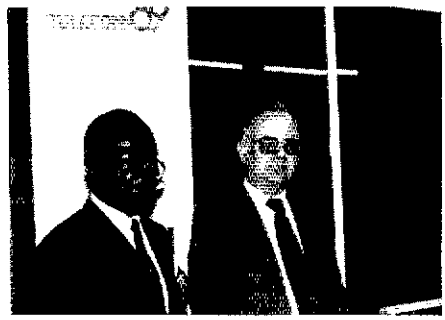
Copies of the IARU publication, *The Case for Amateur Radio*, were distributed to interested parties, and SARTS took the opportunity to publicize its own activities to Singaporean visitors. There were many Singaporeans, particularly on the last day, Saturday, when the exhibition was open to the public. Maybe some more 9V1 amateurs will appear on the air in the future because of what they saw at Asia Telecom '89.

Those who helped with the IARU/SARTS exhibit include Jaya, 9V1VS, who played the leading role in setting up the show; Devan, 9M2DD; and Jay, JA1TRC/KH2J. Richard L. Baldwin, W1RU/7J1ACQ, president of IARU, was present on the opening day to lend moral support and greet VIP visitors.

All in all—a success.

In two decades' time, IARU, again with local help, hopes to be still cooperating with the ITU and national administrations by participating in exhibitions and the like and thereby keeping the flag of Amateur Radio flying high.—*David H. Rankin, 9V1RH/VK3QV*

Facing the camera—ITU Secretary-General Richard E. Butler. At the left, Jaya, 9V1VS, who did much of the work in setting up the exhibit. (*photo courtesy JA1TRC/KH2J*)



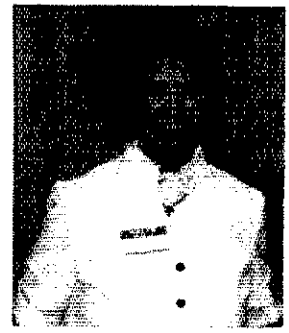
ITU Deputy Secretary-General Jean Jipguep and Chairman of the IARU Region III Directors David Rankin, 9V1RH. (*photo courtesy W1RU*)

9V1VS and 9V1RH at the packet-radio setup, Asia Telecom '89. (*photo courtesy W1RU*)

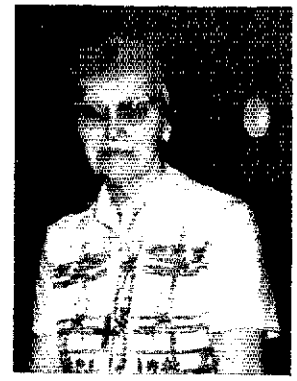
Conducted By Joan Gibson, KG1F
RR 1, Box 1465, Waterbury, VT 05676

The YLs of the International Mission Radio Association

Marie Sutter, N8DBC, generously contributes her time and talent to IMRA from her home in Ann Arbor, Michigan. *(photos WB2GQW)*



Sr Mary Louise Hughes, KD8VX, is the extroverted promoter for the IMRA who gives of her energies to promote the IMRA with public appearances and speeches.



Sr Marjorie Kramer, KD8WS, is the IMRA's loyal net control and traffic handler. Look for her daily on 14.280 MHz.

The International Mission Radio Association, Inc (IMRA) celebrated its 25th anniversary in 1988. IMRA's president, Rev Michael F. Mullen, WB2GQW, contributed the following material about several of the YLs who further IMRA's goals and purposes.

IMRA is proud of its 1000 members representing 40 countries. The group provides a Monday through Saturday traffic net on 14.280 MHz, 1830-2000 UTC to help missionaries and other volunteers working outside the United States speak with family and friends at home. The net annually carries an average of 12,000 pieces of traffic with approximately 20,000 check-ins.

In 1964, Marie Sutter, N8DBC, attended one of the first meetings of a group of Catholic clergy and religious who were Amateur Radio operators interested in communicating with missionaries. Marie found that she was the only layperson attending this gathering; however, before this initial meeting had ended, she was elected vice president. She started the newsletter, was one of the net controls, held various offices and served as a director. She also served as secretary, taking care of most of the correspondence of the Association.

In preparing to go on mission work outside this country, Marie studied at a language school in Mexico. While there, she hosted an IMRA convention in Cuernevaca. When she returned to the US, she attended graduate school at the University of Missouri in Columbia for one year and received a diploma in community development.

N8DBC served with a parish mission team in Peru for four years in the early 1970s. The living conditions there were primitive. Most homes were made of adobe or estera (straw construction), with no water or electricity. Marie aided the women of the village by teaching them crafts that could be sold for income. She also taught sewing and cooking. Although Marie's life was full, she experienced isolation and loneliness. "I would go to the IMRA frequency every day," she said. "There was no other means of communication where I was, and only one telephone in the village which didn't work very often."

Once back home, she continued her involvement and support of the IMRA with an even greater realization of what Amateur Radio means to missionaries. Today, Marie works as an accountant at the University of Michigan in Ann Arbor and checks into the net as often as her schedule allows.

Sr Mary Louise Hughes, KD8VX, and Sr Marjorie Kramer, KD8WS, have much in common. They are both members of the Sisters of Notre Dame de Namur and live in the same convent. Both are retired teachers and Amateur Radio enthusiasts. Sr Mary Lou's interest in IMRA is to be out there promoting, writing and producing for the IMRA, while Sr Marge, at home, works as IMRA net control on Thursdays and is usually on frequency every day to help anyone who needs to reach people in the Cincinnati area. Sr Marge also has the job of assistant net manager. Sr Mary Lou celebrates her 60th anniversary as a religious this year and is very active in her many roles for the IMRA. She has been co-chairperson of the promotion committee for many years.

Not only has Sr Mary Lou promoted the work of the IMRA at various exhibits, but she has used her background in speech and communications to produce video presentations.

In 1965, Sr Mary Lou began her studies to become an Amateur Radio operator. No doubt her father and brother's interest in making home-brew sets during her childhood must have rubbed off. She enrolled in a Novice class sponsored by the Greater Cincinnati Amateur Radio Association. After teaching all day, she would go to class to study Morse code and radio theory at night. By 1968, she was on the air, and today, KD8VX works the 2-meter band keeping in touch with her many friends in the Cincinnati area.

Sr Marjorie Kramer, KD8WS, is on the 14.280 IMRA net every day. She handles traffic for nuns in Brazil and Peru and runs traffic on the weekends into the Cincinnati and Chicago areas for Fr Ed Schmidt, SJ, OA4SS, and others in Peru. During a hurricane that hit the Dominican Republic, Sr Marge worked with the Salvation Army to set up housing for the victims and supplied communications on behalf of the Red Cross to bring news to stateside relatives.

In the 1970s, she was semiretired after 30 years of teaching history and political science to high school students. During this period, she worked in the library at Summit Academy in Cincinnati. In 1972, the Superior decided to enlarge the library and add a media center. Sr Marge, who had no background in electronics, found herself involved with all kinds of projectors, tape recorders and record players, plus the challenge of maintaining and repairing the equipment. Suddenly she was interacting with electronic servicemen and puttering around radio stores looking for supplies. A serviceman told her that since she had become so interested in electronics, she should consider obtaining an Amateur Radio license. She responded to the challenge and took a correspondence course in electronics from a company in Cleveland. Next, she studied the code from borrowed tapes. One year later, at the age of 52, she had her General ticket.

Over the years, Sr Marge not only served IMRA as net control, but also as correspondence secretary sending out get-well cards to members and sympathy cards to families of Silent Keys. Her efforts have contributed to maintaining a family-type atmosphere within the Association. Sr Marge said, "IMRA has a family spirit among its members." *(to be continued next month).*

Silent Keys

Administered by Nancy A. Slipski

It is with deep regret that we record the passing of these amateurs:

N1AQM, Arthur A. Charpentier, Mount Desert, ME
W1FZS, Edward G. Olson, Concord, NH
W1LSJ, Arne R. Rengo, Belleview, FL
K1QPP, Peter A. Annunziato, Ridgefield, CT
WA1VMJ, Edward N. Gove, Inverness, FL
KB1VP, Chadwick M. McMahon, New Bedford, MA
W1WQT, Roger K. Mayhew, Conway, NH
WP2ADC, G. Ronald Wolfgang, Trenton, NJ
K2AXO, John D. Buck, Centerport, NY
KA2BGW, Arthur E. Bohnke, Henrietta, NY
WA2BGW, Frank Vigorelli, Belleville, NJ
W2CHA, Herbert G. Klawunn, Millington, NJ
W2DQJ, Harry A. F. Wunderlich, Bronx, NY
N2EI, George M. Suter, Port St Lucie, FL
K2GB, Wyman N. Holden, Richmond Hill, NY
W2KPD, Ralph W. Thompson, Mattituck, NY
WA2QNS, Edgar A. Coapman, Jr, Brockport, NY
WA2UKU, Paul Press, Oceanside, NY
*W3CDQ, Elizabeth M. Zandonini, Washington, DC
KA3IKV, Thompson Woodward, Exchange, WV
K3QFU, Paul I. Leasure, McKeesport, PA
WA3SWD, Douglas G. Ferris, Easton, MD
K3WSZ, Donald R. Black, Pittsburgh, PA
W4AFG, Henry M. Amoss, Jr, Griffin, GA
K4AYS, Edgar W. Mitchem, Spindale, NC
N4DXU, Earl D. Hilburn, Stuart, FL
K4EOG, Kenneth E. Wickham, Jr, West Point, GA
KC4FIW, David R. Lockard, Sorrento, FL
W4FJN, William J. Robinson, Jr, Orange Beach, AL
N4FWX, Robert H. Bramlett, Albany, GA
W4GAW, Henry B. Dunphey, Jr, Marietta, GA
WD4GUH, Kenneth S. Little, Fort Lauderdale, FL
*W4JUK, Carter Glass, III, Lynchburg, VA
N4KBX, Charles E. Evans, Lithonia, GA
W4NXM, Fred S. Tattersall, Winston-Salem, NC
W4QDA, Athos Rostan, Shelby, NC
WA4QVI, James A. Millard, Jr, Fairhope, AL
WB4RGG, Leonard C. Wilson, Jr, Decatur, AL
K4THC, Earl W. Lane, Franklin Springs, GA
W4WWI, C. C. Gantt, Jr, Jacksonville, FL
N5BCP, Gerald G. Edler, Lamesa, TX
W5CRI, Loyd J. LeBlanc, San Antonio, TX
W5DCB, Dorothea A. James, Oklahoma City, OK
W5OLF, C. Dudley Wilson, Las Cruces, NM
*WB5TPG, Jimmy A. Bonnough, Shreveport, LA
W5WBY, O. H. Nance, Lamesa, TX
KR5W, Walter Hudlow, Austin, TX
KS6A, Vernon F. Erickson, Oceanside, CA
KG6AX, Don Alpine, Temple City, CA
KH6BQ, Richard M. Bain, Pearl City, HI
K6BTZ, Norman E. Schmidt, Woodland Hills, CA
N6DU, Robert L. Perry, Modesto, CA
W6ELK, Ben F. Wetzel, Los Osos, CA
WA6GRO, Robert W. Lund, Fremont, CA
*K6IIG, John J. Geary, Santa Barbara, CA
W6KWA, Richard O. Nielsen, Lompoc, CA
W6MFZ, William A. Harris, Oakland, CA
W6PBC, F. Everett Emerson, Roseville, CA
W6QD, Herbert Becker, Los Alamitos, CA
WB6STB, Erma L. Cole, Fresno, CA
KA6UYY, Mildred Thompson, Fresno, CA
W6WGO, R. Paul Tibbs, Watsonville, CA
K6YH, Wilton H. Wood, Loma Linda, CA
KE6ZF, Phinon R. Lewis, Lakeside, CA
*KD7AS, Frank Lloyd Taylor, Rigby, ID
WA7AYB, Kilburn L. Foote, McMillin, WA
W7BHP, Robert Snell, Mansfield, WA
N7JFI, William L. Davidson, Tucson, AZ
W7PXB, John E. Reagan, Seattle, WA
K7REP, Alex L. Parks, Lake Oswego, OR
K7VTH, Anthony W. Smith, Las Vegas, NV
W7ZEP, Leo E. Neiswender, Spokane, WA
W8ALR, Joseph "Les" Kuehne, Daytona Beach Shores, FL
K8AMJ, Fred G. Harbit, Detroit, MI
K8ANV, Harry R. Habig, Cincinnati, OH
N8AUO, Frank E. Jamnik, Macedonia, OH
*WD8CSB, Harold W. Seif, Heath, OH
W8DBT, Wilfred A. Royer, Galena, OH
NY8J, Hugh Mullins, Cyclone, WV
W8KM, Creed O. Russell, Glen Morgan, WV
W8MW, Maynard Weston, Fairview Park, OH
WB8NGX, Kenny Long, Washington Court House, OH
WB8NYX, William J. Lusk, Creston, OH
W8ZM, Robert F. Zimmerman, Dayton, OH
W9BFA, Leonard Gunderson, Addison, IL
N9BZZ, Henry O. Stock, Gary, IN
N9CER, Kenneth J. Greenwald, Sheboygan, WI
W9DOZ, Joseph S. Clark, Carrollton, IL
K9EZT, Charles J. Tyle, Woodridge, IL
K9GXR, Gus Van Dynhoven, Appleton, WI
W9IEC, Lionel A. Gardiner, Aurora, IL
W9KIC, Lowell A. Davis, Lebanon, IL
KC9QD, John Moore, Butternut, WI
WA9RVI, James A. Matheny, Peoria, IL
W9THN, Robert Hunteman, Wauwatosa, WI
KA9ZPS, Albert J. Long, Salem, IL
NØBMG, R. A. Lewis, Tucson, AZ
WAØBNC, Frank Van Keuren, Denver, CO
WØCDO, Hugh A. Lyon, Sharon, ND
WØDEI, Francis C. Kramer, La Crosse, WI
KØERD, Marion C. Crane, St Joseph, MO
KAØFLO, Leo P. Halbach, Austin, MN
WØIXX, N. D. Frajola, West St Paul, MN
WØLAG, Frank A. Corgiat, Webster Groves, MO
NØOA, Kilian Dolsberry, Leavenworth, KS
WØOMD, George S. Nupp, St Petersburg, FL
WØOXU, Fred M. McBride, Jr, Sioux Falls, SD
WØRJF, George L. Shuster, Gilbert, MN
WBØSJG, John T. Cartwright, MD, Sun City West, AZ
KØUAB, Walter C. Brown, Woodland Park, CO
KAØWEJ, Bruce E. Segerstrom, Hopkins, MN
KØWLT, La Vern G. Hansen, Eden Valley, MN
DL7AD, Fritz Woletz, Berlin, West Germany

*Life Member, ARRL

Notes: 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.

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. Canadian reports should be sent to the CRRL HQ address on page 9.

Many hams have remembered a Silent Key with a memorial contribution to the ARRL Foundation. Should you wish to make a contribution in a friend or relative's memory, you might designate it for an existing youth scholarship, the Jesse A. Bieberman Meritorious Membership Fund, the Victor C. Clark Youth Incentive Program Fund or for the General Fund. Contributions to the Foundation are tax-deductible to the extent permitted under current tax law. Our address is: The ARRL Foundation, Inc, 225 Main St, Newington, CT 06111.

50 Years Ago

July, 1939

☐ A postcard in this issue requests views of amateurs on whether the League should request that 7200-7300 kc. be opened to voice use solely to protect the regularity of amateur communication in the face of high-power foreign broadcast operations.

☐ A 3000-kc. i.f. amplifier for image rejection plus a 465-kc. unit for selectivity are features of stepped-up performance in the receiver built by W9CJJ and W9AUJ.

☐ Wilson Burgess, W1BDS, was chosen winner of the 1938 Paley (CBS) Award for his outstanding performance as the only communications link between Westerly, R.I. and the outside world during two days of hurricane disaster.

☐ A letter in the Correspondence Section from Ethel Smith, W7FWB, now K4LMB, wonders if there are enough YL hams to form something like a Young Ladies Radio League.

☐ With Westinghouse financial sponsorship, the League staff has designed an elaborate (more than 100,000 tiny lamps in one circuit alone) exhibit for the New York World's Fair, portraying what goes on inside amateur radio equipment.

☐ W1APA revamped a Dodge rear end as a rotator gear for his beam. W6TE, on the other hand, gets his directivity by switching fixed/phased verticals.

☐ Pipe-fitting experience is not necessary to build an adequate rig for operation at the very high frequency of 112 Mc.; the old "T.N.T." circuit with a small wire coil tank produces surprisingly good results for W5CSU.

☐ You can buy a Hallicrafters "Defiant" 9-tube superhet for $69.50. And during this month and August, you can get both League membership and a *Handbook* for $3.00. A copy of the reports of officers and directors is only 50 cents.

25 Years Ago

July, 1964

☐ Amateurs once again rose to the challenge and provided essential emergency communication during the earthquake disaster which struck Anchorage and other Alaska points. Both local circuits and links with the "lower 48" were in full operation.

☐ Our communications efficiency should improve if we take advantage of W2PUL's speech clipping approach for single sideband operation and W2QWS' use of the 7360 switch-beam tube as a mixer (in his 75A4) to reduce overloading in conversion stages.

☐ Eureka! President Johnson has signed the Goldwater bill permitting the U.S. to enter into agreements with other countries for reciprocal operating privileges for each nation's amateurs.

☐ The Project Oscar crew lists a number of interesting experiments we may try when Oscar III, a translator and three-channel telemetry beacon, goes into orbit—hopefully this year.

☐ You don't have to be an astronomer to check on sunspots, and K8ZQE shows us a simple design of a portable telescope to see what is going on up where propagation conditions are made.

☐ Zoning or other local ordinances are hampering amateur activity in a number of areas; the League's General Counsel has been active in all cases which have come to ARRL attention, usually in cooperation with the ham's attorney. TVI, of course, is almost always the reason for complaints against us.

☐ Automobile 12-volt broadcast receivers have no "B" supply we can use for plate voltage on mobile converters; W2UTH solved the problem by using 8056 Nuvistors, which work fine with only 12 volts.

☐ You can send combinations of letters and numerals for code practice without violating the FCC prohibition of use of "codes and ciphers."

☐ Persistent moonbounce enthusiasts are achieving spectacular results every now and then; most recent is Massachusetts (W1BU) to Puerto Rico (KP4BPZ) via the EME route.

☐ Inflation note: Copies of the reports of officers and directors are now 75 cents each. League membership is $5, the *Handbook* $3.50. A Heathkit 10-tube superhet (which you assemble yourself) is $265.—*W1RW.*

Hamfest Calendar

Administered By Bernice Dunn, KA1KXQ
Convention Program Manager

Attention: The deadline for receipt of items for this column is the 5th of the second month preceding publication date. Hamfest information is accurate as of our deadline; contact sponsor for possible late changes. For 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.

†**Arizona (Flagstaff)—July 28-30.** *Sponsor:* Amateur Radio Council of Arizona. *Time:* Friday noon until Sunday noon. *Place:* Fort Tuthill which can be found on the west side of I-17 Freeway, 3 miles south of the I-17 and I-40 junction, also known as the Flagstaff Municipal Airport exit 337. *Features:* packet, Cactus Keys, Saturday meetings, ARES/RACES, ARRL forum featuring Larry Shima, WØPAN, from ARRL HQ, ARRL/VE exams (deadline for 610 forms is July 1). *Talk-in:* 146.22/82, 447.125/442.125. *Admission:* free. *Contact:* Bernie Sasek, WØYOY, 8925 N Morningview Dr, Tucson, AZ 85737.

British Columbia (Maple Ridge)—July 8-9. *Sponsor:* Maple Ridge ARC. *Place:* St Patricks Ctr, 22589 121 Ave. *Features:* commercial displays, flea market, refreshments, camper space no hookups. *Talk-in:* 146.20/80, 146.34/94. *Contact:* Bob Houghton, VE7BZH, Box 292, Maple Ridge, BC V2X 7G2.

†**California (Chico)—August 13.** *Sponsor:* Golden Empire ARS. *Time:* 8 AM-4 PM. *Features:* CW Contest, VE exams, swap tables, tech talks, refreshments. *Talk-in:* 146.25/85. *Admission:* advance $5, door $7. *Contact:* Golden Empire ARS, PO Box 508, Chico, CA 95927, tel 916-343-1848.

Colorado (Glenwood Springs)—July 29. *Sponsor:* Ski Country ARC. *Time:* 9 AM-2 PM. *Place:* Colorado Mountain College Community Education Ctr, 1402 Blake Ave. *Features:* swap tables, VE exams, refreshments. *Admission:* free. *Contact:* Ski Country ARC, PO Box 302, Carbondale, CO 81623, tel 303-945-9342.

†**Colorado (Grand Junction)—July 1.** *Sponsor:* Western Colorado ARC. *Time:* 8 AM-3 PM. *Place:* National Guard Armory. *Features:* free parking, refreshments. *Talk-in:* 146.34/94. *Admission:* no advance, door $2. *Contact:* Randy Martens, 157 Red Rock Rd, Grand Junction, CO 81503, tel (D) 303-241-1951, (N) 303-242-4205.

Colorado (Woodland Park)—July 22-23. *Sponsor:* Mountain ARC. *Place:* Red Rocks Campground in Pike National Forest, 4 miles north of Woodland Park on Hwy 67. *Features:* dealers, flea market, refreshments, camping with entry permitted late afternoon July 21, (advance reservations required for overnight camping $5 per night), $5 per tailgate space (no double fees if camping and selling). *Talk-in:* 144.56/145.16, 146.52, 146.37/97. *Admission:* free. *Tables:* bring your own. *Contact:* Mountain ARC, Box 1012, Woodland Park, CO 80866, or tel Joe Tafoya, NØCMD, tel 719-687-3641.

†**Florida (Jacksonville)—August 5-6.** *Sponsor:* Greater Jacksonville Hamfest Assn. *Time:* setup Friday from 2-6 PM, Saturday 9 AM-5 PM, Sunday 9 AM-3 PM. *Place:* Prime Osborn Convention Ctr, located near the junction of I-10 and I-95. *Features:* exhibitors, forums, meetings, boat anchor auction Sunday at 1 PM, VE exams Saturday at 1 PM, nonham activities. *Talk-in:* 146.16/76. *Admission:* $5. *Tables:* $15 both days, $12 Saturday and $6 Sunday only. *Contact:* Greater Jacksonville Hamfest Assn, PO Box 10623, Jacksonville, FL 32207, tel 904-350-9193.

†**Georgia (Atlanta)—July 8-9.** *Sponsor:* Atlanta RC. *Time:* Saturday 9 AM-5 PM, Sunday 9 AM-4 PM. *Place:* I-85 south to Riverside Rd, turn right and follow sign up to Georgia International Trade Ctr on Sullivan Rd College Park. *Features:* DX forums, VE exams, Country-Style BBQ, free parking, tailgate sales. *Admission:* advance $7, door $8. *Contact:* Atlanta Ham hotline 404-739-8716 (24 hrs).

Illinois (Berwyn)—July 23. *Sponsor:* Amateur Cross Link Repeater. *Time:* setup 6 AM-8 AM, public 8 AM-1 PM. *Place:* "THE HALL," 1535 S Harlem Ave. *Features:* outdoor flea market area (bring your own tables). *Talk-in:* 147.825/225, 222.88/224.48, 443.700/448.700. *Admission:* advance $3, door $4. *Contact:* Amateur Cross Link Repeater, PO Box 348257, Chicago, IL 60634 (SASE please), or tel 312-712-5100.

†**Illinois (Garden Prairie)—July 23.** *Sponsor:* Big Thunder ARC. *Time:* 7 AM-2:30 PM. *Place:* 5 miles east of Belvidere on US Rte 20. *Features:* refreshments, flea market, VE exams. *Talk-in:* 147.975/375 or 146.52. *Admission:* advance $2.50, door $3. *Contact:* Jim Grimsby, W9HRF, 210 Oak Lawn Ln, Poplar Grove, IL 61065, tel 815-765-2573.

†**Illinois (Peotone)—July 30.** *Sponsor:* Hamfesters RC Inc. *Time:* 6 AM-6 PM. *Place:* Will Co Fairgrounds, easy access from I-57, exit at 327, site is ½ mile east of I-57. *Features:* flea market, overnight parking, swap meet, VE exams (preregister by June 30, call Bill, KA9HDN, 312-247-0650). *Talk-in:* 146.16/76, 146.52. *Admission:* advance $3, door $4. *Contact:* for advance tickets, send check or money order and no. 10 SASE to Hamfesters RC, Donald R. Burch, Sr, N9DWI, 8438 S Kolin Ave, Chicago, IL 60652, tel 312-582-9776.

†**Illinois (St Charles)—July 16.** *Sponsor:* Fox River Radio League. *Time:* 6 AM-3 PM. *Place:* Pheasant Run Lodge. *Features:* indoor commercial vendors, outdoor flea market, refreshments. *Talk-in:* 144.87/145.47, 144.61/145.21. *Admission:* advance $4, door $5. *Contact:* Phil Fors, N9FXQ, 104 May St, West Chicago, IL 60185, tel 312-231-0707.

Indiana (Angola)—August 6. *Sponsor:* Steuben County Radio Amateurs. *Place:* Crooked Lake. *Features:* refreshments, overnight camping (fee charged by County Park), inside tables for exhibitors and vendors. *Talk-in:* 146.52, 147.81/21. *Admission:* $3. *Contact:* Donn Laird, WB9YIT, 202 W Pleasant St, Box 330, Angola, IN 46703.

†**Indiana (Greenfield)—August 6.** *Sponsor:* Greenfield ARA. *Time:* vendors 6 AM, public 7 AM. *Place:* 4-H Fairgrounds. *Talk-in:* 147.60/00, 444.725/449.725. *Admission:* $5, children under 12 free. *Contact:* Keith Dalrymple, N9GWK, 2210 Wayne Dr, Greenfield, IN 46140.

†**Indiana (Indianapolis)—August 5** *Sponsor:* Shadow of the Pyramids RC. *Time:* 8 AM-4 PM. *Place:* across I-465 from the pyramids office bldgs. *Features:* Forums, auctions, tours of ITT Technical Institute, refreshments. *Talk-in:* 144.65/145.25. *Admission:* advance $1, door $2. *Contact:* David Johnston, 9511 Angola Ct, Indianapolis, IN 46268, tel (D) 317-875-8640, (N) 317-354-2884.

†**Iowa (Des Moines)—July 8.** *Sponsor:* Des Moines ARA. *Time:* 8 AM-5 PM. *Place:* Adventureland Inn, I-80 and US 65 (wheelchair accessible). *Features:* free seminars, QCWA luncheon, Iowa Repeater Council, 3900 Club, MARS, tailgaters, flea market, VE exams (send completed 610 and a check for $4.75 payable to ARRL/VEC and a copy of your current license to Jim Snapp, NAØR, 605 5th Ave SE, Altoona, IA 50009, bring your original license with you; walk-ins welcome, call Jim if you have any questions at 515-967-3890. *Talk-in:* 146.34/94, 444.5/449.5. *Admission:* $5, 12 and under free. *Contact:* SASE to WØAK, Attn: KBØCQV, PO Box 88, Des Moines, IA 50301, tel 515-276-8949 or 515-282-8655.

Louisiana (New Orleans)—July 12-16. *Sponsor:* OMIK Amateur Electronics Communications Assn. *Place:* downtown Howard Johnson's, 330 Loyola Ave, (1-800-535-7830). *Features:* VE exams Saturday 9 AM-12 PM. *Talk-in:* 146.34/94, 7.265, 14.295. *Admission:* advance $5, door $8. *Contact:* Bounita T. Favorite, KA5EXW, 7725 Lew Hoad Ave, Baton Rouge, LA 70810, tel 504-769-4578.

†**Maine (Union)—July 15.** *Sponsor:* Maine Hamfest Assn. *Time:* setup 6 AM, public 8 AM-2 PM. *Place:* Union Fairgrounds, from Rockland take Rte 17 west about 8 miles, from Augusta take Rte 17 east about 35 miles. *Features:* packet demonstrations, ARRL forum, net meetings, club meetings, tailgating $1, special-event station W1TLC, campsites with electricity and water available $10 per night ($8 if preregistered by June 30), VE exams at 2 PM, walk-ins accepted, those who wish to upgrade must bring photocopy and original of their current license as well as two forms of positive ID. *Talk-in:* 146.22/82, 146.28/88. *Admission:* $2. *Contact:* Maud, N1EBC, or John Peterson, N1CBA, Box 601, Augusta, ME 04330, tel 207-445-2977.

†**Maryland (Timonium)—July 30.** *Sponsor:* Baltimore Radio Amateur TV Society. *Time:* setup Saturday 2 PM, setup Sunday 6 AM. *Place:* Maryland State Fairgrounds, located on York Rd adjacent to I-83 near I-695 (sellers are asked to use the Timonium Rd entrance and buyers are asked to use York Rd). *Features:* tailgating space $5 per space, free VE exams in the Administration Bldg at 9 AM. *Talk-in:* 147.63/03, 146.16/76, 146.52. *Admission:* $5, children under 12 free. *Tables:* 8-ft tables with access to ac power in the Main Exhibit Hall are $35 each or 3 for $100, flea-market tables in the 4-H Bldg (no ac power) are $20 each. *Contact:* Baltimore Radio Amateur TV Society, PO Box 5915, Baltimore, MD 21208.

Michigan (Flint)—July 23. *Sponsor:* Genesee Co RC. *Time:* 8 AM-4 PM. *Place:* Flint City Market, Robert T. Longway Blvd and E Blvd Dr, exit 8A I-475. *Features:* counter space $10 each, trunk sales $5 each, free parking. *Talk-in:* 146.34/94, 444.200/449.200, 146.52. *Admission:* no advance, $3 at door, children under 12 free. *Contact:* Carl Miller, KF8Y, 604 S Adelaide, Fenton, MI 48430, tel 313-629-2970.

Michigan (Mio)—July 22. *Sponsor:* Ausable Valley ARC. *Time:* vendors 7 AM, public 8 AM-2 PM. *Place:* Mio Ausable School, M-72. *Features:* flea market, VE exams, also Great Lakes Forestry Expo and County Fair (July 20-22). *Talk-in:* 144.75/145.35, 146.52. *Admission:* $4. *Tables:* $3. *Contact:* Gerry, N8GWP, tel 517-848-5996 or Tim, KA8YWV, tel 517-826-5549.

†**Missouri (Washington)—July 16.** *Sponsor:* Zero Beaters ARC. *Place:* Bernie Hillerman Park (Washington Fairgrounds). *Features:* refreshments, flea market (flea-market parking $2 a space), VE exams (walk-in basis starting at 10 AM, bring original license and a photocopy), seminars, dealer displays, nonham displays, free parking. *Talk-in:* 147.84/24, 146.52. *Admission:* free. *Contact:* Al Lanwermeyer, 909 Nora St, Washington, MO 63090, tel 314-239-2072.

†**Montana (Essex)—July 14-16.** *Sponsor:* Glacier-Waterton International Hamfest Committee. *Time:* Friday night until noon Sunday. *Place:* Three Forks Campground, 10 miles from Essex and 16 miles from East Glacier, Montana. *Features:* seminars, QCWA meeting, swap tables, dealer displays. *Talk-in:* 146.10/70, 146.52. *Admission:* advance $8, door $10. *Contact:* Marion Angyal, Box 594 Milk River, Alberta, Canada TØK 1MØ

†**New Jersey (Augusta)—July 16.** *Sponsor:* Sussex County ARC. *Time:* 8 AM. *Place:* Sussex Co Fairgrounds, Plains Rd, off Rte 206. *Features:* refreshments, free parking, tailgate space $5. *Talk-in:* 147.90/30, 222.90/224.50, 146.52. *Admission:* $3. *Tables:* indoor $7 each. *Contact:* Don Stickle, K2OX, Weldon Rd RD 4, Lake Hopatcong, NJ 07849, tel 201-663-0677.

New Jersey (Ewing)—July 23. *Sponsor:* East Coast VHF Society. *Time:* 8 AM. *Place:* Trenton State College. *Features:* antenna gain measurements on 144 MHz through 2304 MHz, NF clinic, VHF/UHF microwave exhibit and flea market. *Admission:* free. *Tables:* bring your own. *Contact:* Russell C. Pillsbury, K2TXB, tel 609-268-9586.

†**North Carolina (Asheville)—July 29-30.** *Sponsor:* Western Carolina ARS. *Time:* Saturday 9 AM-4:30 PM, Sunday 9 AM-3 PM. *Place:* from US 19-23, to NC 63, approximately 2 miles; turn right on Old County Home Rd, then turn right on Lees Creek Rd, then another right onto Erwin Hills Rd, hamfest will be on the left. *Features:* refreshments. *Talk-in:* 146.31/91, 146.16/76. *Admission:* advance $4, door $5. *Contact:* Phil, KA4CAC, tel 704-667-3212 after 6 PM or Willi, KA4WPM, tel 704-253-0269.

†ARRL Hamfest

North Carolina (Cary)—July 15. *Sponsor:* Cary ARC. *Time:* 9 AM-3 PM. *Place:* VFW Building, I-40 exit at #287 (State Park and Cary), go south ½ mile to Reedy Creek Rd, turn left go 1.7 miles, VFW will be on the left. *Features:* open auction, tailgating. *Talk-in:* 146.28/88. *Admission:* free. *Tables:* inside $10. *Contact:* Cary ARC, PO Box 53, Cary, NC 27512.

†**Ohio (Randolph)—August 6.** *Sponsor:* Portage ARC. *Time:* 8 AM-4 PM. *Place:* Portage Co Fairgrounds located between Akron and Youngstown, 1 hour drive southeast of Cleveland on Rte 44, between I-76 and Rte 224. *Features:* forums, nonham activities, refreshments. *Talk-in:* 144.79/145.39. *Admission:* advance $3, door $4, children under 12 free. *Tables:* indoor tables $8 each, flea-market spaces $3 per space. *Contact:* Joanne Solak, KJ3O, 9971 Diagonal Rd, Mantua, OH 44255, tel 216-274-8240.

†**Ohio (Van Wert)—July 16.** *Sponsor:* Van Wert ARC. *Time:* setup 6 AM, public 8 AM-4 PM. *Place:* take either US Rtes 127, 224 or 30 to Van Wert, then follow signs. *Features:* VE exams, technical forum, refreshments, free parking. *Talk-in:* 146.25/85. *Admission:* $3. *Contact:* Bob Barnes, WD8LPY, 301 N Washington, Van Wert, OH 45891 (SASE), tel (D) 419-495-2209, (N) 419-238-1877.

Ohio (Wellington)—July 15. *Sponsor:* Northern Ohio ARS. *Time:* 7 AM. *Place:* 23 miles southwest of Cleveland at the Lorain Co Fairgrounds, Rtes 58 and 18 in Wellington, 100 miles from Columbus, 45 miles from Akron/Canton area, 90 miles from Toledo, Rte 250 exit from I-71 to Rte 58 north, turn left on Rte 18. *Features:* refreshments, forums. *Talk-in:* 146.10/70. *Admission:* advance $3, door $4. *Contact:* Darlene Ohman, KA8VTS, (N) 216-651-9529.

Ontario (Kenora)—August 4-7. *Sponsor:* Lake of the Woods ARS. *Place:* Rushing River Provincial Park, about 10 miles east of Kenora Hwy 17 and 71. *Features:* swap shop, refreshments. *Talk-in:* VE3LWR 146.43/147.03, VE3YQK 146.31.91. *Contact:* Reg Brown, VE3NNF, 1236 8th St N, Kenora, Ontario P9N 2R9, tel 807-468-7633.

Pennsylvania (Lancaster)—August 6. *Sponsor:* Red Rose Repeater Assn. *Time:* vendors 7 AM, public 9 AM-3 PM. *Place:* McCaskey High School, exit Rte 30 at Hwy 23 west, drive approximately 1.3 miles and turn left onto Franklin St, then left onto Reservoir St. *Features:* tailgating, computers, electronics, programs, refreshments. *Talk-in:* 147.615/015. *Admission:* $4, children under 14 free with paying adult. *Contact:* David Phillips, PO Box 5029, Lancaster, PA 17601, tel 717-872-6578.

†**Texas (Texas City)—July 29.** *Sponsor:* Tideland ARS. *Time:* 8 AM-5 PM. *Place:* Nessler Civic Center, 2010 5th Ave N. *Features:* forums, flea market, commercial vendors, VE exams, demonstrations. *Talk-in:* 147.74/14. *Admission:* advance $3, door $4. *Contact:* Tidelands ARS, PO Box 73, Texas City, TX 77590, tel 409-948-0308.

†**Virginia (Berryville)—August 6.** *Sponsor:* Shenandoah Valley ARC. *Time:* 7 AM-3 PM. *Place:* Clarke Co Ruritan Fairgrounds, Rte 7, two miles west of Berryville. *Features:* commercial exhibitors, VE exams at 9 AM in Cooley Elementary School, across from fairgrounds (limited walk-ins, must register by 8:30 AM), refreshments, womens' activities. *Talk-in:* 146.22/82, 146.52. *Admission:* advance $4 (with SASE to address below before July 15), door $5, children under 12 and wives free. *Tables:* tailgaters and limited tables $7. *Contact:* Joanne Blaker, WB2CMV, tel 703-869-4878, or write Shenandoah Valley ARC, PO Box 139, Winchester, VA 22601.

†**West Virginia (Bluefield)—July 22.** *Sponsor:* East River ARC. *Time:* 9 AM-3 PM. *Place:* Brushfork National Guard Armory. *Features:* indoor flea market, refreshments. *Talk-in:* 144.89/145.49. *Admission:* no advance, door $4. *Contact:* Bluefield Hamfest, Rte 5, Box 457, Bluefield, WV 24701, tel 304-325-3058.

Wisconsin (Rhinelander)—August 12. *Sponsor:* Northwoods ARC and Tomahawk & Rhinelander Repeater Assns. *Place:* Rhinelander Ice Arena. *Features:* free parking, VE exams, refreshments, auction at 1 PM. *Talk-in:* Rhinelander Repeater 146.34/94, Tomahawk Repeater 144.83/145.43. *Tables:* 3' by 8' available for $5 each, (reserved tables available until July 31, all reserved tables must be prepaid) anyone bringing their own tables may reserve space inside at $3 per table or may setup in parking lot at no cost. *Contact:* Leonard Bauman, K9RMN, 804 Lincoln St, Rhinelander, WI 54501, tel 715-369-3296 or 715-369-5564.

Coming Conventions

COLORADO STATE CONVENTION

July 16, 1989, Golden

The Colorado State Convention will be sponsored by the Denver RC. It will be held at the Jefferson Co Fairgrounds, 15200 W 6th Ave, take the Indiana exit. Doors will be open from 9 AM-2 PM. Features will include technical seminars. Admission is $2. Tables will be available for $7 in advance and $10 at the door (this does not include admission). Talk-in will be on 147.93/33. For further information contact Tim, WJØG, tel 303-988-1288.

WEST GULF DIVISION CONVENTION

July 28-30, 1989, Oklahoma City, Oklahoma

The West Gulf Division Convention will be sponsored by the Central Oklahoma Radio Amateurs. It will be held at the Lincoln Plaza Hotel Conference Center, 4445 Lincoln Blvd. Features will include technical and nontechnical programs, VE exams, QCWA breakfast, flea market, banquet, Sunday morning worship service, West Gulf Division/ARRL Forum, Wouff Hong, new dealers, live demonstrations of packet, HF computers and so on. Talk-in will be on 147.63/03. Admission will be $8 in advance and $9 at the door. For more information contact Central Oklahoma Radio Amateurs, PO Box 850625, Yukon, OK 73085.

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.

July 1-2
West Virginia State, Jackson's Mill

July 8-9
Central Division, Indianapolis, IN

July 16
Colorado State, Golden

July 28-30
West Gulf Division, Oklahoma City, OK

August 11-13
10-10 International Net, Milwaukee, WI

ARRL NATIONAL CONVENTION
June 8-10, 1990—Kansas City, Missouri

Attention Hamfest and Convention Sponsors

ARRL HQ maintains a date register of scheduled events that may assist you in picking a suitable date for your event. You are encouraged to register your event with HQ as far in advance as your planning permits. Note that the hamfest and convention approval procedures for ARRL sanction are separate and distinct from the date register: Registering dates with ARRL HQ does not constitute League sanction, nor does it guarantee there will not be a conflict with another established event in the same area.

We at ARRL HQ are not able to approve dates for sanctioned hamfests and conventions. For hamfests, this must be done by your Division Director. For conventions, approval must be made by your Director and, additionally, by the Executive Committee. Application forms can be obtained by writing to or calling the ARRL Convention Program Manager, tel 203-666-1541 ext. 283.

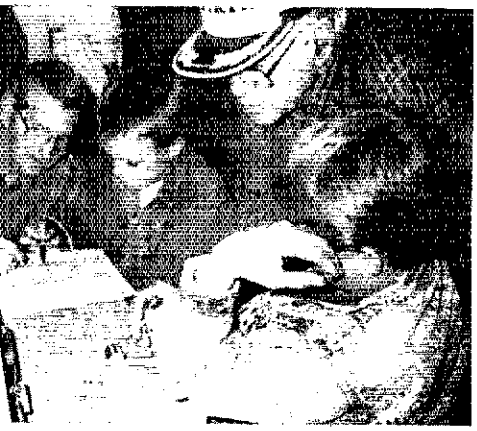
Mini Directory

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	May 1989, p 70
Club Contest Rules	Jan 1989, p 104
Considerate Operator's Frequency Guide	Jan 1989, p 77
DXCC Annual Listing	Jan 1989, p 71
Frequency/Mode Allocations	Jan 1989, p 77
17 Meters	Apr 1989, p 58
License-Renewal Information	Jan 1989, p 76
Major ARRL Operating Events and Conventions—1989	Jan 1989, p 65
Packet-Radio Frequency Recommendations:	
Below 225 MHz	Sep 1987, p 54
Above 225 MHz	Mar 1988, p 51
QSL Bureaus	
Incoming	June 1989, p 72
Outgoing	Mar 1989, p 68
Reciprocal Operating Agreements	Oct 1988, p 63
Third-Party-Traffic Agreements	Oct 1988, p 63
VUCC Annual Listing	Dec 1988, p 85
What is Amateur Radio?	June 1989 p 52

Club Spectrum

Conducted By Rick Palm, K1CE
Field Services Manager, ARRL



The Payson Project

There's a lot brewing in Payson, Arizona elementary schools these days—home brewing, that is. Thanks to the efforts of Tonto Amateur Radio Association Elmers, grade school students are learning about radio by building their own receivers. Tonto's Pete Pedersen, W7KTK, reports that students learn to solder, drill, and wind coils, and have fun while developing a knowledge of basic radio fundamentals.

The Tonto Elmers furnish tools and parts, and assist students in the classroom during the school day. Local industry provides additional building materials. The program is a marvelous success judging by parent, teacher and student responses.

Students feel that hands-on experience helps them put practical meaning behind the scientific terms they see in their textbooks. The Tonto club will follow up with summer Amateur Radio licensing classes.

The photos show students working on kits, TARA Elmers in action, and W7KTK's Amateur Radio demonstration. Nice going, Tonto ARA! *(photos courtesy W7KTK)*

Results, 1988 ARRL 10-Meter Contest

What incredible conditions! It was a real treat for those of us who have never experienced contesting during sunspot peaks.—*WQ5L*

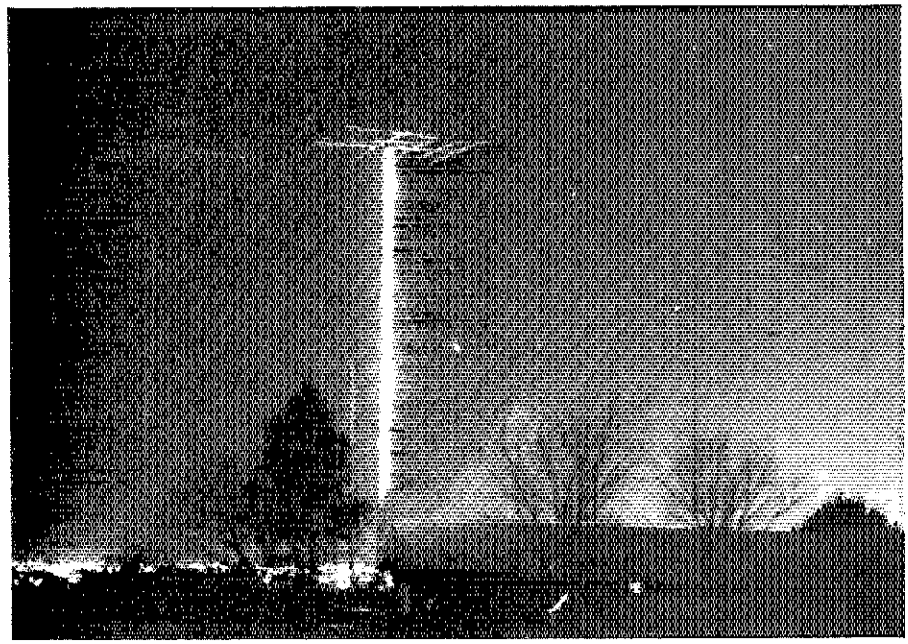
By Billy Lunt, KR1R, Contest Manager and Phil Rice, WB9JKI Assistant Contest Manager

Wow! What a contest! Conditions were hot, hot, hot! They were even better than last year. Steve, GW4BLE, summed it up, "What a difference a year makes!" "Every ham in the world must have worked the contest!" asserted Mark, N8IOH. Boy, were they right! HQ received a whopping 1796 logs, reflecting about a 54% increase over last year's entries. Many of these were welcome newcomers who tried the contest for the first time. One such first-timer, Tim, G4ARI, stated, "This is the first time I have entered this contest, but it will not be the last. I hope to be back next year with a better antenna and then I imagine things will really swing!"

From the beaches of the Azores to the jungles of Zambia, and from the deserts of Arizona to the arctic cold of the Yukon, 95 DXCC countries and virtually all US states and Canadian call areas were well represented. DX entries this year totalled 653, up substantially from last year's 230. Of all the entry classes, CW-only was the most popular with 636 entries. Phone only was the second most popular with 459, followed by mixed mode with 361 and multioperator with 178. HQ also received a welcome 162 checklogs.

Last year in the mixed-mode category, only one entry broke the 1-meg mark. This year every entry in the top ten scored over a million points each. NL7GP didn't think he did well and explained, "It was a fun contest but I slept through both European openings." But to Jon's surprise, he edged out KM1H (KQ2M,op) by 60k to win first place in the mixed-mode category. Dave, WØØG, retained his third-place spot again this year. In the DX mixed-mode category, Carl, P4ØV, scored an impressive 2.39 million points to run away with first place. Jim, KH2D, scored 1.2 million points for second place. DL6FBL was just 2k points behind in third place.

On the phone-only front, Rick, KI1G, operated K1NG to a 933k first-place win. Last year's fourth-place winner, K3EST, nearly tripled last year's score to finish in second place with 914k points. George, NR5M, the winner of the multiop category in 1987, tried his luck at single-op phone this year and finished in third place. Tony, LU2FFD, operated AZ4F and scored 977k points to win first place DX phone-only. Harry, KA3B/VP5, took second place with 758k and Steve, GW4BLE, finished third.



The brighty lit tower of Connie, K5CM, lets everyone know where his station is located. (Or is RF cooking the tower?).

In the CW-only category, Jeff, N8II, moved from fifth place mixed mode last year to win first place CW-only in 1988. Bob, K1XA, bettered last year's score by over 500k and finished in second this year. Ted, W1GL, scored 761k points for a close third. The DX top-ten CW-only was dominated by Europeans this year. F2CW operated TV6MHZ to win first place with a score of 729k. Jacky also won as the European continental leader. YU3GO put in a good second-place finish with 663k. Branko finished 70k ahead of Giorgio, I2VXJ, who placed third.

The team at WØAIH/9 doubled their score and moved from second place last year to take top honors in the multioperator category with 1.8M points. Not far behind was the crew at N6ND, who put in a good effort and finished second with a score of 1.5M points. The gang at W5LTR made a valiant run and placed third with 1.4M points. The multiop group at HC2G won first place in the DX-multiop category by amassing a total of 3150 QSOs. NP4CC came in second just 500k points behind and PY5ZBA was a close third with 1.85M points.

Before the onset of winter, while ole Sol is still perking, get out and get those antennas pruned and tuned! The conditions for next year's contest should be more spectacular than ever! See you in the 1989 ARRL 10-Meter Contest next Dec 9-10!

SOAPBOX

The pileups were terrific! (9J2AL). Very good conditions on 10 meters except to the East Coast (HL9TF). There were good conditions to the US. I will QRV this contest next year (JJ3CNL). I could not believe I was called by so many DX stations like

Top Ten—W/VE

Mixed Mode

Call	Score
NL7GP	1,878,484
KM1H (KQ2M,op)	1,818,410
WØØG	1,775,136
K6LL	1,602,692
W5WMU (KZ5D,op)	1,578,368
K4JPD (KM9P,op)	1,571,094
K3ZO	1,470,280
N2AA	1,411,732
WØYK	1,265,908
K3EW	1,161,576

Phone

Call	Score
K1NG (KI1G,op)	933,900
K3EST	914,220
NR5M	845,460
K4XS	797,034
W5VX	774,690
W3LPL (WA8MAZ,op)	749,176
W1WEF	708,192
NIØE	689,584
K3ZJ	679,024
NØXA	655,690

CW

Call	Score
N8II	857,788
K1XA	769,000
W1GL	761,544
WC4E	735,584
N4AR	729,000
KZ2S	718,812
N2AZS	676,320
N8DCJ	668,528
K2TW	656,384
K5NW	615,368

Multioperator

Call	Score
WØAIH/9	1,808,252
N6ND	1,511,640
W5LTR	1,480,256
N6TU	1,453,710
W7XR	1,397,866
K6JYO	1,395,900
W7EJ	1,314,108
AI7B	1,301,460
AA4NC	1,288,488
N7KA	1,260,092

Top Ten—DX

Mixed Mode

Call	Score
P4ØV (AI6V,op)	2,393,188
KH2D	1,270,120
DL6FBL	1,267,986
HAØDU	1,060,242
OK1RI	801,738
IB8A (IK8DOI,op)	791,908
JA8YBY (JH8PNE,op)	771,120
YU2W (YT2FI,op)	687,888
SKØPC	672,078
JA8RWU	632,016

Phone

Call	Score
AZ4F (LU2FFD,op)	977,952
KA3B/VP5	758,172
GW4BLE	693,616
YV6CAX	659,974
EA6VQ	629,888
HC1OT	625,820
ZL1ANJ	616,176
TG9GI	586,880
DL8PC	573,900
HK1LDG	551,980

CW

Call	Score
TV6MHZ (F2CW,op)	729,872
YU3GO	663,840
I2VXJ	593,844
DL1VJ	540,672
OK1ADS	478,192
LU6U (LU6UO,op)	472,624
5T5CJ	461,616
DLØWW (DF7ZP,op)	459,360
HAØNNN	457,436
JH6SOR	452,436

Multioperator

Call	Score
HC2G	2,446,830
NP4CC	1,982,730
PY5ZBA	1,856,480
LP2U	1,752,092
VP2M/ND3A	1,402,080
GW8GT	1,361,822
LR1V	1,320,872
GB75DX	970,260
HA5KKC	958,900
OG1AF	917,766

5N and SU. The propagation was so unusual stations came in from irregular directions. I wondered if someone was making fun of me? (JE1CKA). The snow noise was quite bad all during the contest (JAØDAI). The second day's band conditions were much better (JR7OMD/2). Nice conditions this time. I worked about 300 US stations and 49 states (JM1LRQ). See you next year (JF7WED). It was my first entry for the 10-Meter Contest (JI1LAI). We enjoyed this contest very much (JA6YBR). Great contest! I'm 75 years old and had fun (CT1QF). Thanks for the nice contest. We had excellent conditions. Unfortunately, my brand new 4-element quad came down just before the contest! (CU2BR). My 50-meter long wire broke in the ice storm (DL3ME). I was quite lucky! The day after the contest the tubes in my rig blew up! (DL2OBF). Excellent conditions! (DL1TH). I am 65 years old and not a contest freak but it was a very great pleasure for me to have had contacts with some old and new radio friends (DK9EA). A good contest but poor propagation (EA3BOX). Please increase activity above 28.900 MHz! (EC4CPW). This is my first ARRL 10-Meter Contest. It was marvelous! (EA7FTZ). It was an FB contest and there were good operators (EA5CLO). It's nice to have 10 meters back and in such good shape. I'm only sorry I didn't have more time to operate (EI1AA). Very nice contest! It was my first 10-Meter Contest and I was very pleased to work so many stations with just a ground plane (FD1HQY). I had good propagation for my first ARRL 10-Meter Contest (F6FYA). I thoroughly enjoyed the contest. As an OT aged 72, I used 100 watts barefoot and no beam. I had to chase everybody for a QSO! No sitting back and letting them call me! (G6QQ). I put up a beam a day or two before the contest and used the contest to check it out (G4IQM). I finished my home-brew monobander just before the contest. No problems until Monday when the neighbor complained about TVI! (G4MET). I enjoyed the contest but was unable to work the full 36 hours (G4WVX). I can't compete with the big boys, but I very much enjoyed taking part in the contest (G4ZME). The contest was a great end to the RSGB 75th Anniversary celebrations. I hope to take part again next year (GB75DX). A super contest but I had to QRT early on Sunday to attend a family christening, and the score suffered (GW4RHW). A fine contest! Nice to hear 10 meters open again after so many years (HAØDU). Nice conditions and a fine contest! (HA7RB). A great contest with good conditions (I1POR). A very beautiful contest! (IKØJUI).Incredibly good propagation during the contest (IO4JMY). Unfortunately, I could not spend too much time contesting. Maybe next time I'll do a more serious effort (OH6VR). Thanks for the contest (OH3GZ). The US 4th call area was very active. Sunday's opening to the West Coast was very good (OH3RF). Poor propagation to Japan and the US West Coast dropped the final score down 1 million points (OG1AF). A nice contest with an amazing number of old-timers, especially on CW. I worked a lot of them more than 30 years ago (OK3EA). I worked Z21 and UI9 for two new countries on 10-meter QRP (PAØIA). I hope the 1989 contest will be even better (PA3EOB). I did the contest just for fun (PA3ELS). A very nice contest with a lot of activity from all over the world (PA3EWP). Conditions were better than expected (PA3BNT). Thanks for a nice contest, but it was hard going with just a vertical (OZ6PI). The amp broke down with blue flashes and smoke the second day (OZ5EV).Thank you for arranging this nice contest every year (SM5DAC). Thanks for the nice contest (SM5EMR). Thanks to the club members that operated the computer, fixed the coffee, and encouraged and comforted the operators (SK5DB). There was poor propagation on 10 meters (SP1PBW). Thanks for the contest! The conditions didn't last (UA1OT). A lot of DX was worked. Thanks for the nice contest! (UT4UZ). Good health and success in all your endeavors in 1989! (UC2ADX). Thanks for the contest! (UQ1GXT). Good propagation to the US. Nice to meet all of you in the contest (UR2RHF). FB conditions and an FB contest! See you again in 1989! (Y43XE). Thanks for the contest! (YO6BZL). Sorry I had no more time to spend in the contest. Very fine conditions on 10 (YO3AC). My first 10-Meter Contest! Next year I will use a beam. I worked 46% Ws! HI! It was a pleasure! (YO5BQ). Fine propagation to the states! (YO8KZD). We had good propagation during the contest. See you next year (YU3HR). My first contest and I really enjoyed it! (KG4OM). Conditions were very good but the band slowed down too soon (TG9GI). It was frustrating to listen to South American stations working strings of JAs when the band had closed here (KA3B/VP5). As usual, I enjoyed the 10-Meter Contest (XE1XIV). This is my first ARRL contest and I didn't have much time to work it (XE2KHG). Working a CW pileup into the US during a contest is sheer punishment (KH2D). It was fascinating to watch the propagation change during the contest. I think the band is open more than we realize. Keep on calling CQ! (KX6TY). A most enjoyable contest. I'm looking forward to the next one (VK1RJ). I enjoyed this contest. It was a change from the all-band rat race. HI! Propagation times made the contest more relaxing and I hope to enter more of these in the future (VK8AV). I am a newcomer to Amateur Radio and this is my second contest (YC6INU). Conditions were much better than in 1987! (YBØATB/3). I tried my best with 100 watts to a ground-warming (I mean mounted) vertical. Next year I will use a beam! (KA1MXZ). I only enter contests to work new DXCC countries. I got 3 new ones this time (W1IVB). I operated the entire contest using a bank of 60 Ah gel cells in my van. I wish the equipment had thrown off more heat because it sure was cold mountaintopping that weekend! (N1ENV/T). I was able to add a few new countries and really got to try out the new Yagi (KA1RPQ/N). The XYL was in the hospital so I didn't operate much (W1CNU). I'm glad most of us were Novices at one time (KQ1V). A great contest! A lesson in propagation as each hour passed (NA1G). My highest score to date with less operating time. How about an indoor-dipole, townhouse/condo category? (WA1PLK). If our score is any indication, all the elements were present to make this year's contest the best ever (KX1G). Great contest but propagation died early Saturday evening. I got tired of coffee, and duping the logs was a bore (N1ATO). My first contest! It was fun and educational (KA1DZP). I'm 11 years old and I did the most DXing in my life in this contest. They should have it twice a year (KA1SSU/N). I had a terrible time fighting a throat infection and a case of food poison-

Division Leaders

Division	Mixed Mode	Phone	CW	Multiop
Atlantic	K3ZO	W3LPL (WA8MAZ,op)	W3USS (AA4U,op)	N2NU
Central	N9RD	KQ9L	NA9J	WØAIH/9
Dakota	NØAT	ACØW	WBØO	KRØB
Delta	W5WMU (KZ5D,op)	WB5SKQ	W4XJ	WD5JZL
Great Lakes	WD8AUB	K8CC (W8WD,op)	N4AR	N4TBJ
Hudson	K3EW	N2BJ	KZ2S	N2EOC
Midwest	WØØG	NØXA	KØRWL	KYØB
New England	KM1H (KQ2M,op)	K1NG (KI1G,op)	K1XA	KX1G
Northwestern	NL7GP	N7HAZ	K7QQ	W7XR
Pacific	NC7K	K3EST	N6ZB	N6TU
Rocky Mountain	WØYK	NIØE	ACØS	W5LTR
Roanoke	WB8HDD	K3ZJ	N8II	AA4NC
Southeastern	K4JPD (KM9P,op)	K4XS	WC4E	WT4A
Southwestern	K6LL	WB7FDQ	KD7E	N6ND
West Gulf	AD5Q	NR5M	K5NW	K5CM
Canada	VE5UF	VE3CVX	VO1MP	VE3XO

DX Continental Leaders

Continent	Mixed Mode	Phone	CW	Multiop
Africa	ZS6BRZ	TU4BR/5U7 (KA9DOO,op)	5T5CJ	—
Asia	JA8YBY (JH8PNE,op)	JA7YAA (JJ3CNL,op)	JH6SOR	JA9YBA
Europe	DL6FBL	GW4BLE	TV6MHZ (F2CW,op)	GW8GT
North America	XE1XIV	KA3B/VP5	HP1AC	NP4CC
Oceania	KH2D	ZL1ANJ	AX4XA	VK2MAG
South America	P4ØV (AI6V,op)	AZ4F (LU2FFD,op)	LU6U (LU6UO,op)	HC2G

PAØLOU operated YBØATB/3 in the CW category and won first place in Indonesia.

ing! (KQ2M). How about a QRP section next year? (KT1H). The weekend was a blur (WB2JSJ). Great contest! I had a super time with FB conditions (K3EW). Propagation was generally good (N1CC). This was my first 10-Meter Contest. It was great! (KD2BW). I made my first ever QSOs on HF (N2EHZ). With the return of good conditions on 10 meters this contest, it was very nice to renew old friendships (WB2AMU). Thanks to the hot band and the cold weather I worked twice as many stations as I had planned (K4BNC). Whew! What a contest! And my first one, too! I can't wait for the next one! (NX2V). I challenged WC4E to a code-only battle about a week before the contest. It looks like we ended up in a dead heat (KZ2S). I had 75 QSOs an hour with 100 watts and a 20-foot-high dipole. What a band! (K2PS). It was fun as usual but not much activity from Africa or South America. You should have an award for Worked All Europe! HI! (N2ETJ). A great contest again with terrific conditions (W2NZH). A nice contest and great conditions. Too bad the flu was going around! (WF2L). After a long weekend of contesting the aurora Sunday evening seemed to get everyone's adrenalin up again! (K2QR). My first 10-Meter Contest. I had lots of fun along with rotor problems and a high noise level (KM2P). A good contest again. I might have had a higher score if I was more up about where those Russian prefixes were! HI! (K3HBP). I enjoyed the contest immensely. It's the first time I've participated in the 10-Meter Contest (N3ED). This contest was a very enjoyable one (KA3ROF). Band conditions were excellent. It was the most fun I've ever had in a contest (K3QQ). I lost my keyer in the first hour and the rest of my patience the following hour (KA3AFY). Superb conditions provided lots of fun! (N3GOW). I only had time to put a few hours into the contest. It was my first contest other than Field Day (N3GNW). I was glad to hear 10 meters wide open. I wish I had more time to spend in the hunt (W3CEI). My first contest with a completely renovated station and equipment (W3BGN). Terrific conditions but the line noise was a severe problem (K3ZO). Strong backscatter made it fun to work all the familiar guys in the middle of European runs (WB2EKK). I'll never dupe another 10-meter log by hand! (W3LPL). This was only my second year of participation in this contest. Last year, all contacts were US. This year, lots of fine DX! I look forward to the 1989 contest! (KA3CXG). I only had time to work about 3 hours. I enjoyed the little time I did operate (WB3CDX/T). I would have liked to have seen more Novices and Technicians on the air (N3GLK/T). Casual operation yielded two new countries (K3MD). Wish I was 50 again (K4SB). The best conditions I ever saw for the 10-Meter Contest (N4UZ). I worked my first Pacific station (N4OHW). This was my first time operating QRP and I had fun (AB4LR). I love the contest and I'm looking forward to one day being able to compete seriously (N4QVM). Great conditions! Doesn't anyone keep a dupe sheet? I had over 200 dupes and almost all of them called me! (K4XS). Believe it or not it gets cold in FL. We almost froze the first night! (W4NN). This was my first contest and I enjoyed it very much. I was amazed with the European countries I was working (N4SQC/T). I was baby-sitting, washing clothes and other chores during the contest, but managed to make a few contacts (N4RYO). Where were all the CW stations? (N4SFY/T). This was my first contest since I was licensed in 1978 (KD7GD). Conditions were generally very good although the band closed early in the evenings (K4LTA). This was the best I have ever seen the 10-meter band (N4JRG). Where were all the Novices and Technicians on CW? (KA5DAN). 10 meters sounded like a Sweepstakes contest (W5EW). After trying for some time to work TU4BR/5U7, he asked everyone to stand by to see if there were any MS stations on frequency! Talk about luck! (WD5JZL). The contest was a lot of fun but the paperwork afterwards was a pain. HI! (KA5FSB). The band was so open I just pointed the beam NE and worked the world! (N5EZA). Thanks for the good contest. It was a good test for a new antenna (N7KA). I enjoyed the contest but where were all the Novice and Technician stations? (KO5D). I had TVI, a TR relay blow up in the amp and I lost the receiver with 6 hours to go! (N5DDO). The highest solar flux levels for this contest since 1982 brought lots of activity on the band. One has to wonder what it might have been like if the even, higher flux two weeks later had been present! (WA5IYX). A great contest! P40V sounded like he was next door! (NZ5T). It was very exciting to have rare DX calling me and it was a blast working all of the Novices and Technicians (WX6M). This year I had to keep my tower all the way down because of the high winds the first day (WB6NFO). The best conditions ever for this contest! (AE6E). It would have been nice to work AZ, NM and UT for a weekend WAS but no dice this time (W6TKV). The band conditions in southern CA were just beautiful and I beat my best old score of '81! (WA6GFR). This is my first attempt at contesting and I don't expect to win anything, but I did the most important thing: I had fun! (N6RNG/T). The ingredients for a great West Coast 10-Meter Contest: good conditions, lots of JAs, lots of EU multipliers and your YL's out of town! (NS6V). I missed a lot of DX because of my ground-mounted vertical. Maybe next year I'll have a beam antenna (WA6HRK). How about a new category? Add up the total cost of all the equipment used in the contest, divide by the total score and the ham with the smallest number wins! Whaddaya think? (W6BKY). I entered just for fun and I had a ball! (W6PU). The conditions were excellent but I had frequent S7-8 line noise (W6MVW). The snappy exchange and the hordes of enthusiastic Technicians and Novices make for some rapid-fire contacts. I love it! (N6EE). My first real contest effort. The paperwork was the toughest part (KJ6CA). Ten meters was worth waiting for! (NL7KB). 48-hour contests seem like 72 hours as I get older! (KD7E). Murphy was good to me! This is the best I've ever done in any contest! (KA7NOC). Thanks for a great contest. I can't wait to see what the conditions will be like next year (KN7K). I operated as long as the band was open! Then I finished the contest and packed everything up and moved to WA (N7HAZ). Operating barefoot was a nice change of pace (KS7T). I am looking forward to next year when conditions should be really fantastic (K7NV). I had a great time! (W7EYE). I couldn't make it into Europe at all and it was frustrating listening to the midwest and eastern stations working them in the morning (NZ7Q). What a difference compared to last year! (WE7B). This was a marathon weekend for me (WA7HQD). A relaxed way for us TOTs (Tired Old Timers) to stay in the contest with a minimum of bookkeeping is to work each multiplier only once! (W7TE). Thanks to everybody for a fine contest. Maybe next year I'll have an antenna with gain! Watch out! (WB7EJS). The vast majority of operators were courteous. It was a fun event (K7IOO). I had constant interruptions from customers, friends and neighbors on Saturday so I closed the drapes, ignored the phone, and turned off the VHF rigs on Sunday (KA7MCX). I really enjoyed this contest and intend to enter more of them (WA7UGB). I used an indoor dipole and I can't wait to get up a serious antenna! (W7LZP). It's nice to hear 10 meters open again. QRP guys like me love contests like this (NØAX). The biggest bang of the contest was working the XT station who I hope wasn't a pirate! (WS7I). My best contest ever (NC7O). I hope next year is even better (K8LJQ). Great contest! Everything my dad (K8EXP) told me about 10 meters back in 1957 is true. I can't wait for next year (N8AGU). God Bless Cycle 22! (N8ICW). I worked more DX than I had all year! (WFØE). I missed the first evening of the contest due to a date with the salt mine! (N8II). Great fun from out in the boonies (N9FXS/T). Putting the YL on the mic caused some interesting comments (WB9JKI). 100 watts with a mini-beam kept things interesting (NX9T). The conditions were not as good as I had hoped, but certainly far better than last year. I hope to see you all next year (NI9C). This is the first time I've ever participated in a contest. It was fun! (KA9NTO/T). I came within one page of running out of log sheets! (KVØK). There was great propagation during the daylight hours and several QRP stations were S7 or better. I hope 1989 will be as good (NØFFZ). I had to work most of the weekend, so not much time was spent operating (KAØYXI/T). Two of my harmonics caught contest fever! I wish I had 2 more rigs (KDØRN). It was my first contest in 47 years of Amateur Radio. I was surprised to contact almost as many countries as states (WØWGZ). This was my first contest operation since returning from Hawaii. I see that I need a little different strategy in chasing DX (WEØA). 10 meters is fantastic when it's open! (NOØY). It is hard to tell how much of the larger score this year is due to improved conditions or improved operating skills (WBØU). Thanks for a real fun contest (KAØUPF). My 10-month-old daughter enjoyed sitting on my lap while I worked the contest (N6VB). I missed the Novices on CW. Were they all on phone? (KDØSF). We had to shut down early to help out a stranded motorist (NØBNG). You would think ND was rare DX by Sunday afternoon! (WBØO). My first contest! I'm think I'm hooked! (KA9IZP). I'm gonna get a babysitter next time so I don't have to run upstairs to change diapers (KBØAWB/T). I had a ball and was surprised at the stations worked (KAØVZB/N). It's my first contest (VE2FS). Conditions were good but not great given the previous three months on 10 meters (VE3FIU). Daytime openings and no marathon endurance required! (VE3NBE). Friday-night aurora knocked out the polar path to Europe for the weekend (VE5UF). Next year I will put up my 5-element log periodic! (VE5AAD). I'm 76 years old and it's sure tough getting those close-in multipliers on backscatter (VE5XU).

VP2M/ND3A made over 2300 QSOs from beautiful Montserrat to place fourth in the DX multiop category.

Scores

DX scores are listed by continent and country according to the ARRL DXCC list. US and Canadian scores are listed by call area and ARRL section. Each line score lists call sign, score, QSOs, multipliers and entry class (A = Mixed Mode; B = Phone only; C = CW only; D = Multioperator). The /T after a call sign indicates a Technician entry and the /N a Novice entry.

DX

Africa

CT3DL 454,784- 1496- 152- B
CT3DJ 73,440- 204- 90- C
EA8AMT 232,560- 1020- 114- B
EA8AXN 13,440- 120- 56- B
EA9RY 391,748- 1646- 119- B
EA9IE 85,680- 476- 90- B
ZS6BRZ 311,912- 1211- 80- A
ZS6HO 88,380- 491- 90- B
ZS6S 55,080- 169- 81- C
5T5CJ 481,616- 978- 118- C
TU4BR/5U7 (KA8DOO,op)
524,790- 1785- 147- B
9J2AL 166,272- 477- 96- A
9Q5NW 65,120- 407- 80- B

Asia

A92BE 86,424- 554- 78- B
HL9FN 17,072- 113- 44- A
HL9TF 134,784- 648- 104- B
HL9CA 7,320- 61- 30- C
JA6YBY (JH8PNE,op)
771,120- 1331- 204- A
JA8RWU 632,016- 1122- 189- A
JA7DAH 562,368- 1177- 174- A
JH4UTP 555,360- 1054- 195- A
JI2KVW 472,880- 841- 184- A
JF1SEK 431,460- 1008- 170- A
JR3BOT 348,348- 762- 154- A
JM1SMY 304,260- 635- 165- A
JA9JFO 281,280- 603- 160- A
JA8DMV 140,400- 407- 117- A
JI1JVG 129,456- 353- 124- A
JA1QZC 97,416- 370- 99- A
JA2YAU (JE7MAY,op)
91,000- 283- 100- A
JA1BUI 46,458- 264- 46- A
JH6TYD 36,580- 157- 59- A
JA5IP 34,364- 161- 71- A
JM1AOU 28,792- 154- 59- A
JG2TSL/1 28,548- 132- 61- A
JR2MLV 27,280- 122- 62- A
JA1YAD (JH9AMJ,op)
23,998- 120- 71- A
JA3UWB 14,940- 140- 45- A
JH7CJM 13,200- 83- 40- A
JH1PXY 7,956- 81- 34- A
JH7AJD/1 7,656- 70- 33- A
JA6BPY/1 3,968- 52- 32- A
JA4DUD 3,306- 43- 29- A
JA1EL 2,408- 38- 28- A
JA6KZ 2,120- 38- 20- A
JA6BWH 1,430- 36- 13- A
JA2EAB 462- 17- 11- A
JA7YAA (JJ3CNL,op)
306,032- 1234- 124- B
JE8XRF 127,988- 653- 98- B
JF2GYH 39,852- 243- 82- B
JE7DOT 34,086- 247- 69- B
JA1HWO 32,340- 210- 77- B
JA3IWA 31,416- 204- 77- B
JH1UUT 29,890- 245- 61- B
JA6EFT 29,792- 196- 76- B
JP1SRG 27,300- 182- 75- B
JA1PUK 19,740- 210- 47- B
JA1ASO 17,690- 145- 61- B
JA3BBG 16,104- 122- 66- B
JA6QDU 15,370- 145- 53- B
JL1MWI 14,664- 156- 47- B
JE2IFM/2 11,224- 122- 46- B
JA5EO 10,058- 107- 47- B
JR7LVK 6,640- 96- 45- B
JA6AKV 6,720- 84- 40- B
JI6OWY 6,408- 89- 36- B
JF2KUU 5,712- 84- 34- B
JA3FZI 3,900- 65- 30- B
JA4PA 3,050- 61- 25- B
JE6EHE 2,050- 41- 25- B
JG7LBN 1,472- 32- 23- B
JO1MCC 672- 21- 16- B
JR2IQV 18- 3- 3- B
JE1TTO 2- 1- 1- B
JH6SOR 452,436- 1017- 111- C
JE1CKA 367,632- 828- 111- C
JA6DAI 326,128- 746- 109- C
JA1KFX 292,032- 702- 104- C
JR7OMO/2 150,400- 400- 94- C
JA2EU 132,784- 383- 86- C
JM1LRQ 131,008- 356- 92- C
JA1WYQ 126,488- 321- 97- C
JE1AER 126,140- 371- 85- C
JA8UMV 107,124- 354- 79- C
JS1UMQ 101,376- 286- 88- C
JA3AA 56,280- 201- 70- C
JA7ASD 51,992- 191- 67- C
JR1ZTT (JF7WED,op)
43,008- 189- 56- C
JI3BFC 42,552- 197- 54- C
JR7CDL 40,704- 159- 64- C
JA8HBO 39,600- 163- 60- C
JA8AJE 35,840- 140- 64- C
JA3DLE/1 35,400- 144- 59- C
JH1NSD 28,920- 144- 45- C
JI1LAI 24,576- 128- 48- C
JA7EDZ 23,520- 120- 49- C
JA1DFQ 19,824- 118- 42- C
JJ1NZA 19,656- 126- 39- C
7J2AAF (W1END,op)
12,300- 74- 41- C
JO1QZI 12,168- 77- 39- C
JA0HC 9,240- 70- 33- C
JA2ODV 9,184- 56- 41- C
JA1BNW 9,176- 74- 31- C
JA2AJA 6,600- 66- 25- C
JH8RGQ 4,876- 50- 23- C
JR3XEX 4,800- 50- 24- C
JN1WXW 3,872- 43- 22- C
JA4ATV 1,900- 25- 19- C
JR1WHR 1,600- 24- 16- C
JH1ADR 1,040- 20- 13- C
JA1KKA 952- 17- 14- C
JR4ISK 540- 15- 9- C
JA7AXP 280- 14- 5- C
JA9YBA (JA9s VDA,-10148,
JH9VSF,ops) 771,620- 1345- 205- D
JA1YCL (JK1STT,JL1s LNC,QOC,
JO1GAD,JG4PZM,JH7XMO,
JH8PMO, ops)
572,792- 1291- 194- D
JA0YAK (JH0s NVX,OPX,RGJ,USD,
VYG,JR0s DVM,FQM,HYT,JS1PTU,
JE7GWO JG7JMO,JI7OED,
JA9VSX,ops) 646,750- 1049- 199- D
JA2YKA (JE2JCV,JE4LIK,JF2UTL,
JG2VTD,JJ2s FAU,NJF,JK2CZL,JL2s
KRD,TZC,JM2FPO,ops)
604,032- 1056- 192- D
JE2YRD (JF2EOC,JR2SQU,JH4VBQ,
JE7BIZ,ops) 578,664- 952- 188- D
JG3ZDK (JH1ORL,JH3DBI,JL3WLC,
JF4FUF,ops) 570,114- 1093- 171- D
JA1YXP (JI1UTP,JP1SMR,JO1JOZ,
JS1DRL, JH9CAU,JH0RRR,ops)
567,420- 1026- 193- D
JA6YAI (JN1LLA,JE6OBL,JF6UFJ,
JG6OZC,ops)472,524- 859- 169- D
JA4YJA (JJ3LJU,JM3ILK,JO3GPL,
JE4IFM,JG8PAF,ops)
465,840- 855- 180- D
JA6YCU (JI4s CHN,CHV,JE6s UWK,
UWU,JF6MND,JI6EDY,JJ6s PXB,
XZG,JK6LCY,ops)
336,622- 872- 143- D
JE6ZAI (JF4ETK,JS1PWV,
JI6KYX,ops) 254,540- 613- 110- D
JE1YLP/1 (JP1BNM,JE7RJZ,
JH0VMJ,ops) 234,080- 537- 152- D
JA7YCQ (JA7-30336,JF7HYZ,
JI7GBI ops) 100,848- 323- 88- D
JA6YBR (JF6s CVW,TMH,JG6CVO,
JI6BRB,JR6GKT,ops)
48,900- 279- 75- D
JA2YEF (+ops) 32,976- 227- 72- D
JT1BQ 10,296- 156- 33- B
JY9LC 45,448- 299- 76- B
UA9FAR 13,261- 94- 37- A
UA0FF 94,340- 530- 89- B
RW9AB 78,312- 502- 78- B
UA6WW 42,330- 415- 51- B
UA9CQB 4,896- 136- 18- B
UA0SNT 3,720- 93- 20- B
UW0LT 106,056- 491- 54- C
UW0CM 19,184- 109- 44- C
UA0FDX 14,720- 115- 32- C
UA9QBT 832- 16- 13- C
UD6DKW 468- 13- 9- C
UF6QAC 180,722- 552- 109- A
UL7ACI 357,000- 1500- 119- B
UL7LEG 750- 25- 15- B
UL8BWW (UL7s BB,BY,018-389,ops)
30,680- 146- 59- D
UM8MU 29,816- 200- 46- A
UM8MIG 40,420- 430- 47- B
VS6UP (KB7G op)
441,000- 1125- 98- C
4X4VF 65,254- 413- 79- B
9V1VB 49,200- 282- 50- A

Europe

G0AEV/CT1 66,000- 375- 88- B
CQ2BBJ (CT1BBJ,op)
51,976- 292- 89- B
CT1QF 18,450- 123- 75- B
CT1BNW 14,892- 146- 51- B
CQ0TM (CT1TM,op)
1,848- 33- 28- B
CT1DKG (W7LPF,op)
64,768- 253- 64- C
OU2BR 570,500- 1544- 175- A
DL6FBL 1,267,986- 2188- 233- A
DF1LX 494,840- 1053- 178- A
DA2CU 241,900- 1009- 118- A
DL6YAO 138,420- 464- 90- A
DK8AX 22,308- 114- 66- A
DL1SBF 2,688- 37- 28- A
DL8PC 573,900- 1913- 150- B
DJ3HJ 194,400- 810- 120- B
DL7XR 61,992- 287- 108- B
DL3SBI 32,574- 183- 89- B
DJ8BX 24,254- 181- 67- B
DL3ME 8,428- 98- 43- B
DL9DBR 6,960- 87- 40- B
DL1VJ 540,672- 1021- 132- C
DL0WW (DF7ZP,op)
459,360- 957- 120- C
DL8PY 185,288- 437- 106- C
DL2OBF 120,400- 317- 86- C
DL4BAH 118,608- 346- 84- C
DJ5GG 112,344- 300- 93- C
DL1TH 112,112- 306- 91- C
DL7CF 92,916- 261- 89- C
DL1ZO 85,840- 267- 74- C
DL5GBG 66,576- 228- 73- C
DJ9IF 50,424- 191- 66- C
DK3LM 21,800- 109- 50- C
DL4UL 20,776- 102- 49- C
DF5BL 13,680- 90- 38- C
DK9EA 11,832- 101- 29- C
DL4GBR 7,936- 62- 32- C
DL9VDQ 5,220- 45- 29- C
DF3QN 5,040- 90- 18- C
DK2OY (+ DF7RX,DL6RAI)
773,832- 1247- 228- D
DF0SX (DL1s SBR,SCV,
DL2SAX,ops) 560,160- 1215- 180- D
DF0BA (DL1BIS,DL3GBQ,DL4ZBZ)
141,192- 453- 106- D
DL3SCR (+ DH1SAB,DL3SBI,
DL8CCC) 32,574- 183- 89- D
DL8SCC (+ DH1SAB,DL3s SBI,SCR)
32,574- 183- 89- D
DH1SAB (+ DL3s SBI,SCR,DL8SCC)
32,574- 183- 89- D
EA4EP 160,428- 347- 174- A
EA5CHT 62,000- 308- 100- A
EA3CCN 411,252- 1594- 129- B
EA3BOX 185,704- 668- 139- B
EA3BER 178,978- 799- 112- B
EA3EGB 164,952- 711- 116- B
EA5FDK 135,424- 529- 128- B
EA2BRF 95,616- 498- 96- B
EA1CON 85,100- 370- 115- B
EA7AVU 81,084- 466- 87- B
EA3ELM 61,000- 305- 100- B
EA3FRJ 44,492- 227 98- B
EA3ELZ 40,280- 212- 95- B
EA1AW 39,312- 182- 108- B
EA3EJI 34,440- 210- 82- B
EA3C2R 32,208- 183- 88- B
EA7CU 27,200- 170- 80- B
EA4DMB 25,702- 181- 71 B
EA5AEN 25,110- 135- 93- B
EA4EER 22,200- 185- 60- B
EA3DZZ 21,594- 183- 59- B
EA4EHQ 21,060- 162- 65- B
EC4CPW 18,590- 169- 55- B
EA3EBN 16,642- 157- 53- B
EC3CPT 14,592- 152- 48- B
EA1CAI 11,800- 100- 59- B
EA7DXR 11,550- 105- 55- B
EA7BYM 7,968- 83- 48- B
EA5EFV 7,300- 73- 50- B
EA2BUZ 6,336- 88- 36- B
EA1BKT 5,100- 85- 30- B
EA7GMK 4,902- 57- 43- B
EA5BZS 2,666- 43- 31- B
EA7FTZ 1,292- 34- 19- B
EA5FYJ 540- 18- 15- B
EA1CYG 288- 12- 12- B
EA5YU 198,172- 476- 103- C
EA2IA 189,200- 550- 86- C
EA5AR 92,560- 260- 89- C
EA4AYX 65,880- 183- 90- C
EA5BZM 62,764- 216- 71- C
EC7DEB 58,952- 216- 63- C
EA3BDO 53,108- 187- 71- C
EA2CR 36,720- 153- 80- C
ED7CA 33,184- 136- 61- C
EA5GAY 10,792- 70- 38- C
EA2CIR 10,692- 79- 33- C
EA5CLO 8,840- 63- 34- C
EA3BOW 8,424- 54- 39- C
EA7XC 5,368- 61- 22- C
EA7AAW 5,040- 45- 28- C
EA4BV 3,472- 57- 28- C
EA5FMJ 432- 12- 9- C
EA7RCC (EA7s CEL,CEZ,DLC,DLD,
FKN,ops) 688,938- 1055- 199- D
ED7RKC (EA3GAS,EA7s DZI,DZL,
ESA,ops) 321,310- 1108- 115- D
EA6GP 14,790- 110- 51- A
EA6VQ 629,888- 2128- 148- B
EA6XQ 33,852- 186- 91- B
EA6ZS 26,622- 153- 87- B
EI1AA (EI2BB,op)
287,404- 1101- 119- A
EI4DQ 98,900- 575- 86- B
FD1LMI 189,924- 627- 119- A
F6FNL 185,850- 506- 107- A
FB1MUX/N 81,404- 323- 94- A
FB1NQL 21,120- 116- 55- A
FE6IDZ 528- 22- 11- A
F6EHJ 348,030- 1289- 135- B
F6AOJ 283,464- 1116- 127- B
FD1LBL 272,780- 1186- 115- B
FD1MRV/P 91,698- 493- 93- B
FD1HQY 35,604- 207- 86- B
F6FHA 13,440- 120- 56- B
FE6FNA 10,780- 110- 49- B
FD1MFB 10,152- 108- 47- B
F6HTD 8,282- 101- 41- B
F6FYP 6,930- 77- 45- B
TV6MHZ (F2CW,op)
729,872- 1506- 121- C
F6AUS 280,296- 687- 102- C
F6DKV 204,020- 480- 101- C
F6FYA 177,160- 430- 103- C
F6HSW 175,320- 487- 90- C
F6IIE 134,808- 405- 82- C
F1JDG 108,020- 338- 79- C
F6EEM 81,576- 304- 66- C
F3AT 58,108- 198- 73- C
F6DZD 52,704- 243- 54- C
F6EQV 51,456- 200- 64- C
FD1LJY 43,904- 195- 56- C
F6GNP 39,520- 186- 52- C
F9BB 29,044- 137- 53- C
FD1LBD 23,856- 142- 42- C
F6CCI 15,840- 90- 44- C
F9QE 13,764- 92- 37- C
F2DE 12,528- 71- 36- C
F5AM 8,352- 58- 36- C
FE2VV 3,612- 43- 21- C
FD1MAE 840- 15- 14- C
TV6DNF (F1HAS,FB1NBX,
F6CQU,ops) 600,880- 2072- 145- D
FF6KAW (F6DZS,FD1s JDS,MAY,
FI1s FFB,IBT)
572,704- 1440- 176- D
F6IFR (+ F6s CWN,GWV,HMQ)
546,448- 2009- 136- D
F6ENO (+ F6WA,F9IQ)
321,552- 695- 116- D
FF6KPQ (+ops)
244,188- 1197- 102- D
FD1MNC (+ FD1MLJ)
73,788- 349- 86- D
G6OQ 120,510- 286- 117- A
G4IQM 31,104- 142- 72- A
G4IUF 156,584- 851- 92- B
G4MET 118,360- 538- 110- B
G0HU 27,218- 216- 63- B
G3ESF 185,464- 473- 97- C
G4BUO 164,312- 437- 94- C
G3SXW 107,520- 380- 70- C
G4WVX 81,524- 221- 89- C
G4ARI 63,232- 242- 64- C
G4ZFE 61,100- 231- 65- C
G0BON 54,896- 180- 73- C
G6NK 39,380- 182- 55- C
G4ZME 32,232- 152- 51- C
GB6AQ (G3AWR,op)
26,316- 124- 51- C
G3CWL 5,104- 44- 29- C
GB75DX (G4BWP,G5LP,ops)
970,260- 2476- 157- D
G0KPW (G4s BAH,PIQ,G7ABQ)
507,174- 1851- 137- D
G4WYG (+ G4OHX)
236,096- 596- 112- D
GJ0KKB 40,672- 248- 82- B
GM4GXR 380,034- 1473- 129- B
GM3BCL 120,800- 604- 100- B
GM4ELV 48,256- 232- 104- B
GM3CFS 108,232- 326- 83- C
GM8SQ 22,572- 99- 57- C
GW4RHW 405,166- 681- 173- A
GW4BLE 693,616- 2249- 154- B
GW0ARK 461,952- 1604- 144- B
GW3NYY 176,460- 519- 85- C
GW8GT (GW3KYA,GW4s JBQ,
LXO,TTU,GW5NF,GW6ZUQ,
GW8UCQ,ops)
1,361,822- 2065- 239- D
HA0DU 1,060,242- 1641- 249- A
HA8XX 217,724- 816- 106- A
HA8XF 2,320- 40- 29- B
HA0NNN 457,436- 961- 119- C
HA7RB 75,900- 250- 75- C
HA8ZC 7,192- 58- 31- C
HA5KKC (HA5s LV,MO,ops)
955,900- 1556- 223- D
HA8KCK (HA8s FT,KH,ops)
149,040- 517- 92- D
HB9DDO 34,048- 139- 76- A
HB9DMQ 15,150- 101- 75- B
HB9AGH 58,460- 184- 79- C
HB9ARF 56,760- 211- 66- C
HB9KC 46,368- 161- 72- C
HB9DX 32,752- 92- 89- C
HB9DFY 23,532- 111- 53- C
IB8A (IK8DOI,op)
791,908- 1489- 194- A
N4QIV/I8 55,944- 297- 74- A
I3KVW 27,246- 231- 57- A
I1POR 470,654- 1693- 139- B
IO4LCK (I4LCK,op)
412,896- 1518- 136- B
I8BYG 183,286- 811- 113- B
IV3YYK 174,720- 780- 112- B
IK8JUI 45,390- 265- 89- B
IK7BRX 35,680- 223- 80- B
IV3BMV 30,212- 182- 83- B
I4CSP 19,176- 141- 68- B
I2VXJ 593,844- 1198- 123- C
IK8FWI 161,792- 512- 79- C
I1XPQ 96,324- 349- 69- C
IO4JMY (I4s ABF,JMY,UFH,USC,
YSS,IK4JTL,ops)
724,752- 2083- 168- D
IK4HLQ (I4s JBJ,MES,YNO,IK4s ALM,
CFV,HZD,JQQ,LHC,ops)
403,840- 1247- 160- D
IK2GWH (+ IK7GDP)
38,136- 241- 48- D
IS8LYN 22,356- 110- 53- A
IS8AEQ 53,044- 298- 89- B
LA5JX 109,830- 523- 105- B
LA9DI 43,896- 236- 93- B
LA2TY 26,854- 229- 63- B
LA9FFA 13,000- 125- 52- B
LA2AD 6,308- 83- 38- B
LA7WCA 144- 9- 8- B
LA6DY 34,720- 151- 56- C
LA8CE 30,160- 141- 52- C
LA9RFA 5,152- 46- 28- C
LA4C (LA3ZFA,LA6FFA,ops)
88,830- 409- 105- D
LX2QR 55,016- 299- 92- B
LX2PA 242,556- 493- 123- C
LZ1KNP 166,668- 423- 129- A
LZ1ZF 113,806- 462- 77- A
LZ1KVF 67,760- 320- 77- A
LZ1YG 30,720- 255- 60- A
LZ2QV 11,310- 74- 39- A
LZ2ES 48,764- 334- 73- B
LZ1OT 20,140- 190- 53- B
LZ2WM 6,888- 82- 42- B
LZ1V (LZ1s UF,ZO,ops)
42,380- 200- 59- D
OE6IMD 9,472- 64- 37- C
OH2PM 598,660- 1095- 185- A
OH6VR 131,340- 316- 110- A
OH7NW 16,810- 109- 41- A
OH6NVC 71,760- 480- 78- B
OH4OO 30,420- 234- 65- B
OH6SU 10,800- 135- 40- B
OH3GZ 3,420- 57- 30- B
OH3NXN 3,016- 58- 26- B
OH3RF 242,880- 546- 110- C
OH3JF 215,904- 519- 104- C
OH7EU 163,908- 465- 87- C
OH6RC 132,496- 338- 98- C
OH2EJ 58,384- 178- 82- C
OH3NM 23,600- 118- 50- C
OG1AF (OH1s EH,NOA,NSJ,ops)
917,766- 1538- 201- D
OK1RI 601,738- 2042- 147- A
OK3EA 467,544- 1119- 132- A
OK2BVX 65,688- 221- 92- A
OK1KZ 48,410- 253- 65- A
OK1DXW 43,218- 200- 63- A
OK1AIR 21,364- 110- 49- A
OK1DXL 16,380- 115- 42- A
OK1JFP 9,792- 86- 36- A
OK2SWD 7,068- 56- 31- A
OK2OAY/P 1,800- 59- 15- A
OK3CFA 232,804- 962- 121- B
OK1AJN 97,768- 484- 101- B
OK1VAM 60,416- 512- 59- B
OK2BHM 9,900- 110- 45- B
OK1ADS 478,192- 984- 121- C
OK3IF 134,016- 346- 96- C
OK1TW 129,960- 338- 95- C
OK3GB 75,392- 244- 76- C
OK3YCA 66,792- 248- 66- C
OK3BA 19,008- 99- 48- C
OK2ABU 17,544- 100- 43- C
OK1MIN 15,520- 96- 40- C
OK1DRQ 14,904- 74- 48- C
OK2PBG 10,656- 72- 37- C
OK1DCE 5,724- 45- 27- C
OK2PLD 5,184- 42- 27- C
OK3CEL 4,600- 50- 23- C
OK3CWF 3,128- 23- 17- C
OK3TEL 1,584- 22- 18- C
OK1OFM (+ops)
77,024- 251- 83- D
OK1ORA (2 ops)
71,166- 317- 87- D
OK1KQH (+ops)
40,572- 185- 63- D
OK2KVI (+ops) 13,992- 99- 44- D
OK2KUB (+ops) 5,376- 45- 28- D

OK1KCF (+ops) 2,070- 32- 13- D
ON5WL 13,908- 131- 38- A
ON4KST 238,360- 1010- 118- B
ON4AMX 145,036- 718- 101- B
ON4ALL 96,824- 424- 113- B
ON4AWK 71,280- 386- 90- B
ON8WN 11,264- 128- 44- B

OZ6PI 6,640- 75- 35- A
OZ5EV 204,180- 830- 123- B
OZ1DPW 137,280- 624- 110- B
OZ1ASP 18,666- 153- 61- B
OZ8T 3,220- 46- 35- B
OZ2BM 3,042- 39- 39- B
OZ4FNX 2,900- 50- 28- B
OZ3FS 540- 18- 15- B
OZ4UN 63,312- 195- 68- C
OZ3PE 40,832- 175- 58- C
OZ3ZW 38,720- 176- 55- C
OZ8E 15,936- 81- 48- C

PA2REH 17,300- 88- 50- A
PA9A 18,644- 145- 57- A
PA3ERL 14,344- 91- 44- A
PA3EQB 4,200- 60- 28- A
PA3EPN 272,796- 1074- 127- B
PA9DUO 29,014- 163- 89- B
PA3ELU 20,868- 111- 94- B
PA8DJ 10,672- 116- 46- B
PA3ELS 8,052- 66- 61- B
PA3EWP 4,032- 56- 36- B
PA3CXC 348,096- 777- 111- C
PA9NA 94,688- 265- 88- C
PA3B1H 21,420- 105- 51- C
PA3AFF 20,424- 110- 46- C
PA3BNT 19,552- 104- 47- C
PA3BBP 11,858- 76- 39- C
PA9PLN 11,088- 97- 28- C
PA3CAL 3,344- 38- 22- C
PA3CNI 1,428- 21- 17- C
PI4THT (PA2AWU,PA3s AZT,ESO, PB9AED) 539,812- 1483- 182- D
PA3DWD (+PA9COR) 426,284- 1501- 142- D
PI4DEC (PA3s AWW,CJF,CZW, ENO,ERA,PA2s BOE,TUK) 270,936- 1180- 106- D

SK6PC 672,078- 1151- 187- A
SM5DAC 27,324- 198- 69- A
SM5CAK 2,650- 51- 25- A
SM7KIL 119,400- 795- 75- B
SM6SSK 57,672- 267- 108- B
SM7AIO 49,808- 283- 88- B
SM5PPS 9,900- 110- 45- B
SM4BTF 9,282- 91- 51- B
SM5GA 3,534- 57- 31- B
SM5EMR 2,480- 40- 31- B
SM6RCE 1,920- 40- 24- B
SM6LIF 1,150- 25- 23- B
SM8TW 107,360- 305- 88- C
SM3CER 45,360- 180- 63- C
SM3RAB 45,156- 213- 53- C
SM3DXC 34,368- 179- 48- C
SM6HVR 30,580- 139- 55- C
SM4KL 25,272- 117- 54- C
SM3SGP 24,780- 105- 59- C
SM5PAX 17,424- 99- 44- C
SM5RE 14,784- 109- 33- C
SM7LAZ 9,120- 60- 38- C
SM6BDS 3,680- 37- 33- C
SK5DB (SM5s API,LYM,PAS,PAV. PMR,ops) 78,850- 353- 85- D

SP5KVW 383,744- 995- 128- A
SP5NHM 80,916- 314- 97- B
SP9EMQ 38,048- 232- 82- B
SP5FKW 18,354- 133- 69- B
SP6AGD 10,302- 101- 51- B
SP6DVP 6,384- 86- 37- B
SP6OYY 1,972- 34- 29- B
SP7IIT/A 7,600- 49- 38- C
SP5JTR 2,640- 33- 20- C
SP1PBW (SP1s AMU,BZZ ops) 45,790- 241- 95- D

SV6MC 4,824- 67- 36- B
SV9ADH 176,320- 577- 76- C
TF3SD 11,808- 68- 41- C
UA1OT 2,128- 26- 19- C
UA2FZ 90,472- 273- 86- A
RA3RN 16,470- 162- 27- A
UA6ADC 246,180- 1119- 110- B
UA4NC 20,160- 210- 48- B
UA3DJY 118,560- 380- 78- C
UA3LAR 7,560- 71- 26- C
UV6HFK 1,768- 25- 17- C
UT4UZ 361,998- 1034- 119- A
UY5TE 111,544- 454- 73- A
UB4TWL 20,080- 170- 54- A
RB5QW 7,722- 80- 27- A
UB5WDD 6,900- 59- 25- C
UB4WZA (UB5s WBY,WCX, WGR,ops) 772,212- 1516- 128- D

UC2WO 1,848- 42- 22- B
UC2ADX 20,020- 138- 35- C
RC4OA 258,332- 550- 131- A
RC4OZ 58,520- 266- 55- C
UP2BZ 123,496- 357- 86- C
UP2FF 18,560- 116- 40- C
UP1BYL (UP8BA,UP2s 038-1162, 038-2527,ops) 99,360- 401- 80- D

UQ2GMB 5,544- 60- 22- C
UQ1GXT (2 ops) 455,960- 815- 180- D

UR2RHF 350,208- 768- 114- C
Y48YN 87,360- 240- 96- A
Y22WF 76,208- 433- 88- A
Y57ZL 53,040- 200- 85- A
Y56WG 12,814- 80- 43- A
Y21DG/A 7,896- 84- 47- A
Y66ZF 4,312- 49- 28- A
Y22EK 172,020- 705- 122- B
Y26DO 73,352- 346- 106- B
Y43XE 47,200- 295- 80- B
Y26XO 15,750- 105- 75- B
Y24MB 3,192- 57- 28- B
Y22BF 1,680- 35- 24- B
Y24NN/A 1,000- 25- 20- B
Y33VL 372,736- 832- 113- C
Y22UB 75,168- 213- 87- C
Y23CM 22,440- 99- 55- C
Y23YE 18,800- 100- 47- C

YO8KOS 33,744- 168- 57- A
YO7BGA 28,866- 180- 51- A
YO2ARV 9,680- 93- 40- A
YO6BZL 29,640- 247- 60- B
YO3DCO 19,404- 154- 63- B
YO8AII 13,158- 129- 51- B
YO2BP 54,528- 201- 71- C
YO3AC 26,880- 120- 56- C
YO5BQ 21,896- 115- 46- C
YO8BOI 18,020- 85- 53- C
YO8KZD (YO8s CQQ,DDP,EB,ops) 213,696- 732- 96- D

YU2W (YT2FI,op) 687,888- 1101- 204- A
YU7GW 220,704- 644- 114- A
YU2QU 215,930- 441- 143- A
YZ1Z 128,064- 537- 67- A
YU3SB 38,940- 329- 59- A
YZ1E (YU1EXY,op) 330,000- 1375- 120- B
YU3EF 88,920- 468- 95- B
YU7RU 2,550- 51- 25- B
YU3GO 683,840- 1381- 120- C
YT2IX 417,928- 868- 119- C
YT2D (YU2SD,op) 365,040- 770- 117- C
YU3BU 316,004- 767- 103- C
YU7SF 172,608- 459- 93- C
YT3AU 33,948- 201- 41- C
YU7LS 30,000- 124- 60- C
YU7KM 25,272- 117- 54- C
YU5GX 14,652- 99- 37- C
YU3HR (+YU3BQ) 825,604- 1452- 202- D
4N2D (YT2DU,YU2s FK,WQ,ops) 678,960- 1262- 180- D
YU3M (YT3s FM,GP,UG,RO,YU3s GQ,PG,ops) 546,414- 988- 187- D
4N4K (YU4s MV,XA,RS-4786,ops) 71,280- 262- 88- D

North America

C6AN4JQQ 285,714- 1287- 111- B
N4RP/C6A 38,520- 168- 55- C
HI3AMF 20,904- 201- 52- B
HI8LC 18,216- 99- 46- C
HP1AC 156,612- 414- 93- C
KG4OM 35,154- 279- 63- B
KP2N 103,304- 332- 74- C
WP4GQB/N 25,728- 402- 32- B
NP4CC (+NP4Z) 1,982,730- 2984- 265- D
OX3ZM 39,312- 234- 84- B
TG9GI 586,880- 2240- 131- B
TE5T 91,696- 248- 88- A
TI2DB 213,908- 1009- 106- B
VP2M/ND3A (+WB3FSB) 1,402,080- 2300- 230- D
KA3B/VP5 758,172- 2747- 138- B
XE1XIV 273,924- 885- 126- A
XE2KHG 16,464- 168- 49- B
XE1OC (+XE1OX) 86,580- 481- 90- D
XE1TSR (XE1s THR,TSR,ops) 76,800- 450- 85- D
YS1OD 28,380- 215- 66- B
ZF2AG (N8AG,op) 227,630- 1105- 103- B

Oceania

4D9RG 227,552- 1094- 104- B
FO5IW 80,850- 525- 77- A
JH7EAY/JD1 32,214- 413- 39- B
KH2D 1,270,120- 1906- 226- A
KH2CY 3,444- 82- 21- B
KX6HE (N2PC,op) 128,160- 417- 89- A
KX6TY (K5SH,op) 202,852- 1079- 94- B
VK1RJ 215,424- 1056- 102- B
VK2KL 70,550- 425- 83- B
VK2AYK 38,688- 312- 62- B
VK5WO 13,420- 110- 61- B
AX4XA 313,944- 762- 103- C
VK8AV 305,340- 720- 105- C
VK4TT 281,248- 748- 94- C
VK2APK 193,488- 556- 87- C
AX2BQQ 89,096- 361- 74- C
VK4XW 6,048- 84- 18- C
VK2MAG (+VK2XJX) 51,380- 366- 70- D

YB3ASQ 176,640- 620- 120- A
YB2CR 68,586- 497- 69- B
YC6INU 10,912- 124- 44- B
YB6ATB/3 (PA6LOU,op) 97,308- 477- 51- C
YB2FEA 53,460- 243- 55- C
ZL1ANJ 616,176- 2334- 132- B

South America

CE3BFZ 485,078- 933- 187- A
CE3NR 241,758- 999- 121- B
HC1OT 625,820- 2158- 145- B
HC1KQ 144,402- 587- 123- B
HC2G (HC2s CG,DZ,FU,RG,SL,ops) 2,446,830- 3150- 279- D
HK1LDG 551,980- 2123- 130- B
HK4HHG 148,114- 719- 103- B
AZ4F (LU2FFD,op) 977,952- 2928- 167- B
LU2FYU 211,108- 887- 119- B
LU8FDZ 98,072- 533- 92- B
LU1HE 81,804- 401- 102- B
LP2U 1,752,072- 2552- 254- D
LU9JTC 79,040- 416- 95- B
LU6U (LU6UO,op) 472,624- 1084- 109- C
LU1EWL 140,080- 404- 85- C
LP2U 1,752,092- 2552- 254- D
LR1V (LU2YE,LU1VK,LU1VM, LU1VV,ops) 1,320,872- 1870- 229- D
LU7D (LU3EGT,LU5DU,LU6s DH. DTS,LU7s DDC,DID,LU8s EGO,EYE,LU9s DVV,DXM,EUS, LW1EMY,ops) 230,384- 836- 119- D
L6D (LU4DM,LU8DWN,LU9DUW,ops) 101,528- 496- 98- D
OA4ZV 307,800- 797- 95- C
P40V (AI6V,op) 2,393,188- 3716- 254- A
P43GR 333,792- 732- 114- C
PP8WHL 1,560- 36- 13- A
PY3OL 147,056- 728- 101- B
PY3TD 82,992- 266- 78- C
PY7AA 25,704- 153- 42- C
PY5ZBA(+PY5CW) 1,856,480- 2340- 283- D
YV6CAX 659,974- 2773- 118- B
YX7A (YV5QP,op) 5,500- 55- 25- C
ZP5XDW 5,040- 45- 28- C

W

1

Connecticut

K1YRP 510,000- 912- 170- A
NE1A 181,272- 537- 91- A
WE6G 78,260- 328- 103- A
KY1T 48,706- 169- 71- A
WIVH 38,308- 155- 61- A
KA1MXZ 34,350- 223- 75- A
W1BIH 18,526- 100- 59- A
NI1L 14,304- 103- 48- A
K1VKO 10,032- 97- 38- A
W1IVB 9,460- 104- 43- A
W1WEF 708,192- 2459- 144- B
N8RA 486,350- 1775- 137- B
KC8PE 339,552- 1296- 131- B
KA1ION 328,252- 1198- 137- B
KB1IL 93,372- 502- 93- B
N1ENV/T 47,208- 281- 84- B
NU0X 46,926- 297- 79- B
N1ABY 36,062- 247- 73- B
N1FHR 19,642- 181- 61- B
N1FNV/T 17,278- 183- 53- B
WB1EPO 8,118- 99- 41- B
WA3VIL 1,872- 36- 26- B
KA1LYF/T 1,080- 45- 12- B
K1WVX 836- 22- 19- B
WB3IOS/T 420- 15- 14- B
K1XA 769,000- 1533- 125- C
K3FN 296,712- 621- 117- C
KA1RPQ/N 217,668- 539- 97- C
KA1LBV/N 159,960- 420- 93- C
N4XR 66,820- 257- 65- C
KA5GIS/1 48,564- 159- 71- C
AB1U 48,360- 183- 65- C
W1CNU 38,796- 178- 53- C
N1GAU (+N1GAT) 38,202- 208- 59- D
W1ORS (K1s OCR,TMW,KA1s JKT, NOW,OUS,RQA,SMU,W1FMU,ops) 20,350- 178- 55- D

Eastern Massachusetts

KQ1V 521,700- 1169- 185- A
K1CLN 434,576- 1333- 157- A
N1EDM 113,752- 333- 118- A
W1AX 70,374- 200- 111- A
WB2DND 66,930- 277- 97- A
NA1G 49,728- 173- 84- A
KA1MX 23,184- 149- 63- A
K1XM 15,092- 100- 49- A
AB1A 267,764- 1022- 131- B
W1KRS 83,220- 365- 114- B
KA1AMR 80,262- 441- 91- B
N1FYZ 12,078- 99- 61- B
W1TUM 2,200- 50- 22- B
WA1PLK 1,980- 45- 22- B
W1LUG 308- 14- 11- B
KT1O 145,168- 420- 86- C
W1IHN 111,360- 348- 80- C
KQ1F 25,376- 122- 52- C
W1FJ 20,000- 100- 50- C
K1IJU 19,404- 99- 49- C
KB1VL 8,760- 72- 30- C
KX1G (+AB1X,KG1V) 1,170,624- 1807- 224- D
W1XS (+K1ZZJ,KA1PES,KB1KA, KC1s HI,JM,N1s DZJ,FLO,NQ1F, K2TGX,KD2SX) 1,021,724- 1660- 242- D
NC1M (K1FFX,KA1s MEN,PHA,ops) 376,000- 852- 200- D

Maine

N1AHG/T 18,720- 152- 60- A
K1UO (N1ATO,op) 542,164- 2023- 134- B
KA1DZP 10,152- 94- 54- B
KA1SSU/N 9,000- 100- 45- B
W1XN 94,860- 273- 85- C
N1AFC 37,052- 157- 59- C

New Hampshire

KM1H (KQ2M,op) 1,818,410- 2325- 271- A
AC1J 57,138- 259- 89- A
KT1H 21,384- 131- 66- A
KA1ORB 91,168- 407- 112- B
KA1OEO/N 48,894- 281- 87- B
NE1K 23,364- 177- 66- B
KA1RYI 14,382- 141- 61- B
KA1SHC 2,378- 41- 29- B
KV1E 523,320- 1244- 105- C
K1TR 103,584- 332- 78- C
W1FZ 4,536- 42- 27- C

Rhode Island

W1RFO 26,572- 116- 73- A
K1NG (KI1G,op) 933,900- 2830- 165- B
K1IU 511,024- 1681- 152- B
KA1TS 251,968- 1016- 124- B
KB1EM 146,448- 1017- 72- B
K1PLX 26,740- 191- 70- B
W1GL 781,544- 1511- 126- C
K2MN 14,940- 80- 45- C

Vermont

W2AX 569,640- 948- 202- A
WB1GQR (WB2JSJ,op) 535,040- 2268- 140- B
KA1NRR/T 115,204- 694- 83- B
KA1RRX/N 22,016- 172- 64- B
W3LPR 14,256- 132- 54- B
KA1RQY 14,200- 142- 50- B
N1FKV 2,944- 64- 23- B
KA1OVA 2,850- 55- 26- B
K1IK 468,288- 1084- 108- C
W3SOH 147,768- 385- 94- C
KA1KLJ/T (+KA1KLI) 35,560- 254- 70- D

Western Massachusetts

K1DKX 632,420- 912- 208- A
KZ1M 137,004- 480- 98- A
WA1ZAM 79,464- 305- 129- A
KY1H 14,892- 93- 73- A
K1SF 236,750- 947- 125- B
W1EQO 4,332- 57- 38- B
KB1W 128,016- 381- 84- C

2

Eastern New York

K3EW 1,161,576- 1755- 234- A
N1CC 680,080- 1231- 185- A
KC2QF 477,600- 875- 199- A
KF2O 376,240- 671- 192- A
KB2EMB 10,290- 100- 49- A
N2BJ 575,736- 1932- 149- B
WB2EAR 238,476- 1169- 102- B
WA2EOU 206,340- 905- 114- B
WG2E 81,812- 362- 113- B
WB1BTJ/T 31,440- 262- 60- B
N2HIG 21,988- 171- 64- B
KN2Q 14,310- 159- 45- B
KE2DF 12,600- 126- 50- B
N2FS 11,400- 114- 50- B
KB2EIK 7,252- 98- 37- B
N2HT1 4,560- 57- 40- B
N2AZS 676,320- 1397- 120- C
KU2Q 586,696- 1242- 118- C
W2NRD 54,984- 171- 79- C

NYC-Long Island

KK2E 419,988- 758- 186- A
WA2MUA 397,546- 704- 197- A
W2GKZ 70,028- 217- 82- A
K2HVN 25,114- 181- 58- A
KA2ZYX 19,502- 102- 49- A
KA2RSJ/N 10,350- 95- 45- A
WB2RCJ (K2HVN,op) 3,250- 39- 25- A
WB2PWR 151,200- 700- 108- B
KS2G 137,088- 672- 102- B
W2MOY 84,816- 372- 114- B
W2KZE 59,572- 281- 108- B
KD2BW 45,936- 284- 87- B
WA2SVT 20,172- 123- 82- B
WA2GMC 11,682- 99- 59- B
N2DNY 10,374- 91- 57- B
AC2P 8,470- 77- 55- B
WA2CJK 7,800- 100- 39- B
N2EHZ 32- 4- 4- B
WB2AMU 157,192- 392- 98- C
K2YGM 100,480- 313- 80- C
N2DTW 63,616- 268- 76- C
W2KTF 58,220- 199- 71- C
WB2DLA 45,076- 187- 59- C
N2ES 42,240- 163- 64- C
N2GPA 3,612- 43- 21- C

Northern New Jersey

WA2IKL 651,222- 1211- 207- A
AE2A 587,308- 1717- 122- A
KD2UF 214,473- 452- 147- A
WA2UDT 166,750- 526- 125- A
KT2D 42,240- 203- 80- A
WA2VUM 161,840- 680- 119- B
W2FCR 133,440- 556- 120- B
KE2CG 84,000- 350- 120- B
K4BNC 60,762- 247- 123- B
NX2V 30,618- 189- 81- B
N2HMM 26,640- 150- 74- B
WB2JTE 11,584- 118- 49- B
KZ2S 718,812- 1449- 123- C
K2TW 656,384- 1282- 128- C
N2EOC (N2CEI,WB2ONH,ops) 677,600- 1371- 200- D

Southern New Jersey

N2AA 1,411,732- 1871- 254- A
K2PS 556,226- 950- 193- A
K2ZA 66,356- 215- 108- A
N2ETJ 163,020- 741- 110- B
KA2TDC/N 27,594- 188- 73- B
W2CKJ 8,954- 61- 57- B
N2AWL 4,464- 72- 31- B
N2GZL 306,592- 517- 96- C
W2NZH 100,640- 334- 74- C
W5KI 11,088- 75- 36- C
N2NU (+WA2IUO) 1,117,680- 1669- 235- D
WA2TMZ (+KD2I) 630,772- 1172- 206- D
K2AA (AB2Y,KA2YKN,N2s GUW,HOL, W2FKB,WB2OEZ,KA3LCF,ops) 148,372- 757- 98- D
N2RCF (+K2NH) 68,338- 244- 94- D
KA2RRK/N (+KA3JSO) 4,575- 41- 26- D

Western New York

WJ2O 248,518- 529- 137- A
WF2L 182,878- 456- 131- A
K2QR 168,000- 384- 150- A
N2WK 15,840- 112- 69- A
W2OMV 4,224- 59- 32- A
N4TW 484- 18- 11- A
KM2P 362,336- 1352- 134- B
NS2P 132,000- 750- 88- B
KB2EMU 105,252- 537- 98- B
KB2SE 54,600- 309- 91- B
N2GQF 34,008- 218- 78- B
WE2T 32,528- 214- 76- B
KA2AWE 29,896- 202- 74- B
KA2VCW 19,278- 153- 63- B
KB2CHV 5,920- 80- 37- B
W2JRI 1,480- 64- 35- B
K2SM 135,168- 377- 68- C
KW2J 88,920- 285- 78- C
KU2A 70,720- 221- 80- C
W2FUI 58,616- 213- 69- C
WA2EYA 29,328- 135- 52- C
W2GJ 19,920- 87- 47- C

3

Delaware

K3WUW 158,800- 499- 100- A
N3DLM 120,540- 304- 123- A
KD3JQ 209,505- 979- 107- B
K3SHD 50,940- 283- 90- B
N3DNX/T 4,080- 51- 40- B
KV3U 3,072- 64- 24- B
K3HBP 177,068- 450- 96- C

Eastern Pennsylvania

WB3FED 393,420- 790- 166- A
N3ED 391,419- 688- 189- A
NE3I 288,576- 582- 167- A
KA3ROF 191,142- 572- 111- A
K3TEJ 156,032- 409- 106- A
K3WW 115,236- 375- 97- A
NK3U 51,110- 219- 95- A
KC3LM 46,080- 200- 80- A
W3GBG 37,332- 203- 81- A
WA3IIA 37,204- 188- 71- A
K3QO 29,820- 206- 70- A
WB3CMH 21,580- 154- 65- A
KA3AFY 7,392- 64- 28- A
AG3G 2,688- 36- 21- A
WB3KTX 328,344- 1328- 124- B
N3GOW 45,030- 285- 78- B
N3FOG/T 18,810- 151- 65- B
WA1MKE 8,820- 105- 42- B
KA3TAD 6,588- 89- 37- B
WB3FAA 4,690- 67- 35- B
WA3YTT 2,500- 50- 25- B
N3GNW 1,430- 95- 19- B
KY3K 308,432- 678- 112- C
KL7HIR/3 58,904- 199- 74- C
KC3Q 22,080- 115- 48- C
WA3VFM 19,516- 119- 41- C
W3CEI 8,556- 69- 31- C
KQ3V (+K3ZLK,KA3s DSW,PLC, KD3JC,N3s CHL,FTI,WA3LFY, WB3s EPW,FYL) 797,184- 1663- 199- D
KA3SIO (+KT2B,KD3GC,N3FZH, AA4II,WD9EQD) 784,108- 1422- 221- D
W3BGN (+NET) 74,772- 280- 93- D
KA3QLF (+WB3KFJ) 57,036- 294- 97- D

Maryland-DC

K3ZO 1,470,280- 2219- 235- A
WB3LUI 280,162- 753- 124- A
K3IMC 205,718- 657- 149- A
K4CGY 101,454- 454- 111- A
W3HVM 61,944- 223- 89- A
WA3EOP 46,268- 257- 72- A
N3ES 23,808- 159- 64- A
WB2EKK 18,080- 124- 47- A
K3SA 10,494- 91- 33- A
WA3YVT 3,540- 55- 30- A
W3LPL (WA8MAZ,op) 749,176- 2531- 148- B
WA3SQU (W3IDT,op) 340,032- 1288- 132- B
N3AOE 285,120- 1080- 132- B

Angela, (age 12), N7KAR, Brian (age 8), N7LJV, and Joshua (age 12), N7KAN, operating WO7F from sunny Arizona.

The multiop crew of HC2G turned in a fine effort to win first-place DX.

Carl, P40V, relaxing after winning first-place DX mixed-mode from Aruba.

WB2BZR/T	36,980-	215-	86-	B
KA3TIU/T	29,088-	202-	72-	B
KA3TMI/T	27,548-	194-	71-	B
KD3IQ	27,324-	198-	69-	B
W3PWO	23,166-	117-	99-	B
NS3T	10,070-	95-	53-	B
KA3CXG	6,624-	72-	46-	B
KA3QER	1,656-	46-	18-	B
KA3TUE	1,260-	30-	21-	B
W3USS (AA4U,op)	577,412-	1187-	121-	C
W3GN	339,680-	771-	110-	C
W3FX	102,172-	286-	89-	C
KB3HH	25,300-	115-	55-	C
WB3CDX/T	720-	14-	12-	C
K3YGU (+NET)	710,424-	1031-	198-	D
W3GG (+N3CDB)	394,956-	887-	159-	D
K3AA (K3ZNV,KA3s PMX,QDJ,KX3U, KZ3F,N3s FUL,TE,NA3Q,ops)	345,828-	750-	179-	D
K3IVO (K3YDX,KA3NZR,N3s CBJ, DCI,GGP,NN3O,KA4RHS,WB6VGI, ops)	235,744-	779-	139-	D

Western Pennsylvania

K5ZD/3	209,752-	437-	167-	A
W3KH	122,292-	443-	129-	A
K3LVO	6,720-	62-	30-	A
WA3INX	5,624-	64-	38-	A
N3GLK/T	3,168-	55-	22-	A
W3DKL	21,280-	152-	70-	B
WA3GQU	4,752-	72-	33-	B
K3UA	445,068-	951-	117-	C
K3MD	98,400-	328-	75-	C
KA3MMM	71,808-	264-	66-	C
W3YA (K3s CM,LVO,WB3CXR,ops)	10,712-	103-	52-	D

4

Alabama

K4NNQ	52,680-	239-	70-	A
WZ4F	49,096-	320-	76-	A
N4SFR	5,880-	82-	35-	A
AA4LE	116,480-	560-	104-	B
KA7WPD/T	73,528-	404-	91-	B
KE4BM	64,484-	329-	98-	B
AA4UF	25,102-	163-	77-	B
WB4OEE	25,080-	209-	60-	B
KB4CVN	1,872-	36-	26-	B
N4JF	147,680-	351-	104-	C
WA4QBX	113,344-	301-	92-	C
KD4TT (+KK4TE)	308,880-	1188-	130-	D

Georgia

K4JPD (KM9P,op)	1,571,094-	2167-	259-	A
K4SB	1,055,108-	1421-	243-	A
K4BAI	178,944-	384-	128-	A
AB4LX	13,938-	80-	52-	A
KX4R	476,652-	1518-	157-	B
N4REE	33,440-	209-	80-	B
KC4DOO	6,336-	96-	33-	B
KN4B	283,600-	709-	100-	C
N8LM	55,008-	191-	72-	C
N4UZ	24,072-	117-	51-	C

Kentucky

WA4QMQ	281,936-	1052-	134-	B
KB4SQG	80,080-	385-	104-	B
KB4ZAX	45,288-	306-	74-	B
KI4QJ	23,954-	203-	59-	B
KB4YJG	17,180-	130-	66-	B
N4OHW	1,820-	35-	26-	B
N4AR	729,000-	1456-	125-	C
N4TBJ (+KU8E,N4DBR,NV4H,WM4T)	1,032,384-	1512-	228-	D
K4CO (N1ZA,AF4Y,KK4DO,N4GNL, NG4M,ops)	184,392-	495-	156-	D
WD4CRG (+N4DIT)	140,812-	658-	107-	D

North Carolina

WD4OHD	70,720-	243-	104-	A
KF4HK	152,830-	527-	145-	B
AB4LR	85,440-	445-	96-	B
KC4FGG	49,136-	332-	74-	B
WJ4T	21,016-	142-	74-	B
WA0WAU	7,830-	87-	45-	B
KC4GCK	6,790-	97-	35-	B
K4PQL	464,640-	959-	121-	C
N4MO	351,440-	764-	115-	C
N4QVM	13,448-	75-	41-	C
N4QEO	11,988-	77-	37-	C
W4UW	6,032-	52-	29-	C
AA4NC (+AA4VK,K4CIA,N4SF)	1,258,488-	2022-	222-	D
K5CTG (+K4JEX,KB4IL,WD4HMA)	792,084-	1578-	221-	D
KB4QLZ (KB4FWN,KC4HIW,ops)	112,050-	675-	83-	D
WB4FTI (+KB4NFY,KC4GRU)	81,988-	398-	103-	D
K4EG (KA4OVZ,KB4s KNQ,TDF, N4RMY,WB4SGA,ops)	66,240-	265-	82-	D

Northern Florida

N4EEB	1,003,794-	1914-	201-	A
W4WKQ	259,720-	641-	151-	A
K4XS	797,034-	2711-	147-	B
N4MAD	48,616-	238-	103-	B
W4NVV	44,892-	261-	86-	B
WA4VIY	41,934-	241-	87-	B
W4NN (KA1GMN,op)	36,720-	255-	72-	B
N4PSD/T	21,696-	226-	48-	B
KD4FG	19,500-	150-	65-	B
N4SQC/T	6,320-	79-	40-	B
AB4BZ	4,224-	64-	33-	B
W2LRJ	2,160-	43-	25-	B
WC4E	735,584-	1448-	127-	C
KD1U	109,536-	319-	84-	C
KC4CSD	64,988-	207-	77-	C
WA4SSB	46,200-	172-	66-	C
KK4RV	17,460-	95-	46-	C
WT4A (+KB4HF,KC4s GTR,GTW, KU4F,N4QEE,KØOO)	689,688-	1147-	206-	D

South Carolina

N4QWL	43,070-	272-	73-	A
WF2G	15,812-	124-	59-	A
N4RYO	5,148-	59-	33-	A
WD4BHM	26,134-	179-	73-	B
KA2CUF/T	9,222-	87-	53-	B
KA4TUT	7,462-	91-	41-	B
N4SFY/T (+N4SZE)	43,952-	178-	67-	D

Southern Florida

WB4BBH	398,208-	721-	183-	A
K1TN/4	373,394-	639-	179-	A
K4GKD	57,720-	214-	78-	A
N4ONQ/T	26,240-	111-	80-	A
N4TXR/T	10,440-	127-	36-	A
W3BUC	85,282-	479-	89-	B
KC2KU	68,016-	327-	104-	B
KD7GD	28,726-	271-	53-	B
K1FJM/4	25,740-	195-	66-	B
KC4GFW/N	22,302-	177-	63-	B
KR4U	15,544-	134-	58-	B
WK4F	11,130-	105-	53-	B
N4BP	608,392-	1345-	113-	C
K4MF	416,240-	937-	110-	C
WD4AHZ	340,400-	724-	115-	C
W4WWW (+AL7DL,K4AFZ,KA4LBU, KD4S,KR4X)	550,900-	1455-	175-	D

Tennessee

N4RFV	28,024-	228-	62-	B
N4SFO	216-	12-	9-	B
W4XJ	495,808-	1045-	116-	C
K4LTA	450,684-	957-	117-	C
N4IR	415,584-	933-	111-	C
N4ZZ	316,292-	739-	107-	C
K4AMC	230,680-	597-	95-	C
KI4UZ	203,648-	592-	86-	C
N4JRG	50,960-	180-	70-	C
KS2X (+KA2PGW)	84,240-	540-	78-	D

Virginia

WB8HDD	397,212-	1122-	158-	A
W1WTG	57,856-	208-	113-	A
WA4YBV	289,674-	1089-	133-	B
W4TMN	31,108-	379-	107-	B
N4NPX	51,522-	277-	93-	B
N4XD	61,282-	333-	77-	B
KC4HN	42,212-	173-	122-	B
AA4IC	18,370-	167-	55-	B
W4KMS	15,544-	116-	67-	B
N4MM	14,112-	112-	63-	B
K4PXO/T	9,374-	109-	43-	B
W4KSV	782-	23-	17-	B
W4YE	190,944-	457-	104-	C
W4NPX	167,400-	450-	93-	C
K4BAM	57,096-	233-	61-	C
AA4NG	31,860-	134-	59-	C
K8ETM	22,848-	118-	48-	C
WA4ITY (+KB4OLM,KC4IDJ,KJ4OP, W4XD,WA4ITY,WB4PJW,ops)	329,896-	619-	172-	D

5

Arkansas

KA5DAN	158,976-	571-	108-	A
W5EIJ	75,684-	235-	106-	A
N5KKD	69,732-	419-	78-	A
K5FUV	21,400-	214-	50-	B
WA5UCT	18,600-	156-	60-	B
WA5VWH	13,420-	122-	55-	B
N5LEK	240-	12-	10-	B
WD5BIV	59,496-	219-	67-	C

Louisiana

W5WMU (KZ5D,op)	1,578,368-	2548-	236-	A
W5EW	148,304-	670-	104-	A
WB5SKQ	197,000-	788-	125-	B
WB5SSD	162,004-	802-	101-	B
W5MUG	41,400-	230-	90-	B
K5KLA	33,558-	329-	51-	B
KC5BH	4,200-	75-	28-	B
KA5QPI/T (+N5JMO)	86,976-	423-	96-	D

Mississippi

W5XX	933,570-	1580-	207-	A
KB5ECK/T	80,510-	485-	83-	B
N8DTW	25,856-	202-	64-	B
W5NCB	3,300-	50-	33-	B
WQ5L	246,272-	589-	104-	C
WD5JZL (+KA5BEE,WD5GJS)	541,100-	1019-	175-	D

New Mexico

K7UP	989,728-	1694-	197-	A
KA5FSB	206,692-	976-	99-	A
W7LHO	110,670-	300-	119-	A
N5EZA	134,518-	653-	103-	B
N5MBD	42,672-	254-	84-	B
KN5S	6,040-	134-	30-	B
KF7E	366,768-	849-	108-	C
W5YZ	286,752-	617-	116-	C
W5OBT	74,784-	280-	57-	C
W5LTR (+KI3L,AA5B,K5TA)	1,480,256-	2602-	229-	D
N7KA (+AI9X)	1,260,092-	2287-	211-	D
WS5O (+KE5BL,NC5O,W5OLN)	991,328-	1702-	208-	D

North Texas

N5LXD	43,884-	318-	69-	B
KG5NE	11,160-	124-	45-	B
KB5GEO/T	180-	15-	6-	B
K5NW	615,368-	1261-	122-	C
W5UDA	307,776-	684-	112-	C
N5AW	213,384-	519-	102-	C
KD5PJ	53,592-	231-	58-	C
W4YOK	53,320-	209-	62-	C
WH8AYI/5 (W5ONL,op)	43,200-	187-	54-	C
KL7FDO/5	22,000-	120-	44-	C
W5CMX	14,080-	88-	40-	C
N5HD (+KT5V)	740,128-	1109-	202-	D

Oklahoma

KB5ENP	37,332-	187-	51-	A
WØRRY	100,192-	496-	101-	B
K5GL	15,360-	128-	60-	B
KA7ARC	8,820-	98-	45-	B
N5LGF	2,346-	51-	23-	B
WM4Z	383,984-	932-	103-	C
KM5H	341,972-	799-	107-	C
KO5D	109,020-	342-	79-	C
K5CM (+N5s CG,KW)	1,180,880-	2199-	210-	D

South Texas

AD5Q	1,146,912-	1820-	208-	A
KC5CP	270,648-	1050-	126-	A
NR5M	845,460-	2745-	154-	B
W5VX	774,690-	2635-	147-	B
N5DDO	491,776-	2176-	113-	B
WU5Z	212,544-	984-	108-	B
WA5IYX	136,040-	716-	95-	B
W5UFA	49,248-	304-	81-	B
WB8YEA	23,360-	167-	70-	B
WA2VJL	15,960-	140-	57-	B
N5INV	4,624-	68-	34-	B
K5WA	507,152-	1088-	116-	C
WV5K	161,920-	459-	88-	C
K5HKX	136,080-	378-	90-	C
AK5E	86,760-	237-	90-	C
W6ASP	80,600-	310-	65-	C
WB5RUS (+K5LZO)	875,637-	1729-	189-	D
WN4KKN/5 (+NET)	338,100-	472-	245-	D
NZ5T (+KG5G)	151,280-	548-	124-	D

West Texas

WF5E	442,860-	1815-	122-	B
K5IS	10,716-	94-	57-	B
KE5GO	42,840-	240-	42-	C

6

East Bay

WR6R	475,890-	1593-	145-	A
N6EK	375,688-	763-	151-	A
K6SIK	104,328-	332-	126-	A
K6CSL	62,020-	267-	70-	A
WX6M	284,460-	1293-	110-	B
N6CCL	258,468-	1267-	102-	B
W6RPY	10,152-	108-	47-	B
N6TIQ	3,224-	52-	31-	B
KS6H	311,220-	818-	95-	C
KJ6FY (+KE6IA,KG6LY,N6ERR)	16,500-	138-	50-	D

Los Angeles

WA6AJB	34,928-	148-	59-	A
KC6AWS/N	8,272-	90-	44-	A
WB6NFO	65,688-	357-	92-	B
KI6SU	52,104-	334-	78-	B
N6GL	103,680-	324-	80-	C
W6BIV	93,936-	303-	76-	C
K1EQA	46,056-	199-	57-	C
W6CN	41,140-	184-	55-	C
WB6RXE	14,080-	88-	40-	C
AE6E (+AD6C)	1,078,480-	1893-	221-	D
KC6W (+WA2BWO,KI6CM,WU6L)	36,648-	186-	73-	D

Orange

KB6RXF	603,408-	1561-	156-	A
WB6OWD	82,740-	335-	105-	A
KH6WZ/K6	30,686-	201-	67-	A
W6TKV	163,200-	1020-	80-	B
WA6GFR	18,810-	165-	57-	B
N6TJK/T	13,720-	140-	49-	B
N6RNG/T	2,496-	48-	26-	B
NI6W	171,080-	468-	91-	C
W6SX	10,944-	76-	36-	C

Pacific

AH6IM	80,250-	268-	107-	A
WH6I	71,060-	272-	95-	A
NH6HF/T	127,170-	785-	81-	B
NH6GJ	14,758-	157-	47-	B
KH6BI	13,680-	120-	57-	B
WL7E/KH6	306,240-	870-	88-	C
AH6JF	86,580-	328-	65-	C
AH6IO (+NH6s PX,QC)	175,340-	735-	110-	D

Santa Barbara

WA6FGV	565,720-	1288-	161-	A
N6NMH	268,830-	577-	145-	A
W6AB (N6GC,op)	254,208-	883-	98-	A
N6QOA	20,880-	174-	80-	B
W6OUL	209,492-	631-	83-	C
AA6EQ	69,632-	260-	64-	C
KI6QE (+W6JU)	156,538-	458-	83-	D

Santa Clara Valley

NS6V	449,020-	1013-	143-	A
AD6E	244,958-	491-	137-	A
W6PLJ	68,640-	227-	104-	A
N6NF	54,288-	350-	58-	A
KJ6MW	51,878-	391-	66-	A
AG1H	23,030-	163-	49-	A
K6HNZ	574,080-	2392-	120-	B
WA6HRK	21,888-	192-	57-	B
KA6WWT	21,560-	154-	70-	B
KA6ING/T	19,592-	158-	62-	B
KJ6NN	18,960-	158-	60-	B
N1EE/6	16,450-	175-	47-	B
N6HQY	12,936-	132-	49-	B
WY6U	2,300-	46-	25-	B
KB6ETA	950-	25-	19-	B
N6ZB	318,060-	825-	95-	C
W6RVY	44,232-	187-	57-	C
W6BKY	33,600-	161-	50-	C
N6YE	15,520-	91-	40-	C
W6YVK	12,324-	66-	39-	C
KB6FPW	1,176-	19-	14-	C
N6TU (+N6RZ,WB6SHD,ops)	1,453,710-	2539-	235-	D
K6YA (K6MA,KA6FEC,N6s BIS,IIU, NDB,W8ASH,WA6s AOF,ZBX, WB6W,ops)	716,496-	1593-	177-	D
K6TMB (+KA6W)	362,710-	1577-	115-	D
KI7N (+KA7EXM)	170,970-	496-	123-	D
N6RER (+K6KM)	27,720-	210-	66-	D

San Diego

W6UQF	594,832-	969-	188-	A
W6PU	447,772-	1191-	158-	A
KB6PJU/N	244,816-	1103-	104-	A
KF6BB	27,720-	252-	55-	B
W6MVW	63,756-	231-	68-	C
K6NA	18,000-	100-	40-	C
AA6EE	3,888-	56-	27-	C
N6ND (+KI6MS,K9VV)	1,511,640-	2618-	234-	D
K6JYO (+KB6SAR,WB6OKK)	1,395,900-	2227-	235-	D
k6HAI (K6s OBS,PD,KA6VCD,KB6s FHN,ZQX,KW6V,N6OVR, W6s EHR,JXA,OVO,ZBE,WB6s BDY,LLO,WA8QXO)	285,192-	646-	153-	D

San Francisco

WB6SKU	84,860-	292-	102-	A
K8LVD	52,140-	330-	79-	B
KI6QT	33,852-	217-	78-	B
KD6GC	130,572-	382-	81-	C
W6BIP	18,400-	100-	46-	C

San Joaquin Valley

KJ6DL	184,552-	598-	118-	A
K6YK	63,792-	245-	72-	A
KD6WW	501,630-	2181-	115-	B
KA6BIM	173,280-	825-	105-	B
N6EE	85,184-	484-	88-	B
KB6LEI	23,936-	176-	68-	B
KE6CZ	2,132-	41-	26-	B

Sacramento Valley

N6TIB	305,584-	799-	142-	A

KV6H 197,718- 1063- 93- A
N6JM 148,304- 409- 124- A
KJ6CA 46,376- 199- 68- A
K3FST 914,220- 3386- 135- B
KI6O 440,982- 2273- 97- B
KB6HWZ/T 77,448- 461- 84- B
W6BJH 317,912- 811- 98- C
N6JV 239,306- 581- 97- C
N4KS 111,088- 524- 53- C

7

Alaska

NL7GP 1,878,484- 2918- 251- A
WL7BQF/T 5,346- 81- 33- B
KL7UR 198,612- 613- 81- C
KL7GN 191,512- 624- 74- C
NL7DU 69,080- 314- 55- C
NL7KB (+AL/CC) 721,840- 2090- 140- D
KL7HKX (WA2PIV,KA7SFS,NL7NL, opsl 418,460- 1523- 122- D
NL7NB (KL7s CQ,IOL,IZC,NL7s DL, JZ,KN,NN,N9DOE,ops) 104,788- 733- 57- D

Arizona

K6LL 1,602,693- 2634- 221- A
KB7KZ 190,608- 636- 132- A
KC7V 80,964- 252- 78- A
WB7FDQ 538,704- 2088- 128- B
WR7P 140,390- 695- 101- B
K8TW 118,118- 649- 91- B
KD7JR 16,402- 139- 59- B
N7IZM 9,072- 108- 42- B
KD7E 278,584- 699- 97- C
KY7M 170,352- 607- 84- C
WB7CFL 127,800- 422- 75- C
KC7MJ 59,280- 247- 60- C
KF7B (N5AQM,W5s DBZ,VBO, KD7GL,N7s GCE,JQY,LTD,LQM, WA7NIY,WB7ASH,ops) 490,176- 1534- 148- D
WO7F (+KF7MQ,N7s KAN,KAR,LDI, LJV,KD6s H,SJ,N8ADI) 218,592- 968- 108- D

Idaho

KA7NOC 216,094- 905- 103- A
W7QDM 1,320- 25- 22- A
WA8DYU 302,880- 1035- 98- B
KA7T 284,960- 736- 80- C
KN7K 141,056- 551- 64- C
WS7U 81,496- 312- 61- C
WB7Y 14,104- 86- 41- C

Montana

N7ICC 49,266- 215- 63- A
N7HAZ 322,002- 1809- 89- B
K7GQI 28,704- 208- 69- B
KA7NCY/T 7,062- 107- 33- B
KA7HTC 5,440- 85- 32- B
KS/T 202,272- 602- 84- C
WQ7S (+N7s LDR,LSM) 201,600- 1120- 90- D

Nevada

NC7K 642,512- 1344- 172- A
WA7CWM 498,860- 921- 135- A
ND7M 488,640- 2036- 120- B
KZ4H 41,138- 407- 62- B
K7NV 40,170- 309- 65- B
WB7VVH 9,292- 101- 46- B
WB5ROY 1,380- 30- 23- B

Oregon

K6MM/7 573,036- 1337- 158- A
N8JO 358,792- 988- 148- A
AD7L 161,544- 381- 127- A
W7GUR 123,708- 326- 122- A
W7IMP 86,526- 316- 99- A
WB4IOJ 232,418- 1471- 79- B
K7VIT 56,304- 414- 68- B
KF7KY 50,468- 407- 62- B
W7EYE 47,170- 265- 89- B
KB7QXI/T 36,936- 324- 57- B
N7LTT/T 13,970- 127- 55- B
W7LI 2,842- 49- 29- B
KQ7I 379,812- 1021- 93- C
NZ7Q 138,900- 454- 75- C
KU7K 41,944- 212- 49- C
KA7FEF 33,048- 159- 51- C
KS7P 3,920- 49- 20- C
W7FJ (+N7ZT,W7ZR) 1,314,108- 2776- 211- D
AI7B (+W7XN,WB7RFA) 1,301,460- 2662- 199- D
N7EPE (KA7s RFD,UFG,KB7DWJ, N7KIH,ops) 389,298- 2090- 93- D

Utah

WE7B 780,864- 1719- 168- A
WT7D 186,010- 979- 95- B
KB7EEG 58,650- 575- 51- B
N7BRG/1 96- 8- 6- B
WA7HQD 105,816- 678- 86- C
W7TE 19,516- 197- 89- C

Washington

NG7P 527,940- 2020- 105- A
N7KZN 296,112- 796- 124- A
N7LOX 287,894- 801- 123- A
WB7EJS 124,444- 375- 106- A
WU7F 64,640- 215- 80- A
NK7V 29,064- 217- 39- A
K7IOO 205,326- 1037- 99- B
KA7MCX 172,800- 900- 96- B
WG7X 63,580- 374- 85- B
WB7CLU 51,800- 300- 86- B
WA7UGB 48,100- 481- 50- B
KY7K 34,500- 230- 75- B
W7IZP 17,400- 145- 60- B
N7LXQ 15,810- 155- 51- B
KD7LJ 14,862- 158- 47- B
K7QQ 610,880- 1328- 115- C
K7DZ 392,656- 1012- 97- C
W6KZV/7 342,936- 865- 99- C
WA7UVJ 85,680- 339- 63- C
N7ETC 80,476- 338- 59- C
N7EPD 78,372- 302- 63- C
KA7CSE 61,680- 254- 60- C
W7IEU 42,720- 175- 60- C
W7KJ 36,400- 175- 52- C
N0AX 25,192- 133- 47- C
W7QN 18,768- 100- 46- C
N7OT 9,108- 69- 33- C
K7WA 3,312- 36- 23- C
W7XR (+K7SS,W7WA) 1,397,866- 2640- 227- D
WS/I (+N7KRG,WA7EGA) 868,020- 1969- 170- D
KR7G (+KI7G) 853,146- 1681- 183- D
N7DX (+N7UZO) 84,286- 473- 67- D
K7IDX (+NET) 51,504- 147- 47- D

Wyoming

KV7L 76,032- 257- 96- A
N7GVV 136,680- 670- 102- B
WG7S 58,806- 363- 81- B
KB7M 54,000- 375- 72- B
NO7Q 26,880- 210- 64- B
KD7RX 16,310- 233- 35- B
N3AHA/7 9,072- 108- 42- B
K7MM 201,620- 591- 65- C
NC7O 61,200- 222- 68- C
WG7Z (+KB7AWM,WU7Y,WD8ENC) 381,634- 1416- 121- D

8

Michigan

KA8JBK/N 176,580- 441- 109- A
K7JBQ 114,896- 327- 128- A
K8CC (W8WD,op) 471,440- 1660- 142- B
N8CXX 291,460- 1121- 130- B
K8DJR 73,892- 377- 98- B
KE8OC 33,108- 267- 62- B
K8KUH 30,636- 207- 74- B
KE8NH 28,080- 195- 72- B
N8DDV 16,128- 126- 64- B
KE8RA 11,844- 126- 47- B
KB8DAC 6,664- 98- 34- B
N8JVZ/T 5,440- 80- 34- B
K8LJO 80,276- 321- 61- C
K8CV 23,520- 120- 49- C
W8WVU 13,596- 100- 33- C
N8FUP 7,616- 68- 28- C
K8KIR 4,836- 39- 31- C
KA8DKQ/T 704- 22- 8- C
AA8U (+AI8D,K8s EFS,MJZ, TK,KA8AEE,KB8s DLH,OF,KC8EK KD8B,N8s AW,BNE,CC,IUM,JFH, JJO,WD8s DSV,MBB) 972,036- 1702- 234- D
WB8BUQ (+N8FME,WA8RUF,WE8LI 426,756- 1217- 159- D

Ohio

WD8AUB 298,132- 604- 146- A
KE8KT 186,432- 833- 96- A
N8DGZ 128,504- 476- 120- A
KA8VPL 25,976- 183- 68- A
N8AGU 25,080- 119- 76- A
K8MR 19,712- 114- 64- A
KB8FQK 6,742- 61- 33- A
WA8RCN 4,080- 50- 30- A
W8KKF 275,536- 1013- 136- B
N8ATR 250,830- 929- 135- B
KE8FD 97,662- 397- 123- B
KA8WAS 58,464- 261- 112- B
W8MVE 49,364- 301- 82- B
N8ICW/T 43,608- 276- 79- B
W8NPF 43,160- 260- 83- B
KB8DTY 39,024- 271- 72- B
N8JNB 26,780- 206- 65- B
WD8MZH 20,280- 169- 60- B
K8KSN 19,418- 133- 73- B
WA8IMF 15,700- 157- 50- B
KA8ZEP/T 14,160- 120- 59- B
N8JIW 13,780- 130- 53- B
KE8LD 5,904- 72- 41- B
KB8CPC 4,020- 67- 30- B
KA8YKI/N 3,224- 62- 26- B
N2FRW 2,744- 49- 28- B
N8IOH 2,550- 51- 25- B
N8JXG/T 1,296- 36- 18- B
AF8C 1,160- 29- 20- B
N8JLT/T 1,020- 30- 17- B
WD8KTM 624- 26- 12- B
N8DCJ 668,528- 1311- 127- C
WA8DXB 476,268- 973- 122- C
W8FN 110,700- 369- 75- C
WF0E 86,028- 321- 67- C
W8XT 27,180- 149- 45- C
WB8WTS 2,220- 37- 15- C
N8IKX (+N8EKE,WB3KKX) 1,022,580- 1833- 234- D
WD8LLD (+KB8CMK) 776,400- 1244- 200- D
WB8IFP (+KB8CET,KD8s RO,YR,N8EZM,W8NJR,WD8s ROD,SBD) 445,730- 1537- 145- D
WB8PHI (+W8SJU,WD8LTM) 225,288- 820- 126- D
WI8T (+KC3CL,KD8MQ,KE8VE,N8s DZA,IAK) 26,784- 188- 72- D

West Virginia

KB8FJ 54,600- 224- 70- A
K3ZJ 679,024- 2294- 148- B
W8FEH 14,300- 143- 50- B
N8II 857,788- 1634- 131- C
KB0WL 10,336- 75- 34- C
N8APA (+N8ABW) 392,788- 1283- 118- D

9

Illinois

WB9Z 745,712- 1525- 223- A
KS9O 724,724- 1366- 181- A
N9JF 333,036- 661- 174- A
W9IL 225,450- 478- 167- A
N9GIV/T 99,844- 265- 109- A
WD9EXD 56,932- 232- 88- A
N9FXS/T 36,188- 201- 83- A
KA9IMX 27,040- 150- 52- A
K9UQN 19,952- 141- 43- A
ND9Y 15,608- 155- 44- A
W9REC 12,312- 72- 57- A
WD9DCW 3,036- 55- 23- A
K9MDO 295,972- 1213- 122- B
WB9W 33,120- 307- 60- B
KA9RQC 24,948- 198- 63- B
AD9K 24,120- 180- 67- B
W9KVF 13,090- 119- 55- B
KA9QIK 11,250- 125- 45- B
N9EVW 8,064- 112- 36- B
WA9DIP 2,856- 68- 21- B
NA9J 453,720- 995- 114- C
K9BG 417,088- 924- 112- C
N9AEJ 330,012- 801- 103- C
K9LJN 185,400- 515- 90- C
W9AXL 58,608- 220- 66- C
KS9U (+K9s HMB,QVB,WD9s AHU,IIC) 1,109,360- 1622- 245- D
KD9ST (KA9s SQR,SUS,SGT, KB9BAT,ops) 343,512- 1051- 156- D
WB9JKI (+WB9YPL) 274,060- 567- 142- D
WC9M (+KB9AXM,KC9DK,N9s EZC,HIV,NN9K) 21,392- 360- 97- D
N9GQE/T (+N9GQE) 32,060- 137- 70- D
KE9NB (KA9VAK) 14,560- 140- 52- D

Indiana

N9RD 757,796- 1522- 196- A
N9ACD 135,420- 378- 122- A
W9RE 129,400- 472- 75- A
NX9T 111,156- 377- 118- A
WB9CIF 102,212- 301- 101- A
K2CF 40,512- 207- 64- A
KA9SVR/T 12,870- 134- 45- A
KE9FZ 6,942- 85- 39- A
WA4VWV 533,360- 1389- 120- B
NE9O 110,000- 560- 100- B
WB9LUG 19,656- 126- 78- B
KA9CVW 18,620- 133- 70- B
K9VQK 11,648- 112- 52- B
KB9C 2,794- 48- 29- B
KA9ZFG 1,020- 30- 17- B
KA9VMU 850- 25- 17- B
W9OEH 372,384- 882- 108- C
NV9B 282,052- 650- 107- C
K9JWI 18,480- 105- 44- C
K9IJWA (+K9s HW,VFE,KA9s A,MBT, KE9AG,KR9s U,V,WD9DGA) 1,031,618- 1530- 217- D
N9QX (+KE9I) 887,922- 1595- 189- D

Wisconsin

W9OP 527,280- 1002- 195- A
WA1UJU 315,890- 700- 155- A
NI9C 50,286- 182- 87- A
KQ9L 346,456- 1364- 127- B
K9OSH 127,968- 686- 93- B
KA9CHM/T 113,876- 686- 83- B
KB9ALK/N 44,418- 347- 64- B
KA9HFN/T 28,032- 219- 64- B
KA9SRU/T 14,416- 136- 53- B
W9VZR 3,010- 43- 35- B
W9NWY/T 648- 27- 12- B
KA9NTO/T 380- 19- 10- B
W9WAQ 274,716- 561- 117- C
W9GIL 212,768- 484- 109- C
WB9HGS 54,560- 217- 62- C
W9HE 46,368- 207- 56- C
WA1IH/9 (KB9S,K9FVF,KM8O,W8UC,ops) 1,808,252- 2622- 257- D
KW9K (+W9KKM,WA9CDY,WB9s GPF,YXY) 988,344- 1758- 222- D

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Colorado

WØYK 1,265,908- 2623- 203- A
KDØZH 736,384- 1726- 176- A
NØZA 706,092- 1483- 174- A
KVØK 254,696- 948- 124- A
KJØG 187,200- 503- 120- A
KBØQGV/N 30,960- 188- 49- A
ABØG 18,812- 100- 66- A
NIØE 689,584- 2632- 131- B
KØPVI 154,944- 807- 96- B
KØGAS 129,710- 763- 85- B
WØGOR 124,830- 657- 95- B
WØGOO 44,660- 319- 70- B
KEØRO 28,140- 201- 70- B
WBØZ 23,548- 203- 58- B
K3ZMO 19,584- 192- 51- B
KQØT 14,664- 156- 47- B
K9MWM 10,336- 152- 34- B
AGØS 481,344- 1099- 109- C
KIØJ 160,120- 409- 90- C
NØFFZ 93,852- 290- 79- C
KA1MPF 23,680- 137- 40- C
KAØYXI/T 9,240- 61- 33- C
KMØQ (+KAØTON,KJØI) 1,173,816- 2026- 204- D
ADØO (+KN5H,WDØT) 1,004,640- 1988- 210- D
NØGII (+KAØWLM) 263,152- 883- 108- D
NØASN (+ops) 120,862- 679- 89- D
WØTX (KBØS ADG,CHT,ops) 23,850- 213- 53- D

Iowa

WBØRJF/N 28,844- 179- 76- A
KØSRL 10,656- 100- 37- A
KBØHR 383,568- 1464- 131- B
KBØPQ 157,964- 792- 101- B
WBØZKG 140,120- 620- 113- B
WØPPF 59,514- 327- 91- B
KDØRN 17,408- 136- 64- B
KØEVC 15,912- 156- 51- B
KAØYAP/T 6,992- 92- 38- B
NØJR 310,608- 716- 108- C
WØWGZ (+WBØWII) 18,676- 151- 58- D

Kansas

NE4F 54,136- 266- 67- A
NWØF 10,988- 67- 41- A
WD9FTZ 3,680- 72- 23- A
NØXA 656,690- 2261- 145- B
WE0A 320,620- 1394- 115- B
KØEW 34,748- 238- 73- B
WDØBWM 26,880- 158- 85- B
KAØITA 6,952- 93- 32- B
KBØAEW/T 3,480- 64- 35- B
NOØY 624- 24- 13- B
NØBLD 20,640- 114- 45- C
W2RPZ 14,400- 51- 50- C

Minnesota

NØAT 454,224- 1035- 163- A
KBØCWV 66,676- 357- 76- A
KFØT 61,656- 203- 84- A
WBØU 48,048- 203- 78- A
WØNGB 30,846- 205- 53- A
KØMPH 23,280- 141- 60- A
WØRXL 10,656- 84- 48- A
ACØW 192,940- 877- 110- B
WØRXJ 49,664- 256- 97- B
NØEXN 31,440- 262- 60- B
WBØGQM 24,156- 183- 66- B
KABZPP/T 16,288- 147- 52- B
KABZIA/T 6,512- 88- 37- B
KABUPF 5,848- 86- 34- B
KBØCDB 5,638- 71- 39- B
WABSVR 324,380- 765- 106- C
KNØV 205,152- 639- 92- C
N6VB 135,372- 393- 87- C
KDØSF 104,188- 427- 61- C
WØHBE 32,864- 157- 52- C
KRØB (+AF9T,KØl,KJØB,NØBKL, WJØM) 1,126,272- 1731- 224- D
NØBNG (+K8s BR,ET,KAØJZV, KBØLC,KKØH) 622,680- 1365- 191- D

Missouri

WOØG 1,775,136- 2410- 264- A
NXØI 379,852- 716- 194- A
WAØOUI 84,480- 278- 110- A
NØIZZ 22,680- 150- 60- A
NSØB 8,190- 70- 35- A
WJØI 33,768- 252- 67- B
KØHOF 18,360- 170- 54- B
WBØGFV/T 14,762- 121- 61- B
NZØF 7,752- 102- 38- B
NBEGX 5,688- 79- 36- B
NØHBH 1,020- 34- 15- B
KØRWL 414,352- 892- 116- C
KMØL 29,760- 186- 40- C
NDØK 3,400- 26- 20- C
KYØB (+KAØVSM,KEØI,NØHBM,WAØJ, WBØs RSZ,SQY,YIU) 170,956- 1082- 79- D

North Dakota

NTØV 67,878- 363- 81- A
NØHJM (WBØO,op) 38,614- 449- 43- B
KAØIZP 15,456- 184- 42- B
WBØO 414,100- 1022- 101- C

Nebraska

KEØVQ 38,190- 335- 57- B
NØLAT 29,500- 250- 59- B
KØPFV 26,800- 215- 60- B
WBØWRZ 25,048- 202- 62- B
KBØAWB/T 6,662- 73- 47- B
KAØVZB/N 4,224- 64- 33- B
KØSW 56,280- 210- 67- C

South Dakota

WBØMWJ 171,020- 1006- 85- B
KØDD 155,952- 722- 108- B
WØACT 132,672- 691- 96- B

VE

Maritime—Newfoundland

VE1BLL 1,804- 40- 22- A
VE1BZO 140,850- 939- 75- B
VO1MP 599,632- 1146- 121- C
VO1AW 11,256- 66- 42- C

Quebec

VE2OPB 41,124- 172- 69- A
VE2UL 14,274- 83- 51- A
VE2FS 75,516- 578- 81- B
VE2RO 61,054- 343- 89- B
VE2OWL 27,136- 212- 64- B
VE2XL 26,666- 199- 67- B

Ontario

VE3FGU 282,956- 767- 118- A
VE3CVX 371,712- 1408- 132- B
VE3XN 315,808- 1112- 142- B
VE3LGC 261,340- 895- 148- B
VE3FWQ 227,148- 820- 138- B
VE3FIU 107,350- 475- 113- B
VE3FSV 34,860- 249- 70- B
VE3FVW 20,234- 151- 67- B
VE3BXY 11,250- 75- 75- B
VE3VET 32- 4- 4- B
VE3KP 418,018- 972- 107- C
VE3NBE 195,896- 518- 94- C
VE3HX 146,216- 371- 98- C
VE3NRU 62,832- 233- 66- C
VE3ST 56,952- 225- 63- C
VE3NUL 25,440- 108- 53- C
VE3XQ (+VE3s IGR,MFP,MMB,UDX, WA2MNM) 547,178- 1571- 137- D
VE3UOW (VE3s NPB,OIL,PYH,RKS, SMA,WNR,ops) 153,762- 416- 147- D
VE3SAU (VE3s FHK,FHU,KHE, OJN,ops) 65,800- 329- 100- D

Manitoba

VE4IM 190,968- 615- 124- A
VE4VV 100,204- 375- 94- A
VF4GV 316,404- 1683- 94- B
VF4TM (+VE4s ATC,SI,WS) 89,120- 527- 80- D

Saskatchewan

VE5UF 1,057,320- 2282- 178- A
VE5AAD 38,124- 197- 37- A
VE5FN 309,120- 1472- 105- B
VE5GC 72,864- 759- 48- B
VE5XU 135,720- 427- 78- C

Alberta

VE4DZ 232,328- 596- 113- A
VE4RI 45,240- 187- 60- A
VE4HGV 51,504- 444- 58- B
AA8QQ/VE4 9,936- 138- 36- B

British Columbia

VE7DLM 560,170- 1352- 158- A
VE7FJE 58,880- 272- 80- A
VE7PN 240,076- 1277- 94- B
VE7XO 40,528- 298- 68- B
VE7CTD 19,686- 193- 51- B
VE7DVV 59,724- 250- 63- C
VE7CKF 14,356- 96- 37- C
VE7AFS (VE7s ABW,CFX,GWS,ops) 169,152- 955- 96- D
VE7EKS (+ops) 15,200- 152- 50- D

Yukon

VY1DX (VY1s AL,AU,BR,CC,CW,DN, DU,ops) 259,428- 1826- 88- D

Northwest Territories

VE8IAM 4,640- 80- 29- B

Checklogs

AA4WX, CT3BM, DF3VC, EA3DKP, EA4EAP, EA4EDU, EA5DIT, EA5JC, EA5NQ, EA7CIM, EA7DUD, EA7EBH, EA7GBD, EA7KN, EA8AKN, HA1UB, HA8OD, HB9PQ, HG4XX, HG6LP, HK3MAH, IK7JJP, IK8GGW, IK8JMS, K5RF, K6ERM, KA1CLV, KA3MLY, KB7FSD, KC7UO, KE0WV, KF7MF, KM4IC, LA4IAA, LU2DGZ, LU2FFV, LU7EO, LZ1CW, LZ2RS, N1CIX, NW9T, OH1UN, OH2NMW, OH3TQ, OH5FA, OK1DGN, OK1DQW/P, OK1FGU, OK1US, OK2BQQ, OK2PAY, OZ1EDJO, OZ1IDL, OZ1JSZ, OZ1LTB, OZ2JI, OZ4XX, OZ7L, PA3AAV, PA3AMA, PA3BWQ PA3EBX, PA0PHK, PA0TV, PY1AJK, PY1EU, RA1WT, RA3DDU, RA3DQP, RA3QR, RA9FA, RA9JD, RB5GCJ, RB5LF, RO5OW, RT4UA, RV6ACZ, RV6AF, RV9CDV, RV9US, RW3QA, RZ3DC, RZ3DZ, SM2NTU, SM3CVM, SM3MHD, SM4JUW, SM4SET, SM5APS, SM5UF, SM6BZE, SM6CDN, SM6GOR, SM6OEF, SM6OLL, SM6CSX, SM6MC, SP5DIR, SP6FER, SP7FDG, SP9AHB, UA1AJW, UA3AB, UA3AGW, UA3DEE, UA3DNR, UA3TAM, UA3TN, UA4ANZ, UA4PJA, UA4YZ, UA8HPK, UA9LFN, UA9OO, UA9OS, UA9URF, UA9WNG, UA9XCL, UA9QCA, UB4AXN, UB4CYT, UB4JIF, UB4LAT, UB4QWW, UB5JS, UB5LRS, UB5MW, UB5QDF, UB5ZA, UB7VA, UC4AWZ, UC7AAD, UC2OGN, UI9BWE, UL8CWW, UM8DX, UP1BZA, UP2DM, UQ1GXJ, UQ2GCW, UQ2GSW, UT4UH, UV3DN, UV3MM, UW6HS, UW8JC, UZ3AF, UZ6HXK, UZ9JXD, UZ9SXT, UZ8CWW, VE1ACK, VE6JER, VE7DTA, WB9VMY, YZ1IC, YZ2HF, YZ4EA, YZ4SL, YZ6NL, YZ6SG, YZ4RJ, YU2RD, ZP5JCY

Rules, 1989 ARRL UHF Contest

1) **Object:** To work as many amateur stations in as many 2° × 1° grid squares as possible using authorized amateur frequencies above 220 MHz and all authorized modes of emission.

2) **Contest Period:** Begins 1800 UTC Saturday, Aug 5 and ends at 1800 UTC Sunday, Aug 6. Entrants may use as much of this time as they wish.

3) **Categories**

(A) *Single operator:* One person performs all operating and logging functions, as well as equipment and antenna adjustments.

(1) *Multiband.*

(2) *Single band:* Single-band entries on 220, 432, 902 and 1296 MHz, and 2.3-GHz-and-up categories will be recognized both in *QST* score listings and by awards offered. Contacts may be made on any and all bands without jeopardizing single-band entry status. Such additional contacts are encouraged and should be reported. Also see Rule 8 (Awards).

(B) *Multioperator:* Multioperator stations must locate all equipment (including antennas) within a circle whose diameter does not exceed 300 meters (1000 feet).

4) **Exchange:** Grid-square locator (see Jan 1983 *QST*, page 49). Example: W1AW in Newington, CT would send "FN31." Exchange of signal report is optional.

5) **Scoring**

(A) *QSO points:* Count three points for each complete 220- or 432-MHz QSO. Count six points for each complete 902- or 1296-MHz QSO. Count 12 points for each 2.3-GHz-or-higher QSO.

(B) *Multiplier:* The total number of different grid squares worked per band. Each 2° × 1° grid square counts as one multiplier on each band it is worked.

(C) *Final score:* Multiply the total number of QSO points from all bands operated by the total number of multipliers for final score. Example: W1AW works W3CCX in FN20 on 220, 432 and 1296 MHz. This gives W1AW 12 QSO points (3 + 3 + 6) and also three grid-square multipliers. Final score is 12 QSO points × 3 multipliers, or 36.

6) **Miscellaneous**

(A) *Stations may be worked for credit only once per band from any given grid square, regardless of mode.* This does not prohibit working a station from more than one grid square with the same call sign. Such a roving station, however, must submit a separate entry for each grid square from which the operation takes place. In this situation, the entrant may opt to waive rule 6 (C) and use a single different call sign from each different grid square. Crossband QSOs do not count. Aeronautical mobile contacts do not count.

(B) Partial QSOs do not count. Both calls, the full exchange and acknowledgment must be sent and received.

(C) A transmitter, receiver or antenna used to contact one or more stations under one call sign may not be used subsequently during the contest period under any other call sign (with the exception of family stations where more than one call is assigned to one location by FCC/DOC. The intent of this rule is to accommodate family members who must share a rig, not to manufacture artificial contacts.

(D) All equipment and antennas used by entrants must be owned and operated by amateurs. Use of non-amateur-owned gear is not prohibited, but use of such equipment places the entrant in a separate category, ineligible for awards.

(E) While no minimum distance is specified for contacts, equipment should be capable of real communications (ie, able to communicate over at least 1 km).

(F) Contacts made by retransmitting either or both stations, whether by satellite or terrestrial means, are prohibited. Frequencies regularly occupied by a repeater in a locality may not be used for contest work, even if the repeater is turned off.

(G) A station located *precisely* on a dividing line between grid squares must select only one as the location for exchange purposes. A different grid-square multiplier cannot be given out without moving the complete station (including antennas) at least 100 meters.

(H) Above 300 GHz, contacts are permitted for contest credit only between licensed amateurs using coherent radiation on transmission (eg, laser) and employing at least one stage of electronic detection on receive.

(I) Marine Mobile (and Maritime) entries will be listed separately as "Marine Mobile" in the score listings and will compete separately for awards.

7) **Reporting:** Entries must be postmarked no later than Sep 6, 1989. Official forms are available for an SASE from ARRL HQ, and all entrants are strongly urged to send early for a set.

8) **Awards**

(A) *Single operator*

(1) Top single-operator score in each ARRL Division.

(2) Top single operator on each band (220, 432, 902, 1296 and 2304-and-up categories) in each ARRL Division where significant effort or competition is evidenced. (Note: Since the highest score per band will be the award winner for that band, an entrant may win a certificate with additional single-band achievement stickers.) For example, if K2SMN has the highest single-operator multiband score in the Atlantic Division and his 432-MHz score is higher than any other Atlantic Division single-op's, he will earn both a certificate for being the single-operator Division leader *and* an endorsement sticker for 432 MHz.

(B) Top multioperator score in each ARRL Division where significant effort or competition is evidenced. Multioperator entries are not eligible for single-band awards.

(C) Additional certificates, such as for Novices, may be awarded where significant effort or competition is evidenced.

9) **Disqualifications:** See January 1989 *QST*, page 104.

Contest Corral

Conducted By Phil Rice, WB9JKI
Assistant Contest Manager

JULY

1

Canada Day Contest, see Jun *QST*, p 103.

1-2

Six Meter Invitational Net Activity Day, sponsored by the Colorado SIN from 1400Z Jul 1 until 0300Z Jul 2. 50 MHz only. Exchange call sign, name, grid square and SIN number (if member). QSOs with SIN members count 3 points each; others count 2 points each. Multiply number of grid squares × number of points for final score. Send logs including date and time of QSOs by Jul 31 to Richard Johnk, NØAKI, 8529 Fenton St, Arvada, CO 80003.

Venezuelan Independence Day Contest, phone, see Jun *QST*, p 103.

5

West Coast Qualifying Run, 10-40 WPM, at 0400Z Jul 6 (9 PM PDT, Jul 5). W6OWP prime, W6ZRJ alternate. Frequency is approximately 3.590 MHz. Underline one minute of the highest speed you copied, certify that your copy was made without aid and send to ARRL for grading. Please include your full name, call sign (if any) and complete mailing address. A large SASE will help expedite your award or endorsement.

6

W1AW Qualifying Run, 35-10 WPM at 0200Z Jul 7 (10 PM EDT, Jul 6). Transmitted simultaneously on 1.818 3.58 7.08 14.07 21.08 28.08 50.08 147.555 MHz. See Jul 5 listing for more details.

8-9

IARU HF World Championship, see Apr *QST*, p 87.

9

ARCI QRP Summer Homebrew Sprint, CW, Jun *QST*, p 103.

15-16

CQ World-Wide VHF WPX Contest, see Jun *QST*, p 103.

Colombian Independence Contest, see Jun *QST*, p 103.

SEANET Contest, CW, see Jun *QST*, p 103.

22-23

QRP Summer Contest, sponsored by the DL Activity Group CW, from 1500Z Jul 22 until 1500Z Jul 23. CW only, 160 through 10 meters. Classes are: A—less than 3.5-W input (2-W output), single operator; B—less than 10-W input (5-W output), single operator; C—less than 10-W input (5-W output), multioperator; D—QRO stations, more than 10-W input (5-W output), to contact QRP stations only; E—SWL. Class C stations may operate full time; classes A, B, D and E must break for nine hours (may be taken in two parts). Exchange RST, QSO number and input, adding "X" if crystal controlled. No more than 3 crystals may be used on one band. Contact each station once per band. Count 1 point for QSO with own country, 2 points for QSO with own continent, 3 points for QSO with DX (outside own continent) per DXCC list. JA, PY, VE, W and ZS call areas count seperately. Count 1 multiplier for each country and 1 for each DX QSO. Multiply points by multipliers on each band. Logs must be received within 6 weeks after the contest. Send logs (include 1 IRC for results) to Siegfried Hari, DK9FN, Spessartstrasse 80, D-6453 Seligenstadt, Fed Rep of Germany.

29

W1AW Qualifying Run, 10-35 WPM at 2300Z (7 PM EDT) Jul 29. See Jul 5 and listings for more details.

29-30

Venezuelan Independence Day Contest, CW, see Jun *QST*, p 103.

AUGUST

1

West Coast Qualifying Run, 10-35 WPM, at 0400Z Aug 2 (9 PM PDT, Aug 1). See Jul 5 listing for more details.

5

YL/OM Summer SSB Sprint, sponsored by the YLRL from 1800-2200Z Aug 5. All licensed amateurs invited to operate. OMs call CQ YL and YLs call CQ OM. All HF bands may be used. Exchange signal report, name and state/province/country. Stations may be worked once per band. Add points on all bands for total QSO points. Alpha-numeric multiplier: Use the last number and first letter in the call for a possible 260 multipliers. (i.e. W1XZ is 1X, W2GLB/7 is 2G, etc.) Contestants running 200 W PEP output or less may multiply score by 1.5. Total score: Total QSO points × alpha-numeric multipliers × low power multiplier (if applicable). Suggested frequencies: 3.940-3.970 7.240-7.270 14.250-14.280 21.380-21.410 28.380-28.410. Logs must show station worked, QSO number given and received, signal report given and received, name, country/state/province, time, band and date. State power used. Logs must be received by Sept 5. Send entry to Vice President YLRL, Carol Shrader, WI4K, 4744 Thoroughgood Dr, Virginia Beach, VA 23455.

5-6

ARRL UHF Contest, p 93, this issue.

YO DX Contest

Ten-Ten International Net Summer Phone QSO Party, sponsored by the Ten-Ten International Net, from 0000Z Aug 5 until 2400Z Aug 6. Open to all amateurs, but only paid-up 10-10 members are eligible for awards. Single operator only. SSB, AM or FM only. Work stations once on 10 meters only. Contacts must be in the phone subband. Exchange call, name, state and 10-10 number (if member). Count 2 points for each QSO with a member, count 1 point for each QSO with nonmember. Final score is total QSO points. Awards. Send logs along with cover sheet and dupe sheet before Sep 1 to Fort McHenry Chapter, c/o Fred Plitt, W3DCN, 2271 Four Seasons Dr, Gambrills, MD 21054.

11

W1AW Qualifying Run, 10-35 WPM, at 0200Z Aug 12 (10 PM EDT, Aug 11). See Jul 5 listing for more details.

12-13

European DX Contest, CW, sponsored by the Deutscher ARC, from 1200Z Aug 12 until 2400Z Aug 13. (Phone contest, Sep 9-10; RTTY contest, Nov 11-12). Work stations once per band; 3.5, 7, 14, 21 and 28 MHz only. Entry Classes: Single operator, all band; Single operator, high band (14, 21, 28 MHz only); Multioperator, Single transmitter; SWL. Stations must remain on a band for at least 15 minutes, except for a quick QSY to work new multipliers. Single operators may operate a maximum of 30 hours. The 6 hours of off-time may be taken in one to three periods and must be noted in the log. Non-EU stations work EU only. Exchange signal report and serial number. W/K stations also give state. Count 1 point per QSO and 1 point per QTC (explained below). Multiply by number of EU countries worked per band. European Country list: C3 CT1 CU EA EA6 EI F G GD GI GJ GM GM-Shetland GU GW HA HB HBØ HV I IS IT JW-Bear JW-Spitsbergen JX LA LX LZ OE OH OHØ OJØ OK ON OY OZ PA SM SP SV SV5-Rhodes SV9-Crete SY-Athos T7 TA1 TF TK UA-1346 UA2/UZ2F UA1-Franz Josef Land UB UC UN/UA1N/UZ1N UO UP UQ UR Y2 YO YU ZA ZB2 1AØ 3A 4J1 4U1-Geneva 4U1-Vienna 9H1. The multiplier on 3.5 MHz may be multiplied by 4, the multiplier on 7 MHz by 3, and the multiplier on 14-21-28 MHz by 2. A QTC is a report of a confirmed QSO that has taken place earlier in the contest and later sent back to an EU station. QTCs may be sent only by non-EU stations to EU stations. A QTC contains the time, call sign and QSO number of the station being reported (eg, 1307/DA1AA/431). A QSO may be reported only once and not back to the originating station. A maximum of 10 QTCs to the same station is permitted; the same station may be worked several times to complete this quota. Only the orginal QSO, however, has QSO point value. Keep a uniform list of QTCs sent. For example, QTC 3/7 would indicate that this is the third series of QTCs sent, and that seven QSOs are reported. Awards. List 40 QSOs or QTCs per sheet. Use separate logs for each band. Dupe sheets must be submitted for bands with more than 200 QSOs. Deadlines: CW—Sep 15; (Phone—Oct 15; RTTY—Dec 15). Mail to WAEDC-Committee, PO Box 1328, D-8950 Kaufbeuren, Fed Rep of Germany.

QRP ARCI Summer Daze Sprint, phone, sponsored by QRP ARC International, from 2000Z Aug 13 until 2400Z Aug 13. Phone only. Work stations once per band. Exchange signal report, state/province/country and QRP number if member. Non-members send power output. Suggested frequencies: 1.810 3.985 7.285 14.285 21.385 28.385 28.885 50.885. Count 5 points for QSO with ARCI member. Others count 2 points for same continent and 4 points for different continent. Multiply QSO points by states/provinces/countries worked per band by power multiplier (8-10 W output ×2; 6-8 W output ×4; 4-6 W output ×6; 2-4 W output ×8; 0-2 W output ×10). More than 10 W output counts as checklog. If 100% natural power, multiply final score by 2; if 100% battery, by 1.5. Include a description of equipment with entry. Awards. Mail entry before 30 days after end of contest to QRP ARCI Contest Chairman, Red Reynolds, K5VOL, 835 Surryse Rd, Lake Zurich, IL 60047.

New Mexico QSO Party, sponsored by the Albuquerque Assn, from 1800Z Aug 12 until 1800Z Aug 13. Phone and CW/digital. Work stations once per band and mode. No repeater, crossband, crossmode or satellite QSOs. All QSOs must include one NM station. Mobile stations may be worked once per band and mode in each county. County-line QSO counts as one QSO and two counties. Stations outside NM do not call CQ on suggested frequencies. Three categories of entries: NM portable/mobile stations; NM fixed station; and non-NM stations. Exchange RST and state/province/country (NM stations give county). Suggested frequencies: CW—1.810 3.555 7.055 14.055 21.055 28.055; phone—1.845 3.945 7.280 14.280 21.380 28.580. Score 3 points per CW QSO and 2 points per phone QSO. Multipliers are NM counties (max 33), VE provinces (max 12), DX countries (DXCC list, except US and Canada) and states (max 47). For scoring, multiply total QSO points by total multipliers. Class A stations multiply total score by 3. Class B stations multiply total score by 2. Awards. Include summary sheet, logs and dupe sheet if more than 200 QSOs. Send entries and SASE for results before Sep 30 to Richard Stump, KD5VV, PO Box 11201, Albuquerque, NM 87192.

19

SARTG World Wide RTTY Contest

19-20

ARRL 10 GHz Cumulative Contest, Jun *QST*, p 102.

KCJ Single-Operator CW Contest, sponsored by the Keyman's Club of Japan, from 1200Z Aug 19 until 1200 Aug 20. Single operator, CW, multiband only. No cross-mode, cross-band, repeater, or satellite contacts, or contacts with multioperator or non-JA stations. Work stations once per band. Exchange: JA stations send RST and two-character prefecture code; others, RST and two-character continent code (AF, AS, EU, NA, OC, or SA). Count one point per QSO. Multiply by total number of JA districts (60 max) on each band. Log should indicate time in UTC, call sign and exchange with multipliers clearly marked. Be sure to include a summary sheet and separate sheet for each band. Mail entry by Sep 20 to Yasuo Taneda, JA1DD, Gyoda Cho 3-9-2-102, Funabashi City, Chiba 273, Japan.

New Jersey QSO Party, sponsored by the Englewood ARA, from 2000Z Aug 19 until 0700Z Aug 20 and from 1300Z Aug 20 until 0200Z Aug 21. Phone and CW are considered the same contest. Work stations once per band and mode. CW QSOs in the CW subbands only. NJ-to-NJ QSOs allowed. Exchange signal report, serial number and QTH (county for NJ station, ARRL Section or country for others). Suggested frequencies: CW—1.810 3.535 7.035 7.135 14.035 21.100 28.100 MHz; Phone—3.950 7.235 14.285 21.355 28.400 144-146 MHz. Suggested activity schedule: phone on the even hours; 15 and 10 meters on the odd hours, 1500-2100Z; 160 meters at 0500Z. NJ stations count 1 point per W/VE QSO and 3 points for DX (include KP4, KH6 and KL7). Multiply by the number of ARRL Sections worked (including NNJ and SNJ). Non-NJ stations count 1 point per NJ QSO, and multiply by number of NJ counties (max 21) worked. Awards. Include an SASE for results and mail logs to be received by Sep 17 to EARA, PO Box 528, Englewood, NJ 07631-0528.

SEANET Contest, phone, Jun *QST*, p 103.

Missouri QSO Party

26-27

All Asian DX Contest, CW, see Jun *QST*, p 103.

Deadline: The deadline for receipt of items for this column is the 1st of the second month preceding the publication date. For example, your information would have to reach HQ by **Aug 1** to make the **Oct** issue. Please include name of contest, dates, times (Z) and complete rules. Send to Contest Corral, 225 Main St, Newington, CT 06111.

Standard Contest Guidelines

1) Make sure your log details the date, time, band, call sign and complete exchange sent and received, for each QSO claimed for contest credit.
2) Your summary sheet should indicate your score, including how you figured it, and a declaration that you followed FCC/DOC regulations and the contest rules. Your name, call sign and complete address should be typed or printed in block letters.
3) Crossband, crossmode and repeater contacts are usually not permitted. Contacts with the same station on different bands are usually permitted.
4) Your log should be checked carefully for duplicate QSOs; and if more than 200 QSOs are made, dupe sheets should be included with your entry.
5) Your log may be considered a checklog or disqualified if it is incomplete or if too many errors are detected by the contest committee.
6) Avoid standard net frequencies.
7) International contests generally offer awards to top scorers from each US call area and each country, state QSO parties to each state/province.
8) Your summary sheet should include the following statement: "I have observed all competition rules as well as all regulations established for Amateur Radio in my country." The declaration should be signed and dated.

Special Events

Conducted By Phil Rice, WB9JKI
Assistant Contest Manager

South Dakota: South Dakota hams will operate a special-event station from **May 10** through **Sep 4** from a horse-drawn covered-wagon train to commemorate the state's Centennial. Suggested frequencies: CW—40 kHz from the bottom end of all bands 80-10; phone— 3.890 7.265 14.265 18.150 21.340 24.970 28.340. They will also check in SD nets at 1300Z on 3959.5; 1715Z/2300Z on 3870.5 kHz. County Hunters should check 14.066 and 14.336 throughout the day. Send QSL and SASE to South Dakota Centennial Wagon Train, PO Box 91, Sioux Falls, SD 57101.

London, England: The International Maritime Satellite Organization ARC will operate GB1ØSAT from their headquarters in London, England for short periods throughout July to celebrate their 10th Anniversary. The station will be most active 0700-1900Z **Jul 10-21.** Operation will be on phone or CW on all HF bands. A special QSL card will be forwarded to all contacts.

Jacksons Mill, West Virginia: The West Virginia State AR Council and ARRL Convention will operate W8WVA from 1100Z **Jul 1** through 1600Z **Jul 2.** Suggested frequencies: 25 kHz above bottom of General portion on all bands and 145.01-MHz packet. For special certificate send large SASE to WD8V, PO Box 9076, South Charleston, WV 25309.

Moffett Field, California: The Naval Air Station at Moffett Field in cooperation with NASA Ames Research Center ARC and the Navy Moffett Field ARC will operate K6MF from 1600-0100Z daily **Jul 1-2** during the annual NAS Moffett Field Open House. Suggested frequencies: 14.280 21.380. For QSL send QSL and SASE to AARC, PO Box 73, Moffett Field, CA 94035.

Troy, New York: Amateur Radio station KA2TFM will operate from 1500-2100Z each day **Jul 1-4** to celebrate the 200th anniversary of the Home of Uncle Sam. Suggested frequencies: 1.865 3.950 7.250 14.340 21.350 28.350 146.940. For certificate send QSL and no. 10 envelope to Arnie Fowler, 237 Belleview Rd, Troy, NY 12180.

Keyport, Washington: The Naval Undersea Warfare Engineering Station will celebrate its Diamond Anniversary from 1300-2300Z **Jul 3.** The station will sponsor W7TVA and MARS NNNØTVA. Suggested frequencies: 3.970 7.270 14.270 21.370 28.370 145.57. QSL to Roy Norton, KE7UC, 1075 Luoto Rd, Poulsbo, WA 98370.

Thompson, Ohio: KD8FJ will operate the fifth annual **4th of July** "Heritage of Our Country" from Heritage Hill Camp. Operation will begin at 1400Z in the lower General portion of 40-meter phone, and on 28.453 MHz if band conditions allow. QSL with a large SASE for certificate to KD8FJ, 386 Cedarbrook Dr, Painesville, OH 44077.

Morgan City, Louisiana: The St. Mary ARTS **4th of July** station will operate from 0300-2300Z using the call KA5LMZ to celebrate the holiday. Operation will be phone portions of 80, 20, 20, and 15. Send QSL and SASE to The Frame Shop Inc, 708 Front St, Morgan City, LA 70380.

Staunton, Virginia: The Valley ARA will operate N4ICT in conjunction with the Statler Brothers 20th Happy Birthday USA Celebration from 1200Z **Jul 4** to 0030Z **Jul 5.** Operation will be in the General phone band on 80, 40, 20 and 15; General CW bands on 40 and 20, and Novice phone on 10. For certificate send QSL, contact number and 9- × 12-in SASE to Valley ARA, PO Box 666, Staunton, VA 24401.

Fort Laramie, Wyoming: The High Plains ARC will operate KT7V from 0000Z **Jul 4** to 0000Z **Jul 5** at historic Fort Laramie. Suggested frequencies: phone—3.850 7.250 14.250 21.360 28.550; CW—50 kHz up from the lower band edge. For QSL send no. 10 SASE to KT7V, 111 Camino Del Rey, Torrington, WY 82240.

Clinton, Iowa: The Clinton ARC will operate a special-event station **Jul 4-5** to commemorate the celebration of the Clinton Riverboat Days. Suggested frequencies: phone—3.875 7.275 14.275 21.375 28.400; CW—3.720 7.120 21.120 28.120. For special certificate send no. 10 SASE to Darryl Petersen, KDØPY, RR1 Box 84, Bryant, IA 52727.

Clarksburg, West Virginia: The Stonewall Jackson ARA will operate WB8ZVS from 1400Z **Jul 4** until 0100Z **Jul 5** in conjunction with the 3rd Annual American Values Weekend. Operation will be in the lower 20 kHz of the 40-meter General phone band. For certificate send SASE to SJARA, WB8ZVS, PO Box 752, Clarksburg, WV 26302.

Astoria, Oregon: The Sunset Empire ARC will operate W7BU/MM on the Lightship Columbia **Jul 5-16** to commemorate the last US Coast Guard Lightship to serve on the Pacific Coast. Operation will be the bottom of General phone on 80-10 meters, including Novice 10 meter phone. For certificate send 9- × 12-in SASE to Edward Aho, NR7F, 3361 Franklin Ave, Astoria, OR 97103.

International Peace Garden, North Dakota and Manitoba: VE4IHF will operate from 1400-2230Z daily **Jul 7-8** to celebrate the 26th anniversary of the International Hamfest. For QSL send 1 IRC or for the Peace Garden Award send 3 IRCs plus SAE to Dave Snydal, 25 Queens Crescent, Brandon, Manitoba R7B 1G1, Canada.

Isola Rossa Island, Italy: The Carbonia Sardegna RC will operate a special-event station from Isola Rossa Island using IMØ/ISØYUJ **Jul 7-9.** Suggested frequencies: phone and CW in the General portion of 80, 40, 20, 15, 10. QSL via ISØYUJ through the bureau or direct with SASE and IRC.

Frederick, Maryland: The Frederick ARC will operate K3ERM and K3SKE from **Jul 7-9** to celebrate the 125th anniversary of the Battle of the Monocacy. Suggested frequencies: 25-30 kHz from the bottom of the General phone bands 80-15, and the Novice/Technician portion of 10 phone. A special QSL and/or certificate is available by sending an SASE to the route given on the air for station K3ERM. Further information can be obtained by writing Dan Szymanski, K3SKE, 7310 Parkview Dr, Frederick, MD 21701.

Vernal, Utah: The Boarderline ARC will operate member stations from 1500Z **Jul 8** to 0500Z **Jul 9** to celebrate the Dinosaur Roundup Rodeo. Suggested frequencies are the General phone portions of 40, 20 and 15, and the Novice phone portion on 10. Send QSL and SASE for a Dinosaur Hunting license to WX7L, 1040 S 2000 E, Vernal, UT 84078.

Hobbs, New Mexico: The New Mexico District Royal Rangers will operate KD5RZ from 1300Z **Jul 8** to 0100Z **Jul 9** for the 1st Annual National Royal Ranger Special Event. All Amateur Radio operators are invited to help their local Royal Ranger Outposts. Suggested frequencies: 3.870 7.250 14.250 21.320 28.380 28.520. For certificate send QSL and large SASE to KD5RZ (NRRSE), 1420 N Tasker, Hobbs, NM 88240.

Fulton, New York: The Oswego County ARES and the Fulton ARC will operate KY2F from 1500-2300Z daily **Jul 8-9** from the Central New York International Air Show. Suggested frequencies: middle portion of the General 40, 20, 15, 10, 2-meter bands and Novice 10 phone. For

certificate send QSL and large SASE to Fred Swiatlowski, PO Box 5227, Oswego, NY 13126.

Catalina Island, California: Amateur Radio station WA6OPZ will operate from 1500Z to 0700Z daily **Jul 9-15** from Emerald Bay to commemorate the Boy Scouts Camp and use of the bay since 1925. Suggested frequencies: phone— 28.450 and the lower 25 kHz of the 15, 20 and 40 General phone bands; CW— 7.125 21.150. For certificate send QSL and 9- × 12-in SASE to Marshall Jacobson, 16441 Gilmore St, Van Nuys, CA 91406.

Cardington Airfield, England: The Bedford and District ARC will operate a special-event station **Jul 15** from Cardington Airfield to celebrate the 50th Anniversary of 157 Squadron (Bedford) ATC. Operation will be on 20, 15 and 2 meters. Send QSL to Richard Smith, G1ZOJ, 1 Perring Close, Sharnbrook, Bedford MK44 1JE, England.

Naperville, Illinois: The Bolingbrook ARS will operate NW9T from 1400-2100Z **Jul 15-16** in commemoration of the Revolutionary War. Suggested frequencies: 7.250 14.300 144.210. For certificate send QSL and no. 10 SASE to Rich Wayne, NW9T, Box 1429, Bolingbrook, IL 60439-7429.

Kimberling City, Missouri: The Kimberling ARC will operate NØØG daily from 1600-2200Z **Jul 15-16** to celebrate the third anniversary of their founding. Suggested frequencies: phone— 7.230 14.300 21.400 28.355; CW— 7.040 21.040. For certificate send QSL and SASE to The Mayor, Kimberling City, MO 65686.

Belle Plaine, Minnesota: The Southwest Metro ARTS will operate WBØRMK daily from 1700-2200Z **Jul 15-16** at the BBQ Days celebration. Suggested frequencies: bottom 15-25 kHz of the General phone portion of 40, 20 and 15, and 28.325 in the Novice phone band. Send QSL and SASE to WAØCXW, Secretary of SMARTS, PO Box 144, Chaska, MN 55318.

Goshen, Connecticut: The Goshen Quadrimillenium Committee will sponsor the operation of KU1Q from 1300Z **Jul 15** to 1300Z **Jul 16** from the Goshen Fairgrounds to commemorate their 250th birthday celebration. Operation will be phone on the low end of Novice 10 and the low end of General phone 80, 40, 20 and 15. For commemorative certificate send QSL and 9- × 12-in SASE to 250th, PO Box 65, Goshen, CT 06756.

Schefferville, Quebec: Amateur Radio station VE2/NA1Q will operate from 2200-0300Z daily **Jul 15-20** from an old mining town located in Schefferville, Quebec. Suggested frequencies: phone only— 3.870-3.880 14.260-14.275 21.400-21.450 28.450-28.460. A special QSL card is available. Send QSL and SASE to Robert Taylor, NA1Q, Williamsville Rd, Hubbardston, MA 01452.

Fairbanks, Alaska: The Arctic ARC will operate KL7KC from 0000Z **Jul 15** to 0900Z **Jul 24** in celebration of the discovery of gold by Fedrix Pedro in the Fairbanks area. Suggested frequencies: phone—7.290 14.240 21.340 28.350; CW— 7.030 14.030 21.030 28.005. For QSL send SASE to Arctic ARC, PO Box 81389, Fairbanks, AK 99708.

Fishers Island Sound, New York: The Tri-City ARC will mount its sixth annual expedition from this island from 1300-2000Z **Jul 16** using the call KA1BB. Suggested frequencies: the lower 20 kHz of the General phone and CW bands on 40, 20, 15 and 10; center of the Novice 10 phone band and 2-meter SSB. For QSL send QSL with no. 10 SASE to Tri-City ARC, Box 686, Groton, CT 06340.

Hollywood, California: The CBS ARC will operate KZ6N from Television City in Hollywood from 1600-0400Z daily **Jul 17-23** in celebration of the 62nd anniversary of the establishment of CBS in the radio and television industry. Suggested frequencies: 7.235 14.030 14.280 21.310 28.475-28.550. For QSL send large SASE to KZ6N, CBS TV City, Room 50, 7800 Beverly Blvd, Los Angeles, CA 90036.

Kennedy Space Center, Florida: NASA and the Titusville ARC are commemorating the 20th Anniversary of the First Manned Lunar Landing, Apollo 11, from 2200Z **Jul 19** to 0200Z **Jul 21**. TARC will use club-member calls in the General phone portion of 80, 40, 20 and 15, and the Novice portion of 10. For a special QSL send an SASE to TARC, c/o KB4YLY, 995 Alabama St, Titusville, FL 32796-2064.

La Blanquilla Island, Venezuela: The Venezuelan Navy in conjunction with Radio Club Venezolano, the Venezuela DX Club and Asociacion de Radioaficionados de Venezuela will operate YY5LB at La Blanquilla Island from 0000Z **Jul 19** to 2400Z **Jul 22** in honor of its 166th anniversary. Operation will be SSB, CW and RTTY on 160 through 10 meters. Ask operators about awards. For award send QSL to Radio Club Venezolano, PO Box 2285, Caracas 1010-A, Venezuela.

Gaylord, Michigan: The Top of Michigan ARC will operate WM8T from **Jul 19-22.** Times will vary. Look especially from 1700Z Jul 21 to 0200Z Jul 22. The TOMARC will be operating from the annual Swiss festival Alpenfest. Suggested frequencies: phone— 3.965 14.265 21.350 28.365; CW— 14.040. For certificate send QSL and 9- ×12-in SASE to TOMARC, PO Box 88, Gaylord, MI 49735.

Wapakoneta, Ohio:: The Reservoir ARA will operate K8QYL from 1300-2000Z **Jul 22** and 1600-2000Z **Jul 23** to commemorate the 20th Anniversary of Neil Armstrong's Walk on the Moon. Operation will take place from the Neil Armstrong Air + Space Museum. CW, Phone, and RTTY operation in the General bands plus Novice 10 meter phone. For certificate send QSL and no. 10 SASE to K8QYL, 1005 Linden Ave, St Marys, OH 45885-1327.

Falls City, Nebraska: The Falls City ARC will operate KØJKS from 1300-2300Z **Jul 22** to commemorate the 4th annual Hot Air Balloon Extravaganza from Brenner Air Field. Suggested frequencies: 14.285 28.310. For certificate send 8½ × 11-in SASE and QSL to Bob Eis, WAØW, 1702 Fair Ave, Falls City, NE 68355.

Joliet, Illinois: The Suburban Technical AR System will operate K9PAW from the largest round barn in the country from 1600-2300Z **Jul 23.** Suggested frequencies: lower part of General phone and CW bands. For QSL send SASE to STARS, PO Box 1240, Tinley Park, IL 60477.

Madison, Wisconsin: The REACT ARC will be operating in conjunction with the 2nd Annual meeting of the REACT ARC and the 14th Annual Convention of REACT International, Inc, from **Jul 23-27.** Operating will be in the lower portions of 80, 40 and 20 and 10 Novice phone. For QSL send SASE and QSL to REACT ARC, c/o WB3FQY, PO Box 1033, Lancaster, PA 17603.

Cheyenne, Wyoming: The Shy-Wy ARC will operate WC7S from 1400-0400Z daily **Jul 23-30** during the 93rd Annual Frontier Days Celebration. Suggested frequencies: 50 kHz from the bottom of 80, 40, 20, 15 and 10, and 10 Novice phone. No QSLs except DX will be acknowledged after Aug 31. For certificate send QSL, contact number and 9-× 12-in SASE with 2 units first-class postage to WB7RRZ, 930 Western Hills Blvd, Cheyenne, WY 82009-3323.

Gilroy, California: KG6GF will operate from the 11th Annual Gilroy Garlic Festival from 1600-2300Z Jul 28-30. Suggested frequencies: 3.875 7.275 14.250 21.350 28.350. For certificate or QSL send QSL and no. 10 SASE to Don Brice, W6ONO, 1378 Gloria, Hollister, CA 95023, or KG6GF via the bureau.

Davenport, Iowa: The Davenport ARC will operate WØBXR during the Bix Biederbeck Memorial Jazz Festival from 0000-2400Z **Jul 28-30.** Operation will be phone and CW, 80-10, 10 kHz from the lower edge of the General bands. For certificate send your QSL and SASE to Davenport ARC, 2131 Myrtle, Davenport, IA 52804.

Clute, Texas: The Contest Club of Brazosport will operate WB5I **Jul 29** to celebrate the 9th annual Great Texas Mosquito Festival. Suggested frequencies: phone—14.235 21.335 28.335. For commemorative QSL send QSL and SASE to WB5I, 305 Rabbit Trail, Lake Jackson, TX 77566.

Christmas, Florida: The Central Florida Repeater Association will hold its 3rd Annual Christmas in July picnic and special-event station. They will operate WA3ZBN from 1200-2100Z **Jul 29** from Fort Christmas park. All are invited to attend. Suggested frequencies: lower portion of General bands 20, 15 and 10. Talk-in on 147.360 and 224.500. For certificate send QSL and 8- × 11-in SASE to CFRA, c/o Christmas in July, PO Box 854, Goldenrod, FL 32733.

Oshkosh, Wisconsin: The Fox Cities ARC will operate W9ZL from the 37th annual International Experimental Aircraft Association Fly-In and Convention beginning **Jul 29** and concluding **Aug 2.** Operation will be primarily during daylight hours on 7.243 14.293 21.300 28.450. *All QSLs* must include the contact number. For certificate send QSL and large SASE to FCARC, 318 E Brewster St, Appleton, WI 54911, or via WD9FLJ.

Eugene, Oregon: The Valley ARC will operate W7PXL from 0100 **Jul 29** to 0100Z **Aug 7** from their Eugene Red Cross location to commemorate the VIII World Veteran's Track and Field Championships. Suggested frequencies: phone— 3.850 21.300 14.250 28.500; CW— 14.060 21.060 28.060. For QSL or certificate send appropriate size SASE to Valley ARC, PO Box 70314, Eugene, OR 97401.

Canton, Ohio: The Canton ARC will operate W8AL from 2200-0200Z daily **Jul 31** to **Aug 4**, and from 1700-2300Z daily **Aug 5-6** to celebrate the Pro-Football Hall of Fame Greatest Weekend. Suggested frequencies: phone—7.270 14.270 21.350 28.350; CW—7.060 14.060 21.060 28.150; RTTY operation also. For certificate or QSL send 9- × 12-in SASE with 2 units of first-class postage to Randy Phelps, KD8JN, 1226 Delverne Ave SW, Canton, OH 44710.

Deadline: The deadline for receipt of items for this column is the 1st of the second month preceding the publication date. For example, your information would have to reach HQ by **Aug 1** to make the **Oct** issue. Please include the name of the sponsoring organization, the call sign of the special-event station, the city location, dates and times (Z), suggested frequencies and QSL information. Requests for donations will not be published.

QSLing Special-Event Stations: To get your QSL or certificate from any of the special-event stations listed here, follow these simple guidelines. (1) After working the station, carefully fill out a QSL card for the QSO. Show the date and time accurately using UTC. (2) Prepare a self-addressed, stamped envelope. If sending for a certificate, use a 9- × 12-in envelope if you want an unfolded certificate, or a no. 10 envelope if folds are okay. Include enough postage for return of your envelope. (3) Mail both your QSL and your SASE to the address listed, or to the address given on the air by the station you QSO. Be patient. Special-event stations will often print their cards and/or certificates after the operation is over so they will know how many to order.

Strays

***QST* congratulates...**

☐ Lt Col Robert L. Vandevender, KA9DHL, on being given the Indiana Commendation medal for exceptional meritorious service last August. Bob is the Executive Officer of the First Battalion, First Brigade, Indiana Guard Reserve.

☐ Rear Admiral John Scott Redd, United States Navy, KØDQ, on his new assignment as Deputy Chief of Staff, Plans and Policy, to the Supreme Allied Commander Atlantic. Adm Redd was formerly Commander, NATO Standing Naval Force Atlantic.

Section News

Administered by Steven Ewald, WA4CMS

The ARRL Field Organization Forum

ATLANTIC DIVISION

DELAWARE: SM, Walt Dabell, KD3GS—Hal Low, WA3WIY, has stepped down as Section Manager. A new SM has taken office as of June 1 and is listed above and on page 8. Thanks Hal for your service to Delaware. We are glad you were there when we needed you. Bob Rounds, KC3G, has left Delaware and has relocated in Vermont. You may remember Bob if you have tested for a license or upgrade in the northern part of the state in the last few years. Bob has done a lot for Delaware, most recently in his role as ARRL VE coordinator for the AWARE club. Bob's enthusiasm and dedication to Amateur Radio will be deeply missed in Delaware and the Delaware Valley. We wish you all the best, Bob. Don't forget the Del. Hamfest will be August 20 at the Kent County VoTech Center, North. The VoTech is right beside the Terry Campus of Del-Tech, just north of Dover. 73 es gud DX! April net rpt: DTN stns 278 tfc 25 in 20 sessns, DEPN stns 58 tfc 13 in 5 sessns, SEN stns 62 tfc 7 in 4 sessns. Traffic: W3QQ 67, WA3WIY 29, WB3DUG 27, K3JL 23, KA3GRQ 23, K3YBW 18, W3FEG 12, W3PVO 9, KD3GS 8, TOTAL 216.

EASTERN PENNSYLVANIA: SM, Kay Craigie, KC3LM— ASM: WA3PZO, KA3A, KO3B, K3ZFD. SEC: KB3YS. ACC: KC3QB. OOC: W3IS. SGL: WA3IAO. STM, BM: KB3UD. PIO: W3ZXV. TC: W3FAF. Many thanks for all the Field Day messages. Please note my new home phone number: (215) 993-9623. Last month was busy with moving to a new house and visits to Tri-State ARC (Pike Co.) and Winfield/Central PA hamfest. Don't miss the Murgas hamfest on July 2 and the Harrisburg Firecracker hamfest on July 4. Red Rose's computerfest is August 6. Watch packet radio for a complete Atlantic Division hamfest calendar — please share it with those not on packet. Now that Field Day is over, it's time to plan for PA QSO Party Oct. 7-8. Get ready to clean up again in '89! Warminster's new officers are N3EXA, W3MJR, W3GAD, and KA3PKL. Some club presidents around the Section: Keystone ARC N3JB, Lancaster RTS KA3NKB, Susquehanna Valley WA3UVP, West Branch KD3CR, Cumberland ARC N3GCG, Tamaqua Transmitting NI3H, Reading NT3V, Central PA DX WB3DNA, Keystone ARG W3SMF, Unisys KA4GMC, Marple Newtown W3PUP. Support Amateur Radio in your community by joining one or more clubs and volunteering to do the jobs that keep clubs going. Thanks to all the clubs and individuals who helped with communications for ARES/RACES "Operation Windshear" in Delaware Co. last April. On the same day many hams turned out for a major RACES drill in Montgomery Co. DEC1 KD3DE, DelCo EC KA3QKV, and ASM WA3PZO made a successful presentation on ham radio to the Delaware Co. Board of Fire Marshals. In any emergency, remember that hams are volunteer communicators. Nobody can "order" you to go into a dangerous area, such as one contaminated by hazardous materials. You always have the right to "just say no." PIA K3WPI hopes to include Amateur Radio in a community volunteer series on the East Stroudsburg State cable TV channel. When you speak to a reporter about ham radio, have your main points firmly in mind, backed up with a typed press release and some ARRL folders. That way, YOU control the interview. The reporter won't have to improvise and is less likely to write weird stuff. PIO W3ZXV is sending his series of articles on how to prepare a basic press release to all PIA's, and it has also been published in ARRL FIELD FORUM nationally. April traffic: N3AZW 534, N3DRM 259, W3JKX 129, N3CD 128, AA3B 79, KD3AO 78, KA3RGF 67, KA3DLY 54, W4UO 52, K3TX 39, W3IPX 28, W3DP 25, KU3R 22, W3AQN 20, N3FGC 19, WB3EVL 19, N3COY 18, KA3QYH 17, W3VA 16, K3ARR 13, W3CL 12, W3FAF 12, W3KOD 11, W3ADE 10, KA3MVM 9, KA3SKT 6. Nets (April QNI/QTC): SEPATN 106/11, MARCTN 146/47, MARCNET 71/7, D6ARES 75/7, SCESN 97/8, D8ARES 71/0, EPAEPTN 537/141, D5ESN 75/8, EPA 438/170, PTTN 217/63. @PBBS: WA3TSW 170, WB3JOE 49.

MARYLAND-DC: SM, Philip E. Battey, W3FZV—This is the last column for a while, the last word meaning that someday I may return to this job! It's been interesting and really hasn't changed so much thru the years, just become more comprehensive than the old SCM position. Ken Cohen, NI3F, is the new SM, and I'm sure that everyone will give him full support. Please sent your reports to him. Thanks for everything. The 1989 Atlantic Division Cabinet Mtg was held Apr 8-9 in Levittown, PA. Topics discussed included public relations, biological effects on RF, NTS, the "no-code" controversy, and many others. Leading the meeting was Hugh, W3ABC, division director. New pubs from ARRL include "The ARRL Net Directory" and The ARRL Net Manager's Guide," both good for the traffic man, big or small. New members of MSN include KB4MUJ, N3AAS, KA3RCF. AA4MP, W3HEI, N3FGO, WA2YLP, KA3DYV, KA3DXX, VE3RBF, WB3DSQ, and KA1RVN. Buck, KC3Y, sez "get involved in public service!" Field Day is 24-25th of June. WA1QSS is very active in helping plan ham-related events. The Columbia Triathlon, with swimming, bicycling, and running, took place on May 21, and comms. were provided by hams. On Apr 15 Anne Arundel Cty held a comprehensive drill involving many public agencies. May 29 a gala picnic for local ham clubs was held at the AARC. WB3JRW, EC, PG Co., writes for the "SMARC SPARKS." Auto-Call magazine is fact-filled. See for yourself. PVRC issues a newsy bulletin. AARC, RCARA, and LARC have submitted their annual club reports to ARRL. BRATS hamfest is on July 30 at Timonium. Joel, N3FSH, has an interesting editorial in May's Auto-Call. W2IRD is active in tornado watching. RACES/ARES jackets and shirts are available thru WA1QAA. There is a nice set of commandments reelectronic msg etiquette in the Chessie Communicator. KA3DXX and K1LNJ have PBBS and WA3SCW, AB3F, and NT3Z have packet mailboxes. "...one can only be expected to devote as much time (to ham radio) as one feels comfortable with."—WA3TAI. WITH THE NETS: NET/MGR QND/QTC/QNI: MSN/KC3Y 30/32/315, PON/WB3BFK 25/17/209, MDD/W3FA 60/256/531(MDD TOP BRASS W3FA/122 K3GHH/82 W3QQ/82 K3JL/73 N3EGF/59), MEPN/K3RXK 31/134/810, HOCARES/WA1QAA 2/3/25, MAVEN/W3YVQ 1/0/1. Traffic: W3IWI 475, K3GHH 174, NC3V 174, NB3P 152, K3RXK 146, W3FA 131, KC3Y 123, WA3EPT 122, N3GDF 119, KJ3E 82, N3EGF 75, WA3YLO 70, K3NNI 66, KX3U 65, K1BGT 44, AG3L 40, W3FZV 39, W3YVQ 28, WA2WDT 23, WB3BFK 20, K3USO 18, KDØM 18, N1FJW 18, W3EAX 17, KC3ZJ 15, WA3GYW 8, KK3F 7, WA3ZNW 7, KD3JK 6, KA3DXX 5, WA1QAA 3, W3DQI 3. PSHR W3FA 90, KC3Y 86, N3EGF 83, K3RXK 73, 71, KJ3E 68, NC3V 64, K3GHH 62.

SOUTHERN NEW JERSEY: SM, Richard Baier, WA2HEB—SEC: K2QIJ. STM: WB2UVB. ACC: K2IXE. TC: N2BQT. PIO: KA2RAF. SGL: VACANT. BM: WB2UVB. OOC: WA2HEB. ATCs K2JF, KA2RJA and WB2MNF. VE testing by the DVRA on July 22. See May 1989 QST column, page 109 for details. Testing will also be given in Bellmawr on July 20. See Jan. 1989 QST column for full info on this session. April saw a very active month for the GCARC. They had 38 members operate with the Assn. of Retarded Citizens, supplying communication and road control throughout Gloucester County. Then about 20 members supplied communications to a division of the Kennedy Hospital Assn. Finally, about 25 members of the club participated in a mock disaster where a 747 crashed on Tinicum Island. Great public-service work! Our Packet Node Station, KB1BD, furnishes me with the following traffic stats for April: Traffic received from other PBBSs: 22; traffic sent to other PBBSs: 21; traffic originated on KB1BD by other users: 4; and traffic taken by users on the board: 5. I'm sorry to say no other traffic totals were received for April. Until next month, very 73.

WESTERN NEW YORK: SM, William W. Thompson, W2MTA—ACC: N2EH. BM: K2KWK. PIO: WA2PUU. SEC: NN2H. TC: K2QR. STM: N2EIA. SGL: WB3CUF. OOC: W2MTA (A). ASM: W2GJ W2GLH. PSHR: N2ABA KG2D N2EIA N2EVG WA2FJJ W2FR NN2H KC2HJ N2IKR N2IYA W2MTA WB2OWO KA2QOO ND2S KA2UBD NJ3V K2YAI W2YGW KA2ZNZ. EVENTS: June 4 Lancaster Fest, Rome Ham Family Day; June 17 Cortland; July 9 Batavia at Alexander NY; TFC Handlers at Verona August 12; August 19 Tompkins County; Sept. 16 Liverpool; Sept 30 Horseheads; Oct. 14 Syracuse. Appointments: (ASM) W2GJ; (EC) N2IIY-Seneca; (OES) KA2AON KA2ZNZ; (ORS) KA2ZKM N2EVG N2IYA WB2OEV. WNY now has 126 stations holding 178 appointments. WELCOME new school club affiliate at UNATEGO Jr-Sr. High School. RAGS has renewed (2) as Special Service Club. Club officers: PROS KA2ZMC KB2DNL N2IND; RARA N2EVG WB3EKP WB2SUN K2VCZ; RAWNY, KA2NYS WA2FKV KA2IWK WB2OWS (with thanks to KD2V and W2CUU for past services to RAWNY); Utica ARC K2BRF. April BPL to WB2OWO.

Net	Mode	QNI/QSP/QND	Net	Mode	QNI/QSP/QNI
NYSEMO	SSB	137/009/05	NYSR	CW	017/004/04
NYS/M*	CW	317/218/30	NYS/E*	CW	311/169/30
WDN/M*	FM	419/165/30	WDN/E*	FM	548/216/30
NYP*	SSB	178/149/29	TIGARDS	FM	059/008/05
NYPON*	SSB	485/339/30	Glueline	FM	097/018/25
ESS	CW	397/073/30	VHF THIN	FM	044/000/04
NYSPTEN	SSB	401/062/30	BRVSN	FM	274/005/30
LGARES	FM	034/000/05	CNYTN*	FM	319/085/30
OCTEN/E*	FM	595/069/30	OCTEN/L*	FM	257/090/30
Q NET	FM	388/001/30	WDN/L*	FM	470/108/30
STAR*	FM	224/052/30	NYS/L*	CW	344/224/30
PFN	FM	283/006/30	ORTN	SSB	028/000/04
JCRACN	FM	224/011/30	OARCN	FM	050/003/04

*NTS Net. SPNS reports: WB2ACV ST = 48, KT = 22. The 30th Annual STARC Hamfest was held at new site on Tioga County Fairgrounds, showing great potential for the future. Seems that the best sites are the various county fairgrounds around Western New York, fireman's fields running a close second. The 1989-1990 Repeater Directory shows that WNY has dropped down to only SIX Special Service Clubs: Chautauqua County AFA, Fulton ARC, RAGS, RARA, RAWNY and StARC. Others did not file SSC annual reports for past two years and have reverted to being strictly an affiliated club. Write to Affiliated Club Coordinator N2EH, if you want to know more about your club becoming a Special Service Club. I predict that in the not-too-distant future you may find added incentives to being a SSC —ant there are already several good ones in existence! By the way, the Annual Reports from affiliated clubs are coming in very well. KEEP 'EM COMING! I just wish all that good info had not been eliminated from the bottom of the form! Your Section Manager would still appreciate receiving a copy of your club newsletter! Traffic: (April) WB2OWO 533, W2MTA 429, N2EIA 411, KC2HJ 323, WA2FJJ 247, KA2DBD 182, NJ3V 179, K2YAI 179, W2FR 166, ND2S 162, W2YGW 161, KA2QOO 138, WB2IJH 133, KA2UBD 123, N2ABA 122, NN2H 116, KG2D 91, N2IYA 87, WB2OEV 87, KA2ZNZ 74, N2IKR 73, WB2QIX 65, KA2ZKM 62, WB2NLU 48, W2UYE 47, N2DNL 36, AF2K 36, W2PPS 26, WA2JPB 22, KA2DQA 19, N8JSO 12, N2EVG 11, KA2TWY 10, WA2OEP 6, KE2EA 4. (Mar.) W2PHQ 6.

WESTERN PENNSYLVANIA: SM, Otto L. Schuler, K3SMB—SEC: WA3UFN. STM: N3EMD. BM: KC3ET. TC: N3EFN. OOC: KX3V. ACC: AK3J. SGL: KA3OEM. PIO & ASM: N3DOK.

Net	QNI	QTC	Sess	kHz	T/D	Man
WPACW	219	119	30	3585	7:00P	WA3UNX
WPAPTN	416	67	30	3983	6:00P	WA3HLN
KFN	141	59	30	3983	1:30P	KA3OEM
PFN	173	147	30	3958	5:00P	WA3THT
WPA2MTN	308	45	30	.28/88	9:00P	KA3BGC
NWPA2MTN	633	42	29	.53/45.133		KC3NY

WB3EHR our rep for the weather station during severe storms is back home and we hope he can get back to operating soon. Also, KB3L, Leo Cipriani, one of the founders of the USAIR ARC is in very serious condition in Allegheny General Hospital in Pgh with a brain tumor. Leo was a very active amateur here in Beaver County amateur events. We wish him a very rapid recovery. Please send me any events that your club is involved in. I would like to give any of you credit for any public-service activities a club performs. N3DOK and I spent a pleasant evening with the members of the Washington County ARC. They have a nice group of gentleman and ladies there. I would like to draw your attention to the NDMS drill to take place on August 23 and we have been asked to provide communications for this event. We will be looking for operators until then. Anyone wanting more info get in touch with me. This event involves 59 Hospitals in Western Pennsylvania and we need at least one operator for each at least, preferably two. By the time you read this, we should have several mailings with more info. I wonder where all the NTS members are? The numbers of stations reporting are the lowest since I have been SM. April traffic: KQ3T 325, N3EMD 271, NO3M 106, W3OKN 105, WA3UNX 86, N3AES 59, K3SMB 58, WA3DBW 40, W3NGO 36, KA3OEM 32, KC3HR 17, W3KUN 17, KC3GO 12, K3LTV 73.

CENTRAL DIVISION

ILLINOIS: SM, Dave Carlson, AA9D—SEC: W9QBH. STM: K9CNP. OOC: W9TT. BM: K9EUI. SGL: K9IDQ. PIO: N9EWA. ACC: WB9SFT. TC: N9RF. DEC: WD9EBQ

Illinois Section Nets

NET	FREQ	TIMES (LOCAL ILLINOIS)
ISN	3905	1800 DAILY
ILN	3690	1830 & 2200 DAILY
ITN	3705	1900 DAILY
CTN	149.69/09	2100 DAILY
ILARES	3905	1630 1ST & 3RD SUNDAYS

Illinois Independent Nets

IEN	3940	0900 SUNDAYS
ILPN	3855	1645 M-F; 0830 SUNDAY
NCPN	3915	0700 MONDAY-SATURDAY
NCPN	7270	1215 MONDAY-SATURDAY

Members of the Illinois Valley ARC attended "Introduction to Disaster" and Survey/Damage Assessment" courses given by the American Red Cross in Alton, IL on April 15th. IVARC members also attended a SKYWARN training seminar in Macomb, IL on April 3rd. This program was presented by

representatives from the National Weather Service Office in Peoria. 15 members of the York Radio Club provided communications for the Elm Classic 10 K Run. Members of the North Shore Radio Club participated in a "Ham Day" at the Highland Park Radio Shack. They demonstrated Amateur Radio operation and equipment with stations on 10 meters and on packet. Both employees and patrons showed a keen interest. Good job! The Illinois Legislature continues its attack on radio communications with House Bill 1409, sponsored by Rep. Morrow of Chicago. This one would require a license from the State Police to acquire a paging device. As with House Bill 376, the definition of "pager" is sufficiently vague as to include many radio receivers not commonly called pagers. THIS IS A REAL THREAT TO AMATEUR RADIO. Illinois hams, you have the power to spot these and future attempts by the State of Illinois to regulate radio communications! Don't expect someone outside the state to do it for you. These are your elected representatives, and they are not answerable to people in other states! Make your feelings known to them NOW, or be prepared to accept their decisions no matter how bad they may be. Traffic: KA9FEZ 386, W9HLX 197, K9CNP 121, WA9VLC 104, NN9M 97, W9HOT 94, W9HBI 84, KA9QXI 70, WD9CIR 59, WB9TVD 56, NC9T 48, W9OBU 41, N9HVH/T 31, KA9CTW 30, WA9SLT 25, KA9TVU/T 23, W9KR 19, N3AIA 17, WD9EBQ 10, WA9AXL 7, WA9RUM 7, W9VEY/M 7, N3AIA-BBS 7.

INDIANA: SM, Bruce Woodward, W9UMH—SEC: WD9AVQ. STM: WA9OHX. ACC: K9ZBM. TC: WA9JWL. SGL: WA9VQO. BM: W9OCL. PIO: KA9WXT. OOC: KJ9G. Net Managers: ITN KA9EIV, QIN KJ9J. ICN KD9ER. VHF W9PMT. IWN KA9ERC. FEBRUARY Net Reports:

Net	Freq	Time/Daily/UTC	QNI	QTC	QTR	Ses
ITN	3910	1300/2130/2300	2991	473	2187	87
QIN	3656	1430/0000/0300	404	229	1002	60
ICN	3705	2315	129	43	594	28
IWN	3910	1310	1230		319	30
IWN VHF Bloomington			803		210	30
IWN VHF Kokomo			950		183	30
IWN VHF FM Ligonier			731		225	30
Hoosier VHF Nets (17)			4422	154	4022	160

D9RN for April 268 QTC 60 ses. IN 95% by N9DWU, K9ZLS, K9GBR, WA9OHX, K9CGS, W9UEM, W9DLN. CAND 500 QTC in 30 SES. D9RN 96% K9ZLS, NR9K, WA9OHX. WA9OKK Early Bird Wet Net Report for April 335 QTC in 2250 minutes and 25 ses. Silent Keys: William Johnson, W9BUQ former: Indiana Section Manager, President Indianapolis Radio Club, Chief Operator and President Indianapolis Red Cross ARC Member RCA Amateur Radio Club, Member NAVY MARS, Indiana Radio Club Council Amateur of the Year, Served six years as SCM. William R. Cure, WB9IMI, of Terre Haute, IN, and Robert Creamer, N9FUU of Taylorsville, IN. They all will be missed. Appointments: PIA David D. Barrabee, N9GQN Indianapolis , PIA Don Murphy , W9SFZ Peru, OBS Richard H. Hawk, N9HOP New Castle, OES Indianapolis Red Cross ARC, WA9LGQ Indianapolis, ORS WA9LGQ Indianapolis Red Cross ARC. Congratulations to Norm Perkins, N9HAV Clark County ARC Ham of the Year, to Charles and Margaret Dahn, WD9FIG & WD9FIH Lake County joint Ham of the Year to Melvin "Tony" Frazier, W9MJI WVARA Ham of the Year, to Rich Dugger, WD9ARW LaPorte County Elmer of the Year, to Herb Howe, W4WQD Clark County Elmer of the Year, to Jack Davidson, KA9FDF, for his work in emergency communications, and to Jim McFall, K9VDQ, and Bill Payton, WA9SGA, honored by the Vigo County American Red Cross. EC reports for April: W9BTZ N9DTG KD9ZN N9ENC N9FMO W9KGE WB9LFR WB9CNE WA9OQT WD9X K9SBW N9ADS KB9AVS WB9UNL WA9HEE KA9VNK KD9HB WA9DOL WD9BKA KC9CU WB9AHJ N9GYO N9DUZ N9BHA N9GSX. Packet BBS reports: W9ZRX 6261, N8GTC 2137 KA9LQM 1374, WB9SYK 1354, KD9QB 1336, N5AAA 1042 WA9IVB 605 N9BAC (lightning). Traffic: NR9K 709, KJ9J 271, W9UMH 166, WB9TFD 133, WA9OHX 112, WØZGC 97, WA9QCF 76, K9SBW 64, WD9JAA 63, K9ZLS 60, N9BS 60, WB9QPA 45, KA9ERC 43, N9DWU 42, KE9OV 41, KE9PR 31, K9GBR 30, WB9IHR 30 NX9A 29, N9HQO 27, K9ZBM 27, KD9HH 27, K9DBY 26, K9FEI 26, W9PPO 23, WB9OZZ 20, WD9HII 20, N9DTG 19, N9FOZ 16, KA9QME 16, K9EBK 16, W9BTZ 15, W9UEM 15, KD9DU 13, KA9QMI 13, N9ENC 12, K9OUP 11, WA9OKK 10, N9FMO 9, KA9RTD 8, W9PMT 8, W9ZSK 8, K9DIY 8, KA9RNY 8, WD9CIV 7, NZ9S 7, KB9SU 6, NX9I 6, WD9DWD 6, W9CNE 4, AB9A 3, WA9JNC 2, WA6OIZ 1, W9BDP 1, W9KMY 1, KA9FFO 1, KD9ER 1, W9OJZ 1, WB9AJY 1.

WISCONSIN: SM, Richard R. Regent, K9GDF—Welcome to new Emergency Coordinators, N9FIB, of Jefferson County; KA9YQH, in Oneida County; and N9HJF, for Lincoln County. Section Emergency Coordinator, W9ZAG, has sent six Emergency Coordinator training tests to ECs, with more requests on the way. W9YCV has confirmed over 200 countries. KE9LL, active in ARES, had gobbles of fun chasing Turkey—a new DX country to add to the 36 he already has confirmed. KA9TVD, son of K9SAO, is now in Navy electronics school in Orlando, Florida. KA9UXN of Colby made 2-way contact on 145.55 simplex with Soviet Space Station U4MIR. N9GHZ working on non-profit club status and repeater controller programming for Taylor County ARC. Central Wisconsin Radio Amateurs group has new rules to borrow amateur club equipment by club members. WA9KLM has applied for League affiliation of the Superior area radio club. New Club League affiliation received by KE9LV on behalf of the 42-member Northeast Wisconsin Radio League, their club newsletter is called N.E.W. Radioline. July 1st is start of my sixth year as Section Manager, thanks for all of your help and support. Happy fourth of July. July 8th, South Milwaukee ARC swapfest held outdoors, 7 AM at American Legion Post, Shepard Avenue north of Ryan Road, Oak Creek July 15th Eau Claire Hamfest, 4-H Buildings on Fairfax Street, walk-in exams. Experimental Aircraft Association Special Events Station in Oshkosh will be operational daylight hours from July 31 through August 1st, may be on air and in air from Goodyear blimp, contact WD9FLJ for details. Sorry to report Silent Key, W9KLK. KD9AJ and XYL Donna demonstrated Amateur Radio to 53 students at Jefferson Elementary School in Wauwatosa. Ozaukee RC selected W9WQ as ham of the year. The Green Fox ARC has been trying out an idea that is becoming popular for many clubs to reserve a few tables at swapfests in or for club members to place their equipment on sale, share the duty of watching the tables, promote Amateur Radio, and to get new members. Traffic: WB9YPY 2087, KC9CJ 989, WA9W 725, WG9J 509, W9CBE 242, W9LKN 187, K9GDF 174, W9YCV 168, N9BDL 122, KA9BHL 122, W9CXY 112, WA9WYS 99, AG9G 77, W9UCL 77, K9EP 70, KA9KLZ 64, N9BCX 64, K9AKG 64, K9JPS 47, NS9Q 46, AD9X 43, W9NGP 42, K9UTQ 41, KA9FVX 39, W9IEM 30, WB9ICH 29, K9FHI 28, N9BYS 18, W9ODV 16, W9UW 6, W9PVD 2.

DAKOTA DIVISION

MINNESOTA: SM, George Frederickson, KCØT—Traffic was really down for MSN this month (April) as was probably true everywhere. Our traffic total for the month was lowest in at least two years, standing at 2,213 with 20 stations reporting. The downside is of course, related to prevailing band conditions which seems to be a perennial topic. Magnetic storms and high absorption has taken its toll on the low bands where most traffic is handled. No nets have had to shut down yet, but net activity is bound to suffer a loss of vitality. The only thing to do is to keep going and hope for better things. I want to thank Cal, NRØS, of Rochester, for his help as Net Manager for MSN/1 for the past several months. Until further notice, I will be acting as net Manager for MSN/1. Duane, NØBEI of White Bear Lake, passed me information that within a couple of weeks of one another, two members of the 3M Radio Club became Silent Keys. They are Barney Schultz, WAØOOU, and Bill Stone, WAØOOS. On a happier note, it is with pleasure that we announce the Amateur of the Month for April as NØHWD, John Eye, of Isle, MN. Congratulations John, and keep up the good work. And thanks to all MSN participants for their help and support in all the Net activities. Until next time, 73 es GL, Jim Swisher, KAØEPY, STM.

NET	FREQ	TIME	QNI/QTC/SESS	NET MGR
MSN/1	3685	6:30P	298/42/30	NRØS
MSN/2	3685	10:00P	277/53/30	KDØNH
MSSN**	3710	6:00P	378/27/30	KAØSBY
MSPN/N	3860	12:05P	307/131/30	WBØWNJ
MSPN/E	3860	5:30P	792/214/30	KCØT
MAW	3860	6:00P	224/127/16	KDØCI
PAW	3925	9:00A	2559/272/113	WDØBAC

*Additionally, MSSN sent 69 Training Messages. Traffic: WBØWNJ 705, WAØTFC 321, KAØEPY 217, WØGRW 180, KAØPDM 143, KT9I 119, KAØSBY 113, NØFOO 94, KDØNH 48, KCØT 46, KDØCI 43, W9DM 40, WAØONE 40, NRØS 37, KØOGI 18, NØYE 17, WFØQ 12, WDØGUF KN9U 8, WOØW 3.

NORTH DAKOTA: SM, Bill Kurtti, WCØM—Peace Garden Hamfest July 7-9. Ft. Abercrombie Corn Feed 1st Sunday in Aug. Many of the clubs in ND have had their SKYWARN training again this spring. SKYWARN is one of the most important parts that we can take part in. Mary, WAØCSL, is back on 6 meters after a long absence. Congratulations to WØRGT on being 1 of the 1st 10 to complete his WAS on 17 meters. Also to NSØQ for 1st place in the ND QSO party. Upgrades Extra KFØAE, NØLL. Advanced NØJAN, NØHUS, KAØVLH, KAØTBY. General KBØDMD, KAØZZE. Tech KBØBRQ, KBØBRP, KBØBJR, KBØCIU, KBØDQU, KBØDRL, KBØCIT, KBØDRK, KBØDRM, WBØTNW, KBØDYA, KBØCDX. Regret to report that WØDMJ is a Silent Key. Visited with WAØRWM & WAØVGJ. They informed me that this year's corn feed would be their last. Many thanks, Lois and Jerry from all of us. Oh so much more to report, but only 16 lines. See you next month. Traffic: KAØFSM 34.

Net	Freq	Time	Sess/QNI/GTC	MGR
Goose River	1990 kHz	9 PM Su	4/115/0	
Data	3941 kHz	6:30 da	NØJR	
Wx Nets	3941 kHz		40/482/41	WØGFE
		9 AM-12:30 PM Monday-Friday		
Storm Net	3941 kHz	DURING STORMS ONLY		WCØM

SOUTH DAKOTA: SM, R. L. Cory, WØYMB—Asst SM NØABE, WAØFPR. SEC: KAØKPY. STM: KDØYL. The HUB City ARC at Aberdeen has received an award and Commendation from the National Weather Service stating it is impossible to know how many lives were saved or injuries prevented because of information provided by the clubs' spotters. DX ops are sad to learn of the death of Alma Rogers of the Ø district QSL bureau. If you have not signed up to operate on the SD Centennial Wagon Train, do so right away. It runs until Sept 4. Don't miss out on the fun. Congratulations to Danny, WBØMJY, on receiving the Honorary State FFA degree. KDØYL reports a decline in activity on the SD Novice net and the NE SD 2-meter net for this past month. Hot Springs ARC conducted a Fox Hunt on May 6th with the team of KAØFUI the winner. Total traffic reported for April was 614.

DELTA DIVISION

LOUISIANA: SM, John "Wondy" Wondergem, K5KR—ASM: KB5CX. SEC: N5ADF. ACC: K5KR. SGL: KD5SL. TC: W5RWF. OOC: WB4ICV. Packet: NE5S. Recently elected officers of the Central Louisiana ARC are Pres: Lou WG5W; VP John N5JMO; Treas: Ed KB5CX; Sec: Mary WB5CRU. The Central Louisiana Hamfest will be on July 1 at the Pineville High School Gym. This year it will be a 1-day event and promises to be bigger and better than ever. For information about the hamfest, contact Bob Guin, KD5RW, at (318) 992-5076. Ed Crump, KB5CX ARRL Assistant Section Manager and I will conduct an ARRL Forum and meet with the Section Leadership Volunteers. Many DX groups obtain up to the minute data on the mode, time and frequency of DX stations being worked by a recently developed packet network called a DX Packet Cluster. It is a computer program that receives DX information via packet from stations using the system and displays the information on a computer screen or printer in a concise, formatted manner. In addition to listing DX stations being worked at present time, all types of other information can be displayed such as future activities, QSL info, propagation, recent activities, etc. This system is now being introduced in Louisiana by Jim O'Brien, K5NV in New Orleans and Frank Biba, N5GH in Opelousas. Texas presently has a wide- spread system in operation. Statewide expansion of a Louisiana network could lead to a link with Texas expanding to hundreds of users. 73 de K5KR.

MISSISSIPPI: SM: Butch Magee, KF5DE-SGL: KA5WRX, STM: KBW, BM: W5EPW, ACC: NC5Y. PIO: WN5M. Welcome aboard to three new ARRL Section appointees: Bill Fryer, N5DVR is the new SEC, Jim Akers, W5VZF is the new TC and Mark Henry, WD5GHW is the new ASM. Lots of talent in this group, the Section is sure to be rewarded from the efforts of these men. The tornado season has gotten off to an early start this year, and as I write this we have potential threatening weather approaching. May be a long summer. I encourage each EC to get annual SKYWARN training. The NWS will schedule your club or county EOC for this training.

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SWR 1.2:1 Typical 2:1 Bandwidth, MHz	>3	>5	>10
Gain, dB	excellent	excellent	excellent
Power Rating, Watts FM	1000	500	500
Radiation Angle, Deg.	7	7	7
Horizontal Radiation Pattern, Deg.	360	360	360
Height, ft. (m)	14 (4.3)	9.3 (2.8)	4.9 (1.5)
Weight, lbs. (kg)	6 (2.7)	5 (2.3)	1 (.45)

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RC-20 Full-function remote control head	249.95
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Larsen PO-MM Mag mt, coax; MA-700/4000	24.70
Larsen PO-TLM Tnk lip mt, coax; MA-700/4000	24.70
TM-321A 25w 220 FM Xcvr w/TTP mic	469.95
RC-10 Remote controller handset	240.95
PG-4G Extra control cable for full duplex	21.95
TSU-5 Programmable CTCSS decoder	50.95
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TM-431A 35w 440 FM Xcvr w/TTP mic	469.95
TM-531A 10w 1.2GHz FM Xcvr w/TTP mic	569.95
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MC-85 Multi-function 8-pin elect desk mic	141.95
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TU-5 Programmable encoder	50.95
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PS-30 Power supply	200.95
PS-430 Compact power supply	204.95
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MC-48B Up-down 8-pin TTP microphone	70.95
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TH-215A 2.5w 2m FM HT/batt/cgr/TTP/PG-2V	399.95

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Accessories - TH-205AT/215A/315A/415A

BC-7 Desk rapid charger for PB-1/2/3/4	$109.95
BC-8 Desk charger for PB-1/2/3/4	52.95
BH-5 Swivel mount	29.95
BT-5 Alkaline battery case	22.95
HMC-2 VOX/boom mic headset	57.95
LH-4 Leather case for PB-2/3/BT-5	49.95
LH-5 Leather case for PB-1/4	54.95
MB-4 Mobile bracket	17.95
PB-1 800ma 12v (5w) battery	82.95
PB-2 Extra 500ma 8.4v (2.5w) battery	50.95
PB-3 800ma 7.2v (1.5w) battery	62.95
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RA-3 2m BNC ¾ wave telescopic antenna	19.95
RA-5 2m ¼-wv/440 ⅝-wv BNC telescopic ant	24.95
RA-8B 2m BNC stubby duck	16.95
RA-9B 220 BNC stubby duck	16.95
RA-10B 440 BNC stubby duck	16.95
SC-12 Soft case for PB-2/3/BT-5	32.95
SC-13 Soft case for PB-1/4	32.95
SMC-30 Speaker/microphone	52.95
SMC-31 Speaker/mic w/right angle plug	52.95
SMC-32 Mini water resistant rt angle spkr/mic	35.95
TSU-3 Encoder/decoder for TH-205AT	45.95
TSU-4 Decoder for TH-215A/315A/415A	45.95
VB-2530 2m 25w amp; TH-205AT/215A	128.95
WR-1 Water resistant bag	25.95
TH-25AT 2.5w 2m FM HT/batt/cgr/TTP	369.95

Extra PB-6 battery $5 with purchase of TH-25AT

TH-75A 1.5w 2m/440 HT/batt/cgr/TTP	549.95
TH-45AT 2w 440 FM HT/batt/cgr/TTP	389.95
TH-55AT 1w 1.2 GHz FM HT/batt/cgr/TTP	524.95

ACCESSORIES - TH-25AT/45AT/55AT

BC-10 Compact charger	$ 48.95
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BT-6 AA battery case	22.95
DC-1 DC adapter	25.95
PG-2V DC cable for DC-1	9.95
PG-3E Cig cord w/filter for DC-1	25.95
HMC-2 VOX/boom mic headset	57.95
PB-5 200ma 7.2v (2.5/2w) battery	57.95
PB-6 Extra 600ma 7.2v (2.5/2/1.5w) batt	57.95
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SC-15 Soft case for PB-6/BT-6; 25AT/45AT	25.95
SC-16 Soft case for PB-7/8/9; 25AT/45AT	25.95
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SC-19 Soft case for PB-7/8 w/55AT	22.95
SC-22 Soft case for PB-6 w/75A	29.95
SC-23 Soft case for PB-8 w/75A	29.95
SMC-30 Speaker/microphone	52.95
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Accessories; TH-A/B/2600A/3600A/2500/3500

AJ-3 Thread-loc to BNC adapter; TH-A/B	$ 11.95
BC-2 Wall charger for PB-21H	22.95
BC-6 Two-pack quick charger for PB-21/21H	104.95
DC-21 DC adapter for TH-A/B series	32.95
EB-2 External 'C' alkaline batt case; TH-A/B	22.95
PB-21 Extra 180ma battery for TH-A/B	26.95
PB-21H* 500ma battery for TH-A/B series	45.95
*BC-2 or BC-6 required to charge PB-21H	
RA-3 2m BNC ¾ wave telescopic antenna	19.95
RA-5 2m ¼-wv/440 ⅝-wv BNC telescopic ant	24.95
RA-8A 2m stubby duck for TH-A/B	14.95
RA-8B 2m BNC stubby duck	16.95
RA-9A 220 stubby duck for TH-A/B	14.95
RA-9B 220 BNC stubby duck	16.95
RA-10A 440 stubby duck for TH-A/B	14.95
RA-10B 440 BNC stubby duck	16.95
SC-8T Soft case w/belt hook; TH-AT/BT	20.95
SMC-30 Speaker/mic; 2600A/3600A/all TH's	52.95
VB-2530 2m 25w amplifier	128.95

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TENNESSEE: SM, Harry Simpson, W4MI— Eastern Assistant SM and PIO: W4TYU, Central Assistant *SM WA4GLS*, Western Assistant SM and ACC K4CXY, STM: NG4J. SEC: K4UVH. OOC: K4LSP. SGL: N4PQY. TC: W4HHK. The TN Phone Net is on 3890 kHz with early sessions at 6:40 AM Eastern, regular sessions at 7:45 AM Eastern Monday thru Friday, at 9 AM Eastern on Saturdays, Sundays and Holidays. Evening sessions are Monday thru Saturday at 7:30 PM Eastern. CW Net Sessions are on 3635 kHz at 8 PM Eastern, Monday thru Friday. Holy Smoke! You people were right! There is nothing like the Dayton Hamfest! After my first visit, I can only say, "I don't believe it!" All the radio and TV stations were quoting 100,000 as the number of visitors, and they might be correct. It is the only place I have ever heard of that you could work DXCC Eyeball without moving out of your tracks! My son Wayne, W4HUT, served as my chauffeur, guide and conscience, and the trip was enjoyable. It will not be the last. Ike Musselman, WB4LAL, has accepted the Net Manager's position on the CW net. He has been a dedicated member of that net, and I know his appointment will lead to a larger CW net membership. Thanks to W4TYU for handling the ARRL portion of the Oak Ridge Hamfest. Sorry that I couldn't attend, but when you are in the bottom left-hand corner of a 650-mile-long state, travel arrangements get difficult and expensive. Mid-South Amateur Radio Association, MARA, has a new President, Johnny Wofford, WA4ETE, due to the resignation for health reasons of Jim Larson, WB4KQQ. The club has made a step forward in appointing a permanent Hamfest Chairman and Co-chairman. In turn, they will appoint other members of a steering committee, not dependent upon annual club elections. This will let them work fulltime at the hamfest effort, at least as far as their other duties will let them. W4MI is Chairman and Nita, N4DON (whom we stole from Chattanooga), is Co-chairman. We'll ask for your help. Traffic: W4FMR 128, W4MI 55, K4WOP 50, W4DDK 35, KA5KDB 33, WA4GZZ 30, W4TYV 29, WB4LAL 26, K4CXY 24, W4PFP 20, WA4HKU 19, WD4GYT 8, KI4V 6, W4EWR 4, W4SGI 4.

GREAT LAKES DIVISION

KENTUCKY: SM, John Thernes, WM4T—Asst. SM: KC4WN. SEC: WB4NHO. STM: KA4MTX. PIO: WA4SWF. (April) WD4RWU has just published a new roster of KTN members. See Tom if you did not receive your copy. Our SEC is busy working with N4EEL and WA4UMR to recruit amateurs for emergency communications work in the District 6 area in Louisville. Lexington area hams gave communications support to three events all on the same day of April 15th. By the time your read this, the no-code issue will be up for a vote by the ARRL Board. Now is the time to let your director know your comments. I urge you to read the committee report again found in the May issue of QST. Have a safe and happy summer!

Net	QNI	QTC	Sess	Mgr
MKPN	1384	147	30	WD4RWU
KTN	814	94	30	WD4RWU
KYN(both)	311	145	60	K4AVX/KZ8Q
TSTMN	402	34	30	KZ8Q
KNTN	354	67	40	WA4EBN
NKEN	65	1	4	KI4QH

SAR (Apr.): WD4RWU 256, K4VHF 136, KI4QH 73, WA4EBN 58, N4LAF 52, KB4UJA 41, KC4WN 37, K4AVX 33, WA4HLM 29, N4PET 26, KA4MTX 22, WB4AUN 22, KU4A 4, WD4CQF 4. PSHR: KI4QH 98, KA4MTX 63.

MICHIGAN: SM, George E. Race, WB8BGY (@N8FTY)— ASM: WA1LRL (@WA1LRL). STM: WD8KQC (@NT8R). SGL: N8CNY. TC: W8YZ. OOC: WA2AJQ. ACC: N8JVA. PIO: N8KBA. BM: WI8W. New Oakland Co. EC, Dale, N8IIC, has had his hands full during his first month. With the help of PRB-1, Dave-W8YZ, and many other local Amateurs, Dale has successfully held off a very prohibitive antenna ordinance in Oakland Co. The results, Amateur antenna structures have been successfully deleted from the new local antenna ordinance. A week later, Dale and the group provided emergency communications for a train tank car derailment and the evacuation of nearby families. It seems to be tradition, for many of your MI ARRL Staff to attend the U.P. Hamfest. This year it is hosted by the Hiawatha ARA and will be held at Marquette Lakeview Arena on July 29. Hope to see many of you there. Don't forget to mark August 27-28 for the Five-County Swap-N-Shop and the MI ARRL Convention to be held in Saginaw. More details next month. Depending on when you get this issue of QST, Field Day competition is about to start, in progress, or just over. The big question is who will claim the Ivory J. Olinghouse, W8ZBT, MI Field Day award. Competition is open to all MI ARRL Affiliated Clubs. The L'Anse Creuse ARC was awarded a Certificate of Appreciation by the Mount Clemens Business Association for Community support. No code seems to be the topic of discussion on the air and in many news letters. I urge you to put your comments in writing, pro or con, to Director Nathanson, W8RC. See page 8 of QST for address. The ARRL board will meet in July and Director Nathanson needs your input on this important issue. No code licensing is being proposed by many groups other than the ARRL. Your input through Director Nathanson will help to decide the type of proposal from the ARRL, if any, that will reflect the feelings of MI Amateurs. See committee report in May 1989 QST for full details of proposed no code structure. Don't forget the MI ARPSC Net, Sunday 5:00 PM on 3.932 MHz. Please support the following MI area Nets:

Net	Freq	Time	QNI	QSP	Ses	MGR
UPN*	3921	5:00PM Dy	942	102	35	WA8DHB
MACS*	3953	11:00AM M-Sa	288	51	30	K8OCP
MITN	3953	7:00PM Dy	521	181	30	WD8EIB
QMN*	3663	6:00PM Dy	866	144	88	WB8R
MNN*	3722	5:30PM Dy	353	129	60	KA8BBY
SEMTN	145.33	10:15PM Dy	394	70	30	N8HSC
GLETN	3932	9:00PM Dy	1072	54	30	NW8M
WSSBN	3935	7:00PM Dy	534	27	30	W8NDI
VHF Net Activity		No Report Received				NO8Q

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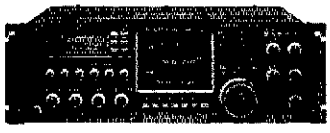

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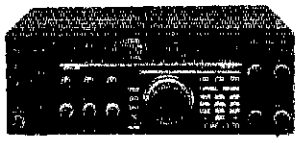

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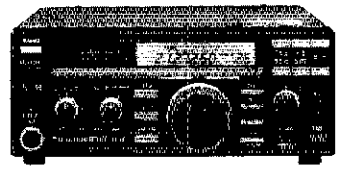

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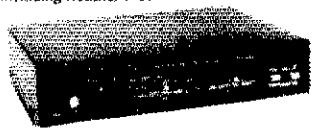

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*QMN Fast-6:30PM Dy; QMN Late-10PM Dy.; MNN Late-8:00PM Dy.; MACS-1PM Sun.; UPN-12PM Sun. Traffic for April: KA8CPS 276, KA8BBY 266, N8FTY/BBS 116, WD8KQC 112, WB8YDZ 101, K8GXV 86, WB8SYA 80, NJ8S 73, WB8R 65, N8HSC 65, N8FPN 64, NY8W 60, WB8YPG 59, WB8BGY 58, WD8MJB 57, WA8DHB 55, NW8M 53, N8CNY 38, N8JAT/BBS 38, N8IIC 35, K8UPE 34, WB8YPG 32, W8EOI 31, K8ZJU 31, WD8EIB 31, K8CQF 28, KA8SYK 26, WN8H 26, W8YIQ 25, K8OCP 25, K3UWO 21, WI8J 20, W8RNQ 17, W8IHX 12, W8CSO 12, KI8Q 12, W8BEZ 10, WA8MVH 10, W8VIZ 9, N8HKX 7, W8URM 7, KN8JDN 6, W8YZ 5, WB8WJV 5, W8CUP 3, N8EXS 3, K6HAP 2. March: NJ8S 108, WB8YDZ 101, W8IHX 29, *N8HKX 13.*

OHIO: SM, John Haungs, WA8STX—Welcome to the new OSSBN Manager, Orville E. (Doc) Russell, N8IBS, of London, Ohio. Doc spoke at the OSSBN forum at the Dayton HamVention and charged everybody to get busy and check into the nets. So let's all cooperate and help Doc have an active net. The death of Jerry Spencer, K8OZ, a former Ohio STM, ORS and long-time Net Manager of the OSSBN was reported. He was a regular member of every Section and Area Net, and active on Packet Radio and was a source of inspiration to all who dabble in Packet. He was founder of the Burning River Traffic Net, the North Coast Traffic Watch, the Sunrise Slow Net and the Buckeye Sideband Net. Jerry will be missed very much. Dayton Amateur Radio Assn. has established a Memorial Scholarship Fund in honor of Bob Zimmerman, W8ZM, who was one of their most active members. For his many friends in Dayton and around the country wishing to remember him, contributing to the Memorial Scholarship is a fitting tribute. (DARA, POB 44 Dayton, OH 45401) Jason Everly, KB8GAJ, the 11 yr old son of K8IKE, who was newly licensed as a Novice in January has worked 106 countries in four months, half on CW and half on SSB. He was also active in the Novice roundup. He is a real enthusiast of CW and will probably be upgraded to General class by the time you read this. Bob Carswell, KA8MNS of the Canton ARC was presented a special ARRL Elmer Award by Craig Studker, KA8PNQ of the Canton ARC. Congratulations to Bob. The Lake County ARA presented their "Good Ducky" Award to K8CDQ...Harry Habig, K8ANV, of Cincinnati, who was one of the early developers of the Delta Loop antenna passed away recently. He donated a Delta Loop antenna to ARRL and they ran extended tests on Harry's model on top of their towers. The new Editor of the Greater Cincinnati Amateur Radio Assn. "Mike & Key" is Walter Harris, KA8KLP. The Cincinnati Hamfest is scheduled for Sunday Sept. 17 at Stricker Grove, Ross, OH. Listen in on 145.80- 146.00 MHz SSB at most any hour of the day and chances are that you will hear familiar sounds of Hams enjoying an OSCAR-13 contact... Larry Solak, WD8MPV, the SEC has reminded all DECs and ECs of their reporting responsibilities as leadership appointees in the ARES organization. Reports for Special Events, Public Service Activities, and Emergency Operations should be filed as soon as possible after the event on Form FSD 157. File these directly with ARRL Headquarters and the SEC with a copy to the DEC.

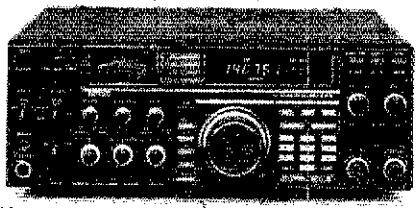
Net	QNI	QTC	Ses	Time	Freq	Mgr
BN(E)	249	98	30	1845	3.577	WD8C
BN(L)	196	68	30	2200	3.577	K8TVG
BNR	266	93	30	1800	3.605	W8EK
BSSN	64	25	15	1830	3.873	
OSN	236	68	30	1810	3.708	WD8KBW
OSSBN	1723	661	90	1030,1615 1845	3.9725	N8IBS
OSSN	213	65	30	0645 M-F	3.577	KD8HB
OSSN	---	---	---	0800 S-SN	3.708	KD8HB
O6MN	---	---	---	2100 M-W-F	50.16	WD8CTX
OHIO SECTION AREA NET				1700 SUN	3.875	WD8MPV
OHIO WIDE AREA WX NET				A/R	3.875	WD8MPV

Traffic: W8BO 247, KD8KU 224, W8PMJ 210, KD8HB 188, W8ZOL 172, KA8CGF 148, WD8KFN 143, K8TVG 140, WA8STX 133, KS8J 121. K8JDI 119, W8LDU 106, WA8SKP 104, W8EK 98, N8IIP 95, WA8HED 95, KA8HBN 95, WA8SSI 95, K8CMR 94, K8ALV 90, N8FWA 85, W8CXM 71, KA1S 71, W8QZK 67, WD8IKC 65, N8GEC 63, KA8GJV 60, KA8SON 56, N8INP 53, WD8KBW 52, KE8CV 52, KC8TW/BBS 52, WB8JGW 51, WD8QXT 48, K8IOW 45, N8XX 44, W8PBX 40, KA8BNQ 39, WB8FSV 37, K8LQM 34, NW8E 32, KC8YV 32, NS8C 30, K8ES 27, WB8KWC 27, WB8VNV 27, NE8X 27, W8LDQ 26, KA8YIT 26, N8GOB 25, KB8ABO 25, WD8JYE 24, N8CW 24, WB8HHZ 24, NC8Q/BBS 23, KA8DRR 22, K8EF 20, N8CEI 19, WA8EYQ 18, W8BDC 18, KE8WK 17, KD8XL 16, WD8DPZ 16, N8AJU 15, N8GOQ 14, N8JH 14, W9SWM 13, N2NS 13, N8EFB 13, K8DXZ 11, N8CJS 11, N8AIJG 11, W8BI 11, N8JSN 10, W8XT 10, K8WOQ 10, WD8PWG 10, KA8RIX 9, KB8FAL 9, W8RG 8, KB8ESU 8, KB8AKW 8, W8FPA 8, N8HJB 5, KB8FSR 5, N8JYV 3, K8CKY 3, KA8RQF 2, WA8NZE 2, N8GIO 2, WB8OFR 1, WB8CSP 0. (Mar.) W8BI 50, N8INP 19, KA8CKZ 14, N8JDH 14, WD8PWG 10, N8CJS 6, WB8CSP 1, N8HBF 1. (Feb) K8EF 17.

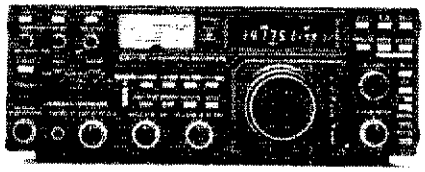
HUDSON DIVISION

EASTERN NEW YORK: SM, Paul S. Vydareny, WB2VUK—ASM: K2ZM. STM: WB2EAG. SEC: WA2ZYM. BM: WB2IXR. PIO: KB2TM. OOC: N2DVQ. ATC: WA2VGM. SGL: KB2HQ. ACC: KV2A. ASM/NWSLTR ED: WB2NHC. ASM/PACKET: N2FTR. NET REPORTS FOR APRIL MANAGERS CALL/QSP: AESN: WA2JBO/1 CDN: WB2ZCM/82 ESS: W2WSS/73 HVN: KA2MSL/47 NYP: W2MTA/149 NYPON: KA2UBD/339 NYSE: N5MEA/169 NYSL: W2YGW/224 NYSM: N2EIA/236 SDN: K2ZVI/128. CLUB NEWS: Albany ARA held their annual dinner the beginning of May. Catskill Mtn ARA report that W2FSL had a stroke. They report that they, in conjunction with Rip Van Winkle provided communications for WalkAmerica with WB2UEB, AA2Y, KA2RLH, N2IWB, N2HRC, WB2UYO, WB2UYR, WB2VYB, N2CRJ, WD2K and WE2G. CCNR reports that their long-time treasurer, WB2MOG became a silent key. PEARL had a successful hamfest May 6th. Rip Van Winkle heard a presentation in May by AK2E on the Official Observer program and self-policing of Amateur Radio. Saratoga RACES heard about the national weather service and held elections in May. KM2N addressed Schenectady ARA on RF Bio-effects and your health. They welcome new members WA2CPP KB2FUS. W2LH and W2EEO presented their antenna demonstration at WEST. ARA in May. WECA held elections with new VP WA2FSR, new Educ Dir: K2ZVI, new Tech Dir: N2DVQ, new Dir/Ige: N2DHH, new Monitor dir: N2FMC. Start planning now for your fall club meetings.

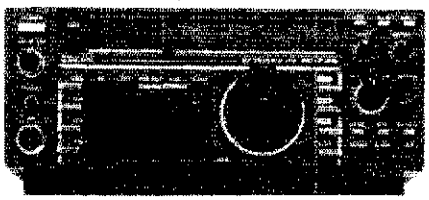
HF Equipment	Regular	SALE
IC-765 Xcvr/ps/keyer/auto tuner	3149.00	2789
IC-781 Xcvr/Rcvr/ps/tuner/scope ...	6149.00	Call



IC-761 Xcvr/Rcvr/ps/tuner	2699.00	**2369**
HM-36 Scanning hand microphone	47.00	
SP-20 Ext. speaker w/audio filter ..	149.00	**139.95**
FL-101 250 Hz 1st IF CW filter	73.50	
FL-53A 250 Hz 2nd IF CW filter	115.00	**109.95**
FL-102 6 kHz AM filter	59.00	
EX-310 Voice synthesizer	59.00	



IC-751A 9-band xcvr/.1-30 MHz rcvr	1699.00	**1469**
PS-35 Internal power supply	219.00	**199.95**
FL-63A 250 Hz CW filter (1st IF)....	59.00	
FL-52A 500 Hz CW filter (2nd IF)...	115.00	**109.95**
FL-53A 250 Hz CW filter (2nd IF)...	115.00	**109.95**
FL-33 AM filter	49.00	
FL-70 2.8 kHz wide SSB filter	59.00	
RC-10 External frequency controller	49.00	



IC-735 HF transceiver/SW rcvr/mic	1149.00	**989.95**
PS-55 External power supply.....	219.00	**199.95**
AT-150 Automatic antenna tuner ...	445.00	**369.95**
FL-32A 500 Hz CW filter	69.00	
EX-243 Electronic keyer unit	64.50	
UT-30 Tone encoder	18.50	
IC-725 Ultra compact HF xcvr/SW rcvr	949.00	**849.95**

Other Accessories	Regular	SALE
IC-2KL 160-15m solid state amp w/ps	1999.00	**1699**
EX-627 HF automatic antenna selector	315.00	**279.95**
PS-15 20A external power supply.....	175.00	**159.95**
PS-30 Systems p/s w/cord, 6-pin plug	349.00	**319.95**
MB Mobile mount, 735/751A/761A...	25.99	
SP-3 External speaker	65.00	
SP-7 Small external speaker	51.99	
CR-64 High stab. ref. xtal for 751A....	79.00	
PP-1 Speaker/patch.....	179.00	**164.95**
SM-6 Desk microphone	47.95	
SM-8 Desk mic - two cables, Scan,....	89.00	
SM-10 Compressor/graph EQ, 8 pin mic	149.00	**139.95**
AT-100 100W 8-band auto. ant. tuner...	445.00	**389.95**
AT-500 500W 9-band auto. ant. tuner ...	589.00	**519.95**
AH-2 8-band tuner w/mount & whip....	758.00	**689.95**
AH-2A Antenna tuner system, only.....	559.00	**499.95**
GC-5 World clock	91.95	**79.95**

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IC-275A 25W 2m FM/SSB/CW w/ps	1299.00	**1099**
IC-275H 100W 2m FM/SSB/CW	1399.00	**1199**
IC-375A 25W 220 FM/SSB/CW *(Close.)*	1399.00	**799.95**
IC-475A 25W 440 FM/SSB/CW w/ps	1399.00	**1199**
IC-475H 75W 440 FM/SSB/CW.....	1599.00	**1369**
IC-575A 25W 6/10m xcvr w/ps	1399.00	**1129**
IC-575H 100W 6/10m xcvr.....	1699.00	**1499**

VHF/UHF/1.2 GHz Mobiles	Regular	SALE
IC-47A 25w 440 FM/TTP mic *(Closeout)*	549.00	**369.95**
PS-45 Compact 8A power supply...	145.00	**134.95**
UT-16/EX-388 Voice synthesizer ...	34.99	
SP-10 Slim-line external speaker ...	35.99	
IC-28A 25W 2m FM, **TTP** mic *(Special)*	469.00	**379.95**
IC-28H 45W 2m FM, **TTP** mic	499.00	**439.95**
IC-38A 25W 220 FM, TTP mic	489.00	**349.95**
IC-48A 25W 440-450 FM, TTP mic....	509.00	**449.95**
HM-14 Extra TTP microphone	59.00	
UT-28 Digital code squelch.....	39.50	
UT-29 Tone squelch decoder.....	46.00	
HM-16 Speaker/microphone	34.00	
IC-228A 25W 2m FM/TTP mic *(Special)*	509.00	**429.95**
IC-228H 45W 2m FM/TTP scan mic...	539.00	**479.95**
IC-448A 25W 440 FM/TTP mic	509.00	**449.95**
UT-40 Pocket beep function.....	45.00	
IC-900A Transceiver controller.....	639.00	**569.95**

★ Package Special . . .
IC-900A Transceiver controller with **UX-29H** 2m/45W and **UX-39A** 220/25W band units.
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UX-19A 10m 10W band unit	299.00	**269.95**
UX-29A 2m 25W band unit.....	299.00	**269.95**
UX-29H 2m 45W band unit.....	349.00	**319.95**
UX-39A 220MHz 25W band unit....	349.00	**299.95**
UX-49A 440MHz 25W band unit....	349.00	**319.95**
UX-59A 6m 10W unit	349.00	**319.95**
UX-129A 1.2GHz 10W band unit ...	549.00	**499.95**
IC-1200A 10W 1.2GHz FM mobile.....	699.00	**599.95**
IC-2500A 440/1200MHz FM mobile	999.00	**899.95**
IC-3210A 25w 2m/440 FM/TTP	739.00	**649.95**
AH-32 2m/440 Dual Band antenna ...	39.00	
AHB-32 Trunk-lip mount	35.00	
Larsen PO-K Roof mount.....	20.00	
Larsen PO-TLM Trunk-lip mount	22.00	
Larsen PO-MM Magnetic mount	22.00	
RP-1210 1.2GHz 10W 99 ch FM xcvr	1529.00	**1349**
RP-2210 220MHz 25W repeater	1649.00	**1399**

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IC-2A 2-meters.....	289.00	**259.95**
IC-2AT with TTP.....	319.00	**279.95**
IC-02AT/High Power	409.00	**349.95**
IC-04AT for 440 MHz	449.00	**389.95**
IC-u2AT for 2m w/TTP	329.00	**279.95**
IC-u4AT 440 MHz, TTP	369.00	**289.95**

FREE Battery! . . .
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IC-2GAT for 2m, TTP	429.00	**379.95**
IC-4GAT 440MHz, TTP	449.00	**399.95**
IC-32AT 2m/440MHz	629.00	**559.95**

Aircraft band handhelds	Regular	SALE
IC-12AT 1W 1.2GHz FM HT/batt/cgr/TTP	473.00	**369.95**
IC-12GAT 1W 1.2GHz HT/batt/cgr/TTP	529.00	**469.95**
A-2 5W PEP synth. aircraft HT.....	525.00	**479.95**
A-20 Synth. aircraft HT w/VOR.....	625.00	**569.95**

Accessories for all except micros	Regular
BP-7 425mah/13.2V Nicad Pak - use BC-35	79.00
BP-8 800mah/8.4V Nicad Pak - use BC-35...	79.00
BC-35 Drop in desk charger for all batteries	79.00
BC-16U Wall charger for BP7/BP8.....	21.25
LC-11 Vinyl case for Dlx using BP-3	20.50
LC-14 Vinyl case for Dlx using BP-7/8	20.50
LC-02AT Leather case for Dlx models w/BP-7/8	54.50

Accessories for IC and IC-O series	Regular
BP-2 425mah/7.2V Nicad Pak - use BC35....	49.00
BP-3 Extra Std. 250 mah/8.4V Nicad Pak	39.50
BP-4 Alkaline battery case	16.00
BP-5 425mah/10.8V Nicad Pak - use BC35	65.00
CA-5 5/8-wave telescoping 2m antenna	19.95
CP-1 Cig. lighter plug/cord for BP3 or Dlx....	13.65
CP-10 Battery separation cable w/clip	22.50
DC-1 DC operation pak for standard models	24.50
MB-16D Mobile mtg. bkt for all HTs.....	25.99
LC-2AT Leather case for standard models.....	54.50
RB-1 Vinyl waterproof radio bag.....	35.95
HM-9 Speaker microphone.....	47.00
HS-10 Boom microphone/headset.....	24.50
HS-10SA Vox unit for HS-10 & Deluxe only	24.50
HS-10SB PTT unit for HS-10.....	24.50
SS-32SMP Commspec 32-tone encoder	27.95

For other HT Accessories not listed please CALL

Receivers	Regular	SALE
R-71A 100kHz to 30MHz receiver.....	$999.00	**869.95**
RC-11 Infrared remote controller....	70.99	
FL-32A 500 Hz CW filter	69.00	
FL-63A 250 Hz CW filter (1st IF)	59.00	
FL-44A SSB filter (2nd IF).....	178.00	**159.95**
EX-257 FM unit.....	49.00	
EX-310 Voice synthesizer	59.00	
CR-64 High stability oscillator xtal	79.00	
SP-3 External speaker.....	65.00	
CK-70 (EX-299) 12V DC option.....	12.99	
MB-12 Mobile mount	25.99	
R-7000 25MHz to 2GHz scan rcvr	1199.00	**1029**
RC-12 Infrared remote controller....	70.99	
EX-310 Voice synthesizer	59.00	
TV-R7000 ATV unit.....	139.00	**129.95**
AH-7000 Radiating antenna	99.00	
R-9000 100KHz-2GHz all-mode rcvr...	5459.00	**4899**

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With the ability to purchase from anywhere in the country by phone in the common available fly of approved banking and the ease in which products can be shipped, we feel this new method of distribution is far more cost effective and of benefit to our customers.

We believe in quality and we will continue to produce quality. The net effect of selling direct will enable us to maintain our quality while giving you, the consumer, the best possible price.

This change in marketing will not only enable us to give you an even better value for your dollar, but it will allow us to serve you better in answering your questions and servicing your needs.

Due to your belief in us and our products we will continue to give you the products and services you have come to expect from MOSLEY.

73's

Gary, K0MUW

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TA-31FM	519.95	389.95
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TA-40KT	149.95	89.95
CL-33M	449.95	318.95
CL-36M	615.95	469.95
PRO-57	569.95	495.95
PRO-67	829.95	625.95

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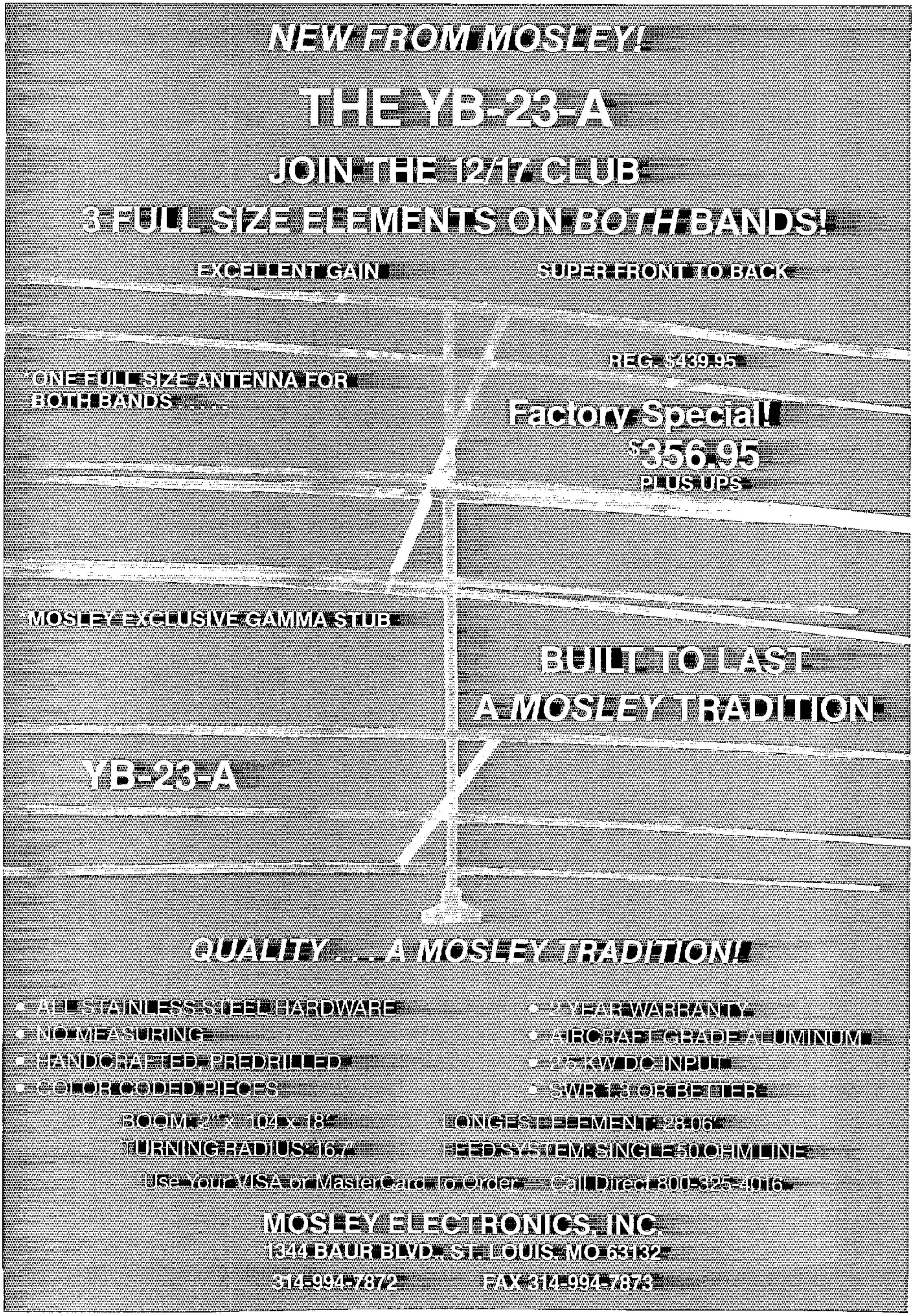
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Speakers are available on various subjects. Contact me if interested. Any information on club summer activities is welcome. April PSHR: WB2EAG N5MEA WB2VUK K2ZVI N2HIF WB1BTJ KB2EPU WB2NVR. April BPL: WB1BTJ (2nd in row). April traffic: WB1BTJ 729, N2HIF 292, WB2EAG 263, N5MEA 253, WB2VUK 132, K2LYE 123, K2ZVI 101, WA2GYY 86, NQ2H 70, WB2IIV 67, KB2EPU 56, WD2K 54, WA2JBO 44, WF2M 23, WB2NVR 13, W2CJO 12, K2HNW 8, KA2Q 8.

NEW YORK CITY-LONG ISLAND: SM, Walter M. Wenzel, KA2RGI—ASM: N2GQR. ACC/PIO: KA2LCC. SEC: WA2UJI. STM: K2MT. OOC: NB2T. TC: W2QUV. BM: W2JUP. The following are traffic nets in and around the section that handle NLI:

NET	FREQ	TIME	DAY	MGR
BAVHF	145.350/R	2000	DLY	K2TWZ
NCVHF	146.745/R	1930	M-F	N2IMP
SCVHF	145.370/R	2000	S-F	KA2JMA
NYPON	3913 kHz	1700	DLY	KA2UBD
NYS/M	3677 kHz	1000	DLY	N2EIA
NYS/E	3677 kHz	1900	DLY	KU2N
NYS/L	3677 kHz	2200	DLY	KU2N
NLT	28450 kHz	2100	WED	N2IMP
ESS*	3590 kHz	1800	DLY	W2WSS
PNS	145.01	24hr	DLY	AI2Q-4
PNS(Alt)	145.03	24hr	DLY	WB2IBO-4

*Independent Net, recognized by NTS, all times are local. VE LISTINGS: LIMARC - second Saturday of each month at 9:30 AM at Salten Hall, NY Institute of Technology,Old Westbury - contact Al Jones,W2ZDB 516-676-5790 SUFFOLK COUNTY VE TEAM - second Saturday of each month at 9:30 AM at the Suffolk County Community College, Selden-contact George Sintchek,WA2VNV 516-751-0894; GRUMMAN ARC-second Tues. of each month, at the Bethpage High School, Bethpage, at 5:00 PM at the Grumman Recreation Center, Bldg. 800, South Oyster Bay Road, Hicksville-contact Howard Liebman W2QUV ✆6-354-6861; GREAT SOUTH BAY ARC-fourth Sunday each month at 12 Noon at the Babylon Town Hall Office Annex, North Babylon-contact Walter Wenzel, KA2RGI 516-957-5726; MAARC-last Thursday each month at 8:00 except July, Aug. and Dec., at the Robert Wagner JHS, Manhattan-contact Rubina Asti, KD2IZ 212-838-5995. If your group holds regularly scheduled license exam sessions and/or classes let me know so they can be added to this listing. Recent appointments within the section include: Marc, WB2DWC as an Assistant Technical Coordinator and Bob, N2HZO as an Assistant Emergency Coordinator for Brookhaven Township. The section is still looking for people to assist in the capacity of ATCs, PIAs, and OOs. If you are interested please contact me for more information. Larkfield ARC is running an Aviation Net on Weds. 8 PM on 147.210. All Hams with an interest in flying are invited to check in. Larkfield ARC is also starting an Amateur Information Service Net to assist hams in understanding computers and digital communications. Please contact the club for more information. MAARC has expanded its weekly Simulated Emergency Net which is on Tues. 8:30 PM on 147.36 to include another net on Mon. 8:30PM on 223.94. All amateurs are welcome to participate in the nets. For more information contact Bob, KA2TQV. A very enjoyed event happened while in the middle of writing this month's column, my wife, Carol, KA2VYH, gave birth to our third harmonic, David John. The whole family wishes to thank everyone for their best wishes and thoughts.

NORTHERN NEW JERSEY: SM, Robert R. Anderson, K2BJG —ASMs NW2L (NE), N2CXX (SE), N2WM (NW), WB2NQV (SW), N2XJ ((Cen) and VE), SEC WB2HBZ, STM K2VX, OO/AAC KA2BZS, ACC K2BJG, SGL W2KB, TC K2BLA, BM WA2UPK and PIO NW2L. NNJ Ham Radio Info Line 201-680-1585. Appointment endorsements for the next two-year term starting 07/89 are: Dave Webb, WB2HVF District Emergency Coordinator (DEC) for Essex County. OBSs N2CXX, W2FMN, WA2SNA and WA2UPK. ORS's KA2HNQ, KR2J, N2AAM, W2RRX, W2VY and WA2EXX. New appointments effective 05/89 are WE2R PIA for Major Armstrong Memorial ARC. New Jersey REACT ARC is now an ARRL affiliate club. The Charter Certificate was presented by Division Director Mendelsohn, WA2DHF and NNJ SM/ACC K2BJG, at NNJ meeting held at Maywood on May 7, 1989, Ramapo Mountain ARC has successfully renewed its Special Service Club status. Congratulations to the following who were newly licensed or upgraded during April sessions conducted by: West Morris ARC (37/16), Northeast NJ Testing Asso (6/4), Raritan Bay ARC (17/12), NNJ VE Board (24/12), Bergen ARA (21/12) and Cherryville Repeater Asso. Novice (19): F Boots, R Riverbart, N Mazor, D Esth, Jerome Ferri, Joseph Ferri, K Badenhausen, O El Rafei, A Guerrera, C Nunes, B Weaver, Z Zakarian, J Chen, L Mahan, D Deily, C Malzone, M McKenzie, R Smith a D Thorne. Technician (29): KA3KDL, KB2GUZ, D Sinner, R Di Paolo, A Seghataleslami, KB2GXL KB2GRM KB2GTF KB2BKT KB2HKY KB2CDQ KB2GYI KB2GYJ KB2FJR KB2GUX KB2FPV KB2HLO KB2HLP KB2GQT KB2CXQ KB2GXM KB2FVV KB2HJC KA3NRI J Jackson, R Krysiak, F Shunaman and M Vanornum, General (13): KB2HFF, KB2AMH, J Naughton, KB2EBV, D O'Brien, KB2HEJ, KB2EFT KB2ENR N2ITL WA2FPO KB2FKE, A Lemma, and P Collins. Advanced (12): KA2KJM WA2JSB N2JUK KB2GQR N2IUT N2IRO WA2OSI KA2NOS N2JAJ K2CCN WB2VVV and KA2FUG. Extra (10): N2ESD KE2GF KB2QZ WB2CVL W2HQH N2COH KE2JD KC7KU N2HJP and KA3QYH. Total applicants (165). Total New or Up-Grade (83). 50.3% Traffic Nets and Statistics for April 1989 follow:

Net	Mgr	Freq	Time	Sess	Ses	QNI	QSP
NJM	WB2ZJF	3695	1000	Dy	30	224	168
NJPN	W2CC	3950	1800	Dy	35	299	108
NJ/E	W2QNL	3695	1900	Dy/P	30	314	144
NJN/L	WA2OPY	3695	2200	Dy/P	30	130	40
NJVN/E	WB2FTX	146.895	1930	Dy	30	665	144
NJVN/L	N2FGC	146.49	2230	DY/P	30	240	112
NJSN	KA2INE	3735	1830	Dy	30	171	22
OBTTN	W2RRX	147.12	2000	Dy	30	282	158
NJTTN	N2DXP	223.88	2100	Dy	30	165	34
NNJ/PL	W2QNL	145.01	24 hr via			WA2SNA-1	

Packet NTS activity: Total 228. WA2SNA-1 auto forward (120) plus liaison (108) by NZ2T (31), W2QNL (63), W2KB (2), WB2FTX (8), KC2YG (3) and KR2J (1). SAR/PSHR: W2RRX 220/110, K2VX 143/97, W2QNL 317/123, N2XJ 223/105, N2DXP 514/60, KA2INE 61/72, W2FTX 87/65, WA2MHA 11/-, W2XD 11/-, KA2KJF 230/102, KE2JX 72/- N2DIY 50/45, KB2QO 94/- WB2QMP 561/101, WA2CLP 10/-, NR2O 45/-, KB2WI 30/- and W2CC 27/-. BPL: N2DXP and WB2QMP.

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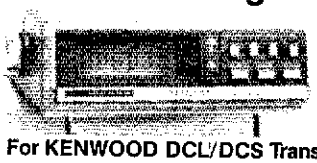

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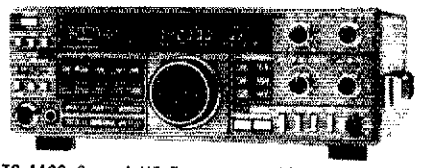

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MIDWEST DIVISION

IOWA: SM, Wade Walstrom, WØEJ—ASM: WBØAVW. SEC: KDØBG. STM: KCØXL. ACC: NUØP. OOC: WAØQMU. BM: KØIIR. TC: KØDAS. Recent upgrades during recent VE exams in Waterloo were KAØVUT, KBØBAQ, KBØBAR, KBØEDF and KBØEFG to Technician, KBØBTB and NØJXK to General, and KAØCQP and NØJXW to Advanced. The Fort Madison ARC had four pass the Novice test. In Des Moines, KAØFNC and KBØDPU upgraded to Technician and KAØAQY to Advanced. Congratulations to all! The Fort Madison ARC has donated copies of "Tune in the World..." and the "ARRL Handbook" to the Cattermole Memorial Library. WBØVYG, NØGCP, WØIHC, KAØYAP, KAØFAJ, K9BD, WBØSGW, and WAØKLD, all of the Fort Madison ARC, assisted with the Special Olympics. WBØAVW was reelected as net manager for the Iowa 75 meter Noon and Evening Nets and KØBHE was reelected as secretary- treasurer. WBØVYG and KDØRN have successfully completed the Emergency Coordinators training course. Well done! Regretfully, WØIEY, KØUM, and KØPSC became Silent Keys this past month. Many will surely remember KØPSC's left footed key demonstrations. The Central Iowa Technical Society recently completed a permanent weather satellite display for the Science Center of Iowa in Des Moines. This was an ambitious project by CITS and will be an excellent addition to the Center. Traffic: WØSS 119, KØIPT 98, WØYLS 60, KAØADF 51, KØGP 40, KAØVBA 28, WBØAVW 19, WBØMCX 13, KØCNM 5. March Traffic: WBØMCX 40, KØCNM 19.

KANSAS: SM, Robert M. Summers, KØBXF—SEC: NØBLD. STM: WØOYH. Net Manager KSBN/KPN, WØFRC. Net Mgr QKS, WBØZNY. Ks RTTY Mgr, open. District Emergency Coordinators are WØOAG, WBØYJT, WØEB, WØFRC, NKØV, WAØCVR, WBØMDF. State Govt. Liaison NØBLD. Tech Co-Ord. KAØHEP. Bulletin Mgr KØJDD. ACC, KØBXF. PIO: WBØWSG. Manager of QKS-SS is WØMYM. Wx Net Manager, WBØYWZ. Packet Coordinator NXØR. With deep sadness, I report to you another Silent Key: Harold, WØNSD. Congratulations to Special Service Clubs Central Kansas ARC and Pilot Knob ARC for renewing their SSC status; also to the Jayhawk ARC, Kansas City, for their efforts in becoming an SSC. Is your club striving to do things above and beyond the usual as far as activities etc? If so, why not pursue the SSC status for the club! Marshall County ARC elected the following as club officers: WBØSZS, Pres. NØAEU V. Pres; KAØRNY Sec/Treas. and KAØYZL as Trustee. Results of our Public Service for March: KSBN QNI 1510 QTC 109. KPN QNI 428 QTC 21. CSTN QNI 2238 QTC 78. QKS QNI 240 QTC 79 AND QKS-SS QNI 16 QTC 4. With all the new Novices out there, we need to spread the word about the SLOW SPEED net M-W-F 7:30 PM local time. A good frequency to learn a lot about a number of things. Traffic: KØBXF 363, KAØRCH 263, WØFIR 215, NZØM 201, WØFRC 144, KSØU 130, WAØTJU 94, WØOYH 81, WØFDJ 56, WØQMT 55, WBØZNY 55, NBØZ 30, WØMYM 10, NØBDG 9, WØRBO 8, WAØYXK 8.

MISSOURI: SM, Ben Smith, KØPCK—In honor of the third anniversary of the Kimberling Amateur Radio Club, the Mayor of Kimberling City, proclaimed the week of April 17, 1989 as "KIMBERLING AMATEUR RADIO CLUB WEEK." Three years ago, the club started with eight members and they have 34 at this time. The 1989 club officers of the Jefferson Barracks ARC are: Pres. WBØBZP, VP WD5IIK. Sec WBØRIP, and Treas WAØIDS. CMRA members, WBØTEG and NØMS provided communications for the April 8 March of Dimes walkathon in Columbia. The following weekend, CMRA members NDØN, WMØH WMØY NUØT and NØKD provided communications for the Central Missouri Bicycle Rally and Roadrace. The Lake of the Ozarks ARC operated Special Event Station NØNI at the annual Dogwood Festival. Twelve messages were originated and sent for the public, special event certificates will be sent to stations contacted by NØNI. Club members assisting in the project were: NØNI, KDØAW, NØHVH, WAØE, NØKGB, NØKGC, NØKGD and WØEPD. The Heart of America ARC and other amateurs from the Kansas City area provided communications for the April 9 MS Super Cities Walk. Amateurs helping with the operation were: KMØE WRØR WDØEIG KC4VG NØHBH KØUAA KAØREN and WBØRHR. The number of walkers was 1,444.

Net	QNI	QTC	Mgr
MON	60	249	104
MOSSB	30	775	72
MEOW	31	579	67
HAMBUTCHERS	20	299	20
KCARC	3	103	17
SWMSW	4	89	4
CMEN	4	37	4
St.L. ARES	4	265	2
ZAEN	5	55	1
PAUL REVERE	4	170	0
HARC	4	99	0
MIDCONT QCWA	4	58	0
JCRC	4	53	0
MEXARES	4	42	0
SEDARES	4	37	0
CARL	3	24	0
MOPAC1	4	18	0

Traffic: WBØOIZ 213, AIØO 151, NDØN 146, WAØYJX 99, KØORB 89, WAØHTN 72, KØPCK 46, WØOUD 42, WAØE 24, WRØR 17, KFØBM 16, WBØCJB 8.

NEBRASKA: SM, Vern Wirka, WBØGQM—A line of severe thunderstorms rolled across eastern Nebraska the evening of April 27, 1989. Amateurs throughout the eastern part of Nebraska participated in weather nets as spotters. The Omaha-Council Bluffs metropolitan area had three tornado warnings issued within an hour and a half time period. Two of the warnings resulted from National Weather Service radar, and then confirmed by Amateur Radio weather spotters there were three confirmed tornado touchdowns. Property damage was minimal and there was only one confirmed tornado-related injury. The Victoria Springs Hamfest and steakfry is July 28-30. Hamfest activities are scheduled for the weekend, but Victoria Springs State Park, located near Anselmo, Nebraska. The campers enjoy a week of hamming and eyeball QSOs in the beautiful surroundings of the Victoria Springs State Park. On March 13, 1989, at 1740 CST, the new KØKKV Beaver Crossing repeater system was put on the air. The $4500 project of the Lincoln Amateur Radio Club updated the entire system; repeater, antennas, feedlines, control receivers, and controller. With an ERP of 100 watts the 146.16-76 MHz-repeater covers from Omaha to Grand Island, and northern

Kansas to parts of north-central Nebraska. The project involved many people. The KØKKV repeater members include: Michael Ruhrdanz, NØFER; Steve May, WAØASM; Bruce Colgrove, WDØDMS; John McNaught, KCØFM; Jim Barner, KAØVKJ; Curt Pihschus, NØGVK; Dan Moravec, KAØWRZ; John Dale, NØFYE; Roy Burgess, WBØWWA. Further technical assistance, for the repeater project, came from Joe Eisenberg, WAØWRI, and Roger Cox, WDØDGF. Members of the Blue Valley Club participated in tornado awareness week in March by conducting a training net that had a QNI of 21, which represented 11 towns in the Blue Valley Club area. The new assistant volunteer chairman of the Omaha Red Cross damage assessment committee is George Deas, NWØM, of Omaha. Amateur radio exams will be offered in Lincoln on August 12, contact John Hauner, WAØYPY, of Lincoln, for details. Traffic: KØDKM 162, WAØBOK 9, WDØEWH 7, WBØGQM 5, KEØXQ 3, WCØO 2.

NEW ENGLAND DIVISION

CONNECTICUT: SM, Caesar Rondina, N1DCS—ASM: KB1H. STM: K1EIC. SEC: N4GAA. OOC: NA1I. ACC: NK1J. BM: N1EEE. PIO: WA1CMF. TC: W1HAD. SGL: K1AH. Well now that Field Day is over, I hope everyone had fun and enjoyed the festivities this year. Conn had 90% rep in 1RN/3 and 95% rep in 1RN/4. Nice article by KA1RLX in CARA cpers on packet radio. Thanks to the members of WARC for their participation in Walk America 1989. Congrats to WA1NPX of Meriden for winning the club logo contest. Also from the newsletter desk, been following a nice series of articles by N1BBI of Escara about home VCR tips. I'm happy to report the Conn Council of Amateur Radio Clubs is going well. Glad to here of the support and involved in the section. The packet community in Conn is undergoing some nice changes. Conn packeteers are setting up a nicely organized packet network. The purpose is to relieve channel congestion and set up a network which can be accessed by users on every packet channel in the 2-meter band. By the time this writing goes to presss, we hope the system will be up and running. Since this project has been specific interest to myself and NB1ASH, I would like to formally thank all of the BBS and system operators that have given of themselves to help Jack and I get this off the ground. With a little luck, we hope to have a list of whose who and where ready for mailing soon. Congrats to WHARA for a successful harbor cruise event, and FARA has a BBS for its member on 145.09. Check it out. Also tnx to the traffic community for another successful and enjoyable traffic dinner. Had a great time. Will have to get Dan, KY1F, to Indian Bingo. 73...N1DCS

Net	Sess	QNI	QTC	Stations	Traffic
WESCONN	30	347	97	KA1GWE	CPNRS
NVTN	30	615	205	NM1K	CSTN
CN	58	318	168	WB1GXZ	IRN
CPN	30	440	98	KY1F	FRN
CSN	20	97	35	WB1GXZ	1RN
RTN	30	195	48	WA1FCA	CN
TMRCN	5	105	3	NM1K	

Traffic: NM1K 541, WB1GXZ 220, W1EFW 203, KA1GWE 113, KY1T 100, KA1JAN 99, KA1ROL 85, KY1F 72, N1GFM 52, KB1ZC 41, N1FNN 39, N1GBP 38, W1WP 32, K1QPN 29, K1HEJ 23, N1API 20, N1BOW 19, W1BDN 18, W1KYD 16, W1QV 10, W1YOL 9, W1CUH 7, WA1NLD 7, N1FQO 5.

EASTERN MASSACHUSETTS: SM/SEC, Barry Porter, KB1PA— STM: WA1TBY. PIO: K1HLZ. BM: KA1NOI. OO/AA: AG1F. SGL: K3HI. TC: KA1IU. ACC: KA18AO. EMass Hotline: 617-437-0111

Net	Mgr	Freq	Time(EDT)	Day	Sess	QTC	QNI
EMRI	N1AJJ	3658	1900/2200	DY			
EMRIPN	WA1FCD	3680	1730	DY			
EM2MN	N1DUB	53/23	2000	DY			
NEEPN	K1BZD	3945	0830	SUN			
HHTN	N1FLO	04/84	2230	DY			
EMRISS	N1CVE	3715	2100	DY			
CITN	KB1AF	145/045	1930	DY			

The debate over the proposed code-less entry-level license continues over the computer networks. I have rarely heard a discussion of this "on the air." It also seems many hams are either indifferent or resigned to the fact that it is going to happen. I have heard from a grand total of 3 Hams, all opposed to creating this type of license. BUT, I am willing to bet that after whatever happens, it will be all over the bands that the ARRL has "shoved another one" down our faces!! The ARRL, through the local field organization, is supposed to represent YOUR interests, not just mine. It is hard to make recommendations to the Division Director without any membership input! Whatever happens with the node-code proposal, it WILL NOT BE A PANACEA for our hobby's growth problem. It will take a lot of committed hams to get us back on track. It will mean more classes, more exam opportunities and more public relations. Novice enhancement was not as successful as it could have been, because many clubs didn't want to make an effort to attract new people. I would like each affiliated club in the section to adopt a local school, also to adopt a "retirement" community center. Another good source for new hams and a source for good PR is the local chapter of Kiwanis, the JC's and Rotary clubs (and other community service clubs). I am willing to go and give presentations to these groups if they are interested. Some of the local clubs have done an outstanding job, but the majority have dropped the ball. If you need info on any of these club programs, contact KA1SAO or myself. We need more committed people to help !! I hope everyone had a nice Field Day!! Have you done anything to enhance ham radio's reputation this month?? Please express your opinion on amateur radio issues to your Section or Division staff. We appreciate your input.

MAINE: SM, Ted Bonesteel, WA2ERT—Maine is now divided into 3 emergency districts. New appts as DECs: N1CBA District 1; W1HTG District 2; N1AHH District 3. KB1P new EC for Washington County. New club in Washington Cty; Sunrise ARA, Pres. KB1XV, VP WB1EZU, SEC KB1P, Treas N1GBL. SARA net Sun 8 PM 147.33. SARA members provided comms for East River Challenge and Machias Wilderness Whitewater races Apr 29/30 (WA1JTH K1QBI WA1DEY KB1P and Novice class members Nancy, Nathan, and Danny). KB1LZ, W1FZL, N1FKO, K1AG, KA1MVK, KA2RXO, KA1BWH, K1CZ, N1AHH, and KA1CVB provided comms for Souadabskook and Kenduskeag canoe races. W1JTH resigned as BM on Apr 30. Phil provided 7 years of dedicated service as BM. Many thanks, Phil! Exams: Jul 8, Sat 9AM, Rockland. KC1CG; Jul 15, Sat 2 PM, Union Hamfest, WA2CJO; Jul 26, Wed, 6:30 PM, Newcastle, KA1DAX, Aug 12, Sat, 10 AM, St. Albans Hamfest, AK1W; Aug, Sat 9AM,

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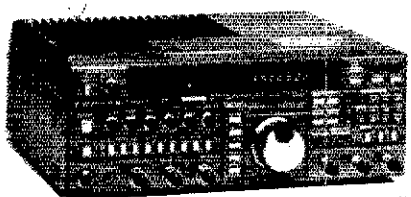

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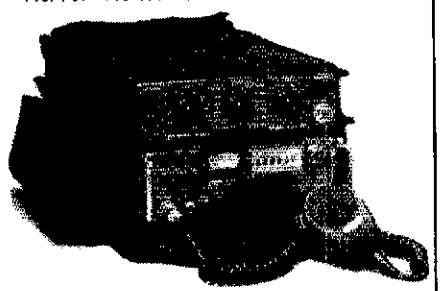

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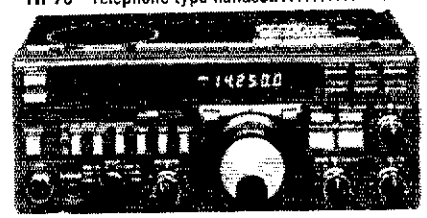

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FIF-232C for VIC-20/TI/most RS-232	79.95
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GX Turbo/C01 Software; C64/128	89.95
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FT-747GX* Transceiver (Call for Special)	889.95
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MMB-38 Mobile bracket	16.95
FL-7000 Auto. tune HF linear amplifier	1995.00

Misc. accessories	LIST
MD-1B8 Desk microphone	109.95
MH-1B8 Mobile microphone	27.95
YS-60 1.8-60 MHz 2kw PEP wattmeter	99.95
YS-500 140-520 MHz 200w wattmeter	89.95
YH-55 Lo-Z headphones	24.95
YH-77 Lightweight headphones	24.95
FF-501DX Low pass filter	47.95

VHF/UHF equipment	LIST
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HF/726 10-12-15m unit	289.95
6M/726 6m unit	269.95
430/726 430-440 MHz unit (OSCAR)	329.95
440/726 440-450 MHz unit (FM band)	329.95
SU-726 Satellite duplex module	129.95
AD-2 50w 2m/440 duplexer	41.95
FT-736R 25W 2m/430 full duplex xcvr	1749.95
FEX-736-50 6-meter module	259.95
FEX-736-220 220MHz module	279.95
FEX-736-1.2 1.2 GHz module	539.95
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FT-690R MKII 10w 6m FM/SSB xcvr	589.95
FT-790R MKII 25w 430-450 FM/SSB xcvr	799.95
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CSC-19 Soft case	10.00
MH-10F8 Speaker/Microphone	29.95
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FT-23R/TTP 2.5w 2m HT w/TTP	334.95

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FT-73R/TTP 2w 440MHz compact HT w/TTP	349.95

Acc. for 09-series/03-series/FT-727R	LIST
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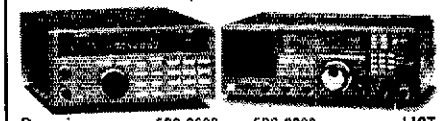
FBA-5A Alkaline batter holder for 727R	14.95
FNB-3 425ma 10.8v batt (comes w/03 series)	49.95
FNB-3A 425ma 10.8V battery for 727R	49.95
FNB-4 500ma 12v batt (comes w/09-series)	64.95
FNB-4A 500ma 12v batt for 727R	64.95
FTS-6 Encoder/decoder; 09-series	49.95
FTS-7 Encoder/decoder; 03-series	49.95
MH-12A2B Speaker/microphone	41.95
MH-18A2B Lapel speaker/microphone	41.95
NC-9B Wall charger for FNB-3	11.95
NC-15 Desk quick charger/AC ps	89.95
NC-18B Wall charger for FNB-4	11.95
MMB-21 Mobile bracket	11.95
PA-3 Mobile adapter and charger	39.95
TA-2 2m 19" telescoping whip ant	11.95
YH-2 VOX headset	29.95
Other Handheld Accessories	CALL



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FRA-7700 Indoor active receive antenna	59.95
FRT-7700 Antenna tuner	64.95
FRV-8800 118-174 MHz VHF converter	129.95
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FF-5 500 kHz low-pass filter for VLF	20.00
DC-8800 DC kit	4.50
FM-W/8800 FM-wide kit	20.00
FRG-9600 60 to 905 MHz receiver	699.95
VU-9600 NTSC video unit	25.00
Catpack software (specify computer)	79.95

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TECH TALK from ICOM

Computerizing Your ICOM Station

Computer-interfaced transceivers are opening an exciting new dimension in on-the-air operations, and, thanks to ICOM's dedicated customer support, assembling your own computerized station has never been easier or more attractive! After interfacing your ICOM transceiver and home computer, DX'ing and contesting truly move into the "big league" category. You can control various rigs and their functions right from the computer or modify roles so the computer becomes your assistant operator. Using a readily available shareware program for ICOM transceivers, for example, you simply enter a contacted station's call into your computer system rather than writing it in a log. The system, in turn, logs the QSO using the computer's date and time plus your transceiver's frequency and mode. You are even alerted to duplicate or previous QSO's, needed countries for DXCC, desired states for WAS, antenna pointing directions, and much more. Exciting? Yes indeed, and this Tech Talk explains ICOM's tried and proven steps to assembling a smooth operating system.

Two logical questions during station planning are which computers and transceivers are good candidates for interfacing, and exactly what is involved in that procedure. Readily available programs supporting ICOM rigs are written for most IBM-compatible computers, and all ICOM multimode/base station transceivers are easily computer controlled. Interfacing consists of using ICOM's optional CT-17 level converter to mate your transceiver's TTL and the computer's RS-232 voltage levels, loading rig-controlling software into the computer, then ensuring software-selectable parameters agree with transceiver-interface switch settings. Baud rates of each unit must be set equally to exchange data, for example, and specific rig code numbers or "addresses" are necessary so transceivers and computers know "where to send their data." Confusing? Not really. Follow our suggestions and your chances of first time success will be maximized.

Begin by checking your transceiver's interface circuit and setting its related DIP switches for compatibility with your computer and software. These interfacing circuits are built-into ICOM's IC-765, IC-781, IC-761, IC-575, IC-475A/H, IC-375 and IC-275A/H transceivers. Their switches are factory preset for ICOM's suggested rig addresses and 10200 baud data rates as outlined in your owner's manual and reviewed in Figure 1.

ICOM's IC-735, IC-725 and R-7000 use a logic circuit-integrated interface. They have a fixed rig address, but their computer-interfacing baud rates are jumper or diode selectable. They are factory-set at 1200 bps but changeable to 300 or 9600 bps.

ICOM models IC-751, IC-751A, IC-471A/H, IC-271A/H, IC-1271A and R-71A must be fitted with their optional UX-14 parallel to serial data convertor unit. Before installing the UX-14, set its switches to specify your transceiver's address, band and baud rate as outlined in the UX-14's booklet and reviewed in Figure 1. S1's DIP switches 1 and 2 select baud rates of 300, 1200 and 9600 bps, switch 3 is set "ON" for transceiver operation, and switches 4, 5 and 6 select HF, VHF or UHF band operation. S2's DIP switches 1 through 6 set the radio's address in binary form with OFF equalling "0" and ON equalling "1."

Your computer's RS-232 I/O port and your transceiver's TTL remote control terminal are then connected to ICOM's CT-17 adapter. The CT-17's purpose is to convert your computer's RS-232 level, '+' and '-' 12 volts, to TTL level, +5 volts and 'O' volts. Finally, a transceiver operating program is loaded into your computer and the full setup is checked for proper operation. Initial problems or "bugs" are usually traced to different software and DIP switch-selected parameters. Remember the UX-14 fits several radios, and its S1/S2 switches must be set before installation.

If you experience transceiver or computer interfacing problems or have difficulty locating ICOM-related software, ICOM's customer service hotline at 206/454-7619 stands ready to assist you all the way. Computer-interfaced rigs are the future and, as usual, ICOM continues developing tomorrow's dreams into today's realities!

	ICOM MODEL NUMBER	COMPUTER ADDRESS NUMBER	S2 SWITCH SETTINGS (Binary Count)	S1 SWITCH SETTINGS 1, 2 depend on your computer's baud rate.	S3 SWITCH SETTINGS 8=TURN ON FOR TRANSCEIVE, 9, 10=BAUD RATE
			1 2 3 4 5 6	4 5 6	1 2 3 4 5 6 7
UX-14 REQUIRED	IC-751/751A	28	OFF OFF ON ON ON OFF	OFF OFF OFF	
	IC-471A/H	34	OFF ON OFF OFF OFF ON	ON ON OFF	
	IC-271A/H	32	OFF OFF OFF OFF OFF ON	ON OFF ON	
	IC-1271/A	36	OFF OFF ON OFF OFF ON	ON ON ON	
	R-71	26	OFF ON OFF ON ON OFF	OFF ON ON	
SERIAL INTERFACE BUILT IN	IC-761	30			OFF ON ON ON ON OFF OFF
	IC-575A/H	22			OFF ON ON OFF ON OFF OFF
	IC-475A/H	20			OFF OFF ON OFF ON OFF OFF
	IC-375A	18			OFF ON OFF OFF ON OFF OFF
	IC-275A/H	16			OFF OFF OFF OFF ON OFF OFF
INTERFACE INTEGRATED WITH LOGIC CIRCUITRY	IC-735	4	• Related addresses preset (fixed) at factory.		
	IC-725	40	• All baud rates factory-preset at 1200 BPS.		
	R-7000	8	• Jumpers/diodes used for changing baud rates. (Check Owner's Manual).		
NEW TRANSCEIVERS	IC-781	38	All parameters front panel selectable (See Owner's Manual).		
	IC-765	CALL	ICOM Customer Support for computer addresses and baud rate.		

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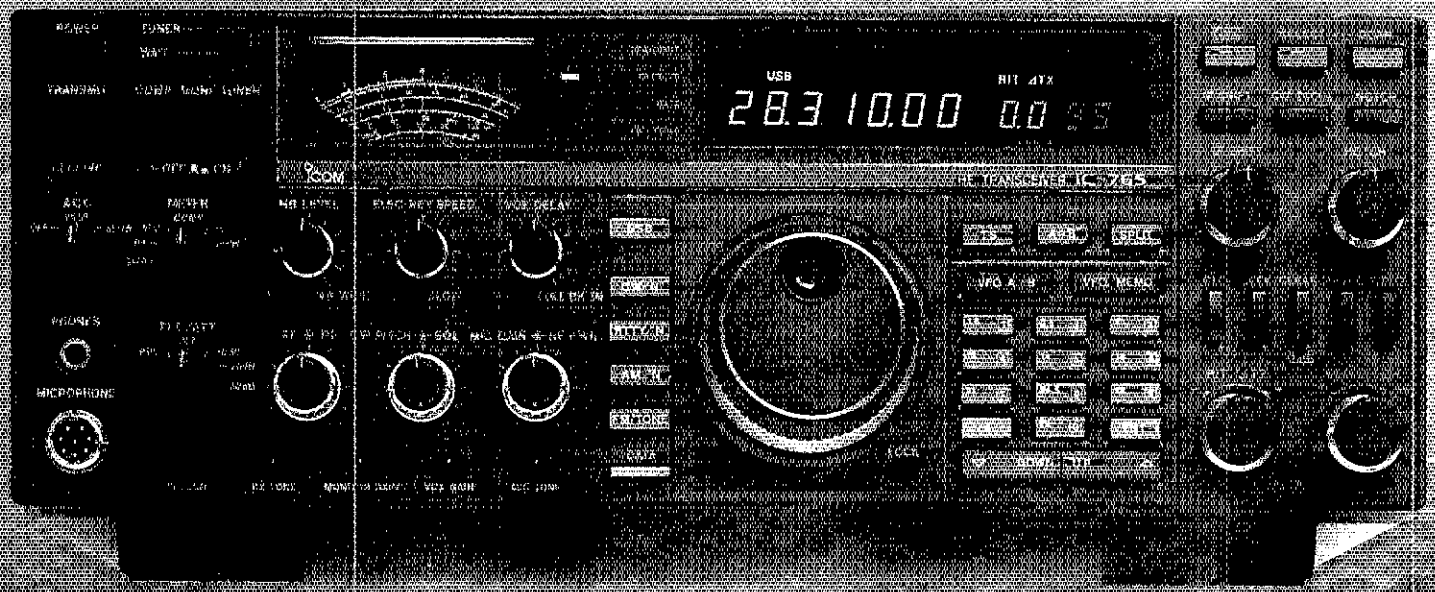
IC-765 HF Transceiver



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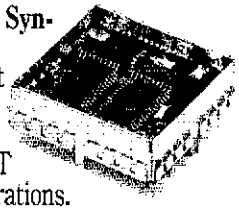

***Direct Digital Synthesizer (DDS).** Assures ultra-fast PLL switching and lock-in for excellent PACKET and AMTOR operations.

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Bangor, K1AG. Nets: PTN/30/264/123/W1KX, SGN/24/773/94/K1GUP; Oxford Cty RACES/5/50/13/W1RWG; Cumberland Cty ARES/4/53/0/KA1ODT; Maine Public Svc/5/36/2/KA8UVQ; Aroostock Emerg/4/64/13/WA1YNZ; Kennebec Cty ARES/5/87/1/KA1LPW; Central Maine Emerg/9/161/11/N1DZI; Hancock Cty/5/59/5/WA2ERT. Station ttc: W1KX 192, W1RWG 65, K1UNO 65, W1ISO 63, WA2ERT 162 WA1YNZ 58, KA1JOJ 56, W1JTH 46, NR1F 37, ND1A 25, N1BCF 19, W1BMX 17, N1BJW 15, KA1ODT 13, W1OTQ 11.

NEW HAMPSHIRE: SM, Bill Burden, WB1BRE—SEC: K1ACL. BM: K1OSM. Apparently even the dreaded IRS deadline of 15 Apr did not dampen the spirits or energy of the Hams in NH! Public-service activities and new Novices highlighted club activities. Bob N1CIR reports that several hams in the Hanover-Lebanon area provided communications support to activities associated with ice breakup in the Connecticut River. The semi-annual meeting of WRONE was held in Walpole, NH. Dot and I attended (she is WRONE secretary) and with 74 WRONE members and OM's attendance, Dawn K1TQY presented an excellent program on traffic handling with instructions on filling out the standard message form. A raffle sponsored by WRONE resulted in a donation to the YLRL scholarship fund! This was March of Dimes WalkAmerica month and both GSARA and NARC supported walks in Manchester and Nashua. GSARA pres N1FIL reported that club members
N1FIK,KC1HH,N1FDJ,N1DMU,N1FIJ,N1FJF,N1GCU, and N1IE were out in the cold and drizzle providing comm and safety support for 280 walkers! In Nashua, we had support from club members KA1NDT,N1DGQ,NU1E,NO1Q,K1ULI, N1GGS,N1BKL, WB1BRE,KA1LDS,NF1N,NO1V (who was motorcycle mobile) and NM1N and N1FGP- bicycle mobile in Mines Falls park. Our thanks to all who show Amateur Radio at work in public providing communication support and safety coordination for these walkathons. On the training front, new hams were graduating from classes sponsored by the Interstate Repeater Soc and NARC. NM1D reported 18 grads from the Derry class and KA1LDS graduated 4 and another 3 were tested locally. (Don't forget to let me know if you are doing a class or if YOU have tested any new Novices!) While many were at Dayton in April, the Contoocook club held its first annual fleamarket- I titled it "Dayton East"! It was well attended by hams from as far away as Mass and Dot and I visited first thing in the morning. We spoke with club members hard at work on parking vendors and running a raffle. Nice to see Lou WA1LAS hard at work as usual! The IRS fleamarket was back in Hudson this year with an excellent turnout reported by club pres KA1OU. Much hardware and software exchanging hands as we "tuned-up" for the summer's rounds of fleamarkets! The SVARC had a unique program in April presented by Bill K1BH. Bill has a collection of antique radio equip and demonstrated an operating spark gap transmitter! Club 2M NCS KA1CYU embarked on a sailing adventure in the Carribean and was on 10M M/M. CNHARC is proceeding with a well-attended Novice class and the club has settled into the new meeting site at the Lakeport Fire Station. N1LT is leading an upgrade class with five students in attendance. A DOUBLE congratulations to GBRA- the club was top club station in the NH QSO party with 42,000 points with kudo's to John KA1HYU, contest coordinator. Also, GBRA was renewed as a Special Service Club. For information on how your club can become a Special Service Club, contact K1IM, ACC for NH. The NARC newsletter has now gone international via the magic of electronic mail. Newsletter editor WA1OMM included an article on Dutch Amateur Licensing in the April issue by Wim, PA0AGZ! CVFMA members received with their 1989 memberships a handsome club patch and signups were at a brisk pace according to club treasurer, W1GUA. The Mt Moriah Repeater Soc held a VE session with 22 of 35 applicants upgrading, including 3 new Novices and 10 new Techs! COMING NEXT MONTH- a special on the Seacoast region Bike-A-Thon and Amateur support of the Tour De Sol Solar powered car race! Support your local and regional nets!!- Granite State Phone Net meets M- Sat at 1800 local on 3943 and Sunday at 0930 local on 3945 as NTS phone section net for NH. Contact Net Manager Alan W1FYR for more info. A special thanks to the Net Control team who make good net ops possible!

VERMONT: SM, Jonathan P. Maguire, N1CQE—ASM (RFI): W1CTM. ASM (Education): WB2MIC. ASM (Packet): K1AUE. SGL: WB1AJG. STM: KT1O. TC: W1AIM. PIO: WA1YOY. OOC: WB1BWV. It's official! Bill H.45 has been passed by both branches of the legislature and is awaiting Governor Kunin's signature. Bob, WB1AJG, has put a tremendous amount of work into getting the bill passed. Thanks, Bob! WA1JVV reports that the Border ARC will have an exam session on Sunday, July 30 at 3 PM, immediately following the club picnic. Contact him for details. CVARC held its annual dinner on April 8 at the Lobster Pot in Montpelier. New officers are President: KA1MNH, Vice President: WA1PDN, Secretary: KC1BT, Treasurer: N1FHI, and Trustee: N1BRT. KA1GTY is the new CVARC Sunday FM Net Manager, replacing NK1A. Much work is being done in the Amateur Auxiliary arena, reports WB1BWV. Many problems with illegal phone patches and third-party traffic are being reported. Contact either WB1BWV or N1CQE for information on joining the AA/OO program. Your help is needed. WB2JSJ reports the following upgrades: KC1LO and N2CUA to Extra: N1EXY, N1GKH and N2HJA to Advanced KA1IZX and KA1TLX to General. KA1TNO, KA1TKJ, KA1TQU, KA1TSA and 9 other Novices in waiting to Technician. WB2JSJ was also a featured speaker at the Dayton Hamvention this year. Friday, August 11 is the next Burlington area exam session. time is 7:30 PM. Contact WB2JSJ for more information. Our section had 98.3% representation on 1RN/2, 100% on both 1RN/3 and 1RN/4. Great work. N1DHT reports that the Vermont Traffic Net needs volunteers. It meets each nite at 7 PM local on 3539. Give it a try! PSHR stations were WA2SPL, KT1Q, WA1JVV, KC1KI and N1DHT. BPL was earned by WA2SPL. The VT Packet node, WA2SPL, had a total of 5338 messages in April. Traffic: WA2SPL1265, KT1Q 368, WA1JVV 230, KC1KI 153, N1DHT 146, NB1A 12. Net reports: CN 25/533/38, VTN 30/113/131. VSSN 13/23/0. Twin SFMEN 4/47/0, TriSFM 5/66/3. VPN 5/79/10.

WESTERN MASSACHUSETTS: SM, Bill Voedisch, W1UD—OO/RFI. N1CM. PIO/ACC: K1BE. SEC/SGL: WB1HIH. TC: KA1JJM. STM: W1KK. It's that time again. When you read this, Field Day will have come and gone. Your club has held its last meeting for the season. First, I hope everyone enjoyed their weekend in the field. New England is a great place to spend a vacation. What could be more enjoyable than our area? If you should hear a strange call-sign on your area repeater, make an effort to answer it and make the visitor feel welcome. Advise him of the sights to see and places to visit. I've been told in other parts of our great country that New Englanders are cold and not too friendly. Let's make a concerted effort to dispense that myth. Enough said. Al, K1FEE, won the QSL design contest at MARA. Prize wasn't bad either, a new set of callbooks. MARA will be on Mt Wachusett again. That 40-meter quad did a great job last year. Plans have been formulated by all the clubs to participate in Field Day. Preparations have been in progress since after the first of the year. I'm anxious to see the results. CMARA had the pleasure of Prof Ed Clarke of WPI presenting his experiences encountered during the solar-powered auto race across the Australian outback. A slide show was presented on solar-powered vehicle design in Europe. Our contender, the SUNRACER, was also presented and discussed. CMARA's sponsored Post 73 Scouts used their communications trailer to communicate during the St Patrick's Day Parade. Another great job done by the two organizations. Brian, N1FIY, is the author of the DX column in CMARA's "Ham Chatter." It's a one-page article each month and very interesting. Listed are some of the upcoming DXpeditions and other pertinent facts about DX. All this at the age of 17. Who said our youth have no talent? Great job, Brian. Traffic: KA1IFC 976, KA1QFV 90, KA1EXJ 88, W1KK 75, KA1MEW 80, KA1RVN 65, W1SJV 63, KC2IU 39, WB1HIH 26, KB1XK 13, W1UD 248, W1ZPB 4, WA1OPN 5, W1GQP 5, KA1MWZ 2, KI2L 4.

NORTHWESTERN DIVISION

IDAHO: SM, Don Clower, KA7T—ASM: K7REX. OOC: WB7CYO. STM: W7GHT. ACC: N7BI. PIO: WG7E. The Magic Valley ARC provided communications for the March of Dimes Walk-a-thon in the Twin Falls area. Bill, W7GHT, the STM for Idaho dropped by for a visit with Bill. He has some very good thoughts on the NTS network. Bill has worked very hard and long as STM here in Idaho; we all owe him a big thank you. Traffic: W7GHT 252, KA7WZM 51, WS7U. 73, Don.

NET	SESS	QNI	QTC	MGR
Farm	30	2126	64	WA7GSM
CD	20	679	22	K7UBC
IMN	30	259	149	KA7EEE
NWN	30	844	42	N7LMA

MONTANA: SM, Pete Peters, KF7R—ASM: WA7PZO/WB7QDN. SEC: K8TR. STM: W7TGU. ACC: KC7OA. SGL: KY7I. TC: K7YD. BM: W7TUW. OOC: W7DEO. PIO: K7BFJ. DIGITAL: KE7TB. New VE in Butte: K7BF. New Novices: Joyce Mason, Kevin Aimes, Philip and Donna Harper, Bruce Walters, Kevin McCray. Tech: KA7IMU KB7DPT KB7GSV WB7WRL KB7GXH KB7FPK KB7GXF KB7GDP KB7GDO. New Tech: Grover Wheeton, John Hammer, Edward Clanton. Gen: N7MAN KB7FGV KB7DGV. Adv: N7MIU N7IEZ KB7GYW. New calls: KA7HQK to N7MMJ, N7LGB to WY7M. New Butte Club Officers: Pres. WA7PZP, VP N7LDR, Sec. N7MHB, Trs. K7KCR, Board WA7FOB N7LER KA7YUH. YRC 10 Meter Nightly Net 28400, 7 PM; New auto patch in Missoula area 147.04; Congrats N7AGP/KC7OD first in MT Section of the ARRL 160 Mtr contest held in December. Traffic: KA7YYR 151, WB7WVD 64.

NET	SESS	QNI	QTC	Net MGR
MTN	30	1894	120	KF7R
MSN	5	112	0	KF7R

OREGON: SM, Randy Stimson KZ7T—ASM: KM7R. ASM: W7FBP. STM: W7VSE. SEC: KV7F. PIO: KC7YN. SGL: KA7KSK. ACC: WF7Q. OOC: WN7W. STC: N7ENI. We have new officers in the Hoodview ARC. They are N7HIL, Bill, President; WQ7V, Mary Lou, Vice President; W7HDF, Chuck, Secretary; KA7YFY, Kent, Treasurer. I hope I got them right this year. I had a very interesting experience this last weekend. I was driving around figuring out the communications for the Hood to Coast Run, which will happen in August. The run goes through the coastal range, which does not lead to the best communications. While on the back roads looking for a high spot for a relay station, I blew both rear tires and, with only one spare, I was stranded. I got on the Astoria repeater and asked for help. Joe, N7HAE, came back and offered to call a wrecker, which he did. Three hours later, which made it 6PM, no wrecker. I called Joe again and he called the outfit back. They said they couldn't find me so they went home. While Joe was calling another wrecking company, a Forest Service truck came by and offered to go down and lead the wrecker in, which he did. I got home at 1AM. The only nice part of all of this was the fact that Joe and the fellow from the Forest Service spent hours of their time to help. I want to sincerely thank them both. Traffic (P) = Packet. W7VSE 327, N7BGW 237, WG7H 235, KA7EEE 131, WB7EMO 119, WX7A 107, KA7AID 93, W7ODG 30, KA7WFW 9, AL7W 2. Late March: KD7YJ 23P.

EASTERN WASHINGTON: SM, Tom Plaisance, KC7PH—STM: W7GB. SEC: WB7CBX. ASM: KC7MM. ACC: NQ7M. OOC: W7LKR. SGL: KD7AC. It is my pleasure to announce that Don Pops, W7DBV, has been appointed Eastern Wa. Technical Coordinator. Don is a resident of Spokane and has a great technical background and is a welcomed addition to the Section Staff. If you are technically oriented and would like to assist other amateurs in the section who are in need technically, please contact the SM or W7DBV. Jo Whitney, KA7JJQ, reports that Trek IV of the Lewis and Clark Run included several 2 1/2 hour pre-race trips to the race site, aerial reconnaissance, a portable repeater which the wind sought to destroy, and very difficult communications conditions because of the steep cliff on one side and the Columbia River on the other. Despite these difficulties, the crew from Yakima and the other volunteers from all over Washington did a fine job on the Lewis and Clark Run. If you have a Section News item, or your local club has a news item to be published in this column, please contact KC7PH @ N7HHU BBS. Traffic: K7GXZ 179, W7GB 127, W7LBK 72, WA7YEN 61, N7HXT 22.

WESTERN WASHINGTON: SM, Ed Holloway, KA7INX, (@KE7OM): STM: KD7ME, (@K7KNZ). SEC: NM7N (KE7OM). TC: W7GNR. OOC: N7DVR (@W8LVJ). SGL: KD7AC. BM: N7CAK. (@W7LVJ). PIO: N7FKV. ASM: W7UOF. ASM: K7CLL (@K7IFG) ACC: KR7L (@W8LVJ). Our Section Net Manager, Hal, W7OUF, suffered a knock-down heart attack the last Tuesday of this month. Recuperation is slow but steady. Hang in there Hall West Seattle Amateur Radio Club

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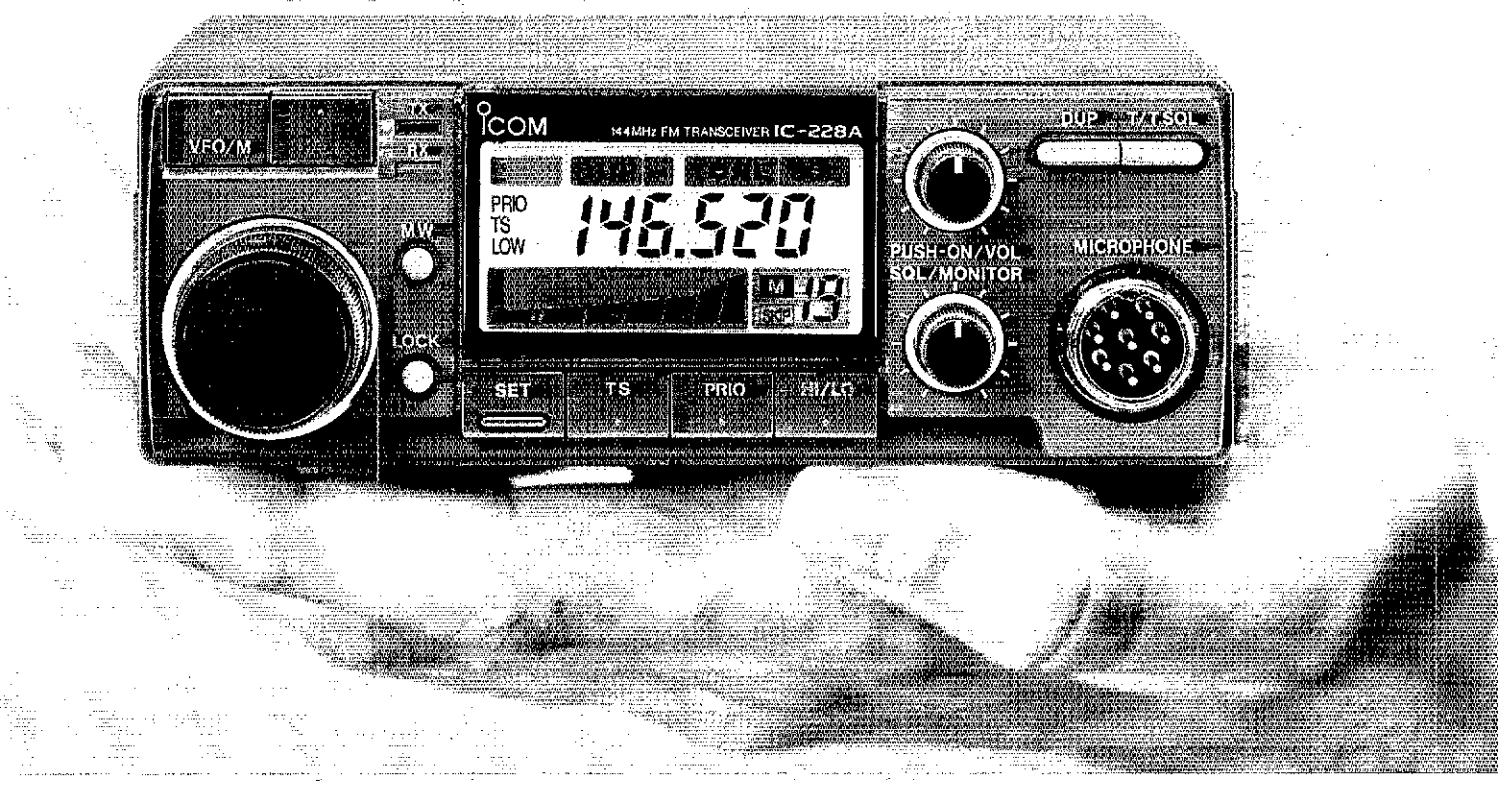

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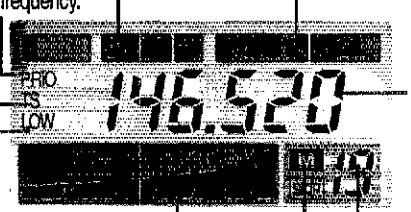

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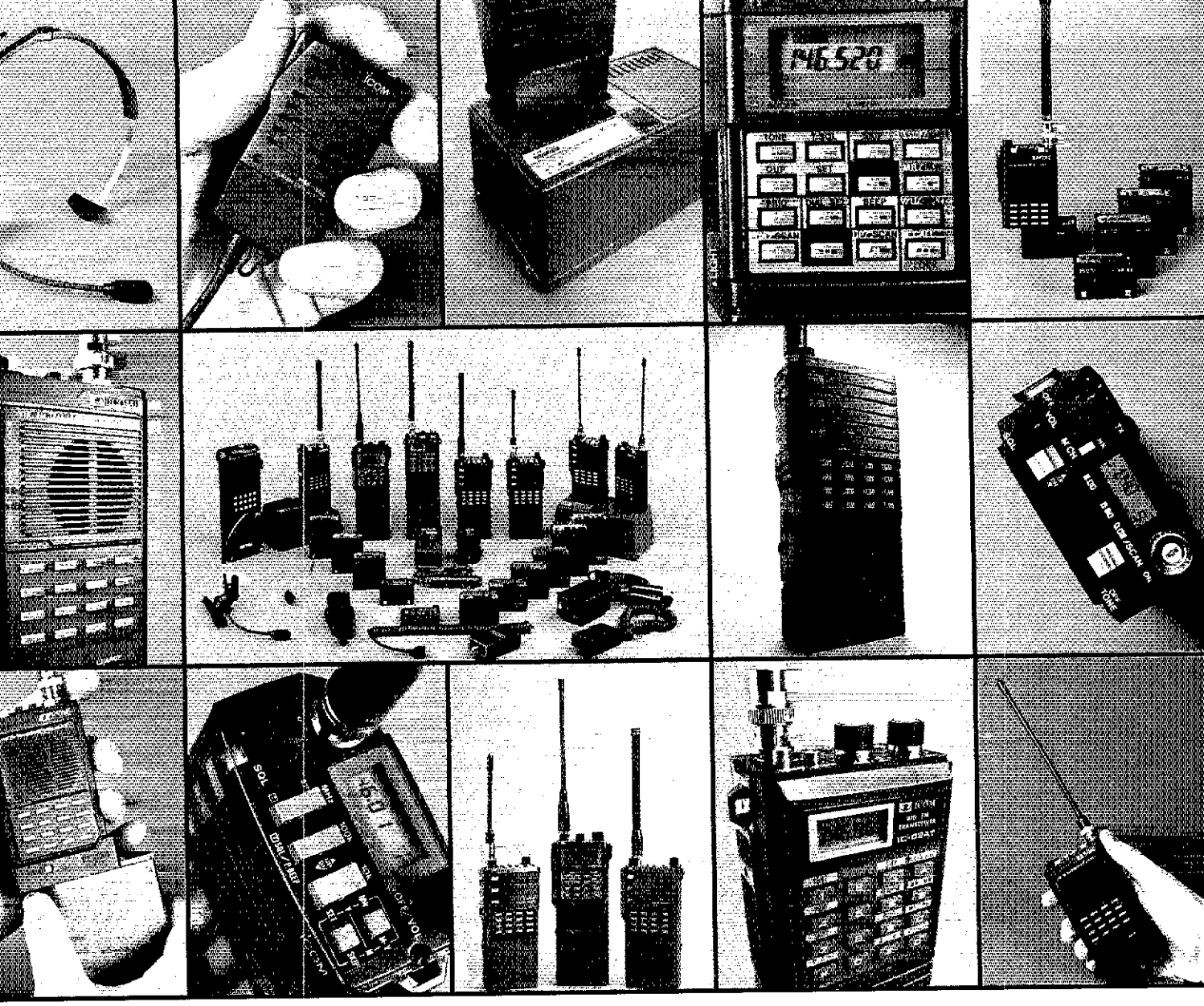

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had an election and the new President is Roy Morse, K7MC. Vice is Earl Trenary, W7SLL. Milton, W7WOG, is leading and teaching the formation of a badly needed TVI Committee. Speaking of TVI, we are experiencing an upswing in complaints due to the new type telephones, touch lamps, VCRs etc. A larger number of experienced ATCs are needed, especially in the King County and surrounding areas. Clubs that are forming TVI committees now should notify either the SM or TC so they could be utilized to help clear up complants in their immediate area. W7TVA NM NTN net advises that due to bad conditions on 75 metrers, they have shifted the net to 7.270 MHz— this to be effective until at least October. Dick Draper, WN7F, has resigned as EC for Pierce County. Plans to go chasing the "Gold Bug." Good luck Dick, and thanks for the good job! Stan Warburton, N7KMF, has accepted the challenge as replacement. Skagit Co EC Paul N7GGX setting up a Training Mission on Earthquake Communications. A few quakes in the area has made people nervous, so "Be Prepared" is the word from that area as far as hams are concerned. The Lewis and Clark run was quite successful with quite a few hams from the W/WA area participating, Some with RVs. An accurate and full list not available at this time. Could be Eastern SM will have more detailed list of participants for us. Traffic: K7AJT 6, K7CLL 10, KA7CRN 24, N7EQZ 46, KF7FF 74, N7GGJ 83, W7IGC 222, N7IIJ 5, W7LG 116, KA7PMD 31, W1PRT 28, K7SUX 68, KA7TTY 22, W7IVA 219, K7UQH 34, WB7WOW 192. PSHR W7TVA 125, WB7WOW 109, KD7ME 88.

PACIFIC DIVISION

EAST BAY: SM, Bob Vallio, W6RGG—ASMs: W6ZF, WB3FCV. SEC: W6LKE. STM: K6APW. OOC: NY6Z. TC: N6AMG. New NCCC officers for 89-90 are AI6V/P, KI6EZ/VP-C, N6EK/S-T, WZ6Z/D. AD6E/D, N6KT/D, and WB6MZQ/D. EBARC welcomed new members N6JGC, WB6IZE, WA6BRL, KB6NDF, and two recent Novice training class graduates, Rodger Burt and Bob DiSilverio. Member WB6DOB reports that N6TUU, age 13, just passed his General 6 months after receiving his Novice license, and is now working on his Advanced! N6TUU's father is AA6LQ, who went from Novice to Extra in 6 months! Sounds like their training program is really working. VVRC welcomed new members N6MVE and Cindy Sanders. KB6YWV has upgraded to N6UHO, and new Novice class graduates are KC6BXI, KC6BNL, KC6BNP & KC6BMP. BARC has published their 1989 Calendar of Events, listing all club meetings and functions for the rest of the year. HRC's newest members are Danny Bowen, Craig Jensen, and Nicholas Karanikolas. LARK's BoD has proposed a By-Laws change which will allow for a variable number of Officers and Directors at each election depending on the consolidation of VP/Activities Mgr and Sec/Treas. Looks very interesting. April traffic: WB6DOB 217, W6VOM 119, WB6UZX 38.

NEVADA: SM, Joe Lambert, W8IXD—SM, Curly Silva, K7HRW. W7QO recently finished another radio class that resulted in 4 new technician licensees. Carl is considering further training classes in emergency net control station operation and in high- speed code classes. If you are interested, please contact W7QO of SIERA. SIERA has also decided to upgrade their bulletin considerably. It looks good to me, congratulations, guys! There will be VEC exams in the Las Vegas area on the 1st Sat of Aug. and Nov. (Contact NK7N for info). LVRA has completed the new Mt. Potosi tower installation which now has most of the antennas installed and operating. ARRL bulletins are being distributed through Nevada by NR7A, KK4M, and WB5RQY. LVRAC held an "all-Las Vaegas ham picnic" on May 20. Good time was had by all. KF7GB continues with his Novice classes; thanks George. If your news is not getting printed, it might be because I receive your newsletters too late to meet the deadline. If they can't get here sooner, maybe your could send whatever you want in the column separtely. That's all for this month! 73 from W8IXD.

PACIFIC: SM, Wayne Jones, NH6GJ—Sadly, I must report that Jim Brown, KH6AH, was lost at sea when the fishing boat Malia was was lost off the coast of Maui on March 31. Also, we recently lost Ernie Cottingham, AH6GM. We will miss them both! On a happier note, there are two events coming up that may be of interest to each of you. First, Kalawao is coming back! KH6FS and a party will be putting this rarest of counties on the air during the period June 29-July 1. 10-80 meters, SSB and CW operations are planned. They have prepared a special QSL card which will be available upon request and receipt of a SASE. Cards may be sent to the bureau, but a SASE is still requested. The second operation will be taking place on Christmas Island Aug 2-9. AH6IO and a party of four will be there and plan to operate SSB and CW on bands 6-80 meters. Also, RTTY is planned. Look for T32IO!! You may QSL through the bureau, but an SASE would be appreciated. Public- service events for the month were the Carol Kai Bedrace Parade on Oahu, the JAL Marathon on Guam, and the March of Dimes Walkathon on Maui. Thanks to all who participated in these events. So, until next time, Aloha from all of us to all of you! Traffic: KH6GMP 39, KH6H 24, Nets 101.

SACRAMENTO VALLEY: SM, Bob Watson, W6IEW—The Mt. Vaca Radio Club sadly ended a 21-year era of outstanding service when a new site manager proposed unreasonable conditions for them to remain at their former repeater site. Temporary locations will be used until they find a new site. Special Service Club River City ARCS has added a new service—A Packet BBS on 145.07 signing KG6XX-1 that will take some of the load that WA6NWE-1 has been carrying. A new Nevada County emergency communications plan has been authored by a highly qualified County Supervisor, Jim Wier, WB6BHI. Chico will be the site, August 13 the date, of a HAMFEST for the celebration of their 50th Anniversary by the Golden Empire Amateur Radio Society, also a Special Service Club. They even promise a special booth honoring "UN-HAMS," the ones who make sure that the hams 'are well fed, clothed, housed and happy,' after serving the Sacramento Valley Noon Net for years. Cecil, WB6ROS, has asked to be replaced as their TELEPHONE RELAY. The net will not be the same without Cecil relaying information from the phone. Have you told your NEWSLETTER editor lately that you read his publication? Art, KA6HVY, who does the Sierra ARC Newsletter, gets your attention with such headlines as "SO-SO News," "Better Class of News." "Future News," "Serious News." Seriously, I'll bet his gets read, which is something many editors doubt. Traffic: WA6WJZ 189, W6CFQ 28, K6SRF 21, WA6ZUD 20, W6RFF 16, WB6SRQ 12.

SAN FRANCISCO: SM, Dick Wilson, K6LRN—We note with sadness the passing of WT6V, K6SBI, Arly Monroe, XYL W6GGR and Dorothy Vawter, XYL-K6BNC. KA7JAN setting up EC programs & contacts in SF, contact Dave as SF is a large area to cover & he can use all the help he can get. N6IIW & N6SJF demo'd packet at Cal PUC- K6BXH, W6FMY, W6LFW & W6OZA operated WB6FDT from SF Civic Ctr & WA6HVX ran a mass-care shelter drill from 11 sites with 29 others, all as a part of 'Quake prep month. New call: KC6CKU-Sonoma. Upgrades: K6KGA to Extra, KC6CFF-Tech. KV6G, WB6BNH, & K6HY fixed 28/88 rptr. W6AJF QSOs on 10 & 432. Sonoma RACES had 74 operators operating 7 packet stations from 7 EOCs, 6 hospitals, covering 46 positions handling 333 messages, congrats & thanks to all for FB job. Save the first weekend in Oct. for Cal QSO Party. An SASE to WA6VEF will bring rules. SF section stns always in demand for this fun 'test. W6PW-3 BBS will be using REBBS software by AA4RE soon. Traffic: N6FWG 40.

SAN JOAQUIN VALLEY: SM, James Wakefield, AH6CO—Aloha- I'm using that for the first and last time just because of the call. My old call was W6PSQ and licensed in 1938 in Fresno. Let's look to service to get involved in the communications for the runs, bike rallies etc for the fun of it and practice for a real emergency. Some clubs are doing it now. New officers for San Bernardino Microwave Society (SBMS from now on) are prexy K6HLH, VP K6HIJ, WA6QYR Cor Secy, W6HCC Rec Secy and WB6DTA is treasurer. SARC (Ridgecrest) reports some funding for RACES/ARES from Unified Way. Just a thought! ATV on from Visalia to Lindsay. Let's have some calls! How about setting up CPR classes. Take the wife as you might be the one in need! All appointments will continue but will be up for review. Send me info you'd like to see in this column. It's yours. Allow 60 days. Fresno Hamfest great with 400. Nice prizes and good food. 73-Jimmie. Traffic: WA6YAB 21.

ROANOKE DIVISION

NORTH CAROLINA: SM, W. Reed Whitten, AB4W—ASM: AB4S. SEC: N4MYB. STM: K4NLK. BM: K4IWW. ACC: WC4T. TC: KM4OX. SGL: KE4ML. PIO: AB4FW. North Carolina was recently reported to be leading the nation in tornados this year, an unfortunate continuation of a trend of several years. The latest tornadoes occurred Friday May 5 and affected 21 of NC's 100 counties. SKYWARN nets had been activated by NWS before the storms hit and many warnings were issued as a result of input from Amateur Radio. 135 homes and 23 businesses were destroyed, 180 homes and 13 businesses damaged, 116 injuries and 5 deaths were reported from these tornados. Total loss is estimated to be $103 million. Many county ARES groups were involved in providing communications for Red Cross, Salvation Army, local & State Emergency Management and other relief agencies. Some were still active two weeks later. Many ARES groups from other counties provided relief operators for areas with major damage. Congratulations and thanks to all who were involved!! Details later after reports are received from local ECs. [BT] LPM was held in Ripley WV on May 20-21 with many amateurs from throughout the Division plus KY1T (former VA SM) representing ARRL HQ. No-code licensing and future growth of Amateur Radio were major topics. Thanks to our PIO, AB4FW, for representing NC. LPM is for all amateurs-plan to attend next year. [BT] Here in NC the best source of NEW HAMS seems to be the many well-publicized Novice and upgrade classes which are sponsored by a club, an EC or sometimes an individual. Offer to help with these classes; if there are none in your area help organize one (contact ARRL for information). These classes, combined with frequent VEC exams, are critical to the growth of Amateur Radio. [BT] Cary ARC Swapfest is scheduled for July 15 and WCARS Ashville Hamfest is scheduled for Jul 29-30. [BT] Silent Keys: N4BXF & WA4YTQ. [BT] Net News: Glad to hear former STM W4EAT on nets agn; very sad to report WA4YTQ as a silent key. Wes was active on NC nets for many years. [BT] April traffic: K4NLK 292, KI4YV 189, K4IWW 154, WD4HTE 141, N9CGD 72, WB4WII 56, AA4ZV 50, WD4MRD 45, N4UE 44, KA4EYF 43, N4MMM 38, N4SVZ 34, WA9NEW 28, W4EHF 24, WD4LOO 21, WA4MNR 19, N4LST 18, KA4KGZ 17, N4SHE 17, W4LWZ 17, NT4K 16, K4DDY 14, WA2EDN 14, KC4GCK 14, WD4LSS 13, N4JTG 12, K4YJB 11, N4TCN 9, W8KLF 9, AB4W 8, KM4BN 6, KB7LX 6, N4VHU 5, AJ5F 4, N4SMS 3, W2JDB 3, N4TCH 3, W4EAT 2 [AR]

SOUTH CAROLINA: SM, Ned Moeller, N4FVU—AIRS: W4DRF. BM: K5CVD. SCSSB NM: WB4MBC. SCNT NM: KA4UIV. OOC: W4NTO. PIO: AB4ID. SDM: KA4GUT, SEC: K8AFP. STM: W4ANK. TC: WA4UNZ. ACC & SGL: N4FVU. To all of you that have recently contributed a little extra to achieve our Amateur Radio goals, I extend a "THANK YOU," especially to those that attended the Statewide Emergency Communications Meeting in Columbia. To those that helped in making the 4-county (Fairfield, Lexington, Newberry & Richland) Emergency Preparedness Exercise a success, I extend my thanks. I hope all of you enjoyed high contest results and good fellowship at your Field Day. Field Day is one event of the year that is totally for the radio amateur's enjoyment. Thank you for all the Field Day messages sent to me and your SEC. In spite of the fact that our individual contributions may be small, it is the combined total effort that makes us proud to be a participant. Traffic: N4MEJ 117, W4ANK 111, W4DRF 46, KA4LRM 34.

VIRGINIA: SM, Claude Feigley, W3ATQ—STM: KB4WT. SEC: N4EXQ. ACC: NT4S. OOC: W4HU. BM: AB4U. PIO: AA4VP. TC: WX4C. SGL: W4UMC.

VTN	1 PM	3907/7260	W4JLS
VSBN	6 PM	3947	KI4BR
VSN	6:30 PM	3680	N4KSO
VN(EARLY)	7 PM	3680	N4GHI
VN(LATE)	10 PM	3680	WB4KSG
VLN	10:15 PM	3947	KK4FV
SVEN	7:15 PM	146.82	N4TS
STARES	9 PM	146.97	KJ4VT
DEC/EC	9:30	3947	KA4NWK (3rd WED)

N4EXQ, SEC, has appointed AB4U as EC for Hanover County replacing N4EKD. Waddy resigned due to a change in his work sked which prevented him from making the evening nets. KB4OPR is a new OES. Earl sez the ARES gang is doing a superb job having reported to him a total of 1,598 hours of public service in 1988. He feels sure there are many hours which were not reported. AB4U, WB4ZTR, KA4NWK, W4PET, K4JNA, WA5FAC and WS8A (ex-N4SMB) have successfully

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completed the "EC" certification exam. Faithful DECs submitting monthly reports are: NC4B N4CWP NM4R KA4ERP AA4HQ WB4UHC WA4TVS WB4AXY WB4ZNB WB4PEA WA4RT8 KB4PW N4KSO and WD4RIE. N4AOP coordinated the communications for medical emergencies during the reenactment of Civil War battles in Louisa County on May 25, 26, 27 and 28th. In visiting several clubs, I found considerable interest in the ARRL committee report regarding a No-Code license. Be sure you send your comments and suggestions to N4MM, Roanoke Division Director, for his guidance at the ARRL Board meeting in July. The Virginia QSO Party had lots of QRN on Saturday, but condx improved on Sunday. Lots of CW activity was reported on 15, 20 and 40 meters. WA4NTP was very active operating mobile both days. Upcoming VE exams—July 15 Chesapeake DX Assn. Contact KC4YX, Aug. 19 Hampton Roads Radio Assn. Contact N4BDH and Sept 17 at the Virginia State Convention. Take note, this exam is on Sunday of the hamfest. The Southern Peninsula ARC (SPARK) has submitted their appplication for recognition as a Special Service Club. the Woodbridge ARC reports that they are heavily involved with the preparations for amateur setup at the Boy Scout Jamboree to be held Aug. 2-9 at Ft. A.P. Hill. They will set up, test, and install six stations in the K2BSA/4 tent. Four HF and 2 VHF/UHF stations will be in use. 1 VHF/UHF satellite and 1 VHF/UHF packet an/or repeater. N4LKB, K8EI, WA3GRS, KC4AFT, N4JLS, and N4PBE are active. WB4GJZ will furnish equipment. Traffic will be passed via packet and conventional SSB/CW. Traffic report for April is: total traffic handled 5482 with 47 stations reporting. Traffic: K4DOR 1632, K4DOR 446, N5GHI 385, W4SQQ 286, N4HOG 280, N4EXQ 239, W4JLS 215, WB4QOJ 182, K4MTX 142, W3ATQ 142, WD4FTK 138, KJ4VT 135, AA4AT 109, WB4KSG 107, KB4WT 82. WD4MIS 78, WD4MIZ 72, WB4ZNB 72, N6ANQ 71, WB4EDB 64, KI4BR 60, WD4VMX 53, K4BGZ 50, N4KSO 47, K4GR 39, AA4GL 37, KK4FV 35, WB4ZTR 32, WB4KIT 26, KI4W 26, N4TJT 25, W4TZC 25, K4JM 20, N4AVJ 19, K4MLC 15, W4HDW 14, N4SMB 12, N4RHV 12, KB4OPR 12, WB4UHC 11, N4FNT 11, KC4ESG 8, N6GVG 8, WB4DQZ 5, WA4TVS 4, KB2CEV 1, K4VWK 1.

WEST VIRGINIA: SM, Karl Thompson, K8KT—SEC: K8QEW. STM: N8FXH. SGL: K8BS. TC: K8LG. ACC: WD8EBH. Repeater Coord: WB8GDY. Was nice to see every one who attended the LPM '89 at Ripley on May 20 & 21. Tom, KC8R, is doing nicely after back surgery. More participation is needed on our state Nets. See below for times and freqs. Everyone is welcome. WB8CQV's BBS handled 1,582 msgs. in April. Nice going John. Remember JAX Mill on July 1 & 2. Mike, WD8DHC, is looking for NCS and Asst NCS for WVFN.

NET	FREQ	TIME	QNI	QTC	SESS	NM
WVFN	3965	6:00	970	126	30	WD8DHC
WVN	3567	7:00	293	94	30	KZ8Q
WVMD	7235	11:45	421	65	30	WD8V
WVRN	3640	6:30	209	28	28	K8LG
WVNN	3730	7:30	79	33	28	KA8ZGY
Hillability	14290	Noonsu	218	15	5	W8YP

Traffic: WD8V 355, KA8WNO 273, N8JPR 206, W8YP 127, K8QEW 75, WD8DHC 60, W8FZP 42, N8FXH 42, K8KT 33, NJ8J 22, WD8EHB 18, KA8QHC 14, KA8OGF 6, W8JWX 6, WA8DGE 4.

ROCKY MOUNTAIN DIVISON

COLORADO: SM, Edie Sheffield, KAØMQA—SEC: WBØTUB. STM: KBØZ. ACC: WBØDUV. PIO: WBØFQB. TC: WØLJF. OOC: KAØCDN/WØIJR. SGL: WDØHNQ/WDØHNP. BM: KAØCDN. This month approx 50 amateurs were involved in the National Day Medical Test, which was local and federal govt agencies and area hospitals along the front range, and several ARES districts involved in the communications. This was the second year for this exercise in the Denver area. Congrats & tnx to all who volunteered their time. There are numerous swapfests coming up this month. July 1st, Grand Junction Swapfest. Contact NØZA for info. July 8-9 will be the Wyoming Hamfest in Cheyenne, WY, to be held at the Holiday Inn. Many from Colorado attend this one. July 16th, DRC Ultimate Swapfest & the Colorado State Convention will be held at Jeffco County Fairgrounds in Golden, CO. Contact WJØG or WSØO. July 21-23 is the Mountain ARC Campout & Swapfest in Woodland Park, CO. It will be held at the Red Rocks Campground. Contact NØCMD. July 29th is the annual Ski Country ARC Swapfest in Glenwood Springs Co. This is being held the weekend of the Carbondale Fair. Hope to CU at these Swaps. 73, KAØMQA. NETS: Col QNI 1071, QTC 62-138, QNF 922, 30 Sess. CWN. QNI 61, QTC 57, QNF 316, 27 Sess. CWXN. QNI 1987, QTC 1573, QNF 2700, 30 Sess. HNN QNI 1713, QTC 149-733, QNF 1024, 30 Sess. NCTN QNI 193, QTC 44, QNF 204, 30 Sess. SCTN. QNI 212, QTC 18, QNF 278, 29 Sess. Traffic: NØBQP 2038, KØYFK 694, WØLVI 663, N1CWP 560, NØHFZ 542, KAØWIE 224, NØFCR 198, WBØFFV 137, KØHOA 102, KBØZ 22.

NEW MEXICO: SM, Joe T. Knight, W5PDY—ASM: K5BIS. SEC: K6YEJ. DEC: WD5HCB. STM: ND5T. NMs: WA5UNO, KA5NNG, W5QNR. TC: W8GY. ACC: KA5BEM. Southwest Net meets daily, 3583 @ 0230 UTC, handled 78 msgs with 75 checkins. NM Roadrunner Net meets daily, 3939 @0100 UTC, handled 82 msgs with 1035 checkins. NM Breakfast Club meets daily, 3939 @ 6:30 AM, handled 133 msgs with 834 chekcins. Yucca 2-Mtr Net, 78/18 handled 17 msgs with 393 checkins. Caravan Club 2-mtr Net, 66/06 with 107 checkins. SCAT Net, 66/06 handled 9 msgs with 513 checkins. Info Net 12/72, with 70 checkins. Traffic: KF5VF 116, KN5D 90. The WX at the Zia Hamfest "the ole Bean Feed" was perfect; however, attendance seemed down a little, but a good time was had by all who attended. KC5GA walked away with the grand prize. So very sorry to report the passing of W5YXD & KI5H. Hope lots of you get to attend HAM COM Ft. Tuthill at Flagastaff and WIMU.

UTAH: SM/STM, Jim Brown, NA7G—Rich Fisher, NS7K. Rich is asking that anyone interested in a Section-level appt to apply to him in writing within 30 days. This includes both present appointees as well as anyone else. Interested in upgrading but can't seem to get ur CW speed up? Try QNI the Utah Code Net, on 3710 KHz at 7:30 PM local nightly. It's a slow-speed traffic net, and is an easy way to get into CW. Fun, too. 73 de NA7G. Traffic: N7IUN 51, WA7MEL 34, N7ASY 29, NA7G 24, NS7K 17, N7JLC 10.

WYOMING: SM, Jim Raisler, N7GVV—ASM: Steve Cochrane, WA7H. SEC: Jim Anderson, W7TVK. STM: Dan Ransom, K7MM. Traffic: NN7H 150, W7TZK 173.

NET	FREQ	MST	QNI	QTC	SES	NM
Cowboy	3923	645 P M-F	680	17	20	KC7AR
Pony Ex.	3923	8:00 A Sun	228	2	5	W7MZW
Sheridan ARES		Tu	37	0	5	WA7D
Albany ARES	53	0	5	WB7K		

Anyone interested in setting up a statewide event for the 100-year celebration for Wyoming? Let's hear from u and hopefully get something going. Next month is WIMU in Jackson. Once again, I'd like to see more volunteers to fill the several vacancies we have in the ARRL Section staff. Please consider and give me a call. 73 till next month.

SOUTHEASTERN DIVISION

ALABAMA: SM, James Spann, WO4W—ASM: W4XI. SEC: KB4GDN. STM: N4RT. PIO: KB4KCH. ACC: AA4BL. OOC: KF4VS. SGL: N4FRQ. BM: KA4ZXL. Recently the Alabama section lost two fine amateurs from Birmingham. I regret to report that Jerome Tanner, W4BJG, and Jimmy Blanton, KA4VZA, are Silent Keys. Jerome's Shades Mountain QTH has been the home of the 146.88 MHz repeater in Birmingham for years. This year, the Huntsville Hamfest will also be the 1989 ARRL Southeastern Division Convention on August 19 and 20. I know I will see many of your there! Thanks to all individuals and clubs who helped with the Alabama Reunion train special-events station in May. The "railroad mobile" station worked hundreds of amateurs across the state and country. The Shelby Co. ARC now meets on the second and fourth Thursday at the First Methodist Church in Pelham at 7:30. New packet node is on the air in Thomasville, THOM1, on 145.01. This has greatly helped connectivity into the Gulf Coast area. The Univ of Ala ARC demonstrated packet radio at the Honors Day/Engineering open house on campus. A codeless amateur license? I have received a flood of comments! Let our Division Director Frank Butler know what you think. See the Alabama Section News from KB4KCH for some thoughts from various Alabama amateurs. BPL: WA4JDH. PSHR: WA4JDH W4PIM W4CKS W4OAT WA4RNP. Traffic: WA4JDH 689, W4PIM 249, W4CKS 172, WA4RNP 47, W4OAT 37, WO4W 12, W4DGH 10, WB4TVY 10, WA4ZPZ 7.

GEORGIA: SM, Eddy Kosobucki, K4JNL—ASM: KC4MJ. SEC: NC4E. STM: WB4WQL. Packet: W4QO. ACC: KM4IH. BM: WB4ZOJ. OOC: W4TG. PIA: WB4DEB. SGL: WB4UVW. TC: WD4PAH. U still have to send in an MV-9 (tan only) form to the Motor Vehicle Div to have ur 1990-94 Ga Amateur Radio tag engraved. REMEMBER THE DEADLINE IS JULY 31st. I have the forms. Send a large SASE & I will forward u one pronto. Augusta & Kennehoochee Hamfest both well attended & successful. Academy Elementary RC the latest in the section. Our sympathy to family & friends of Gerow F. Carr, Sr K4VSW, who became a Silent Key recently. Leila & I enjoyed the visit to Newnan to present Certificates of Merit to hams in the area for their work during the Coweta County tornadoes. We'll miss N4IQR who moved to EPA where his daughter is EPA Section Mgr. Next big Section project is to get Ma Bell rates lowered on repeater telephone lines. Am in need of help, so let's hear from u. Now have seven Special Service Clubs in Ga. I know that ur club can qualify if you try. Contact Sharon, KM4IH, the ACC for forms, etc. PSHR honorees for Apr are: WB4DVZ, KC4BHX, KM4LS, KJ4NK, WA4TXT, WB4WQL, W4RWB, KA4HHE, WD4COL, WA4YYQ, K4ZUY. If u have a response to the "NO CODE LICENSE," pse get it to Dir Butler or me at the Atlanta Hamfest or in the mail prior to it. Dates for the big affair are July 8th & 9th. Remember it's in a new place and will be a lot more convenient to all. I'm sure there will be a map on the flier. As I write this, there is vy severe WX in this Section. Our tnx to all u dedicated Ga HAMS who help with all these emergencies. With the 1100 ARES members in the section, we can get things done. Many ARRL appts are available to LEAGUE members. If u desire one, I'll forward the form, or see me at a hamfest. Also take time to register with NC4E our SEC in Atlanta & have ur ARES identification card made. I hope that all of u have a nice summer & God bless u & ur families. Traffic: KA4HHE 163, WB4DVZ 146, WB4WQL 91, KC4BHX 87, W4AET 82, N4UZ 70, WD4COL 58, WA4TXT 37, K4JNL 36, KJ4NK 30, N4MWR 26, WA4YYQ 15, K4BAI 8.

NORTHERN FLORIDA: SM, Roy Mackey, N4ADI—ASM: Bill, KB4LB. ACC: Dick, WA4BIH. BM: Dave, N4GMU. DIGITAL, Al K4CY. PIO: Petey, WA4PUO. SEC: Rudy, WA4PUP. SGL: John, KC4N. STM: Cotton, KB9LT. TC: Ed, WØRAO. OOC: John, AB6I. The Orlando Hamcation is now history. It was great to see and meet so many of you. Hope you had a chance to be there. One of the busy times was Sunday for FCC exams where 18 VEs and helpers gave 186 tests to 117 people. Of those, 69 qualified for new or upgraded licenses. there were 7 Novices, 24 Tech, 15 Gen, 15 Adv, and 8 new Extra Class licensees. All deserve congratulations and special thanks to the VE's who were kept busy for about 6 hours. They are: Doug NS1A, Gene, KA4RCM, Steve, WA4B, Bob, KD4T, Brad, AA4NV, Ed, WØRAO, Tom NO4A, Nils, AB4FG, Charlie, NE4I, Gerne WA3ZBN, Mac, KV4AM, Lyn WB4HBH, Phil KK4MQ, Fred, W4FI, John AB6I, George, KM4FW, Bob, N4OZD and Frank, WA3ZBM. I received several thank-you letters, even though some candidates said they had to wait several hours to take their code test. GOOD SHOW!! Larry, W4RA, Dave, K1ZZ, Luck, KY1T, Frank, W4RH, Evelyn, W4WYR, and Dick, WA4PFK, were present representing various ARRL positions and they participated in many of the forums. It was a meeting of our Northern Florida Section and I was pleased that most of our Leadership Officials were present to participate in meetings and forums and to meet others from Southern Florida Section to discuss mutual problems and objectives. ARES/RACES was a well-attended session as were those for traffic nets, packet, Amateur Auxiliary and the ARRL Forum. The Sunday morning Traffic Handlers Breakfast was an additional highlight with many NMs, NCSs and Liaison Stations discussing CW and phone net operations and problems. If you haven't tried to become a part of the NTS, check out your local 2-meter nets and listen for the HF nets as listed in the new Net Directory. By the way, congrats to Steve Ewald and others who compiled the new one. It's much easier to read! Thanks HQ! 73. Roy, N4ADI. Traffic: WX4H 666, KB9LT 355, WA4QXT 350, WD4IIO 252, N4SS 235, AA4HT 177, WC4D 169, AA4FG 107, WA4EYU 96, K4UBR 92, N2AOX 74, N4JAQ 62, KI4CQ 59, N4GMU 56, W1UKR 52, W4KIX 51, WA4PUP 47, WA4STZ 40, W4DTV 39, W4UEA 38, N4UF 32, W7YWF 30, KI4NN 22, W4AT 20, N4DY 15, W8IM 11, KF4SP 10, K4CY 9, N4ADI 8, K4UTY 8, WB4FJY 8, N4QYS 6.

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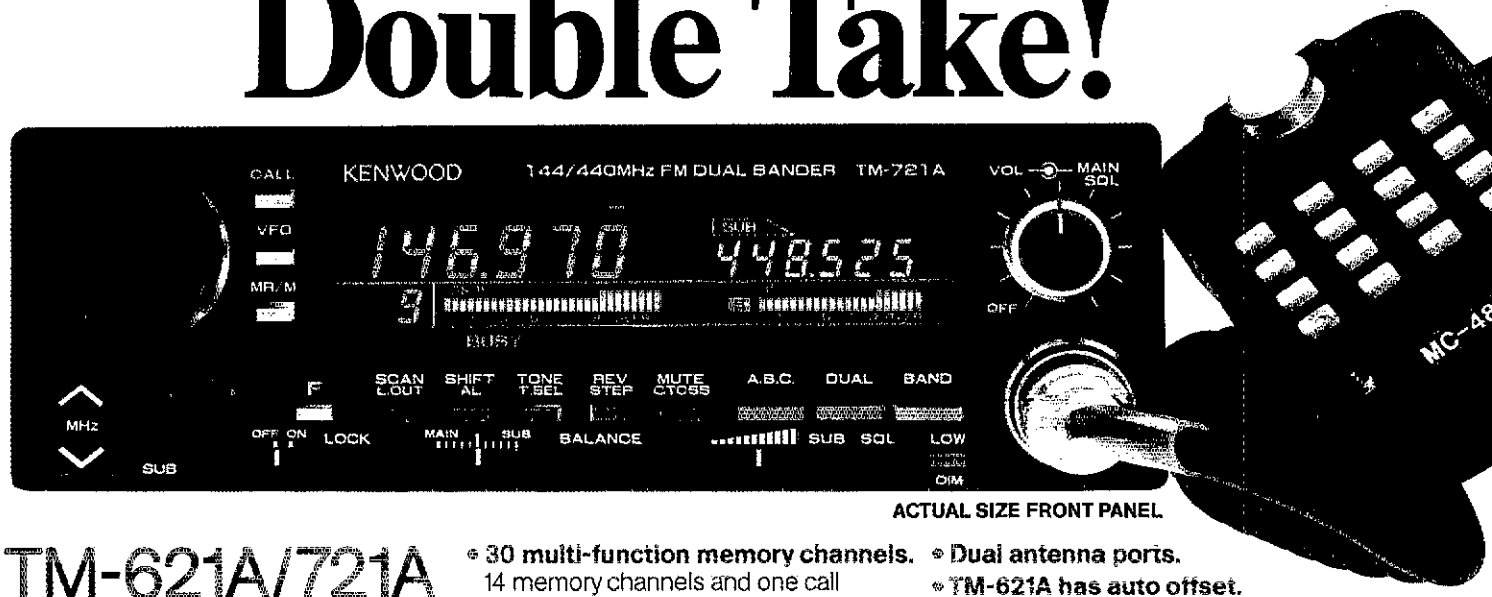

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- **45 Watts on 2 m, 35 watts on 70 cm, 25 watts on 1-1/4 m.** Approx. 5 watts low power.
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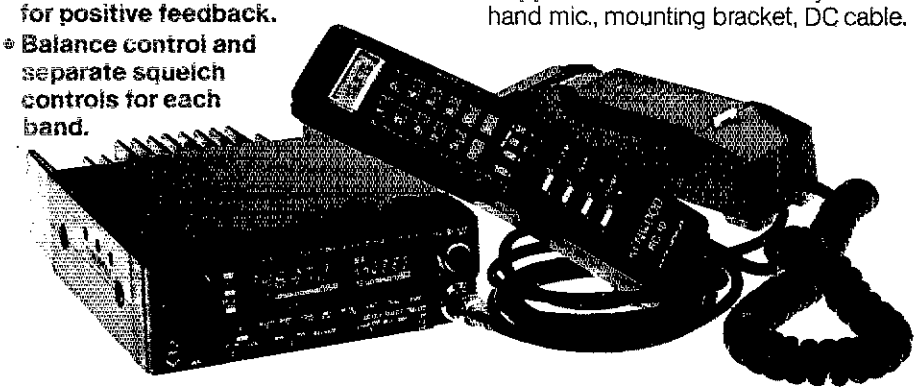
- **Frequency (dial) lock.**
- **Supplied accessories:** 16-key DTMF hand mic., mounting bracket, DC cable.



TM-721A shown with optional RC-10.

Optional Accessories:
• **RC-10** Multi-function handset/remote controller • **PS-430** Power supply • **TSU-6** CTCSS decode unit • **SW-100B** Compact SWR/power/volt meter • **SW-200B** Deluxe SWR/power meter • **SWT-1** 2 m antenna tuner • **SWT-2** 70 cm antenna tuner • **SP-40** Compact mobile speaker • **SP-50B** Deluxe mobile speaker • **PG-2N** DC cable • **PG-3B** DC line noise filter • **MC-60A, MC-80, MC-85** Base station mics. • **MA-700** Dual band (2 m/70 cm) mobile antenna (mount not supplied) • **MB-11** Mobile bracket • **MC-43S** UP/DWN hand mic. • **MC-48B** 16-key DTMF hand mic.

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SOUTHERN FLORIDA: SM, Richard D. Hill, WA4PFK—STM: K4ZK. SEC: W4SS. TC: KI4T. BM: WD4KBW. PIO: N4PBF. SGL: KC4N. AAC: W4TAH. ACC: K4UEK, Packet Manager: K4CY. The Fort Myers ARC MODULATOR reports that the 1990 City of Palms Hamfest will be held at the Moose Hall on Pine Island Road. The Martin County ARA COMMON EMITTER stated that MCARA would hold a Community Awareness Day at the Martin Mall. Activities will include 10-meter HF and 2-Meter packet demonstrations. AB4BC sent a radiogram indicating that elections held at Racal Milgo resulted in AB4BC President, ND4G Vice President, KB4RLS Secretary and WB4EHG Treasurer. Congrats to the South Brevard ARC who has been officially renewed as a Special Service Club. The Englewood ARC gave a great big thanks to KF4BD and KE4FR for getting out the 1989 membership roster. the Everglades ARC BEAM reported that the club gave a demonstration of ham radio to the 4th and 5th graders at the Florida Christian School. A schedule was arranged with HC1JH and all 60 kids and all of their teachers got a chance to participate. The Gator Chapter QCWA newsletter states the Florida State QCWA net is now on at 8 AM on 3995 kHz. N4ORZ reported that N4RMB is now manager of the Dade Emergency Net—coassistants are N4PLY and KC4HDJ. Other newsletters received included the Manasota Repeater Assoc., the South Brevard ARC SPARK and the Palmetto ARC BUG JUICE. K4FQU, Manager of the Southwest Florida Traffic Net has written a booklet on being an NCS and is still considering another on the fundamentals of being a liaison station. The Everglades Beam reports that nearly met one goal of WAS in 24 hours—but fell short by three states—Alaska, Mississippi and South Carolina. But the main goal of exposure to ham radio for a large group of young prospective hams was a booming success. Several violent storms finished off the weekend blowing one antenna down, but all else came through OK. WB5YDD reports that WB0HOX represented Florida on RN5D 48%. The Tampa ARC QRM shows that the results of the elections are: N4LCQ President, KY4C Vice President, KB4RLZ Secretary, WD4HHH Treasurer, KR4X, K4EUK and AB4EC Board, KA4WNZ Past President and KA4HFF Trustee. WD4KBW, Bulletin Manager reports 58 bulletins received and 81 sent by W4DL 36, WA4EIC 43, WT4F 6, K4IEK 16, WD4KBW 12, N4QWN 20 and WA9VND 6. WB4SOU and WT4F wish to thank all of the traffic handlers for their assistance with the SUN and FUN EAA message originations. Lakeland area operators assisting were KB4MON, KC4VK, WB4ZVD, KA4LME, N4LR, K4GOX, K8RIF, N4LXG, N4BU, N4SDV, WB4SOU, K4EBE and WT4F. 73 de WA4PFK, Traffic: W3CUL 3041, W4TJM 1530, WA9VND 1205, W3VR 998, WA4PFK 428, K4EUK 310, K4SCL 295, K4IA 275, AA4BN 240, K4ZK 222, WA4EIC 215, N4HAP 204, N4KFU 186, KA4FZI 165, WB0HOX 145, N4MML 114, KD4GR 114, N4ET 107, WA4RUE 104, WB4KXV 103, W4DL 94, W4DWN 92, W3TLV 91, N4ORZ 79, KC4VK 77, WB4WYG 69, K4PQU 65, KA4YHS 65, KA4AJR 58, WT4F 55, KF4RL 50, WD4KBW 50, KA4SIH 48, WA4NBE 44, KB4WBY 41, N4QWN 38, KB4MON 35, K4JI 32, KC4GHT 32, K3KT 27, KB4UIA 22, KB4UHC 22, WB4GCK 19, KA4NXF 18, N4HAS 17, AB4BC 16, AA4CH 13, K9ALX 10, KI4ZW 10, N4RHJ 10, K9EHP 10, KB6ECH 9, KA9AKY 8, W4NSY 8, KA8GYF 6, KA4GDU 6, N8ABC 5, W4MPV 5, N4PSV 4, N4OIA 3, W4MFD 2, KB4BLM 2, KA4KFV 2, WB4ZJS 2. (Mar.) N4QWN 73, WX4J 26, KI4ZW 7.

VIRGIN ISLANDS: SM, Ron Hall, KP2N—ASM: KV4JC. SEC: NP2E. NM: VP2VI. Thanks to the speedy action of the CARIBBEAN MARITIME MOBILE NET, the S/V "Freedom," stolen from Charlotte Amalie harbor, was spotted by a ham in St Vincent. Police arrested the suspect and the owner got his boat back. Congrats to Net Control KV4JC and group. The Americas Paradise triathalon on St. Croix brought out 37 VI hams to furnish H & W communications. NP2B & KV4JC did an excellent job of net control. This was good training for our new ARES members. St. Croix ARES check-in for April was 63 with no traffic. St. Thomas ARES has 23 check-ins with one training session. Sorry to report that KV4CH, Clem is a Silent Key. Clem was one of the first active hams on St. John. New calls: Steve NP2CX, Duane, NP2CY, Werner, NP2CZ, Joanna, NP2DA, Jim, NP2DB. Look for St. Thomas & St. Croix Field Day stations this year from VI section. I enjoyed meeting other SM's at Dayton. All they need is Virgin Islands weather. 73 from America's Paradise de KP2N.

SOUTHWESTERN DIVISION

ARIZONA: SM, Jim Swafford, W7FF— STM: W7EP. NMs K6LL, K7POF, KI6ZH. Congrats to the Univ of AZ. ARC for "re-upping" their ARRL Club affiliation. Their FB Swapmeet on April 8, a first, was well attended. Let's do it again next year. Letter from NV7O indicates Mesa City Atty willing to negotiate on antenna height for city ordinance in view of their learning about FCC's PRB-1. Let's hope it is changed from present 35-ft. limit. Keep up the good fight! W7TB went to So Cooks Island where he is signing ZK1TB. Tks, W7YS. This year's SW Divn ARRL Convention is known as HAM-COM '89. It will be held at Los Angeles Airport Hilton Hotel on Aug. 25, 26, 27. Lots of technical sessions, exhibits and entertainment are planned. For info contact Gary, KB6TWP, Registration Ch'm, at 12086 Brookhurst St., Garden Grove, CA 92640. KB6??! When I was on Guam Isl. in 1946, we rec'd permission from military command to operate ham radio on 10 meters only, using Guam's then-prefix which was KB6. Brings back old memories! Explorer Post 599 personnell KB9GBB, KB7FYO, KB7FQO and KB7FQP assisted the AZ ARA Club in re-furbishing their Shaw Butte repeater. Good work, guys. This Boy Scout group also did yeoman work at So. Mtn Hamfest providing food and refreshments for several thousand hungry hams. Congratulations to Craig, N7GLT, on his appointment as Ass't Director, SE Divn, representing the Coconino Co. ARC. ARCA running info net at 1945 MST/Sundays on 146.88 for purpose of Ft. Tuthill planning. Anyone interested please check in. Congrats to West Valley ARC who has officially renewed as Special Service Club. Keep up the good work. So. AZ DX Club meeting April 26 featured Bernie, W6YOY, reporting on Visalia Int'l DX Convention. By the time you read this, Field Day will have come and gone. Hopoe everyone had a good time and am looking forward to receiving your FD reports. Maricopa Co. Sheriff's Dept. honord George Chaet, W1RGH as "Posseman of the Year." George's contribution to crime prevention in the Sun City area was in radio installation and maintenance for volunteer posse group plus designing a zoning system for radio dispatchers responding to a call. Response time was reduced from minutes to approx 20 seconds. Congratulations, George. WVARC members provided public-service communications during the 10K bike race and 1-mile foot races held April 8 as part of the City of Peoria Pioneer Days celebration. Bill, W9WFV, was coordinator of this event. My informal input to date on the code/no code license question tend to indicate that many current digital/packet and satellite operators tends to favor the no-code proposal, while the OT's using conventional CW and SSB on HF bands are against it. Some OT's say reluctantly that they may accept the idea provided the "no- coders" are restricted to UHF/VHF/microwave frequencies only. Will these "no-code" licensees significantly increase the occupancy of these upper ham bands? That is the question. By the time this gets in print (July QST), I will be back at summer QTH in Pinetip, Navajo County, and on the air with 100 watts to a dipole. Keep those cards and letters coming in to Tucson QTH as all mail is being forwarded. Have a nice summer, and CU at Flagstaff July 28, 29, 30. Drop by the ARRL booth and chew the rag. 73, Jim. Traffic: W7AMM 203, W1FJI 119, W7EP 116, W7OIF 45, K7POF 35, K7VVC 32, K7JKM 21, WW7P 18, N7ETP 14, W7KXE 14.

LOS ANGELES: SM, Phineas J. Icenbice, Jr., W6BF—Thanks to NV6I, Marty, K6YMJ, Hank, AA6IR, Hank and W6NAZ, Lenore for all of the fine work on the Antenna Ordinance Committee. If our write-up is as good as it appears we may influence a few politicians. We all need antennas and towers when the big one hits. K6YMJ, Hank, and KA6GSE, Dennis, were major contributors to a great Emergency Conference in Los Angeles. KB6FNR, DW Frosty on the staff of Kaiser Permanente Hospital has established such a reputation with his five-county emergency communications network that the Los Angeles School System has called this amateur network a model disaster network. With a team of 66 volunteer hams, Dr Frosty Boyd has set up a regional disaster net which goes on the air every other Wednesday from 12:15 PM to 12:45 PM, using a different simulated emergency scenario each time. Net Control is rotated among the Medical Centers, because—who knows where the next major disaster will take place.—Los Angeles Unified School District ARA publishes a NEWSLETTER for District Hams-if you need more info call KB6GY, Bob Wolfe.—More high-powered CB stations are causing interference to hams in the 28 to 28.5 MHz portion of ten meters. Some are just splattering and others are moving in! Please write to me with details and send a copy to the local FCC. According to the TRW Crosstalk bulletin new nicad AA cells (the ones used in HTs) are available at the Price Clubs from about one-half the usual price. The Visalia DX convention was a big success as usual in April, next year it will be earlier in April. (my reservation says 04/06/90 to 04/08/90)—The hard working HAMCOM 89 Committee reported that our PRIZES (donated) and income is about 15% ahead of last year. This comparison was based upon the same lead time and is very encouraging to all of the hard-working club leaders who are donating all of the hard work. SEE YOU AT HAMCOM 89—Aug 25/26 & 27th at the LAX HILTON in LA just east of the airport on Century Blvd.—More and more interest in shown in the propagation indices transmitted by WWV on 5/10/15 & 20 MHz these days at 18 minutes after each hour. The first number transmitted is the solar flux, the second is the A index and the third is the K index. Sunspot reports are received daily from as many as half a dozen observatories at the Space Environment Center in Boulder, Colorado. The composite information for all regions is then incorporated into the 0200 UTC message for broadcast. The Fredericksburg, VA and Anchorage, Alaska A- and K- indices: The daily 24-hr A-Index and the 3-hourly K-indicies from these mid-latitudes and high-latitude stations monitoring the Earth's magnetic field are reported. The K-indicies range from 0 (very quiet) to 9 (extrememly disturbed) while the A-indicies range from 0 (very quiet) to 400 (extremly disturbed). with an A-index of 30 or greater indicating geomagnetic storm conditions. These numbers are planetary numbers and represent overall conditions that is why you may often find that a specific path is very good or poor when you hear average numbers. These reports are somewhat like weather reports where locally the sun is shining and a few miles away the sky is cloudy and rainy conditions exist. Many services are available (most at some moderate cost) from NOAA Space Environment Services Center, 325 Broadway R43, Boulder, Colorado 80303. Direct inquiries to the duty forecaster anytime, 24- hours per day, seven days per week. Call (303) 497-3171. (Do not call collect & there may be a minor charge). A tape recorded message is also available by calling (303) 497-3235. W6EL, Sheldon C. Shallon, is an expert on propagation and has NINIPROP ™ program available. W6EL, Shel, is a member of the SCDX Club if you need an eye-ball QSO. Shel wrote his first propagation prediction program in 1966, in order to help work DX 73.

ORANGE: SM, Joe H. Brown, W6UBQ—ASM: Riv Co, Bob, W6LKN (714 686-3823). ASM: Org Co. Ralph, WB6JBI (714 776-9272). ASM: San Berdo Co. Ken, WA6ZEF (714 983-1272). Club News: Club Officers Coachella VARC, Pres. Mike KI5C8. VPres Rudy W6YQY. Tres Robin N6OZY. Sec Doug KB6HGS. Ed, Mike KA6IYS. So Cal 6 Mtr Club holds 6 Mtr T-hunts on 1st Sat of the month. 10 AM Acacia and Skyline, Fullerton. Moreno VARA, Bulletin info. Who is that ham I see on TV? Any Amateur holding Tech or higher. Think of the fun you could have with ATV, being able to see the person you are talking to. It's called ATV, a wide-field looking into the unknown. de WA6MVD. Western ARA Dir Ham RDO Programs Nick, W6HRD, moving right along. 20 new hams licensed at Imperial Middle School. Good show, Nick! Tri-County ARA, Hamfest Sat Aug 19, 89. VEC Exams, ARRL Booth, Swap tables for info, call Joe, WB6UFX 714-980-4563. Inland Empire ARC. One of the most important issues affecting amateurs to come along. Code-Free license? No matter what your views are, for or against, no matter if you do or don't belong to the ARRL, I urge you to express your views to the Div Dir SW, prior to the July Board meeting. Now is the time to make your opinion known. I would hope every one lets Fried, WA6WZO, SW Div Dir, know how they feel. Address is on page 8 of QST. de N7QQ. Corona Nerco ARC. Novice and Techs have only a token code test, so what's the big deal about the learning of the code. There are many other skills we learn to pass for upgrade, but promptly forget once past the exam hurdle. de John NF6Y. Riverside Co ARA. The drive to commercialize the amateur freqs is only beginning. It's likely we will lose something. We need to answer questions such as, How big does Amateur Radio need to be? Do we make the best use of our spectrum? Would a no-code license be beneficial

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  USB, LSB, CW, AM, FM, and AFSK. Mode selection is verified in Morse Code.
- **VS-1 voice synthesizer (optional)**
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  Kenwood DynaMix™ high sensitivity direct mixing system ensures true 102 dB receiver dynamic range. (500 Hz bandwidth on 20 m)
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  Super efficient cooling permits continuous key-down for periods exceeding one hour. RF input power is rated at 200 W PEP on SSB, 200 W DC on CW, AFSK, FM, and 110 W DC AM. (The PS-50 power supply is needed for continuous duty.)
- **Built-in automatic antenna tuner (optional).** Covers 80–10 meters.
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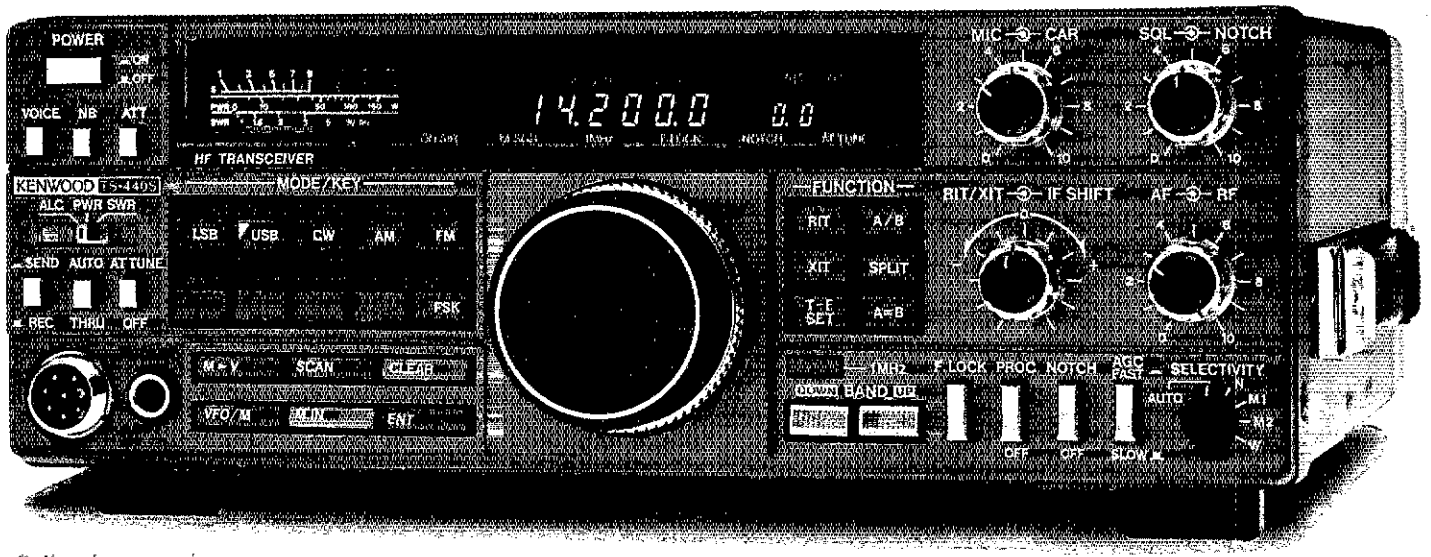
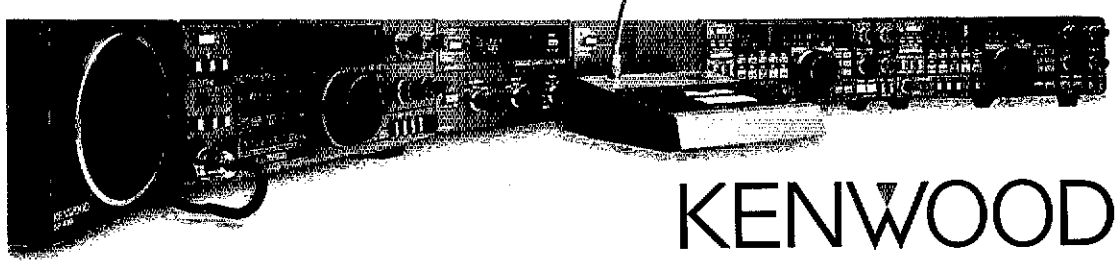
- **VOX, full or semi break-in CW**
- **Dual SSB IF filtering**
  A built-in SSB filter is standard. When an optional SSB filter (YK-88S or YK-88SN) is installed, **dual** filtering is provided.
- **AMTOR compatible**
- **Adjustable dial torque**
- **100 memory channels**
  Frequency and mode may be stored in 10 groups of 10 channels each. Split frequencies may be stored in 10 channels for repeater operation.
- **TU-8 CTCSS unit (optional)**
- **Superb interference reduction**
  IF shift, tuneable notch filter, noise blanker, all-mode squelch, RF attenuator, RIT/XIT, and optional filters fight QRM.
- **MC-43S UP/DOWN mic. included**
- **Computer interface port**



Optional accessories:

- AT-440 internal auto. antenna tuner (80 m – 10 m)
- AT-250 external auto. tuner (160 – 10 m)
- AT-130 compact mobile antenna tuner (160 m – 10 m) • IF-232C/IC-10 level translator and modem IC kit • PS-50 heavy duty power supply • PS-430/PS-3D DC power supply • SP-430 external speaker • MB-430 mobile mounting bracket • YK-88C/88CN 500 Hz/270 Hz CW filters • YK-88SN 2.4 kHz/1.8 kHz SSB filters • MC-60A/80/85 desk microphones • MC-55 (8P) mobile microphone • HS-4/5/6/7 headphones • SP-41/50/50 mobile speakers • MA-5/VP-1 HF 5 band mobile helical antenna and bumper mount • TL-922A 2 kw PEP linear amplifier • SM-220 station monitor (no pan display) • VS-1 voice synthesizer • TU-8 CTCSS tone unit • PG-2C extra DC cable.



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or would it create another problem, etc, etc. de KN6U. NTS News. WA6YNT-1 BBS is off line, W6AXM-1 picked up the BBS function. SCNV new Net Manager Kathi KA6TND. Good luck, Kathi. Tfc BPL: WF6O, PSHR: WF6O 109, KA6HJK 40, WB6QBZ 68. BBS Tfc WA6YNT-1 84, WF6O 537, W6SX 111, AD0A 54, KA6HJK 51, K6ZCE 50, WB6QBZ 43, W6CPB 26, KB6VPI 14, KA6TND 14, W6NTN 9, N6OKS 8, KA6JOB 6, N6HIW, KD6GX 2. SCN Daily Schedules SCN1 CW, 3598 6:30 PM, SCN2 slo CW, 3705 KHz, 10:00 PM. SCNV 2 Mtr rptr. 147.645- 600, 9:00 PM. Tech Coor Activity: K6OV continues to pursue an interference problem that sounds much like the article in Feb QST. Mac, K6WX, working RFI in Riv. Co. ARES/RACES; ART, N6GDM, asks "is your home prepared for the big quake"? Can you assist your neighbor? When the quake hits, the timefor planning is over! The Lung Association Great Escape there-day bike trek was a fun success. TNX to San Bernandino Co Ken, WA6ZEF, Mobile Units, Dean, KG6YS. Org Co. Dav WA6PMX, Riv Co, Bob N6MFJ and over 20 operators from four-county area.

SAN DIEGO: SM, Arthur R. Smith, W6INI—TC: N6JZE. SEC: W6INI. STM: N6GW. PIO: N6PKY. KF6BB is new EC for Southern Dist of SD County. Aug 11 is advance registration deadline for the 1989 Southwestern Division Convention to be held at the LAX Hilton Aug 25-27. Poway ARC's Explorer Post 2073 demonstrated Amateur Radio at 1989 Scout Fair with station operation on 440 MHz voice, 2-meter voice and packet, 10-meter SSB. Participating were Explorers KB6WYL, future hams Jamie, Tim & Andy and leaders WB6BOD, N6OHS, KA6PXD. The American Legion and American Red Cross joined in a successful disaster communications test April 22 in recognition of Earthquake Preparedness Month. The recently organized SD Radio Club (W6GGK) meets monthly on the third Thur at 7:30 PM at the Skyline Wesleyan Church, 1345 Skyline Dr, Lemon Grove. Technical programs will feature the meetings. 1989 officers: 220 Club of San Diego, Pres N6PC, VP K6PD, Sec/Treas WB6QYO. Upgrades: WD6AHX to Advanced, KB6NZA, to General. NCTN 29 sessions, 72 msgs, 286 ck- ins. ARES CW 5 sessions, 12 ck-ins, 1 msg. Traffic: KI6ZH 243, KI6ZM 33, WA1ZEN 30, N6RVO 29, KB6PCF 21, N6GW 21, WA6IIK 9.

SANTA BARBARA: SM, Thomas I. Geiger, W2KVA-ASM/N.Vntra: N6MA. ASM/S.Vntra W8AKF. ASM/Sbar WB6BYU. ACC KB5AH. BM: KI6XG. STM-N6W, OOC: W8AKF. PIO: N6FOU. TC: W6KFV. SEC: WB6IIY. DEC/Vntra: WB6RV. DEC/S.Sbar KA6KGF. DEC/N.Sbar- KI6XG; DEC/SLO-WB6IIY. Not reported previously in this column, this has been a year for toxic spills and the inevitable evacuations in Ventura County. In January a tank containing over 300 gallons of chlorine leaked when a valve was accidentally broken off. A chlorine cloud instantly began to spread and 23,000 people had to be evacuated in Simi Valley. The valley was cut in half, with the western part totally isolated. Five public schools were evacuated and the students taken to two local high schools. Ventura County ARES, working closely with County and Red Cross officials, established communications over three nets, tying schools, shelters and the city EOC together. On the 11th of April a fire at a chemical blending plant in Saticoy caused the evacuation of 1,500 people, with 360 going to shelters. Ventura County ARES again provided communications for shelters, EOC and Red Cross. I hope to have a list of operators involved for the next Section News column. There have already been two more toxic incidents requiring evacuation and ARES support this month (May), and the month just started! Ventura ARES is getting a real workout and their professionalism has earned the respect and admiration of all served agencies. A hearty WELL DONE to WB6RVA and VARESI On a more solemn note we mark the passing of Dave Wright, W7LYE, of Santa Maria. Dave was a valued member of the Central Coast ham community who always gave freely of his time and considerable expertise. As well as being an expert RF engineer, Dave was an accomplished musician, a fine photographer, and a good friend to many Lompoc/Vandenberg/Santa Maria hams. April testing successes - SMRA/VE session (ARRL): To Technician - KA8FVI, KC6CHP, KB6PME, WD6GBX / To General - Bob Fries (unlicensed, Ventura), N8IVN, N7SAK, KB6YJN / To Advanced - N6SMI / To Extra - KB7MC. Volunteer Examiners: N6SR (lead examiner), K6JTJ, AA6ES, W6MUL, KA6KTU, KB6RZG, K6VK, WD6BKF. Non-VE assistants: KA6YFD, KB6DDT and Laura Schroeder (N6SR's wife). Congratulations to those who upgraded and THANKS to those who's work made it possible. 73 for now. Traffic: N6NLW 227.

WEST GULF DIVISION

NORTH TEXAS: SM, Dan Dansby, W5URI—ASMs: W5GPO, K5MXQ. STM: K5MXQ. STM: W5VMP. ACC: KA1CWM. TC: K5SXK. BM: W5QXK. PIO: K5HGL. OOC: WA5YKO, SEC: N6AJP. It is with regret I announce two long- time friends W5BBH & W5JOU are SK. 7290-kHz picnic included hams from TTN, TCWN, T6loCW, DFWtfc, SWTN, RN5 & CANDII. K5UPN was honored with JAMES DUNN AWARD & KC6GO received the Whitney Nugget Award. We still have openings for OO, OES, OBS, ORS, ATC, PIA. GET INVOLVED! N5MUJ introduced Amateur Radio to two Denton Jr Highs. Storms moved into No. Tex on 4 May and Ft.W RACES in two hrs lost five rptrs & were on their sixth when the storm subsided. It's like a broken record. K5UPN has been over 500 pts every month since last Oct. KF5BL also made BPL again for 3 in a row. Super job fellows. Traffic: N5KCL 86, W9OYL 152, W5TNT 292, W5YQZ 328, KD5RC 144, N5NZH 49, WB5CPY 66, KC5NG 31, K5MXQ 110. For BPL K5UPN, Orig 3, Rec 307, Sent 256, Del 4, Total 570. KF5BL Orig 9, Rec 255, Sent 283, Del 14, Total 561. PSHR: WB5CPY KF5BL N5NZH K5UPN W5YQZ N5KCL K5MXQ. Super job fellows.

OKLAHOMA: SM, Joe Lynch, N6CL—This month we say a sad farewell to Dick Hawkins, W5FW. Dick became a Silent Key on April 27, after a long illness. Dick was a former SCM (1957-1959), former NM of STN and an Elmer to many hams, including his wife, Emma, W5PWN. He was a charter member of the Lawton-Ft Sill ARC. He was a member of QCWA Chapters 56, 63 and president of 114 at his passing. He formerly held the call W5FEC and was licensed for 55+ years. The highest compliment of a person is to be well-liked by his or her peers. Dick was well liked by all who knew him and will be missed by all OK hams. Mooreland Hamfest was fantastic. There were many new hams and upgrades at the VE exams, including 8-yr old Lowell Baker, son of Enid Mayor Walter Baker, KB5GSM. Lawton Hamfest sported many bargains at their swapmeet and a good time was had by all attendees. Be sure to preregister now for the West Gulf Division Convention (Oklahoma's Ham Holiday). There will be many

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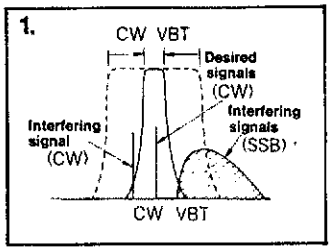

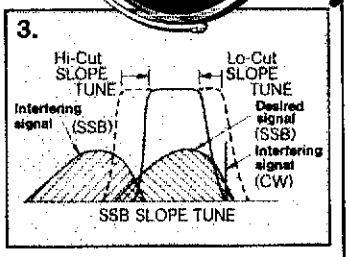

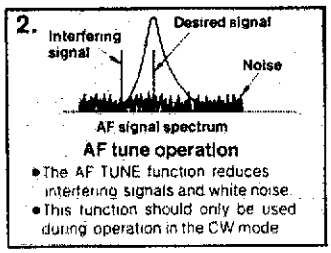

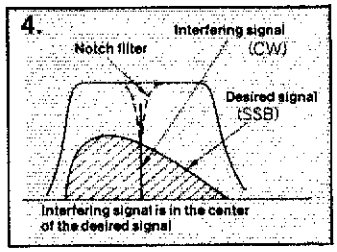

1) CW Variable Bandwidth Tuning. Vary the passband width continuously in the CW, FSK, and AM modes, without affecting the center frequency. This effectively minimizes QRM from nearby SSB and CW signals.

2) AF Tune. Enabled with the push of a button, this CW interference fighter inserts a tunable, three pole active filter between the SSB/CW demodulator and the audio amplifier. During CW QSOs, this control can be used to reduce interfering signals and noise, and peaks audio frequency response for optimum CW performance.

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Optional accessories:
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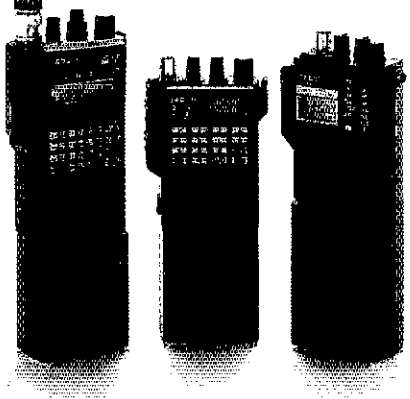

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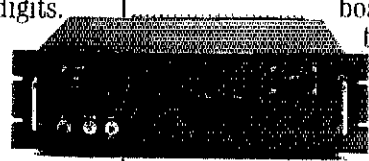
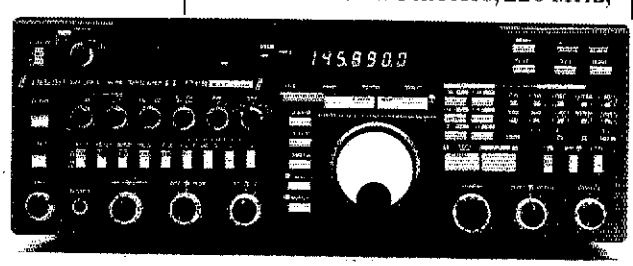
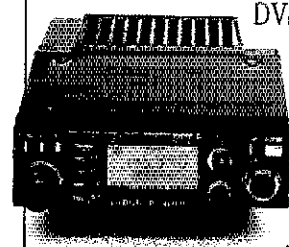
4 **FM Repeaters.** Looking for a repeater? Look no further. Our 2-meter and 440-MHz models feature 10 watts output. Glass-epoxy circuit boards. Plus they're FCC type accepted and ready for 19" rack mounting. Yaesu repeaters are the perfect building block for a complete repeater station.



5 **Space Station.** Work satellites, moonbounce, troposphere, aurora, and meteor scatter with our FT-736R VHF/UHF base station. SSB, CW, and FM on 2 meters and 70 cm (430-450 MHz!) standard. Slots for optional 50-MHz, 220-MHz, or 1.2 GHz modules. Crossband full duplex capability. Satellite frequency tracking function. 25 watts on 2 meters, 220 MHz, and 70 cm (10 watts on 6 meters and 1.2 GHz). 100 memories. RF speech processor. IF shift. IF notch filter. CW and FM wide/narrow IF filters. VOX. Noise blanker. Three-position AGC selection. Much more.

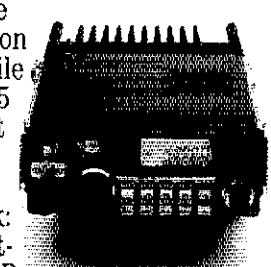


6 **Mobiles that double as answering machines.** Our FT-212R Series mobiles take messages just like an answering machine (with DVS-1 option)!

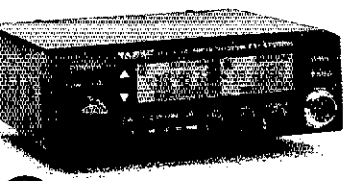


2-meter and 440-MHz models. 45 watts output (35 on 440-MHz). Auto-dialer DTMF mic with 10 memories (22-digit memory each). 18 memories. Multiple scanning routines. "Do-re-mi" audible command verification. High/low power switch. Oversize amber display. Much more.

7 **Mobiles you can take on foot.** Our FT-290R Mark II Series (2-meter, 430-450 MHz, and 6-meter models) come standard as mobiles. But remove the heat sink and snap-on the optional battery pack, and you're ready to take your operation on foot! Mobile operation: 25 watts output (10 watts, 6 meters). Battery pack: 2.5 watts output. With SSB, CW and FM. 10 memories. Dual VFOs. LCD display. Offset tuning. Relative power-output/S meter. More.



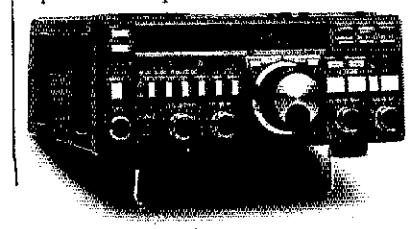
Prices and specifications subject to change without notice. PL is a registered trademark of Motorola, Inc. Specifications guaranteed only within amateur bands.



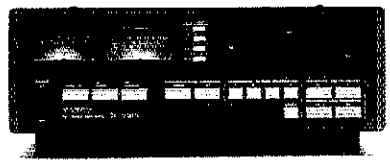
8 **Dual-band mobile with remote control head.** The FT-4700RH mounts almost anywhere—the "brains" on your dash, visor, or door, the "muscle" under your seat. 50 watts output on 2 meters, 40 watts on 70 cm. Full crossband duplex. Simultaneous monitoring of each band. Volume balance control for dual receive operation. 9 memories (each band). Extended receive coverage. Reverse repeater shift. Bright dual-band display. 10 memory autodialer mic (option). More.

9 **HF price/performer.** Don't let the FT-747GX's affordable price fool you. This rig really works the DX! 100 watts RF output on 160 to 10 meters. Continuous receive from 100 kHz to 30 MHz. LSB, USB, CW, and AM. Slot for optional FM unit. 20 memories. Split-frequency operation. CW and AM filters. Plus one-touch noise blanker. All-mode squelch. RIT. 20-dB attenuator. Great receiver with superb overload protection. More.

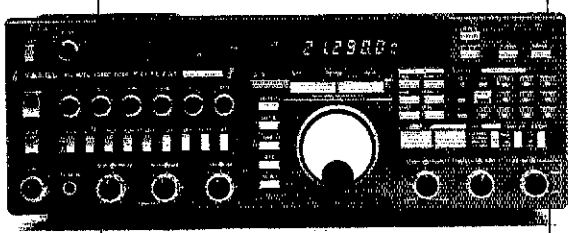
10 **HF field-day favorite.** Contesters appreciate the portability and performance of Yaesu's FT-757GX Mark II. 100-watt output. 10 memories. Dual VFOs. Slow/fast tuning selection. IF notch filter. Iambic keyer. 600-Hz CW filter. AF speech processor. 500 kHz to 30 MHz receive. 10 to 160 meters transmit, including WARC bands. All-mode coverage. QSK operation. Continuous RTTY operation up to 30 minutes. More.



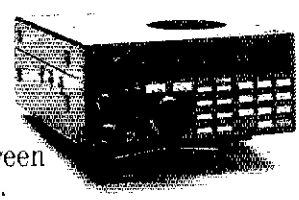
11 **Flex your RF muscle.** Cut through pile-ups with our FL-7000 power amplifier. 160 to 15 meter coverage. Built-in power supply. Automatic tuner. Fast turnaround for break-in (QSK) CW, HF packet, and AMTOR. 70 watts excitation for full output, 1200 watts PEP input. More.



12 **World's first HF/VHF/UHF base station.** Talk about complete. The FT-767GX gives you 160 to 10-meter transmit standard. Optional plug-in modules for 6-meter, 2-meter and 70-cm operation. 100 kHz to 30 MHz receive. AM, FM, SSB, CW, AFSK modes built in. 10 memories for frequency, mode, and CTCSS info. Dual VFOs. VFO tracking. Digital display in 10 Hz steps. Slow/fast main dial tuning. Synthesizer step programming at up to 99.99 kHz per step. Digital RF power/SWR meter. Built-in RF preamplifier. And these are just a few highlights!



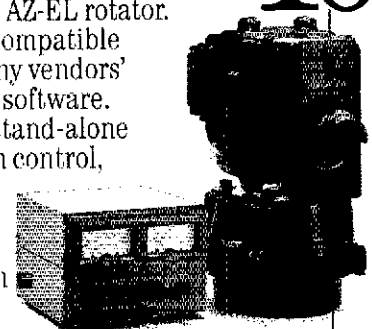
13 **Serious VHF/UHF Receiver.** Our FRG-9600 is a smart way to monitor. 60 to 905 MHz coverage. USB, LSB, CW, AM, FM wide and narrow. Optional NTSC video module. Scanning steps of 5, 10, 12½, 25 and 100 KHz. 99 memories store frequency and mode. Memory scan (also scans between memories). Keyboard frequency entry. 24 hour clock. Multiplexed output. Fluorescent readout. Signal strength graph. AC power adapter. Much, much more.



14 **World-class HF receiver.** The FRG-8800's perfect for keeping up with the world. Continuous coverage from 150 KHz to 30 MHz. Expanded coverage with optional 118-174 MHz VHF converter. USB, LSB, CW wide/narrow, AM wide/narrow, FM. 12 memories. Also programmable scanning routines. Keyboard frequency entry. LCD display. SINPO signal graph. Computer interface capability. Two 24-hour clocks. Recording functions. Much more.

15 **Antenna rotators for your application.** Our G-1000DX, G-800SDX/G-800S, and G-400RC models feature 360° "radio compass" control heads, and are compatible with most tower-plate configurations. Plus G-1000SDX and G-800SDX models feature 450° rotation and presets.

16 **Az-El rotators for space applications.** Into OSCAR or moonbounce? Choose our G-5400B or heavy-duty G-5600B AZ-EL rotator. Each is compatible with many vendors' tracking software. And for stand-alone elevation control, choose our G-500A elevation rotator.



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activities for hams and non-hams alike. There will also be over 10,000 sq ft of swap meet area plus new dealers, an ARRL forum and seminars. This Ham Holiday promises to be the greatest ever! Circle July 28-30 on your calendar now. See you there! 73, Joe. Traffic: K5GBN 159, N5IKN 115, KF5RD 86, WA5OUV 60, WA5OGC 31, W5VLW 26, WA5ZOO 25, W5VOR 12.

SOUTH TEXAS: SM, Arthur R. Ross, W5KR— PIA N5FIX rprts NW ARS, Houston, aided Peeking Regatta Canoe Race; ops were KF5ZL, N5KEU, N5FIX, KB5BCL, AA5IM, KA5AKG, KF5OO, KG5LZ, K5ZC, N5LAJ, KA5VIZ, KE5IC, KD5YA, KB5AEL, plus paramedics KA5QAP, KD5YA; March of Dimes Walk America cmctn svc provided by KE5IC, KB5HEL, W5BKK, KCØLM, KG5LZ, N5NPS, KB5DFX; CONGRATS to N5MJB on DXCC cert; NARS is sponsor of KLEIN FOREST HS STUDENT ARC, KB5ESQ as Ed Comte Chmn. DRN5 NM WB5YDD rprts 445 msgs in 60 April sessions; STX represented 100% by NZ5U, KD5KQ, W5KLV, W5CTZ, WB5HZQ, WA5ZJY, KE5ZV, WV5V, WB5EPA, WB5FQU, N5NAV, WB5YDD. WA5F rprts STX Hams provided cmctn for 3200+ cyclists in 1989 MS-150 Megabike Tour (Houston-Austin); 11 clubs took part; ops were W5KV, W5NKQ, W3NJ, W5RIY, W5UBA, WA5LHS, WA5RDS, WB5FSX, WB4LZG, WB5QPR, WB5RUE, WB5SRN, WN5TEN, K5CNU, K5DNK, KA5BLB, KA5EEQ, WN5A, KA5GZX, KA5WMY, KA5SLG, KB5AEJ, KB5ART, N5KT, ND5F, KB5BAY, KB5DNT, KB5EYK, KB5EXM, KB5ICO, WJ5B, WA5G, KF5ZL, KG5CB, KB5GK, KG5HU, N5APW, N5ECP, N5GZW, N5IJL, N5JKD, N5LXE, N5MBN, N5MFD, N5MWD, AA5BD, WA5F, N5LGS, AA5GA, WT5D, WT5U. OBS W5KLV rprts 4 prpgtn fcsts, 4 bltns given 313 rdgs on 7 nets. Brazosport ARC rprts STM WD5GKH, KA5SYW, KA5OJZ, NV5L comprise County Emgcy Team; urgently desire more ARES members. Bexar Wire, San Antonio ARC, spcl-event stn "outside the Alamo" a great success; KB5SQO given much credit; Bexar Wire also prints names and phone numbers of newly licensed Novices. BARN, Beaumont ARC, rprts N5NKB upgraded to Extra! San Benito ARC Pres WA2VJL made local headlines with offer to pass H&W tfc to Mexico following April quake; his son, KA5UVY, is salutatorian for San Benito HS class of 89, 389 srs; nice work. 7290 Tfc Net Secy NF5T rprts 3140 QNI, 413 msgs in 45 April sessions; NTS liaison 2 per session. PIA NZ5J, Seguin, rprts K5TK, K5KEI, WR5X, W5MTO, W5FFG, KB5FUH, WA5UFL, NZ5J provided cmctn for Seguin's 20-K Walk America; N5OEO is new Ham in Kingsbury; 16-yr old Canadian citizen PASSED USA Novice test; USNWS conducting SKYWARN classes in the area. PIA KG5HQ rprts Houston ECHO Society providee cmctns for Heart & Sole Fun Run which raised $145,000 for charity; ops were KB5ASU, W5ATP, NV5B, WB5BBW, KE5CP, N5EJX, N5GQS, WA5GZX, NY5H, KG5HQ, KB5IAN, KB5IQO, N5JEN, VE3JST, N5JXS, KG5KV, N5LFB, WA5LNG, KG5LP, W5MFO, N5NMK, N5MWD, N5NBM, KE5KQ, WA5QXE, W5RIY, WB5VYR, KF5WS, KA5YSL, WQ5Y, KD5YA, AC5Z. PIA KA5PFV, New Caney, rprts or gnzn of Coordinated Amateur Radio Emgcy Support (CARES); members are from Montgomery, Walker, San Jacinto, Liberty and Harris Counties; CARES meets Mondays, 8:00 pm local, 147.18/.78 rptr; WD5CFJ went to Extra from Tech - CONGRATS! Univ of TX ARC, Austin, working South Pacific with new 6-mtr beam! PIA KB5AWM rprts Clear Lake ARC and Clear Lake Emgcy Amateur Rdo Svcs (CLEARS) provided cmctn for Clear Lake City March of Dimes Walkathon and Bay Area Arts Council 1989 Fun Run; ops were K5BY, N5GIN, WD5EEV, WD5EEU, KB5AWM, KB5HSG, WA5LOO, KC5WW, KG5DW, KB5GNA, WD8KUJ, NY5H, KG5HQ, N2AVL, KF5WS, KG5U, KC5RG, W5SX, KB5HSG, KB5GNA, KB5AQV, KB5HFK. Traffic: WB5J 278, WB5YDD 252, W5CTZ 182, WD5GKH 139, N5NAV 84, NV5L 56, NZ5J 40, AC5Z 29, W5KR 27, W5BGE 21, W5KLV 16, N5KAO 15. (Mar.) W5AC 54.

WEST TEXAS: SM, A. Milly Wise, W5OVH—ASM: Glenn Bourdreaux reports from Amarillo that amateurs in the Panhandle provided comm for the March of Dimes in Amarillo with operators WB5QLI, WZ5C, KB5AZA, KB5HBK, KB5HBL and KA5PTG participating. The National Weather Service was very impressed with the amateurs helping the two times the SKYWARN operation was called out during April. The Steamboat Mountain ARC will be holding Field Day on Steamboat Mountain. Report came from ASM Raford Dunagan, WD5EFJ. Big Spring ARC Fielded Eleven Operators to provide comm. and other assist. to Christmas in April (Renovate homes of the Elderly and less fortunate of the community.) Hams provided comm. to more than 20 work sites. Field Day for Panhandle ARC will be Buffalo Lake National Wildlife Refuge. Attention NTX: A very active ATC KE5VH, Heese, is leaving West TX section and moving to Stevenville, TX. Glad to report that the El Paso ARC has been officially renewed as a Special-service Club. San Angelo's bulletin, the Kilo-What, reports that 12 local amateurs demonstrated to 700 boy scouts at the Concho Valley Jamboree the benefits of ham radio. The following hams upgraded to Tech: KB5INP, KB5IKB, KB5IKC and Glen Hawkes. 37 hams were certified as weather spotters at the Red Cross in Amarillo. eight of those participating were from communities of Fritch, Borger, Pampa, Silverton, and Dimmitt in the Texas Panhandle. New calls in the El Paso area, KB5ITR, Daniel, KB5IXQ, Andy, KB5IYP, Hector, KB5IWG, Darrell, KB5IZT, Simeon, KB5IXV, Parke, KB5IOQ, Ben, KB5IPH, Davis, KB5ING, Antonio, N5OGJ, Bill, N5OGK, Marilyn. Gerry Hedrick, N5EIN of El Paso, has received DXCC cert 399 for DXCC operation on 10 meters. Congrats Jerry. 73, Milly, W5OVH, SM. Traffic: AE5I 166 (Mar), AE5I 186 (Apr), W5ERT 35 (Mar), W5ERT 21 (Apr), KE5VH 5, K5KKO 5.

Top performance for less than 80 cents a watt

DX-ing, contests, pile-ups, traffic handling. When you need to command attention, you will with the SB-1000 Linear Amplifier from Heath. And you'll do it for a cost that no one else can match.

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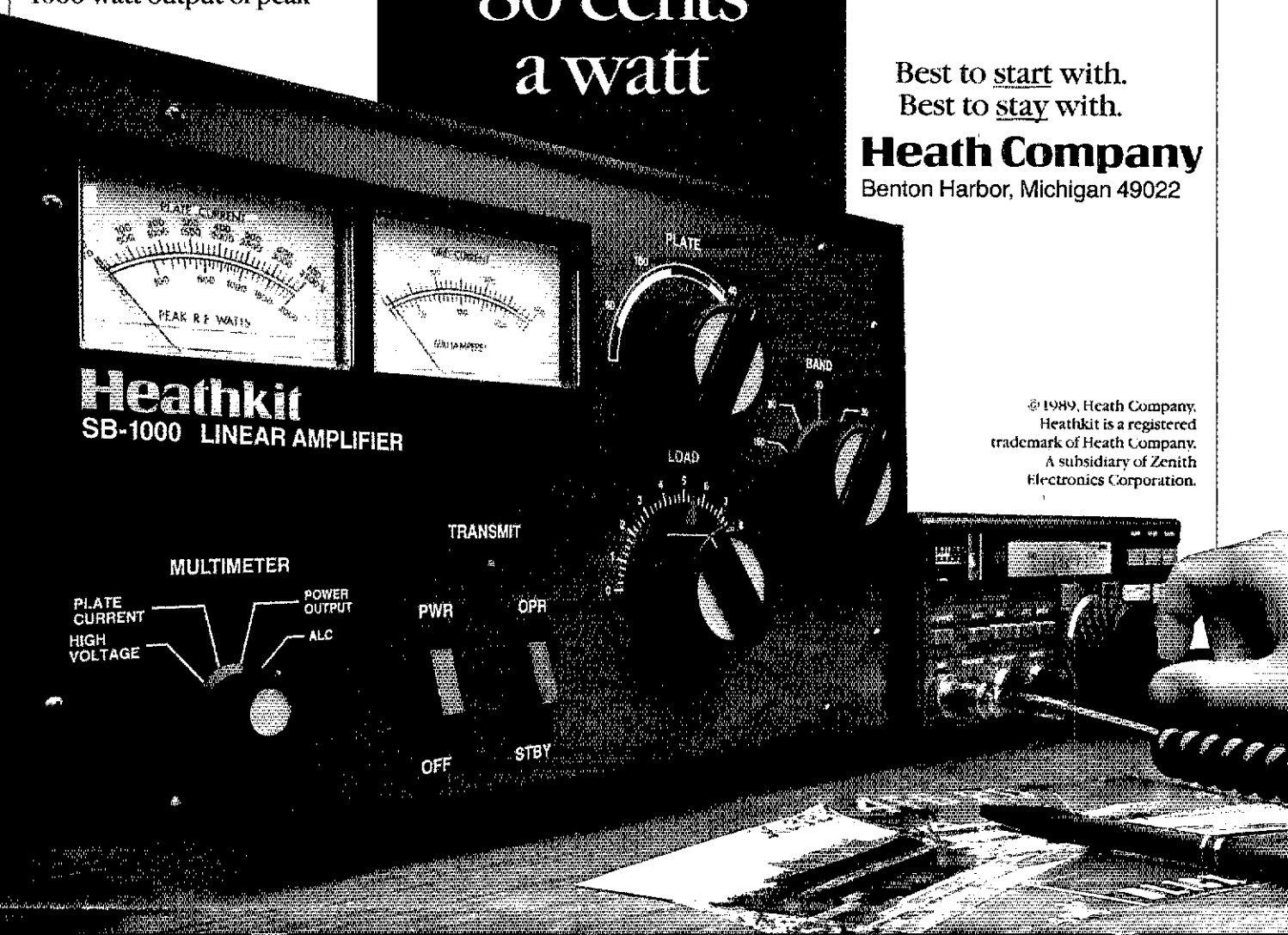

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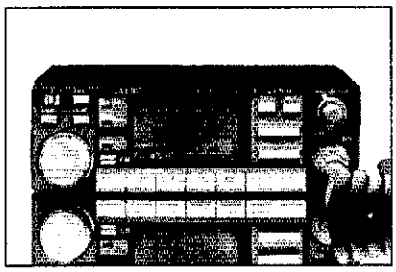
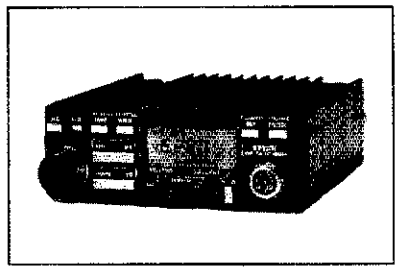
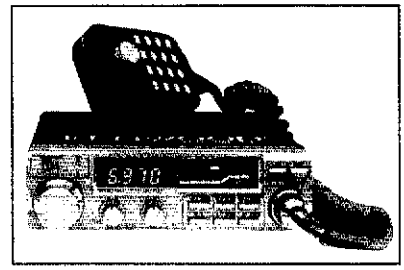
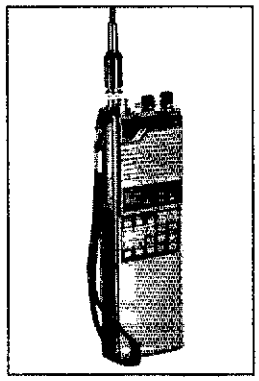
$100.00 REWARD

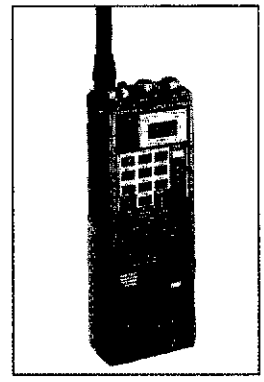






$50.00 REWARD





For a limited time Alinco Electronics will give a $100.00 "Reward" for your working, 2 meter or 70 centimeter Mobile Transceiver, or $50.00 for your working 2 meter or 70 centimeter Hand-Held Transceiver.

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2) The Trade-In unit must be in good working order and salable.

Remember, the company that already gives you the best value for your dollar, and a two year factory warranty, now gives you something else that no other company does -- A substantial Trade-In "Reward" for using our products!

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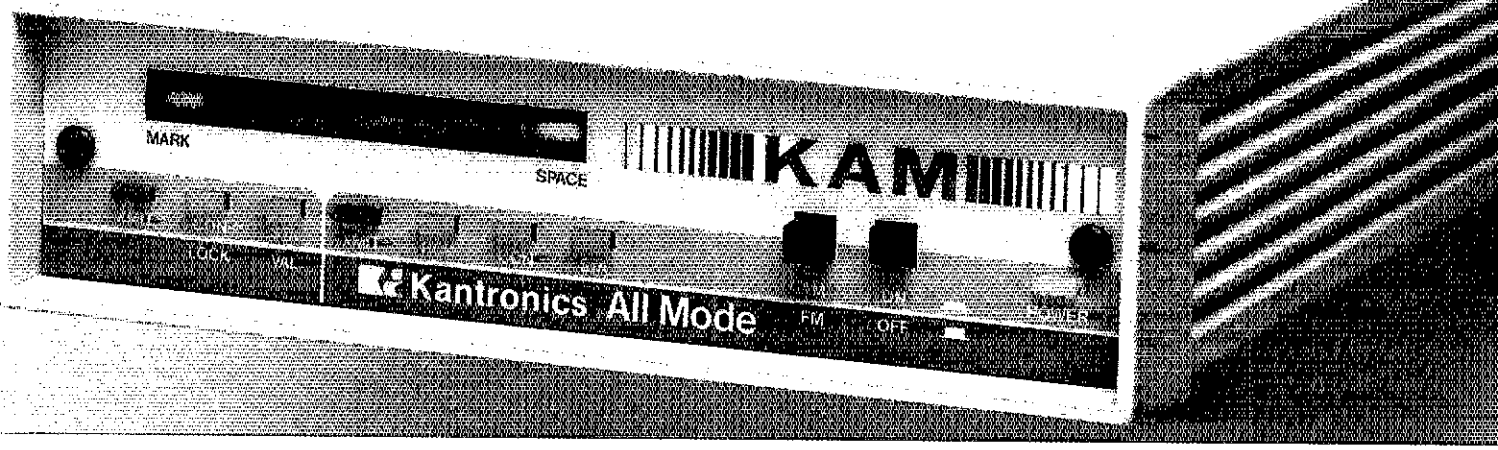

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In 26 countries around the world, tens of thousands of amateurs know that Kantronics is the leader in bringing tomorrow's technology to their stations today. They also know they will always be among the first to incorporate just-introduced features and modes with Kantronics software and firmware updates.

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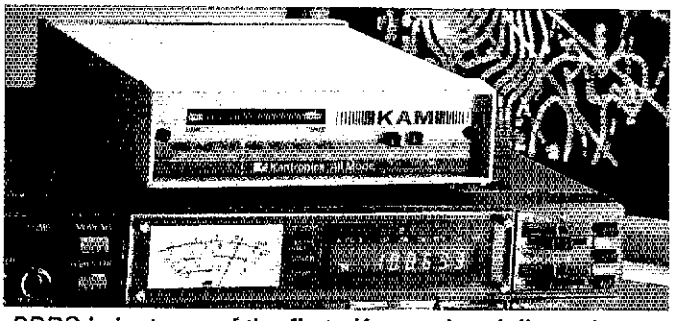

PBBS is just one of the firsts Kantronics delivered.

you will know you have mail in your **Personal Packet Mailbox**™ when your KAM "STA" LED is blinking. New firmware level 2.85 has also added a handy automatic mailbox user-connect. So save your computer and monitor life by turning them off when you are away, and never miss a beat on the airwaves.

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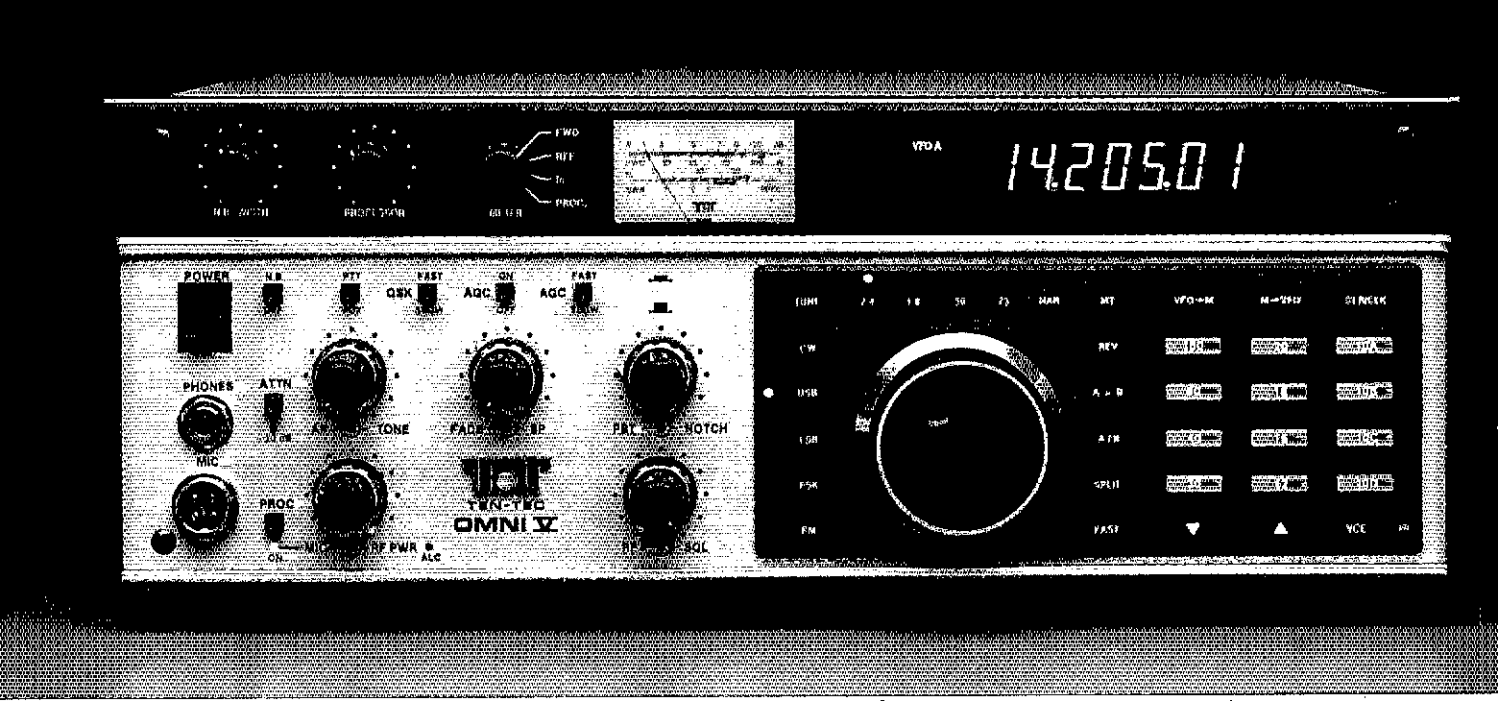


The NEW OMNI V:

The OMNI V is a Paragon with a 12 band crystal mixed local oscillator in place of the general coverage synthesized oscillator. The result is receiver cleanliness like the legendary Corsair and Omni series. The OMNI V local oscillator is a new ultra low noise 5.0 to 5.5 MHz PLL design. Phase noise is simply eliminated as a significant variable. Dynamic range is maintained right up to the edges of the crystal filters, even under the most adverse conditions.

Many of the nifty features made possible by digital technology are included. Dual VFO's with A-B-split select, the frequency stability of a PLL, 25 tuneable memories, VFO to MEM, MEM to VFO and the SCRATCHPAD feature. RS-232 interface is standard and includes remote band switching for the HERCULES II amplifier. The memories are nonvolatile RAM and are retained until you change them. The status registers and clock are backed with a lithium battery (2 year life) so that when the rig is powered up, the status is the same as when you turned it off.

The OMNI V operates USB, LSB, fast or slow QSK CW and real FSK. FM is optional. All bands from 160 through 10 meters are push button selectable. Each band position covers 500 kHz plus 30 kHz over-shoot at the band edges. The four 500 kHz segments of the 10 meter band are switched automatically as you tune through the segment limits. Tuning is in your choice of 10 Hz or 50 Hz increments on SSB, CW and FSK. With the FM option, tuning is in 100 Hz or 500 Hz increments. Up/Down buttons tune in 10 kHz or 50 kHz increments.

An auxiliary frequency tuning system is available and plugs into the rear panel. This allows you to remotely tune the frequency from the most convenient and comfortable position. It takes about 10 ms to fall in love with this option.

A noise blanker and audio speech processor are standard equipment as is the cw sidetone and speech monitor. The rear panel has a full complement of inputs, outputs and controls for the convenience of the all-mode operator, including an auxiliary RX antenna input. High speed key lines are provided for QSK control of a fast switching amplifier, such as the TITAN or HERCULES II. Changeover in fast QSK is less than 30 ms, great for CW and the digital modes.

The front panel is spacious and friendly. The vacuum fluorescent display uses large, bright, easy to read elements. The frequency display doubles as the 24 hour clock display when the CLOCK button is pressed. Other elements indicate VFO status and warn when the memories are full.

All four of the 6.3 MHz I-F crystal filter positions are push-button selectable, independent of mode. A second filter socket is also provided, in series, behind the standard 2.4 kHz filter in the 9 MHz I-F. This may be used for an optional 2.4 kHz, 1.8 kHz, 500 Hz or 250 Hz filter which is selected with the "NARROW" button. This adds six or eight poles into the crystal filter network and even further reduces the impact of adjacent strong signals. Most impressive!

If you do not need a general coverage receiver in your HF rig, the elegant OMNI V is a great choice. If you are also a serious DX-er and/or contester, the OMNI V is the best choice.

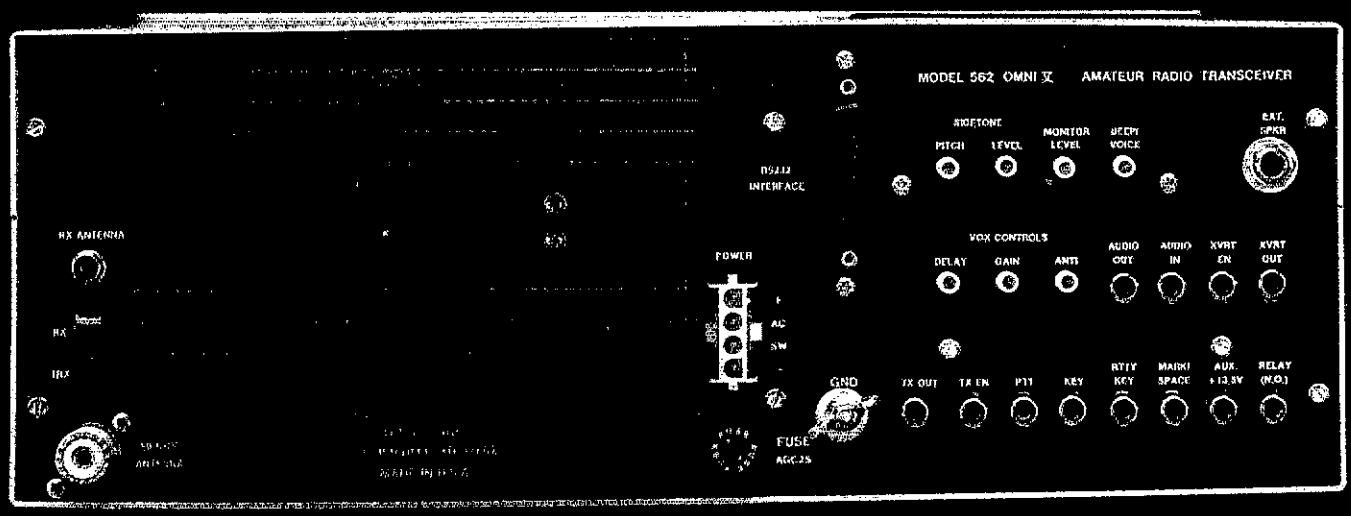
The OMNI V Station with Model 961 Matching Power Supply, and the Mighty Titan Amplifier.

GENERAL SPECIFICATIONS

Frequency Range: Transmit and receive on all ham bands from 160 through 10 meters in their entirety. Twelve 500 kHz segments plus 30 kHz over-shoot at the upper and lower edges of the segments.
Frequency Control: LO generated from a crystal oscillator mixed with a low noise 5.0 - 5.5 MHz phase locked loop.
Frequency Stability: Worst case, 1 PPM per degree C at 29.999 MHz.
Frequency Accuracy: +-100 Hz @ 25 degrees C.
Antenna Impedance: 50 Ohms, unbalanced.
Printed Circuit Boards: G-10 epoxy glass.
Power Required: Receive = 1.5 A. Transmit = 20 A. 12-14 Vdc.
Dimensions: HWD 5¾" x 14¾" x 17". 14.6 x 27.3 x 43.2 cm.
Net Weight: 16 lbs. 7.25 kg.

TRANSMITTER

Modes: USB and LSB (J3E), CW (A1A), FSK (F1A). Optional FM (F3E).
DC Power Input: 200 watts maximum.
RF Power Output: ALC stabilized, adjustable from 20 watts to 100 watts (50 Ohm load) with front panel RF OUT control.
Microphone Impedance: 200 Ohms to 50k Ohms. Bias voltage for electret mic is provided in front panel connector.
CW Sidetone: Internally generated with rear panel level and tone adjustments, independent of front panel audio level control.
SSB Generation: 9 MHz, 8 pole crystal ladder filter, balanced modulator.
Carrier Suppression: Greater than 60 dB.



Impressive from either end... but it's how we make ends meet that really delivers the difference.

Unwanted Sideband Suppression: Greater than 60 dB at 1.5 kHz AF input.
Harmonic Emissions: Greater than 45 dB below peak power output.
Third Order Intermod Products: -30 dB from two tone at 100 watts PEP.
Metering: Switchable forward power, SWR, collector current or audio processing level on SSB.
CW Offset: 600 Hz.
FSK Shift: 170 Hz.

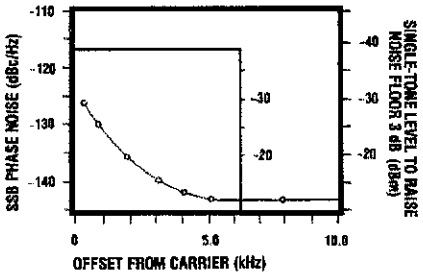
RECEIVER
Modes: LSB, USB, CW and FSK. FM with optional board.
Sensitivity: .15 uV for 10 dB signal to noise ratio at 1.8 kHz bandwidth. With FM option, .3 uV for 12 dB SINAD at 15 kHz bandwidth.
Selectivity:

	-6 dB BW	-60 dB	Shape Factor
Standard 2.4 kHz	2.4 kHz	3.36 kHz	1.87:1
Opt. 1.8 kHz	1.8 kHz	2.90 kHz	1.60:1
Opt. 500 Hz	500 Hz	1.40 kHz	2.80:1
Opt. 250 Hz	250 Hz	.85 kHz	3.40:1
Opt. FM	15 kHz	30.00 kHz	2.00:1

Attenuator: -20 dB.
I-F Frequencies: 1st I-F 9 MHz, passband tuning I-F 6.3 MHz.
Image Rejection: ►100 dB.
I-F Rejection: ►60 dB average.
Noise Blanker: Switchable on/off with width adjustment.
Dynamic Range: 97 dB, measured with standard 2.4 kHz filter at 20 kHz spacing. 100 dB + with cw filters.
Third Order Intercept: + 10 dBm.
Noise Floor: -133 dBm @ 2.4 kHz bandwidth.
Squelch Sensitivity: Less than .6 uV.
Receiver Recovery Time: Less than 30 ms.
Pass Band Tuning I-F Shift: + -2.3 kHz.
Audio Output: Speaker, 1.5 watts @ 8 Ohms. Fixed level 1 mw @ 600 Ohms.
Notch Filter: 250 Hz to 2.2 kHz, greater than 50 dB notch depth.

Audio Bandpass Filter: 4 pole, variable center frequency 220 Hz to 1.7 kHz, 35% band width @ -6 dB.
Tone Control: Variable 15 dB roll-off @ 5 kHz.

PHASE NOISE PERFORMANCE OF THE OMNI V
-127 dBc/Hz @ 250 Hz offset from carrier.
-146 dBc/Hz @ 5 kHz offset from carrier.



Here is a graph of the phase noise performance of the OMNI V receiver. These measurements can only be made under laboratory conditions and, even then, our test equipment is at the limit of its ability to measure the noise at the narrow offsets. The significant measurements are those close-in. Note that this graph does not even go out to 25 kHz offset where many of the published measurements are made. Certainly, we invite comparison.

A WORD ABOUT COST
The OMNI V and the Paragon are the same price. Our 12 band crystal mixed oscillator is the same cost to manufacture as our general coverage synthesized oscillator. The choice between these two transceivers is based on general coverage vs. the best possible receiver performance in the ham bands.

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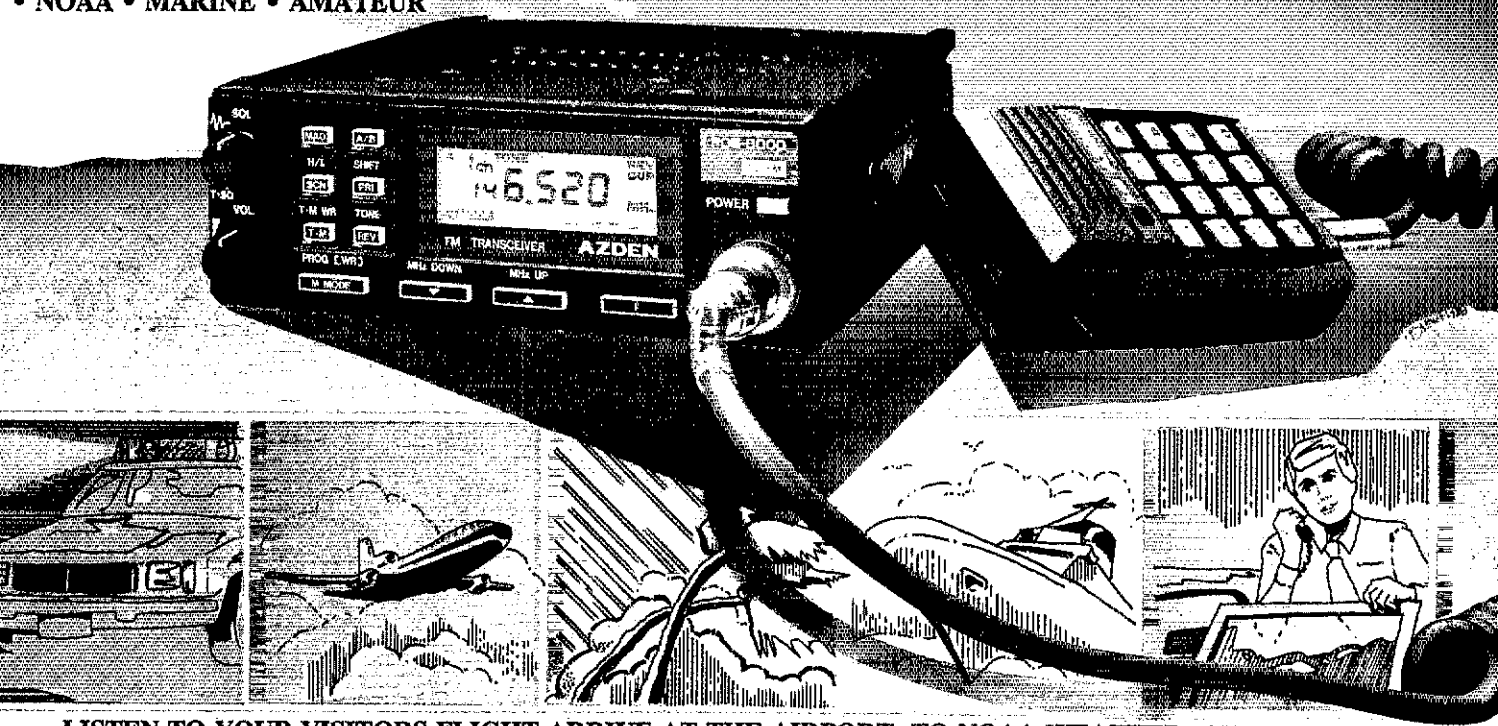

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MODELS: PCS-6000/PCS-6000H (25W/45W). *Also coming soon PCS-6200 220MHZ, PCS-6300 70CM and PC-10 10 Meter FM Handheld.* **CMOS AND ADVANCED SURFACE MOUNT TECHNOLOGY PROVIDE UNPRECEDENTED COMMERCIAL QUALITY AND RELIABILITY.**

UNPRECEDENTED WIDE REQUENCY COVERAGE: The PCS-6000 receives 118.00 to 135.995 MHZ AM Aircraft/136-173.995 MHZ FM and transmits 140.100 to 150.000 MHZ. Modifiable to ALL MARS and CAP frequencies (proof of authorization/license required)

TINY SIZE: Only 2 inches high, 5½ inches wide and 7¼ inches deep!! Easily fits anywhere, even in the smallest car!

20 CHANNEL MEMORY IN TWO BANKS PLUS 1 TEMPORARY CHANNEL (TM): Two memory banks, A and B have 10 memory channels each. The memories store frequency, shift width, offset information, and PL tone frequency as programmed. *An extra memory channel (that we call TM-temporary memory) is provided to allow you to store any operating condition instantly again and again!!*

UP TO 21 NONSTANDARD SPLITS: Program any split in any channel.

VERSATILE SCANNING FUNCTIONS: Dual memory scan, programmable band scanning, hold scan and delay scan functions are provided, with selectable delay time. ALL memory channels are tunable independently.

PRIORITY CHANNEL MONITORING: Memory Channel B0(the first channel in memory bank B) is monitored every four seconds regardless of any operating condition. When a signal is received, a beep is heard.

DISCRIMINATOR CENTERING (AZDEN EXCLUSIVE PATENT): Always stops on frequency desired when scanning.

PROGRAMMABLE FREQUENCY STEPS: In memory, frequency steps can be set at 5KHZ to 20KHZ in any increment.

BUILT-IN PROGRAMMABLE TONE ENCODER: 57 different tones are built in for instant programming of PL tones into memory channels and microcomputer. Tone frequency can be entered independently in RX and TX. A tone decoder is available as an option.

LITHIUM BATTERY BACKUP: Memory information can be stored for up to 5 years even if power is removed.

FREQUENCY REVERSE: Allows you to listen to repeater input frequency.

FEATHER-TOUCH TUNING CONTROL KEYBOARD: The LED backlighted light touch keyboard performs all tuning operations simply by pushing the key(s) and key actuation is audibly verified.

LARGE LCD (LIQUID CRYSTAL DISPLAY): The LCD display shows the operating frequency, S/RF, memory channel in use and various other operating functions. The LCD is back-lighted by green LEDs, making it possible for you to read the display even in total darkness.

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DIGITAL S/RF METER: Shows incoming signal strength and relative transmitter power.

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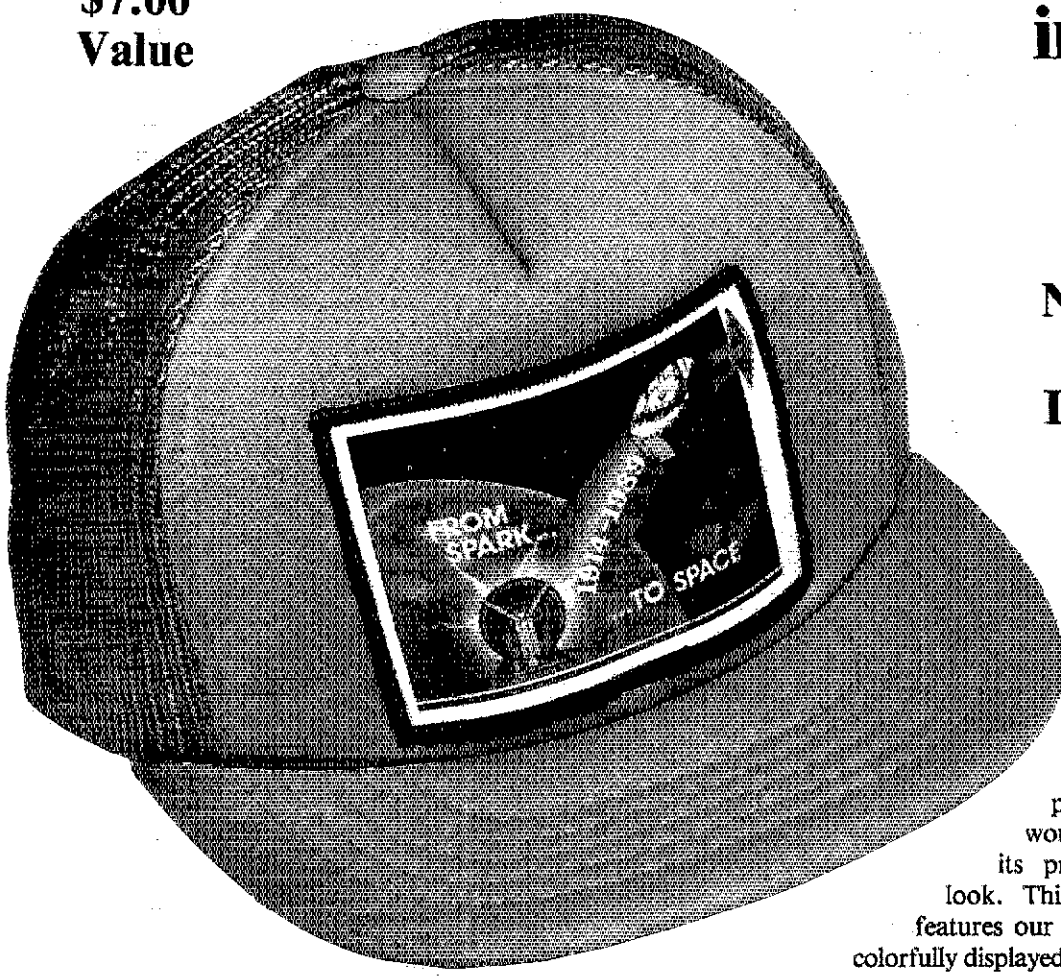

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*In order to receive your free gift, the new member you introduce to ARRL must apply for Regular or Senior membership. This offer does not apply to Family, Youth, Life, or Blind membership submissions. "New Member" is defined as an individual who has never been an ARRL member or has not held membership one calendar year prior to the application submission. Rates: Regular Membership 1 year $25, 2 years $47, 3 years $65. Senior Membership (65 or older with proof of age) 1 year $20, 2 years $37, 3 years $50.

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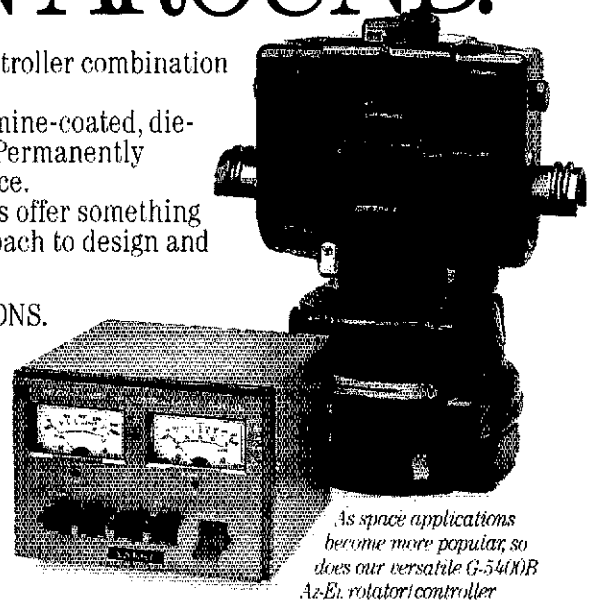

As space applications become more popular, so does our versatile G-5400B Az-El rotator/controller

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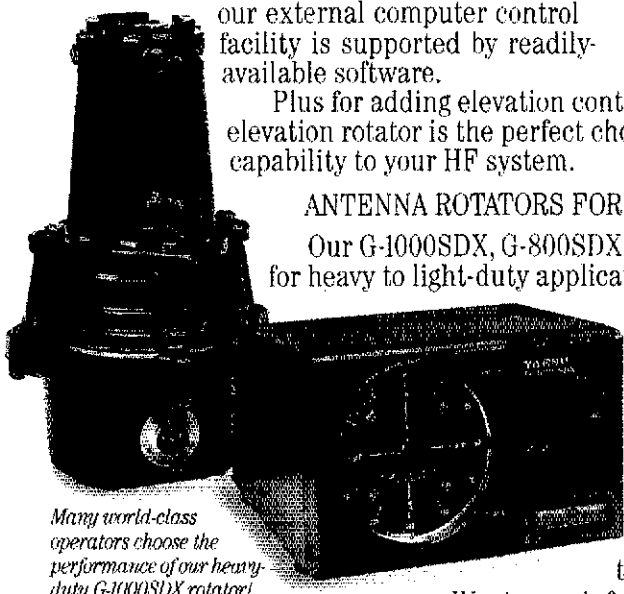

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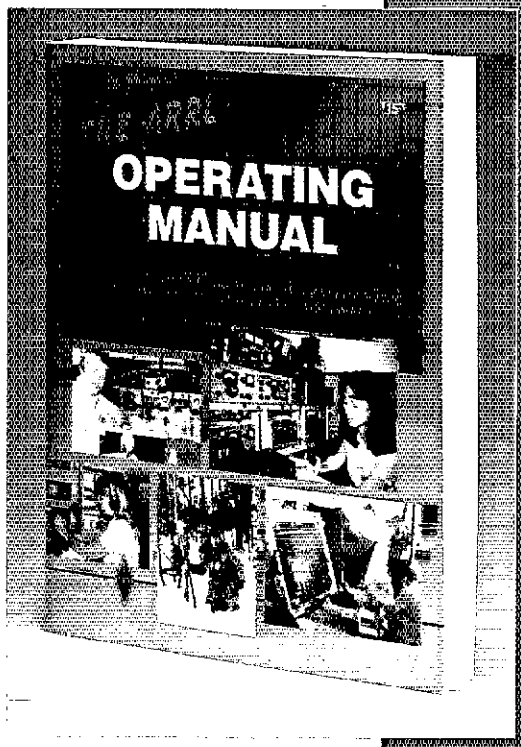
OPERATING EXCELLENCE

No one has ever called Amateur Radio boring. There's so much to do in this multi-faceted hobby and it is all described in the big 688-page *ARRL Operating Manual*! The book proved so popular that we had to go back on press for a second printing in less than a year.

Why is this League publication a smash hit? We gathered together the efforts of talented writers who are experts in each of their Amateur Radio specialties: Basic Operating by Bill Jennings, K1WJ and Carol Smith, AJ2I; FM and Repeaters plus the chapter on Packet Radio by *QST* columnist Stan Horzepa, WA1LOU; DXing by Bob Locher, W9KNI, Overseas DXing/DXpeditions by Carl Henson, WB4ZNH; Traffic Handling by Maria Evans, KT5Y; Emergency Communications by Richard Regent, K9GDF; Image Communications by Bruce Brown, WA9GVK; VHF/UHF Operating by Michael Owen, W9IP; Satellites by Dick Jansson, WD4FAB and Contests by Clarke Greene, K1JX.



The chapters on Shortwave Listening, The Amateur Radio Spectrum, Antenna Orientation, and RTTY Communications were written by HQ staffers: AK7M, W4RI, K1TD and WA3VIL. Bob Halprin, K1XA was the editor of the *Operating Manual* and was responsible for the popular Operating Awards chapter where more than seven dozen awards are described and illustrated in full color.

If you really want to be "in" on what is happening in Amateur Radio operating today, you need a copy of the third edition of the *ARRL Operating Manual*. Available at your dealer or directly from ARRL for $15. For postage and handling add $2.50 ($3.50 for insured mail or UPS—please specify.)

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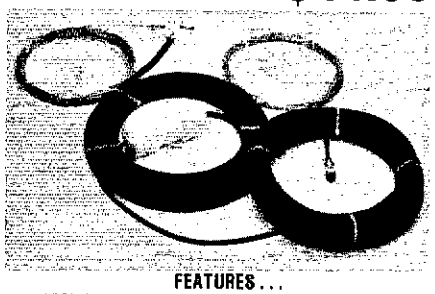

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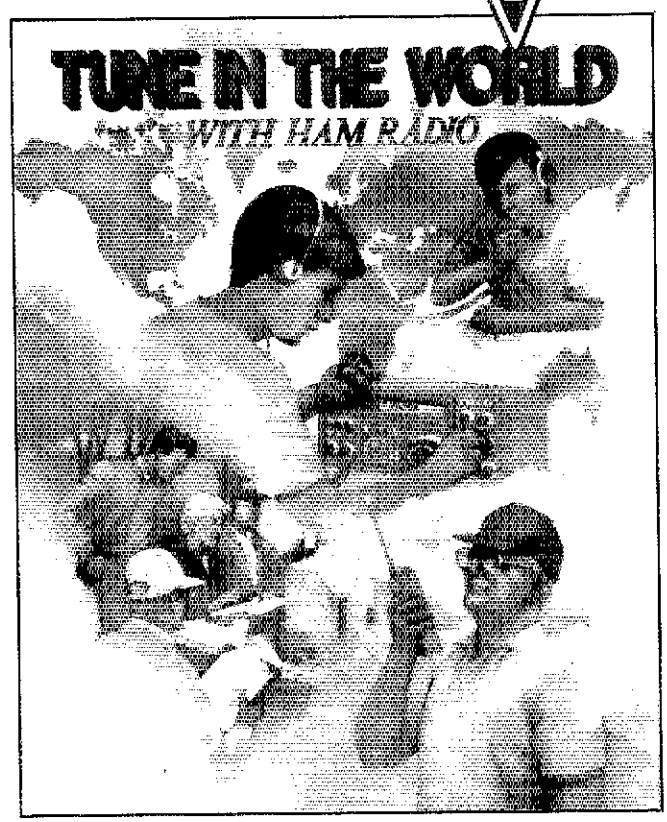

New exams mean a new edition of **Tune in the World with Ham Radio**! Using ARRL's beginner's package, students will quickly pass their exam in no time and be on the air to enjoy the great band conditions we are experiencing today. Novices can now communicate not only using Morse code, but voice communications on 10-meters and VHF/UHF repeaters as well. They can also use digital communications to link home computers through packet radio networks. Imagine being able to personally communicate with an astronaut as the Space Shuttle circles the Earth or with someone on a remote island in the South Pacific!

Besides the bright new cover, we're also excited by the new text which we've made even more understandable and fun for the newcomer. There are hundreds of illustrations that describe important concepts. As with the last edition, two 90-minute cassettes are included. One teaches the code and the other provides practice to make passing the code portion of the exam a snap! Since the tapes are recorded in stereo, the voice portion can be switched off for self-testing and even more practice.

The 30-question part of the exam on regulations and basic radio theory is chosen from categories of topics that are contained in the total pool of 372 possible questions. The text presents all of these questions and distractors along with the answer key and a sample Novice test.

The **Tune in the World with Ham Radio** package including the text and both tapes is available for $19. The book alone is $14. Add $3.50 for shipping and handling.

New 8th Edition

The new edition covers questions that will be used on exams effective November 1, 1989. The new package should be ready for shipping in mid-August.

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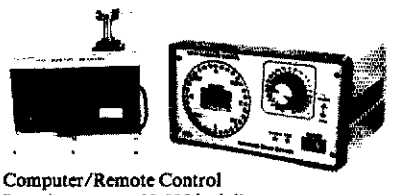

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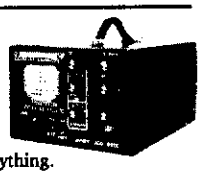

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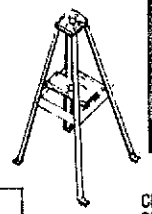
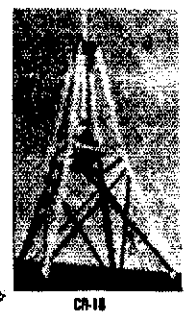
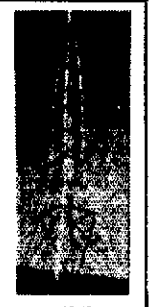




CR-18

CR-30



CR-45

ALINCO ROOF TOWERS

Model No Specifications	ETS-210
Spacing Between Legs At Roof	2'10"
Actual Height	6'6"
Max. Vertical Load	350 Lbs.
Max. Rotational Torque	135 Foot Lb.
Max. Mast Length-from Rotor Plate	5'6"
Roof Mounting Pads	Adjustable For Roof Pitch
Weight	28 Lbs.

roof towers require guy wires for safety.

$140.00

CREATE ROOF TOWERS CONSTRUCTED OF HIGH GRADE ALUMINUM WITH GALVANIZED STEEL BRACING FOR ADDED STABILITY AND STRENGTH WILL EASILY ACCOMMODATE YOUR ANTENNA REQUIREMENTS. THREE SIZES OF ROOF TOWERS WILL SUPPORT VHF ANTENNAS, HF TRI-BANDERS, AND OSCAR SYSTEMS. ROTATORS EASILY MOUNT INSIDE THE TOWER. AN OPTIONAL THRUST BEARING (CK46) IS RECOMMENDED. SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE OR OBLIGATION.

*SUBJECT TO AVAILABILITY

MODEL	HEIGHT	MAXIMUM ANTENNA WIND LOAD IN FT 2	BASE WIDTH	MAX. VERT. LOAD LBS.	TOWER WEIGHT LBS.	PRICE
CR-18	5'10"	21 @ 90 MPH	31-1/3"	440	28	$135.00
CR-30	9'10"	27 @ 90 MPH	39"	1,322	39	224.00
CR-45	14'9"	23 @ 90 MPH	39"	881	55	328.00
CK46	Thrust Bearing For CR-18, CR-30, and CR-45 Maximum Acceptable Mast Diameter 2½"					52.00

*BUYING IS REQUIRED ON ALL ROOF TOWERS. UPS SHIPPABLE

ROHN

20G	10' sect.	56.95
20AG	top sect. 9'	69.95
25G	10' sect.	69.95
25AG2	top sect. 9'	83.95
45G	10' sect.	166.95
45AG2	top sect. 9'	173.95
AS25G	access shelf	28.95
AS45G	access shelf	64.95
TB-3	thrust bearing	66.95
M200	10' mast	19.95
SB25G	short base	33.95
SB45G	short base	71.95
EF2545G	gin pole AND MORE!	395.95

HUSTLER

6BTV	6 band trap vert.	147.95
5BTV	5 band trap vert.	125.95
4BTV	4 band trap vert.	95.95
G7-144	Fix stat. 2mt collinear	125.95
MO-1/MO-2	mobile masts	22.95
RM10/RM15	10m-15m resonator	12.95
RM10S/RM15S	super resonator	17.95
RM20/RM20S	std. & super resonator	16.95/22.95
RM30	30mt. std. resonator	17.95
RM40/RM40S	std. and super	18.95/26.95
RM75/RM80	75 or 80 std.	19.95
RM75S/RM80S	75 or 80 super	37.95
BM-1	bumper mt.	16.95
SSM-2	stainless ball mt.	18.95
SSM-3	spring	16.95
OD2	quick disconnect	15.95
FX2	2mt. 5/8 mag. mt.	24.95
HOT	trunk mt. w/swivel ball AND MORE!	17.95

VAN GORDEN

PD6010	80-10 dipole kit	35.95
PD6040	80-40 dipole kit	33.95
PD4010	40-10 dipole kit	31.95
SD80	80 shortened dipole	29.95
SD40	40 shortened dipole	26.95
ALL BANDER	180-10mt.	28.95
GR5V	AND MORE!	49.95

KLM

KT34A	triband 4 el.	CALL FOR PRICES
KT34XA	triband 5 el.	
2M-14C	2mt. satellite	
2M-22C	2mt. satellite	
435-18C	70cm satellite	
435-40CX	70cm satellite	
432-30LBX	70cm satellite	
2M-13LBA	2 meter	
2M-16LBX	2 meter	

CABLE & CONNECTORS

		per/ft.
Belden 9913	Low Loss	63 cts.
RG213,50 Ω (OHM)		37 cts.
RG8/U	Foam	37 cts.
RG 8X	Mini	22 cts
RG59/U	72 OHM	14 cts
PL259/Silver		99/1.49
N-Male for 8/U		4.50
BNC(M)UHF(F)		5.55
Low Loss eqv. 9913		49 cts.

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CUSHCRAFT ARX2 — CALL!
ALLIANCE HD73 — CALL!

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UGM	1/4 λ mag.	21.95
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Coaxseal		2.95
M5	5' mast	5.95
TRT60	5' tripod	21.95
AR300XL	TV rotor	59.95
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508XUU	50' cable	15.95
758XUU	75' cable	20.95
1008XUU	100' cable	25.95
SW1X2	coax switch AND MORE!	19.95

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PHF10	10m resonator	18.95
PHF15	15m resonator	18.95
PHF20	20m resonator	18.95
PHF40	40m resonator	18.95
PHF75	75m resonator	19.95
PHF160	160m resonator	84.95
AB5	5 band kit	89.95
PAQM	mini mag 2m	21.95

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440 MHz	83.95

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2½"

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CR2A	2M Mag MT	41.00
CR3A	220MHz Mag MT	37.00
CR4A	140MHz Mag MT	34.00
CR2RD	Radome Cover — CALL	-12.00

CABLE IS NOT INCLUDED

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A4S	4 el. triband	357.95
A3	3 el. triband	CALL
AV5	5 band trap vert.	129.95
32-19	19 el. 2mt. boomer	129.95
215WB	15 el. wide band 2 mt.	92.95
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A144-10T	10 el. OSCAR 145.9 MHZ	61.95
AOP-1	OSCAR pack 2mt. & 70cm	178.95
AR-2	2mt. vert. ringo	28.95
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ARX-2B	2mt. vert. ringo ranger II AND MORE!	42.95
R5	5 band vert. AND MORE!	245.95

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HF6VX	80-10 vertical	138.00
HF2V	80-40 vertical	131.00
2MCV5	2MT vertical	60.00
RMKII	roof mtg. kit	52.00
TBR160S	160m add on	53.00
MPS	mtg. post sleeve	7.00
HF5B	HF mini beam	220.00

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TH7DXS	7 el. triband		
TH5MK2S	5 el. triband	C	
EX-14	4 el. triband	A	P
TH3JRS	3 el. 750W pep	L	R
18AVTS	5 band trap vert.	L	I
14AVQS	4 band trap vert.		C
V2S	2mt. omni-direct	F	E
V4	70cm omni-direct	O	S
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AND MORE!

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THE ARRL ANTENNA BOOK Written by members of the ARRL Technical Department staff and sixteen well-known outside authors, all of whom have done much to contribute to the state-of-the-art in antenna and transmission line theory and practice. The recently published 15th Edition presents the best and most highly regarded information on antenna fundamentals, propagation, transmission lines, Yagis and quads, as well as all of the popular wire antenna designs. You'll find antennas for limited space, portable, mobile, VHF, UHF, microwave and space communications. Contains over 700 pages and 987 figures. **Chapter lineup:** Safety First, Antenna Fundamentals, The Effects of Earth, Selecting Your Antenna System, Loop Antennas, Multielement Arrays, Broadband Antennas, Log Periodic Arrays, Yagi Arrays, Quad Arrays, Long Wire and Traveling Wave Antennas, Direction Finding Antennas, Portable Antennas, Mobile and Maritime Antennas, Repeater Antennas Systems, VHF and UHF Antenna Systems, Antennas for Space Communications, Spacecraft Antennas, Antenna Materials and Accessories, Antenna Supports, Radio Wave Propagation, Transmission Lines, Coupling the Transmitter to the Line, Antenna and Transmission Line Measurements, Smith Chart Calculations, Topical Bibliography on Antennas, Glossary and Abbreviations. Edited by Gerald L. Hall, K1TD, *QST* Associate Technical Editor. Copyright 1988, #2065 $18*.

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YAGI ANTENNA DESIGN is based on the series in *Ham Radio* Magazine by the late Dr. James L. Lawson, W2PV. Jim designed and built a highly competitive and successful Amateur Radio contest station. 210 pages cover the following subjects: Performance Calculations, Simple Yagis, Performance Optimization, Loop Antennas, Ground Effects, Stacking, Practical Designs, Designs for 7 through 28 MHz. Hardcover, Copyright 1986. #0410 $15*.

NOVICE ANTENNA NOTEBOOK At last, an antenna book written for the beginner! Don't let the lack of an antenna keep you from getting on the air. With this book you can choose which wire, vertical or beam antenna suits your needs, and you'll be ready for all of the fun of seeing that the antenna you put up really works! Contains pictorial drawings that show dimensions for Novice and Technician band use. Written by W1FB in his usual plain language style that makes him so popular as a *QST* author. Copyright 1988, #2073 $8*.

ANTENNA COMPENDIUM We don't have room for all of the good antenna articles that are submitted to *QST;* so we have packed this volume with new material on verticals, quads, loops, Yagis, reduced-size antennas, baluns, Smith Charts, antenna polarization and other interesting subjects. 176 pages, Copyright 1985. #0194 $8*.

LOW BAND DXING John Devoldere, ON4UN completely explores the 160, 80, and 40-meter bands. A large portion of this book is devoted to propagation characteristics and design and building of efficient antennas for these bands. 210 pages, Copyright 1987. #047X $10*.

HF ANTENNAS FOR ALL LOCATIONS was written by L.A. Moxon, G6XN for the RSGB. Contains 264 pages of practical antenna information. This book is concerned primarily with small wire arrays, but you'll find descriptions of some aluminum antennas as well. Copyright 1982, #R576 $15*.

TRANSMISSION LINE TRANSFORMERS At last there is a source of practical design data covering the use of these devices for both commercial and amateur applications. Written by Dr. Jerry Sevick, W2FMI, this book covers types of windings, core materials, fractional-ratio windings, efficiencies, multiwinding and series transformers, baluns, limitations at high impedance levels and test equipment. Hardcover, 128 pages, Copyright 1987. #0471 $10*.

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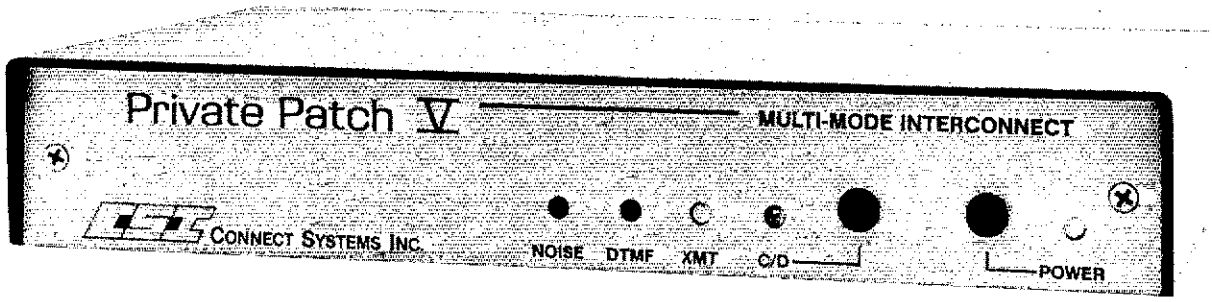

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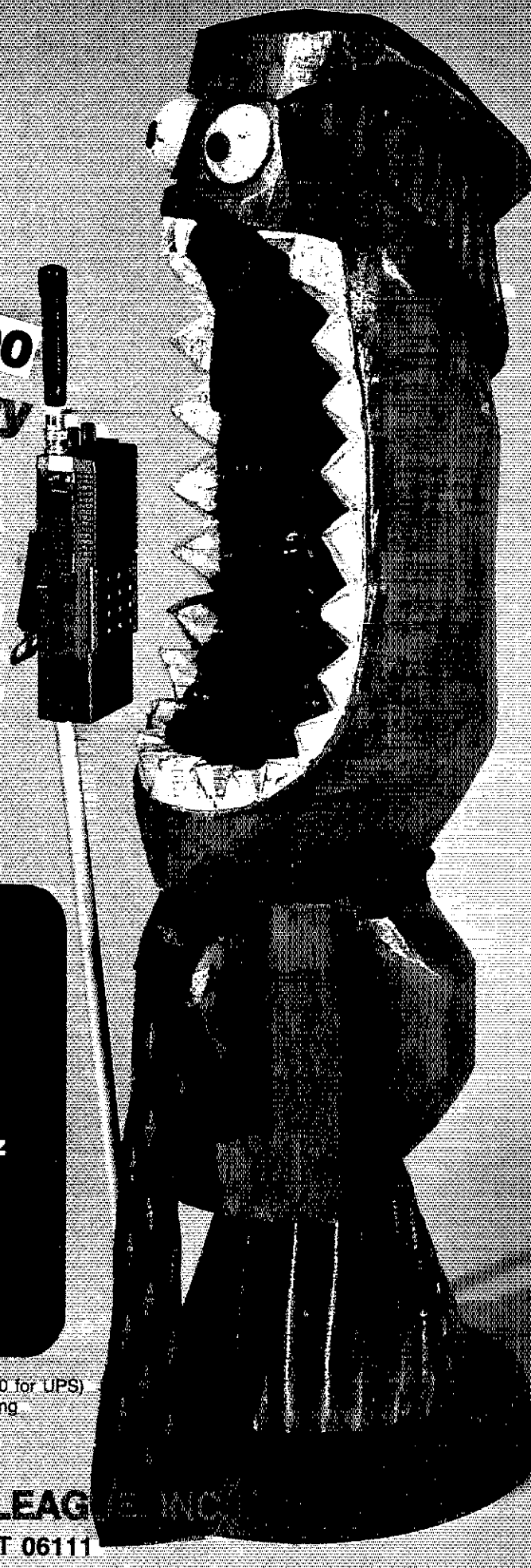

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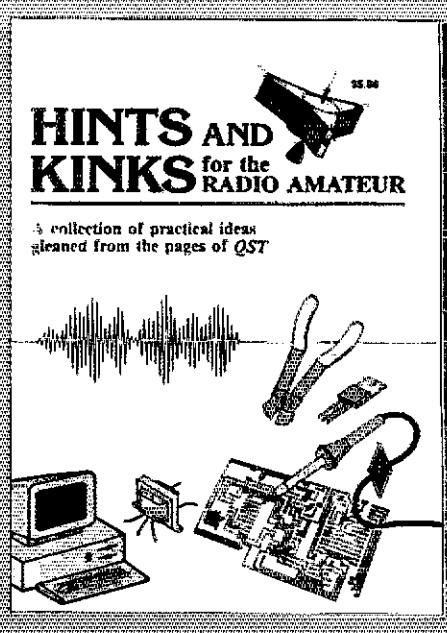


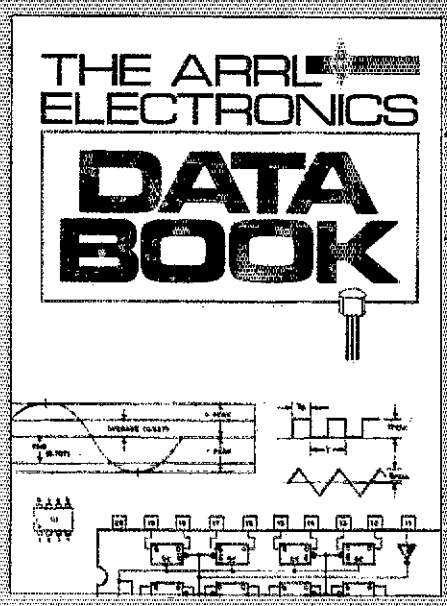
"A terrorist agent, representing an unknown foreign power or an internal subversive group, is bent on crippling or destroying America's space program by operating an illicit radio station from somewhere inside our Lost Padres National Forest wilderness area. A terrorist who has somehow gained access to our secret digital codes, launching schedules and classified radio frequencies required to cause our birds to self-destruct, during or after launch." And so begins a new adventure for Tommy Rockford, K6ATX.

Murder by QRM is packed with action. Join K6ATX on an ill-fated search using motorized hang-gliders and then as he backpacks through the wilderness in search of the hidden transmitter site. With the launch of the space shuttle *Conquistador* only hours away will Tommy be able to ferret out the culprits before the fatal destruct signal is sent?

This is the sixth and final ham radio adventure by Walker Tompkins (the real K6ATX) who became a silent key just before the book was published. 194 pages, $5.00*

*For postage and handling add $2.50 ($3.50 for insured parcel post or UPS—please specify)

The ARRL Data Book is back by popular demand! Doug DeMaw, W1FB has completely revised and expanded the material in this handy reference for the RF design engineer, technician, radio amateur, and experimenter. This *one* source has all of those regularly used tables, charts, and those hard-to-remember formulas. You'll also find hundreds of popular circuit diagrams of oscillators, mixers, amplifiers, other active devices and their operating parameters. This book can be used alone or to complement **The ARRL Handbook** and belongs in every technical library. Here's a brief summary and chapter lineup: **Symbols, Conversion Factors and Tables; Components and Materials** includes color codes, standard values, toroid selection charts; **Inductors and Transformers; Time and Frequency Measurement; Networks and Filters** covers attenuators and matching network design information; **Digital Basics** is 88 pages of logic, TTL Circuits, specific device descriptions, linear ICs, op-amp applications, and regulators; **Antennas and Transmission Lines; Catalog of Circuit Building Blocks** including audio amps, RF and IF small-signal amplifiers, mixers, FM detectors, oscillators, dc switches and amps, and frequency doublers; **Workshop and Lab Practices**. 234 pages, $12.00*



"Gimmicks and Gadgets, Tricks of the Trade." Since 1933, those words have been used describe **Hints and Kinks for the Radio Amateur**, but it has been almost seven years since the last edition appeared. Well, H&K fans, the long wait is over. The 12th in the series of the most popular *QST* "Hints and Kinks" contributions is now available, and hams like yourself share their innovations and wizardry. Like its predecessors, this edition has been said to be almost like having a radio club meeting on your bookshelf!

Here's just a sample: **In and Around the Station:** A Universal Equipment Stand, Safe Power Wiring Practices, Stop the Fire, Not Your Gear. **Transmitting and Receiving:** A Two-Transistor Transmitter for 30 Meters, Improvements for the HW-8, FT101ZD, TS830S, SB200, and SB220. **CW Hints:** Magnetic Switch for CW Tune Up, The Sneaky Knee Key for Mobile CW. **Computers and Digital Modes:** A Message-Waiting Indicator for TNCs, Tips for the VIC 20, TRS80 and Apple II. **Antennas and Feedlines:** Inexpensive 30 and 12-Meter Arrays, Retuning Traps for the WARC Bands, Baluns, Tower and Rotator tips. **Shop Secrets:** Tips on soldering and making PC Boards and more! **Tips on Testing:** Simple Logic Probe, plus 11 pages of test equipment and tips. **Portable and Mobile:** Power supplies, antennas, mobile installation tips. **VHF and UHF:** Antennas, amplifiers, CTCSS Tone Generator and more. **Power Supplies:** Power Supplies from Old Battery Chargers, High-Voltage Supply for Mobile Amplifiers. **Taming Interference:** Telephone RFI, TVI, CATV! cures. **Miscellanea:** COR and Timer Circuit, World-Time-Finder Slide Rule, AFSK System for FAX and more. 160 pages, $5.00*

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CELEBRATE

the 75th anniversary of ARRL with a new Handbook!

1989 marks the 75th anniversary of the founding of the League. There's no better way of celebrating this momentous occasion, than with the new *1989 ARRL Handbook for the Radio Amateur*!

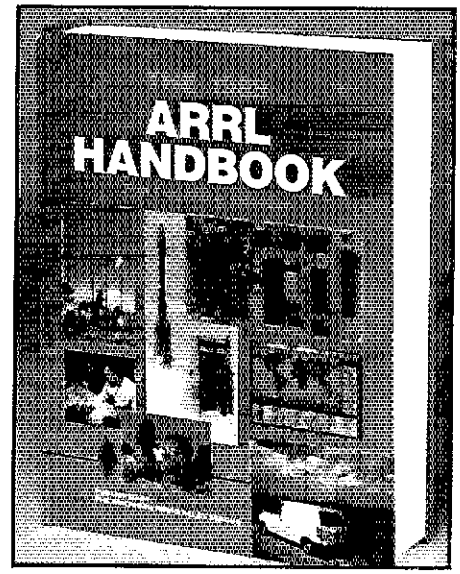
The 1200-page sixty-fifth edition contains over 2100 tables, figures and charts. The new *Handbook* is better than ever with revised information on phase noise measurement, direct frequency synthesis and spread spectrum communication techniques. The section on repeaters has been updated including a new CW identifier circuit. You'll find new spectrum analyzer and oscilloscope material, as well as several new projects in the test equipment chapter.

As always, we've added a host of new construction projects to this new edition. Just some of the new projects include: A 500-MHz frequency counter, 160 through 10 meter legal limit amplifier, simple CMOS keyer project, digital audio memory keyer and a L/Q meter for measuring coil inductance.

But that's not all. You'll find many other popular construction projects that can be built in a weekend such as power supplies and VHF/UHF preamps. For the more ambitious builder there are projects like the 1.8 MHz QSK transverter (there are VHF/UHF transverter projects too) and there are many amplifier designs to suit your needs from HF through microwaves.

The Handbook has always been famous as a reference for component data and you will find an entire chapter devoted to everything from transmitting tube and transistor specifications to aluminum tubing sizes. Satellite enthusiasts will find that the digital TR sequencer will add operating convenience to your station. Of course, you'll find the most up-to-date information on digital techniques, and the video communications chapter is packed with information not only on SSTV, ATV and FAX but Weather FAX as well. QRP enthusiasts will find the famous "Cubic incher" transmitter; not much bigger are the QRP SWR indicator and QRP Transmatch. There is also a VXO-controlled 6-watt CW transmitter for your favorite band between 80 and 15 meters. There are a number of useful station accesories that you can build like DTMF encoders and decoders, PIN-diode TR switch, digital PEP wattmeter and SWR calculator, Transmatches and dummy loads.

For $21, *The ARRL 1989 Handbook for the Radio Amateur*, remains an exceptional value for a hardcover technical publication. The price outside the US is $23. For postage and handling, add $2.50 (or $3.50 for insured mail or UPS—please specify)



Here is a description of what is covered in the Handbook:
The first 5 chapters serve as an introduction and cover: basics of Amateur Radio, electrical fundamentals, radio design technique and language, and solid state fundamentals. Vacuum tube principles as they pertain primarily to high power amplifier design are also presented in these introductory chapters. There are 12 chapters devoted primarily to these radio principles: power supplies, audio and video, digital basics, modulation and demodulation RF transmitters, receivers, transceivers, repeaters, power amplifiers, transmission lines and antenna fundamentals. Another 4 chapters cover voice, digital, image and special modulation techniques. The RF spectrum, propagation and space communications are covered in 2 chapters. The construction and maintenance section has 12 chapters of useful projects ranging from power supplies and antennas through digital equipment. You'll find up-to-date component data that the Handbook is famous for. The final 5 chapters cover how to obtain your license, station design and operation, interference, monitoring and direction finding. An abbreviations list, huge index and etching patterns make up the balance of the book.

The American Radio Relay League, Inc., 225 Main St., Newington, CT 06111 USA

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CLUBS/HAMFESTS/NETS

PROFESSIONAL CW operators, retired or active, commercial, military, gov't., police etc. invited to join Society of Wireless Pioneers—W7GAQ/6. 146 Coleen Street, Livermore, CA 94550.

IMRA—International Mission Radio Association helps missionaries by supplying equipment and running a net for them daily except Sunday, 14.280 MHz, 1:00-3:00 PM Eastern Time. Rev. Thomas Sable, S.J., University of Scranton, Scranton, PA 18510.

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. Pleuler, Jr., Secretary, 46 Murdock Street, Fords, NJ 08863.

FCC EXAMS. Novice-Extra Class, Walk-in's only. Sunnyvale VEC ARC, POB 60142, Sunnyvale, CA 94088-0142, 408-255-9000, 24/hr. Gordon, W6NLG, President. Flea Market, March-Sept, Foothill College, Los Altos Hills, CA.

MARCO: Medical Amateur Radio Council, operates daily and Sunday nets. Medically-oriented amateurs (physicians, dentists, veterinarians, nurses, therapists, etc.) invited to join. For information, write MARCO, Box 73's, Acme, PA 15610.

JOIN The Old 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., 1409 Cooper Drive, Irving, TX 75061.

LITTLE Big Horn Nets Sundays: 14.057-2200Z, 21.150-2230Z. Native American Indians and Others Welcome. Info WA2DAC.

PUT THE "MAGIC" back into Amateur Radio! Join the thousands of Amateurs who have, through "free" membership in the Society for the Promotion of Amplitude Modulation. Write: S.P.A.M., WB6TRQ, P.O. Box 27, Potrero, CA 92063 or call 619-478-9347. (LSASE please.)

HAMFEST Sunday July 9, 1989. LIMARC ARRL Long Island Hamfair at the New York Institute of Technology, Route 25A/Northern Blvd., Old Westbury, NY. Outdoor tailgating, no reservations needed, sellers car space $5, general admission $3. Non-Ham women & children free. Exit 39 North on Route 495, go North on Glen Cove Road 2 miles to 25A, turn right 1 mile to site. Talkin 146.25/85. Food, refreshments available. Open 7:30 AM for sellers, 9:00 AM for buyers. For further info call Mark Nadel, NK2T, 516-796-2366 or Hank Wener, WB2ALW, 201-694-1811.

NORTHERN New Jersey—Sussex County ARC Hamfest, Sunday, July 16th. Sussex County Fairgrounds, Augusta, NJ. 8:00 AM. Indoor/outdoor space. Acres of parking. Refreshments. Talk-in 147.90/30 and 146.52. For information call Donald Stickle, K2OX, 201-663-0677.

AYN RAND admirers new 2nd Sunday every month 0045Z, 14270-14280 from RI discuss ideas in her novels Atlas Shrugged and The Fountainhead. K1UKQ.

HARRISBURG Firecracker Hamfest. Tuesday, July 4th, Bressler Picnic Grounds.

QSL CARDS/RUBBER STAMPS/ENGRAVING

CANADIAN QSL Cards, send $1 for samples refundable with your order. M. Smith, VE7FI, 18610-62nd Avenue, Surrey, BC CANADA V3S 4N9.

BE SURPRISED—get a variety of cards—100 for $8 or 200 for $13. Samples $1 refundable. Add $2 S&H. All three colors, fast service, satisfaction guaranteed. Constantine, 1219 Ellington, Myrtle Beach, SC 29577.

ENGRAVING: Callsign/Name Badges by WØLQV. SASE for price sheet. Box 4133, Overland Park, KS 66204.

CADILLAC of QSLs—Completely different! Samples $1, (refundable). Mac's Shack, P.O. Box 43175, Seven Points, TX 75143.

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.

POST CARDS QSL Kit—Converts Post Cards, Photos to QSL's! Stamp brings circular. My Type Shop, P.O. Box 172, Leeds, NY 12451.

FULL Color—3,000 $350; 6,500 $425; 12,500 $600; 25,000 $750. WA8CZS, 1-614-452-6375.

QSL Samples—25 cents. Samcards, 48 Monte Carlo Drive, Pittsburgh, PA 15239.

BROWNIES QSL Cards since 1939. Catalog & Samples $1 (refundable with order). 3035 Lehigh Street, Allentown, PA 18103.

QSL's—Quality for less is back! See our display ad in this issue of *QST*. Harry A. Hamlen, P.O. Box 1, Stewartsville, NJ 08886.

QSLs & RUBBER Stamps. Top quality QSL samples and stamp information $1 (refundable with order). Ebbert Graphics D-3, Box 70, Westerville, OH 43081.

QUALITY QSLs. Samples $.50. Olde Press, WB9MPP, Box 1252, Kankakee, IL 60901.

QSL CARDS—Look good with top quality printing. Choose standard designs or fully customized cards. Better cards mean more returns to you. Free brochure, samples. Stamps appreciated. Chester QSL's, Dept. B, 310 Commercial, Emporia, KS 66801.

QSL SAMPLES send $1 (refundable with order) Box 1262, Point Roberts, WA 98281.

COLORFUL QSLs by WA7LNW—High quality craftsmanship using unique printing process that combines brilliant rainbow colors and sparkling metallic inks. Samples $1 (refundable). Colorful QSLs, P.O. Box 5358, Glendale, AZ 85312-5358.

DON'T Buy QSL Cards until you see my free samples. Also I specialize in custom cards and QSL business cards. Write or call for Free Samples and custom card ordering information. Little Print Shop, Box 1160, Pflugerville, TX 78660, 512-990-1192.

QSLS Samples—SASE. Eric, WA6FOS, Box 2275, Culver City, CA 90231.

FREE Logbook with first order. QSL samples cost 3 stamps. Gazebo Press, 4148 Mimosa Lane, La Plata, MD 20646.

RAISED Printed QSLs. Very unique. You can feel the type! Our new laser technology produces exotic callsign type effects. Super high quality. Standard designs or use your own artwork/computer graphics to create a really personal QSL. We now offer state outlines in 3-D. $1 for samples & information. Dennis, WA5QMM, Network QSLs, P.O.B. 13200, Alexandria, LA 71315-3200, 318-443-7251, FAX: 318-445-9940.

CAR WINDOW Call Sign . . . 2 inch x 8 inch plastic! Suction cup mountings! Transfer car to car! Call lettering is white. Choose black, blue or red background. Magnetic signs available. Select black, blue or red lettering on white background. $8.50 each. Two for $15 ppd. Club Discounts! Sign-On, Dept. T, 1923 Edward Lane, Merrick, NY 11566.

QSL SALE! 100 QSL cards, plus bonus, $8. $3 thereafter. Shipped postpaid within two weeks. Guaranteed correct! Free samples. Shell Printing, KD9KW, Box 50, Rockton, IL 61072.

LICENSE PLATE Call Sign—on standard 6" x 12" metal blank slotted holes, fits front bracket-white background 2¼" letters in red, blue or black enamel. City and state optional. $8 each, two for $15 plus $1 postage. James Veverka Printing KA9WHK, 6434 Woodridge Drive, Woodridge, IL 60517.

QUALITY QSL Cards, rubber stamps, envelopes and printed letterheads. Send 45 cents postage or SASE for samples. Large selection at attractive prices. Sandollar Press, P.O. Box 30726, Santa Barbara, CA 93130.

QSLS QUALITY And Fast Service For 30 Years. Include call for free decal. Samples 50 cents. Ray, K7HLR, Box 331, Clearfield, UT 84015.

RUSPRINT QSLs. Working to help you look good and log that hard earned contact. Several card themes. (Cartoon, Patriotic, Mike & Key, Contest, Others.) Prices? Some low as 2.5 cents each! Quantities? Start at 100. Plastic card holders. Display 20 cards. 3-$3.95, 4 & up $1.20 each. More information? Business SASE with 45 cents postage. Rusprint, Rt. 1, Box 363QST, Spring Hill, KS 66083.

GAILS QSLs, overnight, $6/100. Stamp for samples. 1150 Muenz, Wright City, MO 63390.

FULL COLOR QSL Cards made on Kodak paper from your negative, slide or print. $32.95 per 100. Request samples (enclose $1). Bizcard Co., Box 191-T, Stevensville, MI 49127.

SCHEMATICS: Radio receivers 1920's/60's. Send Brandname, Model No., SASE Scaramella, Box 1, Woonsocket, RI, 02895-0001.

NORTHWEST Imagery QSLs—check out the added designs, and the one year celebration prices! For QRO impact at QRP prices, send $1 for samples (refundable). Tom, WO7Y, 11969 Tioga Street, Boise, ID 83709.

ANTIQUE-VINTAGE-CLASSIC

WANTED: Old microphones for my mic. museum. Also mic-related items. Write Bob Paquette, 107 E. National Avenue, Milw., WI 53204.

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: Radio, magazines, horn speakers, pre 1930. W6THU, 1545 Raymond, Glendale, CA 91201, 818-242-8981.

WANTED: *QST* VOLUME 1. W6ISQ, 82 Belbrook Way, Atherton, CA 94025.

WE MAY HAVE the tubes you need. (Thousands in stock). Send SASE for our list. Fala Electronics, P.O. Box 1376-1, Milwaukee, WI 53201.

BUY, Sell, Collect and Restore early tube equipment? Early receivers, tubes and telegraph gear? Join the Antique Wireless Association which sponsors old-time "meets," flea markets, museum and journal with technical articles and free want ads. Membership and annual dues only $10. Write for information and Museum hours: Bruce Kelley, W2ICE, Route 3, Holcomb, NY 14469.

WANTED: Hallicrafter silver panel Skyriders and other very old or unusual Hallicrafter equipment, parts, etc. Chuck Dachis, "The Hallicrafter Collector," 4500 Russell Drive, Austin, TX 78745.

MICROPHONES and related memorabilia used in radio/TV broadcasting prior to 1960 wanted. Cash paid: trade terms available. Write: James Steele, WKBX, BOX 2525, Kingsland, GA 31548-2525, 912 729-6106.

MANUALS For most hamgear made 1935-1970, plus Kenwood. No quotes. Our current catalog "J" at $1 required to order. Over 2,000 models. Hi-Manuals, P.O. Box J-802, Council Bluffs, IA 51502.

WANTED: WWII Military Radios and Accessories. Need ATD Tuning Units, DY43 Dynamotor, BC 222/223 Manuals, ART-13 Connectors, ARR/41/MT-1518 Mount, ATB, GRC 106 Receiver, Hallicrafters HT20. Charlie, 501 Mystic Valley Pkwy., Medford, MA 02155.

WANTED Books: Pre-1900 Electricity and Telegraphy, Pre-1925 Radio, Pre-1940 Television. Books, Magazines or any other related literature. Jim Kreuzer, N2GHD, 6270 Clinton Street, Elma, NY 14059, 716-681-3186.

ANTIQUE RADIO CLASSIFIED. Subscribe to antique radio's largest circulation monthly magazine. Old radios, TVs, ham equip., 40s & 50s radios, telegraph, books & more. Ads & articles. Free 20-word ad monthly. Sample free. Six-month trial: $11. Yearly rates: $19 ($28 by 1st class). Foreign: write. ARC, P.O. Box 2-B3, Carlisle, MA 01741.

I PAY CASH for new and used vacuum tubes, especially vintage and transmitting types. Randy Nachtrieb, WA6GJA, 6392 Park Avenue, Garden Grove, CA 92645, 714-897-9351.

WANTED: The entire 1934 "Z" and "H" line of Silver-Marshall Radios, any condition. Chuck Dachis, WD5EOG, The Hallicrafter Collector, 4500 Russell Drive, Austin, TX 78745.

CODE/CIPHER Machines Wanted! Historian buys code/cipher devices, manuals, books, etc! All periods! Melton, Box 5755, Bossier City, LA 71171, 318-798-7319.

E.F. JOHNSON Transmitters, Literature and Accessories wanted for my station. Will pickup. Len Crispino, Box 702, Hudson Falls, NY 12839, 518-638-8199.

WANTED: Pre-1930 *QSTs*. Richard Titus, NV2C, 231-9 Lucas Lane, Voorhees, NJ 08043, 609-772-0316.

SELL: *QST* oldest 1933. Some CQ, 73, HR, and Computer Mags. $1 each plus shipping. LSASE for list. Robert Willsey, Box 10, Martha, OK 73556.

WANTED: McIntosh Tube Type Hi-Fi Gear, any condition for my collection! Ask your friends too! Marcus Frisch, WA9IXP, Box 28803, Greenfield, WI 53220-0803, 414-545-5237.

WANTED: reward for Harvey Radio FT-30 Transmitter. Looks like Collins 32B. Robert Enemark, W1EC, Box 1607, Duxbury, MA 02331, 617-934-5043.

HAMMARLUND Equipment Wanted. I am looking for receivers and tmitters in good working order. Drop me a note on your QSL card stating condition and price. KD4AJ, 1968 Huntington Hall Court, Atlanta, GA 30338. All responses will be answered.

WANTED: Johnson Ranger or Valiant Xmtrs. Boston area only. W1QD, 617-284-4644.

WANTED: Hallicrafters R-80 Receiver (military version of S-29), unmodified, good condition, working. N4EBG, 724 Forest Ridge Drive, Great Falls, VA 22066.

WANTED: Telegraph Keys and Bugs that are old or unusual, other early telegraph instruments, telegraph signs, related items. Telegraph collector will pay premium prices for rare items. Larry Nutting, WD6DTC, 4025 Slate Court, Santa Rosa, CA 95405, 707-539- 1883.

TELEGRAPH Keys, Bugs, Paddles Wanted for private non-profit collection. Needed most models and vanations pre-1960. Write Herb Spivey, NF5Y, P.O.B. 27, Baldwyn, MS 38824.

COLLINS 75A4-$400. KWS1-$800. Bally 3 reel older slot machine. All fine cond. Frank Anderson, 3801 Fifth Avenue South, Great Falls, MT 59405.

WANTED—"Ocean Hopper" Regen. Receiver for good memories. Larry, K7APT, 3005 Bush Mountain Court, Tumwater, WA 98502, 206- 943-7208.

WANTED: Pre-WW2 Pan American Airways aircraft transmitters/receivers and schematics/manuals for same: Pre-WW2 Speed-X bugs. Conly, 819 Henrietta Avenue, Sunnyvale, CA 94086.

WANTED: Low freq. tuning unit TU61 and tank coil 1.5-2 MHz for a BC610-E. Call Jim collect 816-524-7343.

WANTED: Hallicrafter SX-88 Receiver, working or not. Victor Gregowski, WD8DWR, 3635 Orvall Drive, Port Huron, MI 48060.

TELEGRAPH BUGS, early American keys, mid-century paddles wanted. Write John Hensley, WJ5J, 5054 Holloway Avenue, Baton Rouge, LA 70808.

HAMMARLUND HQ-110 Receiver For Sale. This unit is in near mint condition and works great. The optional clock is also installed. Unit tunes ham bands 160 thru 10 meters. Price $125. Call KD4AJ after 7 PM, 404-396-0276.

MY special interest is WW2 German, Japanese, and Italian military radio equipment. Sets, parts, and data wanted for completing systems and restoring to operation. Also interested in some of the US military vehicle, portable, or aircraft types; Forest Service transceivers; or civilian aircraft radios with tunable HF receive, all before 1946. Manuals, directories, advertising, training materials, industry trade publications, union publications, what have you, dealing with radio communications equipment or its operation. Thank you! Hugh Miller, KA7LXY, 6400 Maltby Road, Woodinville, WA 98072-8375 or try 206-487-3047 weekends.

WANTED—Cabinet For SP-600. Should be in good condition. Also older Hammarlund S/W Receivers. John Orahood, 5819 Miller Valley, Houston, TX 77066, 713-440-5598.

WANTED: Old ARRL Repeater Directories. Quote W9SS, Box 1761, Rockford, IL 61110.

I PAY CASH for vintage audio equipment by Western Electronics, Altec, McIntosh, Marantz, Westrex, etc. Randy Nachtrieb, WA6GJA, 6392 Park Avenue, Garden Grove, CA 92645, 714-897-9351.

WANTED: Johnson kilowatt and/or Viking 500 for my station. Will pay cash and pick up. All inquiries are cheerfully answered. Phone 518-638-8199 or write Len Crispino, P.O. Box 702, Hudson Falls, NY 12839.

GENERAL

DO-IT-YOURSELF DXpedition. Stay at ZF8AA. 2 br. cottage, beach, quad. Fish or dive if bands fold. Write airmail: ZF8AA, Little Cayman, CAYMAN ISLANDS.

COLLINS Equipment Wanted: KWM2-A w n/b, 30L-1, 30S-1, 312B-3, 312B-4, 312B-5, 516F-2, 180S-1, 302C-3, 399B-4, 399B-5, KL-1, PM-2, MM-1, MM-2, SM-3, 637T-2. Original top condition only. Sannazzaro Alberto, 1K1CXJ-Str. Pontecurone, 9 15042 Bassignana, ITALY.

WANTED: Kenwood TS430S, Metron/TWE Solid-State Broadband 2-30 MHz Linear Amplifier, mint condition, for missionary in Africa. Best offer for noble cause. VE2OU, 2785 Valcourt, Ste-Foy, Quebec, CANADA, G1W 1W2.

WE BUY Electron tubes, diodes, transistors, integrated circuits, semiconductors. Astral Electronics, P.O. Box 707, Linden, NJ 07036. Call toll-free 800-526-4052.

FAST, ACCURATE, readable, nonsensational— The ARRL Letter! Every two weeks, we fill you in on what's happening in Amateur Radio. But, you have to be an ARRL member to get it. For a one year subscription, send $19.50 (U.S. funds) and we'll send you the Letter first class mail anywhere in the U.S. and Canada. The ARRL Letter, 225 Main St., Newington, CT 06111.

CHASSIS & CABINET Kits. 5120 Harmony Grove Rd., Dover, PA 17315, SASE K3IWK.

COMPREHENSIVE Apple II/II+/IIe Software CW/RTTY with/without TU or TNCless Packet. Callsign and $49.95 brings either and manual on 5.25 inch disk. SASE for free brochure. W1EO, 39 Longridge Road, Carlisle, MA 01741.

SAVE $1.50 SHIPPING on any ARRL book. Send book price plus $1 to Marshall Hill Enterprises, Bradford NH 03221.

RTTY JOURNAL, published 10 times per year for those interested in digital communications. Read about RTTY, AMTOR, MSO, Packet Radio, RTTY DX and Contests, and Technical Articles concerning the digital modes. $10 per year (foreign higher). RTTY Journal, 9085 La Casita Avenue, Fountain Valley, CA 92708.

RADIO SHACK Color Computers: Hardware and Software for ham use. Dynamic Electronics, Box 896, Hartselle, AL 35640, 205-773-2758.

SPY RADIOS WANTED! Buying all types of espionage radios and code machines! Especially wanted are military-type radios in civilian suitcases! Museum, Box 8146, Bossier City, LA 71113, 318-798-7319.

HAM RADIO REPAIR, all makes, all models. Robert Hall Electronics, PO Box 8363, San Francisco, CA 94128, 408-729-8200.

ELECTRONIC CENTER, INC. can save you money! Call for savings on Kenwood, ICOM, Yaesu, Encomm, Rohn Towers, SWL Receivers, and all accessories. Texas 1-800-441-0145; Nat'l 1-800-527-2156; Metro 263-7464; or 214-969-1936. Ham Department, home of the world-famous Sidewalk Sale, 2809 Ross Avenue, Dallas, TX 75201.

BEAM Headings your QTH. $9.95. W8JBU, 253 River Road, Hinckley, OH 44233.

CLEAR Glass Coffee Mug: Custom engraved with your call sign and your first name. Only $10 per mug. CA residents add 6% sales tax. Write: Regency Glass Engraving, P.O. Box 802, Novato, CA 94948.

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GET Smart power when you need it! Universal Regulated Multi-Voltage DC for Experimenters! Laboratories! Industry! Send for facts! Pricelist! Pepperkit, 527-10th Street, Sparks, NV 89431-0811 USA.

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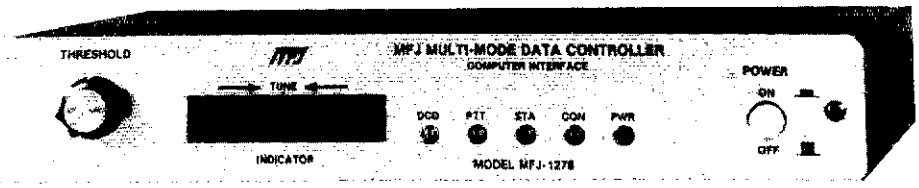

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Count 'em -- you get 9 fun modes --Packet, AMTOR, RTTY, ASCII, CW, WeFAX, SSTV, Navtex and full featured Contest Memory Keyer.

You *can't* get all 9 modes in any other multi-mode at *any* price. And nobody gives you modes the MFJ-1278 doesn't have.

The best modem you can get

Extensive tests in *Packet Radio Magazine* prove the MFJ-1278 modems gives better copy with proper DCD operation than all other modems tested.

New Easy Mail™ Personal Mailbox

You get MFJ's new **Easy Mail**™ Personal Mailbox with soft-partitioned memory so you and your ham buddies can leave messages for each other 24 hours a day.

20 LED Precision Tuning Indicator

MFJ's unequaled tuning indicator makes it really easy to work HF packet stations.

And unlike others, you use it *exactly the same* way for *all* modes -- not differently for each mode.

Just tune your radio to center a single LED and *you're precisely tuned in to within 10 Hz* - and it shows you which way to tune!

New MFJ technology prevents collisions: gets packets through faster

MFJ's new *Anti-Collision* technology gets packets through faster, more reliably.

How? Automatic random transmit delays prevent packet collisions.

An MFJ ***exclusive:*** MFJ-1278 is the only multi-mode to have this *new* technology.

Multi-Gray Level FAX/SSTV Modem

You'll enjoy natural looking pictures that only multiple gray levels can give you.

MFJ's *exclusive* new built-in modem lets you transmit and receive up to 16 gray levels.

Only MFJ can transmit FAX

Most packet stations can receive FAX.

But *only* the MFJ-1278 lets you transmit FAX without internal modifications that disable other modes.

So now you can send your own high resolution pictures, maps and diagrams by FAX to stations throughout the world.

Too bad they can't send theirs to you . . . *unless* they have the MFJ-1278.

One FREE Upgrade!

When you buy your MFJ-1278 *today*, you don't have to worry about missing new modes and features that come out *tommorow.*

Why? Because your MFJ-1278 comes with a coupon good for one ***free*** eprom upgrade exchange that'll add new features.

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Get on the air instantly Just plug it all in

All you need is an MFJ-1278, your rig, any computer and a terminal program.

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Order MFJ-1282 (disk)/MFJ-1283 (tape) for C-64/128/VIC-20; MFJ-1284 for IBM compatibles; MFJ-1287 for Macintosh.

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Don't settle for 3 year old technology.

Choose the only multi-mode that gives you the latest advances and *all 9* modes.

Get 9 new ways of having fun -- get yours today!

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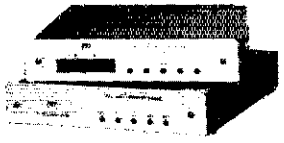

MFJ-1274 **$159.95**

MFJ-1270B **$139.95**

MFJ-1270B super clone of TAPR's TNC-2 gives you more features than *any* other packet controller -- for $139.95.

You can double your fun by operating VHF *and* HF packet because you get **high performance** switchable VHF/HF modems.

You get the **Easy Mail**™ Personal Mailbox with soft-partitioned memory so you and your ham buddies can leave messages for each other 24 hours a day.

In MFJ's new WeFAX mode you can print full fledged weather maps to screen or printer and save to disk using an IBM compatible or Macintosh computer with an MFJ Starter Pack.

A new **KISS** interface lets you run **TCP/IP.** They also come **NET ROM** compatible -- *no modification needed!*

You also get 32K RAM, one year *unconditional* guarantee and a *free* 110 VAC power supply (or use 12 VDC).

For dependable HF packet tuning, the MFJ-1274 gives you a high resolution tuning indicator that's accurate to within 10 Hz -- and it's only $20.00 more.

MFJ Video Digitizer

Here's an actual print-out of Aimee from the MFJ Order Desk. She was digitized with the MFJ-1292 and the result was printed on a 9-pin Epson compatible printer. We reduced the size to fit the ad.

Create fascinating digitized snapshots you can transmit with your MFJ-1278 of *anything* you can point your camcorder at!

The MFJ-1292 "Picture Perfect" Video Digitizer connects your video camera to your IBM compatible computer so you can capture digitized video snapshots on disks.

Your MFJ-1292 package includes a plug-in card for your computer, software and complete instructions for ... **$199.95.**

As an added bonus you get a handy Contrast and Brightness Control unit that you can conveniently place near your keyboard for fine tuning your pictures.

Packet Pictures

Transmit and receive high resolution VGA, EGA and CGA color pictures via packet with MFJ picture passing software.

Beautiful color pictures are automatically received, saved to disk and "painted" to screen.

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You can set up your own picture bulletin board and exchange pictures with others - even if you're not there.

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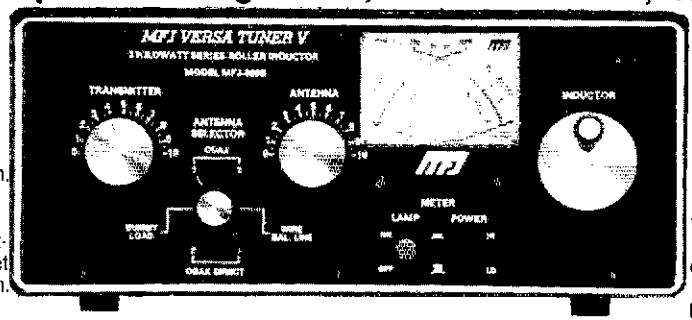
Here is the finest 3 KW PEP Tuner money can buy with roller inductor, dummy load, *new* peak reading meter, antenna switch, balun and more ...

The MFJ-989C is not for everyone. **However,** if you do make the investment you get the finest 3 KW PEP tuner money can buy - one that will give you a lifetime of use, one that takes the fear out of high power operation and one that lets you get your SWR down to absolute minimum.

The MFJ-989C is a compact 3 KW PEP roller inductor tuner with a new **peak** reading Cross-Needle SWR/Wattmeter. The roller inductor lets you get your SWR down to absolute minimum.

With **three continuously** variable components two massive 6 KV capacitors and a high inductance roller inductor - you get precise control over SWR **and** the widest matching range possible from 1.8-30 MHz.



MFJ-989C **$349.95**

You get a **new** lighted **peak** and average reading Cross-Needle SWR/Wattmeter with a **new** more accurate directional coupler.

You get a giant two core balun wound with teflon wire for balanced lines and a 6-position antenna switch with extra heavy switch contacts.

Its compact 10¾x4½x15 inch cabinet fits right into your station.

You get a 50 ohm 300 watt dummy load for tuning your exciter, a tilt stand for easy viewing and a 3-digit turns counter plus a spinner knob for exact inductance control. Add $10 s/h.

2-knob *Differential-T*™ Tuner

MFJ-986 **$269.95** The **new** MFJ-986 Differential-T™ 3 KW PEP 2-knob Tuner has a differential capacitor to make tuning foolproof and easier than ever. It ends constant retuning with broadband coverage and gives you minimum SWR at only **one** best setting. Covers 1.8-30 MHz.

The roller inductor lets you tune your SWR down to absolute minimum. A 3-digits turns counter lets you quickly return to your favorite frequency.

You get MFJ's **new** peak and average reading Cross-Needle SWR/Wattmeter with a **new** directional coupler for more accurate readings over a wider frequency range. It reads forward/reflected power in 200/50 and 2000/500 watt ranges. Meter lamp is front panel switched and requires MFJ-1312, $9.95.

A **new** current balun for balanced lines reduces feedline radiation and forces equal currents into antenna halves that are not perfectly balanced for a more concentrated, stronger signal. Add $10.00 s/h.

MFJ's *Fastest Selling* Tuner

The MFJ-941D is MFJ's fastest selling 300 watt PEP antenna tuner. Why? Because it has more features than tuners costing much more and it matches everything continuously from 1.8-30 MHz.

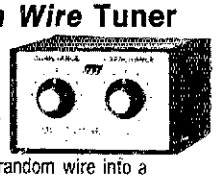
MFJ-941D **$109.95**

It matches dipoles, vees, verticals, mobile whips, random wires, banlanced and coax lines.

SWR/Wattmeter reads foward/reflected power in 30 and 300 watt ranges. Antenna switch selects 2 coax lines, direct or through tuner, random wire, balanced line or tuner bypass. Efficient airwound inductor gives lower losses and more watts out. Has 4:1 balun. 1000 V capacitors. 10x3x7 inches.

MFJ's *Random Wire* Tuner

MFJ-16010 **$39.95**



You can operate all bands anywhere with any transceiver when you let the MFJ-16010 turn any random wire into a transmitting antenna. Great for apartment, motel, camping operation. Install a wire anywhere! Tunes 1.8-30 MHz. 200 watts PEP. Ultra small 2x3x4 in.

MFJ's *Best 300 Watt* Tuner

MFJ-949C **$149.95** The MFJ-949C gives you more precise matches than any tuner that uses two tapped inductors. Why? Because you get two **continuously** variable capacitors that give you infinitely more positions than the **limited** number on switched coils.

This gives you the precise control you need to get your SWR down to a minimum. After all, isn't that why you need a tuner? Covers 1.8-30 MHz.

You also get MFJ's lighted 2-color Cross-Needle SWR/Wattmeter, 6-position antenna switch, 50 ohm 300 watt dummy load and a built-in balun - all in a compact 10x3x7 inch cabinet that fits right into your station. Meter light requires MFJ-1312, $9.95.

With MFJ's **best** 300 watt PEP tuner you get an MFJ tuner that has earned a reputation for being able to match just about anything - one that is highly perfected and has years of **proven** reliability.

MFJ's *Mobile* Tuner

MFJ-945C **$89.95**

Don't leave home without this **mobile** tuner! Have an uninterrupted trip as the MFJ-945C **extends your antenna bandwidth** and eliminates the need to stop, go out and adjust your mobile whip.

You can **operate anywhere in a band and get low SWR.** You'll get maximum power out of your solid state or tube rig and it'll run cooler and last longer.

Small 8x2x6 inches uses little room. **SWR/ Wattmeter and convenient placement of controls make tuning fast and easy while in motion.** 300 watts PEP output, efficient airwound inductor, 1000 volt capacitors. Mobile mount, MFJ-20, $3.00.

144/220 MHz VHF Tuners

MFJ-921 **$69.95**

MFJ's new VHF tuners cover both 2 Meters and the 220 MHz bands. They handle 300 watts PEP and match a wide range of impedances for coax fed antennas. SWR/Wattmeter. 8x2½x3 in. **MFJ-920, $49.95.** No meter. 4½x2½x3 inches.

MFJ

MFJ ENTERPRISES, INC.
Box 494, Miss. State, MS 39762
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MFJ's *Artificial* RF Ground

$79.95 MFJ-931

You can create an artificial RF ground and eliminate RF "bites", feedback, TVI and RFI when you let the MFJ-931 resonate a random length of wire and turn it into a tuned counterpoise. The MFJ-931 also lets you electrically **place a far away RF ground directly at your rig** -- no matter how far away it is -- by tuning out the reactance of your ground connection wire.

Barefoot/1.5 KW Linear Tuner

MFJ-962C **$229.95** For a **few** extra dollars, the MFJ-962C lets you use your barefoot rig now and have the capacity to add a 1.5 KW PEP linear amplifier later. Covers 1.8-30 MHz.

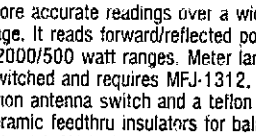
You get two husky **continuously** variable capacitors for maximum power and minimum SWR. And lots of inductance gives you a wide matching range.

You get MFJ's **new** peak and average reading Cross Needle SWR/Wattmeter with a **new** directional coupler for more accurate readings over a wider frequency range. It reads forward/reflected power in 200/50 and 2000/500 watt ranges. Meter lamp is front panel switched and requires MFJ-1312, $9.95.

Has 6-position antenna switch and a teflon wound balun with ceramic feedthru insulators for balanced lines. 10¾x4½x14 7/8 inches. Add $10.00 s/h.

MFJ's *smallest* Versa Tuner

MFJ-901B **$59.95**



The MFJ-901B is our smallest -- 5x2x6 inches -- (and most affordable) 200 watt PEP tuner --when both space **and** your budget is limited. Good for matching solid state rigs to linears.

It matches whips, dipoles, vees, random wires, verticals, beams, balanced and coax lines from 1.8-30 MHz. Efficient airwound inductor. 4:1 balun.

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MFJ's *Deluxe* 300 Watt Tuner

... *gives you* ***full*** 1.8-30 MHz coverage, a ***peak reading*** (and average) Cross-Needle meter, built-in ***dummy load,*** antenna switch and balun ... all covered by a ***full one year unconditional guarantee*** ... for only $149.95

MFJ-949D

$149.95

Made in U.S.A.

- ***Peak reading meter***
- ***Built-in dummy load***
- ***Covers 1.8 to 30 MHz***
- ***1 full year guarantee***

You won't find all these useful features in *any* other 300 watt tuner -- not even at twice the price.

New peak reading meter

The new ***peak*** and average reading Cross-Needle meter in the MFJ-949D shows you SWR, forward and reflected power -- all in a single glance.

Without a ***peak reading*** wattmeter you just won't be able to tell if your rig is putting out all the peak SSB power it's designed for. Don't be without one if you want top performance.

Built-in dummy load

A built-in 300 watt 50 ohm dummy load makes tuning up your rig soooo easy. How do you tune up your rig without one?

An external dummy load will cost you about $30 more -- plus it takes up valuable space at your operating position and requires another cable.

Full 1.8 to 30 MHz coverage

The MFJ-949D gives you **full** 1.8-30 MHz coverage.

Make sure the tuner you're considering covers *all* the HF bands.

Don't get a tuner that keeps you from operating all the frequencies you've worked for -- now or in the future.

Plus more . . .

You get a versatile 6-position antenna switch and a 4:1 balun for balanced lines.

You can run up to 300 watts PEP and tune out SWR on coax, balanced lines or random wires.

Unconditional Guarantee

You get a *full one year unconditional guarantee.* That means we will repair or replace your MFJ tuner (at our option) *no matter what* for a full year.

Others give you a 90 day *limited* warranty. What do you do *after* 90 days? Or *before* 90 days when they say, "Sorry, it's your fault"?

What's really important? *precise* control for minimum SWR

What's really important is your tuner's ability to get your SWR down to a minimum -- and the MFJ-949D gives you more precise control over SWR than *any* tuner that uses two tapped inductors.

Why? Because the two *continuously* variable capacitors in the MFJ-949D give you *infinitely* more positions than the *limited* number on two switched coils.

This gives you the precise control you need to get minimum SWR and maximum power into your antenna.

After all, isn't that why you need a tuner?

High efficiency *and* a compact size: *performance* is most important

The MFJ-949D uses a *single* airwound coil. Using only one inductor takes up a minimum of space and there's no mutual coupling problems.

The excellent form factor of the short fat coil gives you highest Q. Plus you get plenty of inductance that gives you a much wider matching range than other designs.

This results in a highly efficient tuner that puts maximum power into your antenna *and* a compact 10 x 3 x 7 inch size that complements your rig and fits right into your station.

Competing tuners using *two* tapped coils *require* a large cabinet -- not just to house the coils but also to help reduce detrimental coupling between the inductors. The result? *A tuner that's* ***bigger*** *than your radio.*

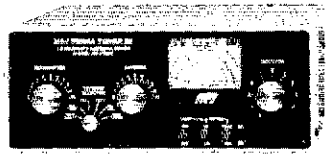
Your very best value

The MFJ-949D gives you your very best value, first-rate performance, proven reliability and the best guarantee in ham radio . . . all from the *most trusted* name in antenna tuners. Don't settle for less. Get yours today!

MFJ's 1500 Watt Tuner

MFJ-962C

$229.95



For a *few* extra dollars the MFJ-962C lets you use your barefoot rig now and have the capacity to add a 1.5 KW PEP linear amplifier later. It covers 1.8 to 30 MHz.

You get MFJ's *new* ***peak*** and average reading Cross-Needle SWR/Wattmeter.

You also get a 6-position antenna switch and a teflon wound balun with ceramic feed-thru insulators for balanced lines. Measures just 10¾x4½x14 7/8 inches.

How can an American manufacturer like MFJ give you more tuner for your money than clearing houses for foreign competition?

MFJ tuners are made in America.

Here's how MFJ gives you more tuner for your money than *any* clearing house for foreign competition.

MFJ builds every tuner cabinet from scratch using the latest high-speed computer controlled punch presses.

MFJ manufactures, assembles and tests every PC board that goes into MFJ tuners.

Instruction manuals and other materials are printed in MFJ's print shop.

MFJ tuners go directly from our factory to your dealer. We're not just an importer adding profits, tariffs and import charges.

With MFJ's efficient in-house manufacturing and straight to your dealer distribution you get the most tuner for your money.

WHY CHOOSE AN MFJ TUNER?

Hard-earned Reputation: There's just no shortcut. *MFJ is a name you can trust* -- more hams trust MFJ tuners throughout the world than all other tuners combined.

Proven Reliability: *MFJ has made more tuners for more years than anyone else* -- with MFJ tuners you get a highly-developed product with proven reliability.

First-rate Performance: MFJ tuners have earned their reputation for being able to match just about anything -- *anywhere.*

One full year *unconditional* guarantee: That means we will repair or replace your tuner (at our option) *no matter what* for a full year.

Continuing Service: MFJ Customer Service Technicians are available to help you keep your MFJ tuner performing flawlessly -- no matter how long you have it – just call 601-323-5869.

Your very best *value:* MFJ tuners give you the most for your money. Not only do you get a *proven* tuner at the lowest cost -- you also get a one year *unconditional* guarantee and *continuing* service. That's how MFJ became the world's leading tuner manufacturer -- by giving *you* your very best *value.*

Choose your MFJ tuner with confidence! You're getting proven performance and reliability from the most trusted name in antenna tuners. Don't settle for less.

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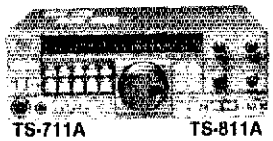

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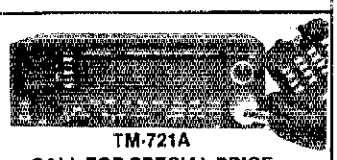

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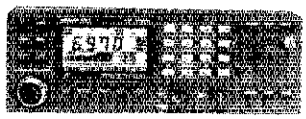

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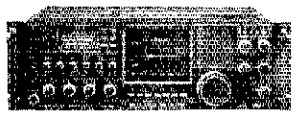

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- Band Stacking Registers

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RS7A	5	7	59
RS12A	9	12	79
RS20A	16	20	99
RS20M	16	20	119
RS35A	25	35	159
RS35M	25	35	179
RS50A	37	50	229
RS50M	37	50	249

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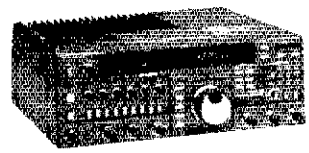

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2-117	2M	10-170W	$299.00
2-417	2M	45-170W	$299.00
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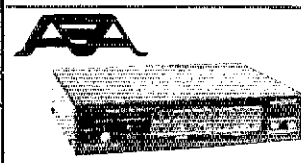

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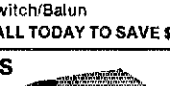

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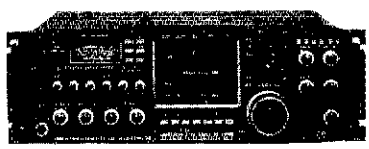

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HF Equipment	List	Juns
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IC-765 New, Loaded with Features	3,149.00	Call $
IC-735 Gen. Cvg Xcvr	1099.00	Call $
IC-751A Gen. Cvg. Xcvr	1699.00	Call $
IC-725 New Ultra-Compact Xcvr	949.00	Call $
IC-575A 10m/6m Xcvr	1399.00	Call $
Receivers		
IC-R7000 25-1300+ MHz Rcvr	1199.00	Call $
IC-R71A 100 kHz-30 MHz Rcvr	999.00	Call $
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IC-228A/H New 25/45w Mobiles	509./539.	Call $
IC-275A/H 50/100w All Mode Base	1299./1399.	Call $
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IC-2GAT, New 7w HT	429.95	Call $
IC-2SA New Micro Sized HT	419.00	Call $
IC-900 Six Band Mobile	639.00	Call $
IC-901 New Remote Mount Mobile	TBA	Call$
UHF		
IC-475A/H 25/75w All Modes	1399./1599.	Call $
IC-48A FM Mobile 25w	509.00	Call $
IC-4GAT, New 6w HT	449.95	Call $
IC-04AT FM HT	449.00	Call $
IC-32AT Dual Band Handheld	629.95	Call $
IC-3210 Dual Band Mobile	739.00	Call $
IC-2500A FM, 440/1.2 GHz Mobile	999.00	Call $
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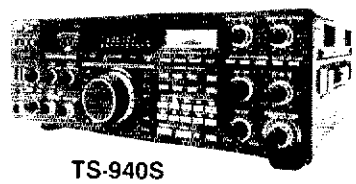
IC-375A All-Mode, 25w, Base Sta.	1399.00	Call $
IC-38A 25w FM Xcvr	489.00	Call $
IC-37A FM Mobile 25w	499.00	Call $
1.2 GHz		
IC-12GAT Super HT	529.95	Call $



TS-940S

HF Equipment	List	Juns
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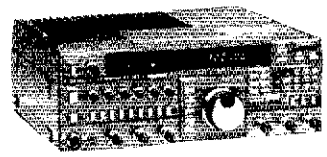
TS-440S/AT Gen. Cvg Xcvr	1449.95	Call $
TS-140S Compact. Gen. Cvg Xcvr	949.95	Call $
TS-680S HF Plus 6m Xcvr	1149.95	Call $
TL-922A HF Amp	1749.95	Call $
Receivers		
R-5000 100 kHz-30 MHz	1049.95	Call $
R-2000 150 kHz-30 MHz	799.95	Call $
RZ-1 Compact Scanning Recv.	599.95	Call $
VHF		
TS-711A All Mode Base 25w	1059.95	Call $
TR-751A All Mode Mobile 25w	669.95	Call $
TM-231A Mobile 50w FM	459.95	Call $
TH-215A, 2m HT Has It All	399.95	Call $
TH-25AT 5w Pocket HT NEW	369.95	Call $
TM-721A 2m/70cm; FM, Mobile	729.95	Call $
TM-621 2m/220, FM, Mobile	729.95	Call $
TM-701A 25w, 2m/440 Mobile	599.95	Call $
TH-75A 2m/70cm HT	TBA	Call $
UHF		
TS-811A All Mode Base 25w	1,265.95	Call $
TR-851A 25w SSB/FM	771.95	Call $
TM-431A Compact FM 35w Mobile	469.95	Call $
TH-45AT 5w Pocket HT NEW	389.95	Call $
TH-55 AT 1.2 GHz HT	524.95	Call $
TM-531A Compact 1.2 GHz Mobile	569.95	Call $
220 MHZ		
TM-3530A FM 220 MHz 25w	519.95	Call $
TM-321A Compact 25w Mobile	469.95	Call $
TH-315A Full Featured 2.5w HT	419.95	Call $



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HF Equipment	List	Juns
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FT-757 GX II Gen. Cvg Xcvr	1129.95	Call $
FT-767 4 Band New	1929.00	Call $
FL-7000 15m-160m Solid State Amp	1995.00	Call $
Receivers		
FRG-8800 150 kHz - 30 MHz	759.95	Call $
FRG-9600 60-905 MHz	699.95	Call $
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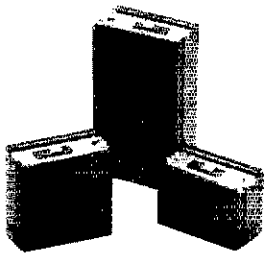

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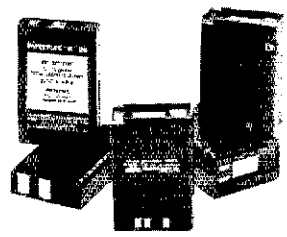

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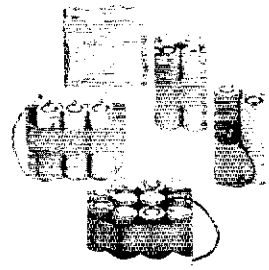

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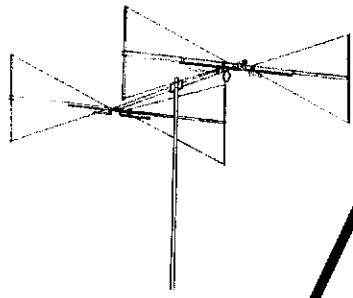

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FOR SALE: AEA PK-232, like new, latest ROM update, $275; homebrew, 1 KW antenna tuner w/roller inductor, $100; Realistic Pro-2020 20 channel scanner, exe. cond., $75; Atari 800XL computer (new, never used), $75; Keytronics 5151 keyboard (like new), $60; 12 inch green screen monitor (like new), $40; TI keyboard for CW6805 keyer, $2; Coleco Adam keyboard for CW6870I keyboard, $20; Cauzin Softstrip reader, $100. Buyer ships. Paul K. Pagel, N1FB, 4 Roberts Road, Enfield, CT 06082, tel. 203-666-1541 9 AM to 5 PM.

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GSC 550 MHz Frequency Counter, $130; Function Generator, $30; Tektronix Oscilloscope Probes, $22.50. Send LSASE for list of equipment for sale. Kirk Ellis, KK4YP, 18 Foxfire, Selma, NC 27576.

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FOR SALE: Yaesu FT102 with Fan also FV102DM VFO and MD1 Dynamic Mike $480, Ameritron RCS84 Remote Coax Switch $45, Yaesu YO101 Monitor Scope $75, Autek Electronic Keyer with memory expand $60, Yaesu YP150 Dummy Load Wattmeter $50, Palomar Engineers M827 Automatic SWR and Power Meter $35, Trac-One TE424 CW Processor $15, MFJ401B Econo Keyer II $5, Drake TV3300LP Lo-Pass Filter $20, Bencher Iambic Paddle (chrome) $35, Vibroplex Iambic Paddle (gray) $30. You pay shipping. KB4PQ, 407-674-2496.

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SELL: Kenwood TS-830, new finals, orig. carton, manual, $600 plus shipping. K3YKM, 215-687-1687.

PHOENIX, Arizona Ham Home and Antenna Farm For Sale. The home is a beautiful large 3 bedroom, 1-3/4 bath, sunken livingroom in NW Phx., near Metro Shopping Center. The antenna system is one of the best in the state. The tower is a Tri-Ex HZ471N with a 20' extension. The 10M beam is a Wilson M104 at 87' and the 15-20M beam is a Wilson DB54-5 elements on 20M-4 elements on 15M on a 40' boom, also a Hy-Gain 18HT vertical and a 22 element 2M beam and vertical. Dick Small, WA7VUU, 1-602-938-4939.

LATE Round KWM2A, 516F2, excellent condition with Dial Brake, $895. Schaaf, Box 627, Marion, OH 43302, 1-614-389-4960.

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WANTED—Heathkit HW-99 Transceiver, SP-99 Speaker, HM-9 Wattmeter, HFT-9-A Antenna Tuner. Dave Landino, 29 Patterson Road, Hamden, CT 06518.

WANTED: Ten-Tec Accessories: 234 Processor and Mike, 206A Calibrator, 10 Meter Crystals and 50W Linear (for Argonaut). Rick, AA4GC, 3237 Cranleigh, Tallahassee, FL 32308, 904-893-9682.

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WANTED: Kenwood IF-232C Translator; SB-110 6-Mtr. Transceiver. WB2WPM, 716-675-5797 or FAX 716-862-4176.

WANTED—Ten Tec Argosy II 525D. State price, condition, phone number first letter. Russ, W8OZA, 1411 Lonsdale Road, Columbus, OH 43232, 614-866-2406.

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KENWOOD TS830S w/Filters, SP230 Speaker, Remote VFO230, Station Monitor SM220 w/Adapter, MC50 Mic and more. All or none, $800. Bill, AA6BZ, 4309 Ironwood Drive, Chino, CA 91709, 714-597-4982.

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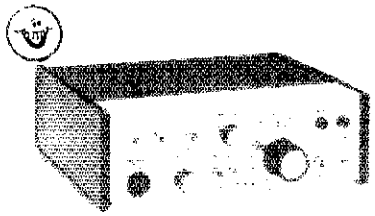

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CQ de W8FZ. 5" x 8" metal chassis (four ¼" feet on bottom) with a 5" x 8" x 2" wood grain finish metal cabinet. Used but in excellent condition. Ideal container for that special project. Included on chassis, but not guaranteed (most checked have worked) are a 115 VAC power cord, 24 volt transformer, 22.3 volt regulated DC P/S, and a frequency converter (converts 50-300 MHz to TV channel 2). $4.95 plus $3 S&H. Two for $8 plus $6 S&H. Three for $11 plus $9 S&H. Available continental US only. L. Blackstone, Rt. 6, Box 97, Milton, FL 32570.

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SOMMER XP-707 Beam, never assembled, $700. Heath SB-300, $75. Dead Heath TX-1, $25. Pick-up only. Mike, W5FTD, Ft. Worth, 817-274-0595 nights/weekends.

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FOR SALE: Harvey Wells TBS-500, with crystals, power supply and crystal mike, AM & CW, 50 watt, antique, excellent condition. W9PHF, 2747 Brookview Drive, Green Bay, WI 54313, 414-434-2948.

FOR SALE: Drake SPR-4 Solid State Receiver. Good condition. Ham and short-wave bands. $250. Heath HW-99 for HF Novice. $150. AD7I, P.O.B. 205, Holmdel, NJ 07733-0205.

40' ROHN Foldover Tower and 3 Element Tribander with Rotator. You take down. Brookfield, CT. Porges, 212-689-3385 after 6.

WANTED: mint Brown Brothers CTL, BTL, UTL, ST, and Iambic Memory Keyer. NCØN, 316-421-8468, callbook.

DRAKE—moving must sell TR-7 with Fan, AUX-7, NB-7, PS-7 with Fan, MN-75, SP-75, RV-75, 6, 2.3, 1.8, and .5 KHz Filters, Drake Microphone. All mint condition-no modifications-with original cartons, operating and service manuals. All connecting cables. $700. Prefer you pick up or ship at your expense. Ben, W2GUP, 44 Murray Hill Terrace, Marlboro, NJ 07746, 201-972-8692.

WANTED: Military Surplus Radio Equipment. We need R.F. Harris Corp., Model RF-280 Transceiver, RF-281 Antenna Coupler, RF-280 Module Boards, URC-94 Transceiver, also need ARC-164, ARC-150, ARC-159 Radios. Top dollar paid or trade for new amateur gear. Write or phone Bill Slep, 704-524-7519. Slep Electronics Company, Highway 441, Otto, NC 28763.

WANTED: a Drake Noise Blanker Model 4NB and 1.5 and .25 Filter. Call or write. John, KØJT, 314-631-7910.

SELL, Trade, or Deal MFJ Artificial Ground ($50) hardly used. Palomar Engineers Noise Bridge ($35). Looking for battery operated keyboard sender (commercially made-Heath ok) or portable antenna. Call Ed, eve 1-718-575-9885.

FREE 2000 pounds modified vacuum-tube type transmitting gear. Rumble, 912-994-6845.

HEATH SB-104A Solid State Transceiver, been dormant for five years, needs attention, with SB-604 Power Supply and SB-644 External VFO. Any reasonable offer. Lew Prescott, W1RFQ, 15 Loring Drive, Lincoln, RI 02865, 401-725-9887.

LIKE to trade an excellent Kenwood TS-830S for an excellent Kenwood 440S or ICOM 735. N7HOL, 505-835-3346.

DIPOLE/QUAD Wire: New Hybrid Product, 168 strand copper "Flex-Weave," #14, strong, flexible, non-stretch, won't rust/kink like copper weld. $34 first 275' (minimum), $.12/ft. thereafter, includes shipping. Davis RF, P.O. Box 230-Q, Carlisle, MA 01741, 508-369-1738.

BEAM Headings, DX and WAS, from your QTH $7. Wagner, WD8SBB, 855 North Willowglen, Tipp City, OH 45371.

KENWOOD TM411-A $200, Santec ST 442 and Drop In Charger $130, Kantronics Packet Communicatior Version 2.8 $85, Vibroplex Standard Key $30, AEA CK-1 Keyer $40. KJ6NW, 90 Edgewood Drive, Oroville, CA 95966.

WANTED: Hallicrafter HT6 Transmitter, Howard 430-435 Receiver, Coils for HT6, Ten Tec Modules, Signalizer, 833A, 845, 849B, 805 Tubes, Sockets. K4UJZ, 608 W. Thompson Lane, Murfreesboro, TN 37129, 615-893-5344.

C64-128 SOFTWARE: 1000s of programs for ham, education, utilities, games. $3.50 to $5 per disk. SASE for catalog. Manna Software, 15426 Yukon Avenue, Lawndale, CA 90260.

TOWER—Heavy Duty Rohn Commercial Grade, 55' Crankup, $500. K2LCU, 914-941-1000.

WANTED: Dead or Barely Alive Heath HW101 and PS. Write N1EBA.

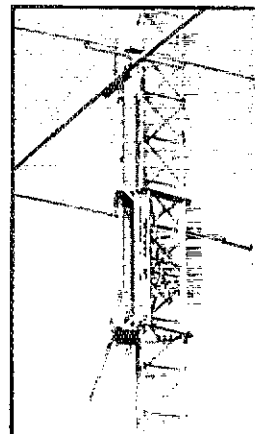
ANTENNA Parts Catalog, Lowest Prices: Dipole/Quad/Ground Radial Wire, Insulators, Flexweave #14-168 Strand, Center Feeds, Open Wire Feed Line Coax, Remote Coax Switches, Relays. Catalog: $2. Davis RF, P.O. Box 230-Q, Carlisle, MA 01741, 508-369-1738.

JOBS FOR HAMS

TELECOMMUNICATIONS Expert, 11 yrs. experience in communications system engineering. Fluent in French and German. US Government's highest radio license. Computer/Satellite/Data Transmission my specialties. Charles E. Martin, AB4Y, 1605 Singletree Way, Bowling Green, KY 42103-1425.

SENIOR Field Engineer: Cellular One Of Galveston seeking technical manager with knowledge of cellular, microwave, telephony. Minimum 3 years experience. FCC/NABER a plus. Relocation required. Resumes to 3128 Broadway, Galveston, TX 77550.

RECREATION Director: 11 years experience with children, elderhostel groups, scouting, programming, camping, outdoor education skills, amateur (ham) radio, stone carving and crafts, computers. C. Bindrim, Route 2, Box 157, Riceville, TN 37370, tel. 615-745-7465.



SAVE TIME and MONEY with THE HAZER

Bring things down for safety and convenience.

Never climb your tower again with this elevator system. Antennas and rotator mount on HAZER, complete system trams tower in vertical upright position. Safety lock system operates while raising or lowering. Never can fall.

Complete kit includes winch, 100 ft. of cable, hardware and instructions. For Rohn 20 and 25 G Towers.

Hazer 2-Heavy duty alum. 12 sq. ft. load	**$311.95 ppd.**
Hazer 3-Standard alum. 8 sq. ft. load	**$223.95 ppd.**
Hazer 4-Heavy galv. steel 16 sq. ft. load	**$291.95 ppd.**

NEW for ROHN 45 and 55 Towers

Hazer 8-Heavy duty galv. steel 16 sq. ft. load	CALL
Ball Thrust Bearing TB-25 for any of above	$64.50 ppd.

Send for free details of aluminum towers specifically engineered for use with the Hazer. Two sizes: M-13 (13" wide) and M-18 (18" wide). All bolted construction, no welds. Easy to install hinge base, walk up erection. Complete tower UPS or air freight shippable. Pre-assembled or kit form.

Satisfaction guaranteed. Call today and charge to Visa, MasterCard or mail check or money order.

GLEN MARTIN ENGINEERING INC.
Rte 3, Box 322
Boonville, MO 65233
(816) 882-2734 FAX 816-882-7200

THE ARRL DXCC COUNTRIES LIST

- COMPLETE DXCC RULES
- SHOWS COUNTRIES WHERE CARDS MAY BE SENT THROUGH THE ARRL OUTGOING QSL BUREAU
- LISTS ITU AND CQ ZONES PLUS THE CONTINENT OF EACH COUNTRY
- CHECK-OFF BOXES FOR MIXED, PHONE, CW, RTTY, SATELLITE, AND FOR EACH BAND.

Now keep all of your DXCC records on this handy and complete 16 page book. Available postpaid for $1.00 a copy.

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Bruce O. Williams, WA6IVC, Advertising Manager
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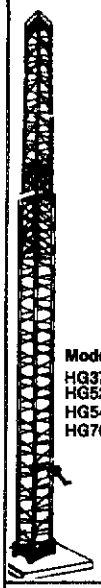
203-667-2494 is a direct line, and will be answered only by Advertising Department personnel.

Index of Advertisers

ANTENNA/TOWER SALE!



hy-gain

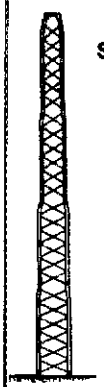
CRANKUP SALE!

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	$CALL
HG52SS	52 ft	9 sq ft	$CALL
HG54HD	54 ft	16 sq ft	$CALL
HG70HD	70 ft	16 sq ft	$CALL

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

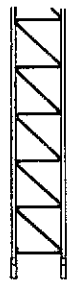
- All Steel Construction—Rugged
- Galvanized Finish—Long Life
- Totally Free Standing—No Guy Wires
- America's Best Tower Buy—Compare Save $
- Complete With Base and Rotor Plate
- In Stock Now—Fast Delivery

Model	Height	Ant Load*	Weight	Delivered Price*
HBX40	40 ft	10 sq ft	228	$449
HBX48	48 ft	10 sq ft	303	$589
HBX56	56 ft	10 sq ft	385	$699
HDBX40	40 ft	18 sq ft	281	$569
HDBX48	48 ft	18 sq ft	363	$689

*Your Total Delivered Price Anywhere in Continental 48 States. Antenna Load Based on 70 MPH Wind.

ROHN

Guyed Tower Packages



- World Famous Rohn Quality and Dependability
- Rugged high wind survival provides safe installation
- Multi purpose towers satisfy a wide range of needs
- Complete packages include: guy hardware, turnbuckles, guy assemblies, concrete base, rotor plate and top section per manufacturers specs.

Packages shown below are rated for 70 mph wind zone. 90 mph wind zone packages slightly higher. All tower packages shipped freight collect from our Plano, TX warehouse, in stock for prompt delivery.

	Model 25G	Model 45G	Model 55G
50'	$839	$1499	$1939
60'	929	1679	2169
70'	1129	1879	2399
80'	1199	2199	2799
90'	1279	2369	2999
100'	1629	2569	3239
110'	1629	2979	3449
120'	1699	3149	3699

US TOWER CORPORATION

These rugged crankup towers and masts now available from Texas Towers!

Check these features:
- All steel construction
- Hot dipped galvanized
- Totally self-supporting-
- No guys needed

Coax arms, Thrustbearings Masts, Motor drives, Remote controls, Hinged bases, Rotor bases, & Raising fixtures also in stock.

CALL FOR SALE PRICES!

Model	Min.Ht.	Max.Ht.	Ant.load*	Sale price
MA40 mast	21'	40'	10 sq ft	$529
MA550 mast	22'	50'	10 sq ft	919
TX438	22'	38'	18 sq ft	1385
TX455	22'	55'	18 sq ft	2279
TX472	23'	72'	18 sq ft	2279
HDX555	22'	55'	30 sq ft	2079
HDX572	23'	72'	30 sq ft	3559

Note-US Towers Shipped Freight Collect From Visalia, CA Factory

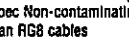
**Note-towers rated at 90 mph to EIA specifications*

RG-213U

$.39/ft $379/1000 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



$.22/ft $209/1000 ft.

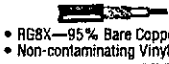
- RG8X—95% Bare Copper Shield • Low Loss
- Non-contaminating Vinyl Jacket Foam Dielectric

9086

$.45/ft $439/1000 ft.

- Same Specs as Belden 9913
- Lower loss than RG8U
- 100% shielded-braid & foil

HARDLINE/HELIAX®



Lowest Loss for VHF/UHF!

½" Alum. w/poly Jacket.....$.79/ft.
½" LDF4-50 Andrew Heliax®.....$1.99/ft.
⅞" LDF5-50 Andrew Heliax®.....$4.99/ft.
select connectors below

Heliax® is a Registered Trademark of the Andrew Corp.

Coaxial Cable Loss Characteristics (DB/100 ft)

Cable Type	Imped.	10MHz	30MHz	150MHz	450MHz
RG-213/U	50	.6	.9	2.3	5.2
RG8X	52	.8	1.2	3.5	5.8
9086	50	.4	.64	1.7	3.1
½" Alum	50	.3	.5	1.2	2.2
½" Heliax	50	.2	.4	.9	1.6
⅞" Heliax	50	.1	.2	.5	.9

HELIAX® CONNECTORS

Cable Type	UHF FML	UHF MALE	N FML	N MALE
½" Heliax®	$29	$29	$29	$29
⅞" Heliax®	$55	$55	$55	$55

COAX CONNECTORS

Amphenol Silver PL259.....$1.50
UG21B N Male.....$3.50
9086/9913 N Male Connector.....$4.95

ANTENNA WIRE & ACCESSORIES

Stranded Copper 14ga.....$.10/ft.
¼ mile 18ga copper-clad steel wire.....$30
Dog bone end insulator.....$.79 ea.

Van Gordon

1:1 Balun.....$15 Center Insulator.....$8
Dipole Kits.....D80 $31.95/D40 $28.95
Short Dipole Kits.....SD80 $35.95/SD40 $33.95
All-band Dipole w/ladder line.....$29.95
G5RV all band antenna.....$49.95

ALPHA DELTA

DX-A 160-80-40 Sloper.....$49

CUSHCRAFT

A3 3-el Tribander.....
A4S 4-el Tribander Beam w/S.S. Hdwre.....
A743 & A744, 30/40 mtr KIT for the A3 & A4.
R4 20-10 mtr Vertical.....
AP8 80-10 mtr Vertical.....
AV5 80-10 mtr Vertical.....
D40 40 mtr Dipole.....
40-2CD 2-el 40 mtr Beam.....
A50-5 5-el 6 mtr Beam.....
215 WB NEW 15-el 2 mtr Beam.....
230 WB NEW 30-el 2 mtr Beam.....
4218 XL 18-el 2 mtr Beam.....
3219 19-el 2 mtr Beam.....
424B 24-el 432 MHz Beam.....
ARX2B 2 mtr Vertical.....

CALL FOR SPECIAL PRICES!

hy-gain

Discoverer 2-el 40-mtr Beam.....
Discoverer 3-el Conversion Kit.....
EXPLORER-14 SUPER-SPECIAL.....
QK710 30/40 mtr. Add-On-Kit.....
V2S 2-mtr Base Vertical.....
V4S 440MHz Base Vertical.....
TH5MK2S Broad Band 5-el Triband Beam.
TH7DXS 7-el Triband Beam.....
TH3JRS 3-el Triband Beam.....
205BAS 5-el 20-mtr Beam.....
155BAS 5-el 15-mtr Beam.....
105BAS 5-el 10-mtr Beam.....
204BAS 4-el 20-mtr Beam.....
64BS 4-el 6-mtr Beam.....
12 AVQ 20-10 mtr vertical.....
14 AVQ 40-10 mtr vertical.....
18 AVT/WB 80-10mtr Vertical.....
18HTS 80-10 mtr Hy-Tower Vertical.....
23BS 3-el 2 mtr Beam.....
25BS 5-el 2 mtr Beam.....
28BS 8-el 2 mtr Beam.....
214BS 14-el 2-mtr Beam.....
2BDQ 80/40 mtr Trap Dipole.....
5BDQ 80-10 mtr Trap Dipole.....
BN86 80-10 mtr KW Balun W/Coax Seal

CALL FOR SPECIAL PRICES!

HUSTLER

6BTV 80-10 mtr Vert $149 5BTV 80-10 mtr Vert $129
4BTV 40-10 mtr Vert $99 G7-144 2-mtr Base $129
G6-144B 2-mtr Base $89

Mobile Resonators	10m	15m	20m	40m	75m
400W Standard	$16	$17	$19	$22	$26
2KW Super	$20	$22	$25	$29	$39

Bumper Mounts - Springs - Folding Masts In Stock!

BUTTERNUT ELECTRONICS CO

HF6VX 80-10m Vertical $149 Delivered
- Full Legal Power
- Highest Q Tuning Circuits

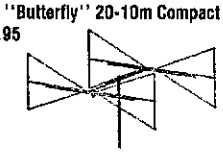
HF2V 80-40m Vertical $139 Delivered
- Full Legal Power
- Automatic Band Switching

Accessories:
RMK II Roof Mtg. Kit.....$55
STR II Stub-Tuned Radials.....$35
TBR160 160m Coil Kit.....$55
30m Add-on Kit.....$35
17/12m Add-on Kit.....$35

HF6V HF2V

FREE UPS on ACCESSORIES when purchased with antenna

HF5B "Butterfly" 20-10m Compact Beam $229.95



- Unique Design Reduces Size
- No Lossy Traps
- Turns w/TV Rotor
- Boom Length 6 Feet
- Element Length 12.5 Feet

FREE UPS Shipping in Continental USA

MIRAGE/KLM

KT34A 4-el Broad Band Triband Beam.....$419
KT34XA 6-el Broad Band Triband Beam.....$619

ROTORS

Alliance HD73 (10.7 sq. ft. rating).....$129.95
Alliance U110 (3 sq. ft. rating).....$49
Telex CD 4511 (8.5 sq. ft. rating).....$Call
Telex HAM 4 (15 sq. ft. rating).....$Call
Telex Tailtwister (20 sq. ft. rating).....$Call
Telex HDR300 Heavy Duty (25 sq. ft. rating).$Call

ROTOR CABLE

Standard 8 cond cables $.25/ft (vinyl jacket 2-#18 & 6-#22 ga)
Heavy Duty 8 Cond cable $.45/ft (vinyl jacket 2-#16 & 6-#18 ga)

ROHN GUYED TOWER SECTIONS

10 FT. STACKED SECTIONS
20G.....$54.50 45G.....$153.50
25G.....$65.50 55G.....$197.50

ALL ACCESSORIES IN STOCK—CALL

ROHN FOLDOVER TOWERS

Model	Height	Ant. Load*	Price
FK2548	48 ft.	15.4 sq. ft.	CALL FOR PRICES
FK2558	58 ft.	13.3 sq. ft.	
FK2568	68 ft.	11.7 sq. ft.	
FK4544	44 ft.	34.8 sq. ft.	
FK4554	54 ft.	29.1 sq. ft.	
FK4564	64 ft.	28.4 sq. ft.	

25G Double Guy Kit.....$299.
45G Double Guy Kit.....$319.

*Above antenna loads for 70 mph winds w/guys at hinge and apex. All foldover towers shipped freight prepaid in 48 states. Prices 10% higher west of Rockies.

TOWER/GUY HARDWARE

3/16 EHS Guywire (3900 lb rating)	$.15/ft
1/4 EHS Guywire (6850 lb rating)	$.18/ft
5/16 EHS Guywire (11,200 lb rating)	$.29/ft
5/32 7 x 7 Aircraft Cable (2700 lb rating)	$.15/ft
3/16 CCM Cable Clamp (3/16" or 5/32")	$.45
1/4 CCM Cable Clamp (1/4" Cable)	$.55
1/4 TH Thimble (fits all sizes)	$.45
3/8EE (3/8" Eye & Eye Turnbuckle)	$6.95
3/8EJ (3/8" Eye & Jaw Turnbuckle)	$7.95
1/2 x 9EE (1/2" x 9" Eye to Eye Turnbuckle)	$9.95
1/2 x 9EJ (1/2" x 9" Eye & Jaw Turnbuckle)	$10.95
1/2 x 12EE (1/2" x 12" Eye & Eye Turnbuckle)	$12.95
1/2 x 12EJ (1/2" x 12" Eye & Jaw Turnbuckle)	$13.95
5/8 x 12EJ (5/8" x 12" Eye & Jaw Turnbuckle)	$16.95
3/16" Preformed Guy Grip	$2.49
1/4" Preformed Guy Grip	$2.99
6" Diam - 4 ft Long Earth Screw Anchor	$19.95
500 D Guy Insulator (5/32" or 3/16" Cable)	$1.69
502 Guy Insulator (1/4" Cable)	$2.99
5/8" Diam - 8 ft Copper Clad Ground Rod	$12.95

PHILLYSTRAN GUY CABLE

HPTG2100 Guy Cable (2100 lb rating)	$.32/ft
HPTG4000 Guy Cable (4000 lb rating)	$.52/ft
HPTG6700 Guy Cable (6700 lb rating)	$.72/ft
9901LD Cable End (for 2100/4000 cable)	$9.95
9902LD Cable End (for 6700 cable)	$11.95
Sockelfast Potting Compound (does 6-8 ends)	$16.95

GALVANIZED STEEL MASTS

Heavy Duty Steel Masts 2 in OD - Galvanized Finish

Length	5 FT	10 FT	15 FT	20 FT
12 in Wall	$29	$49	$69	$89
18 in Wall	$49	$89	$129	$149
25 in Wall	$69	$129	$189	$249

ORDER TOLL FREE 1-800-272-3467

Texas, Alaska & for information 1 (214) 422-7306

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Div. of Texas RF Distributors Inc. 1108 Summit Ave., Suite 4 • Plano, Texas 75074

(Prices & Availability Subject To Change Without Notice) *(Antenna/tower product prices do not include shipping unless noted otherwise)*

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Missouri Radio Center

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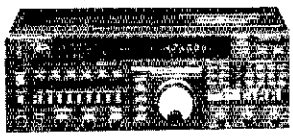
TS-940 "DX-CELLENCE"
- All Band, All Mode Transceiver
- Direct Keyboard Entry
- Engineered for the DX-Minded and Contesting Ham
- Its Got It All!

YAESU



FT-767GX HF/VHF/UHF BASE STATION
- Add Optional 6m, 2m & 70cm Modules
- Dual VFO's
- Full CW Break-in
- Lots More Features

ICOM NEW!

IC-765 NEW HF TRANSCEIVER
- Built-in Automatic Antenna Tuner and Power Supply
- 99 Memories • 100 W Output
- 160-10M/General Coverage Receiver
- Band Stacking Registers

uniden

SCANNERS

BC-100 XLT	$189.
BC-200 XLT	259.
BC-590 XLT	199.
BC-760 XLT	269.
BC-800 XLT	229.
HR-2600 (10 meters)	295.

KENWOOD

TS-140S AFFORDABLE DX-ing!
- HF Transceiver With General Coverage Receiver
- All HF Amateur Bands
- 100 W Output
- Compact, Lots of Features

YAESU

NEW!

FT-736R VHF-UHF BASE STATION
- SSB, CW, FM on 2 Meters and 70 cm
- Optional 50 MHz, 220 MHz or 1.2 GHz
- 25 Watts Output on 2 Meters, 220 and 70 cm
- 10 Watts Output on 6 Meters and 1.2 GHz • 100 Memories

ICOM IC-725

NEW ULTRA-COMPACT HF TRANSCEIVER

NEW!
- USB/LSB/CW, AM Receive Optional Module for AM Transmit and FM TX/RX
- 160-10M Operation • 100 W Output
- Receive 30 kHz to 33 MHz
- 26 Memories with Band Stacking Registers

AEA CP-100

Complete Terminal Unit for Morse, Baudot, ASCII, AMTOR

NOW ½ PRICE CLOSEOUT SPECIAL
ONLY $169. DELIVERED
Software Available
Call Now—Don't Delay

KENWOOD

220 MHz SALE

TH-315A 2.5W, FM HANDHELD

TM-621A 2M/220, 45/25W MOBILE

TM-321A 25W, FM TRANSCEIVER

YAESU

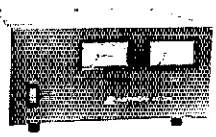
FT-212 RH

THE "ANSWERING MACHINE" 2 METER MOBILE
- 45 Watts Output • 10 Memories
- Multiple Scanning Routines
- Hi/Lo Power Switch

ICOM

IC-2GAT
IC-4GAT
2 Meter & 440 Handhelds
- IC-2GAT RX 138-174 MHz TX 140-150 MHz 7 Watts
- IC-4GAT 440-450 MHz 6 Watts

ASTRON



• RS7A $51	• RS35M . . $167
• RS12A . . . $75	• VS35M . . $179
• RS20A . . . $92	• RS50A . . $209
• RS20M . . $112	• RS 50M . $235
• VS20M . . $129	• RM50M . $259
• RS35A . . $149	• VS50M . . $245

KENWOOD

NEW!

TH-75A 2M/70CM DUAL BAND HT

- Receive 141-163.995 & 438-449.995 MHz
- One Watt Power on Each Band
- Monitor Both Bands at Same Time
- CTCSS Encode/Decode Built-In

YAESU

NEW!

FT-470 COMPACT DUAL BAND FM HANDHELD (2M/70CM)

21 Memories for Each Band
Dual VFO's for Each Band
Up to 5 Watts Power
Built-In CTCSS
Built-In 10-Memory DTMF Autodialer

ICOM

IC-32AT SUPER DUALBAND FM HANDHELD

- 5 Watt n Both Bands
- Receive 138-174 MHz 440-450 MHz
- Stores Standard and Odd Offsets

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Extra Savings on the **MFJ-1278** Multi-Mode Data Controller

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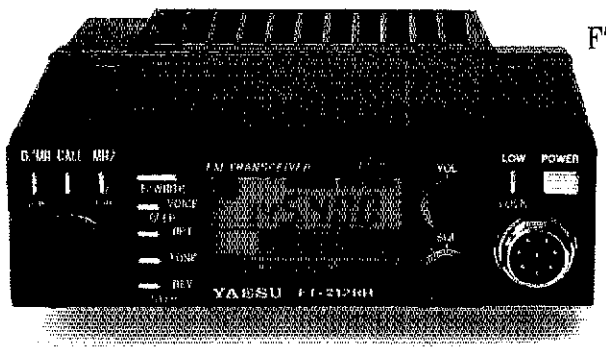
TWO OF AMERICA'S MOST POPULAR FM STATIONS.

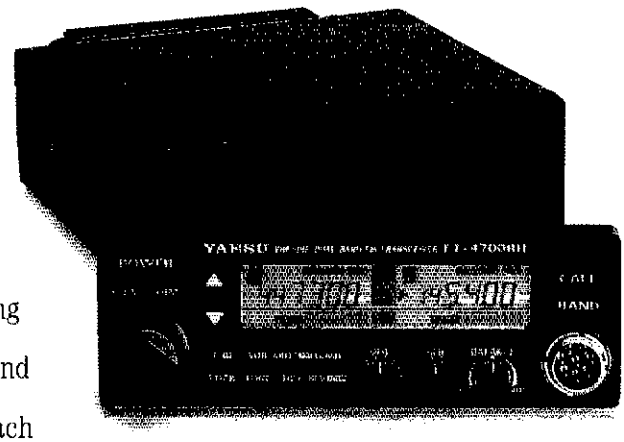


No wonder Yaesu's FT-212R Series and FT-4700RH mobiles are so popular.

Not only are the features unique and plentiful. The operation hassle-free. And the mounting options flexible. But also, each radio now features a built-in PL board. Plus *you* choose the optional mic that best fits your operating and budget needs.

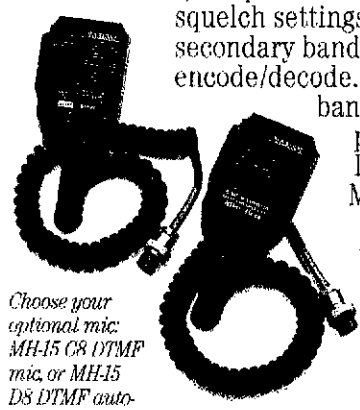
FT-212R SERIES. MOBILES THAT DOUBLE AS ANSWERING MACHINES.

Let the 2-meter FT-212R and 440-MHz FT-712R take messages while you're away (with DVS-1 option)! 45-watt output (35W on 440 MHz). Built-in PL encode/decode. 18 memories. Auto repeater shift. Scanning routines. Offset tuning from any memory channel. Extended receive. Audible command verification. High/low power switch. Oversize amber display. Choice of optional mic. More.



FT-4700RH. DUAL-BAND PERFORMANCE, REMOTE-HEAD DESIGN.

Mount the FT-4700RH almost anywhere—the "brains" on your dash, visor, or door; the "muscle" under your seat. 50 watts on 2 meters, 40 watts on 70 cm. Full crossband duplex. Simultaneous monitoring of each band, complete with independent squelch settings on the main and secondary bands. Built-in PL encode/decode. 9 memories (each band). Extended receive. Reverse repeater shift. High/low power switch. Patch cord for remote mounting. Bright LCD display. Backlit controls. Choice of optional mic. More.



Choose your optional mic: MH-15 C8 DTMF mic, or MH-15 D8 DTMF auto-dialer mic

Want more information? Call **(800) 999-2070** toll-free. Or ask your dealer about Yaesu's FT-212R Series and FT-4700RH mobiles today. Two of America's favorites.

YAESU USA 17210 Edwards Road, Cerritos, CA 90701 (213) 404-2700. **REPAIR SERVICE:** (213) 404-4884. **PARTS:** (213) 404-4847.

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All New Dual Bander

Two in the Hand!

TH-75A

2m/70cm Dual Band HT

The new TH-75A Dual Band HT from Kenwood is here now! Many of the award-winning features in our dual band mobile transceivers are designed into one hand-held package.

- **Dual Watch** function allows you to monitor both bands at the same time.
- **1.5 watts on 2 meters and 70cm: 5 watts when operated on 12 VDC (or PB-8 battery pack).**
- **Large dual multi-function LCD display.**
- **10 memory channels** for each band stores frequency, CTCSS, repeater offset, frequency step information, and reverse. A lithium battery backs up memories. Two memories for "odd split" operation.
- **Selectable full duplex operation.**
- **Extended receiver range:** 141–163.995 and 438–449.995 MHz; transmit on Amateur band only. (Modifiable for MARS and CAP. Permits required. Specifications guaranteed on Amateur bands only.)
- **Uses the same accessories as the TH-25AT (except soft cases).**
- **Volume and balance controls, plus separate squelch controls on top panel.**
- **Super easy-to-use!** For example, to recall memory channel, just push the channel number!
- **CTCSS encode/decode built-in!**
- **Automatic Band Change (ABC).** Automatically switches between main and sub band when signal is present.
- **Automatic offset selection on 2 meters.**
- **Tone alert system for quiet monitoring.** When CTCSS decode is on, the tone alert will function only when a signal with the proper tone is received.
- **Four ways to scan,** including ***dual memory scan,*** with time operated or carrier operated scan stop modes, and priority alert.
- **Automatic battery saver circuit extends battery life.**

- **Supplied accessories:** Dual band rubber-flex antenna, PB-6 battery pack, wall charger, belt hook, wrist strap, water resistant dust caps.

Optional Accessories

- **PB-5** 7.2 V, 200 mAh NiCd pack for 1.5 W output • **PB-6** 7.2 V, 600 mAh NiCd pack • **PB-7** 7.2 V, 1100 mAh NiCd pack • **PB-8** 12 V, 600 mAh NiCd for 5 W output • **PB-9** 7.2 V, 600 mAh NiCd with built-in charger • **BC-10** Compact charger • **BC-11** Rapid charger
- **BT-6** 6-cell AA battery case • **DC-1/PG-2V** DC adapter • **HMC-2** Headset with VOX and PTT • **SC-22 and SC-23** Soft case • **SMC-30/31** Speaker mics. • **WR-1** Water resistant bag.

Specifications and prices subject to change without notice or obligation.
Complete service manuals are available for all Kenwood transceivers and most accessories.

KENWOOD

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