Official Journal of
ARRL
The national association for AMATEUR RADIO

QST

devoted entirely to
AMATEUR RADIO

December 2000

QST reviews

- Patcomm PC-16000A HF transceiver
- RadioShack HTX-252 2-meter FM mobile

Field Day 2000 Results

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12
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There's something magical about amateur radio. The fact that you can speak into a little box and communicate with someone else on the other side of town, or even on the other side of the world, with nothing between you and that person but thin air...what an incredible, powerful feeling. It feels like magic.

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Great for Contesting and DX'peditions

Give your desktop station 1kW of power. Remote control head, 100% duty cycle, compact size. Can be used with almost any HF, 6M, or HF/6M rig - not just ICOM rigs.

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- IF Shift
- Auto Tuning Step
- Direct Frequency Input
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- Internal CW Keyer
- VOX
- Compact Size
- PC Programmable*

IC-746

Advanced HF performance w/6M & 2M

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- IF-DSP
- Front Panel Adjustable NR
- Audio Peak Filter
- Auto Notch Filter
- 3 Optional Filter Positions
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- VOX
- Auto Antenna Tuner
- PC Controllable*

Most ICOM rigs are PC programmable with select ICOM options

PC Ready!

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This new HF/6M rig pushes digital to new levels! With 32 bit IF-DSP

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- Twin Passband Tuning
- 5" TFT Color Display
- CW Memory Keyer
- VOX
- Auto Antenna Tuner
- PC Controllable*

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Pull out the weak signals!

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- All Mode
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- Dual Watch
- Adjustable AGC
- CW Keyer
- Auto Antenna Tuner
- VOX
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- Features all the Bells and Whistles
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- 200 Memories
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- Wide Rx†

IC-Q7A
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All ICOM HTs meet

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810 C/D/E
VIBRATION

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- Water Resistant

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Police radio rugged

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- Our most affordable

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December 2000 ♦ Volume 84 Number 12

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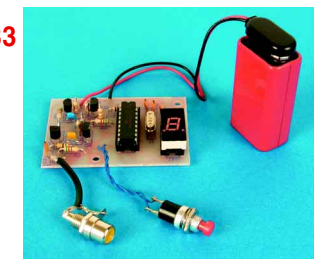

News and Features

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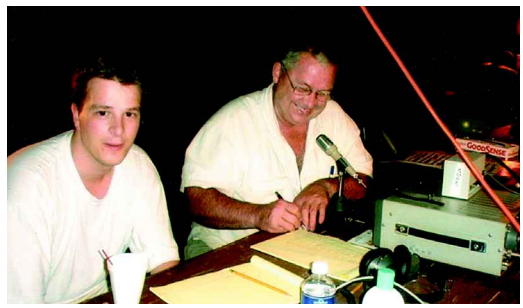
QST Workbench

Our Cover

Did you think Santa's elves made all the Christmas toys? Santa—also known as Bill Moore, NC1L, ARRL Century Club Manager—prefers a hands-on approach when it comes to "toys" for all the good ham girls and boys!



Operating

Departments

Membership in the ARRL, including a subscription to *QST*, is available to individuals at the following rates: $34 per year in the US and possessions, $47 Canada, $54 elsewhere, payable in US funds. Age 65 and over, with proof of age, $28 (US only). Licensed radio amateurs age 21 and under may qualify for special rates; write for application. Life membership is also available. Membership and *QST* cannot be separated. Fifty percent of dues is allocated to *QST*, the balance for membership. Subscription rate for libraries and institutions: $34 per year postpaid in the US and possessions, $47 Canada, $54 elsewhere. Single copies $5 in the US.

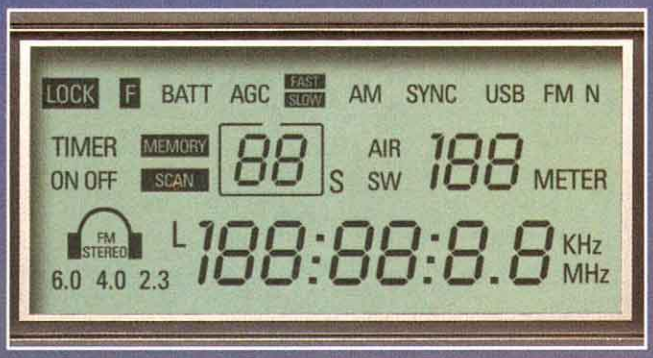
Membership without *QST* is available to the immediate family of a member living at the same address, and to anyone who is legally blind, for $5 per year.

Foreign remittances should be by international postal or express money order or bank draft negotiable in the US and for an equivalent amount in US funds.

QST is available to blind and physically handicapped individuals on audio cassette from the Library of Congress, National Library Service for the Blind and Physically Handicapped. Call 1-800-424-8567.

Indexed by Applied Science and Technology Index, Library of Congress Catalog Card No: 21-9421

GRUNDIG The Ultimate in



The LCD

Big! Bold! Brightly Illuminated 6" by 3½". Liquid Crystal Display shows all important data: Frequency, Meter band, Memory position, Time, LSB/USB, Synchronous Detector and more.

The Signal Strength Meter

Elegant in its traditional Analog design, like the gauges in the world's finest sports cars. Large. Well Lit. Easy to read.

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- For the traditionalist: a smooth, precise tuning knob, produces no audio muting during use.

Ultra fine-tuning of 50Hz on LSB/USB, 100Hz in SW, AM and Aircraft Band and 20 KHz in FM.

- For Fixed-step Tuning: Big, responsive Up/Down tuning buttons.
- For direct frequency entry: a responsive, intuitive numeric keypad.

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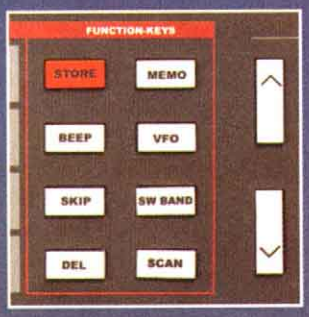

The Operational Controls
Knobs where you want them; Buttons where they make sense. The best combination of traditional and high-tech controls.

The Sound
Legendary Grundig Audio Fidelity with separate bass and treble controls, big sound from its powerful speaker and FM-stereo with the included high quality headphones.

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- Connectors for external antennas – SW, AM, FM and VHF Aircraft Band.
- Line-out, headphone and external speaker jacks.

The Power Supply
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PMC-200 Advanced Desk Mic: This desktop microphone features adjustable compression with a built-in analog meter to make adjustments easy! It has both locking and momentary PTT, and a graphic equalizer so you can tailor your on the air audio to your own personal tastes!

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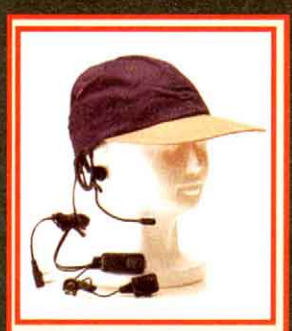
EH-1 / EH-2 Earphone for portable radios: The EH-1 / EH-2 Series provide comfort, privacy, and convenience. Simply plugs into the external speaker jack of most handheld radios. Available with either flesh colored cord (EH-1) or black colored cord (EH-2)



SPM-400 Series mini boom microphones: The SPM-400 series headsets include an in-the-ear speaker and a patented rubber-covered earloop design that adjusts to comfortably fit either the right or left ear of any user. The unit features an in-line Push-To-Talk switch that can be clipped to the user's lapel or belt, or the unit can be keyed remotely using an optional remote cord. The SPM-400 is available wired to fit most of today's popular handheld radios.

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"IT SEEMS TO US..."

What Have You Done to My *QST*?

For the greater part of its 85-year life span, *QST* has been a black-and-white publication. As printing technology improved, we were able to add color covers, color advertising and some color in the editorial section, but most of the articles and columns were black-and-white. Beginning with this issue, we're taking the final step — color throughout the editorial section.

Our *QST* production staff — the typographers and illustrators and graphic artists who work behind the scenes to assemble *QST*'s pages each month — have been working toward this colorful debut since the ARRL Board approved use of additional color in July. Bit by bit, they tried and evaluated dozens of small design decisions that lead to the final result you're holding in your hand.

Life happens in color. You've been watching color TV for decades. You probably wouldn't buy a monochrome monitor for your PC. Black-and-white photography, as stunning as it can be in the hands of a master, is becoming a lost art. Most magazines on the newsstand have color throughout the issue, and now your *QST* does too.

As we reviewed the completed page proofs for this issue, I was struck by the difference that a little color makes in the look and feel of each *QST* page. Photos of people and equipment jump off the page. Antenna plots with multiple traces on the same grid are easier to follow. Tables and graphs are easier to read. And, in response to requests from a number of you, we took this opportunity to increase the type size slightly as well.

Despite our new look, we don't anticipate major editorial changes in the immediate future. Our new columns and the Workbench section unveiled last January have been very well received. The "Short Takes" product reviews have been particularly popular.

Amateur Radio encompasses a wide variety of interests and activities. Some of you have been doing this forever. Others just joined our ranks. Many of you have been involved in some areas of ham radio for a while, but would like to try something new. We'll continue to do our best to find and publish articles that cover as many of these interests as possible.

What Have You Done to My Web Site?

Visitors to the ARRL Web site at **www.arrl.org/** were treated to a completely new look beginning October 2. The new design offers easier navigation and quick access to the most popular pages. In addition to the search engine and site index, there's now a drop-down menu system with links to nearly 100 of ARRLWeb's most popular features. If that seems like a lot of links, remember that there are about *6000* pages and downloadable files available to you on the site.

QST is a fine magazine, but it comes only once a month and is prepared pretty far in advance. If you want to know what's going on in ham radio *right now*, you can't beat the Internet. Recognizing that active ARRL members have an insatiable appetite for the latest ham radio happenings, we've moved the news stories to ARRLWeb's front page and post updates nearly every day. If you're a real news junkie, your League membership entitles you to sign up for automatic e-mail delivery of the weekly *ARRL Letter*, and you can sign up for e-mail delivery of a variety of W1AW bulletins. About 54,000 ARRL members get the *ARRL Letter* each week.

The new design reflects changes in the Internet and in Web browsers since our last major Web site redesign in 1997, when we added a Members Only area. We are, however, committed to keeping the site usable on a typical dial-up modem connection, supporting older browsers, and ensuring site accessibility for all users. Although some members have had a little trouble finding their favorite features using the new navigation system, an ARRLWeb poll shows that an overwhelming majority of visitors like the new design.

Finally, although it probably won't be obvious to the casual user, by the time you read this we will have moved ARRLWeb to a new location with redundant servers and multiple high-speed Internet connections. We took this step to ensure the highest Web site availability and reliability practical. For more on the "new" ARRLWeb, check out the article by Steve Ford, WB8IMY, beginning on page 51. If you haven't done so already, visit ARRLWeb and register for members-only features. You'll be in good company; more than 83,000 ARRL members are already enjoying this service.

We hope you like what we've done with your *QST* and your Web site. Please let us know what you think. We also hope that you'll read the interview with ARRL President Jim Haynie, W5JBP, starting on page 49, and share some of his vision of the future of ARRL and Amateur Radio. And we hope you'll tell your friends who aren't members that it's not "business at usual" at ARRL and encourage them to take a fresh look at what we've been up to recently.—*Mark Wilson, K1RO, QST Editor*

We're At Your Service

ARRL Headquarters is open from 8 AM to 5 PM Eastern Time, Monday through Friday, except holidays. Call **toll free** to join the ARRL or order ARRL products: **1-888-277-5289** (US), M-F only, 8 AM to 8 PM Eastern Time.

If you have a question, try one of these Headquarters departments . . .

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If all else fails, send e-mail to **hq@arrl.org** and it will be routed to the right people or departments.

Technical Information Server

If you have Internet e-mail capability, you can tap into the ARRL Technical Information Server, otherwise known as the *Info Server*. To have user instructions and a handy index sent to you automatically, simply address a plain-text e-mail message to: **info@arrl.org**, Subject: **Info Request** In the body of your message enter:

HELP
SEND INDEX
QUIT

ARRL on the World Wide Web

You'll also find the ARRL on the World Wide Web at:

www.arrl.org/

At the ARRL Web page you'll find the latest W1AW bulletins, a hamfest calendar, exam schedules, an on-line ARRL Publications Catalog and much more. We're always adding new features to our Web page, so check it often!

Members-Only Web Site

As an ARRL member you enjoy exclusive access to our Members-Only Web site. Just point your browser to **www.arrl.org/members/** and you'll open the door to benefits that you won't find anywhere else.

- Our on-line Web magazine, the *ARRLWeb Extra* with colorful news and features you *won't* see in *QST*.
- *QST* Product Review Archive. Get copies of *QST* product reviews from 1980 to the present.
- *QST/QEX* searchable index (find that article you were looking for!)
- Previews of contest results and product reviews. See them here before they appear in *QST!*
- Access to your information in the ARRL membership database. Enter corrections or updates on line!

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If you're a member, you can take advantage of our e-mail forwarding service. This is a forwarding (or "alias") service only. No messages will be stored on our servers. You can sign up quickly at the Members-Only Web site.

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Would you like to write for QST?

We're always looking for new material of interest to hams. Send a self-addressed, stamped envelope (55¢ postage) and ask for a copy of the *Author's Guide*. (It's also available via the ARRL Info Server, and via the World Wide Web at **www.arrl.org/qst/aguide/**.)

Press Releases and New Products/Books

Send your press releases and new book announcements to the attention of the ***QST* Editor** (e-mail **qst@arrl.org**). New product announcements should be sent to the Product Review Editor (e-mail **reviews@arrl.org**).

ARRL Audio News

The best way to keep up with fast-moving events in the ham community is to listen to the ARRL Audio News. It's as close as your telephone at 860-594-0384, or on the Web at **www.arrl.org/arrlletter/audio/**

Interested in Becoming a Ham?

Just pick up the telephone and call toll free 1-800-326-3942, or send e-mail to **newham@arrl.org**. We'll provide helpful advice on obtaining your Amateur Radio license, and we'll be happy to send you our informative Prospective Ham Package.

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The 15 divisions of the League are arranged into 71 administrative *sections*, each headed by an elected *section manager* (SM). Your section manager is the person to contact when you have news about your activities, or those of your club. These news items could find their way into the pages of *QST*! If you need assistance with a local problem, your section manager is your first point of contact. He or she can put you in touch with various ARRL volunteers who can help (such as technical specialists).Your section manager is also the person to see if you'd like to become a section volunteer. Whatever your license class, your SM has an appointment available. If your ARRL section has a Web site, the address can be found at **http://www.arrl.org/field/org/smlist.html**.

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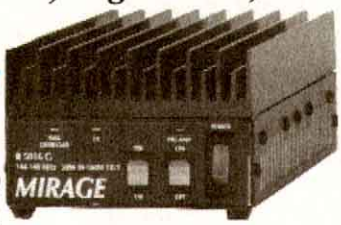
MIRAGE . . . 160 Watts on 2 Meters!

Turn your mobile, base or handheld into 160 Watt powerhouses and talk further, longer, clearer . . . All modes: FM, SSB, CW . . . Superb GaAsFET preamp . . . Overdrive, high SWR, Over-temperature protection . . . Remote controllable . . .

MIRAGE RUGGED!

B-5016-G
$299
Suggested Retail



Power Curve -- typical B-5016-G output power								
Watts Out	130	135	140	145	150	155	160	165
Watts In	20	25	30	35	40	45	50	55

The MIRAGE B-5016-G gives you 160 Watts of brute power for 50 Watts input on all modes -- FM, SSB, or CW!

Ideal for 20 to 60 Watt 2 Meter mobile or base. *Power Curve* chart shows typical output power.

Hear weak signals -- low noise GaAsFET preamp gives you excellent 0.6 dB noise figure. Select 15 or 20 dB gain.

B-5016-G has legendary ruggedness. *We know of one that has been in constant use since 1979!*

Heavy-duty heatsink spans entire length of cabinet -- prevents overheating. Power transistors protected by MIRAGE's *Therm-O-Guard*™.

Fully protected from high SWR and excessive input power. Has warning LED.

Has smooth adjustable Transmit/Receive switching with remote external keying.

Draws 17-22 Amps at 13.8 VDC. 12x3x5½ in.

RC-1B, $45. Remote Control. On/Off, preamp On/Off, selects SSB/FM. With 18 foot cable.

More 160 Watt, 2 Meter Amplifiers . . .

B-2516-G, $299. For 10 to 35 Watt mobile or base stations. 160 Watts out for 25 Watts in.

B-1016-G, $379. MIRAGE's most popular *dual purpose* HT or mobile/base amplifier. 160 Watts out for 10 Watts in. For 0.2-15 Watt transceivers.

B-1016-G Great for ICOM IC-706!

B-215-G, $379. MIRAGE's most popular *handheld* amp. 150 Watts out with 2 watts in; 160 watts out with 3½ Watts in. For 0.25 to 5 Watt handhelds radios.

100 Watts for 2 Meter HTs

B-310-G
$199
Suggested Retail
MIRAGE RUGGED!

Power Curve -- typical B-310-G output power								
Watts Out	25	50	75	95	100	100	100	100
Watts In	¼	½	1	2	4	6	7	8

- *100 Watts out with all handhelds up to 8 Watts*
- *All modes: FM, SSB, CW*
- *Great for ICOM IC-706*
- *15 dB low noise GaAsFET preamp*
- *Reverse polarity protection*
- *SWR Protection*
- *FREE mobile bracket*
- *Auto T/R Switch*
- *FREE handheld BNC to B-310-G patch cable*
- *Ultra-compact 4¾x1¾x7¼ inches, 2½ pounds*
- *One year MIRAGE warranty*

***Boost** your 2 Meter handheld to 100 Watts!* Ultra-compact all mode B-310-G amp is perfect for all handhelds up to 8 Watts and multimode SSB/CW /FM 2 Meter rigs. *Great for ICOM IC-706!*

35 Watts for 2 Meter HTs

B-34-G
$89.95
Suggested Retail

Power Curve -- typical B-34-G output power							
Watts Out	18	30	33	35	35	35	35+
Watts In	1	2	3	4	5	6	8

- *35 Watts Output on 2 Meters*
- *All modes: FM, SSB, CW*
- *18 dB GaAsFET preamp*
- *Reverse polarity protection*
- *Includes mobile bracket*
- *Auto RF sense T/R switch*
- *Custom heatsink, runs cool*
- *Works with handhelds up to 8 Watts*
- *One year MIRAGE warranty*

MIRAGE RUGGED!

35 Watts, FM only . . . $69.95

B-34, $69.95. 35 Watts out for 2 Watts in. Like B-34-G, FM only, less preamp, mobile bracket. 3⅛x1¾x4¼ inches.

MIRAGE Dual Band 144/440 MHz Amp

BD-35
$159.95
Suggested Retail

Power Curve -- typical BD-35 output power							
Watts Out 2 Meters	30	40	45	45	45	45	45+
Watts Out 440 MHz	16	26	32	35	35	35	35+
Watts In	1	2	3	4	5	6	7

- *45 Watts on 2 Meters/35 Watts on 440 MHz*
- *Auto Band Selection*
- *Auto T/R Switch*
- *Full Duplex Operation*
- *5x1¾x5 inches*
- *FREE mobile bracket*
- *"On Air" LEDs*
- *Single Connector for dual band radios and antennas*
- *Reverse polarity protection*
- *Works with all FM handhelds to 7 Watts*
- *One year MIRAGE warranty*

Add this Mirage dual band amp and boost your handheld to a powerful mobile or base -- 45 Watts on 2 Meters or 35 Watts on 440 MHz! Mirage's exclusive *FullDuplexAmp*™ lets you talk on one band and listen on the other band at the same time -- just like a telephone conversation. *(Requires compatible HT).*

6 Meter Amplifier

FCC Type Accepted

The A-1015-G, $389, is the *world's most popular* all mode FM/SSB/CW 6 Meter amplifier. 150 Watts out for 10 in. For 1 to 15 Watt transceivers.

70 cm Amplifiers (420-450 MHz)

D-3010-N, $365 -- 100 W out/30 in. For 5 to 45 Watt *mobile/base*. **D-1010-N, $395**, 100 W out/10 in. *Dual purpose* -- for handhelds or mobile/base. **D-26-N, $269**, 60 W out/2 in, for *handhelds*.

Amateur TV Amps

Industry standard ATV amps -- **D-1010-ATVN, $414**, 82 Watts PEP out / 10 in. **D-100-ATVN, $414**, 82 Watts PEP out/2 in. (without sync compression).

Remote Control Head for Amps

RC-1, $45, remote controls most MIRAGE amps. Check with Mirage for compatibility. Power On/Off, preamp On/Off, switch for SSB/FM. 18 foot cable (longer available). Tiny 1¾x3¾x2½ inches.

Repeater Amps

11 models -- continuous duty all mode FM/SSB/CW repeater amps for 6, 2, 1¼ Meters, 70 cm, 450 MHz, ATV.

Low noise GaAsFET preamps

KP-1

KP-2

High gain ultra low noise GaAsFET preamps for receiving weak signals. Selectable gain prevents receiver intermod. 15 to 22 dB gain. Less than 0.8 dB noise figure. Automatic RF switching up to 100 Watts.

Choose *In-Shack* model or *Mast Mount* (includes remote control) model to reduce loss. Rugged die-cast enclosure.

Frequency (MHz)	In Shack $139	Mast Mount $195
28-30	KP-1/10M	KP-2/10M
50-54	KP-1/6M	KP-2/6M
144-148	KP-1/2M	KP-2/2M
220-225	KP-1/220	KP-2/220
430-450	KP-1/440	KP-2/440

1¼ Meter Amps (223-225 MHz)

Choose from 10 models -- 20 to 220 Watts out for 2 to 50 Watts in, $129 to $655.

Commercial Amps ($199 to $395)

FCC Type Accepted

Commercial Amps for 150-174, 450-470 MHz and VHF marine bands, 70-130 Watts out.

Accurate SWR/Wattmeters

Read SWR directly and Forward/Reverse, Peak/Average power. Remote coupler. 1.8-30, 50-200, 420-450, 1260-1300 MHz band models.

One Year Mirage Warranty

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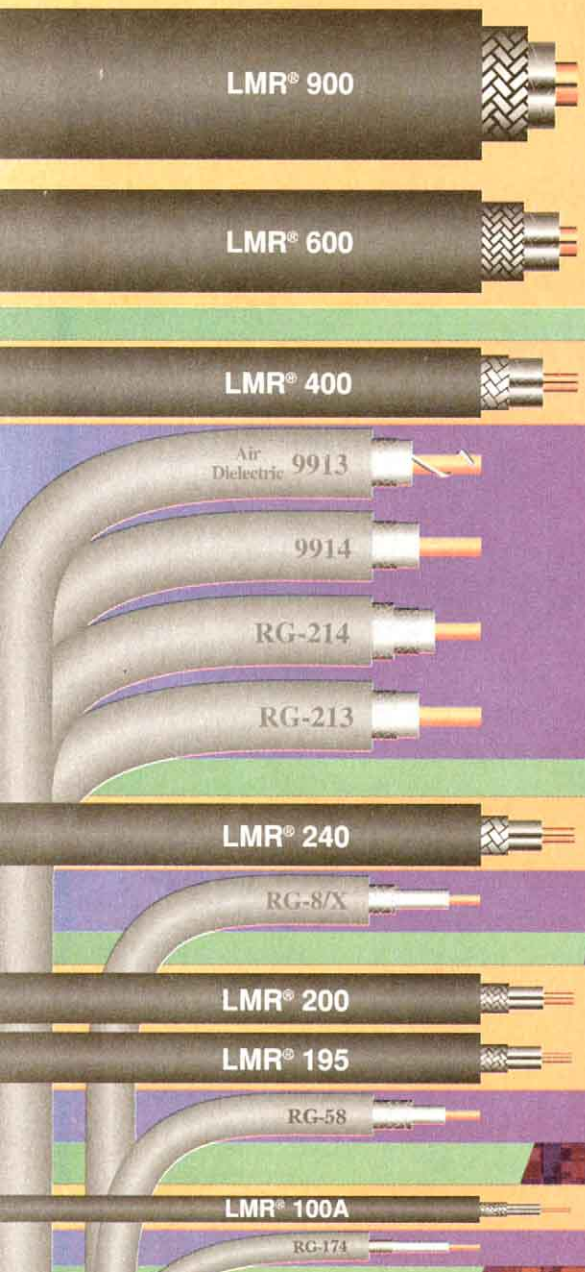
Low cost, low loss flexible LMR® cable!

for HF through Satellite Bands



	Diameter in Inches	Jacket Material	Shielding (dB)	*Attenuation (dB/100') 30 MHz	146MHz	440 MHz	2.4GHz
LMR® 900	**.870**	**Black PE**	**90**	**.29**	**.65**	**1.2**	**2.9**
LMR® 600	**.590**	**Black PE**	**90**	**.42**	**.95**	**1.7**	**4.3**
LMR® 400	**.405**	**Black PE**	**90**	**0.7**	**1.5**	**2.7**	**6.6**
Air Dielectric 9913	.405	PVC	90	0.8	1.5	2.8	7.5
9914	.403	PVC	90	1.0	2.1	3.8	8.7
RG-214	.425	PVC-IIA	60	1.2	2.8	5.1	13.7
RG-213	.405	PVC-IIA	40	1.2	2.8	5.1	13.7
LMR® 240	**.240**	**Black PE**	**90**	**1.3**	**3.0**	**5.2**	**12.7**
RG-8/X	.242	PVC	40	2.0	4.5	8.1	21.6
LMR® 200	**.195**	**Black PE**	**90**	**1.8**	**3.9**	**6.9**	**16.5**
LMR® 195	**.195**	**Black PE**	**90**	**2.0**	**4.4**	**7.7**	**18.6**
RG-58	.195	PVC-IIA	40	2.5	6.1	10.4	35.0
LMR® 100A	**.105**	**Black PVC**	**90**	**3.9**	**8.8**	**15.6**	**38.9**
RG-174	.110	PVC-IIA	40	5.5	13.0	25.0	75.0

LMR features: Watertight foam polyethylene dielectric • Non-kinking • EZ install connectors

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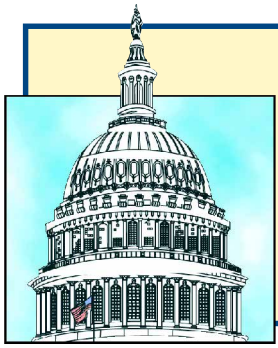

DC Currents

By Steve Mansfield, N1MZA
Manager, Legislative and Public Affairs

Just as radio waves aren't constrained by artificial boundaries, neither is ARRL's government relations effort. "DC Currents" covers behind-the-scenes activity you need to know about in Congress, at the FCC and other regulatory agencies, as well as at worldwide bodies such as the International Telecommunication Union.

Amateur Spectrum Bill Stalls as the 106th Congress Ends With a Whimper, Not a Bang

As the 106th Congress struggled through massive end-of-session appropriations bills, scheduling difficulties and even talk of a lame duck session after the November elections, the Amateur Radio Spectrum Protection Act (HR.783 and S.2183) appears to have stalled out at the committee level. Near session's end, HR.783 had a total of 167 cosponsors, and S.2183 had eleven. The bill would have required the FCC to provide "equivalent replacement spectrum" to any frequencies removed from the Amateur Radio Service.

The end-game pace of legislation in Washington was so glacial that Congress even missed many of its own budget deadlines. But the ship of state was kept afloat by a series of stopgap measures called continuing resolutions. Aside from appropriations, there were more than 15,000 other pieces of legislation introduced in the House and Senate earlier in the session, (including bills, resolutions and major amendments), but fewer than 300 passed and were signed into law, and the President only vetoed 8 bills in the two year period.

From the beginning, it was clear that both Amateur Radio Spectrum Protection Acts would be afloat in heavy seas. Indeed, there were more than 180 bills in the House and Senate dealing with some aspect of telecommunications, including broadcasting, wireless, common carrier services and broadband and Internet issues (see the sidebar on page 16). These all offered competition with the spectrum legislation for congressional attention.

But of the telecommunications bills, only four made it all the way through to be signed into law. While it's certainly not fair to use the number of bills passed to evaluate the effectiveness of the Congress—a single large and important bill can eat up months of deliberation—it is probably fair to say that the kind of bills which pass indicates the priorities of the Congress. It is certainly fair to say that telecommunication was not the highest priority this year, a fact of legislative life that has led a number of Capitol Hill insiders to predict that telecommunications will enjoy much higher priority in next year's Congress regardless of which party wins the majority on The Hill.

CONGRESSMAN WEIGHS IN ON CC&R EFFORT

♦ At the ARRL's request, Congressman Sam Gejdenson (D-CT-2nd) sent a letter to FCC Chairman William E. Kennard. In the letter he urged a "favorable resolution to a pending petition for reconsideration" in ARRL's request for rulemaking to bring Amateur Radio antennas affected by codes, covenants and restrictions (CC&Rs) under the same federal preemption that PRB-1 currently gives to antennas under state and local regulations. Currently, CC&Rs are regarded as private contracts and not under the federal preemption. Gejdenson's letter noted that Amateur Radio has filled a public policy role by providing emergency communication in areas prone to flood, hurricane, tornado, earthquake, brush fire or other natural or manmade disasters. Gedjenson said that "as the number of planned residential communities continues to grow, it is imperative that the FCC provide thoughtful guidance that affords Amateur Radio operators reasonable accommodation in dealing with CC&Rs while recognizing the legitimate concern of homeowner associations." There's no word yet on a response to the Congressman's letter.

UPDATE ON CC&R DATA PROJECT

♦ ARRL's data collection effort on the impact of CC&Rs on Amateur Radio so far has resulted in the submission of more than one hundred stories about individual experiences of hams around the US in coping with restrictions imposed by "covenants, conditions and restrictions" and other private limitations on the ability to put up antennas and towers. Many submissions included copies of CC&R language, and some included a bit of information on how the individual hams have managed to pursue their hobby in spite of eagle-eyed homeowner associations. ARRL continues to collect and analyze the information, and some has already been used in background information in recent discussions with the FCC (no names, addresses or call signs were used). For more information, see October 2000 "DC Currents."

Media Hits

- Rob Reaser, KC8KCH, wrote a piece on Amateur Radio and the outdoor life that appeared in *Camping Life Magazine*. The article compares the benefits of Amateur Radio, CB radio and cellular telephone in backcountry communication. Guess which looks best?
- The *Journal Inquirer* of Manchester, Connecticut depicted ARRL's own Joe Bottiglieri, AA1GW and Brennan Price, N4QX, operating at W1AW in a nice wrap-up piece on the joys of ham radio. Also mentioned was Newington's Al Cohen, W1FXQ.
- A one-year review of the impact of Tropical Storm Floyd on New Jersey featured an article on the role of Amateur Radio in emergency communication in the aftermath of extensive flooding. The article, which appeared in the *Hackensack Record* noted that, as sophisticated municipal and police systems went down, ham radio continued to do the job.
- A short piece in the *Charlotte Observer* (North Carolina) echoed the sentiment that "in times of emergencies ham radio will fill the gaps…", particularly with the approach of hurricane season. The piece, written by George Vickery, KB4OQU, urged readers to get ham tickets.

Telecommunications Bills, 106th Congress

What was on the congressional plate? This listing includes only bills on wireless issues that might be of interest to Amateur Radio operators, and does not include a very large number of additional telecommunications bills that dealt with taxation; antitrust; tele-health; common-carrier; cable TV; media mergers, acquisitions or ownership; "broadband," internet and internet security issues; nor with computer games, films, videos and other AV products. Unless the status of the bill is indicated otherwise, you may assume that the bill did not move (although provisions from some bills may have been amended into others that did pass). More information on these bills can be found on the government's THOMAS Web site at **www.thomas.loc.gov/**.

HOUSE

H. CON. RES. 178: sense of Congress regarding importance of "family friendly" TV programming.

H. CON. RES. 182: to shape congressional information technology policy into next century.

H. CON.RES. 184: sense of Congress regarding importance of "family friendly" TV programming. Passed House, sent to Senate. See S. Con. Res. 56.

H. RES. 346: sense of House that "Family Hour", time period between 8 and 9 PM, should be set aside for family-oriented TV programming.

H.J. RES. 47: sense of the Congress on need for Surgeon General's report on media and violence.

HR. 89: to reform copyright law on satellite retransmissions of broadcast signals.

HR. 125: to direct FCC to establish ethnic and minority affairs section.

HR.438: to promote public safety through use of 911 as universal emergency assistance number. Passed House. Senate version, S. 800 became law, PL 106-81.

HR.486 : to require FCC to preserve low-power television stations that provide community broadcasting.

HR.514 : to strengthen and clarify prohibitions on electronic eavesdropping. Passed House, referred to Senate.

HR.539 : to establish 9-1-1 as universal emergency assistance number for wireless telecommunications users.

HR. 768: to reform copyright law with respect to satellite retransmissions of broadcast signals. See also HR.1554.

HR.783: to ensure availability of spectrum to Amateur Radio operators. Sponsor: Referred to House subcommittee.

HR.851: To require FCC to establish improved predictive models for determining availability of TV broadcast signals.

HR.866 : to protect critical infrastructure radio systems from interference and to promote efficient spectrum management of private land-mobile radio bands.

HR.879: to exempt licenses in instructional television fixed service from competitive bidding.

HR.952: to preserve State and local authority over construction, placement, modification of personal wireless service facilities

HR.1027: To provide for carriage by satellite carriers of local broadcast station signals. See also HR.1554.

HR.1078: to amend law regarding retransmission consent and must-carry for cable operators and satellite carriers.

HR.1273: to require the FCC to repeal unconstitutional reporting and recordkeeping requirements.

HR. 1554: to amend copyright law with respect to broadcast signals by satellite. Passed House, amended version passed Senate, remained in conference. See also S. 247.

HR.1817: to improve cellular telephone service in selected rural areas and to achieve equitable treatment of certain cellular license applicants.

HR.2346: to authorize enforcement by State and local governments of FCC regulations regarding use of CB radio equipment. Passed House.

HR.2379: to ensure adequate frequencies for biomedical telemetry.

HR.2630: to reauthorize NTIA.

HR.2834: to clarify State and local authority to regulate placement, construction, modification of broadcast and telecommunications facilities.

HR. 2835: to require assessment of research on effects of radio frequency emissions on human health.

HR.2891: to provide access to buildings owned or used by Federal Government for telecommunications carriers.

HR. 3261: to promote competition and privatization in satellite communications.

HR.3439: to require FCC to revise regulations authorizing operation of new, low-power FM radio stations. Passed House.

HR.3487: to ensure access to rooftops of mulitenants buildings by competitive telecommunications carriers and promote development of fixed wireless, local telephony and broadband infrastructure.

HR.3489: to regulate interstate commerce in use of mobile telephones and to strengthen and clarify prohibitions on electronic eavesdropping.

HR.3525: to require FCC to follow normal rulemaking procedures in establishing additional requirements for noncommercial educational television broadcasters.

HR.3615: to ensure improved access to signals of local television stations by multichannel video providers to all households in unserved and underserved rural areas. Passed House.

HR. 3848: to direct Secretary of Transportation to conduct study on distractions to drivers operating motor vehicles in the US (including wireless phones, CB radios, dispatch radios, broadcast receivers, GPS systems and other devices, but not Amateur Radio).

HR.4201: to clarify service obligations of noncommercial educational broadcast stations. Passed House.

HR. 4454: to authorize appropriations to expand and enhance United States international broadcasting around world.

HR. 4610: To require Food and Drug Administration to conduct study of health effects of radio frequency emissions from wireless telephones.

HR.4742: to require FCC to establish minimum standards regarding quality of wireless telephone service.

HR.4758: to permit wireless carriers to obtain sufficient spectrum to meet growing demand for existing services and ensure that they have the spectrum deploy fixed and advanced services.

HR. 5300: to prohibit use of text, graphic or image messaging systems of wireless telephone systems to transmit unsolicited commercial messages (wireless spam protection).

SENATE

S.CON.RES.49: sense of Congress regarding importance of "family friendly" programming on television.

S.CON.RES.56: sense of Congress regarding the importance of "family friendly" programming on television. Passed Senate. See also H.Con. Res.184:

S.151: to amend law to ensure continuing provision of certain global satellite safety services after privatization of business operations of the International Mobile Satellite Organization.

S.247: to reform copyright law with respect to satellite retransmissions of broadcast signals. Incorporated into HR.1554 when Senate passed that bill.

S.303: to enhance ability of direct broadcast satellite and other multichannel video providers to compete effectively with cable television systems.

S.376: to amend law to promote competition and privatization in satellite communications. Passed Senate and House, became Public Law No: 106-180.

S.800: to promote and enhance public safety through use of 9-1-1 as universal emergency assistance number, support of States in upgrading 9-1-1 capabilities for personal wireless services. Passed Senate and House, became law, PL 106-81. See also HR 438.

S.876: to amend law to limit broadcast of violent video programming to hours when children are not a substantial portion of audience.

S.1301: to provide reasonable and non-discriminatory access to buildings owned or used by Federal government, by telecommunications carriers.

S.1538: to clarify State and local authority to regulate placement, construction and modification of broadcast transmission and telecommunications facilities.

S.1547: to require FCC to preserve low-power TV stations that provide community broadcasting.

S.1755: to regulate interstate commerce in use of mobile telephones.

S.1824: to enhance efficient use of spectrum by non-federal government users.

S.1923: A bill to prohibit FCC from applying spectrum aggregation limits to spectrum assigned by auction after 1999.

S.2010: to require FCC to follow normal rulemaking procedures in establishing additional requirements for noncommercial educational TV broadcasters.

S.2057: to prohibit use of electronic measurement units (EMUs), near roads to determine what stations motorists are listening to.

S.2068: to prohibit FCC from establishing rules authorizing the operation of new, low power FM radio stations.

S.2183: to ensure availability of spectrum to Amateur Radio operators.

S. 2215: to clarify treatment of nonprofit entities as noncommercial educational or public broadcast stations.

S.2326: to strengthen and clarify prohibitions on electronic eavesdropping. Similar in intent to HR.514.

S.2454: to authorize low-power television stations to provide digital data services to subscribers.

S.2518: to provide for technical integrity of FM radio band.

S.2767: to authorize enforcement by State and local governments of FCC regulations regarding use of CB radio equipment. Similar to HR.2346.

S.2989: A bill to provide for the technical integrity of the FM radio band.

S.3020: to require FCC to revise regulations authorizing operation of new, low-power FM radio stations.

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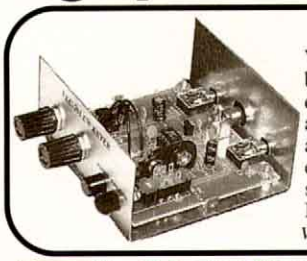

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20/30/40/80 Meter QRP CW transmitter Kits have variable crystal oscillator tuning, front panel switch selects 1 of 2 crystals. 1 crystal included. Transmit and Receive switch. Connect receiver. 1¾x4x3½ in. *Intermediate skill level.* Order **VEC-1220K** (20 Meters), **VEC-1230K** (30 Meters), **VEC-1240K** (40 Meters), **VEC-1280K** (80 Meters), **$29.95 ea.**

Tunable SSB/CW Audio Filter Kit has sharp *four* pole peak and notch filters. Zero in with frequency control & adjust bandwidth for best response. Tune frequency from 300-3000 Hz. Notch is an outstanding 50 dB. 1 Watt amplifier. Speaker/Phone jacks. 12 VDC at 300 mA. 1¾x4¾x5¼ in. *Intermediate skill level.* Order **VEC-841K, $34.95.**

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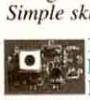
Super SSB Audio Filter Kit improves readability with 8 poles, optimizes audio bandwidth, reduces SSB splatter, low, hi-pitched interference, hiss, static crashes, background noise. Use 9V battery. 1¾x4x 3½ in. *Simple skill level.* Order **VEC-830K, $19.95.**



144/220/440 MHz Low-Noise Preamp Kits soup up your antenna system. Helps pull in weak signals. Works wonders for scanner or ham-band receiver. Gives great low-noise performance and immunity from damaging electrostatic discharge. 1x1½ in. *Simple skill level.* Order **VEC-1402K** (144 MHz),**VEC-1422K** (220 MHz), **VEC-1444K** (440 MHz), **$17.95.**

CW Memory Keyer Kit stores 512 characters in four 128 character non-volatile EEPROM message memories. *Carry on entire QSOs by just pressing memory message buttons.* True sinewave sidetone with soft rise and fall time eliminates harsh keyclicks. Has all features of VEC-201K CW Keyer Kit. 1¾x 6¾x5¼ in. *Simple skill level.* Order **VEC-221K, $69.95.**

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2/6/10 Meter FM Receiver Kits let you tune into the world of ham radio. Catch all the action! Each covers the entire FM sub-band and runs off your 9 volt battery. Plug in speaker or headphones for loud clear reception. 1¾x4x3½ in. *Intermediate skill level.* Order **VEC-1002K** (2 Meters), **VEC-1006K** (6 Meters), **VEC-1010K** (10 Meters), **$34.95 each.**

2 Meter Monitor Kit receives 144-148 MHz. Low noise, high gain RF preamp gives you excellent 0.1 uV sensitivity. Air variable tuning capacitor has 8:1 reduction. Dual conversion superhet provides selectivity and stability. Automatically eliminates squelch tails. Built-in speaker, squelch, tone, volume controls. 19¼ in. telescopic whip. 9V battery. 2x4¼ x4 in. *Intermediate skill level.* Order **VEC-104K, $79.95.**

5 Watt 2 Meter FM transmitter Kit lets you transmit voice and data -- AFSK data (up to 1200 baud) and FSK data (up to 9600 baud). Jumper select reactance or direct FM modulators. Reliable Motorola NBFM transmitter IC and PA transistor. Crystal controlled (x8 frequency multiplication). -60 dBc spurs and harmonics. Use 12-14 VDC, 1.5 amps. 5-pin DIN microphone jack. 1¾x4¾x5¼ in. *Difficult skill level.* Order **VEC-1202K, $99.95.**

Ni-Cad/Ni-MH Battery Charger Kit safely quick charges expensive batteries -- no overcharging -- many in less than an hour. HTs, cell phones, camcorders, lap top computers. Handles 1 to 12 cells. Charging status LEDs. Discharge before charge function reconditions batteries. Also removes memory effect. Runs on 12-15 VDC. 1¾x4¾x5¼ inches. *Moderate skill level.* Order **VEC-412K, $49.95.**

Shortwave Converter Kit converts AM or AM/FM radios to shortwave receivers at a push of a button. Choose two 1 MHz bands between 3 and 22 MHz. Popular 13, 16, 19, 25, 31, 41, 49 and 60 Meters international broadcast bands. On/off bypass, NE-602/612 mixer-oscillator IC and tuned input circuit. Use 9 V battery. 1¾x4x3½ in. *Intermediate skill level.* Order **VEC-101K, $27.95.**

Crystal radio set Kit lets you relive the experience of early radio pioneers. This baby really works! Wind your own inductor, wire up the earliest radio circuit without soldering a thing and listen to the magic of radio that needs no power. Put up an antenna, connect a ground. Stations come in amazingly loud and clear. Includes antenna wire, sensitive earphone. 1¾x5x6½ in. *Simple skill level.* Order **VEC-121K, $19.95.**

Shortwave Receiver Kit lets you listen to the world! Covers 75/80, 49, 40, 30, 31, 20, 25, 22, 19, 17, 16, 15 and 13 Meter bands. Explore AM, SSB, CW, WWV, RTTY and Packet signals. Vernier reduction drive, smooth regeneration control, RF stage. *Includes all metal cabinet.* 2 earphone jacks. Use 9V battery. 2½x7x6 in. *Intermediate skill level.* **VEC-102K, $59.95.**

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Super CW Audio Filter Kit gives you three bandwidths: 80, 110, 180 Hz. Eight poles gives super steep skirts with no ringing. Pull CW QSOs out of terrible QRM! Plugs into phone jack to drive phones. QRM down 60 dB one octave from center frequency (750 Hz) for 80 Hz bandwidth. Improves S/N ratio 15 dB. Use 9V battery. 1¾x4x 3½ in. *Simple skill level.* Order **VEC-820K, $19.95.**

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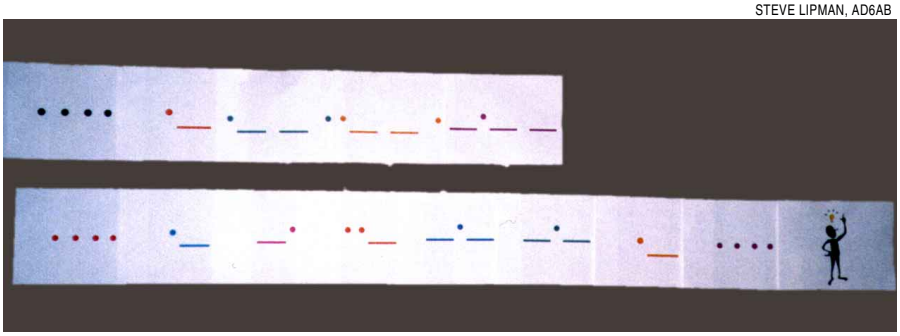


Hanukkah greetings in Morse. This unusual banner graced the 1999 Northern California Chaverim holiday party.

'Tis the Season!

You can see this tower for miles! Mike, N0PVU, decorates his tower in spectacular fashion for the season. According to Mike, the entire array of lights goes up and down "in a few minutes."

On a cold, windswept road in Minnesota, even Santa knows where to put the QSL cards! Andrew, KC0EDB and Alan, KC0EDC, welded this unusual mailbox accessory for their father Larry, K0RVN, during the holidays.

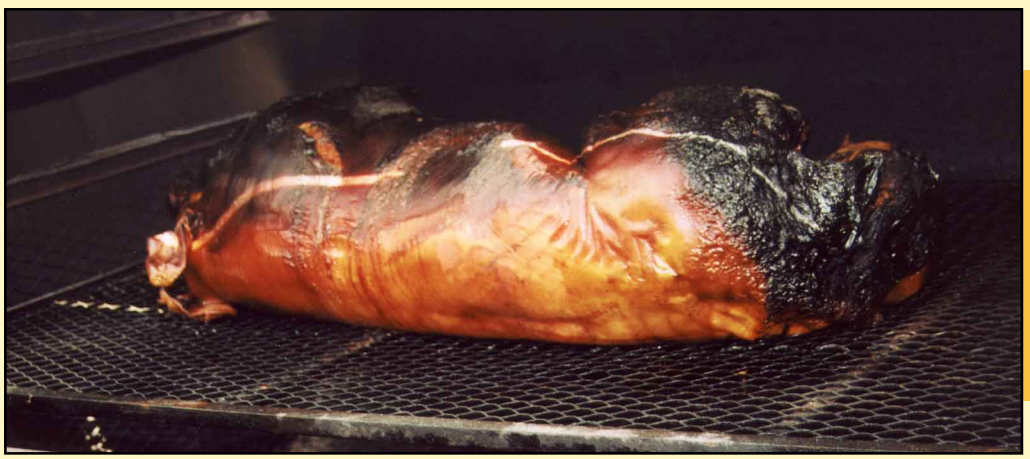
A QSO with Kris Kringle. April Moell, WA6OPS, helps a young cancer patient speak to Santa at the Children's Hospital of Orange County, California. April is the originator of the North Pole Network, which has been delighting children during the holidays for 25 years.

"When an 811-A glows, an angel gets its wings." Okay, so it isn't a direct quote from *It's a Wonderful Life*, but this isn't an angel atop K2PG's Christmas tree, either!

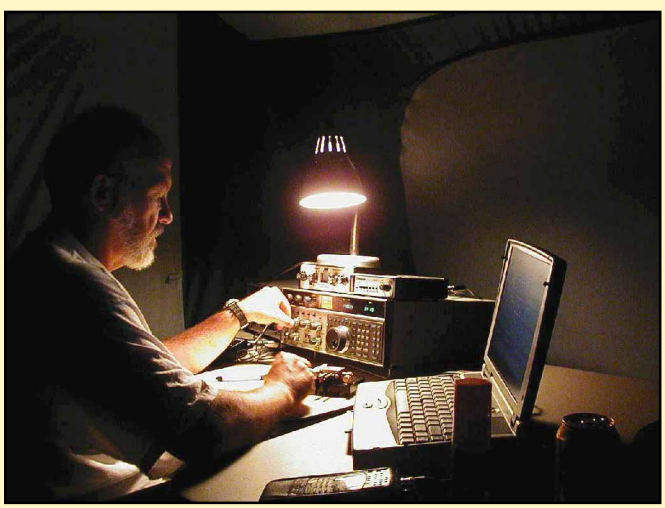
FIELD DAY 2000

"I did it!" Eleven-year-old Amber beams with pride after busting through a Field Day pileup on 10 meters at the K6OX site. Her father is KQ6Y.

A hands-on demo. W9ZL, the Fox Cities Amateur Radio Club, used a Kenwood VC-H1 to demonstrate slow-scan television.



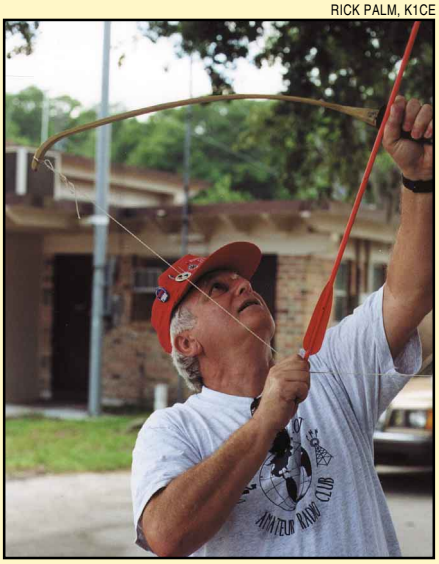
If you don't know what it is, don't eat it. This photo, taken at the Lake Monroe (Florida) Amateur Radio Society operation, was simply labeled "Dinner." Your guess is as good as ours.



Burning the midnight gasoline. Ken, W3USN, pounds out the CW contacts into the wee morning hours at the Maryland Mobileers Amateur Radio Club operation.

Chivalry in action. Ken, KE4AWY, crawled underneath an automobile at the Bullitt Amateur Radio Society Field Day site to rescue a kitten belonging to Mary, KT4GB. Should there be a Field Day bonus for helping endangered animals?

RICK PALM, K1CE



Where is Robin Hood when you need him? Sharpshooter Jay, AF2C, president of the Flagler-Palm Coast (Florida) Amateur Radio Club, prepares for Field Day by shooting one end of a G5RV antenna into the trees at the Flagler County EOC.

BEN FISHER, K9BF

At the end of every rainbow, you find . . . a triband Yagi? At least that's the case at the W9YR Field Day site. A divine blessing, perhaps?

A day to remember. Nine-year-old guest operator Mark Denman enthusiastically works the mike at the Athens (Texas) ARC Field Day as elmers Dale, N5MZV and John, KD5BCU, look on.

Field Day at a legendary location. The West Chester (Ohio) Amateur Radio Club group set up their KD8C operation at the site of the former Voice of America Bethany relay station north of Cincinnati. Too bad the old VOA antennas were dismantled in 1997!

"I sound like a 4-year-old? I *am* a 4-year-old!" Stephanie Parrott (left), Elisabeth Younce (at the microphone) and Eva Parrott enjoy Field Day at the Kamiak Butte Amateur Repeater Association (KB7ARA) gathering.

A good cook is a happy cook! Thanks to Mike Di Persio, KC2Q, the Garden State Amateur Radio Association crew (W2GSA) in Middletown, New Jersey was treated to a Field Day feast of spaghetti, meatballs and sausage with Mike's recipe sauce!

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The IDBT feature greatly simplifies operation by matching the bandwidth of the DSP (Digital Signal Processing) system to the net bandwidth of the 8.2 MHz and 455 kHz IF stages. The IDBT system accounts for the settings of the IF WIDTH and SHIFT controls, and automatically sets a DSP bandwidth which matches the analog IF bandwidth.

II. VRF: Variable RF Front-End Filter

Protecting the MARK-V's receiver components from strong out-of-band signals, the VRF system acts as a high-Q "Preselector," located between the antenna and the main bandpass filter networks, providing additional RF selectivity on the 160-20 meter Amateur bands for multi-operator contest teams, DX-peditions, or for operation near MW/SW broadcast stations.

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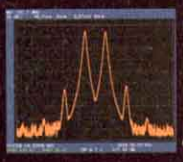
Utilizing two Philips® BLF147 Power MOSFETs in a 30-Volt, push-pull configuration, the MARK-V's transmitter puts out up to 200 Watts of clean output power, thanks to the conservative design of the PA section.



Class A 75 W PEP IMD

IV. Class-A SSB Operation

Exclusively available on the MARK-V FT-1000MP , a press of a front-panel button engages Class-A SSB operation of the transmitter, at a power output level of 75 Watts. Class-A operation produces incredibly clean signal quality, with 3rd- order IMD suppressed 50 dB or more, and 5th- and higher-order products typically down 80 dB or more!

V. Multi-Function Shuttle Jog Tuning/ Control Ring

The immensely-popular Shuttle Jog tuning ring, which is concentric with the Main Tuning Knob, has a new look in the MARK-V: it now includes the activation switches for the VRF (left side) and IDBT (right side) features, so you don't have to move your hand position to activate these important circuits during contest or pile-up situations!

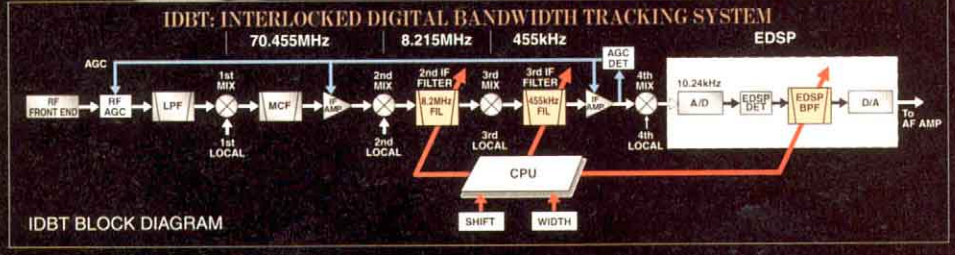
IDBT: A Breakthrough in Selectivity!

DC 30 V / 13.8 V Power Supply FP-29

Photo shows optional MD-100A8X Deluxe Desk Microphone

HF 200 W All-Mode Transceiver

MARK-V FT-1000MP



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MUCH WORK STILL TO DO

♦ In the "Washington Mailbox" column in the September issue of *QST* ("PRB-1, A Good Thing, but Still Not a Panacea"), a question asked, "I have a house with deed restrictions against antennas. Any relief for me?" The answer was, "Yes, short of moving, operate from your car."

While N1KB states right away that this is a flippant answer, it seems to clearly represent the next (and perhaps last) battle for hams to fight. Yes, there is a war going on out there and hams have been fighting it somewhat in guerrilla fashion for the short-term and still losing ground in the overall war.

Fortunately, for the short-term solution, there have significant improvements for mobile setups for operating portable—the smaller radios and simple antenna setups that are now available. Six, ten and twelve meters are all easily accessible this way and with other verticals with loading coils, lower bands are also available. I have operated on the higher bands from numerous locations, including during lunch hour from work with reasonably good results in working DX.

Many hams that I know who live in condos that have deed restrictions have set up antennas in the attic or in the framework of the structure. Again, some reasonable success can be achieved this way, too, as with a car.

Although many hams do not willingly want to go into condos or into communities with deed restrictions: it can be a matter of economics or perhaps what the spouse wants. In some areas of the countries, new housing developments have the dreaded deed restriction already and there are no other choices in the area. These hams have found short-term solutions that will allow them to operate, but there is no relief for them in the long term as far as them being allowed to put up a simple dipole or vertical antenna outside of their home.

The long-term solution requires that the general public's perception be changed so that they have no fear or misunderstanding about the ham radio hobby. We know the good things that hams do, but we are still a mystery to the general public. Some aspects of the hobby scare or annoy nonhams. These scary things include big antennas that in their eyes may be unsightly or unsafe or even be the cause of interference to their appliances! The ham tower has become somewhat of a negative symbol to nonhams.

I believe that more work is needed in educating and providing information to the public. But until current perceptions are changed and hams get more respect from the public, we may be losing both the battle and the war. We have some work to do!—*Ken Neubeck, WB2AMU, Patchogue, New York*

PRB-1 AND INDIVIDUAL RESPONSIBILITY

♦ I would like to take issue with the League's apparent position on restrictive covenants applicable to antennas, at least as I understand that position to be after reading the "DC Currents" in the October *QST*. The last paragraph of the item says "The problem of restrictive covenants has been exacerbated in recent years as planned developments have drawn new residents from among the growing number of retired hams, who then learn they may not install a tower or outside antenna of any type." If it is the League's position that restrictive covenants should be challenged due to the ignorance of the buyer, then the League is taking a position counter to what most of us believe when it comes to individual responsibility.

Clearly, it is the responsibility of a property buyer, or the buyer's attorney, to fully investigate all deed restrictions *prior* to signing a contract, especially in planned communities where such deed restrictions are common. Deed restrictions, rules and regulations and association by-laws are all available for inspection from either the seller or the association. It is the buyer's responsibility to research these items prior to contract and/or closing. Complaining about deed restrictions and other limitations on property use *after* the fact is simply unacceptable.

I have been president of my condominium board for a number of years. I am not allowed to have outdoor antennas, and I have not attempted to change our rules to accommodate my personal choice of a hobby. Having reviewed the rules prior to purchase, I knew that I would not be allowed to erect any outdoor antennas. I made an informed decision about the purchase and moved here anyway. That was my choice, and it was my responsibility. Condominiums and planned communities must have the right to protect their interests, including restrictions on antenna construction. Of course, owners may also change the rules and, if a ham living in such a community can garner enough support, the ham is free to push for modifications to antenna restrictions or any other rules.

The League's position appears to fly in the face of individual responsibility, and I would hope the League would alter its position on restrictive covenants and drop the appeal under PRB-1.—*Art Malatzky, WB2WFJ, Valley Cottage, New York*

NARROWER IS BETTER

♦ With the new digital modes I am seeing a rather disturbing trend; using wide receiver IF bandwidths to process relatively narrow digital signals. This has, of course, been occurring for some time as stations use SSB receiver filters to work PACTOR and RTTY, but it is getting worse. Many complain of someone keying up "on top" of an ongoing QSO when in actuality there is plenty of separation if the stations in the QSO were using 500-Hz IF filters in lieu of their 2.8-kHz SSB IF filters. An outboard audio DSP filter does little good because the receiver AGC is still affected by signals inside the IF passband. Much of the blame has to be laid at the feet of the HF equipment manufacturers who, for the most part, have made no provision for the use of narrow filters while in the SSB mode.

The recent trend in PSK31 has been to purposely use a wide receiver bandwidth so that many signals show up on the display and the operator can simply click on the one he wants to print. We are even seeing programs that can now copy two or three signals simultaneously on different areas of the screen. Granted this greatly simplifies tuning of the narrow PSK31 signals, but in exchange it leaves you wide open to QRM. When a strong signal keys up within your receiver IF passband, the AGC action reduces the receiver gain so you see the band noise and the weaker signals disappear from the display. Granted, you don't need to run a lot of power with PSK31, but under the right propagation conditions even 5 W can be received at S9 or above and develop plenty of AGC action.

I believe we need to reverse this trend and begin using narrow IFs for the narrow digital modes whenever possible. We need to insist that manufacturers add a digital mode to transceivers that will permit the selection of narrow receive filters while keeping the transceiver in SSB operation. In the meantime, we need to understand that if we are using a nearly 3-kHz IF to run a narrow digital mode then we cannot expect all other stations to stay outside of our passband. QRM will be a fact of life for which the receiving station will have to accept responsibility.—*Robert W. Lewis, AA4PB, Garrisonville, Virginia*

PASS AROUND THOSE OLD QSTs

♦ I would like to add to W5WIA's comments in the October "Correspondence" ("Putting Old *QST*s To Good Use"). I was licensed at the age of 12 in 1960 as WA6PHH, and the stories I could tell about my young ham career would take up an entire issue of *QST*! As a Ranger in Vietnam, my amateur license was my ticket out of combat during the last 6 weeks of my tour. They pulled me from the field to run a MARS station (*another* story!).

Soon afterward my license expired and Amateur Radio was almost forgotten—except when I would spot a ham antenna. Something would whisper to me, "Rick, you're missing out!"

While living in San Francisco about 10 years ago, I walked down to the local Laundromat and, to my dismay, realized I had forgotten to take along something to read. Pawing through all the tabloids and year-old news mags, I was astonished to discover a couple of *QST*s! I gaped at the new technology—everything from satellites to miniature hand-held transceivers.

Within a week I took my General exam and became KD6SES; a few weeks later I advanced to KN6LD. I eventually became a VE and I'm now teaching ham classes in the local schools. I figure that in about a year my 7-year old son will have *his* license, too. All because someone left some old *QST*s at a *Laundromat*!

Yes indeed, pass those old *QST*s around. It's like putting irresistible bait on a hook!—*Rick Lett, KN6LD, Clinton, Washington*

SETI *IS* AMATEUR RADIO

♦ I must take issue with the letter from WB2GFN in the October *QST* titled "SETI is not Amateur Radio." Mr. Kadner seems to think the hobby is only about chatting and not about science, as though radio's connection to the sciences is something new.

He states that he got into Amateur Radio in the late '50s. In that case, he may have missed a great article titled "Astronomy and Amateur Radio" in the November 1943 issue of *QST*, written by Hollis French, W1JLK. In the article French proclaims, "Radio development has entered a stage in which the amateur experimenter of necessity must become an amateur in other vitally related earth and sky sciences. He must learn to understand and use new tools and apparatus in order to make the most effective use of the very high and higher frequencies. The factors that govern weather and the electromagnetic field of the earth are astronomical, meteorological and topographical. Radio is not strictly a terrestrial art. With advancing knowledge, ever-closer relations appear between the science of astronomy and the art of radio communication. These are more evident as we pass the limitations of the old astronomy of position and enter the fascinating field of astrophysics, where radiation becomes the foundation of the science."

There have been many exciting articles published in *QST* over the years concerning the role that radio amateurs can play in furthering Earth and space sciences, including SETI. I believe the hobby of Amateur Radio can be broad enough to include whatever our interests dictate; there are no bandwidth limitations on our imaginations. Personally, I find the scientific application of radio, in any form, just as "romantic" as a good old down-to-Earth QSO. Besides, how much more exciting could a radio contact be than one with another world…a DXer's dream! I just hope they send along their QSL info. That's a card and/or certificate I *must* have!—*Richard W. Wilson, W5ETI, Albuquerque, New Mexico*

AN EVEN OLDER NETWORK

♦ I read with interest the review by Steve Ford, WB8IMY, of *The Victorian Internet* by Tom Standage in the October 2000 *QST*. The first chapter of the book describes a visual signaling system used in Europe in the 1700s.

A similar, but much older system was once in use, and its visual signaling towers still exist. This is the chain of Crusader castles that runs along the coasts of Syria, Lebanon and beyond. These castles were built 900 years ago and were sited in such a way that a visual contact between them was possible. I lived in Lebanon for many years and visited several of these castles.

Visual signaling is probably much older than the Crusades. All the necessary technology was available 4 or 5 thousand years ago. Living in the Middle East, one is often reminded that many things we think of today as contemporary are really quite old.—*Frank Regier, W8BOH, Strongsville, Ohio* QST

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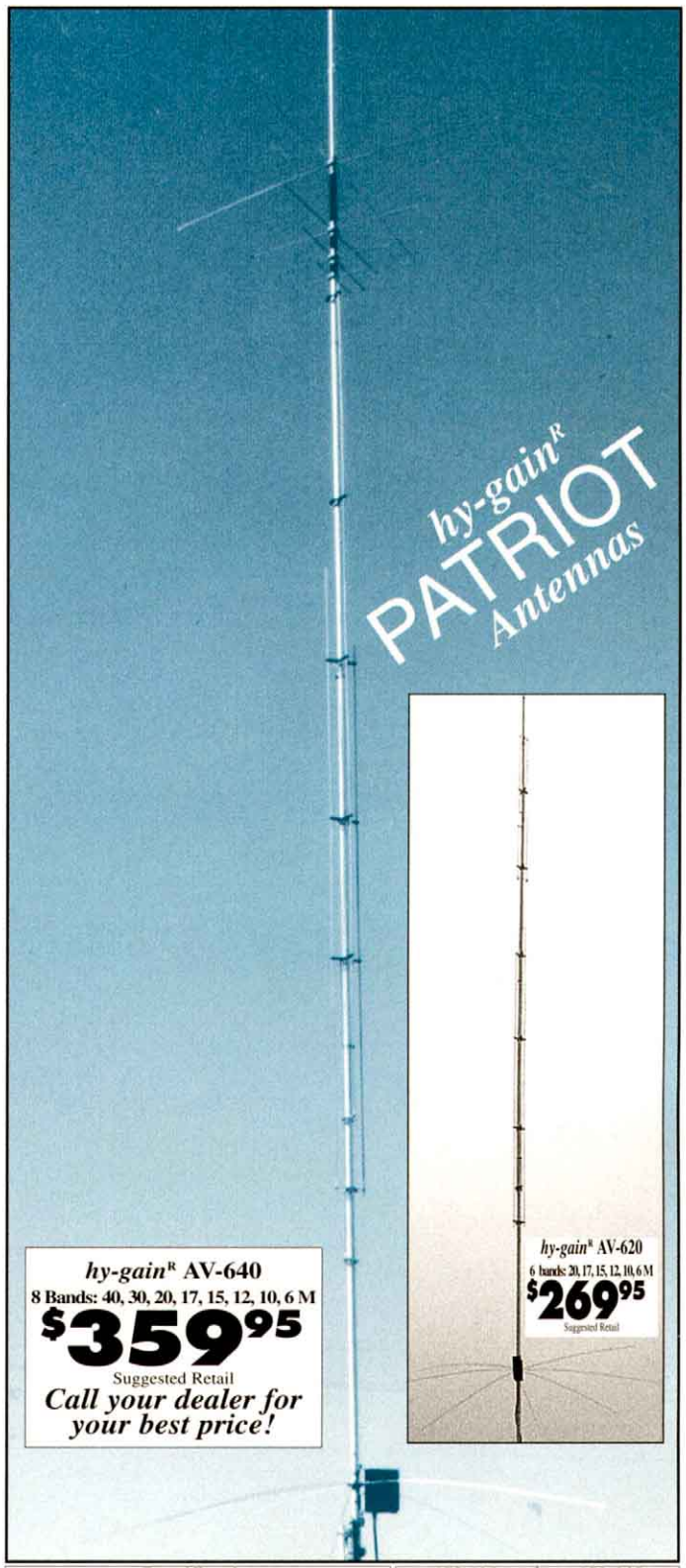

Specifications	AV-620	AV-640
Bands covered (meters)	6,10,12, 15,17,20	6,10,12,15, 17,20,30,40
2:1 VSWR Bandwidth (KHz)		
40M	N/A	150
30M	N/A	175
20M	500	500
17M	500	500
15M	500	500
12M	500	500
10M	1500	1500
6M	2000	1500
VSWR at resonance (typical)	1.5:1	1.5:1
Power handling (watts output) key down 2 minutes	1500	1500
Vertical radiation angle (degrees)	17	17
Horizontal radiation angle (degrees)	360	360
Height (feet)	22.5	25.5
Weight (pounds)	10.5	17.5
Wind surface area (square feet)	2.4	2.5
Wind survival (mph)	80	80

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By Michael Tracy, KC1SX

QRP Transceiver Kits: Six Reports from the Field

With the explosive growth in low power (QRP) hamming, reporting on the current state of the transceiver art is akin to shooting at a rapidly moving target. We have reviewed QRP transceiver kits in *QST* before, but this time we were looking for a totally different approach. Rather than follow the traditional path of buying a QRP kit and running it through the usual "Product Review" gauntlet, we decided to go into the field and contact hams who had recently built several of the most popular kits.

We asked these amateurs to give us their impressions, in their own words. We then had each transceiver shipped to Headquarters and performed a few measurements in the ARRL Lab. The results are shown with each unit. (When reading through the tables, note that the builder often determines the frequency range. Also, audio output was not measured for some radios because they were intended for use with headphones and their output impedance was not specified.)

Of course, we'll continue to subject new QRP rigs to our rigorous "Product Review" scrutiny, but I think you'll enjoy these grassroots reviews. In many ways, they are every bit as valuable and informative as full-fledged *QST* "Product Reviews."

EMTECH NW80/20

By Bob Kellogg, AE4IC
ae4ic@nr.infi.net

I own a complete set of EMTECH NW80/20 transceivers for 80, 40, 30 and 20 meters—all built from kits. They have QRP power to spare. The RF output is a full QRP "Gallon"—variable from less than a watt to well over 5 W using an internal pot. The audio output will drive a small speaker. For me, they've been ideal single band rigs for working the QRP contests and general QRP operation.

The EMTECHs have a very sensitive superheterodyne receiver. A variable bandwidth crystal filter is included in the IF chain. An optional fixed-width audio filter is available and recommended. The IF/audio filter combination allows good selectivity during crowded band conditions.

For me, the EMTECH step-by-step "build, then test" process was especially helpful. The instructions are not as detailed as the old Heathkit manuals, but they cover the necessary steps very well. In addition, the builder assembles a section of the transceiver, then tests that section. So, as more and more components were added to the board, I wasn't worrying that I'd made some mistake that would be difficult to find later. This "build a section and test" process also helped me understand how the transceiver works.

The audio filter option was included with my kit. The instructions include an explanation of how to vary the filter peak frequency and to add gain. I chose a center frequency of about 650 Hz with no additional gain. Actually, I played with this feature a little after the transceiver was completed. It was fun to change a few parts, then observe the results. The audio filter is a nice option.

Alignment and testing of the completed transceiver requires simple equipment. A tuner with a dummy load and

EMTECH NW80/20
Receive current drain: 40 mA (max vol)
Transmit current drain: 1.0 A at 5.3 W with 13.8V dc
Frequency range: 14.001 to 14.096 MHz
Spectral purity: 39 dB below the carrier
Receive sensitivity: –125 dBm
IF rejection: 69 dB
Image rejection: 124 dB
Blocking dynamic range: 100 dB
IMD dynamic range: 78 dB
IF/Audio bandwidth: 534 Hz
Audio power output (into 8 Ω): 1.5 W
2nd Order IMD dynamic range: 101 dB
2nd Order Intercept: +77 dBm

power meter, a volt-ohmmeter and a calibrated station receiver will do the job. I used a frequency counter instead of a calibrated receiver. Alignment required careful adjustment of the transmit frequency, since this is also the sidetone heard when transmitting. The instructions cover two methods for making this adjustment.

The NW80/20 rigs are designed to fit into the inexpensive Radio Shack 270-253 case. EMTECH also offers a fancier custom case. I have rigs in each.

Now it's confession time. The NW20 rig tested for this article was actually built by my wife, Ellen. She won the kit at Dayton and decided to build it herself, even though she had never used a soldering iron. I looked over her shoulder occasionally, and confirmed her test results as she completed each section. Her work passed the "Smoke Test" with no problems.

The EMTECH 80/20 rigs are fun and satisfying to build, and they work very well. They are the single-band workhorses in my shack. *You can contact EMTECH at 1127 Poindexter Ave W, Bremerton, WA 98312;* **www.emtech.steadynet.com/**. *$130, with audio filter and cabinet.*

SMALL WONDER LABS DSW-40

By Rod Cerkoney, N0RC
n0rc@qsl.net

The DSW-40 takes the classic monoband QRP rig to a new level with a keyer, RIT, full CW band coverage and a DDS VFO—all in a small package that draws only 40 mA in the receive mode! Building on the successful NE4040/SWL-40 legacy, Dave Benson, NN1G, of Small Wonder Labs gives us features found in the "Big Rigs" without the Big Rig price. Only $95 gets you the basic kit; add your own case and controls and you're on the air. Another $35 gets you a very attractive blue anodized case, controls, connectors, knobs, etc. The complete package is a hot little radio in a cool blue case.

Central to the design is a PIC chip to control the various features of the DSW-40. Dave also gives us a taste of surface mount technology in the rig; the DDS and most of its support components are surface mount, but they are pre-mounted for construction ease. Even so, you're required to solder two surface mount inductors to the board. The inductors are large by surface mount standards—about the size of 1/4-W resistors. This was my motivation to build the DSW—to get some exposure to surface mount construction.

If you're worried about how difficult the kit is to build, don't be. With modest tools, basic construction skills and a little patience, you'll have the rig on the air in a few nights. Even the novice kit builder shouldn't need more than a week or two to complete the DSW-40. The manual is excellent. Its step-by-step instructions and illustrations help you get the parts mounted correctly. A high quality silk-screened PC board further enhances assembly.

Once the kit is completed, alignment is a snap. A special power-up test mode generates an audio tone that you adjust via one trimmer capacitor for 800 Hz, the transmit offset. Tweak a transformer to maximize receiver gain, and that's it! The PIC/DDS combination eliminates receiver alignment required by other designs. If Murphy should pay a visit, don't panic. The manual has theory of operation and troubleshooting sections that should get you back on track. Beyond that, Dave Benson is available via e-mail to help out.

Expect about 2 to 2.5 W out of the DSW-40. Mine came in at 2.25 W, more than enough to join the QRP fun so popular today. In terms of receive performance, an RF sensitivity knob helps manage the strong signals, or brings the weaker ones up out of the noise. Tuning is accomplished by an optical encoder with mechanical detents. At first I didn't care for the detents, but in mobile situations, campsites, and backcountry operations, the detents are welcome. At power up the rig is tuned to 7040 kHz, the QRP calling frequency a full turn of the knob moves you up and down the band 6 kHz per revolution. To fine tune a station, press the tuning knob and the rig switches to 1.2 kHz per revolution. If the station you're working is a little off frequency, no problem. Turn on the RIT and the main tuning knob controls only the receive frequency.

The DSW's small size makes an ideal traveling companion in a backpack to your favorite hiking destination, or in your briefcase on a business trip. And, you won't need much power to run it. As a test, I ran mine for about 30-45 minutes from a 9-V battery, got 1/2-1 W out and had a nice QSO or two. With eight AA batteries I've run for two hours and still maintained 1 W out-

Small Wonder Labs DSW-40
Receive current drain: 40 mA
Transmit current drain: 0.35 A at 2.2W with 13.8V dc
Frequency range: 7.000-7.300 MHz
Spectral purity: 42 dB below the carrier
Receive sensitivity: –133 dBm
IF rejection: 72 dB
Image rejection: 88 dB
Blocking dynamic range: 103 dB
IMD dynamic range: 84 dB
IF/Audio bandwidth: 401 Hz

put. My "portable" station consists of the DSW, a small set of paddles, a dipole made from 22-gauge hook-up wire fed with RG-174 coax, and a pair of lightweight headphones. With eight AA batteries the whole station weighs less than 2 pounds!

If you're looking to join the QRP fun, and want to build a kit to boot, consider giving the DSW-40 a try. I think you'll like it. *You can contact Small Wonder Labs at 80 East Robbins Ave, Newington, CT 06111;* **www.smallwonderlabs.com/**. *$100, cabinet $35 additional.* [We're advised that the DSW series is not currently available due to a semiconductor supply issue. Check the Small Wonder Labs Web site for updates.—*Ed*]

OAK HILLS RESEARCH OHR-100A

By Christian O. Hunt, KF6IHU/9
kf6ihu@morphine.com

When I first built the Oak Hills Research OHR-100A, I had only been a ham for about 2 years. Other kits I had built at the time were the Wilderness SST-40, a Pixie II for 40 meters, and the OHR WM-2 QRP wattmeter. Aside from the QRP related kits, I have also built many simpler "educational" kits, as well as experimented with electronics and computers. Building kits and homebrewing is one of the aspects of Amateur Radio that appealed to me initially. I rediscovered something I enjoyed as a kid playing with computers.

The first thing I did after opening the kit was to look over the documentation. I was impressed with the clarity of the instructions. They were clear, concise and well laid-out. I found them very easy to follow. The parts were clearly labeled and easy to identify.

As with all kits, the first thing I did was to take a parts inventory. After completing this and finding all parts present and accounted for, I began to assemble the rig. Following the assembly order outlined in the instructions, I started stuffing parts and soldering. There are a few toroids to wind, which I actually enjoy doing. I don't find it nearly as horrible as other people do!

After I finished installing all the on-board components, it was time to install the panel mount controls and internal wiring. The wiring is very nice, accomplished using pre-assembled harnesses that need to be trimmed to length and soldered to the panel mounted controls. Installation was easy and resulted in a very clean internal appearance.

It was now time for the smoke test. When I initially applied power to the rig, it was very noisy, with a loud buzz being the predominant sound emanating from the headphones. I quickly discovered this was not a construction error, but rather a problem with the noisy power supply I was using. The problem was remedied by using a 12-V gel-cell. Everything sounded good, and nothing was smoking, so it was on to the initial adjustments.

I had a bit of trouble adjusting the zero-beat and the variable-bandwidth filter. They were not adjusted as well as I thought they should be, and that was a result of my inexperience with radio. The other internal adjustments were performed using a frequency counter and a DMM. Internal test points are provided in the form of jumper loops, making it very easy to attach test leads while adjusting. After the adjustments were complete, power output was approximately 4 W.

It was now time to put the rig on the air. I connected an antenna and started tuning around the band looking for stations. I noticed that the tuning pot was a little rough mechanically. You could hear the wiper scraping when you tuned. This is probably just a problem with the particular pot included with my kit, and not representative of the kit in general. The RIT control is very nice, and has a center detent, which makes it easy to return to the center frequency. Keying is smooth, with full-QSK making the rig a pleasure to use.

I was impressed with the sensitivity of the receiver, being able to hear stations I normally wouldn't with my QRO rig. The audio output was robust and very clear. A speaker output is also provided on the rear panel, in addition to the headphone output. I tend to prefer having the headphone jack on the front panel, but this is a minor inconvenience. The rig also has an oscillator output jack for connection to a matching OHR DD-1 digital frequency display or other frequency indicator. With the exception of the rough tuning pot, all the front-panel controls are well placed, smooth and easy to use.

The Oak Hills Research OHR-100 is a very nice rig for intermediate-level kit builders. It is terrific on the air and fun to build. For backpacking, I find the OHR-100A to be a bit bulky. The Wilderness SST is better suited for backpacking. But for portable use, the OHR-100A is ideal. *You can contact Oak Hills Research at 2460 S Moline Way, Aurora, CO 80014;* **www.morsex.com/ohr/**. *$129.95.*

WILDERNESS RADIO SST

By John Harper, AE5X
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Recent camping trips with a borrowed rig, and then with my own Norcal 40A, were not only incredibly fun, they increased my appetite for more excursions into the woods with QRP gear. With this in mind, I ordered two SSTs from Wilderness Radio about 18 months ago, one for 30 meters and the other for 40 meters. I did this with the idea of taking the minimalist approach of doing more with less—the same way a QRPer might eventually become a QRPper (*very* low power operator)! I also wanted less weight, less bulk and a simpler rig, with the philosophy that the less there is, the less there is to go wrong. This is an important consideration when hauling the rig (in addition to the "normal" camping stuff) in a backpack and being away from test equipment and tools.

As with the Norcal 40A, I was impressed with the clarity of the SST's instruction manual and the quality of the kit. Parts placement is clearly marked on the silk-screened board, and all connectors—power, antenna, key and phones—mount directly to the circuit board, eliminating internal wiring and increasing reliability. One thing that sets Wilderness rigs apart

Oak Hills Research OHR-100A
Receive current drain: 90 mA (max vol)
Transmit current drain: 0.92 A at 5.1W with 13.8V dc
Frequency range: 14.002 to 14.080 MHz
Spectral purity: 36 dB below the carrier
Receive sensitivity: –124 dBm
IF rejection: 64 dB
Image rejection: 89 dB
Blocking dynamic range: 106 dB
IMD dynamic range: 87 dB
IF/Audio bandwidth: 963 Hz
Audio power output: 0.5 W into 8 Ω
2nd Order IMD Dynamic range: 89 dB,
2nd Order Intercept: +54 dBm

Wilderness SST
Receive current drain: 19 mA
Transmit current drain: 0.21 A at 2.3W with 13.8V dc
Frequency range: 10.1086 to 10.1190 MHz
Spectral purity: 34 dB below the carrier
Receive sensitivity: –139 dBm
IF rejection: 50 dB
Image rejection: 40 dB
Blocking dynamic range: 112 dB
IMD dynamic range: 92 dB
IF/Audio bandwidth: 111 Hz

is that they encourage modifications. The manual suggests several mods and the circuit board has pads to allow tapping into the audio chain, the dc bus, keyline, etc.

Both kits went together and tuned up with no problems. Tune-up is simple and involves adjusting one capacitor to peak receiver noise and another to peak for maximum transmitter output. Output power is then adjusted to your liking with a small board-mounted pot. That's it.

Receive selectivity is very sharp and transmitter power output is 1.8 to 2 W. Modifications to both of these parameters, as well as numerous other modifications, are widely published on the Internet. For instance, each kit comes with two varactors to allow the builder a choice in frequency coverage. One of the most common mods involves the installation of a SPDT switch to allow both varactors to be installed for increased frequency coverage. With both varactors installed, my 40-meter SST covers 7036-7048 kHz. The single varactor in my 30-meter version covers 10.109-10.119 MHz. Other modifications involve replacing the transmitter's final amplifier transistor with a variety of other types in order to increase the output power.

The next modification I intend to make to both of my SSTs is one that lowers the volume of the sidetone. This is a bit more involved than simply adding a resistor to the output of a sidetone generator since the sidetone in the SST is actually a sampled portion of the transmitted signal. But such a modification does exist and was devised by the SST's designer, Wayne Burdick, N6KR. For now, I just turn the AF gain down just a tad before I transmit.

Performing these and/or other modifications has three advantages:

1. I have a rig that is more tailored to my preferences—higher RF power output, more frequency coverage, built-in TiCK keyer and a slightly wider audio filter.

2. I have learned something from each modification, particularly the audio filter mod. Yes, these are still kits that I built from step-by-step instructions, but experimenting with various mods has given me the confidence to take on more ambitious projects.

3. There is more "me" to any radio that I modify. With each modification, the rig became a tiny bit less of a kit and more of a custom project. More than a year later, I'm still tinkering with my 40-meter version, just for the pure fun of it. I have even bigger plans for the 30-meter SST!

I've used these little rigs from home and during camping trips. My antennas have been dipoles, inverted Vs or random wires, with AA or C-cells being the usual power supply. I have never lacked for QSOs during these excursions—CQs are answered and a large percentage of the QSOs turn into rather long ragchews when other operators are surprised and ask about the details of such a small rig. What the SSTs lack in bells and whistles is made up for in elegant simplicity. If there is a bell or whistle you need, there's probably a mod for it. *You can contact Wilderness Radio at PO Box 734, Los Altos, CA 94023-0734;* **www.fix.net/jparker/wild.html**. *$85.*

SMALL WONDER LABS SW-40+

By Mike Maiorana, KU4QO
ku4qo@arrl.net

The SW-40+ is the 40-meter version of the SW series CW transceivers by Small Wonder Labs (also available in 80, 30 and 20-meter versions). I became involved with this radio when several hundred of the members of the QRP-L e-mail list and I decided to build it as a group project. I led the effort, and along with a great group of technical people, we built and documented the functions of the radio. This info can be found at **www.qsl.net/kf4trd**.

The radio as built will cover approximately 35 kHz of the 40-meter band and can be built to function in the Novice/Technician section if desired. It can be easily changed back to cover any section of the 40-meter CW band at a later date. The receiver is a superhet design with a 3-crystal IF filter. The receive bandwidth is "just right" at around 400 Hz—not too narrow, not too wide, and no noticeable filter ringing. The T/R switching is full solid state QSK that is silky smooth and very fast. The transmitter will put out a clean, chirp-free 3.5 W to the antenna. The output is SWR protected and filtered to easily comply with FCC regulations.

The kit comes with all the required on board components, but does not include the case and the controls. An optional enclosure kit is available that includes everything you need to finish the kit, including a high quality case, controls and knobs. I opted not to purchase the enclosure kit because I already had a suitable enclosure on hand.

All connections to the board are made with 0.100-inch locking headers and mating terminal housings. The main board can be easily disassembled from the enclosure. Also available is an optional RIT board that can add RIT function, and an audible frequency counter for those who need to know exactly where they are on the band.

The PC board is 2.8 × 4.0 inches with plated through holes and full silk-screening. All resistors and diodes are mounted vertically to save space. Although the component spacing is fairly tight, there is plenty of room to solder the parts on the bottom, and the silkscreen keeps the solder neat. There are only five toroids to wind, and the instructions are very clear on how to do this. I personally think that the aversion to winding toroids is silly. They are really quite easy once you get the hang of it. The biggest problem I have is getting distracted and losing count.

The introduction in the instruction manual covers the basics like the required tools, test equipment, color codes and soldering basics. The parts list helps the builder clearly identify each component. The radio is built in sections, each with a very clear drawing of what parts should go where. When you follow the instructions, the assembly is easy and painless.

Alignment is also very straightforward. The only test equipment needed is a voltmeter and another transceiver (used for fine tuning). The whole process should take less than 10 hours from the time you start building to the time you are on the air.

Operating the radio is a pleasure. The first thing that struck me is the low power supply current requirements. The rig was pulling less than 16 mA on receive! That would give me 125 hours of listening time

Small Wonder Labs SW–40+
Receive current drain: 16 mA
Transmit current drain: 0.52 A at 3.5W with 13.8V dc
Frequency range: 7.017-7.052 MHz
Spectral purity: 34 dB below the carrier
Receive sensitivity: –134 dBm
IF rejection: 80 dB
Image rejection: >140 dB (not within the measurement capability of the ARRL Lab)
Blocking dynamic range: 104 dB
IMD dynamic range: 85 dB
IF/Audio bandwidth: 381 Hz

on a small 2 A/h battery. The transmitter is also very efficient, drawing around 1/2 amp on key down. The small size and low power requirements of this radio make it an excellent choice for a backpack or remote rig. The receiver is very quiet and extremely sensitive. As you tune around the band the signals just "pop up" out of nowhere. Strong nearby signals have never been a problem with this rig. On-air reports of the transmitted signal have always been outstanding, with no chirp or drift reported after a few minutes of warm-up.

You can contact Small Wonder Labs at 80 East Robbins Ave, Newington, CT 06111; **www.smallwonderlabs.com/**. *$55, enclosure $38 additional.*

RED HOT RADIO RH-20

By Mark Hogan, N5OBC
mhogan@email.msn.com

Well, the kit comes to you in a US Postal Service priority mailer, and right away you wonder if there is really a radio in there! Since I had already built an NC-20 (the club version of the rig from NorCal), I knew it was a radio. I had prepared the inventory sheets on Styrofoam and already poked two holes for each part.

Opening the box you find four case pieces, a manual and schematic and a bag of parts. The bag contains smaller bags that are strategically sorted by Red Hot Radio. Following the instructions, which are great, the parts descriptions are inclusive of resistor colors and cap markings. It took me about 2 hours to inventory the kit. I was missing one capacitor (which I promptly forgot to call for, and that would haunt me later). Noting its absence in the book, I started the kit.

The kit goes together very fast. Silk screening is excellent and parts placement is very clear. Using the inventory boards is the only way to go (for me at least). You end up with all the parts standing in a row waiting to be picked and soldered. By the way, I am not a seasoned builder; this is my second kit, the first was the NC-20. I go very slowly, checking that all the parts go in the right holes and making sure that there are no cold solder joints or pads that run together. Although this radio has a high parts count and a tight board, the way Red Hot Radio has the book and board laid out makes it easy to put together. Dave explains all the intricacies of radio assembly in the book and tells you how to wind and count the windings on a toroid, as well as how to bend the resistors and diodes to get them in the board. Pictures of the toroids are very good and you should have no problems.

Assembling is done section by section with testing at the end of each section. This is a great approach. When you finish a section you can see right away that it works. By the end of the assembly process you know the radio is going to make contacts because each stage has been tested and verified along the way (you did keep all the smoke in the little parts, didn't you?). If there is a problem Dave is available. The manual lists the hours and phone numbers, and he answers his e-mail pretty darn fast.

Receiver alignment is simple and requires only your ear and a tweaking tool. The book explains how to do the alignment very well and there was no problem.

Remember that missing capacitor? I forgot to e-mail Red Hot Radio about it and RadioShack did not have it. True to the ham radio spirit I pulled out the solder wick (I learned how to use this on the NC-20. Didn't I say go slow and make sure what hole you poke the part into? Don't work too late either!) and jerked C-66 out of my NC-20 and—poof!—a working RH-20 was born. The transmitter was even easier to align, and there was a great sigh of relief when I saw the wattmeter jump past 5 W before I turned it down to just below 5 W for my use.

All in all, this is a fun radio to build. I find it therapeutic to build radios, and I sure have fun using something I built to make contacts. I am not sure if these are beginner-level kits, but I did my RH-20 as a first-time kit, so I am sure that you could, too. I'm not an electronics technician, but I have soldered a resistor or two. All the parts make a whole and the whole thing is fun. [Red Hot Radios are now supplied with a new, low-profile enclosure.—*Ed*]
You can contact Red Hot Radio at 14730 Charmeran Ave, San Jose, CA 95124; **www.redhotradio.com/**. *$150.* QST

Red Hot Radio RH-20
Receive current drain: 200 mA (max vol)
Transmit current drain: 0.87 A at 4.7 W with 13.8V dc
Frequency range: 14.022 to 14.087 MHz
Spectral purity: 43 dB below the carrier for close-in spurs and 60 dB below for harmonics
Receive sensitivity: –129 dBm
IF rejection: 95 dB
Image rejection: 128 dB
Blocking dynamic range: 115 dB
IMD dynamic range: 83 dB
IF/Audio bandwidth: 260 Hz
Audio power output: 0.88W into 8 Ω
2nd Order IMD Dynamic range: 102 dB
2nd Order Intercept! +75 dBm

By Ron Stone, KA3J

The UniCounter—A Multipurpose Frequency Counter/Electronic Dial

This one-eyed, 30-MHz, 8-digit counter offers 10-Hz resolution, quickly adapts to different rigs and costs about $25.

A while ago, I started searching for an inexpensive frequency counter that could provide a digital readout for my simple QRP rigs and serve as a bench counter. A variety of very good microcontroller-based designs are available; however, none of them quite met my needs. I found that the lower-cost designs typically provided 1-kHz, or at best, 100-Hz resolution that really isn't sufficient for bench work such as matching crystals or evaluating oscillator stability. Also, some of these counters could not be moved easily from to rig to rig without reprogramming or rewiring them, or they made tuning for a specific frequency somewhat difficult. One solution to my dilemma could have been to simply buy a more-expensive digital-display counter/electronic dial (e-dial). However, it appeared that I might be able to achieve my objectives by more fully exploiting the capabilities of the ubiquitous, low-cost Microchip PIC16F84. I decided to try to design a counter/e-dial with the following characteristics:

- Eight digits, with fairly fast updating
- Full HF coverage (30 MHz+ range)
- High resolution for bench work
- High input impedance and good sensitivity
- User-programmable offsets for different types of rigs
- Single-switch programming and operation
- Low power consumption
- Compact, with minimal parts count
- Low cost, around $25 to build

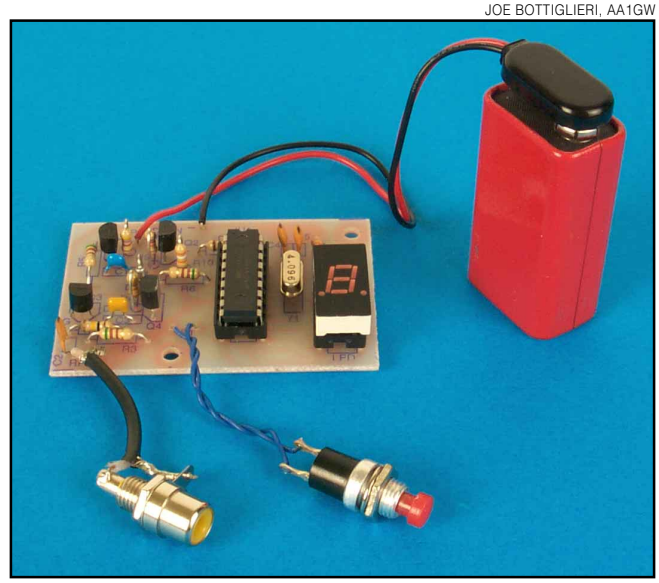
Design Decisions

Output

I first thought about how to provide the frequency count and considered LCDs, LED displays and Morse audio output. I quickly eliminated LCDs because of cost. Using Morse audio output is simple and low cost. However, its serial nature and relatively low speed can make scanning for a specific frequency difficult. In addition, the counter would likely be connected to a rig's audio chain in addition to the VFO. This would make it more difficult to move the counter from rig to rig. So, I turned to the possibility of using seven-segment LEDs. These devices can consume significant power (by QRP standards), may require a fair amount of board space, and can also generate noise especially if multiplexed. Nevertheless, it seemed that I might get around these problems by using a single seven-segment LED display and displaying each digit serially.

My first prototype tested this concept by driving the display with the PIC and varying the display dwell (on) time and duty cycle. I found that numbers could be comfortably read with a dwell time of 150 ms and a 50% duty cycle. This speed is equivalent to about 56 WPM in Morse.[1] I found this to be fast enough to find specific frequencies while scanning fairly quickly through a band. If you have a quick eye, a 100-ms dwell time provides the equivalent of about 76 WPM.

JOE BOTTIGLIERI, AA1GW



During development, I also experimented with driving the display at different current levels. For simplicity, I used a single current-limiting resistor for the entire display (see Figure 1). I found that a drive current of only 9 mA (average of 4.5 mA with a 50% duty cycle) provides sufficient brightness for just about any ambient lighting level. Typically, to ensure uniform brightness, a current-limiting resistor is used on each display

[1]Notes appear on page 37.

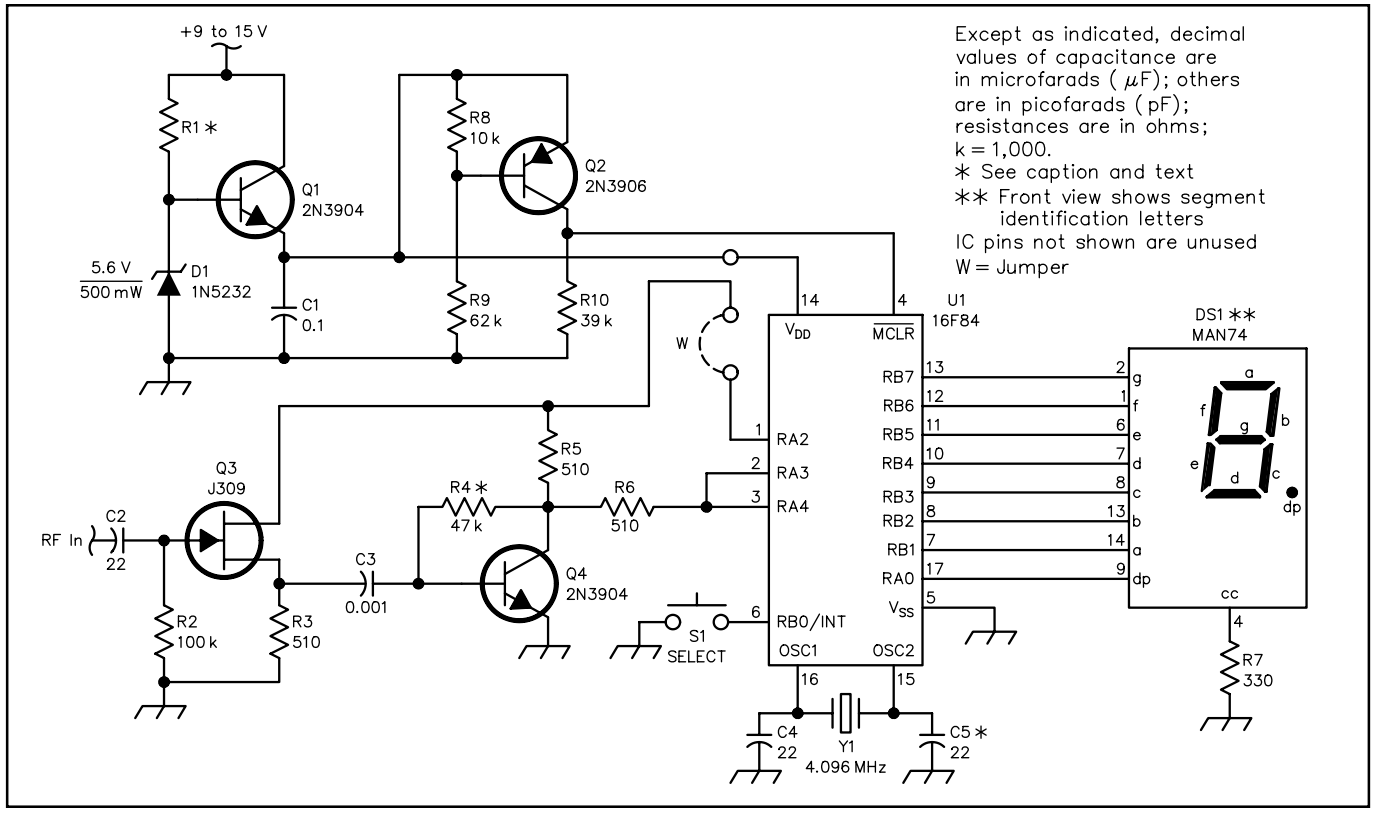


Figure 1—Schematic of the UniCounter. Unless otherwise specified, all resistors are 1/4-W, 5%-tolerance carbon-composition or film units. Equivalent parts can be substituted; n.c. indicates no connection. RS part numbers are RadioShack.com; Jameco = Jameco Electronics. Parts are available from RadioShack.com, PO Box 1981, Fort Worth, TX 76101-1981; tel 800-843-7422; fax 800-813-0087; www.radioshack.com; Jameco Electronics, 1366 Shoreway Road, Belmont, CA 94002-4100; tel 800 831-4242, fax 650 592-2503; www.jameco.com. See Notes 3 and 4 regarding use of the jumper (W)

C1—0.1 μF, 50 V monolithic (Jameco 25523)
C2, C4, C5—22 pF NP0 5% 50 V disc ceramic (RS 900-2193); see text
C3—0.001 μF, 50 V monolithic (Jameco 81517)
D1—1N5232 5.6 V 500 mW Zener diode (RS 900-3089)
DS1—Seven-segment LED display, MAN74 (Jameco 24782)
Q1, Q4—2N3904 or other small-signal NPN transistor (RS 900-5456)
Q2—2N3906 or other small-signal PNP transistor (RS 900-5457)
Q3—J309 or similar N-channel JFET (RS 900-5492)
R1—4.7 kΩ (RS 900-0234) for 12 to 15 V; 3 kΩ (RS 900-0229) for 9 to 12 V
R2—100 kΩ (RS 900-0266)
R3, R5, R6—510 Ω (RS 900-0211)
R4—47 kΩ (RS 900-0258) for Q4 h_{FE} of 130 (see text)
R7—330 Ω (RS 900-0206)
R8—10 kΩ (RS 900-0242)
R9—62 kΩ (RS 900-0261)
R10—39 kΩ (RS 900-0256)
S1—SPST pushbutton (RS-1547); see text.
U1—Microchip PIC16F84 (Jameco 145111)
Y1—4.096-Hz crystal, low-profile HC-49/S holder (RS 900-5130)
Misc: one 18-pin socket (RS 900-5741); one 14-pin socket (RS 900-5739); one phono jack; one dc jack; short length of coax cable (RG-214 or RG-58), PC board (see text).

segment. I was surprised to discover that although some brightness variation could be perceived, the display looked fine when using a single resistor. So, I opted for the simpler approach in the final design.

Frequency Resolution and Range Requirements

The higher resolution required for bench work meant using a fairly long gate time. However, a long gate time would degrade the e-dial function where a fast update rate is more important. One way around this dilemma would be to have two gate times—a slower one, perhaps one second to allow 1-Hz resolution for bench work and a faster one, perhaps 0.01 second, for the e-dial to provide 100-Hz resolution. To keep things simple, I decided to compromise and use a 0.1-second gate time for 10-Hz resolution. This is sufficient for most bench work and would not unduly slow down the e-dial function.

I wanted the UniCounter to handle signals up to at least 30 MHz. This, in combination with the 10-Hz resolution requirement, had several key implications for the design. First, it meant that a three-byte (24-bit) counter would have to be used to allow a maximum count of 2^{24} = 16,772,216. Note that because the lowest digit actually represents 10 Hz, the counter could potentially handle a maximum frequency of about 167.7 MHz, although the PIC's real limit is about 50 MHz. A two-byte (16-bit) counter can only display a maximum of about 655 kHz at 10-Hz resolution. The desired frequency response, resolution, and gate time also mandated that the PIC's prescaler count be used as the least significant byte of the counter. Unfortunately, this register cannot be read directly. However, Microchip's application note (AN592) provides a clever way of extracting the eight-bit prescaler count that I adopted in this design.

Frequency Display Profiles

Programming the basic frequency counter in assembler was fairly straightforward and only required about 20% of the PIC's program memory (about 200 instructions). An additional 500 instructions were needed to permit user programming and calculations that make the UniCounter flexible and easy to use. The key was to create *frequency display profiles* employing the PIC's EEPROM (64 bytes). Up to eight profiles can be programmed. As shown in Figure 2, each profile stores the following data:

Display Rate: The digit display rate

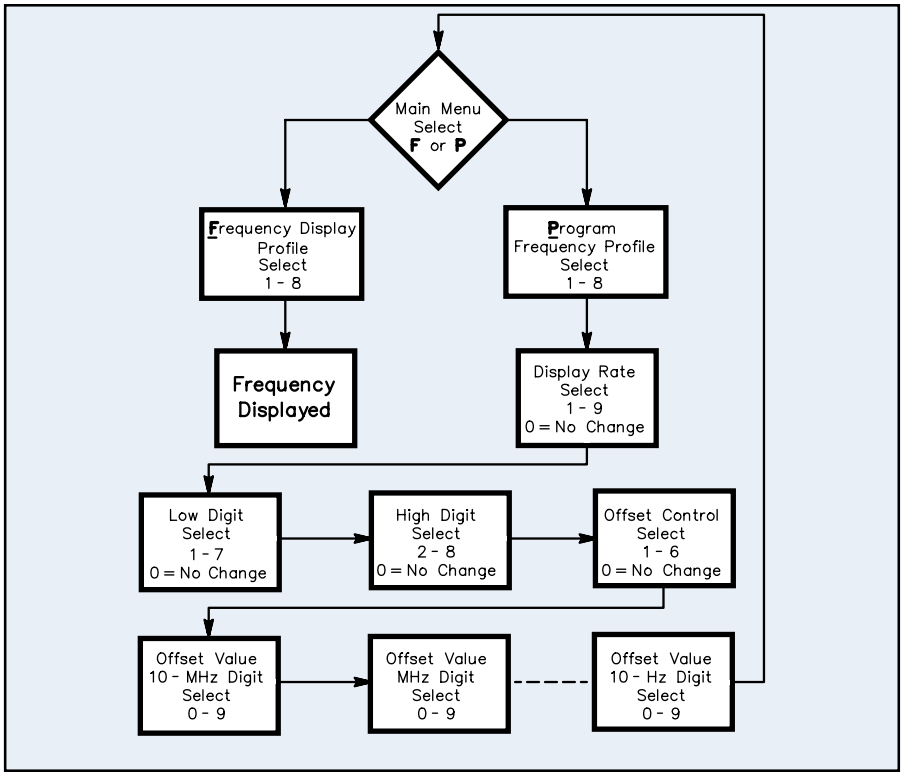


Figure 2—UniCounter programming sequence

can be varied from 100 ms to 500 ms in nine steps (50 ms per step).

Low Digit: Lowest digit to display; selecting **1** indicates 10^1 Hz digit, **2** indicates 10^2 Hz digit, etc.

High Digit: Highest digit to display. The highest digit must be at least one higher than the lowest digit, otherwise an error indication is displayed.

Offset Control: One of three offset modes in combination with a display mode. Selections **1-3** provide a continuously updated display, while selections **4-6** display the frequency one time and then the PIC enters a low-power sleep mode. The offset selections accommodate direct conversion or a variety of superhet mixing schemes as follows (Note: the examples illustrate single-conversion mixing schemes):

Selections **1** and **4**: Displayed frequency (RF) = oscillator frequency + programmed offset

Example: 7 MHz (displayed frequency) = 3 MHz (VFO) + 4 MHz IF (offset)

Selections **2** and **5**: Displayed frequency = oscillator – programmed offset

Example: 10.1 MHz (displayed frequency) = 22.1 MHz (VXO) – 12 MHz (IF)

Selections **3** and **5**: Displayed frequency = programmed offset – oscillator frequency (Note: This results in reverse tuning.)

Example: 3.5 MHz = 9 MHz (IF) – 5.5 MHz (VFO)

Offset Value: Finally, the actual seven-digit offset number is stored starting with the highest digit (10^7 Hz) and ending with the lowest digit (10^1 Hz).

Circuit Description

As can be seen in Figure 1, the circuit is quite simple. The PIC requires about 5 V dc that is provided by the combination of the Zener diode D1, Q1 and R1. This circuit offers better regulation and less power consumption than a simpler Zener diode and resistor combination. Q2 and the associated circuitry provide brownout protection to prevent data (EEPROM) corruption.

The UniCounter works fine with a wide range of clock-crystal frequencies. I chose a 4.096-MHz crystal (Y1) to minimize the chance of IF feedthrough in rigs that use a 4-MHz IF. My prototype used a 3.2768-MHz crystal that was left over from another project.

A plastic trimmer capacitor can be used for C5 to allow adjustment of the PIC clock frequency. If you're very patient and have a delicate touch, you can calibrate the UniCounter fairly closely with one of these, although it's easier to do so with an air-dielectric variable capacitor. For most applications, using a fixed-value capacitor for C5 is just fine because you can largely compensate for any timing error through the programmed offset. Lower-cost crystals usually have a stated 50-ppm tolerance. A worst-case tolerance of –300 ppm or –0.0003% would result in a displayed frequency of 7.10213 MHz when measuring an actual frequency of 7.1 MHz. The 2.13-kHz error can be subtracted as part of the programmed offset. This adjustment results in a very small, inconsequential display error at other frequencies. For example, a 7.0-MHz signal would display as 6.99997 (30 Hz low).

The rest of the circuit provides a high-impedance load for the signal source (typically a VFO or VXO), and signal amplification and conditioning required by the PIC. I tried a variety of circuits and decided that this one offers the best general performance.[2] Q3 is configured as a JFET source follower. If you don't have a JFET, you may be able to get by with an emitter follower using any small-signal NPN transistor (2N3904, 2N2222, etc). Start with values of around 1 kΩ for the emitter resistor and 100 kΩ for the base-to-collector resistor. This arrangement works well with my direct-conversion rig that has a VFO source impedance of about 50 Ω.

The second stage provides gain (if needed) and the bias should be at about one-half V_{DD} (2.4 V) for maximum sensitivity and frequency response. Note that the bias circuit is not ideal because Vc is dependent on the beta (h_{FE}) of the transistor.[3] Again, I opted for simplicity recognizing that the bias variation won't be noticed in most applications. However, if you wish, you can use the equations in Note 3 to determine your Q4's h_{FE} and suitable resistor values that will optimize performance. Or, you can use a trimmer pot for R4 or R5 and simply adjust it for the proper bias voltage. I kept R5 fairly low (510 Ω) at the cost of increased power consumption in order to maximize frequency response (ie, I kept the amplifier output impedance low). This helps because the amplifier is driving a low-pass filter formed by the two PIC ports (parallel capacitive input) in series with the current-limiting resistor, R6.

The amplifier's overall performance is respectable with a minimum input-signal requirement of less than 100 mV P-P up to 5 MHz, gradually increasing to 500 mV P-P at 25 MHz and 1 V P-P at 30 MHz. The amplifier draws an average of about 8 mA. Power to the amplifier can be supplied via the PIC (pin 1) and is turned off when the PIC is sleeping.[4] In this mode, the UniCounter's total current consumption decreases to about 2 mA.

Construction

There are plenty of options for building the UniCounter. PC boards, full kits and partial kits are available.[5] The partial kit includes a *programmed* PIC and crystal. With this option, you can use either

the custom PC board or your favorite prototyping board or other construction method. One of my favorite boards is available from RadioShack (RS 910-3804) and costs about a dollar.

Most of the amplifier parts consist of common transistors, resistors and capacitors that have noncritical values. For example, depending on the specific application, R2 can range in value from 10 kΩ to 100 kΩ; C3 can be any value from 0.01 µF to 0.001 µF; R3 can vary from around 300 Ω to 1 kΩ, etc. DS1 is a seven-segment, common-cathode MAN74 display, but you can use others as well. Figure 1 shows a mapping of the PIC ports to the appropriate LED segments. Experimentation is encouraged!

You might want to place the UniCounter circuit board in a small box or into a rig. In either case, use sockets for the PIC and DS1. Software upgrades (new features) for the UniCounter may be available at some point; you also may want to experiment with programming the PIC yourself. The extra height for DS1 provided by the socket allows it to protrude through a panel. For greater flexibility, you could mount DS1 on a separate small board for a front panel and run a short (preferably shielded) multiconductor cable back to the main board.

For S1, almost any type of simple normally off, momentary on switch will suffice. A push-button, SPST switch is probably best, but use whatever you have. I've used a small slide switch, a hand key and my bug!

Operation and Use

When the UniCounter is turned on, it begins to display a frequency based on the first *frequency display profile* (the default). If this profile hasn't been programmed or contains erroneous data, an **E** is displayed (noting an error condition) and the display returns to the main menu. As shown on Figure 2, at the main menu, either **P** (for programming) or **F** (for choosing a *frequency display profile* to run) can be selected. At each step, the options (in this case **F** and **P**) are repeated in a loop until you make a selection. Selecting involves pressing and releasing the switch while the chosen letter (or number) is displayed. Next, the numbers **1** through **8** corresponding to the specific *frequency display profile* that you are choosing to program or run are displayed. After making your selection, the UniCounter will either begin displaying the incoming frequency, or begin the programming sequence depending on whether you originally selected **F** or **P**. You can return to the main menu at any time while the UniCounter is displaying a frequency by pressing S1.

The programming sequence begins with the selection of the *display rate*. The rate symbol displays first, then the digits **0** through **9** are displayed in a continuous loop until you make a selection. The same procedure is used for selecting the *low digit, high digit* and the *offset control*. Selecting a **0** skips you to the next programming step without changing the previously stored data. This feature allows you to quickly reprogram a *frequency display profile* by skipping over those parameters that you don't need to change.

The final step involves entering a seven-digit *offset value*. This starts with the highest digit. A **7** (representing 10^7) is first displayed followed by the numbers **1** through **9** in a continuous loop. After making this selection, **6** is displayed for the next digit and the process continues until you've made your selection for the lowest digit (**1**). You are then returned to the main menu. On average, programming a complete frequency display profile takes about 90 seconds.

In the following steps, we'll assume you're measuring the frequency of a VFO in a 40-meter receiver you've built. Determining the proper *offset control* and the *offset value* is straightforward. Doing this requires you to know the mixing scheme of your receiver as discussed earlier. Let's assume that *offset control* **1** or **4** is appropriate. Connect the UniCounter to the receiver's VFO and program the UniCounter for an *offset control* of **1** with a **0** offset entry (ie, select **0** for each of the seven offset digits). Then zero beat a signal of known frequency such as the W1AW bulletin frequency on 40 meters (7.04750 MHz). Write down (and keep for your records) the difference between the known frequency and the displayed (VFO) frequency. This is the *offset value* that you will enter to calibrate the UniCounter and allow it to display the proper frequency. If possible, when calibrating, select a frequency of operation near the *center of the range* that you most commonly use in order to maximize the display accuracy across the band. You need to program a separate *frequency display profile* for each single-band rig that you use.

After you've completed programming, just select the *frequency display profile* that you want to use and you're off and running! If you've set the UniCounter to display any of the megahertz digits (ie, *high digit* is set to **6** or higher), a decimal point is displayed after the megahertz digit, and leading zeroes to the left of the decimal point are suppressed. For frequencies lower than 1 MHz, the decimal point and leading zeros to the right of the decimal point are displayed if you set *high digit* to **6** or higher. This is useful for some bench work. If you are set up to display only the lower kilohertz digits (eg, *low digit* **3**, *high digit* **4**), the decimal point and leading zeros are not displayed. Lower digits that are not being displayed are simply truncated, no rounding occurs.

Now comes the fun part! I think you'll find it enjoyable to set up your *frequency display profiles* in a manner that suits your operating style and your set of rigs. You'll probably want to make your favorite band in your favorite rig your default profile and set if for fast scanning. For example, I set my default for my 40-meter CW rig, using *display rate* **2**, and three digits (10 kHz, 1 kHz, 100 Hz—ie, *low digit* **2**, *high digit* **4**). Then I set my second profile for the same rig, but with a slower *display rate* (**5**), using six digits (ie, *low digit* **1**, *high digit* **6**) and sleep mode. I use the second profile to ensure that I know which band or band segment I'm in or to occasionally check my operating frequency during a QSO. When tuning, I use the first profile and the three digits allow me to note and later find a specific station of interest. Switching between profiles involves three switch pushes and takes less than 10 seconds.

Future Possibilities

The UniCounter's architecture can easily accommodate a variety of additional features.[6] I found it difficult to stop development, but other projects started beckoning me. Here are some add-ons that might be considered:

- One-second gate timer to provide 1-Hz resolution
- 10:1 (or higher) front-end prescaler to extend the frequency counter range to 300 MHz with 100-Hz resolution
- Morse audio output (for the visually impaired)
- A frequency lock control for VFOs

Acknowledgements

I would like to thank several people whose articles stimulated my thinking and who provided suggestions and encouragement during the UniCounter's development: Glen Leinweber, VE3DNL; Dave Benson, NN1G; Wayne Burdick, N6KR, and Neil Heckt.

Notes

[1]Morse code speed (WPM) = (dots/min)/25 = 2.4 × dots/sec. So 10 dots/sec = 24 WPM [*The 2000 ARRL Handbook*, p 12-12]. At this speed, the dot (on) duration representing one unit is 50 ms. The number of units in a typical three digit number (eg, 233) is 15 + 3 (interdigit spacing) + (2 × 13) + 3 + 7 (internumber spacing) = 54 units. The associated time to send would be 54 × 50 ms = 2.7 sec. Display time on the UniCounter would be 3 × (150 ms (on time) + 150 ms (off time)) + 250 ms (internumber delay) = 1.15 sec.

Therefore, the equivalent UniCounter speed is about 24 WPM × 2.7 sec/1.15 sec = 56 WPM.

[2]For examples see: Wayne Burdick, N6KR, "The KC2: A Multi-function Accessory for QRP Transceivers," *QRPp*, Sep 1996, pp 3-7; Neil Heckt, "A PIC-Based Digital Frequency Display," *QST*, May 1997, pp 36-38. Dave Benson, NN1G, "FREQ-Mite—A Programmable Morse Code Frequency Readout," *QST*, Dec 1998, pp 34-36.

[3]The following equations can be used to calculate Q4's h_{FE} and appropriate values of R4 and R5. Note: The supply voltage to the amplifier (Vs) = the voltage measured at pin 1 or pin 14 of the PIC (depending on jumper setting). Vc is the dc voltage measured at the collector of Q4 with no signal applied to Q3. Vbe is typically 0.65 V and can be measured.

$$Vc = (Vs + (A \times Vbe)) /(1 + A)$$

where $A = R5 \times h_{FE}/R4$ (Eq 1)

$$h_{FE} = R4(Vs - Vc)/R5(Vc-Vbe) \quad \text{(Eq 2)}$$

Select a value for R5 and calculate R4 using the calculated value of h_{FE} and the desired value of Vc (ie, 2.4 V for a PIC16F84 and 2.1 V for a PIC16F84A).

$$R4 = h_{FE} \times R5(Vc - Vbe)/(Vs - Vc). \quad \text{(Eq 3)}$$

[4]In some applications, turning the amplifier off may cause enough load change to result in a noticeable frequency shift. In this case, you might want to first try decreasing C2 to 5 pF. If this fails, allow the amplifier to run continuously by moving the supply voltage for the amplifier from pin 1 to pin 14 on U1.

[5]These items are available from Ron Stone, 4 Park Overlook Ct, Bethesda, MD 20817: a *programmed* PIC16F84, crystal and instructions, $17 postpaid; a complete kit, including a PC board, all on-board parts and instructions, $25 postpaid. Payment must be in US funds; US and international money orders and personal checks (US only) are accepted. **There will be an initial 6-8 week delay in shipping kits**. Check **homestead.juno.com/rsstone/Unicounter.html** for up-to-date information on shipping status. PC boards only are available from FAR Circuits, 18N640 Field Ct, Dundee, IL 60118-9269; tel 847-836-9148 (voice and fax). Price $4 each plus $1.50 shipping for up to four boards. Visa and MasterCard accepted with a $3 service charge.

[6]Send requests for the source code to the author at **rsstone@juno.com**.

Ron Stone, KA3J, was first licensed as WA8WKA in 1967 while in middle school. He upgraded to Extra in 1970, obtained an engineering degree from Carnegie-Mellon University in 1975 and a management degree from Harvard University in 1983. During the past 25 years he has held various engineering and management positions in the Federal Government. Ron's Amateur Radio interests include QRP and homebrewing. You can contact Ron at 4 Park Overlook Ct, Bethesda, MD 20817; **rsstone@juno.com**.

NEW BOOKS

TESLA: MASTER OF LIGHTNING

By Margaret Cheney and Robert Uth with Jim Glenn, Technical Editor

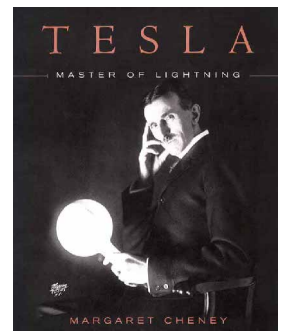
Published by Barnes & Noble Books, New York, 1999. Available from the publisher, ***www.barnesandnoble.com****; 8½×11 inches, 192 pages; Hardcover with 250 monochrome illus. ISBN 0-7607-1005-8. $14.98.*

Reviewed by Rick Lindquist, N1RL ARRL Senior News Editor

◊ Those who champion the cause of seeing Nikola Tesla (1856-1943)—not Guglielmo Marconi—declared as the official inventor of radio will find *Tesla: Master of Lightning* a must-read. Most hams may only recall—and often mispronounce—his name in association with the Tesla "spark" coil and spectacular demonstrations of electrical fire and lightning. Tesla was adept at marshaling showers of sparks as a vehicle to promote his concepts and as a backdrop to sharing his vision for the future.

Whatever your take on the controversies surrounding Tesla's place in the annals of radio and electronics history, the story of Tesla's life and accomplishments makes compelling reading. The illustrations and sidebars in the Cheney/Uth tome inject—dare we say it?—an additional *spark* into the experience.

It could be argued that Tesla sometimes could be his own worst enemy. In 1899, for example, he claimed to have received signals from extraterrestrial intelligence. "When the newspapers picked up this information, the so-called Martian Messages created a firestorm of debate," the authors write. "No one had ever heard regular signals from space, and Tesla concluded that they must be from living creatures on a nearby planet, such as Mars or Venus." The local newspapers ridiculed the claim. Defenders counter that Tesla actually could have received signals from the sun and stars. "Thus, Tesla may have built the first radio telescope," Cheney and Uth write. Tesla also believed in mental telepathy and speculated that it was possible to "project on a screen the image of any object one conceives and make it visible." A bit of a "health nut," Tesla always boiled his drinking water (he had suffered a bout of cholera as a young man), and eschewed meat, tobacco and even chewing gum. But he touted the benefits of a daily dose of whiskey, calling it "a veritable elixir of life."



Born in what is now Croatia, Nikola Tesla was the second son of a Serbian Orthodox clergyman father and what Cheney calls a "brilliant and inventive" mother. Schooled largely in Austria, Tesla studied mechanical and electrical engineering. He is portrayed as a visionary from an early age but didn't evolve into an inventor until he became an adult. He arrived in New York in 1884 and, with a letter of introduction in hand, soon after made himself known to Thomas Edison, for whom he went to work.

Cheney and Uth recount the story of a rash promise made by Edison, who is said to have told the young Tesla that he would give him $50,000—an astounding sum for that day—if he succeeded in making the dynamos at the Edison generating plant work more efficiently. Wanting to be able to build his own research lab to perfect his ac machines, Tesla pulled off the feat within a few months. But when Tesla asked Edison to pay up, the inventor's account of the story goes, Edison claimed to have made the offer in jest. When Tesla threatened to quit, Edison gave him a $10 a week raise, raising his salary to $28 per week. Tesla walked anyway, and was able to find investors who financed him to the extent that he was able to build his prototype ac motors. Tesla filed seven US patents for polyphase ac motors and power transmission methods.

But the crux of the Tesla controversy always has focused on the invention of radio. Tesla's basic patent application for a "system of transmission of electrical energy," filed in 1897, was granted in 1900, a few months before Marconi filed his first US patent application. In fact, as Cheney and Uth point out, the US Patent Office turned Marconi down, citing the priority of work by Tesla and others. But after Marconi's practical success in communicating across the Atlantic in 1901 and attracting investors to his then high-tech venture, the US Patent Office reversed itself and gave Marconi a patent for the invention of radio. "The reasons for this have never been fully explained," Cheney and Uth write, "but there is little doubt that the decision was influenced by the powerful financial backing for Marconi in the United States."

As the authors point out in a sidebar, however, Tesla's first patent "really describes power transmission; radio signaling is specified simply as one useful employment of the principle."

Co-author Margaret Cheney also wrote *Tesla: Man Out of Time*. Robert Uth is a documentary film producer, director and writer. The authors' research for this book is mirrored in a TV documentary of the same name, *Tesla: Master of Lightning*, to be broadcast by PBS on December 12.

Next New Book

By Klaus Spies, WB9YBM and Rolf Spies, N9BRL

Noise Canceling with Electret Condenser Microphones

Reduce the transmission of background noise with a simple circuit and a pair of inexpensive microphone elements.

Are you tired of hearing complaints that you're transmitting more noise than voice? Do you want to avoid screaming into the microphone to make yourself understood? You can find a common cure for these problems with this simple noise-canceling technique.

With older dynamic microphones (which aren't polarity sensitive), noise canceling is easy: You simply mount the microphones mechanically back-to-back, wire each microphone's positive terminal to the other's negative terminal, then feed the combined output to the microphone amplifier. Because most ambient noise enters both microphones simultaneously (sound reflections from hard surfaces notwithstanding), the noise is canceled while the speech received by the microphone closest to the operator's mouth is unaffected by the other microphone. Electret condenser microphones are polarity-sensitive and no longer offer this wiring option, so the noise canceling must be achieved by other means.

Circuit Description

One way of achieving noise canceling with electret microphones is shown in Figure 1. Both electret microphone elements—standard types purchased at RadioShack (RS 270-090C)—are used. (Similar electret elements are available from other sources.) Because the microphone elements have an operating voltage of 1 to 10 V, I feed them via a 9-V regulator equipped with 0.01-µF disk-ceramic capacitors on its input and output leads. Optionally, the microphones

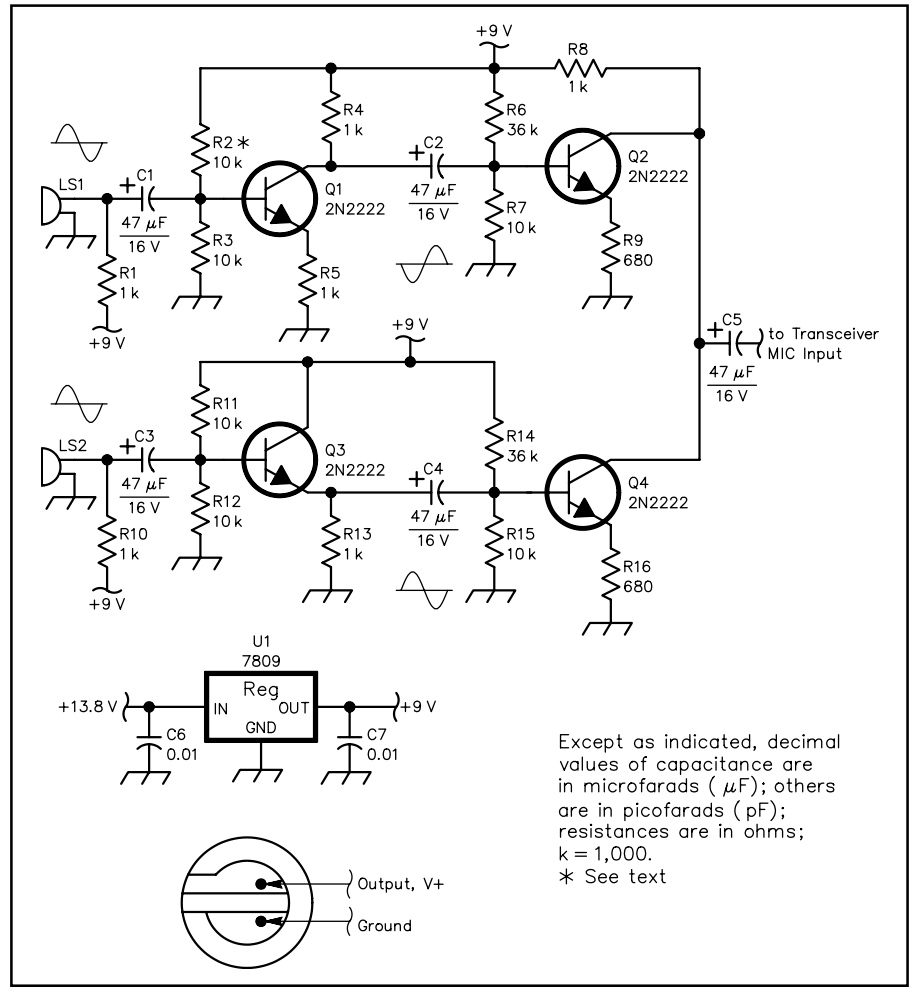


Figure 1—Schematic of the noise-canceling microphone circuit. Unless otherwise specified, resistors are ¼-W, 5%-tolerance carbon-composition or metal-film units. RS and RSU numbers are RadioShack. Equivalent parts can be substituted; n.c. indicates no connection. Parts are available from several sources including: Digi-Key Corp, 701 Brooks Ave S, Thief River Falls, MN 56701-0677; tel 800-344-4539, 218-681-6674, fax 218-681-3380; www.digikey.com; Jameco Electronics, 1355 Shoreway Rd, Belmont, CA 94002; tel 650-592-8097, domestic fax, 800-237-6948, international fax, 650-592-2503; info@jameco.com; www.jameco.com; RadioShack—see your local distributor. RadioShack.com L. P., 300 West Third Street, Suite 1400, Fort Worth, TX 76102; www.radioshack.com/ and Tri-State Electronics, 200 W Northwest Hwy, Mt Prospect, IL 60056; tel 800-445-0896, 847-255-0600; www.tselectronic.com; sales@tselectronic.com.

C1-C5—47 µF, 16 V or more (RS 272-1015)
C6, C7—0.01 µF, 50 V disc ceramic (RS 272-135)
LS1, LS2—Electret microphone element (RS 270-090C)
Q1-Q4—2N2222 (RSU 11328499) or 2N2222A (RSU 11328507)
R1, R4, R5, R8, R10, R13—1 kΩ
R2, R3, R7, R11, R12, R15—10 kΩ; R2 may be a 20-kΩ pot (RSU 11344132); see text.
R6, R14—36 kΩ
R9, R16—680 Ω
U1—7809 9-V, 1-A positive-voltage regulator (RSU 10911048); see text.
Misc: PC board (see Note 1), enclosure (see text), hardware

can be powered by a standard 9-V battery (as are the power microphones used by some CB operators). The only downside is that batteries tend to run out of juice at the worst possible moments—as when that rare DX station wants you to repeat your call sign for QSLing!

Q1 and Q3 provide the phase differential required for signal combination; Q2 and Q4 act as buffers. The output of the buffers is then combined and fed directly to your radio or to an amplifier if your radio needs a higher input level. You can replace R2 with a 20-kΩ pot to use as a **BALANCE** control in case the bias-resistor values of both branches are not close enough to provide optimal noise canceling when signals are added.

Assembly

A PC board for this project is available.[1] There are several ways to mount the electret elements. The easiest approach is to use the case of a surplus or discarded microphone, replacing the original internal components with the electrets. Or, you can mount the elements in a small metal box connected between your microphone and radio. Another alternative with which I'm experimenting is to put one electret element in a microphone housing and bring a connector out of the box for attachment of the second element. The second element can then be mounted at a convenient location. In a mobile environment, that spot might be the headrest of the driver's seat. This allows a mobile operator to use a small microphone.

I highly recommend the use of a grounded metal box, shielded and bypassed leads and filtered power-supply lines to house the circuit. Some of this may be overkill (depending on your environment), but it's cheap insurance against RF from your own radio getting into the audio section, or alternator whine and/or ignitions pops from your car. The medium- to high-impedance lines of microphones make great receiving antennas!

The circuit is designed to use standard components that can be obtained from virtually any electronic parts distributor; my favorites are Digi-Key Electronics, Jameco Electronics and Tri-State Electronics.

This noise-canceling approach is useful whether you're operating mobile, combating indoor noise from washing machines, dishwashers and kids, or outdoors participating in events such as Field Day. Developing and using gadgets such as these can be as much fun as operating!

Klaus Spies, WB9YBM, became interested in Amateur Radio during his last year in junior high school in the mid '70s, when he received his license with the help of the school's Vice Principal. His initial interest was CW, but that got put on hold when his interest in homebrewing became predominant. When he gets caught up with a few more projects, he plans to return to more active CW work. Klaus' work career has paralleled his ham career. He received an associate degree in electronics, worked at Motorola in the corporate research department as a laboratory technician performing design work and obtained a commercial radio license. Klaus currently works as a draftsman in the computer field. He is the trustee of W9CYT, the Weathersfield Radio Club, which promotes homebrewing. You can contact Klaus at 815 Woodland Heights Blvd, Streamwood, IL 60107; **wb9ybm@juno.com**. QST

[1]A PC board for this project is available from FAR Circuits, 18N640 Field Ct, Dundee, IL 60118-9269; tel 847-836-9148 (voice and fax). Price: $4 plus $1.50 shipping for up to four boards. Visa and MasterCard accepted with a $3 service charge; **www.cl.ais.net/farcir/**.

NEW PRODUCTS

BENCHER SKYHAWK YAGI SALES RESUME

◊ Bencher Inc has released a redesigned version of their Bencher Skyhawk 3×10 triband Yagi antenna.

The Skyhawk covers three bands—20, 15 and 10 meters—and consists of 10 full-sized elements. The antenna includes three elements for 20 meters, three elements for 15 meters and 4 elements for 10 meters all mounted on 2-inch diameter 24-foot boom. The weight is specified at 75 lbs and the turning radius, 22 feet.

The antenna had been withdrawn from the market earlier this year due to a potential patent problem with the feed arrangement. A new feed system that directly feeds each of the driven elements from a single coax feed line—replacing the previously used open-sleeve feed—has been designed and implemented.

As with the previous version, the manufacturer states that the antenna can be used on 12 and 17 meters, but the performance is "limited."

For further information on the Bencher Skyhawk visit your favorite Amateur Radio products dealer or contact Bencher Inc, 831 N Central Ave, Wood Dale, IL 60191; tel 630-238-1183; fax 630-238-1186; **bencher@bencher.com**; **www.bencher.com**.

NEW HIGH VOLTAGE SWITCHABLE CURRENT REGULATORS

◊ IXYS Corporation has recently released a new 900 V current regulator.

Typical applications include over-voltage and over-current protection, inrush current limiters, soft start systems and adjustable current regulators.

The device is available in two different packages. The IXCY10M90S is in a TO-252 package; the IXCP10M90S is in a TO-220 package.

The current regulator is normally on and requires a negative bias voltage of 5 V to turn it completely off. A current limit of 1 to 100 mA can be set either by the gate voltage or by placing a resistor in series with the cathode. The device is capable of maintaining the current up to 900 V—subject to the temperature and power limitations of the silicon chip and package (40 W at T_C = 25°C). The dynamic resistance is 100 kΩ and the current regulation is ± 5% from 25°C to 125°C.

IXYS Corporations offers a wide range of power semiconductors, including power MOSFETS, IGBTs, ultra-fast reverse recovery diodes, thyristors, rectifiers, multichip modules, DCB ceramic substrates and power interface integrated circuits.

For further information, contact your local authorized IXYS distributor or IXYS Corporation, 3540 Bassett St, Santa Clara, CA 95054; tel 408-982-0700; fax 408-496-0607; **sales@ixyscorp.com**; **www.ixys.com/**. QST

Next New Product

By L. B. Cebik, W4RNL

A Beginner's Guide to Modeling with *NEC*

Part 2: The Ins and Outs of Modeling

Last month we developed a basic understanding of what antenna modeling is, and became acquainted with some of the language of modeling. We also gained an orientation to the many parts of a good antenna model, including both the structure and its environment. This month we'll focus our attention on two fundamentals necessary to obtain reliable results from a *NEC* program. The first step is to grow comfortable with translating a physical array of wires or tubes into a set of dimensions that we can enter onto the coordinate system. The other basic element that we need to master is the selection and interpretation of the graphical outputs (the azimuth and elevation plots) from modeling programs. This installment cannot possibly say everything about both of these modeling fundamentals. However, we can hope to start you down a road toward working effectively on your own.

To save space throughout this series, we are limiting ourselves to modeling using the *NEC-2* calculating core, with illustrations from *EZNEC 3.0* and *NEC-Win Plus*. The figure captions will identify from which program the graphics have come.

Wires, Coordinates, and Conventions

One initial "mental block" to getting started in modeling is a certain discomfort with constructing antennas using the Cartesian coordinate system. Adopting a few conventions can dispel much of the uneasiness. By always (or nearly always) doing certain jobs in the same way, the system becomes more natural to use. There may be other equally good ways to do any job, but picking and sticking with one good way is the surest way to initial success.

Let's reacquaint ourselves with the coordinate system. In the horizontal plane, we can define any position—like the end of a wire that is part of an antenna element—by specifying a value for X and a value for Y. Z is the vertical dimension, corresponding to height, whether that is the height of the antenna structure itself or the height of the antenna above ground—or the sum of both in some cases.

When we set up an antenna model, we actually have many choices. We can set the model way over into high values of +X and +Y or into very negative values of each. Where the antenna is located in the coordinate system does not affect the accuracy of calculations. However, we want to strive for consistency, so let's set up the following conventions.

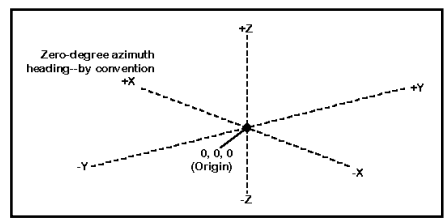


Figure 1—A "3-piece" dipole laid out on the coordinate system. The square indicates the location of the antenna source or feed point. The bold dots indicate a change from one component wire to the next in the overall element.

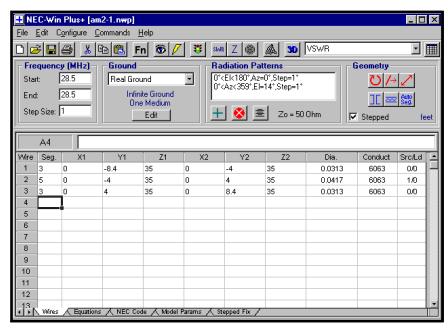


Figure 2—A *NEC-Win Plus* wire spreadsheet for the 3-piece dipole, showing the wire coordinates and other details of the model.

Convention 1: Wherever feasible, we'll split an element into equal parts on each side of a centerline. Therefore, an 8-foot element would have ends that are –4 and +4.

Convention 2: We'll use the Y-axis as the linear element axis. All linear elements will be on or parallel to the Y-axis. Our sample 8-foot element will therefore take values of Y=–4 and Y=+4 for its ends.

Convention 3: We'll use the X-axis for front-to-back dimensions. For single elements, we can use an X-value of zero.

Convention 4: The Z-axis will always indicate height.

Let's work our way through a few examples to see how the conventions work.

Example 1—A 3-piece dipole: Consider a 10-meter dipole (28.5 MHz) made up of two sizes of aluminum tubing ($^1/_2$ inch and $^3/_8$ inch diameters) placed 35 feet into the air. The center section will use the larger tubing. Even though we physically break the tubing in the middle to connect our feed line, we *do not* break the tubing in a model. Use a continuous piece and assign the source to its center. Let's make the centerpiece of half-inch tubing 8-feet long.

Each end of the dipole will consist of $^3/_8$-inch diameter pieces. We would place a bit of each tube inside the centerpiece in a real antenna. However, in a model, we are only concerned with the portion that shows. Let's make each visible end piece 4.4 feet long.

If we add up all the pieces, we have a total length of 16.8 feet for the entire element. It will consist of 3 "wires" or pieces. The next step is to place them into

the wire spreadsheet. Although we might place them in any order and arrive at correct calculations, let's adopt one more convention.

Convention 5: We'll always work from the left end to the right end of any element. Left will normally mean a value more negative and right will mean a value more positive than whatever reference value we use. This convention will help us locate problems and read the modeling results in a consistent manner.

Now we are ready to determine the coordinates of the ends of each piece of wire. Set the units of measure for the program to feet.

1. Since there is only one element, all values of X will be zero.

2. Since the entire antenna is 35 feet in the air, all values of Z will be 35—assuming that we have selected "feet" as the unit of measure for the antenna.

The only thing left to do is to determine the Y-values. Figure 1 can help us in the task.

4. Since the entire antenna is 16.8 feet long, it will stretch 8.4 feet on either side of the centerline for the Y-axis. If we begin with the left end of the element (–Y2 in Figure 1), we assign the element tip a value of –8.4. The other end of this $^3/_8$ inch piece is 4.4 feet more positive, which gives us –4.0 (for –Y1 in Figure 1). This gives us all of the values we need for the first wire (W1 in Figure 1). End 1 is X=0, Y=-8.4, Z=35. End 2 is X=0, Y=–4.0, Z=35.

5. Wire 2 is the $^1/_2$-inch diameter center portion of the antenna. Since it connects to the second end of Wire 1, its End 1 coordinates are the same as Wire 1's End 2 coordinates. Since it is 8 feet long, then we add 8 to the –4 and arrive at a Y-value for End 2 of +4 (Y1 in Figure 1). Hence, Wire 2 coordinates are these: End 1—X=0, Y=–4.0, Z=35; End 2—X=0, Y=+4.0, Z=35.

6. Wire 3 is the far right tip of the element. Since it connects to the centerpiece, its End-1 coordinates are the same as the Wire 2 End-2 coordinates. The length of Wire 3 is 4.4 feet, which we add to the 4-foot position of the Wire 2 end. This gives us an End-2 Y-value of +8.4 for Wire 3's second end (Y2 in Figure 1). Hence, Wire 3 coordinates are these: End 1—X=0, Y=+4.0, Z=35; End 2—X=0, Y=+8.4, Z=35.

We have completely defined the element, despite its complex structure. Figure 2 shows the *NEC-Win Plus* wire entry spreadsheet for the element, where the X1, Y1, and Z1 columns represent End 1 values for each of the 3 wires. X2, Y2, and Z2 represent the end 2 values for each wire that composes our dipole element. We must add some other information to complete our model. Each line has an element diameter value. In *NEC-Win Plus*, this value is in the same units as the wire lengths, so we divide the diameters by 12 to get their values in feet. We chose aluminum for our material, and the "Conduct" (conductivity) column records 6063-type aluminum. (There are other types.) The "Src/Ld" column shows that we have a source on the center wire, and we'll assume that it has been correctly placed at the center of the wire.

Do not neglect the "Seg." column. We wish to have at least 10 segments per half-wavelength of element. A dipole is about a half-wavelength long, and the total number of segments is 11—within our specification. The center wire containing a source has an odd number of segments, meaning that the source segment can be precisely at the antenna's center. We may also note the frequency entry and the ground entry as fitting our original specification. We also note some radiation pattern requests that we'll explore a bit later. For now, we see a symmetrically specified dipole element composed of 3 wires.[1]

Example 2—A 3-element Yagi: Our second example will demonstrate the utility of adopting the convention by which we set elements symmetrically about a centerline. Consider a 3-element Yagi composed of $^1/_2$-inch diameter elements throughout. This specification means that we'll have only one wire per element, but also that we'll have 3 elements. The Yagi will be for 6 meters, 51 MHz, to be more exact. We'll place the antenna at a height of 240 inches (20 feet).

This model will be in inches. The element lengths are these: Reflector—114.36 inches; Driver—108.96 inches; Director:—102.44 inches. To make sure that the shorter elements are inset at their ends by the same amount on both ends—relative to longer elements—we'll build each element symmetrically around the same centerline. By convention, the centerline is the X-axis, with each element being set up parallel to the Y-axis. Each Y-value for the positive and negative values will be half the total length: Reflector—57.18 inches; Driver—54.48 inches; Director—51.22 inches.

The following spacing separates the elements from each other: Reflector-to-driver space—37.8 inches; Driver-to-Director space—40.14 inches. How shall we place the elements along the X-axis? There are numerous schemes. Some modelers like to start with the reflector at X=0 and place all other elements ahead of this position with +X values. Some modelers like to take the entire distance from the reflector to the director and place the model symmetrically on the X-axis. We'll adopt for our starting convention a third popular convention:

Convention 6: Place the driver for any multi-element array at X=0. Place the reflector at a negative value of X that equals the driver-to-reflector spacing. Place all directors at positive values of X equal to the spacing from the driver to that director.

To keep the elements readily identifiable, we should also adopt a convention for the order in which they appear on the wire table.

Convention 7: Order the wires beginning with the reflector(s), the driver(s) and the director(s) for each self-contained array.

With these new conventions in mind, we can develop the values for our wire spreadsheet. Set the units to inches. Use Figure 3 as an aid.

1. Start with the driver, but make it Wire 2. X2 in Figure 3 will be 0. The values for Y (–Y2 and +Y2 in Figure 3) will be the half-length of the driver element. The value of Z for this and all other wires in this model will be 240.

2. The reflector (Wire 1) will have values for Y (–Y1 and +Y1 in Figure 3) that are the half-length of the reflector. Since the reflector is behind the driver, the value of X (–X1 in Figure 3) will be –37.8.

3. The director (Wire 3) will have values for Y (–Y3 and +Y3 in Figure 3) that are the half-length of the director. Since the reflector is ahead of the driver, the value of X (+X3 in Figure 3) will be +40.14.

The resulting wire spreadsheet, in *EZNEC* form, appears in Figure 4. Be sure to set all of the frequency, source, material, and radiation pattern values appropriately. By making the Y-values for each element symmetrical about a centerline, we align the model as the antenna would be aligned on its boom. By using a positive value for the director on the X-axis, we assure ourselves of a pattern where the forward lobe points at zero degrees on a standard azimuth pattern. In

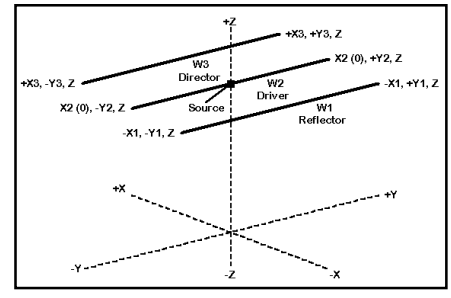


Figure 3—A 3-element Yagi laid out on the coordinate system.

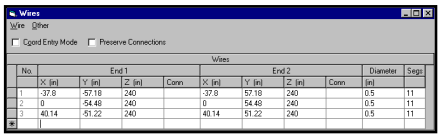


Figure 4—An *EZNEC* wire spreadsheet for the 3-element Yagi of example 2, showing the element end coordinates, wire diameter, and segmentation.

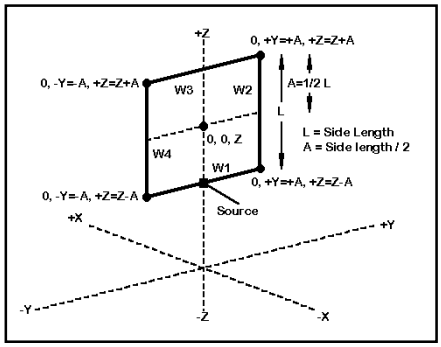


Figure 5—A single quad loop for 146 MHz laid out on the coordinate system.

the end, each convention that we adopt and use consistently contributes to being able easily to sort out the components and have reasonable expectations about the results.

Example 3—A single quad loop: So far, we have dealt with antennas that extend their structures only in the X and Y plane. Let's look at a quad loop in order to become comfortable dealing with antennas that extend into the Z dimension. We'll model a single quad loop for 146 MHz that is set up for broadside operation—where the main signal strength comes off each side of the plane of the loop. The loop will be about 87.04 inches in circumference, which makes it about 21.76 inches per side. The loop will use standard insulated spider construction (which means that we do not model the support arms). The center hub will be 20 feet or 240 inches off the ground.

First, the value of X for this model will be zero throughout. The loop wires will extend along the Y-axis and parallel to the Z-axis. However, the model opens up two questions about loop construction that we can answer with new conventions and with the aid of Figure 5.

Convention 8: Model a loop as a continuous series of wires such that End 2 of Wire 1 is also End 1 of Wire 2, etc.

Convention 9: Model the loop with Z initially equal to zero, and later add the "hub" height to each value of Z in the model.

As Figure 5 shows, the two conventions give us an orderly progression of development and a technique for specifying the dimensions. Since the length (L) of a side is 21.76 inches, the values of +Y and –Y will be half the side length—or A=10.88 inches. Initially, we'll also use the value of A for +Z and for –Z, that is, 10.88 inches.

1. Assign values for Y and for Z for each end of each wire (in order), using the half-length of the side, referring to Figure 5 for guidance. Wire 1, for instance will have the following values: End 1—X=0, Y=–10.88, Z=–10.88; End 2—X=0, Y=+10.88; Z=–10.88. Wire 2 will have these values: End 1—X=0, Y=+10.88, Z=–10.88; End 2—X=0, Y=+10.88; Z=+10.88. Wire 3 will have these values: End 1—X=0, Y=+10.88, Z=+10.88; End 2—X=0, Y=–10.88; Z=+10.88. Wire 4 will have these values: End 1—X=0, Y=–10.88, Z=+10.88; End 2—X=0, Y=–10.88; Z=–10.88.

2. Add the "hub" value of Z to the values developed to arrive at the final dimensions. The new values for Z alone will be as follows: Wire 1, End 1—Z=229.12, End 2—Z=229.12; Wire 2, End 1—Z=229.12, End 2—Z=250.88; Wire 3, End 1—Z=250.88, End 2—Z=250.88; Wire 4, End 1—Z=250.88, End 2—Z=229.12.

The values, plus the other model setup data, appears on the wire spreadsheet in *NEC*-Win form in Figure 6.[2]

By combining the conventions and techniques we have shown here, you should be able comfortably to model virtually any single antenna array, no matter how many elements or which way they point. However, the task requires an orderly procedure in each case. Very often, it is more efficient to do all of the preliminary work of setting the wire end coordinates on paper.[3]

Patterns, Patterns, and More Patterns

Once the model is satisfactory, our next inclination is to race through setting the other necessary parameters, run the model, and see what the pattern looks like. In this episode, I shall race with you, bypassing for the moment all of those less exciting but vital features. We'll land upon a potentially confusing set of graphical outputs. My aim will be to see if we cannot make a little initial good sense out of them.

Let's begin our adventure in free space. Among the ground options, we'll find a label that reads either "Free Space" or "No Ground." Setting the option here places the antenna in what amounts to outer space with nothing to reflect the radiation except possibly the elements themselves. In some programs, the radiation pattern itself is automatically set for

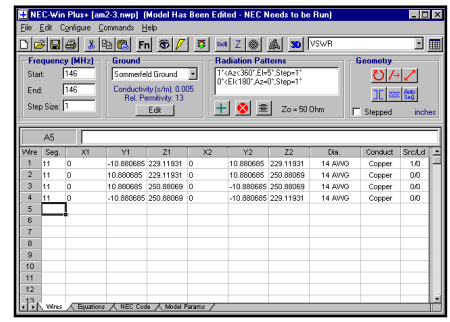


Figure 6—A *NEC-Win Plus* wire spreadsheet for the 2-meter quad loop, showing the wire coordinates and other details of the model.

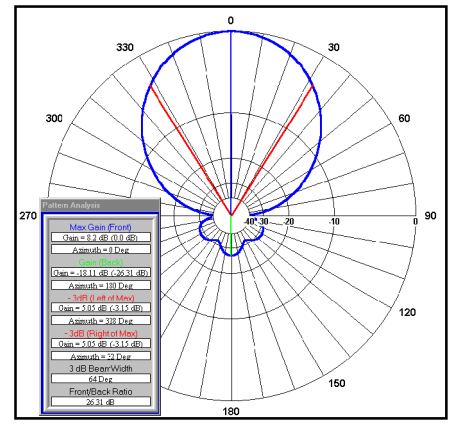


Figure 7—A *NEC-Win Plus* free-space azimuth pattern for the 3-element 6-meter Yagi.

full 360-degree patterns in both the azimuth and the elevation directions. However, other programs require the user to enter the start and stop degree numbers, along with increment between steps in the pattern tracing. The pattern itself is graphically developed outside the *NEC* core by simply connecting the dots that form the *NEC* data points. Hence, the smaller the increment, the smoother the pattern outline. One degree usually suffices for HF antennas at all reasonable heights, while 0.1 degree is sufficient for most VHF and UHF antennas.

The two most fundamental ways to get free-space patterns is to take azimuth and elevation patterns at zero-degrees, that is, along the X and along the Z axes. Figure 7 shows a *NEC-Win Plus* azimuth pattern, along with its analysis box. We may note the free-space gain as a rough measure of the antenna design quality, along with the front-to-back ratio, a measure of rearward QRM suppression. Equally notable is the -3 dB or half-power beamwidth (64°) of the antenna in the horizontal plane.

The elevation plot (Figure 8) of the antenna in free space comes from *EZNEC*

and also includes the available analytic data. Note that the gain and front-to-back ratio are identical to those in the azimuth plot, despite the difference of programs. Both use *NEC*-2 calculating cores and hence, both will yield numbers that are coincident or very close to coincident. Most notable is the –3 dB beamwidth in the vertical plane, which is over 98° between half-power points.

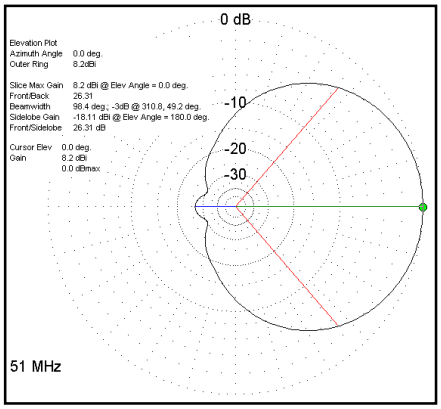


Figure 8—An *EZNEC* free-space elevation pattern for the 3-element 6-meter Yagi.

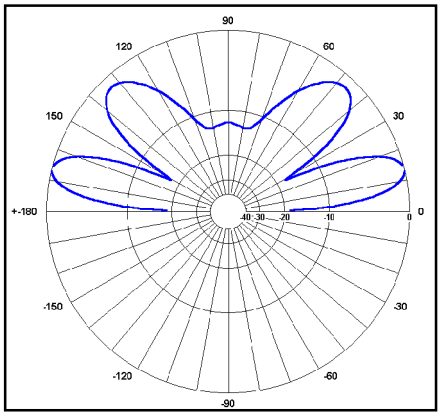


Figure 9—A *NEC-Win Plus* elevation pattern for the 10-meter dipole 1 wavelength above ground.

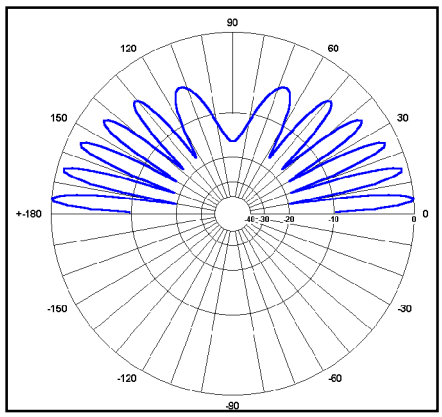


Figure 10—A *NEC-Win Plus* elevation pattern for the 2-meter quad loop 4.1 wavelengths above ground.

Our real antennas, of course, have a ground beneath them that plays a role in the reflection of signals. So let's move from free space back to our Sommerfeld-Norton ground. For all of the horizontal antennas that we'll look at in this episode, we will choose average ground with a conductivity of 0.005 S/m and a relative dielectric constant (permittivity) of 13. Changes in the ground constant values have only small effects on the performance of horizontal antennas, so using "average" ground will work nicely for most beginning analyses.

We'll begin with the 3-piece dipole that we modeled at 28.5 MHz. The antenna has a height of 35 feet, about 1 wavelength above ground. Let us take an elevation pattern, shown in Figure 9, a *NEC-Win Plus* graphic. Note that the pattern now breaks into lobes and nulls, that is, stronger and weaker directions of radiation as calculated for various elevation angles. Compare Figure 9 to Figure 10, an elevation pattern for the 2-meter quad loop that became our third case study of model construction. The quad loop elevation pattern has broken into many lobes and nulls, with the lowest one very near the horizon.

The key difference between the two antennas is not their shapes, but their heights. Height is not measured in feet or inches in this case. In fact, the quad loop is only at 30 feet hub height, whereas the dipole is 35 feet up. Instead, we measure height in terms of wavelength. The 10-meter dipole is 1 wavelength up, while the quad loop is about 4.1 wavelengths high. The higher the antenna in wavelengths, the more lobes and nulls to its elevation pattern.[4]

Let's return to the Yagi that we left in free space. Remember that the 6-meter antenna is 20 feet or 240 inches above the ground. Let's look at a 3-D pattern of the antenna above ground. Figure 11 provides the view in *EZNEC* form. Allowing for the blunting of the curves by virtue of the larger sampling increment, we still see an amazing pattern. It bears some resemblance to the dipole by virtue of having two main elevation lobes. The 2-lobe pattern results from the antenna height, which is close to 1 wavelength above ground. However, almost all of the energy is displaced along the X-axis forward of the antenna structure. In contrast, the dipole had equal amounts of energy in both directions broadside to the wire along the X-axis.

We can refine our view of the antenna pattern by calling for a 2-D elevation pattern. The *EZNEC* elevation pattern in Figure 12 smooths the lobe shapes by using a 1-degree increment between data points. As well, the rear lobes that had been obscured under a mass of 3-D close-spaced lines are now clear. An elevation pattern over ground provides other significant information, for example, the vertical beamwidth and the elevation angle of maximum radiation—the "take-off" angle. In reality, of course, terrain features may modify the actual take-off angle.

Although the elevation pattern for our Yagi has changed radically in the move from free space to a position over the ground, the azimuth pattern does not change shape appreciably for horizontal antennas. Compare Figure 7 with Figure 13, the azimuth pattern for the Yagi at a 13-degree elevation angle over average earth. The pattern shapes are virtually identical, even to the 64-degree –3 dB (half-power) beamwidth. What has changed is the forward gain of the antenna. It now records 13.35 dBi, compared to 8.2 dBi in free space: a 5.15 dB pick-up due to ground reflections. But remember that the forward lobe of the antenna in the free-space elevation pattern was smooth. Over ground, the added power in the main

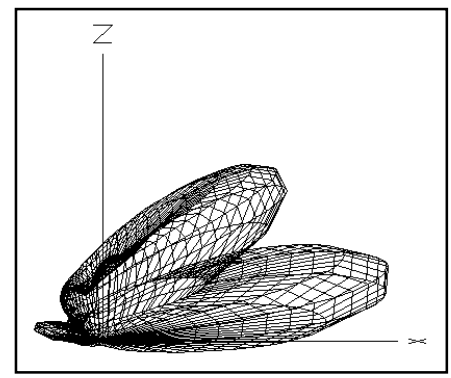


Figure 11—An *EZNEC* 3-D radiation pattern for the 3-element 6-meter Yagi 1 wavelength above ground.

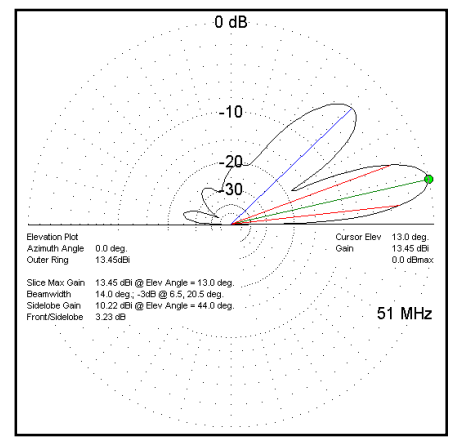


Figure 12—An *EZNEC* elevation pattern for the 3-element 6-meter Yagi 1 wavelength above ground.

lobes, of course, is offset by the reductions in power in the null areas.

NEC measures all pattern gain figures in dBi, which is decibels over an isotropic source. Since *NEC* has no built-in antenna range on which to use a real antenna standard for comparisons, it uses a mathematical standard. The isotropic radiator is defined as one radiating equally well in all directions (relative to a sphere that theoretically surrounds it). It is up to the individual modeler to make comparisons among antennas in order to figure out, for example, how much more gain the Yagi has than a dipole in the same setting.

By systematic modeling and comparisons, *NEC* yields useful information to us, information that might not arise by more haphazard methods and approaches. However, gain, front-to-back ratios, and beamwidths are not the only information that we can systematically develop with a modeling program. Now that we can model almost anything we wish, it is time to refine our modeling further. Next month, we'll explore some of the mysteries of sources, grounds, and frequency sweeps in an effort to clean up some relevant details.

Notes

[1]Those who wish to experiment with their modeling software might wish to perform the following investigation. I noted that the model may be placed anywhere within the plane of the X and Y coordinate system (leaving Z as a constant) and that it would yield the same results. Here is a 3-step process to verify this note.

1. Change all values of X by the same amount (for example, changing all Xs to +36 or to –95).

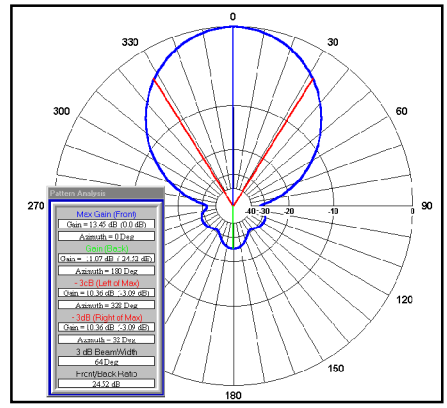


Figure 13—A *NEC-Win Plus* azimuth pattern for the 3-element 6-meter Yagi 1 wavelength above ground at a 13-degree elevation angle.

2. Change all values of Y by adding the same amount (for example, adding +27 or –105).

3. Combine the changes of both X and Y. For each change, run the model and check the radiation pattern and source impedance.

[2]There are ways to simplify quad loop construction available to the user of either *EZNEC* or *NEC-Win Plus*. In *EZNEC*, there is a provision for changing the antenna height, a means of altering all of the values of Z simultaneously. The easiest way to change the dimensions of a quad loop is to determine the center or hub height in advance. Then construct the modeling using values of +A and –A (as defined in the text) to make up the loop. Finally, change the height by the value predetermined for the hub. The upper and lower wires will then be properly placed above and below this height. To alter the coordinates, reduce the height by the hub value, which places the loop center back at zero. Then enter the new values of –A and +A, and change the height back to its raised hub value again.

In *NEC-Win Plus*, there is a "model-by-equation" facility within which we can define the values of A and of the hub height (which we might call B). On the wire entry page, we then enter –A, +A, –A+B, and +A+B for the loop corner positions in the appropriate boxes on the spreadsheet. We can then change the dimensions (or the height) of the antenna simply by changing the value of the variables. Those interested in modeling by equation are invited to look at a four-part tutorial that appeared in the May through August editions of *AntenneX* (**www.antennex.com**) and which is available even to non-subscribers. Alternatively, the 4 parts are also at my site as columns 27 through 30 in the "Antenna Modeling" series (**www.cebik.com**).

[3]A form suitable for model planning (with front and back sheets) can be downloaded from the ARRL Web site in Adobe PDF format at **www.arrl.org/notes/qst/am2-f.pdf**.

[4]We can estimate the number and angle of the lobes for most horizontal antennas from the antenna height alone.

$$\theta = \arcsin \frac{A}{4h} \qquad \text{(Eq 1)}$$

where θ is the angle for a particular lobe, and h is the antenna height in wavelengths. An "arc sin" value means to use the inverse and then the sine button on your calculator. To find the angle of a lobe, use odd numbers for succeeding lobes, where 1 is the first lobe, 3 is the second lobe, etc. For nulls, use even numbers for A, where 2 is the first null, 4 is the second, etc. Of course, you reach the total number of lobes when the angle approaches or reaches 90 degrees.

Since the 10-meter dipole is 1 wavelength up, its first lobe is at about 14 degrees and its second is about 48 degrees up. For the 2-meter quad loop, the first lobe is about 3.5 degrees up, while the second is about 11 degrees. These estimates are more accurately calculated by the *NEC* core, so the numbers it yields would take precedent over estimates.

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NEW PRODUCTS

K1 TWO BAND QRP TRANSCEIVER FROM ELECRAFT

◊ Elecraft has followed its popular K2 with a companion QRP transceiver kit, the K1. The new radio runs up to 5 W of CW on two user-specified bands.

The K1 is as small as most a traditional QRP monobanders—the enclosure measures only 2.2 ×5.2× 5.6 inches—but still includes some of the more advanced features provided on the K2.

The transceiver's front panel has an LCD window that displays the frequency, output power, signal strength, supply voltage, keyer speed and other information. Operating features include pushbutton band selection, RIT and XIT, 8-50 WPM internal keying with message memories and auto-repeat, and three crystal filter bandwidths.

The unit can be ordered with your choice of any two of the following bands: 40, 30, 20 and 15 meters. Elecraft expects the combination of 40 and 20 meters to be the most popular, as these bands offer the opportunity for day or nighttime operation and worldwide DX and are also well suited for Field Day and general QRP use.

The K1 uses only traditional through-hole parts, making it a good project for first time kit builders. Point-to-point wiring has been kept to an absolute minimum. The only test equipment needed for final testing and setup is a digital voltmeter.

Price, $269. Options include a noise blanker ($29) and a three-point universal mounting bracket ($35) which permits angling the unit upward for either desktop or field use. A low-cost, internal automatic antenna tuner option is also planned.

For more information contact Elecraft LLC, PO Box 69, Aptos, CA 95001; tel 831-662-8345; **sales@elecraft.com**; **www.elecraft.com**.

Next New Product

By Jean Wolfgang, WB3IOS

What is Kid's Day?

Kid's Day is a five-year-old and a three-year-old fighting (politely, of course) over possession of a microphone for rights to make the next contact.

Kid's Day is a proud father coaching his nine-year-old son through his first few short, structured conversations on the air, then watching the child operate for the next two hours with virtually no assistance.

Kid's Day is a 10-year-old girl telling her dad, "Now I know why you like to spend time on the radio!"

Kid's Day is a 16-year-old from Texas putting out a general call. Suddenly, literally dozens of stations respond at once, necessitating an intense sorting process to respond to as many of them as possible.

Kid's Day is *fun*.

On the Air, Enjoying Amateur Radio

Originally sponsored by the Boring Amateur Radio Club, and now by ARRL, Kid's Day has grown from a few dozen participants to several hundred in just three years. The whole idea is for young people to hit the airwaves and talk to each other and their elders, exchanging some basic information (call sign, name, age, location and favorite color) and then talking about...anything! One group began a "favorite Beanie Baby" thread; others shared names of favorite pro sports teams. Many conversations were short, with kids reading from scripts to help battle mike fright. "Small voices, short sentences, long pauses" is a good description of some of these. In other cases, the chat stretched out for half an hour or more.

The vast majority of kids will operate under the watchful eyes of older licensees. While many of these mentors are parents of the youths involved, kids are also recruited for the event by grandparents, aunts and uncles, neighbors, Scout leaders and youth group sponsors. Most operations take place at established home stations, but others originate at Scout jamborees, museums, backyard barbecues and local parks. Even the simplest, temporary station location will be sufficient to give a young person the chance to "talk to the world."

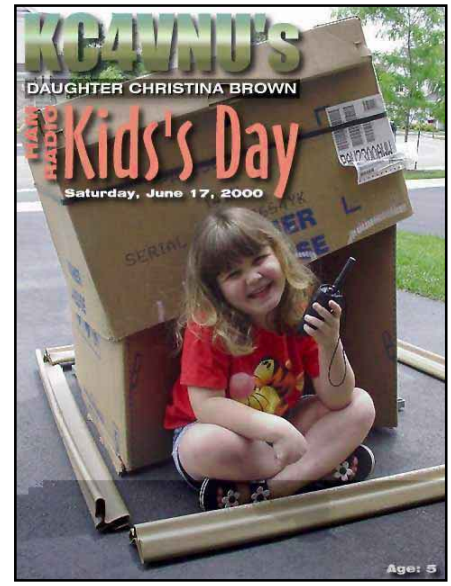
Not only young people get a charge out of Kid's Day. Many hams making contacts with these kids are young at heart. "It's wonderful to hear so many high-pitched voices on the ham bands," remarked one 70-year-old. Older hams spent time encouraging kids to get a license in order to continue to experience the magic of ham radio. When asked if he had a license of his own, one 12-year-old replied, "Not yet, but I'm gonna get it!"

Perhaps these comments from a father and his six-year-old daughter said it best: "This is simply the most fun I have ever had with ham radio! When can we do it again?"

New Certificates For Kid's Day

Our young people are always very enthusiastic about Kid's Day, and we would like to give them another opportunity to "show off their stuff." We are asking these future hams to help us design future participation certificates. Think of the possibilities. Organize a school contest, a homework assignment, or a group effort.

Computer clipart or original artwork is acceptable. The artwork you use should not be copyrighted by others. Remember to include the student's name, age, school and your name and contact information. Please e-mail submissions (as many as you like) to **jwolfgang@arrl.org**, or send them by postal mail to: ARRL, Jean Wolfgang, 225 Main St, Newington, CT 06111.



Christina Brown, (daughter of Gary Brown, KC4VNU) "had a blast" during Kid's Day.

Kid's Day Rules

Purpose: Kid's Day is intended to encourage young people (licensed or not) to enjoy Amateur Radio. It can give young people hands-on on-the-air experience so they might develop an interest in pursuing a license in the future. It is intended to give hams a chance to share their station with children.

Date: January 6, 2001

Time: 1800 to 2400Z. No limit on operating time.

Suggested exchange: Name, age, location and favorite color. You are encouraged to work the same station again if an operator has changed. Call "CQ Kid's Day."

Suggested Frequencies: 28350 to 28400 kHz, 21380 to 21400, 14270 to 14300 kHz and 2-meter repeater frequencies with permission from your area repeater sponsor. Observe third party traffic restrictions when making DX QSOs.

Reporting: Logs and comments may be posted on the Internet to **kids@contesting.com**. You may review these postings at **www.contesting.com/kids/**. Those without Internet access may forward comments to the Boring Amateur Radio Club (see below).

Awards: All participants are eligible to receive a colorful certificate (it becomes the child's personalized ham radio brochure). Send a 9 × 12 SASE to: Boring Amateur Radio Club, PO Box 1357, Boring, OR 97009. More details may be obtained on the Web at **www.jzap.com/k7rat/**.

By Kirk A. Kleinschmidt, NT0Z

License Restructuring: Up Close and Personal

Amateur license restructuring—the hottest ham radio happening in years—is certain to put 2000 on the map for good. Set against the backdrop of our rapidly changing hobby, here's a brief look at the hows and whys of five hams who took advantage of today's "new" Amateur Radio.

To steal a phrase, "our ham radio times, they are a changing.'" Or you might say that today's hobby "isn't your father's Amateur Radio" (which would also be stealing). However you look at it, the thing that's turned ham radio upside down is this year's license class overhaul by the FCC. Properly called restructuring, the Commission trimmed six license classes to three and shelved the Morse code proficiency requirements at a comfortable—and attainable—5 WPM.

There are a lot of details, of course, which you can read about in *QST,* at www.arrl.org and elsewhere. Regardless of how you feel about it, restructuring is the biggest thing since sliced bread for our hobby. If the FCC's plan works in real-time—and it looks good so far—the world of Amateur Radio will be more accessible than ever before.

Tracing our hobby's history from the days of the Old Man himself, it's never been easier to become a ham operator, and it's never been easier to gain significant operating privileges on our precious MF/HF bands. More people than ever before can pursue their radio dreams. There are still tests, of course, but the high-speed Morse requirements that many of us thought would last forever are already gone—and it's safe to say that they'll never return. In fact, in a few short years, countries the world over will wrangle with the concept of *eliminating* Morse code proficiency entirely when it comes to amateur licensing (but that's another story).

"I think the present system is a pretty good compromise," said Steve. "And while I won't miss the 13- and 20-word-per-minute tests, I do think a minimal working knowledge of Morse code is a good thing for the hobby."
—Steve Dickey, KJ7UC

To illustrate the concept of restructuring on a more personal level, the *QST* editors thought it would be interesting to check in with a few operators who have recently upgraded or obtained new ham licenses under the "new rules." Although I interviewed only a handful of people—hardly a statistically valid sample—I was surprised by many of the answers I received.

For every answer that "fit" into my ham radio "worldview" (developed over nearly 25 years of being a ham under the "old rules"), I received another that was surprisingly unexpected! In addition to the tried and true, there's a lot of "new stuff" going on out there. As we move toward a second century of Amateur Radio, it's clear that the things that got most Old-Timer's into the hobby are different than the forces motivating many newcomers.

Without further ado, let's get to the interviews!

Steve Dickey, KJ7UC

Steve, a friendly, articulate Amateur Extra operator who hails from Boise, Idaho, got started in ham radio in 1994.

Beginning with his Novice ticket, he quickly ascended the ranks to Technician, General and Advanced, where he held fast until this year's "restructuring summer."

A few years ago, Steve passed the Extra written test and—frustratingly enough—missed the code test by one question.

"In working my code speed up to 20 words per minute, I didn't practice copying Morse code on paper as much as I should have," said Steve.

When the rules change took effect this summer, KJ7UC picked up a current study guide, brushed up on his subjects and became an Amateur Extra. Because it had been more than a year since he passed the Extra written test, he had to start from scratch (minus the Morse code test, of course).

Whatever the details, Steve is glad the process is finally behind him. His only regret is not being assigned a four-character call sign to go with his new top-

of-the-line ticket. He hopes to remedy that by participating in the FCC's vanity call sign program.

Concerning the future of ham radio licensing, Steve would like to retain at least *some* Morse code test require-ment for future HF operators.

"I think the present system is a pretty good compromise," said Steve. "And while I won't miss the 13- and 20-word-per-minute tests, I do think a minimal working knowledge of Morse code is a good thing for the hobby."

Steve and Toinette's daughter, Allison Browne, KD7CJX, a high school student working on a straight A average, has a ham radio adventure story of her own. When cell phone coverage was unavailable, Allison's 2-meter radio saved the day and helped rescue an injured hiker. Way to go, Allison!

Adam Goering, KC0IGI

Fifteen-year-old Adam's entry into the world of Amateur Radio is as amazing as it is strange.

Early this summer, Adam, who lives in Grand Island, Nebraska, walked into a RadioShack store and saw a two-way radio that caught his eye. The hand-held was a 2-meter ham transceiver, however, and the sales rep behind the counter briefly described what it would take to be able to use the radio.

Being an ever-resourceful tenth-grader, Adam downloaded the Technician-class question pool from the internet, studied like crazy for two days, hooked up with neighbor Jack Barnard, WY0F (who found a nearby exam session) and passed his Tech test with flying colors, missing only one question!

"I studied intensely," said Adam, "and my parents just didn't know what to make of it. I made them quiz me with questions from the pool—and they were surprised when I knew all of the answers."

Now, if you think this story has a typical ending, it doesn't—at least not yet. You see, Adam—test success aside—has yet to make his first contact and doesn't have a radio.

"I'd like to have my own radio and learn more about it, but I haven't saved up enough money yet," said Adam.

School, computers, other hobbies and a large roster of friends take their toll on a young man's time and wallet, so where KC0IGI goes with his newest pursuit is still up in the air.

"I'd like to thank Jack, WY0F, for getting me started," said Adam. "And it's sort of funny. Every time I walked past Jack's house I'd stare at all of the big towers and antennas, all the while wondering what they were for. It's strange that I didn't actually meet him until the guy in RadioShack gave me his number!"

Now that's a bit of serendipity we can all appreciate! Good luck on acquiring your first rig, Adam. We hope to meet you on the air.

Edith Gray, W0OE

Edith, young at heart and quick to laugh, has been a ham operator for nearly 30 years. She held an Advanced ticket for many of those years and upgraded to Amateur Extra this summer when the high-speed code requirement went away. Any way you look at it, W0OE deserved her highest-class ticket!

"I'm not too fond of Morse code and I wasn't going to bother with it," said Edith, "but when Holly Thompson, N0QJM, challenged me, I decided to get busy and get the new license once and for all."

Edith, who hails from Salem, South Dakota, west of Sioux Falls, "studied solid for four days" and no doubt had at least a little help from husband Ed, W0SD. (If you've been a ham for more than a week, chances are good that you've already worked Ed and have his QSL card hanging on your wall.)

Having been active since the early '70s, you might think that earning an Extra ticket wouldn't afford Edith too many new privileges. But in teaming up with her husband—a longtime contester—Edith looks forward to adding multiop contesting to her list of regular activities.

According to Ed—who speaks from experience—"to be really competitive in today's contest arena, you have to be able to operate in the Amateur Extra band segments. And now, with her new license, Edith will be able to do just that."

W0OE, a recently retired restaurant owner, looks forward to spending more time on the air, competing and otherwise. Congratulations, and good luck in the contest!

Bob Doak, AB2JR

Radar designer by day, Amateur Extra ham by night (and weekends!), Bob Doak, AB2JR, of Mount Laurel, New Jersey, is an Extra ham *for the second time*. First licensed in 1971 as WN2AIH, Bob scaled the license-class ladder and by the late '70s was signing K2NR (a call sign he wouldn't mind signing today!). Forty-meter code was his forte—with a bit of QRP thrown in for good measure. But by the mid '80s it was all over. K2NR lapsed and Bob was off the air.

"I guess it happened because I was really busy with college at the time," Bob said, "And then came a demanding career in electronics. With everything going on, something had to give."

In those intervening years, Bob thought about getting back into the hobby more than a few times, but a convenient opportunity didn't present itself until the summer of 2000—just after restructuring.

"About a year before the rules change," Bob said, "I began listening to a new shortwave receiver, which spurred my interest in getting back into ham radio. To spare myself the challenge of bringing my code speed back up to 20 WPM, I studied a bit and waited until the rules change before taking my tests."

Bob reviewed all of the pertinent question pools and researched topics that had changed or had been added since his last time as a ham. In June of 2000, Bob went from shortwave listener (and former ham) to Amateur Extra in one sitting. The tests took an entire evening to complete, but when the dust settled, Bob was set to become AB2JR.

Still a busy guy—and now plagued by deed restrictions and restrictive covenants—Bob is patiently waiting for cooler fall weather before venturing into his attic to install a stealthy HF antenna.

"I'm mostly interested in casual operating and casual DXing," said Bob. "I'm not taking radio *too* seriously this time around, but I do want to have some fun. I'm looking forward to exploring some of the things I've missed since I was last on the air."

For passing the Extra exams *twice*, Bob is amazingly laid back in his approach to the hobby. Welcome back to ham radio!

Cheryl Frank, KB1FMX

Cheryl, age 25, was raised in a ham radio household in Burlington, Vermont, under the guidance of ham operator parents Joe, W1SOV, and Cathy, N1AFZ. Presently a grad student at California's Stanford Business School (working on her MBA), Cheryl earned her Technician ticket in May and upgraded to General class in July.

"I knew I wouldn't have time to do it anytime soon," said Cheryl, "so when I had an opportunity to upgrade before moving to California, I studied and took the test."

And if you think that growing up with

her father, characterized by Cheryl as a longtime, avid operator, was enough of an incentive to get her own ticket, you'd be wrong! Cheryl had a specific reason for getting her ticket—one that merged the utility and camaraderie of Amateur Radio with another cherished activity.

She and her sister Becky (KB1FHN) wanted to hike a mountain trail that runs from Massachusetts to Canada. That would mean being on foot for 23 consecutive days and hiking through some pretty remote country.

"We wanted the safety and convenience of carrying 2-meter hand-helds," explained Cheryl, and we wanted to be able to stay in touch with our parents the whole way."

To make that a reality, the pair needed to become licensed hams, which they did.

"The really amazing thing about carrying the radios was that there were only two days out of 23 when the repeaters were inaccessible. We were able to stay in touch with Mom and Dad virtually the whole way," said Cheryl. "We also met other "ham hikers" along the trail, which was also fun."

When I asked her about her future plans as a General-class ham operator, she said she was interested in chatting with her parents and the folks back in Vermont on HF—if she could get her hands on some of Dad's "extra radios."

Cheryl and Becky were toting 40-pound backpacks and camping out the entire time on the trail, so to keep their burdens manageable, the pair scheduled two "in-person re-supply meetings" with Mom and Dad to stock up on food and batteries for the radio (which was powered by standard alkaline cells to keep things simple).

At the time of this interview, KB1FMX had been at Stanford for two weeks. When I asked her about her future plans as a General-class ham operator, she said she was interested in chatting with her parents and the folks back in Vermont on HF—if she could get her hands on some of Dad's "extra radios."

"He really has a lot of gear," said Cheryl, "way more than one guy can use."

I think there's a subtle suggestion in there somewhere…

While she's waiting for W1SOV to part with some vintage hardware, she'll probably have to settle for the university's well-equipped club station.

Congratulations, Cheryl and Becky, and welcome to the wide-open world of Amateur Radio.

Conclusion

There you have them—five stories from the dawn of ham radio's "restructurist" period. Where we go from here will be up to the thousands of hams who move through the hobby with its fresh approach to licensing. Will you add your story to the list?

You can contact the author at 16928 Grove St, Little Falls, MN 56345; **kirk@cloudnet.com**. QST

NEW BOOKS

AC POWER INTERFERENCE MANUAL

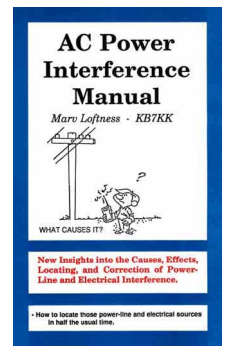
By Marv Loftness, KB7KK

Published by Percival Publishing, PO Box 4122, Tumwater, WA 98501; fax 360-352-5923. First edition, 1996, softcover, 6 × 9 inches. ISBN: 0-9653760-2-8 $24.95 plus $4 shipping and handling. Washington residents add 8% sales tax.

Reviewed by Jody Boucher, WA1ZBL

Most hams will have to deal with power line interference at one time or another. If you've ever wondered how the pros locate and fix it, the *AC Power Interference Manual* is the book for you. This book is written by a professional, for professionals, but in easy to understand terms and concepts that anybody can use to track and identify RFI sources. As an RFI investigator for a large utility for nearly 20 years, reading the *AC Power Interference Manual* gave me a wealth of information on the RF characteristics of noise impulses, what they look like on an oscilloscope and how to find their sources.

The author, Marv Loftness, KB7KK, is an icon in the power line interference industry with over 40 years of investigation experience. He has been an RFI consultant for many years and wrote two other handbooks for radio and television interference, not to mention a number of papers for the IEEE. This updated book is great for anyone responsible for solving or trying to locate power line interference problems.



Loftness begins by discussing cause and effects of power line interference, covering the basics of why power lines are, or can be a noise source, describing in detail utility pole construction and RFI "hot spots." The effects of arcing and its propagation are well illustrated with many photos and diagrams throughout the book, all drawn from his years of experience in the field and laboratory. He goes on to describe his trademarked "Rapid Locating System" used for the quick location of interference sources. He claims you can locate power line noise sources in less than half the usual time using his techniques.

In the *AC Power Interference Manual* Loftness uses more than 20 RFI case studies gleaned from investigators. These studies detail their personal experiences in the field and how they resolved the various complaints. They common and not so common problems that you're likely to encounter.

Some of the television interference (TVI) material may seem a little dated because it does not reflect the fact that digital satellite systems and cable TV are now able to provide reception that is immune from power line interference. However, many cable TV head end systems still rely on antennas to receive local broadcasts for their customers, and these systems remain prone to RFI. This part of the manual describes some useful concepts and methods in dealing with cable TV companies and some of the problems they might encounter.

The *AC Power Interference Manual* is loaded with information that hits on all facets of radio and television interference from power line sources. It covers basic and advanced locating techniques, noise propagation, source locations and correction, radio amateur problems and a vast amount of field experience. If you don't understand what's noisy on that pole in front of your house, you will after reading this book! QST

By Dave Patton, NT1N

"It's My Job to Make Them Thirsty!"

A conversation with ARRL President Jim Haynie, W5JBP

In August a small group of Headquarters staff people sat around a table with President Haynie and discussed his first seven months at the helm of the world's largest Amateur Radio association. During the discussion it became clear that President Haynie is on a mission—a mission to improve and maintain the viability and fun of Amateur Radio. And as the old adage goes: "You can lead a horse to water but you can't make him drink," and says Jim, referring to Amateur Radio enthusiasts, "It's my job to make them thirsty!"

What are some of your initial impressions after seven months in office?

This job is nothing like what I thought it would be. It is like being at the center of a big wheel with spokes coming from all directions—including nonmembers and non-Amateurs. I now realize that we have to continually plan strategies for every issue that arises. And I'm enjoying it. I have attended 31 hamfests and conventions since the election and one of the main things I am hearing is that Amateur Radio is really not going down the toilet. There are people who are truly misinformed about issues, and there are people out there "who play Devil's advocate" just to keep controversy up. I like listening to what other people say, but we have to maintain a balance and try to do and project what is best for Amateur Radio.

Education seems to be the main theme you have adopted for your term. Tell us what you're thinking.

There are a lot of very successful people (multimillionaires) who attribute their success to their Amateur Radio background. This tells me that there are a lot of kids out there who have the same opportunities. We have to work with the younger people and try to present Amateur Radio to them as a way to get ahead. Think about it: If you have a ham license, you have an immediate leg-up in the RF/wireless field. It is similar to the way it

was in the computer programming industry ten to 20 years ago. The programmers did, and still do, demand top dollar for their knowledge. The ARRL Education Project is going to harness this opportunity and put it to work.

Is the Internet the demise of Amateur Radio? The Internet is a wonderful tool, but sitting down and typing into an inanimate object doesn't do anything for me. I like to hear the person on the other side. I like to hear the CW and the voices of the operators and their techniques. At one of my talks were a bunch of Internet savvy kids who seemed to have interest but weren't paying attention. "How do I get to them?" I thought, "These kids all have cellular phones and beepers as well as the Internet." Well, I showed them an oscilloscope picture of their voices when they spoke into a microphone. I asked them if they knew how a microwave oven or a cell phone worked, and explained those concepts. I lit a fire under these kids with the basic magic of electricity and electronics. I then moved the talk into Morse code and they jumped all over that. Amateur Radio is not going to be supplanted by the Internet. The kids need to be exposed to these things—it's not that they aren't interested. They will learn faster than you can show it to them—if you show it to them. It is the responsibility of the Amateur Radio community to get out there and do that. And we can't forget that it's fun, too!

Ham radio is fun. How can we keep that attitude going? Tinkering! Hams will always love to tinker with stuff, you know, making something work a little better, modifying something. And hams love to make contacts all over Earth—on their own, not with a multibillion dollar infrastructure underneath to facilitate the process. What is happening in our society is that our capacity to understand has grown enormously and we will keep up with the technology for which we have been famous for during our entire existence. Look at the success we have had versus the cost involved for the OSCAR satellites and the Phase 3D satellite project as compared to what industry has spent on other space and satellite projects. The future of Amateur Radio is bright. When Phase 3D and Amateur Radio on the International Space Station get going on all the different modes, think about the fun that will go along with that. Digitized, compressed data/voice will be a significant step forward for Amateur Radio that I believe will be here in five years. It will save bandwidth with pure audio! And people will be using software-defined radios as a matter of course. "Dick Tracy" radio wristwatches will be common. There are over 80 million people in the US using cell phones. What's the next step in personal communications? The next step is something that will be designed and built by Amateurs.

In your opinion, what is the biggest threat to Amateur Radio today?

My biggest concern right now involves the Amateur's ability to put up and use antennas. The FCC has to understand what the problem is. The FCC has migrated from being knowledgeable about Amateur Radio to having only a few hams on staff. Part of my job is to educate the people presently at FCC about what we do, and about what is good and important about the Amateur Service to them. In so doing I need to explain how CC&Rs (local restrictions) have become a cancer to Amateur Radio.

Often the anti-antenna language found in CC&Rs is used without any knowledge or understanding of what it means. People want to have the luxuries of new technology, but they don't want it in their backyard. The ARRL has done everything possible to publish books and information to help people understand these things, but there isn't much farther we can go with that angle.

The League is asking the FCC to apply the reasonable accommodations that are in PRB-1 to CC&Rs. Hams also have to understand the meaning of reasonable accommodations. We have to learn to give and take in order to co-exist.

What about Part 15 devices?

Demand for spectrum is the key issue here. With technology exploding, everyone is coming up with devices that use RF for one thing or another. There is tremendous pressure on Amateur Radio spectrum. Part 15 devices will continue to grow and Hams are going to have to learn to work with and around these things no matter what the "must accept interference" rules say for the devices. The communications technology industry is growing so fast that these companies don't have the equipment or expertise to determine what sort of interference they might cause. The manufacturers are throwing it all out there to see who complains.

Is there a role for ARRL in educating the general public?

We are working with industry in an important role to educate the industry side of this problem. Once again, it goes back to the fact that there aren't enough qualified engineers to help these companies. Devices that transmit in the ham bands are a mistake. Any General ham could have identified this for them.

What can we do to combat the threats to our spectrum?

This issue comes up when nonmembers ask why they should join the ARRL. When I first became licensed, I wasn't a member. It just never occurred to me that there was somebody who was responsible for taking care of the Amateur Radio Service and me. When I became more knowledgeable about Amateur Radio, I realized that it was the ARRL that helped me to be a ham. So, I joined the League. Then I joined the local club to associate with other people who enjoyed the same things. There is strength in numbers, and we need all the strength we can get to protect our spectrum. One of the most important things anyone can do is join and support the ARRL. The ARRL's staff, volunteers, and officers must all work together, too. I say this in club meetings and conventions—"We don't do everything perfectly." We are an organization of human beings and we recognize that. We correct our problems. I am pleased with the Board of Directors and the Headquarters staff. I have never met anyone here who didn't care about Amateur Radio. We don't go to Washington DC to promote Amateur Radio just for the League. This is for everybody who has or will have a license.

Let us imagine that there's no national association for Amateur Radio. How much spectrum would we have today if Hiram hadn't been around? I would almost guarantee there would be nothing above 30 MHz. I would dare say that 40 meters wouldn't be there at all. We wouldn't have any of the bands gained at WARC 79, or much, if anything, at 160 meters. Part 97 wouldn't be as complete as it is today. There would be nothing of what we enjoy today such as DXCC and WAS.

Let us imagine that there's no national association for Amateur Radio. How much spectrum would we have today if Hiram hadn't been around? I would almost guarantee there would be nothing above 30 MHz. I would dare say that 40 meters wouldn't be there at all.

What can we do better at HQ?

I refer to our members as customers. They are the most important things we have and we want to take care of them. We also need to promote ourselves to our members sometimes too. We need to emphasize what we are doing right—what feels good. I also like to call members on the telephone and chat with them. That personal touch can go a long way. We need to make sure that we are all on the same page while representing the US radio amateur. When I look at the big picture, with industry and everyone else included, there aren't that many of us hams—especially as a percentage of the population. It is imperative that we stand together and speak as one voice.

We can do better in publishing and talking about what we are doing and thinking here. It is true that we have more information available here than does the average ham, but we don't have the room to publish as much as we would like. But frankly, I don't think our members generally expect to know everything that is going on. It is a reasonable expectation for a member to know that we are doing everything that we can. I have seen good teamwork from the Board to Headquarters to all the volunteers out in the field and we can improve on this.

You have been reaching out to volunteers, too.

Think about the fact that there are over 10,000 volunteers. I feel very strongly that the volunteers do not get enough recognition and appreciation. We could do better in communicating with them, and with encouraging people to volunteer and be a part of the field organization. If you want to make things better you have to get involved. People getting involved helps to make Amateur Radio better as a whole. That's why I am involved. If I didn't believe that I could make a difference, I wouldn't be here. We are well respected globally and I want to maintain that respect. Other associations ask what we do that makes the ARRL so successful. I want those questions to continue.

What's the next step?

I want to increase membership to 200,000. If we had 200,000 members, there would be so many other things we could do to represent them and all of Amateur Radio. Antenna problems and legal assistance can be improved. We can do more of that. Larger membership numbers means more clout with our elected representatives and opens the door to doing a lot of things for Amateur Radio that at present we would like to do but cannot due to obvious economic expense issues to which everyone can relate. We have managed to do a pretty decent job for the membership now, and I want to thank every single member for their support. I also wish that every member could recruit other members so we can expand. I want people to join because "we are the best at what we do." I want them to say that's why they are joining.

Think about the baby boomers and the demographic of older people. These people are affluent and they are looking for new things to do. We need to get to this group and let them know that Amateur Radio and ARRL exist. If we had the 200,000 members, I could place various ads to attract them. There is no age limit for being a Ham. Promoting ham radio is something I would love to do in the general media.

How do we get there? We need everyone to do their jobs better. People like to do business with a winner—not a loser. We at 225 Main Street are winners and we want everybody to want to be a part of that. You know the old saying—you can lead a horse to water but you can't make him drink. Well, my job is to make them thirsty! QST

By Steve Ford, WB8IMY

ARRLWeb: A Storehouse of Knowledge

The world's largest on-line source of Amateur Radio information is just a mouse click away…

It is said that the Library at Alexandria was one of the marvels of the ancient world. If the historical accounts are accurate, the Library held the entire sum of the world's knowledge at that time. We live in an age when it is impossible for any single individual, or even a single library, to collect every piece of information ever created. Thanks to the World Wide Web, however, any of us can instantly tap into a "virtual" library that is everywhere and nowhere. That's the nature of *cyberspace*—everything is virtual, existing as collections of data dispersed throughout the Internet.

When the Internet sprang onto the public stage almost 10 years ago, many hams feared it. This new information medium could only hurt Amateur Radio, they said. While it is true that the Internet has indeed lured away some people who may have otherwise become amateurs, the ham community as a whole embraced the Internet with a passion. As a result, hams are using computers and the Internet to add more pleasure to their hobby than they ever thought imaginable. The Web became their modern-day Library at Alexandria.

Fast-forward to the end of the year 2000 and you find that nearly 90% of all ARRL members have Web access. Hams today see the Web as the tool of choice to find and exchange information. Rather than diminishing Amateur Radio, the Web has *enhanced* it. The advances we are seeing on many amateur fronts (digital communication, for example) have occurred because the Web was there to facilitate the exchange of ideas, software and more.

The ARRL tapped into the Web's potential early on, establishing one of the first large-scale Amateur Radio Web sites in August 1995. We served about 31 GB of data in 1996, our first full year of operation. We serve that much data in a week now. (Five years is an eternity in cyberspace!) Today ARRLWeb is the preeminent Amateur Radio Web site for the entire world—the largest and most comprehensive by far.

Within the last few months ARRLWeb has taken on a new look, and added some

Figure 3—Just click one of these "hot buttons" and you're on your way.

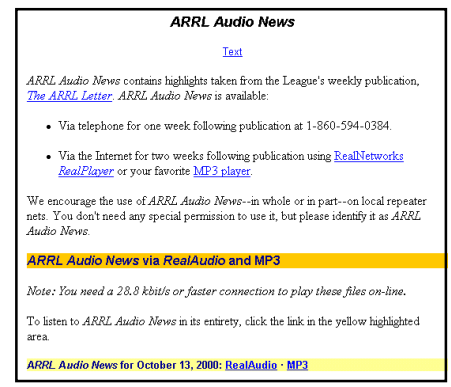


Figure 4—Listen to ARRL Audio News.

ARRLWeb Stats

Documents available: 6000+
Page views per day: 40,000 - 50,000
Downloads: 3 to 6 Gbytes daily

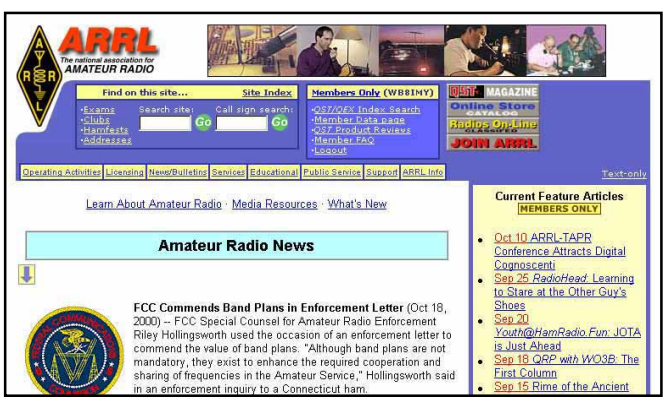


Figure 1—Enter www.arrl.org and you're taken to the main ARRLWeb page.

Figure 2—Drop-down menus make it easy to navigate.

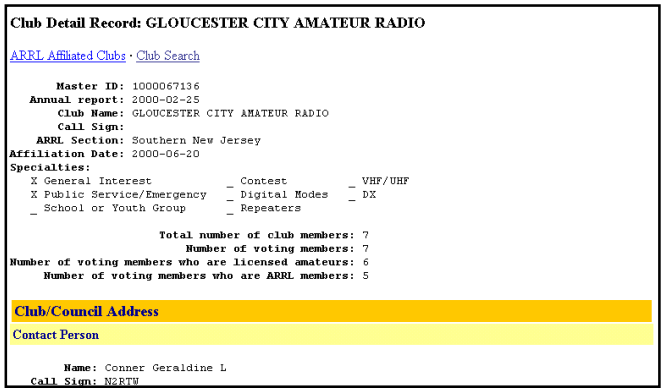


Figure 5—Looking for a local club? Find out everything you need to know from the ARRL Affiliated Club search page.

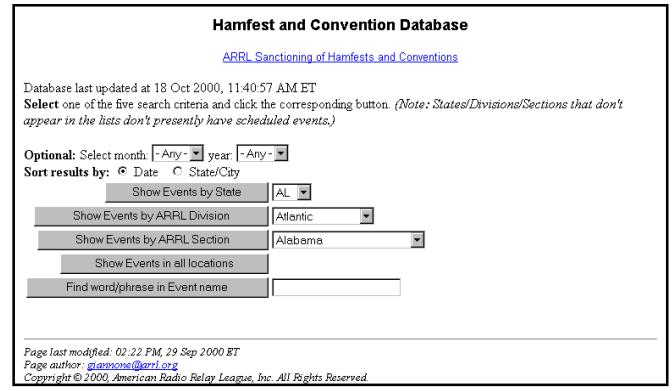


Figure 7—Find a hamfest or convention nearby.

new features. Consider this a "snapshot" of where ARRLWeb is right now.

The New Look

Everyone agreed that ARRLWeb needed some freshening up—not just for appearance sake, but to improve the ease of operation. Our members have told us repeatedly that they value substance over style. The trick is to pull this off without resorting to fancy graphics and "cute" animations—things that tend to slow downloading.

The result is the main page that greets you at **www.arrl.org/** (see Figure 1). Not only is the layout more attractive, it offers improved navigation features. You can search for anything on the site by simply typing the words into the search box. You can also check the site index. In addition, often-used sections of ARRLWeb can be accessed through convenient drop-down menus (Figure 2) or "hot buttons" (Figure 3).

If you are an ARRL member, you can log in and gain access to a number of special features available to members only. (In Figure 3, I'm already logged in. If I wasn't logged in, the Members Only box would say ARRL Member Login.) You have to register using your call sign and ARRL membership number and choose a password before you can access members-only features. You can do so using the "Register" link that appears in the ARRL Member Login box. After you register, you just need your username (call sign) and password. More than 83,000 ARRL members have registered on the Web site so far.

The latest Amateur Radio news is waiting for you right on the home page. Just scroll down the page and you'll get the breaking stories. Stories are added nearly every day, and using the site search you can find news stories from the past several years. If you want exclusive features and columns, you'll find them in the *ARRLWeb Extra*, which is accessed as a members-only feature. If your computer has a sound card, you can even *listen* to the news from the ARRL Audio News page (Figure 4). If you're a registered member, you can also sign up, via the Member Data page, for e-mail delivery of the weekly ARRL Letter newsletter, e-mailed ARRL bulletins, e-mailed news from your local ARRL director and section manager, and news about new ARRL products.

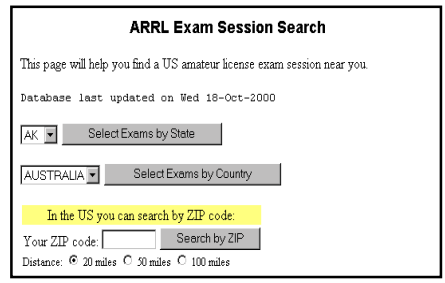


Figure 6—Looking for an exam? Look no further!

Take a Test Drive

Let's pretend that you're browsing through ARRLWeb right now. One of the most popular uses for the Web is looking up information, and ARRLWeb is no exception. The "Find on this site" and "Members Only" boxes provide several links to searchable information. Looking for an address for the ham you just worked on 10 meters? Type the call sign in the "Call sign search" box and get the latest info from the FCC license database (updated daily).

Looking for a local club to join? The ARRL Affiliated Club search page lets you find clubs by state, ARRL section, distance from your town, or name. And when you find one that's promising, we show you lots of information about the club including contact information and meeting schedules (Figure 5).

Time to take your first test or upgrade? Where can you take an exam? The answer is easy. Just click on "Exams" and search for an exam in your area (Figure 6). While you're at it, check out the upcoming hamfests and conventions. Click "Hamfests" and within seconds you'll arrive at the convenient search page (Figure 7).

Wasn't there a *QST* article you were looking for? You remember part of the title, maybe the year it was published, but that's all. Not a problem. Go to the members-only ARRL Periodicals Index Search (Figure 8) and you can search for any *QST* or *QEX* article ever printed by title, author, month and year. Plug in the keywords (those you remember from the title), or an author's call sign, or just a year. You'll see a list of matching articles along with the author, issue month and year, and page number.

Hmmm... The family is out of the house for a few hours this weekend. What's happening on the air? Use the drop-down menus to check the ARRLWeb's contest calendar, special events calendar, or weekly W1AW DX bulletins. What is the forecast? Not for your neighborhood, for the *ionosphere!* Is Old Sol going to allow you to talk to Asia on 10 meters this month? Go to **www.arrl.org/qst/propcharts/** and grab the latest full-color

Looking for a local club to join? The ARRL Affiliated Club search page lets you find clubs by state, ARRL section, distance from your town, or name.

Technical Information Service on ARRLWeb

In the middle of 1999, the ARRL Technical Information Service (TIS) was still being handled as it might have been in the '50s. There were a number of Technical Information Packages on topics such as antenna projects, RFI, construction, grounding and so forth that hams could request. These paper packages were then mailed out at a nominal fee to cover postage and handling. Although most of the packages were available on ARRLWeb, they were still in a format reminiscent of the old BBS days (brief text files).

We tore down the old and built anew, mindful of how the World Wide Web operates. Our current TIS area strives not only to deliver modern versions of the old TIS packages, but also to be a focus for other ARRL Web pages that are of technical interest.

Enter **www.arrl.org/tis/** and you'll go directly to the TIS welcome page. Right at the top there are quick links that take you to several valuable services of a technical nature.

TIS Pages

This area offers a wealth of information in the form of original articles, compiled data and dozens and dozens of *QST* articles reproduced in PDF format for viewing, download and printing. This is the place to find out about PSK31 and other digital modes, antennas, construction techniques, solving RFI problems, and a host of other technical areas. We're constantly adding new topics and articles.

TISfind

This is an on-line, dynamically updated version of the program that started as a table of parts and equipment suppliers in the *ARRL Handbook* and is currently available on the *ARRL Handbook CD*. It is a database containing over 2000 sources for products, services and organization of interest to radio amateurs. For example, just enter RADIO REPAIR and get a list of places to send your rig; enter TUBE to locate a dealer that might have parts to help restore that HT-37 you just picked up at the hamfest.

Product Reviews

Hams can't get enough information about equipment, and the TIS page offers several links to Product Review information. One is a list of Product Reviews going back to 1970, arranged by manufacturer and model name. If you're logged on as a member, you can navigate to downloadable PDF files of Product reviews from 1980 to the current issue of *QST*. In fact, the current Product Review is posted, for members only, when the current issue of the magazine is still at the printer! If you want to know the lab test results for the latest transceivers in far greater detail than we can present in *QST*, check out the expanded test result reports. A typical expanded test report for recent HF transceivers runs 30 to 40 pages and includes graphs and tables detailing band-by-band performance measurements and explanations of ARRL testing procedures. And finally, members may access a table that summarizes key test results for HF transceivers from *QST* Product Reviews going back to the 1970s.

Members may access a table that summarizes key test results for HF transceivers from QST Product Reviews going back to the 1970s.

The Doctor is On-line

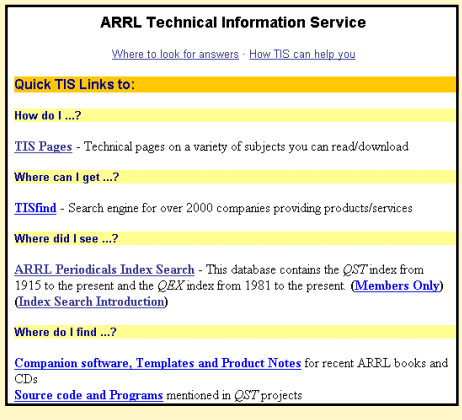
Our latest addition to the TIS Web site is an on-line version of the popular "The Doctor is IN" column. Each month TIS receives e-mail from members with additional information on topics discussed in the Doctor. We had no easy way to forward this info to the original correspondent—the valuable information would be lost. Members may now go to The Doctor is On-line page at **www.arrl.org/members-only/qst/doctor**, find the original question and the Doctor's reply and add an additional response. Of course, new questions to the Doctor must still be sent to **doctor@arrl.org**.

Our latest addition to the TIS Web site is an on-line version of the popular "The Doctor is IN" column.

More goodies

There is also a link to an area with companion software, templates and important notes about various League publications. You can also find the source code for software projects mentioned in *QST* projects and other supplemental information. There's even an entire page devoted to locating manuals and documentation for your latest flea market acquisition.

You'll be sure to find the TIS Web pages very useful. We recommend you visit us and bookmark the page to your favorites. As we like to say, "When you want to e-mail ARRL TIS with a question, look here first!"—*Al Alvareztorres, AA1DO, ARRL Technical Information Coordinator*



ARRL Technical Information Service

Where to look for answers · How TIS can help you

Quick TIS Links to:

How do I ...?

TIS Pages - Technical pages on a variety of subjects you can read/download

Where can I get ...?

TISfind - Search engine for over 2000 companies providing products/services

Where did I see ...?

ARRL Periodicals Index Search - This database contains the *QST* index from 1915 to the present and the *QEX* index from 1981 to the present (Members Only) (Index Search Introduction)

Where do I find ...?

Companion software, Templates and Product Notes for recent ARRL books and CDs

Source code and Programs mentioned in *QST* projects

The TIS home page.

Manufacturer					
Model	**Bands (160/80/40/30/20/17/15/12/10 standard)**	**Typical Output Power (Watts)**	**Worst Case Xmit Spurious (dBc)**	**Worst Case Xmit IMD 3rd/5th (dB PEP)**	
Date of *QST* Product Review	**Modes (CW/SSB standard)**	**MDS 80M/20M 6M/2M (dBm)**	**BDR 80M/20M 6M/2M (dB)**	**IMDDR 80M/20M 6M/2M (dB)**	**Notes**
Alinco					
DX-70T	+6 M	100 (10 on 6M)	-56	29/51	
12/95	AM,FM	-138/-136 -140	129*/126* 125*	90/92 86	4
DX-77T		100	-52	30/41	
6/98	AM,FM, WBFM	-140/-136	110*/112*	93*/95*	4
Atlas					
350XL	--	--	--	--	99
--	--	-131	117	81	
210/215X	--	--	--	--	99
--	--	-120	123	76	

You'll find this fascinating head-to-head transceiver comparison chart in the TIS section of the ARRLWeb.

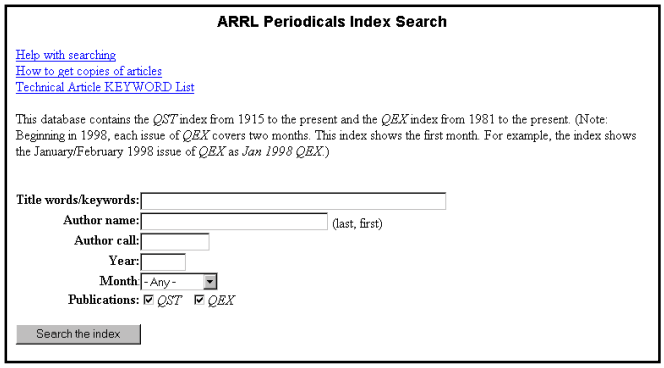


Figure 8—Find that lost article with our searchable *QST* and *QEX* indexes.

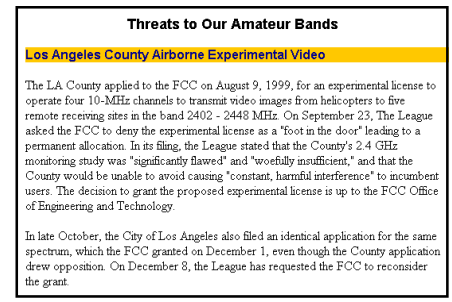


Figure 11—Keep an eye on the latest threats to your privileges.

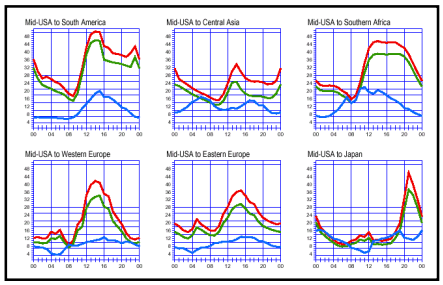


Figure 9—Check out our colorful propagation charts.

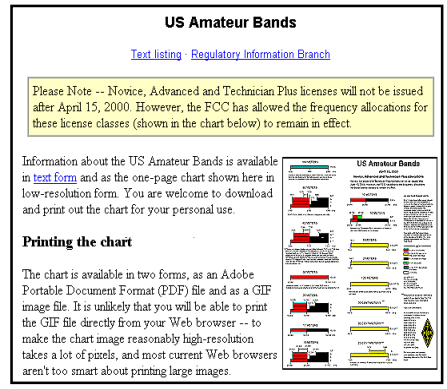


Figure 10—Download an Amateur Radio band chart.

Figure 12—Refer your non-ham friends to www.arrl.org/hamradio.html to learn how they can become hams too.

propagation forecast charts for your part of the country (Figure 9).

Don't be ashamed to admit that you can't remember the all of the frequency and mode allocations of our amateur bands. But where would you find such information? On ARRLWeb, of course. You can view a color Amateur Radio band chart and even print it on your printer (Figure 10). This is typical of the type of practical information that ARRLWeb has waiting for you.

Public service is a key activity for many League members, and ARRLWeb has several pages and features to support this key activity. For example, check out the online versions of the *ARRL Net Directory* and *Public Service Communications Manual*. Learn about the Amateur Radio Emergency Service (ARES) and about how to get involved with public service groups in your ARRL section.

You may know that our amateur bands are under siege from groups who would dearly love to occupy our spectrum, but how much do you *really* know? ARRLWeb is on top of threats that creep onto the radar screen (Figure 11). You can check our site often to view the ARRL's ongoing battles to preserve your privileges. In the Government Relations pages you can learn more about ARRL's ongoing efforts on your behalf in Washington and abroad.

Spreading the Word

You probably already live and breathe Amateur Radio, but what about folks who are just starting out—or who are interested but just don't know it yet? Click the Learn About Amateur Radio link on ARRLWeb's home page, and you can find a wealth of information, photos and sound clips that give visitors a taste of what ham radio is all about (Figure 12). We also answer common questions, explain licensing procedures, and recommend different ways to study.

Wondering how to get some local publicity for your club's latest project? Visit our media resources page at www.arrl.org/pio/ and equip yourself with background information and tips from experts.

Working with kids? Visit our educational activities pages at www.arrl.org/ead/ and learn about teaching Amateur Radio, Jamboree on the Air and other activities for Scouts, Kid's Day and the School Club Roundup, and other resources.

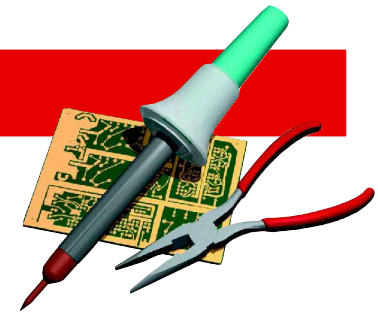
ARRLWeb is like the proverbial iceberg. We've only looked at the tiny fraction that's visible above the water. There is much more that is unseen and waiting for you to explore.

Much More—and More to Come

ARRLWeb is like the proverbial iceberg. We've only looked at the tiny fraction that's visible above the water. There is much more that is unseen and waiting for you to explore.

If you have a question about Amateur Radio, or need to find a source for a particular piece of information, chances are you'll find it (or find the path that will lead you to it) on ARRLWeb. Like everything else in cyberspace, ARRLWeb will continue to evolve, adding new information and features every week. It's a good idea to check back often, just to see what has changed since your last visit. You might even want to make ARRLWeb your browser's default home page so you'll be sure to get the latest news and information every time you connect to the Web.

Think of ARRLWeb as a gigantic storehouse of raw information—your own Library at Alexandria—to be tapped whenever the need arises. Visit ARRLWeb today, and visit it often. There's something new every day! QST



The Doctor is IN

Q In *QST* I often see references to "ground plane" circuit construction. What does this mean?

A Ground-plane construction is a point-to-point technique that uses the leads of the components as tie points for electrical connections. You may also see it referred to as "dead bug" or "ugly" construction. (The term "ugly construction" was coined by Wes Hayward, W7ZOI.) "Dead-bug construction" gets its name from the appearance of an IC with its leads sticking up in the air. In most cases, this technique uses copper-clad circuit-board material as a foundation and ground plane on which to build a circuit using point-to-point wiring, hence "ground-plane construction."

Ground-plane construction is quick and simple: You build the circuit on an unetched piece of copper-clad circuit board. Wherever a component connects to ground, you solder it to the copper board (see Figure 1). Ungrounded connections between components are made point-to-point. Once you learn how to build with a ground-plane board, you can grab a piece of circuit board and start building any time you see an interesting circuit.

A PC board has strict size limits; the components must fit in the space allotted. Ground-plane construction is more flexible; it allows you to use the parts on hand. The circuit can be changed easily—a big help when you are experimenting. The greatest virtue of ground-plane construction is that it is fast.

Circuit connections are made directly, minimizing component lead length. Short lead lengths and a low-impedance ground conductor help prevent circuit instability. There is usually less intercomponent capacitive coupling than would be found between PC-board traces, so it is often better than PC-board construction for RF, high-gain or sensitive circuits.

Q I left my H-T exposed to sunlight for several hours. When I finally retrieved it, I was horrified to see that the LCD (liquid-crystal display) was completely black. However, after it cooled for a few minutes, the display returned to normal. What happened to the display, and how did it recover?

A Liquid crystals used in most LCDs are long, straight molecules that tend to line up with each other, and anything else that's nearby. If you sandwich a film of liquid crystals between glass plates that are ridged like a miniature corrugated roof, the molecules will line up with the ridges. If you rotate one plate by 90° the molecules near that plate will orient themselves at right angles to the molecules near the other plate. Between these plates, the rest of the crystal lattice forms a smooth one-quarter twist. This twist rotates the polarization of light by 90° as it passes through the liquid crystal.

The liquid crystals used in displays are electrically unbalanced: one end of the molecule is slightly negatively charged, the other end slightly positively charged. So applying a small voltage across the glass plates causes all the molecules to "stand on end," and the liquid crystal loses its ability to twist the polarization of light. Switch off the voltage, and the lattice returns to its previous state.

To create a display, the glass plates are replaced with polarizing filters, also out of alignment by 90°, and a reflecting surface is put behind them. Incoming light is polarized by the first filter, twisted 90° by the liquid crystals, passes through the second filter, is reflected and reverses its journey.

Apply a voltage, however, and the incoming light passes unchanged through the liquid crystal and so can't pass through the second polarizing filter. Consequently, the display goes black. By using segmented electrodes, letters, numerals and other shapes can be displayed.

The liquid crystal state is a phase between solid and liquid—cool it and it solidifies; heat it and it melts. Melted liquid crystals lose their ability to change the polarization of light, becoming ordinary liquids. That's when you see the display going completely black or blue. When cooled, it returns to the liquid crystal phase and reflects light again.

Don't make it a habit to leave your rig in the sunlight for prolonged periods of time. Repeated abuse can, over time, permanently alter the chemical properties of the display and render it inoperable.

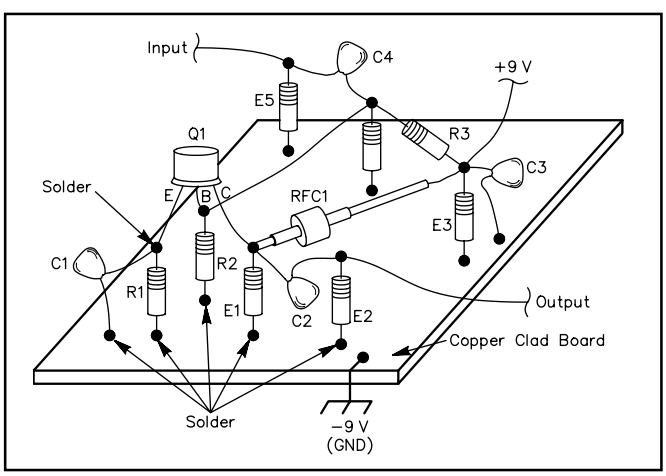


Figure 1—Typical ground plane construction. It may look ugly, but it is quick and easy.

Q Carl, W3MAO, asks, "My Kenwood TS-570D transceiver has a 13-pin receptacle for accessories. They provide a 13-pin DIN plug with the radio. This plug has 13 stubs on the wiring side that do not appear to be meant for soldering. Is there some kind of adapter that I can use with this plug to make an otherwise difficult solder job easier?"

A Through the years, I have encountered DIN plugs like the ones you describe. MFJ sells their 5213 open-end-adapter for $9.95, but if you opt to make your own, *careful* soldering is required.

If the wire is thin enough, and you are not connecting to adjacent pins, you can form a small loop at the tip of the wire, bend it 90° and slide it onto the pin for soldering. More often than not

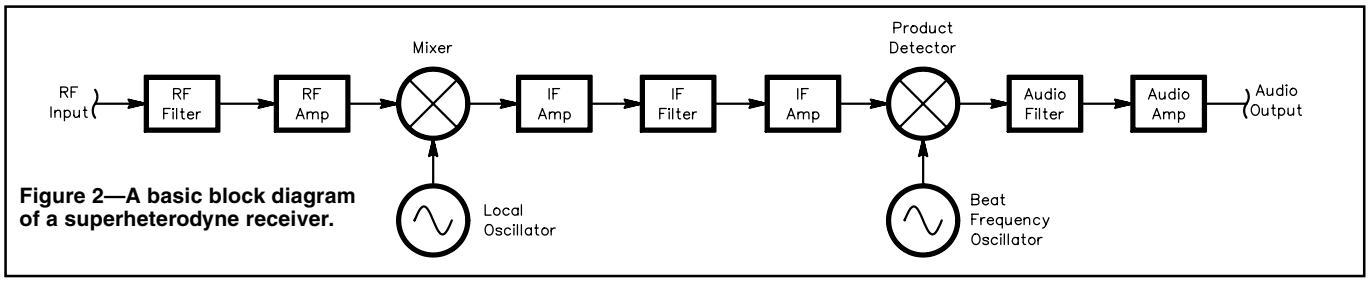


Figure 2—A basic block diagram of a superheterodyne receiver.

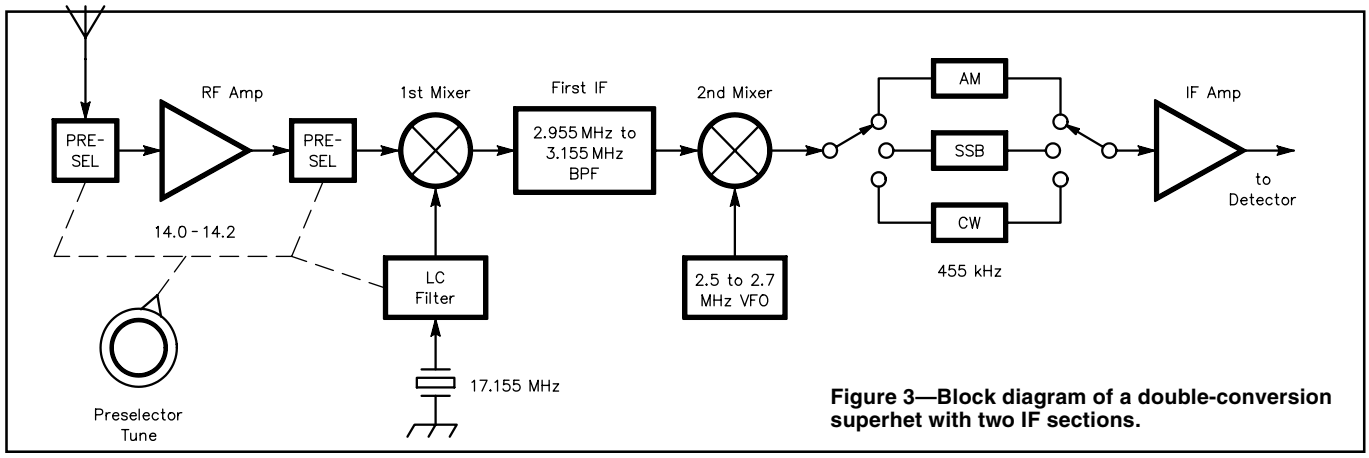


Figure 3—Block diagram of a double-conversion superhet with two IF sections.

you are forced to "tack" solder the wire on, and when you are done, "pot" the connector with silicon rubber or another sealing compound to insulate the wires and pins from each other.

Q When I was working as a broadcast engineer I once had the misfortune to touch a high voltage terminal in a transmitter power supply. Thank goodness I wasn't killed outright, but the shock threw me across the room, seriously injuring my back when I slammed against the wall. To this day, I've wondered how the electricity was able to propel me through the air in such a fashion. Do you have the answer?

A Prepare yourself for another shock: the electricity didn't propel you anywhere—your own muscles did!

When a large electrical current runs through your body, your muscles are stimulated to contract powerfully—often much harder than they can be made to contract voluntarily. Normally the body sets limits on the proportion of muscle fibers that can voluntarily contract at once. Extreme stress can cause the body to raise these limits, allowing greater exertion at the cost of possible injury. This is the basis of the "hysterical strength" effect that allows mothers to lift cars if their child is trapped underneath, or allows psychotics the strength to overcome several nursing attendants.

When an electric current stimulates muscles, these built-in limits don't apply, so the contractions can be violent. The electric current typically flows into one arm, through the abdomen, and out of one or both legs, which can cause most of the muscles in the body to contract at once. The results are unpredictable, but given the strength of the leg and back muscles can often send the victims flying across the room with no voluntary action on their part. Combined with the unexpected shock of an electrocution this feels as if you are flung, rather than flinging yourself.

A common side effect of being thrown across the room by an electric shock, apart from bruising and other injuries, is muscle sprain caused by the extreme muscle contractions. This can also damage joint and connective tissue.

Q I'm studying to upgrade my license and I am having difficulty with some of the terminology that keeps popping up. In particular, the abbreviation "IF." Can you help?

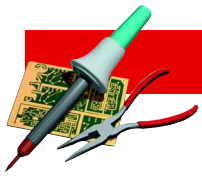
A In a *superheterodyne* receiver, the radio frequency (RF) signal picked up at the antenna must be converted to a lower frequency prior to demodulation. This conversion takes place in the mixer stage of the receiver when the RF signal is mixed with another signal generated by the local oscillator (LO). This mixing process produces sum and difference signal frequencies. The difference frequency is amplified and becomes the Intermediate Frequency, or IF (see Figure 2). The IF is usually high enough to still be considered RF, but it may be substantially lower than the signal at the antenna. For example, FM receivers commonly convert to an IF of 10.7 MHz. AM broadcast receivers often use an IF of 455 kHz. The exceptions are so-called "up conversion" receivers that use IFs that are *higher* than the highest received signal frequency. To complicate matters further, superhet designs may also include more than one mixer/IF section (Figure 3).

It's interesting to note that in a *direct conversion* receiver the RF conversion takes place in one huge step—mixing the signal from the antenna with a local oscillator signal at nearly the same frequency. This puts the difference frequency in the audio range for immediate demodulation.

The Doctor is Now On-line!

If you are an ARRL member you can now access the new Doctor is In Forum on our Members Only Web site at www.arrl.org/members-only/qst/doctor/. This is your forum to exchange information, comment on the Doctor's answers and more!

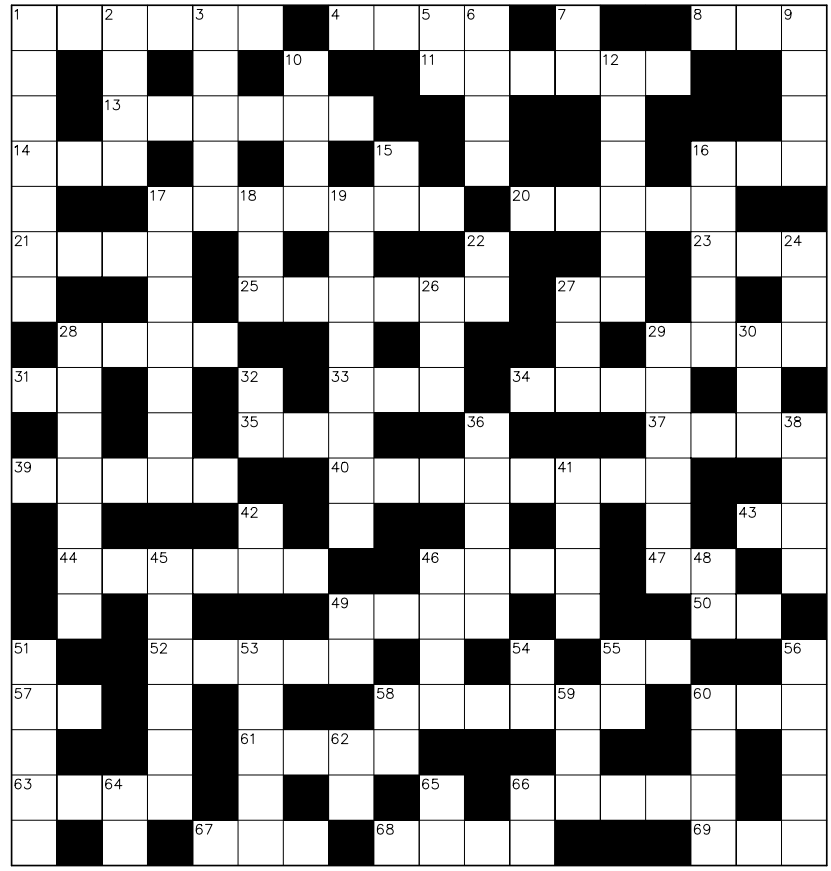
Do you have a question or a problem? Ask the doctor! Send your questions (no telephone calls, please) to: "The Doctor," ARRL, 225 Main St, Newington, CT 06111; doctor@arrl.org; http://www.arrl.org/tis/.



By H. Ward Silver, N0AX

Test Your Knowledge!

This puzzle focuses on what makes ham radio so much fun. A sense of humor will be a definite asset. Lights! Pencils! Action!

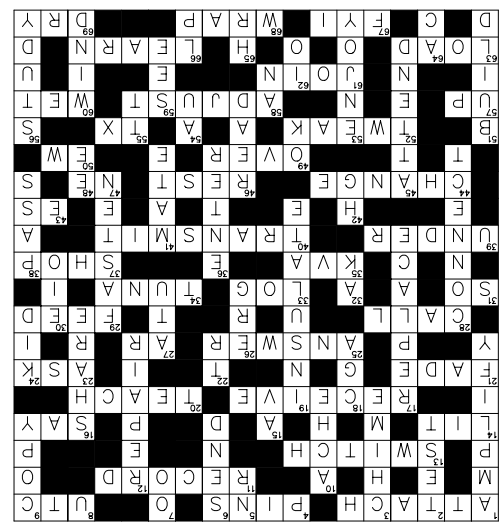


Across

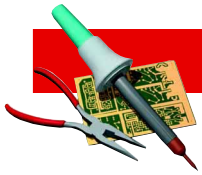
1. Mechanically connect
4. Field Day award
8. Universal Coordinated Time (abbreviation)
11. Save audio for replay
13. Change from one to another
14. A filament is…
16. Speak
17. Listen to a signal
20. Educate
21. Become slowly weaker
23. Pose a question
25. Response to a question
27. End of message (CW abbreviation)
28. Attempt to contact
29. Supply power to
31. Arrange, make just…
33. Record of contacts
34. QRP transmitter: _____ Tin
35. Power (abbreviation)
37. Look for the best price
39. Opposite of over
40. Send a signal
43. And (CW abbreviation)
44. Make different
46. Take a break
47. Northeast (abbreviation)
49. Opposite of under
50. East-West (abbreviation)
52. Small adjustment
55. Transmit (abbreviation)
57. Signals go _____ to the ionosphere
58. Change a setting
60. Best conditions for antenna work
61. Associate with a club
63. Add power
66. A teacher helps you _____
67. For your information (abbreviation)
68. Cover
69. Remove water

Down

1. Make louder
2. Determine quality
3. Clocks do this on the hour
5. No response (abbreviation)
6. Transmit a message
7. Official Observer (abbreviation)
9. Receive a message
10. Dull soreness
12. Fix
15. Audio-Visual (abbreviation)
16. Make available to a friend
17. Substitute a new unit
18. PC video mode (abbreviation)
19. Prevent electric current from flowing
22. Transmit/Receive (abbreviation)
24. Joke
26. Tiny unit of energy
27. Automatic Tuning Unit (abbreviation)
28. Join together
29. Make secure
30. E-I-_-_-_
32. Alaska (abbreviation)
36. Go into
38. Succeed at a test
41. Join matching connectors
42. Mercury (chemical symbol)
45. Go to a club meeting
46. Understand written text
48. Electric Engineers (abbreviation)
49. Everything is A-__
51. Construct
53. Be entertained
54. Gold (chemical symbol)
55. Indefinite article
56. Observe in order to learn
58. An indefinite article
59. Observe visually
60. Coil on a spool
62. Input-Output (abbreviation)
64. Alternating current (abbreviation)
65. Unit of time (CW abbreviation)
66. Low power (abbreviation)



22916 107th Ave SW
Vashon, WA 98070



By Steve Cerwin, WA5FRF

Field Day Glory by Design

A little craziness is par for the Field Day course, but if you think that you can't make a Field Day splash without lots of money and an extraordinary effort, think again. The story of these Texas boaters should get your wheels turning. What will you do for Field Day 2001?

My quest for the ultimate Field Day experience started with a bit of inspiration and a phone call to my friend Charles Thomas, WA3PAY. I suggested that we should really go all out for Field Day this year and do something unusual and interesting.

He reminded me that, although Field Day is a friendly contest-like emergency-preparedness exercise, nobody really *wins* Field day (as they might win a contest). The underlying secret of Field Day, however, is that everybody "wins" Field Day by virtue of simply participating. As you'll read soon enough, we'd strive and scheme to "win" our Field Day class for the novelty and the bragging rights, but at the end of the day we'd judge our Field Day success on entirely different values. Anyway, back to the story!

The Plan Takes Shape

During the previous summer I had a lot of fun operating marine mobile from my 24-foot pontoon boat (the USS *Ham Shack*) and thought it would be fun to operate Field Day "/mm" from the boat. I had done some research on Field Day statistics published in *QST* over the last 10 years and had formulated a plan for a Field Day effort that was definitely out of the ordinary. So, I pressed on with Charles:

"In the last 10 years, 55 to 70 people compete in Class 1C each year, about four enter Class 2C each year, and in 10 years there has been exactly one entrant in Class 3C. If we work 2C, we only have to compete against four other people, and if we go 3C we may only have to make one contact to "win" the category!"

Charles began to warm up to the idea.

"You mean if we enter the right class we could actually take the category by merely eliminating the competition?" he stammered.

"That's the general idea," I said, "but there's a bit more to it than that. We will want to make a credible effort at making lots of contacts, and there are going to be some technical problems to solve."

He was still hesitant, but once I reminded him that dinner would consist of grilled steaks, that mosquitoes don't fly over large expanses of water and that we could simply jump in the lake when we got too hot, he was sold. Compared to previous Field Days in the hot Texas sun, this sounded pretty good.

I spent the next few months tackling the technical issues, which mostly involved setting up several efficient and interference-free HF stations on an 8×24-foot floating platform.

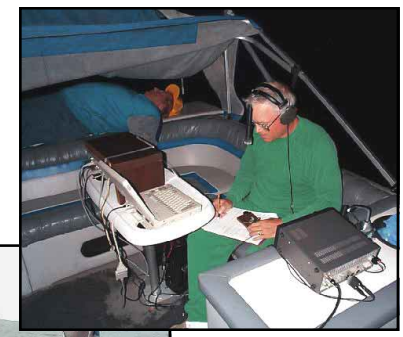
Operating QRP (5 W) eliminated the interference problem and helped to make sure the batteries would go the distance. It also offered a significant scoring advantage. But QRP also required better than average antennas if we wanted to work stations other than our own!

My multiband whip, mounted on the back corner of the boat, had proven itself the previous summer with many 20-meter QSOs, but Charles was the established Field Day King of 20-meter CW, and I wanted to give him a better antenna.

The boat had two metal sockets near the bow designed to accept boat seats. I mounted a plastic insulator under the top of the socket plate and a splash shield on the bottom. I also installed a waterproof coaxial cable attachment and made a good ground connection to the big aluminum pontoons.

Voila! I had a perfect mount for a full size, no-compromise, 20-meter vertical. The freestanding16.5-foot radiator was made from telescoping sections of 10-foot EMT conduit procured from the local hardware store. Field tests of this antenna prior to Field Day showed that the "aqua conduit special" loaded and transmitted in an exemplary fashion.

For 40 meters, the multiband resonating coil on my existing 9-foot mobile whip (on the back of the boat) was replaced with one I had wound previously for high-performance mobile work. It consisted of 40 turns of $^1/_8$-inch diameter copper capillary tubing (the kind used to hook up ice makers in refrigerators) wound on a 2.5-inch diameter, 8-inch-long fiberglass tube. The end pieces from an old commercial mobile whip were used to complete the assembly. The resulting cen-



The combination flashlight/headset sheds light on night CW operation for skipper Steve, WA5FRF, while Charles, WA3PAY, works *snoozebounce*.

Kathy, KB5KYY, works SSB while Steve, WA5FRF, handles CW and RTTY.

ter-loaded whip had extremely low loss (as evidenced by the narrow VSWR bandwidth) and produced excellent on-the-air signal reports during testing. This antenna was easily shifted from the phone to CW subbands simply by clipping a small capacitance hat onto the whip just above the coil.

Antenna models evaluated with *EZNEC* showed that horizontal antennas were a better choice than verticals for fresh water operation because of ground conductivity losses. Although size constraints dictated verticals for 20 and 40, there was room along the side of the boat for a full-size trap dipole cut for 10 and 15 meters. The dipole was made using the coaxial cable traps described in the *ARRL Antenna Book* and was set up as an inverted-**V** with the apex 17 feet above the water. *EZNEC* predicted considerable gain because of the water effects, which was confirmed in performance testing.

I had been concerned all along that we might be subject to significant interference because of the close proximity of the antennas. *EZNEC* verified that there could be as little as 17 dB of isolation on some frequencies. The fix was to build and install high-pass, low-pass, and band-pass filters inline with the antennas. The filter tables in the *ARRL Handbook* were used to help design the filters, which I then built into individual aluminum enclosures. The filters, as tested in the lab, provided at least 45 dB of additional adjacent band rejection.

At one point, while I was designing the antennas and filters, I explained my Field Day plans to my friend and associate Dave Moore, N7RF. Dave thought the Field Day quest was a just and enjoyable cause and asked if he could participate. He said that he had been experimenting with high-Q loops and would like to build one for 80 meters to add to our collection of floating antennas. Thoughts of an unprecedented Class 4C operation began to weave their way through my imagination!

Dave's antenna consisted of a two-turn spiral of $^1/_2$-inch copper tubing, wound in a 3-foot-diameter loop and resonated with a transmitting-type variable capacitor. It was matched to 50 Ω by link-coupling to a smaller loop positioned inside the big one. He mounted the antenna on a 6-foot section of PVC pipe, which plugged into the other seat socket on the front of the boat. The loop had an estimated Q of well over 1000, giving it just enough bandwidth to pass a single SSB signal on 80 meters!

On the Water and on the Air

After months of preparation, Field Day finally arrived. Dave and Charles came to my house early as we started packing. My wife Kathy, KB5KYY, and Charles' wife Teri, KC5BJI, rounded out the crew. Our rigs included an ICOM IC-720, an IC-725, a Kenwood TS-50 and a TS-450, each with its low-power setting adjusted for 5-W output. I also packed my laptop and DSP-2232 TNC to work RTTY.

We assembled and erected our impressive antenna array after launching at a boat dock on Medina Lake, about 30 miles northwest of San Antonio, Texas. As we were preparing to get underway, an avid fisherman was leaving the dock with the back of his bass boat literally lined with fishing poles. Completely awed by the sight of our unusual rig, all he could muster as he left the dock was a humbled "Wow. Good luck, man." I should have told him that after we seined a few pounds of shrimp we were going after the tarpon!

At "H hour" the bands came alive. We soon learned that QRP ops can't work every station they hear, and that some exchange info had to be repeated. Despite our power deficit, hunting and pouncing on stronger stations began yielding consistent QSOs.

Twenty-meter CW was hot, with 40 and 10/15 following suit shortly thereafter. Eighty meters took a while to perk up. Our first QSO there took place at 5 PM local. Dave initially had some difficulty tuning the loop to frequency. During development he used backround noise to peak up the loop at a specific frequency. The lake environment was so quiet, however, he had to find a station on the air before he could start tuning!

From early evening well into the night we enjoyed true Class 4C operation, with all four operating positions logging QSOs simultaneously. Thanks to the filters and the super high Q of the 80-meter loop, interference was minimal.

The guys pretty much worked CW while the gals handled SSB duties. I would switch to digital when the CW subbands began to get stale. It turned out that going 4C was the right move to put us in a class by ourselves, as I ended up working a 3C station!

My wife, Kathy, has never been an HF aficionado, but once she got the hang of the exchange there was no getting the mike away from her. The high point of the afternoon came when Kathy and Teri worked Hawaii—Kathy on 15 and Teri on 20. Working Hawaii with 5 W from a boat in the middle of a lake is an experience they're still bragging about.

Midnight came and Kathy's light began to fade. A recent chemotherapy survivor, her stamina isn't yet what it used to be. She reminded me that the name of the contest was Field *Day*, and that the sun had gone down hours ago. We dropped her off at the dock so she could head for home and hit the hay.

During breakfast, a station was heard on 40-meter phone frantically beseeching his contact, "What's your report, what's your report?" I quipped to Teri, "Well, my neck is sunburned, so are my ears, and I didn't get much sleep last night. What's your report?"

Before we resumed operating we needed to run the engine for a while to recharge the boat battery, so I took us to the far side of the lake while Charles, Teri and Dave flogged the ether. The trip was IFR all the way thanks to guidance from a course previously laid into the Garmin GPS.

After we arrived at the mouth of a large cove, I set the anchor and we settled in for the night shift. As the sky began to lighten just before dawn, Teri fired up a Coleman stove and treated us to some delicious sausage and egg tacos. During breakfast, a station was heard on 40-meter phone frantically beseeching his contact, "What's your report, what's your report?" I quipped to Teri, "Well, my neck is sunburned, so are my ears, and I didn't get much sleep last night. What's your report?" She almost fell off the boat.

At that we called it a contest and enjoyed a relaxing boat ride home on a glass-smooth lake backed by a truly majestic sunrise. While driving home from the lake, Charles and I were chatting on 2 meters. After signing "WA5FRF, four charlie, south Texas" all day, he passed along his final 73 with, "This is WA3PAY, one tired, south Texan."

This was clearly the most fun I've ever had during Field Day. It turned out to be more of a technical challenge than anything else, which is probably why it was so enjoyable. We fired up the grill when we got hungry, jumped in the lake when we got hot, and ended up with more than 300 contacts. And who knows, we may have even won our class or made a new one for the record books. I can't wait to see what next year brings! My only hope is that some other group doesn't operate Class 20C from the deck of a Mississippi River barge…

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San Antonio, TX 78251
scerwin@swri.org

MMTTY 1.58

Amateur Radio software has been evolving at an astonishing rate. Almost every month we see a new program of one kind or another. What is even more astonishing is that some of the best software is *free*.

MMTTY is an excellent example of high-performance freeware. Like much of the amateur HF digital communication software available today, *MMTTY* utilizes the ubiquitous sound card as its interface to the outside world.

MMTTY Does RTTY

MMTTY is software for radio teletype, better known in ham circles as RTTY. It is *Windows* software, designed and coded by Makoto Mori, JE3HHT, hence the "MM" of *MMTTY*. According to Makoto, *MMTTY* will run on sound-card equipped PCs as slow as 486-100s and under several flavors of *Windows* including *95*, *98*, *NT* and *ME*. In my tests, I was able to run *MMTTY* successfully on a 133-MHz Pentium, but to get it to function on a 486-100 I had to shut down several display functions, and even then it was very slow. My personal recommendation would be to run *MMTTY* on a 133-MHz Pentium or faster for best performance.

You'll be on the air with *MMTTY* very quickly if you have the necessary audio cables and transmit/receive switching (either homebrew or via a West Mountain RIGBlaster unit) to connect your computer to your transceiver. If you're in doubt about how to hook it all up, consult *MMTTY's* English-language help files (translated by KB2EOQ).

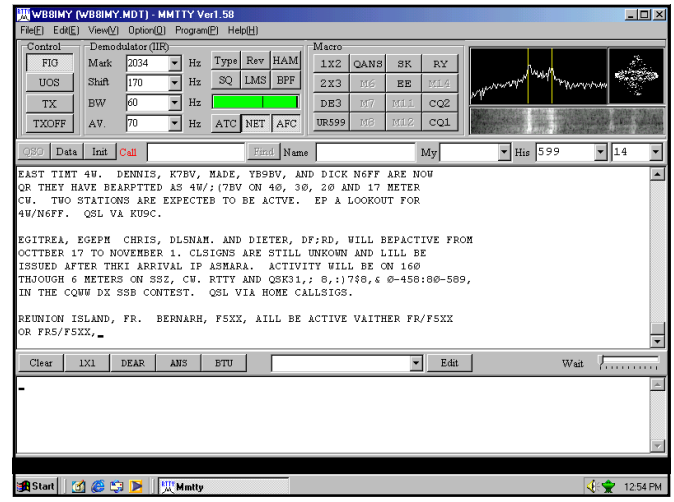
You can route the transmit audio to your transceiver's microphone or accessory input and run AFSK RTTY, or build a simple dual-transistor switching interface and run FSK if your radio supports that function. *MMTTY* allows you to select the mode and COM port of your choice. If you are already set up to run PSK31, MFSK16, SSTV or other sound-card based modes, *MMTTY* will put you on RTTY for no additional investment whatsoever—you simply install the software.

Although designed primarily for casual conversation, *MMTTY* offers a number of enhancements that even "serious" RTTY operators will appreciate. Most functions are selectable directly on the "front panel" through a collection of buttons. You can select from several demodulation settings, depending on conditions. You can program up to 64 macros (does anyone really need 64 macros?). *MMTTY* includes a handy logging function and the ability to choose three different signal displays: waveform, waterfall or traditional "crossed bananas." You can even opt to have all three running simultaneously. Finally, *MMTTY* includes a function that allows you to record the receive audio for later playback.

MMTTY on the Air

In my tests with *MMTTY*, I compared the software to an external multimode processor and several sound-card-based programs. I used MMTTY primarily on my shack computer, a 333-MHz Pentium II running *Windows ME*.

Going up against the external processor, *MMTTY* performed as well or, in some cases, better. With its DSP algorithms,



MMTTY was able to dig deeply into the noise and copy RTTY signals that the processor rendered as gibberish. When it came to signals with moderate strength, *MMTTY* was on par with the processor. *MMTTY's* signal displays seemed much easier to use and interpret than the processor's bouncing LEDs. In fairness, however, the external processor's strength is in its ability to be used with virtually any computer—even ancient Commodores and Tandy Color Computers. (In theory, you don't even need a computer to use a hardware processor; a dumb terminal will do just as well.)

Going up against its sound-card-based brethren, *MMTTY* performed as well or better than anything I threw at it. The one exception was *RITTY* by Brian Beezley, K6STI (see my review in the November 2000 *QST*). *RITTY* seemed to be superior at handing polar flutter and interference.

I found that *MMTTY* was quite easy to use, and having the macro buttons on the main window was convenient. My tendency was to run all three tuning displays at once. I often found myself gazing at the crossed-bananas display for accurate tuning. Actually, the waterfall display was also attractive from an operator's point of view, although it took some practice to get used to it. (I've been spoiled by *DigiPan's* PSK31 panoramic waterfall.)

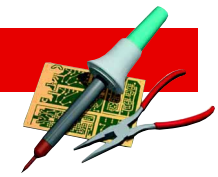
Conclusion

The disadvantage of freeware is that support is often spotty at best—and for good reason. The author has already given away hundreds of hours of development time for nothing, so it is unreasonable to expect "customer support" as well. As with all freeware, you download and take your chances. Still, you'll find a fair amount of *MMTTY* documentation, hints and tips on line. This is mostly information provided by the author, or collected from the comments of *MMTTY* users.

Makoto Mori should be commended for producing such a capable piece of software *pro bono* for the amateur community. When you download and use *MMTTY*, you'll be as astonished as I was that such a versatile program would be simply given away to anyone who wants it. You can try *MMTTY* yourself by downloading it from the English-language Web site at **www.geocities.com/mmtty_rtty/**.

Next Short Take

Steve Ford, WB8IMY ♦ *QST* Managing Editor



The ARRL Incoming QSL Bureau System

Within the US and Canada, the ARRL DX QSL Bureau System is made up of numerous call area bureaus that act as central clearing houses for QSLs arriving from foreign countries. These "incoming" bureaus are staffed by volunteers. The service is currently free and ARRL membership is not required, although operating costs are funded from ARRL membership dues. That's why we welcome your support as an ARRL Member.

How it Works

Most countries have "outgoing" QSL bureaus that operate in much the same manner as the ARRL Outgoing QSL Service. The member sends his cards to his outgoing bureau where they are packaged and shipped to the appropriate countries.

A majority of the DX QSLs are shipped directly to the individual incoming bureaus where volunteers sort the incoming QSLs by the first letter of the call sign suffix. One individual may be assigned the responsibility of handling from one or more letters of the alphabet. All Incoming QSL Bureaus have e-mail addresses. Some bureaus have active Web pages. Please send an e-mail to **buro@arrl.org** for the e-mail address or URL of your Bureau.

Claiming your QSLs

Send a $5 \times 7^1/_2$ or 6×9-inch self-addressed, stamped envelope (SASE) or money credit where applicable to the bureau serving your call sign district. Neatly print your callsign in the upper left corner of the envelope. Place your mailing address on the front of the envelope. A suggested way to send envelopes is to affix a first class stamp and clip extra postage to the envelope. Then, if you receive more than 1 oz of cards, they can be sent in the single package.

Some incoming bureaus sell envelopes or postage credits in addition to the normal SASE handling. They provide the proper envelope and postage upon the prepayment of a certain fee. The exact arrangements can be obtained by sending your inquiry with a SASE to your area bureau. A list of these bureaus appears below.

Helpful Hints

Good cooperation between the DXer and the bureau is important to ensure a smooth flow of cards. Remember that the people who work in the area bureaus are volunteers. They are providing you with a valuable service. With that thought in mind, please pay close attention to the following DOs and DON'Ts:

DOs

- DO keep self-addressed $5 \times 7^1/_2$ or 6×9-inch envelopes or money credits on file at your bureau, with your call in the upper left corner, and affix at least one unit of first-class postage.
- DO send the bureau enough postage to cover SASEs on file and enough to take care of possible postage rate increases.
- DO respond quickly to any bureau request for SASEs, stamps or money. Unclaimed card backlogs are the bureaus' biggest problem.
- DO notify the bureau of your new call as you upgrade. Please send SASEs with your new call, in addition to SASEs with your old call.
- DO include a SASE with any information request to the bureau.
- DO notify the bureau in writing if you don't want your cards.
- DO notify your bureau of a change in address.

DON'Ts

- DON'T send domestic US-to-US cards to the various call-area bureaus.
- DON'T expect DX cards to arrive for several months after the QSO. Overseas delivery is very slow. Many cards coming from overseas bureaus are over a year old.
- DON'T send your outgoing DX cards to your call-area bureau.
- DON'T send SASEs to your "portable" bureau. For example, WB8IMY/1 sends SASEs to the W8 bureau, not the W1 bureau.
- DON'T send SASEs or money credits to the ARRL Outgoing QSL Service.
- Don't send SASEs larger than 6×9 inches. SASEs larger than this require additional postage surcharges.

ARRL INCOMING DX QSL BUREAU ADDRESSES

First Call Area: All calls[1,3]
W1 QSL Bureau
YCCC
PO Box 80216
Springfield, MA 01138-0216

Second Call Area: All calls[1,3]
ARRL 2nd Dist QSL Bureau
NJDXA
PO Box 599
Morris Plains, NJ 07950

Third Call Area: All calls
Pennsylvania DX Association
PO Box 100
York Haven, PA 17370-0100

Fourth Call Area: All single-letter prefixes (K4, N4, W4)
Mecklenburg ARC
PO Box DX
Charlotte, NC 28220

Fourth Call Area: All two-letter prefixes (AA4, KB4, NC4, WD4, etc)
Sterling Park ARC
Call Box 599
Sterling, VA 20167

Fifth Call Area: All calls[1]
W5 Incoming QSL Bureau
Magnolia DX Assn
PO Box 999
Wiggins, MS 39577-0999

Sixth Call Area: All calls[1,2]
ARRL Sixth (6th) District DX QSL Bureau
PO Box 900069
San Diego, CA, 92190-0069

Seventh Call Area: All calls[1]
Willamette Valley DXC Inc
PO Box 555
Portland, OR 97207

Eighth Call Area: All calls
8th Area QSL Bureau
PO Box 182165
Columbus, OH 43218-2165

Ninth Call Area: All calls[1]
Northern Illinois DX Assn
W9 Incoming QSL Bureau
PO Box 273
Glenview, IL, 60025-0273

Tenth Call Area: All calls[1]
0 QSL Bureau
PO Box 4798
Overland Park, KS 66204

Puerto Rico: All calls[1]
Puerto Rico QSL Bureau
PO Box 9021061
San Juan, PR 00902-1061

US Virgin Islands: All calls
Virgin Islands ARC
GPO Box 11360
Charlotte, Amalie
Virgin Islands 00801

Hawaiian Islands: All calls[1]
Wayne Jones, NH6GJ
PO Box 860778
Wahiawa, HI 96786

Alaska: All calls[1]
Alaska QSL Bureau
PO Box 520343
Big Lake, AK 99652

SWL:
Mike Witkowski, WDX9JFT
4206 Nebel St
Stevens Point, WI 54481

QSL Cards for Canada may be sent to:
RAC Incoming QSL Bureau
Box 51
St John, NB E2L 3X1

QSL cards for Canada may also be sent to the individual bureaus:

VE1, VE0,[1]
Brit Fader Memorial QSL Bureau
Box 8895
Halifax, NS B3K 5M5

VE2
Jacques Dube, VE2QK
875 St Severe St
Trois-Rivieres, QC G9A 4G4

VE3
The Ontario Trilliums
Box 157
Downsview, ON M3M 3A3

VE4
Adam Romanchuk, VE4SN
26 Morrison St
Winnipeg, MB R2V 3B4

VE5[1]
Bjarne Madsen, VE5FX
739 Washington Dr
Weyburn, SK S4H 2S4

VE6[1]
Neil Jensen, VE6NRJ
EPO Box 57205
Sherwood Park, AB T8A 5L7

VE7[1]
Dennis Livesey, VE7DK
8309 112th St
Delta, BC V4C 4W7

VE8[1]
Rolf Ziemann, VE8RZ
2 Taylor Rd
Yellowknife, NWT X1A 2K9

VE9, VY2
VE9, VY2 QSL Bureau
Box 12-255
1633 Mountain Rd
Moncton, NB E1G 1A5

VO1, VO2
Rick Burke, VO1SA
Box 23099
St John's, NF A1B 4J9

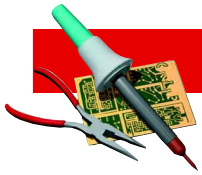
VY1
Hugh Henderson, VY1HH
PO 33062
Whitehorse, YT Y1A 5Y5

Notes

[1]These bureaus sell envelopes or postage credits. Send an SASE to the bureau for further information.

[2]These bureaus can only accept specific sized envelopes. Send an SASE to the bureau for further information.

[3]These bureaus will not accept SASEs. Send money credits only.



By Phil Salas, AD5X

A Simple HF-Portable Antenna

Tired of dragging that bulky old antenna tuner along on your vacation jaunts? Spare your suitcase and your pocketbook because this simple multiband wire antenna will get you on the air in a jiffy—with no extra gear required.

Every summer my wife (N5UPT), my daughter (AC5NF) and I spend about a week on Mustang Island off the coast of Corpus Christi, Texas. I always enjoy operating HF-portable when on vacation, and because Mustang Island is also known as IOTA NA092 (Islands On The Air, North American island number 92), getting on the air is even more fun! In case you're imagining typical DXpedition fare, you should know right from the start that we don't exactly rough it on Mustang Island. In fact, we always stay in a condo, which I request to be "the highest one available."

My first portable rig was a Kenwood TS-50, followed by an MFJ-9420 (see May 1999 *QST*). Last year I went deluxe and upgraded to an ICOM IC-706MKII. That little rig works dc to light—all bands and all modes, with goodies to boot. It it is an excellent choice for almost any type of portable operation.

I've experimented with several types of antennas on these outings—including Hamstick mobile whips, resonant dipoles and random-length wire dipoles fed through a tuner. I prefer resonant antennas so I don't have to worry about transporting and storing an antenna tuner. Of course, multiple dipoles or a handful of Hamsticks can take up a lot of room.

Last summer I used the multiband dipole described here with excellent results. If you're interested in a simple multiband wire that's easy to build and pack away, give this antenna a try.

The basic antenna covers all bands from 20-10 meters. You could increase its coverage, but the dimensions of a typical condo balcony seem to limit the lower frequency to 20 meters or so. If your operating site is larger, feel free to scale the antenna appropriately.

Basically, the antenna started as a full-size 20-meter dipole. I then inserted small in-line insulators to allow for multiband operation as shown in Figure 1.

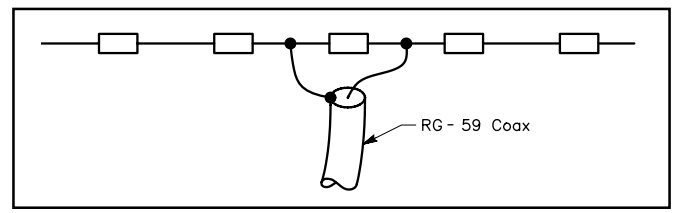


Figure 1—The concept began with a full-size dipole antenna that I "broke up" with small insulators.

The insulators are $^{3}/_{8}$-inch (diameter) by one-inch nylon spacers that can be found at most hardware stores. Each spacer is used as a "band switch" by drilling a small hole in each end and threading a short length of #14 bare wire (house wire) through each end, and attaching a short piece of wire terminated in an alligator clip. The clip, shown in Figure 2, is available at RadioShack stores (ask for part number 270-380).

I used #24 insulated wire for the dipole elements because it's lightweight and flexible. Obviously, any type of wire is fine. Use whatever you have on hand. The best way to determine the various segment lengths is to calculate the individual dipole lengths using:

L (feet) = 468/freq (MHz)

Tack solder the wire sections to the insulators, attach a feed line (RG-59 coax will do) and hang the dipole in a convenient place where it's easy to work on and adjust. Although the SWR meter method will work, to adjust the multiband dipole prop-

The entire antenna can be collapsed to a size that fits in the palm of your hand!

Figure 2— The band switches are constructed from nylon spacers, some wire and an alligator clip.

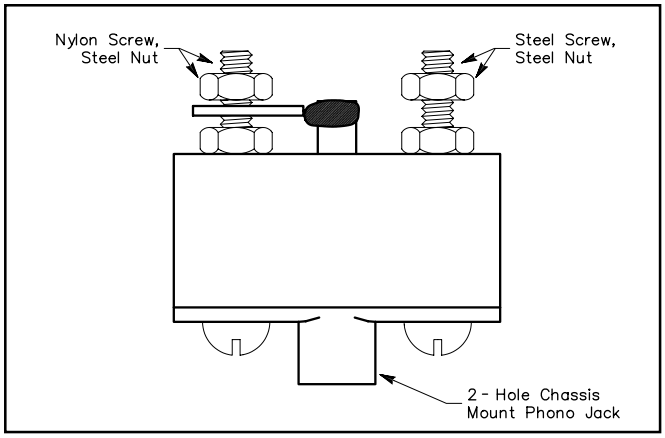
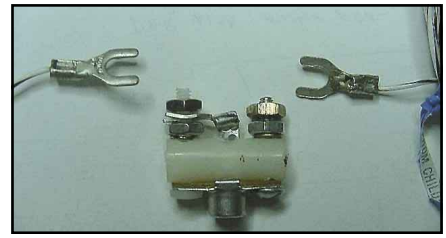
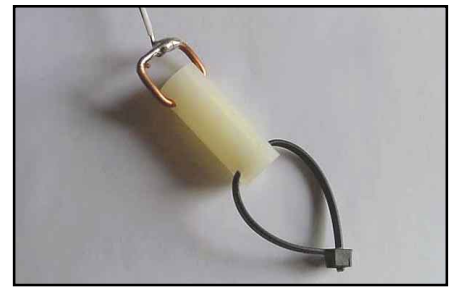


Figure 3—I used an extra nylon spacer for the center insulator. I drilled the ends and attached a chassis-mount phono jack as shown. The nylon screw is used on one side to make sure that the phono jack's center conductor doesn't short to ground. I soldered #4 spade lugs to the inside ends of the 10-meter dipole elements so the dipole can be easily attached (and detached) to the center insulator. Feel free to use other center insulator designs as desired.



A photograph of my version of the center insulator.



My design for the end insulator.

erly, beg, borrow or buy an antenna analyzer.

First, "unclip" all of the alligator clips and adjust the inner wire segments for the lowest SWR on your favorite part of the 10-meter band. The wires should be a bit long, so unsolder them on one end and trim them as follows:

New length = Original length × Measured low-SWR Frequency/Desired low-SWR frequency

Next, clip (attach) the inner pair of alligator clips and adjust the next segment for resonance on 12 meters using the formula and steps described previously. Continue this procedure for 15, 17 and 20 meters.

I know—you're adjusting your antenna low to the ground and your particular portable mounting location will undoubtedly vary. For our purposes it really doesn't matter. Most modern rigs can put out full power into a 2:1 SWR, so reasonable location-based SWR variations probably won't affect your rig's operation. If the SWR is really high, something's drastically wrong or you have the alligator clips set up for operation on the wrong band, etc. Incidentally, you can use a balun if you want to. I normally don't worry about feed line transformers when operating portable.

The antenna leg lengths I wound up with are shown below:

10 meters: 8 feet 3 inches on each side

12-10 meters: 10 inches on each side

15-12 meters: 1 foot 4 inches on each side

17-15 meters: 1 foot 8 inches on each side

20-17 meters: 3 feet 9 inches on each side

Each side is a total of 15 feet, 10 inches, for a total of 31 feet, 8 inches for the entire antenna.

Finally, if you want to electrically "shorten" your antenna, make the clip lead wires a little longer and wrap the excess wire around the insulators to make loading coils.

I used an extra nylon spacer for the center insulator. I drilled the ends and attached a chassis-mount phono jack as shown in Figure 3. The nylon screw is used on one side to make sure that the phono jack's center conductor doesn't short to ground. I soldered #4 spade lugs to the inside ends of the 10-meter dipole elements so the dipole can be easily attached (and detached) to the center insulator. Feel free to use other center insulator designs as desired.

Conclusion

If you need a simple portable antenna, spend an hour or two assembling this one. It's simple, cheap and a good performer. Simply adjust the clip leads for the desired frequency band and you're on the air—no tuner required! Sure, you have to make a quick trip to the balcony (or whatever) to change bands…but this is a vacation-oriented design, after all!

1517 Creekside Dr
Richardson, TX 75081
ad5x@arrl.net

NEW PRODUCTS

TRANSMIT AUDIO IMPROVEMENTS FOR THE FT-1500M

◊ Yaesu Musen Co Ltd, responding to user feedback and recommendations, has performed a minor change to their FT-1500M 2-meter FM mobile transceiver.

The change provides a wider frequency response, and greater fidelity, during contacts with local stations.

Early transmit audio reports placed the FT-1500M's transmit sound quality "squarely in the 'communications grade' category." The sound was not "objectionable;" however, many US amateurs seem to prefer a fuller range of audio frequencies. Notes Chip Margelli, K7JA, Yaesu USA's Manager of Engineering and Research and Development, "We have been able to broaden the frequency response of the FT-1500M, making one's voice much more natural-sounding, without sacrificing its crisp, clear high-frequency response. We feel that this minor change will increase the appeal of this high-performance transceiver to even more users."

Yaesu USA advises that all transceivers shipped to dealers since mid-2000 already have the update incorporated. Customers wishing to have the transmit audio response of an earlier version revised are encouraged to contact Yaesu's Technical Support Department. Their direct e-mail address is **amateurtech@yaesuusa.com**. Yaesu USA, 17210 Edwards Rd, Cerritos, CA 90703; tel 562-404-2700; fax 562-404-1210; **www.yaesu.com**.

Next New Product

W2IHY Technologies 8-Band Audio Equalizer and Noise Gate

Do other operators say you have "wimpy audio?" Do they taunt you on the air? ("Hey, weasel mouth! Speak up!") Are you tired of having sand kicked in your face by muscle-bound band bullies?

Step up to the bar, son. I have a product for you!

The W2IHY Technologies audio equalizer and noise gate is an extraordinarily useful station accessory for voice operators. It works wonders with the worst microphones imaginable, and with high-quality mikes such as the Heil Goldline, the results are astonishing.

The equalizer section divides a typical voice bandwidth from 50 to 3200 Hz into 8 frequency bands. By adjusting the individual slide pots for each band, you can increase the gain of some frequencies, or reduce others. If your mike audio seems biased to the high frequencies, making your voice sound too crisp and tinny, you can reduce the high frequencies to create a more pleasing sound. At the other end of the spectrum, you can cut the low or middle ranges to clean up muddy audio. In other words, you can create a characteristic "sound" that is uniquely *you*.

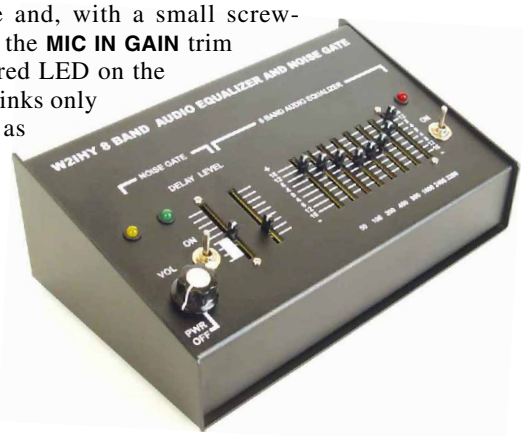
Set Up

You begin by plugging your microphone into any of the three available inputs (3-pin XLR, 8 pin or RCA jacks). A three-position rotary switch on the back panel allows you to choose ICOM, Kenwood or Yaesu configurations (you can modify the 8-pin configuration to work with other microphones by using a mike plug adapter that you can make yourself or purchase from W2IHY).

You have your choice of two output jacks (5-pin DIN) on the rear panel. A slide switch selects the one you desire. The cable of your choice (W2IHY sells cables and adapters) connects between the output and your radio. The rear panel also sports a 5-pin DIN jack for dc power (a "wall wart" power supply is included).

If you're using an electret microphone (such as an ICOM SM-6), you'll need to flip the unit over and set the **MIC IN PWR** jumper. Use a pair of needle-nose pliers, but proceed carefully. One slip and you'll drop the tiny jumper block into the unit, which will require minor screwdriver surgery to open.

With the EQ on its side, speak into your microphone in a normal voice and, with a small screwdriver, adjust the **MIC IN GAIN** trim pot until the red LED on the front panel blinks only occasionally as you speak.



One of the fun aspects of using the W2IHY equalizer for the first time involves plugging in a pair of headphones (there is a 1/4-inch jack on the rear panel) and listening to your own voice. Just crank up the **VOLUME** control and talk to yourself while you adjust the equalizer's various bands. Listen to how your audio characteristics change. As a former broadcast DJ, I couldn't resist bumping up the low bands to make my voice something akin to Darth Vader.

Noise Gate

The noise gate function of the W2IHY equalizer adds even greater quality to your transmit audio. With the noise gate activated, you gently increase the **LEVEL** slide pot without speaking until all ambient noise suddenly vanishes. When you speak, the "gate" opens, but then closes again when you stop, effectively preventing those annoying background sounds—barking dogs, amplifier fans, belligerent spouses—from filling the gaps. You can tweak another front-panel slide pot to adjust the gate delay, ranging from almost instantaneous closure to delays that are a bit more "leisurely."

On the Air

I used the W2IHY equalizer with an ICOM SM-6 desk microphone and my ICOM IC-706 transceiver. According to on-air reports, my SSB audio was outstanding. During my first few contacts, I would ask stations to give critical evaluations, and advise whether I needed to increase or decrease certain audio frequency bands. A chat with YO2LEA on 17 meters was particularly helpful. Nelu listened closely, telling me to boost my high frequencies, while increasing a couple of middle range bands as well. When our tweaking session was done, he declared that I sounded "utterly fantastic."

It is interesting to note that my antenna is very close to my operating position. Even so, I heard no RF in the audio while listening to headphones, even when transmitting at 100 W.

Conclusion

If you're a serious voice operator, the W2IHY equalizer and noise gate is a station accessory you should definitely consider. It isn't a matter of simply massaging your audio so that you "sound good." Having a clean audio response is crucial to being understood over the air—whether you're doing battle in a pileup, or passing traffic in an emergency.

The W2IHY equalizer has the versatility to work with almost any radio and microphone on the market. My only wish for future versions of this product is that they would add the ability to hear *receive* audio in the equalizer's headphone jack. With so many modern rigs having receive audio outputs at their microphone jacks, this wouldn't be an overly difficult feature to add. Then, you could hear your radio and yourself through the same set of headphones.

Manufacturer: W2IHY Technologies, 19 Vanessa Ln, Staatsburg, NY 12580; tel (toll free) 877-739-2449; **Julius@w2ihy.com**; **www.w2ihy.com**. *$229.99 (kit $189.99); microphone cable (specify radio make and model) $15.*

Steve Ford, WB8IMY ♦ Managing Editor

KEYER PTT CONTROL FOR SUPER CMOS KEYERS

◊ I like my station TR control closely linked to my CW keying. This function is present in N6TR's *TR Log* and K8CC's *NA* contest logging programs. Each accepts paddle input and keys the transceiver with variable PTT onset and delay. Nonetheless, it's awkward to have a station set up for the contest logging software PTT, but use the rig VOX (which doesn't track the sending speed) for an external keyer.

Keying-derived TR control is not a new idea with me, but I couldn't find any example of an external PTT-control circuit done well with a keyer. After some thought, I decided to add the function myself—just to see if I could do it. That's why I used junk-box discrete components rather than drive to town for Schmitt-trigger ICs.

Figure 1 shows the circuit I cooked up. It works well in my LogiKeyer K-1 (Super CMOS II). U1's oscillator turns off (enters sleep mode) 1.5 baud after the last character is sent, and its dc level changes at that time. The oscillator starts about 8 ms before the keying output becomes active, so it's a good event to use for PTT control. It lets all the radio TR events complete before the keying starts, but you must be careful not to load the resonator too heavily.

The turnoff timing (1.5 baud) is too quick though. If I were doing this in software, I'd set the total delay to 3 or 4 bauds, so it would follow the keyer speed. Unfortunately, I didn't find any output from the CMOS II chip that was delayed more than 1.5 baud after the end of the last character. For this junk-box project, I use a fixed delay equivalent to about four bauds at the keying speeds I use. The result is a little pulse stretcher that adds 90 ms to the turnoff delay in the keying circuit. This five-minute job, as always, took 24 hours, but it works fine. The combination of 1.5 baud delay plus fixed time delay gives some tracking of code speed, although it's not as good as if nearly all the delay were in bauds.

The timing is set by a 47-kΩ resistor (to +5 V) and a 4.7-µF capacitor (to ground) at the collector of Q2. This time-constant circuit is followed by a discrete-transistor Schmitt-trigger circuit (Q3-Q6) that sharpens the switching time, so there's no chirp from a slow TR transition. The turnoff time with this circuit is still a bit fast; you can increase the delay by increasing the value of the resistor, capacitor or both.

This circuit conducts current through the input transistor of the Schmitt circuit even when it's off. Thus, it continually draws a little over 100 µA. This makes for poor battery life, but I only use a battery for backup power, so I don't worry about current drain. The whole thing can probably be done better with a low-drain Schmitt-trigger IC.

I really like the way the keyer feels with the PTT control, although it takes a bit of getting used to—sort of like an open mic. Whenever you key anything, it is sent! The PTT delay tracks keying very naturally, it's a wonder I waited so long to do this! This modification should apply to other keyers too. Bob, W9KNI, says it should work on the all Super CMOS 2, Super CMOS 3 and Logikey keyers.[1, 2]

Again, I think there's a better solution if someone has access to the code for the microcontroller. There seem to be plenty of unused I/O ports. An output with a programmable four- or five-baud delay that keys a simple NPN transistor would do this job properly. Tom Rauch, W8JI (**w8ji@contesting.com**), who is interested in the keyer/PTT area, suggests that some small additional fixed turn-off delay might be necessary for QSK PTT configurations.

My goal here is to encourage discussion of PTT control by modern keyers. For example, a series of inexpensive keyers offered by Steve Elliott, K1EL seem like a real step forward. He mentions PTT control on his Web site, but I'm not sure if it's timed to the data rate. I suggest you visit **members.aol.com/k1el/**. If there is enough interest, I'd hope the function can be included in keyer chips.—*Dave Leeson, W6NL/HC8L, 15300 Soda Springs Rd, Los Gatos, CA 95030-8621;* **leeson@earthlink.net**

FINDING SMALL PARTS

◊ Lloyd G. Hanson, W9YCB, offered some good tips on finding small parts that have fallen to the floor ("Hints and Kinks,"

[1]Idiom Press, PO Box 1025, Geyserville, CA 95441; tel 1-707-431-1286; e-mail **Sales@IdiomPress.com**; **www.idiompress.com**.

[2]J. Russell, K0CQ, and C. Southard, N0II, "The CMOS Super Keyer" *QST*, Oct 1981, p 11-17.

J. Russell, K0CQ, and C. Southard, N0II, "The CMOS Super Keyer II" *QST*, Nov 1990, p 18-21.

J. Russell, K0CQ, "The CMOS Super Keyer 3" *QST*, Aug 1995, p 26.

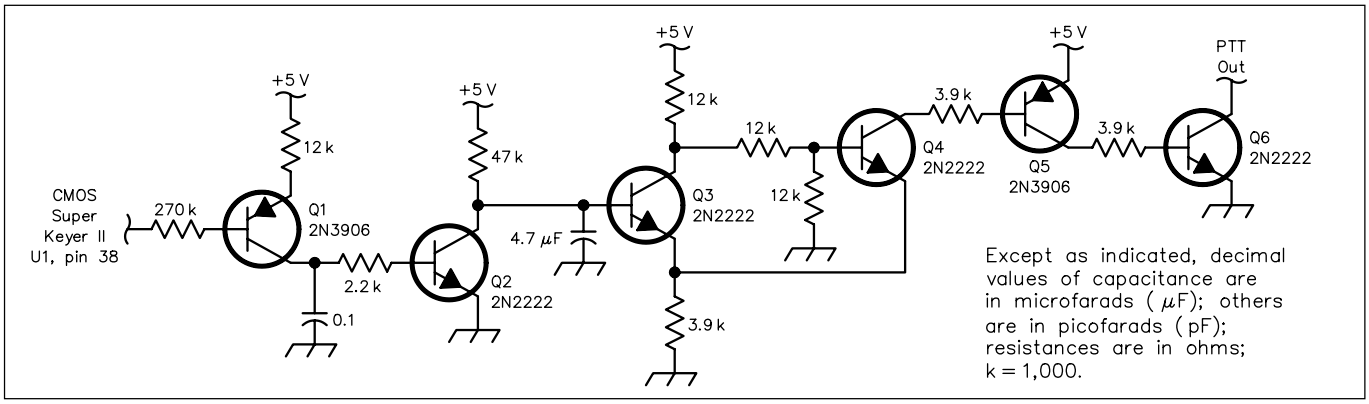


Figure 1—A schematic of W6NL's PTT-control circuit for Idiom Press Logikey and CMOS Super Keyers.

Bob Schetgen, KU7G ♦ Senior Assistant Technical Editor

Aug 1999). My own solution is not to let the parts get that far. I added a very thin drawer to the knee opening in my workbench. It's an open wooden frame only 3/4-inch thick, about 14 inches deep and the width of the knee opening. I stapled white cloth very loosely to the bottom of the frame. The cloth should sag about an inch in the center so it can't act as a trampoline. When I'm working with tiny things, I pull the drawer out over my lap to catch whatever I drop. This idea isn't original. Watchmakers and jewelers use similar drawers.—*Roy A. Raney, K0OVQ, 600 Jackson St, Denver, CO 80206*

WRIST REST CORRALS SMALL PARTS

◊ Here's a hint that I use both at work and on my home workbench. I use a simple wrist rest (the kind used to support wrists while typing at a computer keyboard) while I work at my bench. Not only does it support my wrists and forearms, but it also acts as a guard to keep small parts from falling off the bench. At work, where I repair medical equipment, I repair small devices that have tiny screws, springs and such. At home, it helps to keep surface-mount parts and other small parts from falling into the carpet. Since the rests are not attached to the bench, you can set it aside when you don't need it. Wrist rests can be purchased for a few dollars at ham-swaps and flea markets. I hope other readers find this a useful idea.—*Dan Trigilio, W6DAN, 948-A Kennedy Dr, Capitola, CA 95010-2317;* **danjt@cruzio.com**

SATURATING TOROID CORES

[This hint is part of a discussion I had with Mitchell Lee in 1997 about reports of possible balun-core saturation in RTTY applications.—*Ed.*]

◊ About saturating toroidal cores, I ran some numbers on my spreadsheet. I assumed a hypothetical coil of $4 \times 450\ \Omega = 1800\ \Omega$, or 41 µH at 7.05 MHz. A kilowatt across 450 Ω produces 671 V_{RMS}. As you can see in Table 1, the core loss is a meager 1 to 4 W, or 0.174 dB (4 W). Flux density, even for a bead, is only 150 mT.

Table 1—Calculated Core Losses

Core Number	OD (Inches)	Turns	Core Loss (mW)	Flux Density (Bpk, mT)	Temperature Rise (°C)	Series R (Ω)
T12-2	0.13	143.17	3831	149.7	2176.8	28.1
T16-2	0.16	135.51	3255	104.7	1015.4	23.8
T20-2	0.20	128.06	2784	72.8	654.1	20.4
T25-2	0.25	109.81	2887	52.8	451.1	21.2
T30-2	0.31	97.64	2577	36.6	295.3	18.9
T37-2	0.38	101.24	2768	33.1	243.9	20.3
T4-2	0.44	88.79	2547	24.4	173.3	18.7
T44-2A	0.44	106.71	2194	25.1	164.4	16.1
T50-2	0.50	91.47	2453	20.9	133.9	18.0
T60-2	0.60	79.42	2129	14.4	99.1	15.6
T68-2	0.69	84.81	2197	14.1	81.2	16.1
T68-2A	0.69	76.53	1921	11.6	66.3	14.1
T80-2	0.80	86.33	1895	10.7	54.8	13.9
T94-2	0.94	69.86	2050	8.5	43.7	15.0
T106-2	1.06	55.10	1838	5.9	30.0	13.5
T130-2	1.30	61.05	1749	5.0	22.3	12.S
T157-2	1.57	54.11	1690	3.7	15.4	12.4
T175-7	1.75	52.28	1529	3.1	11.8	11.2
T184-2	1.84	41.33	1710	2.8	11.7	12.5
T200-2	2.00	58.45	1482	2.9	10.2	10.9
T200-2B	2.00	43.36	1391	2.1	7.7	10.2
T225-2	2.25	42.68	2901	3.5	15.4	21.3
T300-2	3.04	59.97	1529	2.1	7.4	11.2
T300-2D	3.04	42.40	1245	1.3	4.2	9.1
T400-2	4.00	47.72	1348	1.3	3.5	9.9

L= 41 µH; f = 7.05 MHz; V= 671 V RMS; X_L = 1816.39 Ω; I = 0.369414 A RMS
Resonating capacitance = 12.42698 pF; 03:48:29 02-12-1997

Considering that powdered iron can take 1 T, this isn't even near saturation. Temperature rise is the real limitation. A reasonable design is a T106-2 with a rise of 30°C. I think this analysis is valid in balun mode, but I'm not so sure about the transformer mode. I don't really know how transformers work.

If people burn up toroids with RTTY, my guess is that they either had too little inductance for the job (my example follows the $X_L = 4 \times RL$ rule), or perhaps the transmission line was not presenting 450 Ω, but rather some reactive load, across which the voltage could be much higher than what a resistive load would predict. The best way to handle that situation is to use a balanced tuner, then go through the balun.—*Mitchell Lee, KB6FPW, 686 N 21st St, San Jose, CA 95112*

SCHEMATIC DRAWING SOFTWARE

◊ Readers occasionally ask me to recommend graphics software for drawing schematics. There are many answers to this question, so I think it's a good topic for Hints and Kinks. I'll give you some ideas this month, and collect what information you send me. I use Windows, so that's where I'm starting. We need to cover Mac and Unix/Linux based applications too. When there's enough material, I'll publish periodic updates.

After a couple years of making circuit boards in the ARRL Lab, I find dead-bug construction much more convenient. With no need to make circuit boards, I seek programs with simple drag-and-drop operation. *QST* described the simplest of these before,[3] but the necessary files fell through the cracks when we discontinued the dial-up ARRL BBS. I've posted them again as SCHEMAT.ZIP.[4] This Zip file contains Schemat.bmp, which may be opened in the Windows Paint accessory or any simple bitmap editor. To make schematics, simply open Schemat.bmp in one instance of Paint and your drawing in another. To place a symbol, select it in Schemat.bmp, copy it to the clipboard and paste it into your drawing. If you want a quick, inexpensive way to draw schematics, this setup is available right now and the price is right.—*Bob Schetgen, KU7G, ARRL Staff*

SWR ANALYZER CHECKS CRYSTALS

◊ I checked the antenna-analyzer article and found what I thought was a new discovery.[5] The other night, just out of curiosity, I tried measuring some crystals with my Autek Research RF-1 RF Analyst. Amazingly, I was able to get a low-impedance reading at the crystal frequency. How is this possible, when the VFO swings 10 kHz with slight changes of the dial? I listened to the oscillator with my rig and found that the oscillator actually locks to the crystal, allowing the crystal to take control. For a limited range of the tuning pot, the oscillator cleanly locks and the crystal frequency can be read rock-solid on the display. The "**Z Ohms**" numbers do not reflect the series resistance of the crystal, and shouldn't be trusted. This technique was described the *QST* article on pages 39 and 40.—*Mitchell Lee, KB6FPW, 686 N 21st St, San Jose, CA 95112*

[3]K. Schofield, W1RIL, "Schematics at Your Fingertips," *QST*, Oct 1993, pp 39-40.
[4]You can download this package from the ARRL Web **www.arrl.org/qexfiles/**. Look for SCHEMAT.ZIP.
[5]"SWR Analyzer Tips, Tricks and Techniques," *QST*, Sep 1996, pp 36-40.

Hints and Kinks items have not been tested by *QST* or the ARRL unless otherwise stated. Although we can't guarantee that a given hint will work for your situation, we make every effort to screen out harmful information. Send technical questions directly to the hint's author.

QST invites you to share your hints with fellow hams. Send them to "Attn: Hints and Kinks" at ARRL Headquarters (see page 10), or via e-mail to **rschetgen@arrl.org**. Please include your name, call sign, complete mailing address, daytime telephone number and e-mail address on all correspondence. Whether praising or criticizing an item, please send the author(s) a copy of your comments. QST

PRODUCT REVIEW

Patcomm PC-16000A HF Transceiver

Reviewed by Joe Bottiglieri, AA1GW
Assistant Technical Editor

Nearly three years have passed since we completed our evaluation of the previous version of this HF transceiver—the PC-16000—and reported our impressions, experiences and ARRL Lab measurement data in these pages (see *Product Review*, February 1998).

At that time, Patcomm Corporation of St James, New York was a new player in the Amateur Radio market.

Patcomm no doubt recognized from the onset that competing head-to-head with the big manufacturers was going to be tough sledding.

Certainly, the cachet of being an *American* Amateur Radio equipment manufacturer wouldn't hurt. The company's heritage might possibly generate a twinge of "Made in the USA" patriotism on their home turf, and could perhaps help their products attract attention in the crowded world market.

One thing was for sure—their equipment would have to be unique. It would need to offer something that clearly set it apart from the competition.

An Interesting Concept

The product concept they came up with was pretty ingenious, and maybe a little too far ahead of its time!

Patcomm's PC-16000 (initially released as a PC-1610) was—and, with their new "A" version, I should add—*still is*—the world's only amateur HF transceiver that includes a fully integrated digital mode terminal for RTTY (Baudot or ASCII) and CW operation *built right in*. Plug in the included IBM keyboard and switch the transceiver into either of these modes, press a "decode" button, properly tune in a RTTY or CW signal, and *voilá*—the received message text begins scrolling along the top line of the main display window.

When it's your turn to make the call (in RTTY *or* CW), it's a simple matter of engaging the transmit mode with a couple of keyboard strokes and away you go. Message text typed into the 16-character transmit buffer begins marching across the bottom line of the main display and gets sent out.

Patcomm also took advantage of the keyboard hookup to implement a radio-control-from-the-keyboard feature. Nearly all of the control operations accessible from the keys on the front panel of the radio (and even a couple that aren't) can be remotely accessed using keys or key combinations on the IBM keyboard.

Of course, conventional phone and CW operation is also supported.

Are You Calling My Baby Ugly?

The original PC-16000 seemed very promising but, as those of you who read our earlier review might recall, Patcomm initially struggled with some hardware and firmware problems.

In what some might consider "adding insult to injury," our reviewers didn't pull any punches when it came to expressing their opinions on the look, the feel and the layout of the controls.

Fast forward to Dayton Hamvention '99. A prototype of a new model of the '16000—the PC-16000A—made its debut at the show.

In the process of its transformation into the "A" version, the PC-16000 had received a radical facelift, and the results were nothing short of remarkable.

Some of the highlights? The LCD display window, shamelessly ridiculed for being "too small" in the text of our original write-up, had doubled in size—and so had the "tiny" S meter. The main tuning knob had been replaced with a larger and considerably more attractive alternative.

What had once been a single, confusing mass of 31 buttons tagged with difficult-to-read legends had been divvied up into subgroups of related keys and herded off to separate regions of the front panel. Silk-screened borders marked off their individual territories and the legends for all of the controls were larger and much easier to read.

Six machined-aluminum knobs, bunched close together in a tight pack on the original model, were also paired up and shuffled off to the suburbs.

Both aesthetically and ergonomically, the prototype PC-16000A appeared to be worlds apart from the original '16000. We eagerly anticipated the availability of regular production units so that we could purchase one to see how the changes would affect operation.

Bottom Line

With tremendous improvements in both aesthetics and ergonomics over the original radios of this series, Patcomm has once again captured our attention with this unique, and distinctly American, HF transceiver.

PC-16000A Particulars

Electronically, the new version of the transceiver is very similar to the previous model, but a recap is in order.

The PC-16000A covers all of the amateur bands from 160 through 10 meters and is capable of SSB, CW, AM and FSK operation. (An optional FM board is *still* not yet available. Patcomm reports that customer demand for this accessory has been virtually nonexistent). General coverage receive stretches continuously from about 100 kHz up to 30 MHz.

The transmitter harnesses the power of

Joe Bottiglieri, AA1GW ♦ Assistant Technical Editor

Table 1—Patcomm PC-16000A, serial number 25070D0047

Manufacturer's Claimed Specifications	***Measured in the ARRL Lab***
Frequency coverage: Receive, 0.1-29.9 MHz; transmit, 1.8-2.0, 3.5-4, 7-7.3, 10.1-10.15, 14-14.35, 18.068-18.168, 21-21.45, 24.89- 24.99, 28-29 MHz.	Receive 0.2-30 MHz[1]; transmit, 1.77-3.0, 3.37-4.59, 6.98-7.32, 10.08-10.17, 13.98-14.37, 18.04-18.19, 20.98-21.47, 24.87-25.01, 27.98-29.72 MHz.
Power requirement: Receive, not specified; transmit, 22 A.	Receive, 3.3 A; transmit, 21.3 A. Tested at 13.8 V.
Modes of operation: SSB, CW, AM, RTTY.	As specified.
Receiver	*Receiver Dynamic Testing*
SSB/CW noise floor: –128 dBm.	Noise floor (MDS), 500 Hz filter: 1.0 MHz –127 dBm 3.5 MHz –123 dBm 14 MHz –127 dBm
AM sensitivity: Not specified.	1.0 MHz 4.8 µV 3.9 MHz 5.8 µV
Blocking dynamic range: 111 dB, spacing not specified.	Blocking dynamic range, 500 Hz filter: 3.5 MHz 112 dB* 14 MHz 118 dB*
Two-tone, third-order IMD dynamic range, 20 kHz spacing, 93 dB.	Two-tone, third-order IMD dynamic range, 500 Hz filter: 3.5 MHz 92 dB 14 MHz 94 dB
Third-order intercept: Not specified.	3.5 MHz +24.1 dBm 14 MHz +17.6 dBm
Second-order intercept: Not specified.	+54.1 dBm.
S-meter sensitivity: Not specified.	S9 signal at 14.2 MHz: 31 µV.
Receiver audio output: 2.5 W at 10% into 8 Ω.	2.5 W at 10% THD into 8 Ω.
IF/audio response: Not specified.	Range at –6 dB points, (bandwidth)[2]: CW-N (500 Hz filter): 533-975 Hz (442 Hz); CW-W: 286-1111 Hz (825 Hz); USB-W: 286-1000 Hz (714 Hz); LSB-W: 286-1111 Hz (825 Hz); AM: 102-1020 Hz (918 Hz).
Spurious and image rejection: Not specified.	First IF rejection, 14 MHz, 59 dB; image rejection, 14 MHz, 45 dB.
Transmitter	*Transmitter Dynamic Testing*
Power output: SSB, CW, 100 W (high), AM, 40 W carrier (high)	CW and SSB, typically 107 W high[3], <1 W low, AM: typically 40 W high, <1 W low.
Spurious-signal suppression: 45 dB; harmonic suppression, 50 dB.	42 dB. Meets FCC requirements for spectral purity.
SSB carrier suppression: 40 dB[4].	28 dB.
Undesired sideband suppression: 45 dB with a 1 kHz tone.	40 dB.
Third-order intermodulation distortion (IMD) products: 28 dB.	See Figure 1.
CW keyer speed range: Not specified.	5 to 67 WPM.
CW keying characteristics: Not specified.	See Figure 3.
Transmit-receive turn-around time (PTT release to 50% audio output): Not specified.	S9 signal, 120 ms.
Receive-transmit turn-around time (tx delay): Not specified.	SSB, 40 ms. Unit is not suitable for use on AMTOR.
Composite transmitted noise: Not specified.	See Figure 2.
Size (hwd): 3.5×13×12 inches; weight, 12 pounds.	

Note: Unless otherwise noted, all dynamic range measurements are taken at the ARRL Lab standard spacing of 20 kHz.
*Measurement was noise-limited at the value indicated.
Third-order intercept points were determined using S5 reference.
[1]Sensitivity reduced below 500 kHz.
[2]See text.
[3]Maximum output on 160 meters was 85 W. Output decreases moderately above 29.0 MHz.
[4]Patcomm specifies this measurement relative to 100 W with no audio input. Their specification was met when tested using this method.
An expanded test result report for this transceiver is available to our members on our Web site. Printed copies are also available for those without Web access.

a pair of bipolar RF transistors, rated for up to 100-W *each*, to deliver 100 W for SSB and CW operation, 75 W for RTTY and 40 W (carrier) for AM.

The small rear-mounted heatsink and the rather massive aluminum chassis are said to supply sufficient heat dissipation to allow the lightly loaded finals to keep their cool. No one will be grumbling about the level of the cooling fan noise emanating from this radio—*there is no cooling fan*.

Fixed-level VOGAD (voice-operated gain-adjusting device) RF speech processing; multiple antenna connectors; variable RF power output (down to under 1-W) and the ability to display the RF power and SWR numerically in the LCD window are all included. The PC-16000A does not contain VOX features or a built-in automatic antenna tuner, however.

The receiver is dual conversion with IF stages at 45 MHz and 455 kHz. The radio employs 2.4 kHz and 500-Hz Rockwell Collins mechanical filters at the second IF. A 6-kHz ceramic filter is used for the AM mode. An optional 1.8 kHz Rockwell Collins SSB filter is also available.

The '16000A makes use of digital signal processing to effectively bracket the passband of the mechanical filters and to generate additional audio level DSP-based filter bandwidths of 1.8 kHz, 250 Hz and 200 Hz. The 200-Hz DSP

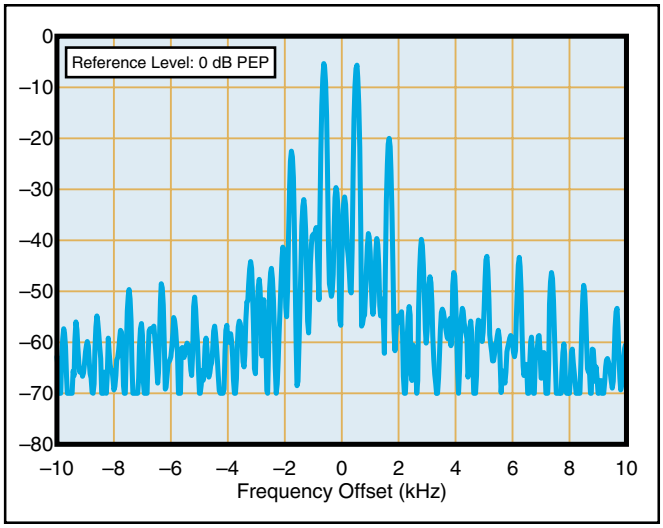


Figure 1—Worst-case spectral display of the Patcomm PC-16000A transmitter during two-tone intermodulation distortion (IMD) testing. The worst-case third-order product is approximately 22 dB below PEP output, and the worst-case fifth-order product is approximately 42 dB down. The transmitter was being operated at 100 W output at 21.250 MHz.

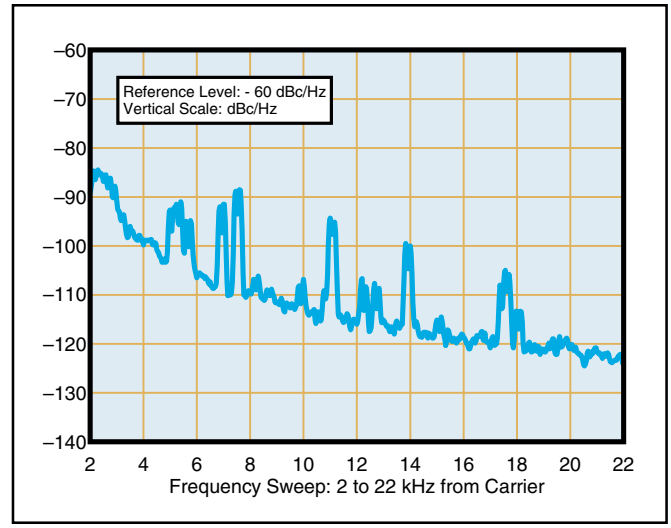


Figure 2—Worst-case spectral display of the Patcomm PC-16000A transmitter during composite-noise testing at 3.520 MHz. Power output is 100 W. The carrier, off the left edge of the plot, is not shown. The plot shows composite transmitted noise 2 to 22 MHz from the carrier. Composite noise is higher than other HF transceivers we've test recently.

filter, available only in the RTTY modes, works in conjunction with the 2.4 kHz and 500 Hz mechanical filters.

In addition to expanding and enhancing the filter capabilities, the DSP also delivers "de-noiser" and "auto-notch" features.

The de-noiser is designed to reduce the level of the background noise. The automatic notch filter, available only when using the 2.4 or 1.8 kHz filter settings, can track and notch up to four constant tones, such as tuning stations and other types of interfering carriers, that appear within the passband of the selected filter. Both features, however, can not be activated simultaneously and are only available in the SSB modes.

Other notables include a manual AF notch filter, an IF shift control, a pulse-type noise blanker, a receive attenuator, selectable AGC, a clock and a 10-minute ID timer.

Easy Now, Big Fella...

The changes that were made in the positions and labeling of the front panel controls makes the PC-16000A much more intuitive to operate.

All of the original 31 control buttons, with the exception of the **MOX/CLR** key, now enjoy exclusive membership in one of six key clubs.

Twelve of them, set up in a 4-row/3-column standard keypad configuration, have taken up residence on the far left-hand side of the front panel. Most of these keys perform three different functions.

The label printed above each indicates its primary assignment. These keys are used to control the split frequency, RIT,

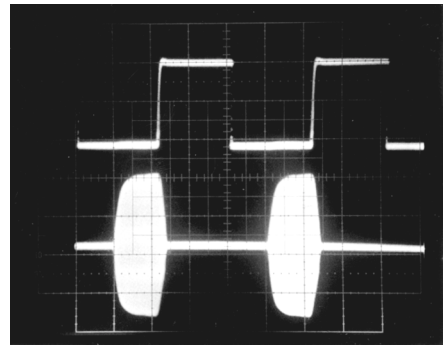


Figure 3—CW keying waveform for the Patcomm PC-16000A showing the first two dits in full-break-in (QSK) mode. The equivalent keying speed is 60 WPM. The upper trace is the actual key closure; the lower trace is the RF envelope. Horizontal divisions are 10 ms. The transceiver was being operated at 100 W output at 14.2 MHz.

QSK, CW spot and RF power/SWR metering features. Most have small red LEDs positioned next to them that indicate the current state of their associated feature.

The button located in the lower left corner of this group, **DIR FREQ/E**, is used to evoke the keypad's secondary control capability, direct frequency input. The corresponding digit assignments appear in yellow just to the right of each key.

The button in the lower right, labeled **BAND/•**, enables the keypad's tertiary function—band selection. Touch this key first and the keypad buttons become band keys. The band legends are printed below each key.

Just to the right of this group is a second 7-button set collectively titled **MODE/FILTER**. Here you'll find the keys used for mode and filter (mechanical/DSP and DSP-generated) selection, and a button that activates the RTTY/CW decode system.

The primary assignment for these keys is mode selection. Press the **BPF** button (in the 12-button keypad) first though, and five of them will also perform filter selection duties. Vertically oriented pairs of LEDs, located to the right of each key, indicate the present mode and filter setting.

The remaining four less-populated key groups control antenna, memory, tuning and noise reduction related operations.

The first contains just two buttons—**ANT** and **ATTEN**. The **ANT** button is used for antenna connector selection. The PC-16000A provides *three* SO-239 antenna jacks, and you can even program the radio to use separate ones on transmit and receive. Unfortunately, this capability is not available when in the QSK mode. The receive attenuator is specified at 20 dB.

The next group, labeled **MEMORY** and conveniently located just to the left of the main tuning knob, includes **STORE, DIR RCL, SCROLL DN** and **SCROLL UP** keys. The memory arrangement in this radio is unlike any other I've previously encountered. I'll provide details later.

The **TUNING** group, positioned just to the right of the VFO knob, consists of a **LOCK** and a **VST** button. The **LOCK** key disables VFO tuning.

When **VST** (variable speed tuning) is activated, the tuning step size is dependent on the speed of rotation of the VFO knob. The system automatically selects among five different step sizes ranging from 1 Hz for slow rotation up to 10 kHz for rapid spinning. It works *very* well.

The final group, with **AGC**, **NB** and **DSP** keys, is located on the far right hand

side of the front panel. These control the automatic gain control (fast or slow—off is not an option); the noise blanker; and a single key that can activate either the DSP de-noiser or the DSP auto-notch systems.

If anyone should ever doubt the importance of "human engineering" in product development, comparisons made between the ease of operation of the PC-16000A and the PC-16000 would rapidly dispel that suspicion. The PC-16000A is much easier to operate than the PC-16000.

One area that could still stand improvement is documentation. The 27-page manual (in a nice 3-ring binder) is well indexed and thorough, but tables or quick reference cards detailing front panel and keyboard control assignments would be a tremendous asset. A schematic diagram should also be provided.

Motivation for Memorization

The 90 "regular" memories are divided into 9 band-specific groups of 10. Each memory will retain the settings of the operating frequencies (including splits if desired), the mode, the filters, the antenna selector, the tuning speed, the VFO lock, the AGC, the noise blanker, the DSP and the attenuator.

The PC-16000A does not offer band-stacking registers. When you switch bands, the frequency that initially pops up will be the frequency stored in the first of that band's 10 memory slots. This took some getting used too.

With this rig, it's worth the effort to load up the first few positions of each band's memory bank with some strategic "starting" points.

As an example, for the 20-meter memories I programmed in 14.000 MHz (CW), 14.090 MHz (FSK), 14.150 MHz (USB), 14.195 MHz (USB) and 14.350 MHz (USB). Now, when I enter the band by way of the band key, I land on 14.000 MHz (CW) and can immediately begin cranking up through the band. If I want to begin tuning in another part of 20 meters, I use the **SCROLL UP** and **SCROLL DN** buttons to select the memorized frequency that's closest to my target.

In addition to the regular memories, there's also a single "scratchpad" memory. Shortwave and utility listeners should be forewarned that this is the *only* memory that will retain a frequency that's outside the limits of the US amateur bands.

Keyboard Control

For typical phone and conventional CW operation, it's not necessary to attach the included keyboard. I found that operating this radio seemed much easier from the transceiver's front panel controls.

It's conceivable that one might eventually warm up to the idea of using the computer keyboard to control the rig. This would require memorization of the numerous keystrokes and key combinations involved. The keyboard Patcomm provides carries only generic computer keyboard labeling. A keyboard overlay template with radio control assignments printed on it—a suggestion that we offered in our earlier review—sure would help.

Keyboard control however, may offer some advantages to the vision-impaired. They may find it more convenient to key in the radio control sequences on a familiar computer keyboard. One keyboard command that they will undoubtedly appreciate is **Alt**-**F**. This will initiate an announcement of the transmit and receive frequencies in Morse code. This feature can *only* be accessed from the keyboard.

Computer Connection

The PC-16000A offers keyboard control, but it does not include provisions for controlling the radio via a computer interface for remote control or station automation applications. Cabling the transceiver to your shack computer (or a "dumb" terminal—remember those?) can still offer some advantages though.

There's a 7-pin DIN connector on the back panel that can be connected to your computer's COM port. Make up an interconnect cable, fire up some terminal software and this will allow RTTY and CW text that's being decoded and encoded inside the transceiver to be displayed on the monitor. This can come in very handy.

When I was using the transceiver as a stand-alone digital mode terminal, on a number of occasions I found myself wishing for a way to scroll back through the received text—once it disappears off the left edge of the 16-character LCD screen, it's gone for good. If you forget the other operator's name or call sign, for example, it can't be recovered. With the radio operating in stand-alone mode, you'll definitely want to keep a pad or logbook close at hand for jotting down notes as the text flows by.

With a terminal "buffering" the incoming text, you'll also have an extended opportunity to play "Wheel of Fortune" with text that may have been corrupted by interference or variations in propagation. While the fairly consistent decoding that typically occurs in the RTTY mode doesn't result in too much garbled text, decoding CW by electronic means—particularly under poor conditions—often leads to a need for significant amounts of "text interpretation."

Snakebit

In the early stages of our evaluation of the original version (back in '97), it became apparent that Patcomm was still in the process of ironing out several problems related to the design and manufacture of the transceiver. To their credit, by the time we were ready to publish that review, nearly all of the performance shortcomings that we had encountered and reported to them had been resolved.

Although our criticisms concerning the man/machine interface aspects of the transceiver's design still remained, the underlying performance of the last of several we tested—a transceiver with all the factory updates installed—had been elevated to a respectable level. Most of their claimed specifications were met.

Along the way, Patcomm had managed to improve the CW keying waveform; reduce the phase noise; and increase the spurious signal and harmonic suppression, the blocking dynamic range and the two-tone third-order dynamic range.

This time around, when we initially received our PC-16000A and began our lab tests, we immediately ran into problems with sideband carrier suppression and spot checks of some of the other important performance characteristics turned up several that fell well short of their current published specifications. The transceiver went back to Patcomm for further investigation.

Their service department tracked the difficulties to a couple of cracked surface mount capacitors. Apparently a subcontractor that provides SMD circuit board subassemblies had encountered a bad batch of caps. Patcomm replaced the defective components and sent the radio back to us.

Back to the Bench

Our second series of tests confirmed that the performance of the PC-16000A was as good as—and in some cases, better than—the best of the PC-16000's we looked at back in '97.

The CW keying waveform (see Figure 3) indicated significant improvement. The best keying we observed in the previous model still showed signs of first-dit shortening and very "soft" rise times—not so this time around.

The two-tone third-order IMD dynamic range on 80 and 20 meters scored in the low- to mid-90s and neither measurement was noise-limited. The blocking dynamic range, although noise-limited, topped their 111 dB spec.

Oddly, the IF/audio response measurements for SSB and AM recorded during testing were much narrower than those we observed in any of the earlier units. The Lab investigated further and found that there was a notable frequency roll-off in the audio response that resulted in a decrease in the −6 dB bandwidths. This

made the filters seem—on paper anyway—way too narrow to pass intelligible audio.

On upper and lower sideband, the –6 dB bandwidths measured in the neighborhood of 700 Hz, but a second check at –30 dB revealed that the bandwidths at that lower level were closer to 1850 Hz. For AM, the –6 dB points indicated a mere 900 Hz of bandwidth, but the bandwidth at –30 dB measured 4 kHz. Although a poor IF filter shape factor can lead to this effect, a less than flat audio response (as was the case here) can also produce similar results.

While our Lab data pointed toward receiver audio that would sound seriously constricted, our field observations didn't bear that out. The audio delivered by this radio actually sounds very nice.

Closing Considerations

The PC-16000A exhibits a level of overall performance that's reasonable for a HF transceiver in this price range with basic DSP, built-in Rockwell Collins filters, RF speech processing, keyboard control and an integrated full-featured RTTY and CW digital mode terminal built in.

If you are presently shopping for a conventional HF transceiver and have a particular interest in RTTY and keyboard CW operation, the PC-16000A provides everything you'll need. Simply pull the radio out of the box; plug in the keyboard; lash it up to a suitable power supply and an antenna; and you are in business. No external TNC, no custom-built cabling and *no* personal computer are required.

Thanks to Michael Tracy, KC1SX, and the ARRL Lab for their assistance with this review.

Manufacturer: Patcomm Corp, 7 Flowerfield Suite M100, St James, NY 11780; 631-862-6512; fax 631-862-6529; **patcomm1@aol.com**; **www.patcomm.net/**.

Manufacturer's suggested retail price, $1350.

RadioShack HTX-252 2-Meter FM Mobile Transceiver

Reviewed by Rich Arland, K7SZ
QST *Contributing Editor*

When I contacted *QST* Product Review Editor Joe Bottiglieri, AA1GW, with an offer to do this review, his immediate response was: "How did you manage to get your hands on an HTX-252? RadioShack hasn't even begun *advertising* them yet!"

I had been searching for a 2-meter mobile to install in the very limited space available in my Subaru Outback. When I caught my first glimpse of this radio at the RadioShack booth at the Murgas Amateur Radio Club hamfest back in July, I quickly began to suspect that my quest was nearing an end.

Barry Brutko, the manager of the RadioShack in Wilkes-Barre, Pennsylvania, along with his sales associate Walt Gouse (N3BSX), were manning the booth. Their store had received one of the earliest shipments of HTX-252s. They brought along a few to sell at the show.

I chatted with them, perused the *Owner's Manual*, looked over the list of features and decided to give this little rig a try. Believe me, Barry and Walt didn't have to resort to too much arm-twisting. (We purchased a second HTX-252 to put through ARRL Lab testing and to try out for ourselves. The measurement data presented in Table 2 is from this second unit.—*Ed.*)

Bucking the Trend

Perhaps what is most immediately striking about this transceiver is its diminutive size. The overall dimensions are about $1\frac{5}{16} \times 5\frac{1}{8} \times 4\frac{7}{8}$ inches. This is one *tiny* radio! The weight is well under 2 lbs. I've owned some 2-meter H-Ts that were heavier than this mobile transceiver.

With their introduction of the HTX-252, it appears as if the folks in Fort Worth have decided to carve themselves a niche in the highly-competitive

2-meter FM mobile market by offering an extremely compact, moderately-featured, easy-to-operate transceiver.

This radio represents a refreshing departure from a current trend within the Amateur Radio industry—cram every conceivable bell and whistle into ever-smaller enclosures. Although the resulting products score high on the "Gee Whiz" scale, a significant—and growing—number of hams have voiced their displeasure with the difficulties they encounter programming and operating some of these "fully-loaded" models.

The '252 offers a blend of features that has been distilled down to just a tad more than the bare essentials. You'll find 10 memory channels (11 if you count the "Call" channel); 10 and 25 W RF power output settings; CTCSS encode and decode; extended receive coverage; priority watch, basic memory and VFO scan; and DTMF (for autopatch and repeater control)—and that's about it.

Bottom Line

RadioShack's HTX-252 provides just a smidgen more than the basic requirements for contemporary amateur 2-meter FM communications. What it may lack in "bells and whistles" however, it compensates for with its subcompact dimensions, ease of programming and simplicity of operation.

Some examples of the things that you *won't* find are high RF power output (50 W seems to be typical for VHF mobiles these days), an abundance of memories with alphanumeric tagging, direct frequency input from the microphone keypad and autodial memories. For my requirements, I consider these omissions to be reasonable tradeoffs. We'll revisit this topic shortly, but first let's take a closer look.

Face Front

The front panel of the '252 is remarkably—but somewhat deceivingly—uncluttered. Three rubberized pushbuttons; a volume, squelch and tuning knob; a conventional 8-pin microphone jack and the $\frac{3}{4} \times 1\frac{3}{4}$-inch display window are all you'll find. The "deception" lies in the fact that some of the control operations that are commonly accessed from front panel buttons on other VHF mobile transceivers have been relegated to four control buttons located on the HTX-252's hand mike.

The LCD window displays black segments on an amber background. Icons that show the state of the various settings pop up along the top edge of the window; a 4-section S/RF meter is located in the lower portion. The displayed frequency digits, the memory channel numbers and the icons are large enough for easy viewing. The display illumination level is fixed. Readability is good over a wide range of angles and lighting conditions.

The three chassis-mounted buttons, located just below the display, are labeled **REV**, **VFO/T-SQL** and **MR/MS**. A brief press of the **REV**erse button (when the transceiver is set up for repeater operation) will swap the transmit and receive frequen-

Table 2

RadioShack HTX-252, serial number 203257

Manufacturer's Claimed Specifications	*Measured in the ARRL Lab*
Frequency coverage: Receive, 136-174; transmit, 144-148 MHz[1].	Receive and transmit, as specified.
Power requirement: Receive, 0.6 A; transmit, 5 A (high power).	Receive, 0.71 A; transmit, 4.4 A. Tested at 13.8 V.
Mode of operation: FM.	As specified.
Receiver	*Receiver Dynamic Testing*
Sensitivity, 10 dB S/N: <0.22 μV.	For 12 dB SINAD, 0.14 μV.
Adjacent channel rejection: Not specified.	20 kHz channel spacing: 55 dB.
Two-tone, third-order IMD dynamic range: Not specified.	20 kHz channel spacing: 57 dB. 10 MHz channel spacing: 90 dB.
Two-tone, second-order IMD dynamic range: Not specified.	80 dB.
S-meter sensitivity: Not specified.	Maximum indication: 3.0 μV.
Squelch sensitivity: Not specified.	At threshold: 0.09 μV.
Receiver audio output: 2.5 W into 8 Ω, THD not specified.	2.4 W at 10% THD into 8 Ω.
Spurious and image rejection: 60 dB.	First IF rejection, 94 dB image rejection, 64 dB.
Transmitter	*Transmitter Dynamic Testing*
Power output (H/L): 25 / 10 W.	24 / 9.2 W.
Spurious-signal and harmonic suppression: ≥65 dB	60 dB. Meets FCC requirements for spectral purity.
Transmit-receive turn-around time (PTT release to 50% audio output): Not specified.	S9 signal, 220 ms.
Receive-transmit turn-around time (tx delay): Not specified.	95 ms.

Size (hwd): 1.3×5.1×5.5 inches; weight, 1.5 pounds.

Note: Unless otherwise noted, all dynamic range measurements are taken at the ARRL Lab standard spacing of 20 kHz.

[1]A special power-on reset procedure, detailed in the manual, will expand the transmit range to 142 to 149.885 MHz for MARS/CAPS operation.

cies. This is a convenient way to quickly determine if a station you are communicating with through a repeater is close enough to attempt simplex (non-repeater) operation.

The **VFO/T**one-**SQ**ue**L**ch button is used to move from the memory mode to the VFO mode or, when used in conjunction with a microphone-mounted "function" key, to set and activate the CTCSS encode and decode tones.

The remaining front-panel key—**M**emory **R**ecall/**M**emory **S**tore—switches the radio from the VFO to the memory mode. Hit the function key first though, and this same button will allow you to store any current VFO information—the operating frequency, the duplex value and direction, and CTCSS settings—into one of the 10 memories or the Call channel.

One in the Hand...

The microphone sports a conventional 4-row/4-column DTMF pad. As previously noted, these keys are used for generating DTMF tones only. Frequency or memory channel numbers can not be directly input from this keypad. A slide switch is provided that can disable these keys to prevent accidental DTMF transmission during normal voice operation. None of the keys on the microphone are backlit.

Located just above this keypad is a row of four radio control keys. From left to right, these are **F/MHz**, **CALL/STEP**, **SCAN/PRI** and **LOCK/SHIFT**.

Pressing the **F**unction/**MHz** button will evoke the secondary assignments of the other control buttons in this group and those on the front panel. While the radio is in the function mode (this state is indicated by a **FUNC** icon that appears in the display) the main tuning knob and **UP/DN** buttons located on the top of the microphone will allow VFO frequency excursions in 1-MHz increments. Touching the PTT button while in the function mode will toggle the radio between the 10 W and 25 W RF power output levels.

Press and hold the **F/MHz** button for a second or two and the squelch will open. This is handy for checking for weak signals that may be below the setting of the rotary squelch control or for signals that are obscured by a CTCSS tone squelch setting.

The **CALL/STEP** key provides one-touch access to the Call channel. The factory default frequency setting is 146.52 MHz, but the Call channel can be reprogrammed with any simplex or repeater frequency desired. When this same button is pressed while in the function mode, the value of the current tuning step appears in the display. The step size can then be changed using the main tuning knob or the mike's **UP/DN** buttons.

The **SCAN/PRI**ority key is used to enter the scan mode. If the radio is in the VFO mode, the scan will cover the entire range of the receiver (136 to 174 MHz); when in the memory mode, memory channels will be scanned. Set the squelch knob to an "open" position, and the scan will stop on each frequency step—active or inactive—for 1 second, and then resume. If the squelch threshold is set above the level of the band noise, the scan will pause on an active frequency for 5 seconds before resuming. A specific "memory channel lockout" feature is not included.

Program and enable the priority feature and the receiver will periodically switch to a selected VFO or memory frequency to check for activity.

The **LOCK/SHIFT** key can be used to disable five of the seven radio control keys (the **LOCK/SHIFT** and the **F/MHz** keys are the exceptions). Pressing this same button while in the function mode will permit variations in the duplex magnitude and direction. The factory default setting is 600 kHz (shown as ".60" in the display), but this offset value can be set anywhere between 100 kHz and 8 MHz. Automatic repeater offset (a feature that automatically selects the appropriate duplex direction—+, – or off—for the portion of the 2-meter band to which the radio is tuned) is not included.

The Far Side

The back panel contains a comparatively large heatsink, a chassis-mounted SO-239 antenna connector, a 1/8-inch external speaker jack and a 9-inch long dc power pigtail terminated in a conventional T-type connector. A 5 1/2-foot fused power cord with a mating connector is provided for wiring the radio to a 13.8 V dc power source.

An internal speaker is located in the top cover of the enclosure. A simple **U**-shaped mobile mounting bracket, fastened to either side of the chassis with large plastic-capped thumbscrews, facilitates radio mounting above or below a supporting surface and at a range of angles. The thumbscrews make for quick and easy removal or installation—a very convenient setup for those who like to employ one radio for a variety of missions.

And Now, Back to Our Show

Personally, I feel that RadioShack did a pretty good job of condensing the long list of possible features down to the

essentials, but—needless to say—not everyone will be content with their choices.

Folks who like to use the expanded receive coverage of an amateur transceiver for monitoring public service and commercial communications will no doubt whine about the limited number of available memory channels and the lack of a memory channel lockout capability. For my mobile radio shack, I prefer to use a separate dedicated multiband scanning receiver. This leaves my transceiver free for instant (and *simultaneous*) 2-way ham communications.

The expanded receive range, in spite of the limited number of memories, is still handy for *casual* non-amateur listening though—such as for checking a NOAA Weather Broadcast or for listening in on a couple of the local VHF police, fire or emergency medical service frequencies.

Others may be concerned that being restricted to 25 W of maximum RF power output might seriously degrade their effective range. I found that this power level is more than sufficient for my typical communications needs. As most of us know, reducing a transmitter's power from 50 to 25 W only results in a signal strength decrease of about $^1/_2$ of an S unit at a distant receiver. This slight reduction is rarely enough to make a substantial difference in the range of typical FM communications. Pairing this rig with an antenna that provides some gain—such as a $^5/_8$-λ as opposed to a $^1/_4$-λ mobile antenna—could help compensate for this "shortcoming."

An *advantage* of the lower RF power output is the associated reduction in the current requirements. The *Specifications* table in the *Owner's Manual* lists the current needed for 25 W operation as 5 A. This is within the range of what's available from most vehicle cigarette lighter sockets (please refer to your vehicle owner's manual). If you prefer not to have to run dc lines through the firewall and directly to the vehicle's battery, you *may* be able to simply install a cigarette lighter plug on the end of the dc power cord, plug it in, and play. Be aware however, that direct battery connection often alleviates problems with RFI and ignition interference.

While we're on the subject of dc power connection… the power cord that's supplied with the HTX-252 is fused near the *radio* end of the cable. Those making direct connections to the battery terminals (as I did) should fuse the *battery* end of the cable. Otherwise, if the positive lead's insulation is compromised anywhere between the battery terminal and the included fuse holder, and that conductor shorts to ground, the wire will light up like the element inside a toaster! This, my friends, is *not* a good thing.

If you've got packet or APRS applications in mind, you'll be presented with a couple of challenges. The first is programming. You'll want to set your operating parameters—such as the frequency and the power level—*before* you disconnect the hand microphone and connect your radio-to-TNC cable to the 8-pin mike jack. Obviously, the control functions that are accessed from the microphone buttons will not be available once you've unplugged it.

The second challenge is determining the microphone pin configuration for making up an interconnect cable. Unfortunately, RadioShack neglected to include this information in the *Owner's Manual*.

Setting Up Shop

Installation of this transceiver in my Subaru Outback went fairly smoothly, although I must admit that I had to resort to asking a mechanic at my car dealership for his help in locating the fasteners that hold down the center console.

I was able to mount the radio in an existing cubbyhole, but this did require pulling out the console and cutting the back wall out of that compartment. I needed to open up enough space to allow air to freely circulate around the heatsink fins.

I won't go into the specific details of my antenna and dc power cable installations. Needless to say, every vehicle, antenna system and radio mounting configuration will present a unique set of considerations.

Once I had completed my installation, it was time to load the memories. I found the HTX-252 very easy to program. This is not to say that you won't need to refer to the manual initially—you probably will. Once you use the radio for a little while though, you'll be amazed with how quickly you'll become familiar with its programming architecture.

The 39-page $4^1/_4$ × 7-inch *Owner's Manual* is nicely organized and the programming instructions are simple to follow. A 3-page *Quick Look at the Controls* table is perhaps all that most moderately experienced operators will need to get up and running. About the only deficiencies that I could spot in the included documentation are the aforementioned lack of a microphone wiring diagram and the absence of a schematic.

On the Road and On the Air

What I like most about the HTX-252 (its small size not withstanding) is its ease of operation. This radio's designers did a commendable job of selecting which control buttons to mount on the front panel and which to locate on the microphone. The more commonly needed control operations are readily available from the microphone—a tremendous convenience when operating while underway.

Ergonomically, the only gripe I can come up with is related to the volume and squelch controls. I would have preferred larger knobs and wider spacing, but there is enough "drag" in their action to prevent inadvertent rotation of one while adjusting the other.

Reports from the locals on the quality of the HTX-252's transmit audio have ranged from "very good" to "excellent." Pre-installation checks on my test bench of the available volume level and sound quality using the built-in speaker indicated that these should fit the requirements of most vehicle environments, but my final "cubbyhole" mobile installation necessitated the use of an external speaker. The audio from that speaker sounds marvelous.

ARRL Lab data generated from tests of the HTX-252 that was purchased by HQ (see Table 2) points toward good overall performance.

The FM sensitivity; the 10-MHz offset two-tone, third-order IMD dynamic range; and the first IF rejection numbers all compare quite favorably with those posted by other recently-reviewed VHF FM mobile transceivers. The image rejection figure however, does fall considerably short of the running average for this measurement, but it still easily meets RadioShack's published specification.

Wrap it Up (I'll Take It)

The convenience of having a VHF amateur transceiver permanently available in your vehicle and the capabilities it can offer, especially in an emergency situation, far outweigh the minor hassles you may run into when initially setting up your mobile system.

The RadioShack HTX-252 is a definite "winner" in my book. This rig has just enough features to be really useful but not so many that you have to spend the better part of an afternoon consulting the manual trying to figure out how to change a basic setting.

With the ever-shrinking amount of unoccupied space in today's vehicle interiors, the HTX-252 will surely find a ready market among those of us who really want to install a permanent mobile FM rig in the car, but can't figure out where the blazes to put it.

Manufacturer: RadioShack Corp, Fort Worth, TX 76102; 800-842-7422; fax 718-415-2303; **www.radioshack.com**.

Manufacturer's suggested retail price, $179.95. Typical current street price, $179.95.

TECHNICAL CORRESPONDENCE

AM BROADCAST AND SPURIOUS HF SIGNALS

By Chuck Counselman, W1HIS, 42 Crestview Rd, Belmont, MA 02478-2108; **ccc@space.mit.edu**

[Editor's note: Chuck is responding to an item that appeared in "The Doctor is IN," QST, February 2000, page 50.]

Dear Doctor: Your answer to Bob, K4RFK, was okay as far as it went, but you neglected to mention a most common source of spurious HF signals derived from nearby AM broadcast transmissions: namely, nonohmic, or nonlinear, conduction of currents induced by these transmissions in household wiring and other nearby conductors. I live one and a half miles away from a 50-kW AM broadcast station and one mile from a 10-kW station. I've spent many interesting hours tracking down, identifying and eliminating several such spurious-signal sources. Although I used a Hewlett-Packard 3586C Selective Level Meter, most of what I've done can be accomplished with just a portable, battery-powered receiver.

Like K4RFK, I hear AM-broadcast-related signals at many frequencies in the lower-HF range; these signals have modulation recognizable as being from local broadcast stations. A few of these signals are simple harmonics, eg, with carrier frequencies equal to exactly two or three times that of a nearby AM broadcast transmitter. In my case, most of these spurs are intermodulation products of two different AM broadcast signals. For example, at 3700 kHz I hear a signal modulated by two different AM broadcasters, one at 680 kHz (f1) and the other at 1510 kHz (f2). Note that 3700 kHz = 2 × f2 + f1. The 1510-kHz 50-kW station is the one just one and a half miles from me; the 680-kHz station is another 50-kW emitter 10 miles away.

A 2 × f2 + f1 product is an example of a third-order product, generated by a conductor or (most often) a discrete device in series with the conductor carrying signals at the two frequencies f1 and f2, and having some amount of cubic nonlinearity. By cubic nonlinearity I mean that the current through the device is not exactly linearly proportional to the voltage drop across the device, but a component of the current is proportional to the cube of the voltage. Typically, a nonlinear device also has square-law and other power-law components or terms in its current-voltage relation.

Nonlinear devices abound in typical household wiring! They're in most kinds of telephone equipment, fire- and burglar-alarm systems, stereo amplifiers, computers, computer peripherals and network interfaces, lighting controls (such as dimmers), surge protectors, garage-door openers and in the power-supply and electronic control circuitry of many other home appliances. Practically any semiconductor device such as a diode or a junction transistor that is connected to a wire more than a few feet long has the potential to generate harmonics and intermodulation (IM) products of strong local broadcast signals. In my house, for example, I found that a garage-door opener was generating strong IM products of the 1510-kHz station and several other stations, at 680 kHz, 1030 kHz, etc.

As you mentioned in your reply to K4RFK, you can identify your receiver as the source of a harmonic or an IM product by inserting an attenuator in the receiver's input and observing whether the spur is attenuated more than the desired, direct response. For example, a third-order IM product generated within your receiver will be reduced in strength by 3 dB for every 1 dB of input attenuation. (The three-to-one ratio is directly related to the three in "third order" mentioned previously.) However, this test may not be definitive because strong signals can enter your receiver by devious routes, and spurious responses may also stem from receiver defects that do not involve a nonlinear operation on the input signal, eg, mixing with a harmonic of a local oscillator.

Exploring your house with a portable receiver and temporarily disconnecting wires such as antenna lead-ins, power, telephone, TV cables, computer network cables, etc, can be very illuminating. Unfortunately, the range of possibilities is practically infinite, and I don't know of a simple procedure that will never fail to find the source of a spurious signal. I have found that some of these problems can be cured with common-mode RF chokes such as ferrite cores, but some require full-blown LC filters that also block RF current in differential or transmission-line mode. Typical household wiring is unbalanced, so common and differential modes are closely coupled. This coupling may change if you flip a switch or unplug something from a line.

A factor that confounded me for a while—until I carefully measured and understood it—is that the strengths of the signals from nearby AM broadcast stations are surprisingly variable—by 20 dB or more! This is caused by a variety of ground effects such as ground- and surface-water level variations, freezing and thawing and road-salt runoff. Signals from different stations can vary independently. For example, in my area, some AM broadcast stations' antennas are located in saltwater marshes whose water levels are affected by tides but not by rainfall and not much by freezing. Other broadcast antennas are in freshwater marshes whose water levels change by many feet in response to rainfall; still others abut larger streams and rivers whose levels are controlled artificially by dams and gates. Each station's signal level exhibits a different response to precipitation or freezing weather, and I observe corresponding, very dramatic, changes in the level of household-generated spurious signals.

Changes in your household wiring configuration can also cause dramatic changes in spurious signal levels, because of changing current distributions and resonant frequencies. For example, I noticed a big change when my wife hooked up our Christmas lights. If you pay attention, you'll be surprised by how often your household wiring changes substantially. In addition to ac power wiring—such as indoor and outdoor extension cords—don't forget extension telephones, desktop and laptop computers and their modems, ac-operated supplies, Ethernet, SCSI, USB and other cabling, your children's video games and TV sets and so on. In my house, I am probably the worst offender, with all my ham antennas, feed lines, tuners and frequently changing equipment and interconnections!

TV AND SWITCHING POWER SUPPLIES

By Leroy M. Stevenson, W9IS, 1804 Bonneville Dr, Muskegee, MI 49441

The item by James Robert Cherry, W3WGR, "Switching Power Supplies? Not for Me!"[1] reminded me of an inter-

ference problem I have. Several years ago I purchased an RCA TV set. Even though the set is turned off, I must unplug it from the wall socket if I want to listen to AM and shortwave signals. If I don't, spurious signals are present well into the HF region. RCA service has been unable to correct the problem.

A NOTE ON CALCULATING WIRE LENGTHS FOR WINDING TOROIDS

By Charles K. Brown, N4SO, 12165 Miller Ln, Grand Bay, AL 36541; **n4so@juno.com**

Responding to Robert (WD4OHD) Olson's Technical Correspondence item "Calculating Wire Lengths for Winding Toroids,"[2] Charles writes:

Mike Czuhajewski, WA8MCQ, published a lengthy article on this subject in "Toroid Inductance Charts," *QRPp*, Vol 1, Issue 3, December 1993. *QRPp* is a newsletter of the Northern California QRP Club, better known as NorCal. You can find an index and subscription rates to this newsletter at **www.qsl.net/k7qo/qrpp.html**.

FOX HUNTING WITH SPURS

By Steve Noskowicz, 4019 W Lakeshore Dr, Wonder Lake, IL 60097; **K9DCI@arrl.net**

Did you ever think that you'd ever want to make your receiver less sensitive—or "wooden"—by 80 to 100 dB? When fox hunting or tracking problem transmitters, once you get close to the signal source, the signal gets strong enough to saturate the receiver and its S meter stays pinned, making it useless. Elaborate phase-measuring devices such as Doppler systems and time-of-arrival units help to minimize or eliminate this problem, but they are large by comparison and require construction or cash outlay.

Once the receiver starts to hear the fox, you know you are close. By removing the receiver's antenna you can get closer, but eventually more signal attenuation is usually needed to hunt by signal strength. Some hams use passive attenuators in the antenna line and shield the radio itself.

One approach is to use an aluminum-wrapped cardboard tube. The H-T is slid into the tube, sans antenna, to get the required attenuation. One of the better solutions to providing needed attenuation is employing an active, offset or mixing attenuator: It turns a sophisticated, highly engineered sensitive receiver into a wooden block! This gem consists of a crystal oscillator and simple diode mixer placed ahead of the receiver.

With, say, a 1-MHz crystal, the receiver is tuned 1 MHz away from the fox signal and that frequency becomes a new first IF. Varying the level of the local oscillator (LO) signal fed to the new mixer varies the mixer-conversion efficiency and can make the receiver quite insensitive and keep the S meter in the active range. This approach does require some construction, but I've always been compelled to construct projects with the absolute minimum of hardware and this is the ultimate construction project for me.

One of the disadvantages of modern superheterodyne receivers, mixer spurious responses, turns out to be an advantage for foxhunters. There is a not-so-active attenuator already built into every receiver. All you need to know is how to enable it. The most well known spurious response is what we call the image frequency. It is located one IF away from the LO on the opposite side of the desired signal. Thus, it is twice the IF away from the receive frequency. A 10.7-MHz IF has a 21.4-MHz image frequency. The receiver's front-end filtering passes the desired frequency and reduces the amplitude of the image-frequency. That is just what we want: a bad receiver! The amount of reduction is fixed and depends on the front-end filtering. Since dual-conversion receivers are common, two images exist. If the second IF is 455 kHz, this image is 910 kHz away from the receive frequency. Since you likely don't know on which side of the LO it is, you have to try both above and below to find it.

Another spur is at the half IF. This one is centered between the LO and the receive frequency. It may be difficult to use since it may turn out to be slightly off the nearest frequency to which you can tune. In the case of a 455-kHz half IF, it is 227.5 kHz away from the main signal and a synthesizer usually won't tune to 7.5 kHz. However, it may be useful depending on your receiver, the frequency of the fox and your synthesizer's characteristics.

Another source of spurs in the modern synthesized receiver is the phase-lock loop reference frequency. There will be a small amount of this signal, and many harmonics, present at the phase-detector output, modulating the VCO. If this frequency is 5 kHz, there can be spurs every 5 kHz on both sides of the carrier. The receiver contains a low-pass filter to remove them, but depending on the filter design and other possible signal paths, these spurs may be present and usable. Because their amplitude decreases the farther they are from the carrier, their level tends to be at or below the sideband noise after the first few spurs, but they may be useful.

One more potential spur source can be any other oscillator in the radio, a microprocessor clock, for instance. If it is crystal controlled, it will be stable enough to use and the spur may be getting into the synthesizer VCO in spite of the best efforts of the design engineers. So if the microprocessor has a 1-MHz clock crystal, the radio may have 1-MHz spurs. These spurs will be on both sides of the receive frequency.

Probably the best way to find your receiver spurs is to use a signal generator connected directly to the rig and adjusted to a suitably high level. Vary the generator's frequency, or have the radio scan the band. Without access to a signal generator, you could sit near a local repeater and scan the band. The disadvantage to this approach is that the receiver will stop on any other repeater frequency it hears; it may stop on intermodulated signals if several transmitters are nearby, so this process will take longer, but it may be your only option.

It's best to use the spurs that are farther from the receive frequency. This is because of the synthesizer's VCO sideband noise. This noise is higher near the receive frequency, and its effects fall off as you move away. If this noise is relatively high at the spur, you can have a spur that sounds noisy and you may think that it is really weak, but in reality it is only a poor S/N due to the high VCO sideband noise level. It will sound noisy even though an S meter shows that it is a rather strong signal. The usefulness of any spur is best found by trying it out.

Though not a product of your receiver, another common "active attenuator" substitute is to hunt the third harmonic of the fox. Of course, for 2-meter foxes, this requires a 432-MHz receiver and knowledge that the fox doesn't have harmonic filtering.

So there you have it. Your receiver is a mass of spurious responses just waiting to help you find that fox!

[1]James Robert Cherry, W3WGR, "Switching Power Supplies? Not for Me!", Technical Correspondence, *QST* Aug 2000, p 75.

[2]Robert Olson, WD4OHD, "Calculating Wire Lengths for Winding Toroids," Technical Correspondence, *QST*, Aug 2000, p 75.

Letters for this column may be sent to Technical Correspondence, ARRL, 225 Main St, Newington, CT 06111, or via e-mail to **ppagel@arrl.org**. Please include your name, call sign, complete mailing address, daytime telephone number and e-mail address on all correspondence. Whether praising or criticizing a work, please send the author(s) a copy of your comments. The publishers of *QST* assume no responsibility for statements made herein by correspondents. QST

ARRL Advises Caution in Deploying Ultra-Wideband

The ARRL has advised the FCC to put its ultra-wideband—or UWB—technology proceeding on hold until more evidence is available on UWB's interference impact. The FCC last May proposed amending its Part 15 rules to permit the operation of ultra-wideband on an unlicensed basis. The Commission said the technology could have enormous benefits for public safety, consumers and businesses.

The League said that while it does not object "as a general principle" to authorizing UWB devices under Part 15, "UWB devices cannot be authorized on a blanket basis at this point without making assumptions which could very well be erroneous, and with potentially disastrous results for licensed radio services." The ARRL recommended putting the UWB proceeding on hold until test results are available on the impact of UWB and a further round of comments sought. Specific rules need to take into account "empirical evidence of interference potential from UWB devices," the ARRL said, and it questioned why the proceeding was issued before test results and analyses were received.

The bulk of the ARRL's comments, filed September 12, focused on the potential for interference from UWB to Amateur Radio allocations. "Part of ARRL's reluctance is that some types of UWB operation will result in wideband noise across multiple amateur bands, something not likely to occur with most presently authorized Part 15 devices," the ARRL asserted. The League called upon the FCC to not authorize any UWB deployment below 2.5 GHz. The ARRL also asked the FCC not only to determine reasonable operating conditions for UWB devices but to also consider how it will address cases of harmful interference that may result from UWB deployment. And the ARRL said it wants the FCC to consider extending the protections it's considering for safety services—such as GPS—to the Amateur Service.

Proponents claim UWB devices are capable of operating on spectrum that's already occupied by existing radio services without causing interference. The FCC says UWB deployment could permit scarce spectrum resources to be used more efficiently.

The League offered to contribute to further studies now under way under the auspices of the NTIA and the Department of Transportation. "At this point, it is not reasonable to adopt rules for UWB devices," the ARRL concluded, "despite an apparent public interest in accommodating such devices."

IARU MONITORS SEEK REPORTS OF UNLICENSED OPERATION

In an effort to better document the extent of unlicensed operation on Amateur Radio frequencies—particularly on 10 and 12 meters—the International Amateur Radio Union Region 2 Monitoring System has been surveying member societies about the extent of the problem. To supplement its response to the survey, the ARRL in October solicited reports from US hams.

"The primary goal of the survey is to document the extent of unlicensed operation on amateur frequencies throughout the world, particularly in IARU Region 2," said Brennan Price, N4QX, administrator of the ARRL Monitoring System. "At the peak of the sunspot cycle, CB-like operations become more and more apparent on the highest HF band."

Price said that on September 28 alone, the ARRL received three reports of such activity on 10 meters. "John Hennessee, N1KB, and I took turns monitoring at headquarters station W1INF and noted 12 such stations in about 15 minutes of listening time—all using AM between 28.0 and 28.1 MHz," he said. While it's not always the case, Price said, lower sideband and AM transmissions between 28.0 and 28.1 MHz "usually are unlicensed and may be treated with suspicion." He pointed out, however, that not all SSB transmissions on the low end of 10 meters should be deemed illegal. "Most countries do not mandate a segregation of voice and digital modes, as the US does," he explained.

ARRL PHOTO

ARRL HQ staffers Brennan Price, N4QX (left), and John Hennessee, N1KB, troll 10 meters at W1INF, keeping an ear open for possible unlicensed operators.

The ARRL solicited reception reports from amateurs during the first two weeks of October. Price said the vast majority of the 300 or so reports received by mid-month cited operation on LSB and AM at 10-kHz increments throughout the bottom end of the 10-meter band. Price emphasized that operations on the so-called "freeband" between 10 meters and the 11 meter Citizens' Band were not a topic of this survey.

"These reports document the severity of unlicensed operation throughout the hemisphere," Price said. He expressed the hope that the League's contribution to the monitoring project would prove helpful to the IARU's efforts to encourage enforcement by other administrations.

Price noted that nearly half of the reports document operation apparently within the US. "We now have a more comprehensive snapshot of the nature of such operation," he said.

FCC Special Counsel for Amateur Radio Enforcement Riley Hollingsworth already has announced plans to concentrate more enforcement on the problem of 10-meter intruders now that overall Amateur Radio enforcement complaints are dropping.

ARRL Executive Vice President David Sumner, K1ZZ, said he believes the best short-term solution is for amateurs to get on the air and use their frequencies. "Illegal operation on 10 meters declines on a contest weekend," Sumner says. "If that volume of stations would operate more often, perhaps these intruders would look elsewhere for an open frequency."

CALIFORNIA GOVERNOR VETOES PRB-1 BILL

California Gov Gray Davis has vetoed that state's proposed Amateur Radio antenna bill, SB-1714. ARRL Pacific Division Director Jim Maxwell, W6CF, and Southwestern Division Director Fried Heyn, WA6WZO, expressed extreme disappointment at Davis' action.

"We are disappointed, to say the least, by this decision of the governor," Maxwell said in a statement on behalf of Heyn

Rick Lindquist, N1RL ♦ Senior News Editor

"We are disappointed, to say the least, by this decision of the governor."

and himself. "We are also puzzled, for SB-1714 was passed unanimously by both the Senate and Assembly, and to the best of our knowledge had no organized opposition."

The California measure carried a price tag of between $70,000 and $100,000 to fund studies and a model ordinance that lawmakers required. In a statement, Davis said he declined to sign the bill because funds for the studies were not included in his budget. The governor also called the topic of amateur antennas "a local rather than a state issue."

The bill was aimed at incorporating the language of the limited federal preemption known as PRB-1 into state law. SB-1714 would have required any ordinance regulating Amateur Radio antenna structures to "reasonably accommodate amateur radio service communications" and "constitute the minimum practicable regulation to accomplish the legitimate purpose of the city or county."

Maxwell said the "1714" Steering Committee would review the governor's decision and decide on a course of action. The California legislature will not be back in session until next January 3.

So far, 10 states currently have incorporated PRB-1 wording into their statutes.

HOLLINGSWORTH SUGGESTS STEPS TO BRIGHTER AMATEUR FUTURE

Looking "beyond enforcement," FCC Special Counsel for Amateur Radio Enforcement Riley Hollingsworth, K4ZDH, has offered his ten personal suggestions to secure a sound future for Amateur Radio.

Speaking at the ARRL New England Division Convention August 26 in Boxboro, Massachusetts, Hollingsworth recapped the nearly two years since he took over Amateur Radio enforcement. Hollingsworth proclaimed the Amateur Service "fundamentally sound" and said complaints were on their way down.

With several major enforcement issues out of the way, Hollingsworth encouraged amateurs to "seize the moment" to ensure a bright future for Amateur Radio. "Look beyond enforcement," he urged, "because if I do my job right, in five years you won't even remember my name." Hollingsworth said that while no one can predict the future, amateurs must invent theirs in an era of converg-

"Look beyond enforcement," Hollingsworth urged, "because if I do my job right, in five years you won't even remember my name."

NOTABLE SILENT KEYS

REPUTED OLDEST US HAM, ARRL MEMBER BILL DEARING, W5QN, SK

Wilbur "Bill" Dearing, W5QN, of Bonham, Texas—believed to have been the oldest US Amateur Radio operator and ARRL member—died September 20. He was 101. First authorized to operate a spark-gap transmitter by the US Department of Commerce in 1913 or 1914, Dearing remained an active amateur until breaking his hip earlier this year. He obtained his W5QN call sign in 1927. Dearing had succeeded George "Dewey" Wilson, W7HF, of Aberdeen, Washington, as the ARRL's most senior member and oldest US ham when Wilson died on July 8 at the age of 102. It's not known who holds senior honors at this point, but Dearing appears to have been the last US Amateur Radio operator born in the 19th century. A CW operator, Dearing in later years got on 20 meters almost daily to chat with friends and acquaintances. He was a member of DXCC and had been an ARRL member for more than 60 years. Graveside services were held September 23 in Bonham. His sister, Aleene, died September 17 at the age of 99 and was buried the day her brother passed away. The family invites memorial donations to the Dr M.B. Nelson Scholarship Fund at Texas A&M University, College Station TX 77843.

FORMER ARRL VICE DIRECTOR JIM KNOCHENHAUER, K6ITL, SK

Former ARRL Pacific Division Vice Director Jim "Knock" Knochenhauer, K6ITL, of San Mateo, California, died September 16. He was 73. An ARRL Life Member, Knochenhauer served as Vice Director from 1986 until 1988 during former ARRL President Rod Stafford's tenure as Pacific Director. "Jim was a strong supporter of ARRL, an avid DXer, and was for many years the San Mateo County RACES officer," said Pacific Division Director Jim Maxwell, W6CF. Knochenhauer also served as a member of an ad hoc committee that prepared an early version of the DXCC field-checking rules and was Board liaison to the ARRL Bioeffects Committee—the predecessor to today's RF Safety Committee. He was a member of the San Mateo Radio Club and the Northern California DX Club. The family invited donations to the American Cancer Society to or a favorite charity in Knochenhauer's memory.

LORRAINE S. MATTHEW, N4ZCF, SK

Army Military Affiliate Radio System Public Relations Coordinator Lorraine S. "Lori" Matthew, N4ZCF and AAA9PR, of Kingman, Arizona, died September 29. She had just turned 68 the day before. An ARRL member, Matthew for 10 years authored "The MARS Corner" column that appeared in *Worldradio* magazine and in *The Florida Skip*. In August, Army MARS presented Matthew with a *Certificate of Appreciation* for her decade of work on behalf of the program. The certificate praised Matthew for her "continuing support, outstanding service and loyalty" to the MARS program and expressed appreciation for "the countless hours which you have dedicated to representing Army MARS in a positive fashion" as Army MARS Public Relations Coordinator. "You are the best example of the dedicated MARS member," the certificate concluded. "Thank you for opening the eyes of the world about MARS. You make Army MARS Proud, Professional and Ready." Matthew and her husband Matt, KC4RKJ, who died earlier this year, launched MARS "Operation Holidays," which encourages using MARS message services to contact military personnel unable to return home during the holidays. Army MARS has retired Matthew's AAA9PR MARS call sign. Matthew also was secretary of the Hualapai Amateur Radio Club in Kingman.

Riley Hollingsworth's Abridged Ten Tips for a Brighter Ham Radio Future

ARRL PHOTO

1. Be proud of what you have. Let the public know what Amateur Radio is and why it's valuable.
2. Operate as if the whole world is listening. *It is!*
3. Take nothing for granted. Bill Gates can't, and you can't either.
4. You're at a crossroads now. Seize the moment, and make this your finest hour.
5. Make sure that on your watch, Amateur Radio *never* becomes obsolete.
6. Teach the new licensees all you know. Think about the legacy you were given and your duty to pass it on.
7. Enjoy ham radio. Celebrate it. But realize it comes with *responsibility*. Every gift of lasting value always does.
8. Stay away from arrogant, negative operators who know all the answers.
9. Never allow Amateur Radio to become the audio version of *The Jerry Springer Show*.
10. I'm standing here talking about enforcement because the ARRL never gave up [trying to get the FCC to resume enforcement]. Take care of the one voice you have.

ing digital and RF technology.

And he reiterated a phrase that has become a Hollingsworth mantra: "There is no reason why our Amateur Radio Service can't be the envy of the rest of the world." Getting there, he suggested, comes with each amateur's taking responsibility for his or her behavior on the air.

Amateurs should encourage arrogant, negative operators to "take their anger and hate to the Internet," he said. "Every minute they are on the Internet is a minute they aren't on Amateur Radio."

Among other suggestions, Hollingsworth said hams should be proud of what they have accomplished. "Let the public know what you are, what Amateur Radio is, and why it's valuable," he said. He also urged hams to "operate as if the whole world is listening" and to never let ham radio "become the audio version of

FCC News

FCC DENIES AMATEUR PETITIONS

The FCC has denied three petitions for reconsideration filed by Amateur Radio operators. All of the petitions were turned down because the FCC said they had not been filed properly.

In separate orders released September 11, the Wireless Telecommunications Bureau, dismissed the petitions of Lawrence Gutter, ex-WA2YTO, and Richard E. Jamison, KG6ARN and ex-K1OTO. Both had sought reconsideration of the FCC's denial of their license renewal applications.

Gutter's and Jamison's licenses both expired in late 1997, and the two filed for renewal in late 1999. Both filed at or near the end of their two-year grace periods. Neither included their Taxpayer Identification Number—typically a Social Security Number for an individual—on his renewal application, and the FCC promptly dismissed both applications.

Citing their earlier ignorance of the FCC's TIN requirement, Gutter and Jamison sent second applications that included their TINs to Gettysburg after their grace periods had expired.

In an *Order* released September 12, the FCC also turned down the *Petition for Reconsideration* filed by Charles W. Heard, W4CO and formerly W2FLA. Heard had sought reconsideration of the October 1999 denial of his application for the vanity call sign W4FX. The call sign went instead to another applicant, Robert C. Williams, formerly KA4H. Both had filed electronic applications for W4FX on August 16, 1999. Heard contended that the FCC erred in assigning W4FX due to a handling error and misuse of the system. The FCC Order said Heard's allegations "lack merit" and that the ULS "processes mutually exclusive vanity call sign applications received on the same day in random order."

But in the end, the FCC dismissed all three petitions as "improperly filed," because they were sent to the FCC's office in Gettysburg, Pennsylvania, rather than to Washington, DC, and were not received by the FCC Secretary's office within 30 days, as FCC rules require.

In footnotes to the Gutter and Jamison rulings, the FCC strongly suggested that their petitions would have been denied even if they had been properly filed. The Commission said the fact that Gutter and Jamison were unaware of the TIN requirement was not sufficient justification for the reinstatement of their licenses.

The FCC also said Gutter and Jamison could have avoided problems by not waiting until the end of their grace periods to file for license renewal. Jamison got licensed again in March after taking the Amateur Extra-class exam battery over from scratch. Gutter, who had held a General ticket, remains unlicensed.

FCC UPHOLDS FORFEITURE FOR ILLEGAL AMPLIFIER SALES

The FCC has denied a *Petition for Reconsideration* and upheld a $7000 fine against The Two Way Shop of Kennewick, Washington. The shop was fined for willful and repeated violation of the Communications Act of 1934 and FCC rules by offering illegal linear amplifiers for sale. In a May 3, 2000, response to the FCC's earlier *Forfeiture Order*, the Two Way Shop alleged that neither its owner-operator nor his wife had spoken with FCC agents in the shop and, accordingly, could not have offered to sell linear amplifiers to the agents. "The Two Way Shop apparently overlooks our statement in the *Forfeiture Order* that the investigating agents posed as 'members of the general public'," the FCC responded in a *Memorandum Opinion and Order* released September 14. The FCC said the agents' decision to go undercover had no bearing on The Two Way Shop's culpability, and it denied the *Petition for Reconsideration*.—FCC

FCC SET TO AUTHORIZE MURS

With no fanfare, the FCC was set to authorize a new Citizens Band Radio Service to be called the Multi-Use Radio System, or MURS. The service, which came about as part of the biennial review of Part 90 of the FCC's rules, will deploy five former Private Land Mobile Radio Service VHF "color dot" channels for voice, data and imaging transmissions. The channels, 151.82, 151.88, 151.94, 154.57 and 154.60—will be authorized for up to 2 W on an unlicensed basis under Part 95 of the FCC's rules.

The Jerry Springer Show."

He also called upon veteran hams to take newcomers under their wing and teach them "all you know" about the hobby.

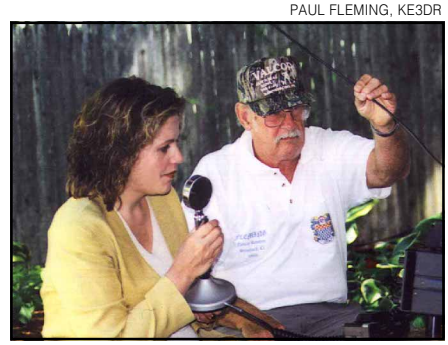
Hollingsworth also expressed his support for the ARRL, which has backed his enforcement initiative on behalf of the FCC. "Take care of the one voice you have," he advised. "You must never doubt that a small group of dedicated people can change the world. They just did."

"Enjoy ham radio," Hollingsworth told his audience. "Celebrate it. But realize it comes with responsibility."

OPERA SUPERSTAR TRIES AMATEUR RADIO

In August, the Fleming descendents of George W. and Elizabeth M. Fleming met for a reunion at the Stamford, Connecticut, home of internationally famous opera star Renee Fleming. The family reunion drew eight hams: Paul R. Fleming, KE3DR, and his wife, Pearl, KB3ANT; sons, Ross, KB3AQO, and Guy, KB3DMJ; brothers Edwin, KB2ZUD, and Lysle, KE4DR; niece Elizabeth Fleming Stafford, KC5PJQ, and her husband Benny Stafford, KC5JCH. Paul Fleming says a 40-meter dipole was erected in a nearby tree and connected to a handy and venerable FT-102 so attending hams could get on the air (what else?). Renee Fleming—who is Paul Fleming's niece—got on the mike to talk with participants in the All Friends Net on 7.188 MHz, among them Slim Seibert, N2SCI, near Philadelphia. The opera singer later mailed Seibert a CD of herself and Placido Domingo in concert. "Renee has been behind many microphones, but this was the first time she had talked on Amateur Radio," Paul Fleming said. "And she greatly enjoyed this new experience." Fleming said he hopes his famous relative gets her ham ticket some day.—*Paul R. Fleming, KE3DR*

PAUL FLEMING, KE3DR



Opera star Renee Fleming talks to participants on the All Friends Net, while her uncle, Paul Fleming, KE3DR, looks on.

The establishment of MURS was buried within a huge *Report and Order and Further Notice of Proposed Rule Making* released this summer as WT Docket 98-182 and PR Docket 92-235. The FCC said it will "revisit" the issue of allocating additional MURS channels "at a later date should additional support develop." The effective date to deploy MURS is pending completion of the FCC proceeding.—*FCC*

FCC APPROVES GPS-CAPABLE FRS TRANSCEIVERS

The FCC has granted, in part, a request from Garmin for a waiver of the Part 95 Family Radio Service rules [§95.193(a) and 95.631(d)] that will let the company manufacture and market for a one-year trial period FRS transceivers capable of transmitting location information derived from the GPS on FRS channels. The FCC says Garmin must include information in the instructions accompanying the units that the capability to transmit GPS-derived location information is provided "for personal and public safety purposes" only. Current FRS rules permit transmission only of F3E voice communications and CTCSS tones. The units must be designed to limit transmission of emission type F2D GPS-derived location information digital data bursts to not longer than one second and not more often than one burst every 10 seconds, actuated by the FRS user. The FCC declined to permit Garmin to manufacture units that can automatically poll other FRS units to determine their locations based on GPS-derived location data.—*FCC*

Amateur Enforcement News

• **FCC trims Tucker family call signs:** The FCC has reduced the overall number of call signs held by members of California's Tucker family from 41 to 22—including personal and club station call signs. In a September 29 letter to the Tuckers' attorney FCC Special Counsel for Amateur Radio Enforcement Riley Hollingsworth outlined a call sign allocation plan identical to one the FCC first proposed a year ago. Family patriarch Roy Tucker, N6TK, would be allowed to keep three of seven club call signs granted November 4, 1996, and Kathryn Tucker, AA6TK, Kent Tucker, AA6KT, and Eric Tucker, AA6ET, each would be allowed to retain three of eight club call signs granted to each November 4, 1996. Nancy Tucker, W5NAN, would be permitted to retain the two club station call signs assigned to her January 9, 1998. Hollingsworth said the FCC plans to take back the subsequent grants of K6ANT to Roy Tucker and of WW6TXB and WX6XX to Kathryn Tucker. Hollingsworth said of the practice of collecting multiple club station call signs "games the system, and we're not going to let anyone game the system." He said club station call sign applications must be on behalf of *bona fide* clubs. The FCC first inquired into the Tucker family's 36 club station call sign holdings in the summer of 1999.

• **Supreme Court dockets KV4FZ renewal case:** The US Supreme Court has docketed the license renewal case of Herbert Schoenbohm, KV4FZ, and will consider it for possible hearing during the current term. Schoenbohm remains pessimistic about his chances, however. In a last-ditch effort to retain his Amateur Radio license, Schoenbohm—who lives in the US Virgin Islands—petitioned the US Supreme Court in August to request the record of his case from the US Court of Appeals for review. Schoenbohm may continue to operate while his petition is pending. If, as expected, the Supreme Court declines to hear his case, Schoenbohm's interim operating authority immediately disappears without further notice from the FCC. His call sign no longer appears in the FCC database. Following Schoenbohm's 1992 felony conviction on federal fraud charges, the FCC set his Amateur Radio renewal application for a hearing in 1994. The FCC subsequently turned down his application, citing his conviction and character issues. The US Appeals Court turned down Schoenbohm's request for a rehearing by the full bench after it rejected his appeal of the FCC's decision in February. Losing his US Amateur Radio privileges will not necessarily put Schoenbohm off the air entirely. He holds licenses on three Caribbean islands as well as in Brazil. He would not be allowed to use his foreign call signs on US soil, however.

In Brief

• **Vote on *QST* Cover Plaque Award:** The winner of the *QST* Cover Plaque Award for September was David Blaschke, W5UN, for his article "MBA: The Mighty Big Antenna." Congratulations, Dave! ARRL members are reminded that the winner of the *QST* Cover Plaque award—given to the author(s) of the best article in each issue—now is determined by a vote of ARRL members. Voting takes place each month on the ARRL Members Only Web site at **www.arrl.org/members-only/qstvote.html**.

• **New Hampshire gets new Section Manager:** Former New Hampshire Section Manager Al Shuman, N1FIK, of Goffstown is the Granite State's new SM. Shuman—who had served as SM from 1992 until 1999—agreed to step back into the volunteer position following the resignation of Michael Graham, K7CTW. Shuman's appointment by ARRL Field and Educational Services Manager Rosalie White, K1STO, was effective October 4. Members may e-mail Shuman at **n1fik@arrl.org**.

• **ITVA produces youth-oriented Amateur Radio TV spot:** The San Francisco Chapter of the International Television Association has produced a 30-second TV public service announcement designed to assist the amateur community in recruiting more young people to the hobby. Copies of the TV spot are being made available at nominal cost to Amateur Radio clubs for distribution to local television outlets. ITVA recruited several San Francisco Bay area hams to consult on the development of the story line for the 30-second spot. Spot producer Michelle Brown said ITVA "focused on the message on the two concepts that most appeal to that demographic: high technology and disaster preparedness." ITVA President Ken Alan, K6PSI, said the producers "wanted to show young people using H-Ts for socializing and in a disaster scenario." The spot concludes with an invitation to "find out more about amateur radio" and provides a 10-second visual backdrop for a local sponsoring club to superimpose its name and contact information. The whole idea, Alan told ARRL, was to steer clear of ham radio stereotypes and "just show the hobby as contemporary, high-tech and fun." A *Quicktime* movie of the PSA can be viewed at the ITVA Web site at **www.itvasf.com**. Amateur Radio organizations may order a professional Betacam copy for use in their TV markets for $20—which covers the cost of tapes, duplication, and shipping.—*ITVA*

• **Alpha/Power to cease linear manufacturing:** Amateur linear amplifier manufacturer Alpha/Power Inc of Longmont, Colorado, has announced plans to cease engineering and manufacturing operations once the current run of Alpha 87A and 99 amplifiers is completed. Alpha/Power said that that warranty and post-warranty service will continue to be available. Dick Ehrhorn, W0ID/W4ETO, says that "a combination of health issues and family obligations" has made it impossible for John Brosnahan, W0UN, the president and technical director of Alpha/Power, to continue at his present pace with Alpha/Power. Ehrhorn said he's "not willing to risk that Alpha legacy" with someone else, "nor am I aware of any person or entity with the desire, the proven ability, the commitment, and the resources to acquire Alpha and perpetuate the standards to which we've been dedicated for thirty-one years." Ehrhorn says the company remains open to "serious discussions." For more information, visit the Alpha/Power Web site, **www.alpha-power-inc.com**.—*Alpha/Power news release*

• **TAPR elects new officers:** John Ackermann, N8UR, is the new president of TAPR—Tucson Amateur Packet Radio. He was elected during TAPR's annual board meeting, held in conjunction with the 19th ARRL/TAPR Digital Communications Conference in Orlando, Florida, September 21-24. Ackermann, who had served as TAPR's vice president, succeeds Greg Jones, WD5IVD, who had served as president since 1993. Steve Bible, N7HPR, was chosen to replace Ackermann as vice president. Bob Hanson, N2GDE, was re-elected as secretary, and Jim Neely, WA5LHS, as treasurer. Ackermann credited Jones with leading TAPR through a period of growth and innovation. "His retirement leaves a void in TAPR that will be hard to fill," he said. Ackermann said that his primary objective will be to ensure that TAPR remains on the cutting edge of radio technology, with a special emphasis on emerging concepts such as software defined radios. The annual Digital Communications Conference attracted 135 amateurs. Conference *Proceedings* are available from ARRL for $15. Order Item 8144. DCC 2001 will be held in Cincinnati, Ohio, September 21-23, 2001.—*TAPR*

• **DARA accepting scholarship applications:** The Dayton Amateur Radio Association now is accepting applications for its annual scholarships. Applicants must be graduating high school seniors in 2001 and hold a valid FCC Amateur Radio license of any class. The DARA scholarships are awarded in varying amounts up to $2000, as determined by the scholarship committee, and may be used for tuition at an institution of higher learning as outlined in the application. To obtain an application, send a self-addressed stamped envelope to DARA Scholarships, 45 Cinnamon Ct, Springboro, OH 45066. Applications must be postmarked by June 1, 2001.—*DARA*

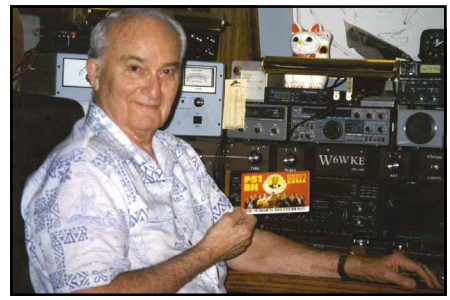
• **UK abolishes age restriction:** After discussions with the Radio Society of Great Britain, the UK Radiocommunications Agency has dropped the age restriction to obtain a "full" Amateur Radio license. Previously, applicants had to be at least 14 years of age or to have held a Novice license for a least a year. Now, applicants who have passed the radio amateur examination and either the 5 WPM or 12 WPM Morse code test for a Class A/B or Class A license respectively, may apply for a full license. "This initiative is part of the ongoing process to refine and improve access and facilities for amateurs," an RSGB announcement said. "Both parties feel that (in view of the increasing technical and operational ability of youngsters today) this restriction is a particular anomaly which ought to be discarded, and recognizing that those talented youngsters should be actively encouraged and nurtured."—*RSGB*

• **Coordinator steps into the void in New York, New Jersey:** A new, independent agency—the Metropolitan Coordination Association Inc, or MetroCor—has been formed to provide Amateur Radio frequency coordination for the New York City/Long Island, Northern New Jersey, and downstate New York region. MetroCor has notified the FCC, the National Frequency Coordinators' Council Inc, the ARRL, and the spectrum management councils in adjacent states of its intention to voluntarily provide coordination services for facilities operating on frequencies above 29.5 MHz. MetroCor has defined its service area to include Bronx, Kings, Nassau, New York, Orange, Putnam, Queens, Richmond, Rockland, Suffolk, Sullivan, Ulster, and Westchester counties in New York, and Bergen, Essex, Hudson, Hunterdon, Middlesex, Monmouth, Morris, Passaic, Somerset, Sussex, Union, and Warren counties in New Jersey. Visit MetroCor's Web site, **www.qsl.net/metrocor**, or e-mail **metrocor@qsl.net**.—*MetroCor news release* QST

Memories of DXing in the 20th Century

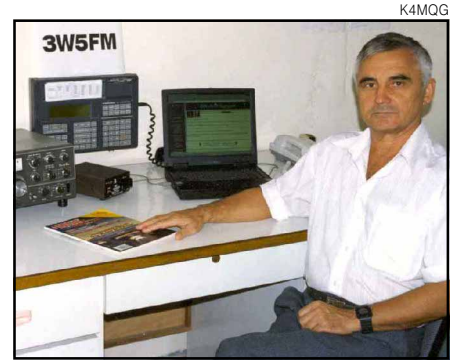
During the 20th century there were many DX stories, friends, DXpeditions and contacts made. This month we will review some of the highlights from the last century. We have also included a "How's DX?" Survey. Results from this survey will be published in a future issue of "How's DX?" The deadline for survey submissions is February 28, 2001. Send yours in today!—Bernie, W3UR

W6WKE



Ivor J. James, Jr., W6WKE, displays his P51BH QSL card he received last year. He was the first person in the US to work North Korea. Are you ready for the next P5 operation? It could happen at any moment. Several groups are working hard to make this one happen and soon!

K4MQG



Coly, 3W5FM/UA0FM, enjoys reading *QST* when he's not on the air or working. He is currently working with the oil industry in Southeast Asia.

Whether you believe the 21st century started on January 1, 2000, or will start January 1, 2001, it's time to reflect briefly on DXing in the 20th century.

You could say that DXing began in 1896 when Guglielmo Marconi made the first recorded communication of just 2 miles with no wires. Shortly afterward, amateurs were building their first transmitters. Most Amateur Radio operators know of the famous transatlantic communication by Marconi on December 12, 1901, between Cornwall, England and St. John's, Canada. In the early 1900s government agencies throughout the world recognized the need to regulate Amateur Radio.

On November 27, 1923, the first licensed Amateur Radio trans-atlantic QSO took place between Fred Schnell, 1MO, in Connecticut and Léon Deloy, 8AB (F8AB), in Nice, France. During the 20s and 30s DX distances were extended further. In the October 1935 issue of *QST* the 23-year-old Clinton B. DeSoto, W1CBD, realized that distance no longer mattered. It was time to work *places*, and thus he wrote the famous "How to Count Countries Worked —A New DX Scoring System." In 1937, the ARRL DXCC List was born, based on DeSoto's concept that "Each discrete geographical or political entity is considered to be a country." Frank Lucas, W8CRA, was the first to make DXCC, turning in 119 counters. Amateurs were off the air during World War II, so the DXCC program was restarted November 15, 1945. Charlie Mellen, W1FH, obtained the first post-war DXCC on April 2, 1947.

Léon Deloy, 8AB (F8AB), made Amateur Radio history in 1923 with his QSO across the Atlantic Ocean with Fred Schnell, 1MO.

DXpeditions and DXpeditioners

During the 20th century there were many DXpeditions and DXpeditioners. VP7NG is thought to be the first modern day DXpedition from the Bahamas in 1948 by Bob Denniston, VP2VI (ex W4NNN), Charley Orr, W4NND, and Buddy Buttizoni, W3GRP.

Other notable DXpeditions of the century include the 1978 FO0XA-FO0XH Clipperton Island team. They ushered in era of the multioperator, multi-transmitter, multi-dollar DXpedition. Remember ZA1A working the pileups by the first letter in your suffix? And just a few years ago VK0IR made 80,000 QSOs at the bottom of the sunspot cycle.

Some of the legendary men and women DXpeditioners of the 20th century who are no longer with us included Danny Weil, VP2VB; Gus Browning, W4BPD; Harry Meade, VK2BJL; Lloyd Colvin, W6KG; and Iris Colvin, W6QL. Thankfully, we still have the likes of Martti Laine, OH2BH; Ron Wright, ZL1AMO; Jim Smith, VK9NS; Franz Langner, DJ9ZB; Baldur Drobnica, DJ6SI; Kan Mizoguchi, JA1BK; Jacky Calvo, F2CW; and Eric Sjolund, SM0AGD. We also have many younger and up and coming DXpeditioners like Sigi Presch, DL7DF; Holger Hannemann, DL7IO; Andy Chadwick, G4ZVJ; Mark Demeuleneere, ON4WW; and the boys from the OK DX Foundation. Of course, there were also the *infamous* in the DX community including Don Miller, W9WNV; Roman Stepanenko, UB5RR; and Yasuo "Zorro" Miyazawa, JH1AJT.

We should never forget our DX brethren who passed away while trying to give a new one to so many. Gero Band, DJ3NG, and Diethelm Mueller, DJ4EI, died while trying to activate the Spratly Islands in April 1983. Ted, ZL2AWJ, and Chuck, K7LMU, were lost at sea after finishing their FW8ZZ DXpedition in the January 1966.

DX Pressmen

During the 20th century one of the DXers best friends was the DX pressman who brought us the news weekly, biweekly and monthly in both the DX bulletins and magazines. Gus Browning was able to make time between DXpeditions to do *The DXers Magazine*. Geoff Watts, who wasn't even a ham, gave us the *DX News Sheets*. Surely no one will forget the wit of Professor Cass, WA6AUD, who always made you think after reading *DX IS!* At one point Chod Harris, VP2ML, was writing three different publications! *The DX Bulletin*, *QRZ DX* and *Long Skip* all had multiple editors. Monthly magazines enjoyed illustrious DX column editors such as Dick Spencely, KV4AA; Rod Newkirk, W9BRD (now VA3ZBB); and Urb LeJeune, W2DEC. Now with the Internet, the news can be disseminated much quicker, and to a broader base.

Bernie McClenney, W3UR ♦ 3025 Hobbs Rd, Glenwood, MD 21738-9728 ♦ w3ur@arrl.org

More Heroes

We can't end the 20th century without thanking all the QSL managers and QSL bureau personnel who delivered us so many new ones over the years. One of the best tools a DXer has in his shack is the computer. Amateur Radio operators can now use these devices to help make better antennas, log QSOs, print QSLs, predict band openings and calculate where to turn their antennas. DXers and contesters can thank Dick Newell, AK1A, and Ken Wolff, K1EA, who created *PacketCluster* and *CT*, two software packages that revolutionized ham radio.

Conclusion

I'm sure I have forgotten others who helped create, mold and shape the DX world in the 20th century; I was only there for the last quarter. During this next century there are bound to be more enhancements to the hobby. E-QSLs are right around the corner, but what else can we expect during the new millennium? We should all look forward to DXing in the 21st century and encourage our friends to join in on the thrill of working the rare, illusive and exotic DX.

WRAP UP

That's all for this month. Season's greetings, and Happy New Millennium to all DXers. May you work many new ones this coming year. Keep those letters, pictures, questions and newsletters coming. This month I would like to thank the following people for helping to make this column possible: AA9OZ, DJ9ZB, KN2N, N1FOC, NC1L and W6CF. Until next month, see you in the pileups!—*Bernie, W3UR*

How's DX 2001 Survey

Please take the time and fill out the following survey. You can submit it by mail to How's DX 2001 Survey, 3025 Hobbs Rd, Glenwood, MD 21738; by fax at 301-854-5105, or by e-mail to **w3ur@arrl.org**. You can also take the survey online at **www.dailydx.com/howsdx.html**. Please feel free to also include comments and photos!

1. How long have you been licensed?
(a) less than 1 year (b) 1-5 years
(c) 5-20 years (d) 20 or more years

2. How many current countries have you worked?
(a) less than 100 (b) 100-200 (c) 200-300
(d)300-325 (e) 325-334

3. How old were you when you were first licensed?
(a) less than 15 (b)15-30 (c) 31-50
(d) 51-80 (e) 81 or older

4. What is your current age?
(a) less than 15 (b)15-30 (c) 31-50
(d) 51-80 (e) 81 or older

5. What is your sex?
(a) male (b) female

6. What is your current license class?
(a) Novice/Technician (b) General (c) Advanced
(d) Extra (e) non-US license

7. Do you have e-mail?
(a) yes (b) no

8. Do you have access to the Internet?
(a) yes (b) no

9. How much time (average) do you spend on the air each week?
(a) less than 1 hour (b) 1 to 5 hours
(c) 6-10 hours (d) more than 10 hours

10. What modes are you actively chasing DX on?
(a) CW (b) SSB (c) RTTY
(d) SSTV (e) other (f) PSK31

11. What bands are you actively chasing DX on?
(a) 6 (b) 10 (c) 12
(d) 15 (e) 17 (f) 20
(g) 30 (h) 40 (i) 80
(j) 160

12. Do you chase band countries?
(a) yes (b) no

13. Do you chase mode countries?
(a) yes (b) no

14. Do you use a computer for logging?
(a) yes (b) no

15. Are you a member of the ARRL?
(a) yes (b) no

16. Are you a member of a DX club?
(a) yes (b) no

17. Are you a member of a general interest club?
(a) yes (b) no

18. Have you ever worked a DX station on a list or net?
(a) yes (b) no

19. How high is your highest antenna above ground?
(a) less than 10 feet (b) 11 to 50 feet
(c) 51-99 feet (d) 100 feet or more

20. What is the most power your station is capable of running?
(a) up to 100 W (b) 100-499 W (c) 500-999 W
(d) 1000-1500 W (e) more than 1500 W

21. How old is your rig?
(a) less than 1 year (b) 1 to 5 years
(c) 5-10 years (d) more than 10 years

22. How would you best describe your rig?
(a) top of the line (b) good
(c) so-so (d) time for a replacement

23. How would you best describe your antennas? (circle all that apply)
(a) mono bander (b) multiband Yagi or quad
(c) vertical (d) dipole (e) other

24. Do you own an amplifier?
(a)yes (b) no

25. Do you own a tower?
(a)yes (b) no

26. What Amateur Radio magazines do you subscribe to?
(a) *QST* (b) *CQ*
(c) *WorldRadio* (d) others

27. Which DX bulletins do you read? (circle all that apply)
(a) 425 DX News (b) ARRL (c) OPDX
(d) Daily DX (e) QRZ DX (f) 599

28. How often do you read "How's DX?"
(a) never (b) sometimes
(c) most of the time (d) always

29. If someone asked you to name your main interest in Amateur Radio, what would you say?
(a) general interest (b) contesting (c) DXing
(d) rag chewing (e) public service (f) other

30. Have you ever read a book about DX?
(a) yes (b) no

31. How much money do you spend per year on Amateur Radio?
(a) less than $500 (b) $500-$2499
(c) $2500-$5000 (d) $5000 or more

32. Have you ever operated Amateur Radio outside of your country?
(a) yes (b) no

33. What country do you live in?

A Tear for Christmas

By Joseph Tyo, KB2WII, AEC Herkimer County SKYWARN, Oneida County Traffic & Emergency Net

Public service events are easy to find except in wintertime. A few years ago, I was looking for a winter event for the Fort Herkimer (New York) Amateur Radio Club. Remembering my very first organized ham activity, I thought of traffic nets. But how would I apply this to a public service event? A holiday message service to friends and family for nursing home residents! A problem was timing; this was a busy season with seemingly endless school choirs, cookies and punch, and so on. Would we fit in?

I met with the activities director and the CEO of a small nursing home where my wife, Kathy, is a nurse, to get permission to operate the radios there. I assured them that the resident and family names and locations provided to us would only be used to deliver messages and generate replies. With minor restrictions to my plan, they consented. We decided on two pre-formatted messages to use; we got four hours for setup, operation, and take down.

We placed two ARRL message forms on a page—the top half was one of the two pre-formatted messages. The bottom message was left blank to record replies. We did a quick training session with the home's activity staff; they began canvassing residents for names of addresses and for the choice of messages. The staff also wrote messages of their own.

The day of the event, Larry Shaul, KC2AOP, Ray Thibodeau, KB2WRP, Ron Knox, KC2ENH and I set up equipment and fed coax out the window to a vehicle with a $^{5}/_{8}$-wavelength 2-meter antenna. We didn't want RF in the building, which might cause havoc to medical monitors, computers or telephones. The trustee of a little-used repeater offered his system. We'd provided Mike Brunet, N2OJI; Chris Bouck, KB4CMF; Jack Roux, KB2TXR; Jack Roshia, KA2ZNZ; George Heppe, W2PII; Kay Kingsford, NN2H; Tom Hesler, N2LTC; Terry Kennedy, N2KPR; Al Topalian, N2CCN; and Don Woodruff, K2YAI with the pre-formatted wording, and they received and delivered messages from home. The fun began when the staff brought residents with their messages to watch us.

Lessons learned: the medical staff should *print* messages—ever try reading their handwriting? Send local messages first (specifying Hotel X-ray Echo); they generate replies in the shortest time, pleasing the residents. Sending pre-written messages is easy with book traffic. We kept a log showing messages sent via whom, and whether a reply was received. Some were received within minutes. The reply was placed on the original message sheet. The replies were brought to the residents by the staff or they accompanied us to the room (this was for our safety as well as the residents).

We handled 27 messages; another 51 were sent by week's end—not bad for our first try. Cross-state or cross-country messages were sent five at once, and instructed that replies be sent via a particular station, a central collection point. Most replies took two days to return. Staff members enjoyed the event so much that they asked us to come back next year. We did, operating from a second nursing home. The message count jumped dramatically. We handled over 250 messages; we were a hit!

Just as I was leaving the nursing home that first year, I received three replies, all to the same resident. After checking with the staff I found the resident's room, knocked, walked in, introduced myself and told her I had answers to her messages. I read the first reply; she commented, "How nice of them." As I read the second, she reached for her tissues. As I said good bye, she thanked me. While I walked down the hall, I realized my Christmas gift had arrived early. If you give someone even a little time, you receive a holiday gift you never thought you would have welcomed—a tear for Christmas. I challenge every club to provide a holiday message service for a nursing home, veterans home or children's hospital.

ALAMANCE COUNTY, NC, STORM EMERGENCY

By Roger Jefferson, AC4U, PIO

Thursday, May 25 began as a bright day in Alamance County, North Carolina. Only a few clouds were visible. Everything changed at 10 AM when a severe storm unexpectedly developed, producing heavy rain and winds in excess of 80 miles per hour. Large old oak trees that had withstood over a century of violent weather were no match for this storm. Utility poles and electrical lines snapped as the trees fell. Trees also toppled onto cars, homes and businesses. Normal communications were lost, and shortly afterward, EC Dwayne Ayers, N4MIO, and DEC Gene Scarborough, W4YBQ, activated ARES from the Emergency Operations Center station. Hams were dispatched to local schools and used the 147.375 MHz Graham Repeater Association (GRA) repeaters.

The North Carolina Baptist Disaster Relief set up in Burlington. Burlington lost power to the pumping station for their municipal water supply; only four hours supply of water was in holding tanks. Commercial power was lost to the GRA repeater, and two hours of continuous operation weakened the batteries. David Thompson, K4GWH, arrived at the repeater site and supplied power with his car battery until a gasoline generator was delivered and placed in service. Emergency shelters were opened; 49 homes were destroyed, 297 had major damage and 140,000 customers lost power (five days later, 10,000 customers were still without power). Damage to businesses, homes and public facilities totaled $16 million. Interstate highways were closed temporarily for repairs to utility poles.

One of the Alamance County homes completely destroyed in a May storm.

ARES was the lifeline of the community in a time of distress. The importance of the ham support of ARES and repeater organizations cannot be emphasized enough.

SPONTANEOUS FOX HUNT HELPS MAKE ARRESTS

By Rick Crider, KD4FXA

The drive home to Anson County, North Carolina, from a family outing last May took an interesting twist. I had the UHF portion of my dual-band mobile rig in scan mode with the volume down. Nearing the house, I increased the volume, switched to the city's public safety frequency and heard a rude comment directed at the squad's supervisor. Apparently, the malicious interference had been going on for hours. Robbie Dale, KT4TF, and Johnny Knight, WB4U, soon called me on the VHF repeater to say that the police lieutenant had requested our assistance. A foxhunt was underway!

I threw the Doppler equipment in the truck while Robbie drove to my house. He confirmed that the signal was inaudible from his house. Johnny also confirmed there was no signal in the southern part of town. We made a couple of quick assumptions: Considering the weak signal, the perpetrator was probably using a hand-held transceiver and would be located east, north or northwest of the city. I headed east. Robbie headed northwest.

I combed the eastern part of town, never hearing a trace of signal. An hour passed waiting for the suspect to transmit. Then the squelch broke—a signal! The duration wasn't long enough to register a Doppler bearing. I had three choices at the intersection: left, right or straight. I chose straight and the Doppler unit finally registered. Robbie and I converged, made north-south sweeps and saw that the signal came from a housing development. Now to figure out which house!

My conspicuous-looking truck suddenly became a disadvantage. It was spotted right away and the transmissions ceased abruptly. We left the scene and called the lieutenant to pass along our information. While we'd been DFing, a female officer had lured the suspect into calling 911. He dialed a friend who initiated a three-way call to 911. The E-911 system read out the friend's address. The 911 police staff, relying on their system instead of the opinion of two hams they'd never met, felt they had their suspect. I told the lieutenant that regardless of the E-911 system, the signal was clearly originating from *our* location. Officers arrested all three individuals involved.

The officers and dispatchers excelled at keeping the suspect on the air for us. The scenario proved to be an excellent learning experience for all. City and county agencies now realize that the local ham community has the equipment and knowledge to quickly track down rogue transmitters. For our part, we realize that we need to vary our training exercises. QST

N8RDP

A division leader (left) for the Anchor Away Rose Parade thanks Brad Chase, N8WIX, for communications handled by Jackson County (Michigan) ARES members between parade units and the command post.

Field Organization Reports

Public Service Honor Roll
September 2000

This listing is to recognize amateurs whose public service performance during the month indicated qualifies for 70 or more total points in the following 8 categories (as reported to their Section Managers). Please note the maximum points for each category: 1) Checking into a public service net, using any mode, 1 point each; maximum 60. 2) Performing as Net Control Station (NCS) for a public service net, using any mode, 3 points each; maximum 24. 3) Performing assigned liaison between public service nets, 3 points each; maximum 24. 4) Delivering a formal message to a third party, 1 point each; no limit. 5) Originating a formal message from a third party, 1 point each; no limit. 6) Serving as an ARRL field appointee or Section Manager, 10 points each appointment; maximum 30. 7) Participating in a communications network for a public service event, 10 points each event; no limit. 8) Providing and maintaining an automated digital system that handles ARRL radiogram-formatted messages; 30 points. Stations that qualify for PSHR 12 consecutive months, or 18 out of a 24-month period, will be awarded a certificate from HQ on written notification of qualifying months to the Public Service Branch at HQ

947
NM1K
554
K9JPS
459
AD4IH
451
N5JZ
415
K5NHJ
401
KK5GY
363
KB8ZYY
312
WA5OUV
279
KJ3E
273
W7TVA
268
WB8SIW
249
KB5WEE
237
W6DOB
234
WD8V
223
K7VVC
222
KF4NFP
213
K7VVC
206
WB5ZED
KA2ZNZ
202
WA9VND
201
KK3F
198
NN7H
185
N2OPJ
184
W4ZJY
K7BDU
182
N2LTC
181
KA4FZI
180
KA5KLU
176
WX8Y
WB2UVB
175
KB2RTZ
W5ZX
174
N5IKN
172
N2YJZ
W6IVV
171
K9FHI
170
W4EAT
169
K4SCL
N2RPI
KA2GJV
168
W4CAC
K6YR
N2KPR
K1JPG
167
KV4AP
166
KB2VVB
165
WA1JVV
N9VE
164
KC2AHS
KC5OZT
161
N7YSS
WB4GM
W6QZ
N7YSS
159
N8JGS
158
KC4TLG
W8YS
W0OYH
N8IO
157
N8FPN
N2JBA
WA3HJC
156
N5OUJ
KC4ZHF
154
K0IBS
WN0Y
151
WA5I
150
KB2VVD
N2CCN
KB2KLH
148
W3YVQ
147
WB5NKC
146
WA1FNM
N5NAV
144
WO0A
N8BV
NR2F
143
KA1GWE
W2RJL
142
N2WDS
KJ4N
KB5W
141
AB4XK
WA4DOX
N1LKJ
KA2CQX
140
K4RBR
WD9HII
WA2YBM
W2MTA
W7ZIW
139
KT4PM
WB2ZCM
KD4GR
138
N0SU
K3JL
KT6A
W0LAW
W7GB
N9BDL
137
WD4JJ
136
K8GA
KC5VLW
135
KK1A
WB4TVY
N2AKZ
134
KJ9J
W5GKH
NY2V
132
N3WKE
AA3SB
NZ1D
AF4NS
131
K5DPG
WD9FLJ
130
WB0ZNY
W9CBE
WB2QIX
KB5TCH
129
KC7SRL
W1PEX
W0WWR
K5IQZ
W3VK
KD1LE
WB2FGL
W7NWP
N7AIK
KA4UIV
128
KE4JHJ
KI4YV
WD8DHC
W2EAG
WA0TFC
NN2H
WB2GTG
K4BG
127
WA4QXT
W9YCV
W2FR
W7GHT
126
KC8CON
KB2VRO
KC2EOT
K4FQU
124
K8KV
K9LGU
123
W1ALE
WA2UKX
WU4C
K7MQF
122
W3CB
121
KE1AI
W2AKT
K0PIZ
K4DMH
120
W7VSE
W5CDX
W3BBQ
K9GBR
AA2SV
K7GXZ
119
NC4ML
K8AE
K4MTX
118
N7DRP
K4IWW
W4CKS
KA8WNO
W4UAN
N3WK
W9ZY
KF6OIF
N9TVT
AF2K
KA2DBD
KG2D
KE4IFD
117
AA8SN
WB2LEZ
N8DD
116
KR4MU
WD0GUF
115
N9MN
114
WI8K
KB0DTI
AD6LW
KB2ETO
113
KC7ZZB
WX4H
112
KC2DAA
K2PB
KC6NBI
AG9G
WI2G
KB4DXN
KC6SKK
111
WW8D
KF4KSN
W2MTO
110
KT4TD
N1JBD
WB5NKD
109
KA9EIZ
N9KNJ
W1JX
W8SZU
WA4EIC
108
AA4YW
AC4CS
W4DGH
K5MC
W1QU
W2JHO
W4WXA
K4WKT
107
W2PII
106
W3IPX
105
KB2WII
WA8SSI
W6JPH
KJ7SI
WB7VYH
104
KA1VEC
KE4VBA
N5JUU
N5GG
103
KC3Y
K2DN
W5AYX
102
K1STV
K2DBK
AF4QZ
101
K6AGD
K2VX
N3SW
99
W4CC
W4XI
KB3AMO
98
AD4XV
K4YVX
97
KF5A
KC8GMT
KG5GE
W2GJ
WA2CUW
KE4GYR
96
K8VFZ
W1JTH
95
AA3GV
94
W4PIM
WB4PAM
KG4CHW
93
KC7SGM
K8ZJU
AA8PI
W2GUT
92
W2LC
K3TX
KD4HGU
91
KO4OL
90
WA8DHB
AA4AT
KA2ZKM
KE4DNO
W7QM
W3OKN
89
WB4ZNB
KA4LRM
87
W2CC
K1SEC
WA4GLS
WA4CSQ
86
KR4MA
KE0K
W7LG
85
K8PJ
84
K8LEN
82
W4QAT
WA1QAA
81
WA2YOW
WB9GIU
WA4EYU
80
KE3FL
N1IST
N2JRS
AA4BN
78
KC7SGL
AF4CD
77
K3UWO
75
W4SEE
WB4UHC
N3WAV
74
K3CSX
KB4WBY
73
KE4PAP
N4MM
KM4WC
72
AE4MR
N1SGB
70
K4BEH
N4JAQ
KA7TTY

The following stations qualified for PSHR in August but were not listed in this column last month: W6QZ 159, N2CCN 146, W6JPHJ 123, KC6SKK 108, KA8VWE 83.

Section Traffic Manager Reports
September 2000

The following ARRL Section Traffic Managers reported: AK, AR, AZ, AL, CO, CT, EMA, ENY, EPA, EWA, GA, IA, ID, IL, IN, KS KY, LA, ME, MI, MN, NC, NFL, NH, NNJ, NTX, NV, OH, OK, OR, ORG, SC, SD, SDG, SFL, SNJ, STX, TN, VT, WI, WMA, WNY, WPA, WCF, WV, WWA, WY.

Section Emergency Coordinator Reports
September 2000

The following ARRL Section Emergency Coordinators reported: AL, CT, ENY, EWA, IN, KS, KY, LA, NFL, NLI, OH, SD, SFL, STX, SV (north), VA, WCF, WMA.

Brass Pounders League
September 2000

The BPL is open to all amateurs in the US, Canada and US possessions who report to their SMs a total of 500 points or a sum of 100 or more origination and delivery points for any calendar month. All messages must be handled on amateur frequencies within 48 hours of receipt in standard ARRL radiogram format.

Call	*Orig*	*Rcvd*	*Sent*	*Dlvd*	*Total*
NM1K	810	1015	1311	11	3147
WX4H	6	872	790	8	1676
KK3F	17	110	1044	56	1227
W9IHW	3	512	33	463	1008
K7VV	37	429	466	8	940
K9JPS	0	465	41	424	930
W5SEG	38	481	410	0	909
W1PEX	0	98	786	15	899
AD4IH	335	56	366	5	762
WB5ZED	6	402	330	22	760
N5JZ	292	89	300	21	702
N2LTC	0	319	358	14	691
W6DOB	28	262	292	61	643
K5NHJ	261	61	292	26	640
KB5W	2	304	283	2	591
N5IKN	13	284	284	0	581
WA9VND	7	334	223	17	581
W9YPY	0	268	268	32	568
KT6A	0	279	285	0	564
K7BDU	12	255	259	4	530
KA1VEC	17	239	249	15	520
KF5A	0	283	49	288	514
KC5OZT	2	243	236	24	505

BPL for 100 or more originations plus deliveries: KJ3E 151, KB5WEE 117. QST

Airplane Reflections at 10 GHz

Metal objects larger than several wavelengths in effective cross section make excellent radio reflectors. If the reflector is an airplane flying thousands of feet above sea level, it is possible to make interesting non-optical contacts over several hundred kilometers distance via airplane reflections.

Airplane reflections happen unintentionally all the time. The fluttery quality that sometimes appears briefly on signals during ordinary VHF or UHF contacts is usually due to an interfering aircraft reflection path. Some stations have planned contacts that are otherwise difficult or impossible (due to blocking terrain, for example) that use solely airplane reflections. This is a quite popular sport on 2 meters in Australia, for example, but it is relatively easy on any band at VHF and higher. (Peter Martinez, G3PLX, has charted aircraft reflections for a *QEX* article.[1]—*Ed.*)

Planning 10 GHz Airplane-Scatter Contacts

Phil Lee, W6HCC, has been making 10 GHz aircraft-reflection contacts over the past several years. His success has been based on careful planning, rather than the chance passage of an airplane at the right altitude and location. He discovered that the approaches and departures for major commercial airports take place along designated routes and altitudes. Phil planned his contacts using such predictable information.

He found, for example, that the approach routes to Los Angeles International Airport (LAX) cross Southern California at between 12,000 and 17,000 feet, ideal for completing well chosen 10 GHz paths over several hundred kilometers. During busy times, Phil calculated that aircraft could traverse the approach as often as every 80 seconds or so, assuming a spacing between planes of 5 miles (8 km).

At least one approach to LAX—where aircraft descend through 16,000 feet—could support a 350 km contact between Keller Peak in Southern California and somewhere along Interstate 8 in southern Arizona. See Figure 1 for a profile. This was the plan for one of the first such contacts Phil attempted.

Success

Phil first completed a 10 GHz airplane-reflection contact over this 350 km path with WA6EXV in 1993. W6HCC subsequently made other contacts as long as 650 km with WB6CWN, most notably from Blue Ridge, California (DM14), to Elk Mountain Ski Lodge, Utah (DM38), using the same techniques. SSB signals were usually fluttery with slight Doppler shifting; at times, narrow-band FM was actually easier to copy.

W6HCC ran 15 W from a Siemens traveling-wave tube to a 1.2-meter dish mounted on the bed of his pick-up truck. A preamplifier with a 1.4-dB noise figure is mounted on the back of the dish. All his equipment runs from a 24 V battery system. WA6EXV has a similar setup, but his mobile station generated 40 W. WB6CWN used a portable station similar to Phil's.

This Month

December 14	Geminids meteor shower peaks
December 17	Very good EME conditions

Planning Your Own Aircraft-Scatter Contacts

Aircraft descent profiles are probably necessary for planning successful contacts. Profiles for major airports are published as separate sheets by Jeppesen and can be purchased at the flight-operations center of any airport. Keep in mind that both stations must be simultaneously within the aircraft radio line-of-sight to complete a contact. The radio line-of-sight distance in kilometers from an aircraft to a sea-level horizon can be approximated by taking the square root of 5.2 times the altitude of the aircraft in feet (or 17 times the altitude in meters). Intervening terrain must be taken into account.

The classic radar equation can be used to calculate expected path loss, signal strength and practical distances. See the ARRL *UHF Microwave Experimenter's Manual*,[2] pages 3-28 and 3-29, for more detailed discussion of the application of

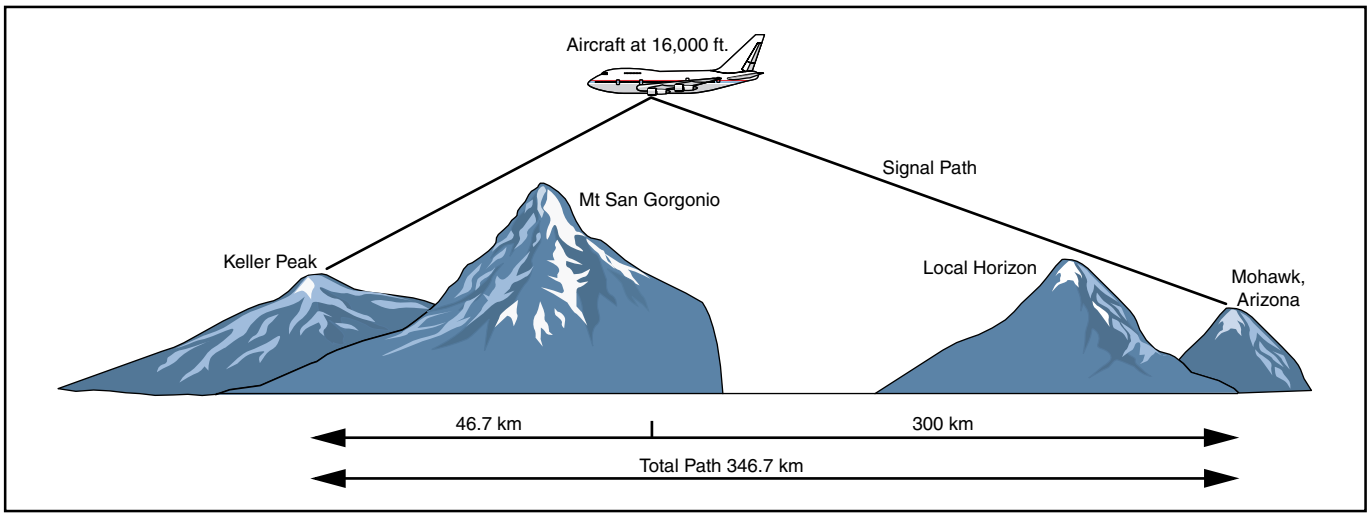
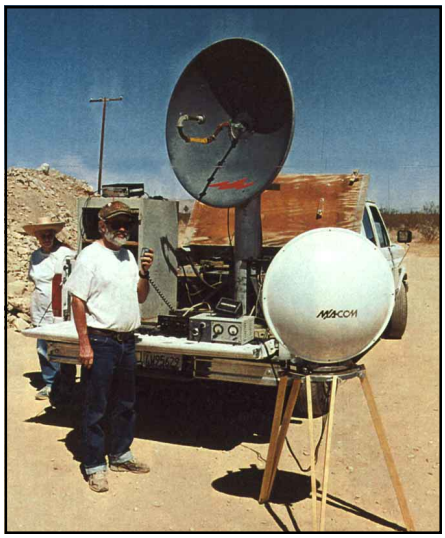


Figure 1—A generalized profile of a 10 GHz airplane-scatter contact between WA6EXV on Keller Peak, California (DM14) and W6HCC on a rise along I-8 near Mohawk, Arizona (DM32).

Emil Pocock, W3EP ♦ Box 100, Lebanon, CT 06249 (Voice 860-642-4347, fax 860-594-0259) ♦ w3ep@arrl.org



Phil Lee, W6HCC, set up for 10 and 24 GHz airplane-reflections contacts. The 1.2-meter Andrew dish mounted on the truck bed is set up for 10 GHz. Phil also runs 24 GHz FM, using a 100 mW Gunn oscillator and the M/A-COM 0.5-meter dish in the foreground. That is Marilyn, Phil's wife (now deceased), in the background.

the radar equation to aircraft-reflection paths. Calculations show that the longest distance for two sea-level stations using an aircraft flying at 40,000 feet is about 900 km. Most practical contacts are likely to be shorter than this, but station locations significantly higher than local terrain can extend distances.

The radar equation also shows that the longest contacts take place when a high-flying aircraft is at the midpoint between the two stations, but that is also when path loss is greatest. Path loss is least (and thus signals the strongest) when the aircraft is significantly closer to one station than to the other. That is the configuration in Figure 1, the 347-km contact between WA6EKV and W6HCC, which probably contributed to their success.

Phil Lee, W6HCC, would be happy to help you get started with aircraft reflections or to make a contact if you are in the Colorado area, where he now lives. You can e-mail Phil at **pwlmml@compuserve.com**.

ON THE BANDS

Activity on all bands during September seemed sluggish in comparison with August, despite the ARRL VHF and 10 GHz contests, a great aurora, some tropospheric ducting across the eastern half of the country and the beginnings of worldwide DX on 6 meters. Thanks to N4KZ, K5CM, KD5HPT, WB5HJV, W7FI, KR0I, G4UPS, TI5KD and everyone mentioned in the summaries for their reports. Dates and times are all UTC and distances are in kilometers (1 km = 0.6 mile), as is the usual custom.

Six Meter DX

Worldwide 50 MHz DX continued to make a fitful start into the fall and winter season, just as NOAA pushed its prediction for the peak of Cycle 23 into early 2001. This is good news for DX prospects this fall. September's activity probably pales in comparison to what has already been worked in October and November, but here it is for the record.

South America

John Butrovich, W5UWB (EL17), worked a pair of Argentine stations on September 3 to start off the month's DX. Indeed, South Americans (primarily LU, CX, PY and CE) worked widely throughout the US on at least 10 late afternoons during September. XE3/W0AH made 23 QSOs with LU, CX and CE stations over the September 9-10 contest weekend.

The best session was probably during the September 17-18 aurora, which often enhances north-south F-layer paths. Many strong PY, LU and CX stations worked widely from the East Coast to the Rocky Mountains between 2300 and 0200. LW5DX logged more than 100 US stations during this time frame. Jon Jones, N0JK (EM28), Victor Scarbro, KD5HPT (EM32) and others found 9Y4AT among the pileups. Howard Sine, WB4WXE (EM74), added ZP5ZR to the list. YV4DIG and YV4DDK worked widely throughout the W4, 8, 9 and 0 call areas.

The most interesting DX probably came on September 30 after 2115, when AE4RO, K2RTH/4 and possibly others in Florida found VP8CSA in the Falkland Islands. The Falklands will certainly be widely sought after as the season progresses.

South Atlantic, Africa and the Indian Ocean

North-south paths between Europe and Africa also showed a bit of life. Mediterranean countries (such as EH, I, SV and 4X) worked into southern Africa, logging 5N9EAM/8, 5R8FU, 7Q7RM, C91RF, TR8XX and others on several days. Tal Izsak, 4X6HI, worked PY2XB, PY5CC and PY2CDS on September 22. PY5CC also found Z22JE and FR1AN among other early season east-west paths.

Asia and the Pacific

North American stations worked across the Pacific during September, most notably on September 18. Stations throughout the West and scattered as far east as Colorado, South Dakota and Kansas worked Australia and New Zealand after 0000. Brian Allen, N0VSB (DM79), logged four VK4 stations and WH6O from Colorado, for example. W7XU/0 and N0QJM (both EN13) in South Dakota logged VK2s and VK4s that evening. Roman Flores, XE2EED, worked VK, ZL, KH6 and V73AT.

Activity further east along the Pacific Rim also began to pick up. Steven Beesley, VR2XMQ, reported that he and other Hong Kong 6-meter operators worked 7Q7LA on September 14, their first African contacts of the season. On September 24, the Hong Kong crew logged FR1AN in the Indian Ocean, and FO3BM and T30JH in the Pacific. T30JH (that's Western Kiribati) also worked several ZL, VK, YB and KH6 stations, as well as 3D2TC, FO3BM and P29BPL, primarily on September 19.

Among the many September catches for the ever-eager Japanese operators were a number of VK, ZL, DU, YB and KH6 stations, as well as 9V1JA, 9M2TO and VQ9JT. JG3HBO snagged OM3PC and PA7MM, and it is likely that there were other contacts between Japan and Europe during the month. September 11 also must have been a good day. EY8MM worked into Australia, VP6PAC worked HP2CWB, and KH6ND/KH5 made a number of contacts into Japan.

Aurora

An intense aurora over the evening of August 17-18, 2100 to 0200, provided yet another opportunity to make contacts on 50 through 432 MHz as far south as Arizona, Texas and Florida. Dick Hart, K0QMS (EN31), stumbled upon the distorted aurora signals while running a 2-meter meteor-scatter schedule with KR4QO (FM03) in South Carolina. The pair abandoned meteor scatter and completed quickly on aurora! San Hutson, K5YY (EM26) in Arkansas, made 22 contacts on 144 MHz extending from KI7WB (DN62) in Wyoming to K1UHF (FN31) in Connecticut.

The aurora also expanded well to the south. Ken Reecy, AC4TO (EM70), in the Florida panhandle heard K0QMS and W8WN (EM77), but could not attract the attention of either station. Ken did go on to work N4KZ (EM77) and AA4H (EM86). Russ Holshouser, K4QI (FM06) in North Carolina, made 75 QSOs on 144 MHz, including one with W5UWB (EL17) in southern Texas for the second time this summer. This was undoubtedly the most southerly contact on 144 MHz or higher during this aurora session. Russ also worked west to N0LL (EM09) on 222 MHz and made a lone 432 MHz contact with W3EP (FN31).

A number of other stations actively sought contacts on 222 and 432 MHz. N0LL made three additional QSOs on 222 MHz. Chris Cox, N0UK (DM59), completed with W9UD (EN41) and W6OAL/0 (DM59) also on 222 MHz. Dick Wilborg, W1ZC (FN42), made his first-ever 432 MHz aurora contact with W3EP and went on to work K4RTS (FM08).

Tropospheric Ducting

Tropospheric-ducting conditions at 144 MHz and higher were generally good across the eastern half of the country from September 5 to 9. The opening extended from Minnesota south to Oklahoma and Texas, and east to Ohio during the first two days. On the morning of September 5, Darren Ream, W5DKE (EM12), made several contacts as far north as K0QMS in Iowa from his northern Texas location. Sam Whitely, K5SW (EM25) in Oklahoma, worked as far north as KC0BZE (EN35) on 222 MHz and east to W8MIL (EN74) on 144 MHz during the evening. The longest contacts were in the 1300-km range.

Signals were quite strong at times, as attested by Terry Johnson, KC8CCZ (EN57) from the Upper Peninsula of Michigan. He ran a string of 2-meter FM contacts southeast to Washington DC and southwest to KE5KR (EM15) in Oklahoma for his longest contact of nearly 1500 km. Terry was helped by his 150 W and two 13-element Yagis.

During the subsequent two days, the opening clearly shifted eastward. On September 6, Ed Fitch, W0OHU (EN34), still had a good path from Minnesota to EM17 in Kansas, but he also hooked up with K2TXB (FM29) in New Jersey on 432 MHz, among nine QSOs he had on that band. The next evening, Ed again found stations as far east as New York and New Jersey on 144 and 432 MHz, including W2DRZ (FN02) and K2SMN (FN20). His longest contacts were in the 1500-km range.

After 0100 on September 7, the opening

had expanded from Kansas in the west to New York and Connecticut in the east. Jon Jones, N0JK, drove to his favorite portable site in the Flint Hills of eastern Kansas (EM28) and immediately began working stations as far eastward as Illinois on 144 MHz. After 0300, Jon was into Ohio and Ontario. His longest contacts were with western New York stations W2DRZ (FN02) and NQ2O (FN13) at about 1600 km, or just about 1000 miles. Jon also heard Connecticut stations W1COT and K1UHF, but could not raise them.

Bob Leiper, W1COT, was quite active that evening. Ironically, his first QSO (at 0127) with W0EKZ (EM17) in Kansas over a 2125-km path ended up being his longest contact of the entire opening. Bob worked nearly all the states in between and continued running 2-meter stations across Ontario, Ohio, Indiana and Illinois the next morning.

By the evening of September 7-8, W1COT was also working stations from Virginia to South Carolina as well as the Midwest. During the morning of September 8, the Midwesterners were gone and the only DX remaining was from the Carolinas. W1COT worked as far south as W4VHH (EM95) in North Carolina, about 1000 km distant, with extremely loud signals.

Microwaves

The generally good tropospheric conditions of September 5 through 9 also provided the growing microwave crowd with DX opportunities. Dave Petke, K1RZ/3 (FM19), noticed the very strong signals on 144 MHz around 0300 on September 8 and began looking for stations to run with him on 10 GHz. His first 10 GHz contact was with K1UHF (FN31) over a 383 km path. Dave went on to work WA1ECF (FN31) at 632 km, WA1VVH (FN42) at 601 km and K2TXB (FM29) at 222 km. That was a nice string of QSOs from home stations.

During the second weekend of the ARRL 10 GHz and Up Cumulative Contest this past September 16, K6GZA and AD6FP completed a 24 GHz SSB contact over a 373 km, for a new claimed North American DX record. The existing record of 267 was also made in California during July 1997.

AD6FP was on Mt Frazier with a 1.2-meter dish, a 500-mW transmitter and a receiver with a 4-dB noise figure. K6GZA set up on Mt Oso with a similarly sized dish, 100 mW and a receiver with a 5-dB noise figure. They used 10 GHz to help align the dishes with the accuracy needed to make contact. Signals were 55 to 57.

NOTES FROM ALL OVER

Two-Yagi 432 MHz EME

Many single-Yagi 2-meter stations have made EME contacts, usually with stations using much larger antennas. There have been a few EME contacts between 2-meter stations using just two Yagis each and a least one notable 144 MHz EME contact between stations running single Yagis. Such feats are more difficult on the higher bands. Thus, the 432 MHz EME contact between EA3DXU and IK5QLO completed a year ago was notable because both stations used just two Yagis.

Josep Prat, EA3DXU, had been making 432 MHz EME contacts for several years with some success running 1350 W and two 38-element Yagis. Josep had completed the first 144 MHz EME contact between two-Yagi stations with PA0JMV in 1998, and he hoped to repeat this feat on 432 MHz.

He set up a 432 MHz EME schedule with IK5QLO, who had two 28-element Yagis and 1000 W. On December 23, the pair completed with "O" reports on both ends, for perhaps the first two-Yagi to two-Yagi EME contact on that band. On August 26, EA3DXU made a random 432 MHz EME QSO with UA3PTW, and only later learned that the Russian was also using just two 35-element Yagis.

More 144 MHz Ionospheric Forward Scatter

After some months of trying, Don Stradley, WA1JOF (FN44), in Maine and Dick Hart, K0MQS, in Iowa, completed a 2-meter ionospheric forward-scatter contact on August 31 at 1540. The distance was 1848 km, typical for this propagation mode, but the weak fluttery CW signals were perfectly readable. The Yagi arrays at both stations were pointed about 5° south of the great-circle path at the time.

Notes

[1]P. Martinez, G3PLX, "Narrow-Band Doppler Spectrum Techniques for Propagation Study," *QEX*, Sep 1999, p 45.

[2]*The ARRL UHF/Microwave Experimenter's Manual* (Newington: ARRL, 1990-1997) is Order No 3126, $20. ARRL publications are available from your local ARRL dealer or directly from the ARRL. See the ARRL Bookcase elsewhere in this issue or check out the full ARRL publications line at **www.arrl.org/shop/**.

Six-Meter DXCC Leaders

Many keen US and Canadian DXers have been disappointed by the limited opportunities to work new countries on six meters the past two or three years, especially as other places in the world have been more fortunate. As a result, country totals for those in more favored locations have grown steadily. (See Table 1.) Perennial leader PY5CC continues to lead the pack and is within striking distance of 200 DXCC entities worked.

The leading Canadian is VE1YX with 145 countries worked, and the leading US station is K1SIX with 136. More than a dozen other US stations have more than 120 countries to their credit. Follow the leaders' progress at **web.libertysurf.co.uk/geoff.brown/50top.html**.

Table 1—6 Meter DXCC Leaders

Call	DXCC Entities
PY5CC	194
SV1DH	181
9H1BT	179
PA0HIP	174
G3WOS	169
GJ4ICD	167
JA4MBM	164
9H1PA	164
ON4KST	163
PA2VST	162
G4CCZ	156
PA7FF	155
JR2HCB	155
SV1EN	155
SM7FJE	153
G3KOX	153
G0JHC	153
PA5EA	152
SM7AED	152
JA1BK	151

US and Canada 50-MHz Standings

To ensure that the standings reflect recent activity, you must submit reports at least every two years. At least 50 DXCC entities are required for inclusion in this list. Stations dropped for lack of reports will be reinstated with a current update. You don't need to work new stations to remain in the published standings, but please indicate your continued interest by submitting a report. Reporting forms are available with an SASE to: Standings, ARRL, 225 Main St, Newington, CT 06111. You can also submit your reports by e-mail to: **standings@arrl.org**.

Call Sign	QTH	States	DXCC	Grids	DX (in km)†
K1SIX	NH	50	136	816	14982
K1TOL	ME	50	133	821	—
W1RA	MA	50	130	—	—
W1JR	NH	50	120	606	14455
W3EP/1	CT	50	113	739	15750
KA1A	NH	50	107	—	14533
K1SG	MA	50	107	—	9688
W1AIM	VT	50	103	346	14928
K1CA	NH	50	100	—	—
K1LPS	VT	50	90	415	12013
K1TEO	CT	50	83	667	13890
K2ZD	NJ	50	124	—	—
K2MUB	NY	50	121	—	—
WA2BPE	NY	50	112	—	15390
W2CNS	NY	50	104	531	15120
K2AXX	NY	50	101	512	12115
W2MPK	NY	50	96	—	—
K2OVS	NY	50	79	367	13124
N2WK	NY	50	74	480	15134
WA2BAH	NY	49	58	438	11040
KA2MCU	NY	49	50	386	11040
W3HHN	NY	48	54	432	6327
W3JO	PA	50	123	—	14929
W3BO	PA	50	112	587	12840
W3TC	PA	50	110	554	14945
AE3T	PA	50	97	—	14500
WA3DMF	MD	50	75	530	11645
N3VBG	MD	50	67	493	12285
W4DR	VA	50	118	796	14500
AE4RO	FL	50	117	—	16326
W4MW	NC	50	111	—	—
W4MOS	FL	50	110	—	—
N4CH	VA	50	104	670	15000
N4MM	VA	50	101	676	—
K4ZOO	VA	50	98	630	13946
K4RF	GA	50	69	375	16288
W4TJ	VA	50	52	316	7000
N4TL	NC	49	60	100	15034
W5FF*	NM	50	130	927	—
W5OZI	TX	50	117	840	15141
WA5IYX	TX	50	108	384	14592
W5HUQ	AR	50	108	280	15000
WD5K	TX	50	104	858	14927
N5JHV	NM	50	101	775	15750
K5AM	NM	50	99	715	15744
K5SW	OK	50	97	—	—
WA5JCI	TX	50	91	661	—
W5UWB	TX	50	55	—	—
W5ZN	AR	50	53	385	10550
K5TN	OK	50	52	465	13380
K6QXY*	CA	50	112	—	15555
N6CA	CA	50	100	—	16683
WA6PEV*	CA	50	92	—	—
K6KLY	CA	50	72	—	—
K6JZK	CA	50	66	—	—
K6UM	CA	50	57	425	15560
N6RMJ	CA	50	43	401	13180
KB6NAN	CA	50	41	503	—
N6ZE	CA	49	75	—	—
W6BYA	CA	—	106	—	—
W7RV	AZ	50	105	828	16165
N7EIJ	ID	50	61	500	16106
W7HAH*	MT	50	56	632	—
WA7KYM	WY	50	40	376	14526
W8UV	OH	50	80	—	—
W8PAT	OH	50	73	227	13196
WA8RCN	OH	50	70	354	—
K8MD	MI	50	58	433	13199
WB8XX	OH	50	56	459	7210
KU8Y	MI	50	51	538	13683
W8TN	WV	50	51	295	12436
N8NQS	MI	50	50	473	13590
N8KOL	OH	49	58	467	13163
W9GA	WI	50	89	450	—
W9JUV	IL	50	82	143	14060
K9APW	WI	50	81	575	—
KA9CFD	IL	50	81	474	14138
K9LCR	IL	50	76	466	13812
W0UC	WI	50	65	566	—
N0LL	KS	50	96	754	14901
K0SQ	MN	50	91	310	13818
KM0A	MO	50	86	743	15313
K0FF*	MO	50	79	601	14031
W0JRP	MO	50	72	556	14310
W0FY	MO	50	66	610	—
N0KE	CO	50	66	565	16700
K0CJ	MN	50	56	—	13328
WA0KBZ	MO	50	51	478	8687
VE9AA	NB	49	83	500	6096
VE3CTT	ON	49	76	504	13148

†Terrestrial
—Information not supplied
*Includes some EME (moonbounce) contacts

Follow the Band Plans, Avoid the Wouff Hong[1]

By Brennan Price, N4QX
Field and Regulatory Correspondent

The following is a true story.

KF4UZB had been a ham for less than a year. He had just passed the then-required 13-WPM Morse code exam to earn the General license. To celebrate the arrival of his newly printed license, he walked the three blocks from his apartment to his club's station and fired up an HF rig. It was a crisp, clear October night, and he decided to try out the low bands.

He started by checking into his state's traffic net. The folks there were glad to get another regular participant, particularly one who was under 30. A few complimented the new guy's operating skills. UZB was feeling pretty good, thinking to himself, "I've got this HF stuff down." He switched the coax to the 160-meter dipole for his maiden voyage on the top band.

He checked out the frequency allocation chart. Phone allowed throughout the band, it said. He dialed around for a clear, low-noise spot. He found one at 1835 kHz. He placed the rig in LSB mode, stepped on the foot switch, and bellowed for the world to hear. "CQ, CQ, CQ. This is Kilo Foxtrot Four Uniform Zulu Bravo, calling CQ on 160 meters and standing by for calls."

The bold, enthusiastic newbie unkeyed and waited excitedly for a reply. He got one, a terse one, four words long and from a moderately perturbed voice. "You're in the window," said a nameless ham in the ether.

"In the window?" he thought. "Didn't I read something about that somewhere? It sure doesn't sound good." After a pause, he keyed again, and said "Sorry. KF4UZB QSY." He wasn't feeling so good anymore.

In the window, eh? What did that mean? The new General cracked open the *ARRL Operating Manual* in an effort to find out. Here are some questions he answered for himself, that night and since.

What does "in the window" mean?

"The window," in this case, is the 160-meter DX window. A window is a portion of an amateur band reserved for certain types of communications by convention. In the above case, KF4UZB was transmitting in an area generally used for intercontinental digital contacts. Under normal circumstances, use of a voice mode from 1800 to 1840 kHz is contrary to the convention and generally considered poor form, as is a domestic SSB contact from 1840 to 1850.

Who comes up with these conventions?

Like many facets of good amateur practice, they are developed over time, by trial and error. The purpose of a band plan is not to keep people "in line," but to promote efficient use of the band and to help newcomers, like KF4UZB, find people who are interested in the same mode of operation.

Many considerations must be made when developing a voluntary band plan. The ideal plan largely separates modes, considers the needs of the various digital and image modes, and accounts for differences in allocations among the nations of the world. For instance, in ITU Region 1, the 160-meter band is only 40 kHz wide, from 1810 to 1850 kHz. This is the rationale for having the DX window from 1830 to 1850; this arrangement allows those who want to work Europe and Africa on the top band to do so, while leaving plenty of room for narrowband modes below the window and wideband modes above it.

How can I find out the plans for my favorite band?

Each January *QST* publishes "The Considerate Operator's Frequency Guide" for the HF bands in the *Help Desk* column. Look for it next month, or check the *Operating Manual* or ARRL Web at **www.arrl.org/field/regulations/conop.html**. For the purposes of further discussion in this column, the widely accepted voluntary band plans for 160, 80, 20 and the lower part of 6 meters are diagrammed in Figure 1.

One-sixty, 80 and 6 meters have windows designated for DX operation, and domestic operation in these windows is considered poor form; stateside amateurs should avoid conducting domestic QSOs there. Twenty meters, being the most re-

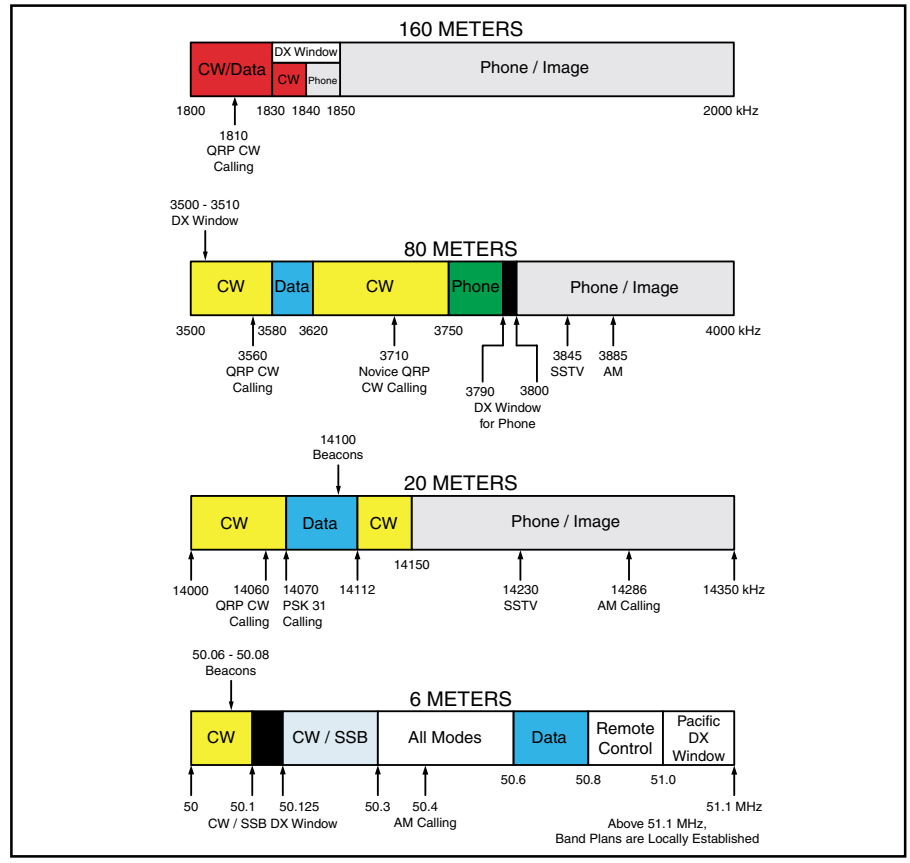


Figure 1—Voluntary band plans for 160, 80, 20 and 6 meters.

[1]Notes appear on page 89.

liable daytime band throughout the sunspot cycle, has attracted just about every mode under the sun, save FM. The popularity of the band leads to crowded conditions, and trying to keep the various modes from walking over each other is a challenge.

Is it against any rule to violate one of these conventions?

An infrequent and unknowing diversion from the band plan is likely nothing more than poor form, but repeated refusal to follow a band plan may be grounds for enforcement action. In a recent inquiry to an amateur operating a 2 meter repeater using the AM mode, FCC Special Counsel Riley Hollingsworth, K4ZDH, made the following statement:

"Although band plans are not mandatory, they exist to enhance the required cooperation and sharing of frequencies in the Amateur Service (see Section 97.101). Band plans minimize the necessity for Commission intervention in Amateur operations and the use of Commission resources to resolve Amateur interference problems. When such plans are not followed, and harmful interference results, we expect very substantial justification to be provided, and we expect that justification to be consistent with Section 97.101."

Note the twofold test: the band plan must be deviated from, and harmful interference must result. In the absence of harmful interference, the voluntary band plans are just that, voluntary.

The voluntary plans exist in an effort to accommodate the many varied interests of our licensees. When people deviate from them without good cause, either through ignorance (in the case of KF4UZB) or stubbornness (as is too often the case), they potentially deny a fellow amateur the ability to enjoy his or her favorite facet of the hobby. This does nothing to promote the goodwill and camaraderie for which the Amateur Service strives.

All the bands between 80 and 2 meters have a mandated separation of narrowband and wideband modes. Why doesn't 160 meters?

A brief history lesson is in order here. The military assumed control of amateur spectrum during World War II. At war's end in 1945, 160 meters was retained by Loran-A, a system for long-range navigation. Hams were assured that this occupation was temporary, but amateur activity on the top band was severely restricted by Loran-A for the next 35 years.

The last United States Loran-A stations went away in 1980, and the FCC returned an exclusive allocation to the amateur service on May 21, 1981.[2] The trend toward deregulation was in full swing in the early eighties, and the Commission was extraordinarily reluctant to make rules about anything. Three separate petitions to establish a narrowband reserve on 160 meters were filed with the FCC from 1981 to 1984. Citing the regulatory burden, the commission denied them all.[3]

The top band in the United States utilizes completely voluntary band planning. In many countries, this is the status quo on all bands. At high-usage times, such as Field Day and major international phone contests, it is not uncommon for us to hear Canadian hams working other stations using upper sideband down to nearly 14.1 MHz. These operations are completely legal! Canadian hams generally follow suggested parameters,[4] but are free to deviate from them in times of heavy usage. Whether a purely voluntary system is a good thing is a matter of lively debate around the amateur world. The 160-meter band is the American front of that debate.

I want to work Europe on 75 meters. A couple of my fellow stateside hams are having a domestic QSO on 3799 kHz and won't move. What should I do?

That frequency is at the top edge of the 80-meter DX window. It is generally considered poor form for domestic QSOs to take place there. One is more likely to achieve the desired result by being solicitous than by being contentious. In other words, whatever you do, don't be a jerk.

You may want to try breaking in with an almost apologetic manner. Be calm. Introduce yourself. Try saying something like "Hey, I know you were here first, and I respect that, but the European phone band ends at 3800. Europeans normally listen and call here, and I was hoping to work a few tonight. Could I persuade you to move up a few, if you've got room?"

Three things could happen. Ideally, they'll say, "Sure, glad to. Good DX and 73." Possibly, they'll say, "We were here first. Go away." That wasn't the desired result, but you wouldn't have gotten a better result from yelling at them. Your best bet is probably to turn the VFO and see what you can do elsewhere.

Finally, they might say something like "I understand, but the band was full. Would you give us a few minutes?" Now you have two options. You can gripe about how they are using poor operating practices and get them mad at you, or you can put up with the situation for a few minutes, gain a couple of new friends, and educate them about the 80 meter DX window. Ask yourself this: which approach is going to net San Marino for your 5BDXCC in the fastest time?

I operate PSK31. It's hard to find room sometimes, and sometimes other modes transmit right on top of me.

The advent of any new mode, particularly a wildly successful, widely used mode like PSK31, has the potential to cause some stress in previously established band plans. There has been some difficulty in PSK31 finding a home without interference from wider bandwidth digital modes.[5]

The fact that PSK31 can be copied without even being heard is both a good and a bad thing. How does PSK31 find a generally accepted home, where users can be simultaneously not heard and not interfered with? A solution can only be achieved through negotiation and cooperation among the users of the various modes involved. New modes have been successfully accommodated before, and they will again.

So, what happened to KF4UZB?

After reading the "Considerate Operator's Frequency Guide," he figured out that he was using LSB on what is widely regarded as a frequency for international narrowband QSOs. He also learned about the 80 meter DX window, and thought to himself, "Self, you need to earn your Advanced so you can work Europe on phone at night."

He passed his Advanced within a month, became KU4WJ, and celebrated by working Poland on 3795 kHz. He plans to use that card for 5BDXCC someday. He eventually passed his Amateur Extra, snagged the 1 × 2 vanity call N4QX, and started working at ARRL Headquarters as their Field and Regulatory Correspondent.

I like to think he turned out fine.

Notes

[1]For newcomers to the hobby, the Wouff Hong is an instrument conceived by ARRL Founding President Hiram Percy Maxim, 1AW, back in 1917. It is symbolically used to attack bad operating practices (and discipline perpetrators thereof). The Wouff Hong attained physical form in 1919 and is displayed at ARRL Headquarters. It is pictured and further described at **www.arrl.org/tis/info/history.html**.

[2]David Sumner, K1ZZ, "160 Meters Lives Again!," *QST*, Aug 1981, pp 54-56.

[3]John F. Lindholm, W1XX, "Is 160 *Your* Top Band?," *QST*, Aug 1985, pp 45-48.

[4]Details of the Canadian plans may be found on the Radio Amateurs of Canada Web site at **www.rac.ca/hfband.htm**.

[5]For diverse views on this issue, see the following letters to *QST*: Peter Martinez, G3PLX, "HF Digital: Live vs. Unattended," Jun 2000, p 24; Carl R. Stevenson, WA6VSE, "Live HF Digital vs. Unattended?," Sep 2000, p. 24.

The Heathkit AT-1

Few doubt that 1951 was an exciting year for ham radio. The introduction of the Novice class license made it possible for many to join our hobby. A good number of those joining were teenagers and young married people with limited amounts of money to spend. All of this helped the Heath Company enter the ham radio market.

Until that time, Heath had been successful selling surplus electronic parts and had just recently started selling test equipment kits such as their vacuum tube voltmeters and oscilloscopes. With all the new hams getting their licenses they determined that a good, inexpensive, transmitter kit was needed. The AT-1 would fill the bill.

The Genesis of the AT-1

Roger Mace was hired to design the transmitter and help Heath get their ham radio product line started. *QST* and the *ARRL Handbooks* had many designs that were popular and reasonably inexpensive to reproduce. Many of these designs had plug-in coils. Heath had tons of war surplus parts on hand and putting together a kit with these parts meant the selling price could be kept very low. Roger knew that adding band switching would be a plus.

One *QST* article of note was "How to Lay Out a Transmitter" by Byron Goodman in July 1951. It was centered on a 6AG7/6L6 transmitter designed earlier by Don Mix in the April 1950 *QST*. This classic transmitter had a similar appearance to the AT-1. I can't help but believe that Goodman's 1951 article influenced Mace.

The AT-1 kit was introduced just in time for Christmas 1951. At $29.50, it was an immediate success. It had everything one needed to build and finish it without having to purchase any additional parts. Its main features were: a built-in power supply, band switching, a built-in meter (switchable for either grid or plate measurements), a front-mounted crystal socket, a complete cabinet and a well designed front panel that was pleasing to the eye. It also included complete documentation on how to use the transmitter, and step-by-step instructions and drawings on how to assemble the transmitter. (This was important to a first-time builder.)

The band switch had four positions: 80, 40, 20 and 10 meters, but it also covered 15 and 11 meters at the 10 meter position (11-meters was still a ham band at this time and 15 meters did not become available until May 1, 1952). This meant that when the new Novice passed the General test, the transmitter would put him on the General bands. It was upgradeable; there are two octal sockets on the rear of the chassis, one for an accessory VFO and one for a modulator. Heath would later offer a VFO kit, but only offered information on how to connect the modulator to the transmitter. Ham magazines offered many modulator designs for the AT-1 over the next few years.

The RF circuit was the popular 6AG7 oscillator driving a 6L6 amplifier. Designed primarily for CW, it produced about 12 to 16 W output, depending on the band. The power supply used a transformer to a full wave 5U4 rectifier tube, with four filter capacitors and a choke. Two front-panel switches were provided: one for ac power and one for transmit or stand-by.

Heath later sold a model AC-1 antenna coupler for the AT-1. Priced at $14.50, it too was immediately popular. De-signed for use with a random length wire antenna, it covered 80 through 10 meters. There is a neon bulb in the front panel that indicates rf output. Tuning is simple; just tune for maximum brightness.

Conclusion

It's not known how many AT-1s were sold, but estimates are several thousand. The AT-1 has become very collectable and owners continue use them on the air. There are many AT-1 to AT-1 QSOs every month. Find one and join in on the fun.

I would like to thank Chuck Penson, WA7ZZE, author of *Heathkit: A Guide to the Amateur Radio Products*, for his help in providing historic information for this article.

More information on the AT-1 and the Heath company can be found on my web page at: **www.eht.com/oldradio/arrl/index.html.** QST

Front and rear views of the AT-1.

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Kids Aren't the Cure

By John Stewart, W0CID
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Many hams these days regularly bemoan the supposed dismal state of Amateur Radio and especially the fact that few youngsters show any interest in it. No, this isn't another stale recitation of the obvious reasons why ham radio isn't the most exciting activity that today's 16-year-olds can possibly imagine. In fact, I don't much care what excites 16, 12 or 8-year-olds, because despite our hearing "Kids First!" so often today, I contend that recruiting children is *not* the key to ham radio's future.

Now understand that I'm not saying we shouldn't introduce children to the hobby whenever possible. On the contrary, it's an excellent idea for their sakes as well as ours. I myself take pride in the modest influence I had on my nephew's recent success at obtaining his license.

But I *am* saying that kids aren't the cure for whatever ails ham radio, and the reason is that children can't do much on their own. Ham radio is a complex, relatively expensive activity that few children have the resources or freedom to pursue independently. Even with today's amazing allowances, it's unlikely that very many kids could outfit themselves with much more than an H-T, if that. When it comes to ham radio activities, the situation is often even worse; when's the last time a child showed up alone at a remote ARES exercise site?

Adults, on the other hand, can take advantage of all that ham radio offers (at least after they've gotten through school, found a job, gotten married…). They have disposable income, cars to drill holes in if they want to, don't have to be watched while using a soldering iron, can find a way around antenna restrictions (or move, if necessary) and do all the other things that being an active ham entails. Unfortunately, though, adults have one problem that kids don't have: adult egos.

Recruiting newcomers is difficult enough, but sometimes we manage to chase them off almost before their licenses show up in the mail. If we want to keep adults involved in the hobby, we must overcome the common tendency to treat them like overgrown, but still easily overawed, children. Most adults have done and seen quite a bit by the time they become active in Amateur Radio. That means they don't like being talked down to. They're often reluctant to ask questions—especially if they get the impression that someone else thinks the questions are "dumb." If they stop asking, they'll quit being active because of embarrassment and uncertainty about what to do.

New hams' first experiences can make or break their interest. Even if *you* knew it all and never made a mistake on the air when you first started out, try to remember how you were treated and what you liked and what you resented. Chances are today's new ham will react the same way. As a minimum, at least think about the following:

First, if you can't stand to answer questions in a straightforward, adult-to-adult manner, don't put yourself in the position of being asked. Not everyone can contribute to the solution, but we can all avoid being part of the problem.

Don't guess or make up answers. Eventually you'll lose whatever superficial respect you got by playing the know-it-all. As any competent instructor understands, occasionally saying, "I don't know," actually enhances your overall credibility. If you don't agree with someone else, justify *your* position—don't just ridicule the other person's ideas. Identify opinions as opinions; don't claim they're some sort of ham radio gospel.

Stay current; ham radio changes all the time. If someone gets licensed or upgrades, ask to borrow her study guide and at least skim through it. You may be amazed by what you didn't know.

Keep your explanations simple and to the point. Making difficult concepts clear and easy to understand is a priceless talent to be proud of; mystifying others to inflate your own ego isn't.

Volunteer information and assistance. People are more likely to accept an offer of help than to ask for it. If you recognize what someone wants or needs to know, answer the unasked question. Too many people find perverse pleasure in watching others squirm on the hook of not even knowing the right questions.

Guide by example whenever possible. If someone forgets to sign at the end of a contact, for example, try to find an excuse to repeat your own call rather than just saying, "Don't forget to ID." Chalk up a silent point for yourself every time you get someone to do something right without telling them to do it.

There's no one better to promote the cause of Amateur Radio than a newcomer with the time, resources, ability and desire to get a ticket and put a station on the air. Some people can do that by themselves with a few books and magazines for guidance, but it's a lot easier and more fun to have help from a friend or trusted acquaintance. You don't have to be a pipe-puffing graybeard to promote the hobby, but you do have to know how to deal with the people you expect to help. Treat them as equals who temporarily don't know as much as you, and you'll make friends. Treat them like backward children and you may find they soon outgrow your company.

QST Op-Ed Policy

The purpose of Op-Ed is to air member viewpoints that may or may not be consistent with current ARRL policy.

1) Contributions may be up to two-thirds of a *QST* page in length (approximately 900 words).

2) No payment will be made to contributors.

3) Any factual assertions must be supported by references, which do not necessarily have to be included in the body of the article to be published.

4) Articles containing statements that could be construed as libel or slander will not be accepted.

5) The subject matter chosen must be of general interest to radio amateurs, and must be discussed in a way that will be understandable to a significant portion of the membership.

6) With the exception that the article need not be consistent with League policy, the article will be subject to the usual editorial review prior to acceptance.

7) No guarantee can be made that an accepted article will be published by a certain date, or indeed, that it will be published at all; however, only articles that we intend to publish will be accepted, and any article we have decided against publishing will be returned promptly.

8) Send your contributions to ARRL Op-Ed, 225 Main St, Newington, CT 06111

CQ FIELD DAY DE N6WG 8A EB

Field Day 2000 results appear in this issue. So, to fight off the winter doldrums, I have enlisted the aid of Bob Tellefsen, N6WG, to give "QRP Power" readers an inside look at what can be accomplished by a large Amateur Radio club when they decide to run QRP during Field Day.

Very shortly after the first "QRP Power" column appeared in *QST*, Bob Tellefsen e-mailed me asking if I would be interested in profiling the Alameda County Radio Club's Field Day efforts over the last several years. The hook was for the last 13 years the Alameda County Radio Club had placed first in the 8A-battery class running QRP! Yes, I was definitely interested.

The ACRC began competing in Field Day in 1980 using K6CSL as the group call sign. Their total score was 516—not contacts, *points!* The next year (1981) they used the W6HOR call sign and, for the first time, ran a Novice station under KA6QSM. Their score: 1940 points. Well, it *was* progress.

In 1984, there was a huge debate among club members over the noise of the generator used at Field Day. The QRPers within the ACRC favored doing away with the generator and participating in FD using only 5 W or less. The other faction of the club felt that they would not be competitive giving up 13 dB of power.

The consensus of the club was that the QRPers were nuts because, as everyone knows, you can't lower your power and simultaneously raise your score. A motion was passed to run QRP for just one year to shut up this deranged group of QRPers, and then return to sanity the following year by running 100 W.

In the 1984 Field Day, running QRP as a 4A entry, the Alameda County Radio Club placed second overall in their category with a score of 5110 points. Their previous high score using high power was 2774 points in the 5A class. It's interesting to note, at this point, that the ACRC gave up one transmitter, dropped their RF output 13 dB and almost doubled their previous high score, proving that QRP and emergency communications are not mutually exclusive terms! Needless to say, the club has never gone back to running QRO power levels.

In 1986 the ACRC, using Bob's call, N6WG, started running an 8A battery entry and placed first with a score of 6805 points (874 QSOs). The club has placed first in the 8A category from 1986 through 1999. Their score of 10,850 points (1305 QSOs) for Field Day 2000 places them on the top of the heap again! Well done, gang.

Bob emphasizes that the club has a Technician station on the air to encourage those members to operate and discover, first hand, the joys of low power communications. He further states that the Technician station has contributed valuable points to each year's Field Day efforts.

This is a classic example of the adage, "Power is no substitute for skill." We applaud the Alameda County Radio Club for showing initiative in using QRP power levels in their Field Day operations and hope that other clubs will take up the QRP challenge for Field Day 2001.

The Year in Perspective

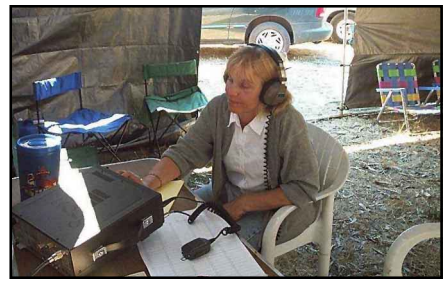
This installment of "QRP Power" marks the end of the first year of publication in *QST*. Where did 12 months go? This is an easy column for me to write. It is truly a labor of love and the positive feedback I've received from the readership has been very encouraging.

I'd like to take this time to share some of my thoughts on this column. When I was initially approached to write "QRP Power" by Mark Wilson, K1RO, and Steve Ford, WB8IMY, we decided that this would be a nontechnical forum. Over the last 12 months, I've had only one or two readers complain that there was not enough technical stuff in the column. The overwhelming feedback was extremely positive about the format of "QRP Power." Obviously, this column fills a need within the QRP community.

QRP is about communicating. While homebrewing and QRP go hand in hand, the real purpose of QRP is to communicate with other ham radio operators using 5 W or less. I have long held the opinion that there are enough technical articles and construction projects published in various QRP club newsletters, *QST*, and other ham radio magazines to satisfy even the most die-hard homebrew junkies. What has always been in short supply is emphasis on the operating side of the hobby. After all, you can build kits all day and night, but eventually you're going to have to operate one of them. When that time arrives, you'll become a true QRPer. The emphasis of "QRP Power" has been, and will continue to be, on the fun people are having operating QRP.

Early on, I did receive some letters from a couple of disgruntled readers complaining of my emphasis on the Internet and the inclusion of Web URLs in the column. Guilty as charged. The Internet is a tremendous information resource that allows worldwide, near-real-time communication. This means the average radio amateur can get answers to problems or information within minutes as opposed to weeks or months.

If, as a QRPer, you're not online, then you're being left behind in a cloud of dust. Prices of quality computer equipment have dropped drastically so there is really no reason the average QRPer cannot join the cutting edge of the hobby. Repeat after me: Computers are our friends. Computers are our friends…



Barb, KC6LVI, works 10-meter SSB at N6WG.

2ND ANNUAL QRP CONTEST CALENDAR FOR 2001

The Eastern PA QRP Club would like to announce the release of the 2nd Annual QRP Contest Calendar for 2001. The calendar contains outstanding color photography and lists QRP contests and contests with QRP categories.

This is an 11 × 17-inch fold-out calendar that you can hang on your wall next to your rig. The color photos feature the winners of kit-building contests that were held at various QRP forums or conventions throughout 2000. This is really a handy calendar to have in the shack.

The cost is $10 for US residents; $12 international (shipping included). For more information and a sample of the calendar check, get on the Web and go to **www.n3epa.org**.

Rich Arland, K7SZ ♦ 25 Amherst Ave, Wilkes Barre, PA 18702 ♦ k7sz@arrl.org

K1MOM and W1DAD Make Ham Radio Fun for Children

Hams love to get together and talk about the latest equipment, DX stations or antennas. Sometimes the conversations become philosophical. A common lament is "Where are all the young people who used to attend our club meetings and events? We have to do something to get them involved." Jeanne Shipelliti, K1MOM, and her husband Peter, W1DAD, of Atkinson, New Hampshire, have done just that by creating a unique way of getting younger kids interested in ham radio.

K1MOM and W1DAD.

Geena and Luciano at the radio during the last Kid's Day contest from their home.

The Ham Family

When Peter started studying for his Amateur Extra license, 2½ years ago, Jeanne started to realize how important Amateur Radio could be as a learning tool. She is a teacher and saw the hobby as an opportunity to help their children learn about geography. "I saw Peter using QSL cards as flash cards with them," she said. "My daughter Geena, who was three at the time, could read the call signs. I brought out the world globe and showed them where the cards originated. They also enjoyed the postage stamps on the cards, which overlapped with our stamp-collecting hobby."

Jeanne realized that if she got licensed they could be a "ham family," create a learning environment for the children and enjoy even more quality fun time together. After quickly getting her license, Jeanne was bitten by the contesting bug. "I wanted to have a call that reflected more of who I am and yet was a good contesting call sign. When I saw K1MOM wasn't taken, I said, "That's the one I want!"

After that, Peter decided to get a complementary call sign and traded in his WB1GEX, which he'd held for 22 years, for W1DAD. As a family, they have been very active with the Kid's Day operating event in January and June. Jeanne said, "Next month, we will once again participate in Kid's Day on January 6th with our children Geena, age five, and Luciano, almost four, using the special 1 × 1 call K1D to promote getting kids involved in Amateur Radio. This time we hope to host even more neighborhood kids, Geena's Daisy Scout troop and young relatives."

The Amateur Radio Coloring Book for Children

Jeanne started thinking about ways to get other young kids interested in ham radio besides the Kid's Day contest. She came up with the idea of an Amateur Radio coloring book, geared to the 4-8 age group. "When I attend ham events with Peter, we sometimes bring our kids. I noticed that the events didn't have younger children's products or programs. I thought it would be nice if they had coloring books with radio things in it." She compiled the book using block diagrams of different types of equipment (HF radio, mobile radio, handheld, meters, computer, etc) from the Workbench section of *QST* and other sources, and topped it off with a special cover. *The Amateur Radio Coloring Book for Children* was born!

She tested it on Geena and Luciano first, and both enjoyed coloring in it. The next step was to publicize the book, so Jeanne spoke with the ARRL New England Division Convention program chairman about presenting a forum especially for young children at the upcoming Boxboro, Massachusetts event. "They were happy about having a program like this. I knew that the program should include role-playing a radio contact, a coloring book, a make-your-own QSL card and a special contest that they could participate in even if they weren't licensed."

Since this was the first forum geared to younger kids they had put together, Jeanne and Peter had no idea how many would attend, or what their ages would be. "We composed an agenda, but didn't know how far down the list we would get," Jeanne said. "For all we knew, some of the kids could even be hams already!" They ended up with six children (6 to 13 years old) at the forum, and two of them were hams. "The parents stayed in the back of the room and I pulled out some chairs for the kids and made a half circle with Peter and me in the front. Using handi-talkies, the two kids with licenses demonstrated a typical QSO. Everyone experienced talking on the radio to another kid. Things went pretty smoothly and the time flew." Jeanne said they spent so much time on the QSOs that they never got to the "make your own QSL card," and said that their agenda was a little ambitious for the 60 minutes allotted them. Jeanne also created her own "contest" based on the WAS award, where kids work all their neighboring states and then progress up to Worked All States. "The child can get a certificate for each level they achieve and even young children can do it with their parents' help," Jeanne noted.

"The comments from the parents and kids were all positive," Jeanne said, "and some suggested having a kid's special event convention station. I hope they invite us back to Boxboro and next time it will be even better. I think everyone enjoyed it and I got some very nice e-mails from the parents thanking us for doing something for their children."

Copies of *The Amateur Radio Coloring Book for Children* and the full rules for the WAS Kid's Awards are available from Jeanne via e-mail at **k1mom@arrl.net**. Jeanne said, "Older kids with licenses could probably do it on their own. Younger children without licenses will need their parents' help. The important thing is everyone has fun together."

Don't forget to participate in Kid's Day on January 6. Jeanne, K1MOM and Peter, W1DAD will be on the air operating special event station K1D from December 23 to January 6 encouraging hams to get children involved in Amateur Radio!—*33, Diane K2DO* QST

Diane P. Ortiz, K2DO ♦ PO Box 296, Bellport, NY 11713 ♦ k2do@arrl.org

SILENT KEYS

It is with deep regret that we record the passing of these amateurs.

W1ATU, Robert S. McCarthy, Concord, NH
N1HQR, Thomas W. Redden, Cottonwood, AZ
W1IOE, Donald E. Allen, Trumbull, CT
W1KJU, Murray Litchfield, Brunswick, ME
W1RYJ, Esther A. Routhier, Amesbury, MA
WB2CVL, Robert W. Pearson, Somerset, NJ
W2DII, Charles Cleveland, Moorestown, NJ
W2EQE, Walter L. Smith, Port Saint Lucie, FL
K2EVC, Paul L. Mason, Lyndonville, NY
KB2HYP, Clement F. Becker, Rochester, NY
W2LIY, Charles W. Siems, Pittstown, NJ
WB2QEB, Nathan D. Kahn, Dover, NJ
KC2QS, Robert C. Dengler, Pittsford, NY
K2VJ, Vince Luciani, Harrisonburg, VA
K2VVT, Mary B. Swiencicki, Parsippany, NJ
KA2YXU, Vernon W. Schroeder, Warrensburg, NY
N3AVD, Leonard Shuster, Philadelphia, PA
N3BGZ, Erma R. Martin, Monaca, PA
KB3CQS, Robert J. Biel, Wilcox, PA
W3KW, Robert J. Gleason, Annapolis, MD
W3NNM, Burl W. Binkley, Elkridge, MD
WA3QQY, David T. Jennings, Williamsport, PA
N3SAV, James J. Buchheister, College Park, MD
KP3S, Guillermo R. Schwarz, Guayanabo, PR
AB3Z, Ben Ginsberg, Mount Laurel, NJ
WA4AVT, John McDonald, Winter Haven, FL
W4BHF, Julian A. Duncan, Bartow, FL
W4BKX, Lawrence H. Lazar, Plantation, FL
‡W4EA, Arthur T. Cline, Atlanta, GA
W4EDM, Edwin P. Fuller, Jacksonville, FL
N4ENP, Robert W. White, Alexandria, VA
W4EWM, John B. Quirk, Owensboro, KY
W4FDF, Vernon D. Westfall, Waleska, GA
KE4FFY, Anthony J. Rossano, Macon, GA
K4HJB, Charles W. Albinger, Theodore, AL
W4HS, Billy R. Orr, Fort Payne, AL
W4IPR, William F. Norris, Lehigh Acres, FL
WA4KEJ, Raymond S. Butler, Mobile, AL
N4OXR, William F. Parker, Louisville, KY
N4QYR, Melvin R. Cook, Saint Petersburg, FL
KE4RB, Andrew J. Faber, Port Richey, FL
W4ROC, James C. Anglea, Franklin, TN
KD4SYB, Carlos L. Caceres, Jacksonville, FL
W4TKR, James A. Murray, Alexandria, VA
KB4TXZ, Charles F. Cowan, Pisgah Forest, NC
N4UVA, Frank O. Smith, Rock Spring, GA
N4WCO, Robert W. Stokely, Andrews, NC
W4WNO, Gordon O. Buckelew, Cullman, AL
KM5C, Manford W. Gray, Searcy, AR
W5CTZ, Harry P. Pfeiffer, Bellville, TX
WD5DTX, Norman F. Green, Duncan, OK
KB5DXM, Frederick H. Prano, Fort Stockton, TX
K5GBN, John F. Fish, Calumet, OK
WD5GLG, Hazel B. Russell, Springhill, LA
W5HDM, Stafford E. Davis, Pottsboro, TX
*W5JO, Joe D. Olson, Branson, MO
WB5MDG, E. B. Landrum, Arlington, TX
W5OJP, Tom Heffington, Graham, TX
W5SML, Edward W. Ransdell, Venice, FL
KF5TC, W. W. Rockett, Corpus Christi, TX
W5TFZ, Charles W. Kram, Yoakum, TX
KA5TLW, Maurice D. Hiers, Las Cruces, NM
KB5ZKK, Guy R. McKeon, Biloxi, MS
KC5ZMG, Sharon K. McClung, Boyce, LA
KB6CRP, Geneva A. Valek, Westminster, CA
AC6HO, Calvin J. Smith, Sebastopol, CA
W6ILR, Lucius W. Waterman, Visalia, CA
W6IWE, J. D. Wood, San Bernardino, CA
AC6JM, Robert L. Wallar, Lakewood, CA
W6KMC, Warner H. Ramsey, Newhall, CA
N6MFL, Howard L. Schreck, San Clemente, CA
N6OTS, Joan M. Sullivan, Fountain Valley, CA
W6RMM, Donald L. Batten, Belvedere Tiburon, CA
KC6RRW, Robert G. McKibben, Foster City, CA
W6TUM, Robert W. Moser, Mountain View, CA
K6VDV, Howard F. Downing, Eugene, OR
W6WMO, Harold E. Hiner, Lynden, WA
WB6WWH, James C. White, Platina, CA
KD7BH, Lewis D. Nash, Richland, WA
K7DCJ, Jerry V. Porter, Grayland, WA
W7DMM, Raymond F. Hawk, Edmonds, WA
KC7EN, William M. Daugherty, Albuquerque, NM
*W7FGM, Lynn H. Davenport, Rexburg, ID
N7FVL, Francis S. Mann, Spokane, WA
W7GIL, Charles L. Deeming, Pleasant Hill, OR
AB7KP, Donald G. Spencer, Newport, OR
W7KZU, David W. Putman, Medford, OR
W7LJG, Paul C. Crittenden, Federal Way, WA
W7LUL, John G. Mello, Scottsdale, AZ
K7LXE, Gordon L. Harvey, Puyallup, WA
N7MDI, Mark L. Myers, Ellensburg, WA
AE7N, Malcolm E. Fuller, Beaverton, OR
W7NP, Rex G. Hays, Roy, WA
KL7SC, Salvatore J. Cucchiari, Sitka, AK
W7VPU, August E. Schwarzbach, Mesa, AZ
N7XFN, Beverly G. Aitken, Sonoita, AZ
K7ZUV, Bee Johnson, Stanwood, WA
W8ADK, Carroll W. Peabody, Sr., Amherst, OH
W8BUA, Frederick F. Yunck, Jackson, MI
W8ERG, Henry R. Kuhn, Forestville, OH
W8HVY, Frank Goodyear, Reynoldsburg, OH
*N8JR, Joel M. Rose, Brecksville, OH
KF8NR, Frans O. Ohlsson, Mount Morris, MI
K8RPF, Roger D. Mais, Niles, MI
KB8SFY, Karen A. Goffos, Smyrna, TN
KA8YAF, Robert B. Hartman, Seville, OH
W8ZH, Paul D. Wolfe, Burton, OH
W8ZOD, Edward F. Dydo, Torrance, CA
KE9BW, Albert S. Harris, Naperville, IL
N9CBM, John G. Foster, Lebanon, IN
K9EIJ, Norman J. Wagner, Chicago, IL
K9GRU, Ivan H. Dotson, Muncie, IN
*N9GS, Charles E. Stanley, Bluffton, IN
WD9HAI, Earl A. Sprague, Muncie, IN
W9HTT, James R. Mabrey, Linn Creek, MO
W9JMG, Everett E. Ellsworth, Park Forest, IL
K9KKZ, Gregory K. Moore, Worth, IL
*K9KRN, Basil E. Thompson, Winslow, IN
W9LPD, Frank J. Giszewski, South Bend, IN
WB9MUP, Kevin W. Keller, Hyde Park, MA
KA9ODA, Hal R. Bodigor, Lakewood, IL
*K9PB, Philip P. Brankin, Hometown, IL
K9QGR, Hazel V. Cain, Escondido, CA
KA9ZWQ, Marvin Bronkema, Berwyn, IL
N0AGQ, Benjamin R. Balay, Denver, CO
N0CCW, Harry Ridenour, San Antonio, TX
KB0DAF, Evelyn M. Caldwell, Davenport, IA
KC0DIF, Howard Wascher, Minneapolis, MN
K0GEX, Edward L. Linde, Austin, TX
N0GNJ, Howard Hawthorne, Hays, KS
W0KM, Clarence Falstrom, Kansas City, KS
WA0OEV, Kenneth A. Caldwell, Davenport, IA
W0PPQ, Albert F. Regler, Kaneohe, HI
LU6DJX, Alfredo E. Luciano, Buenos Aires, Argentina
9A4SP, Pero Simundza, Split, Croatia

*Life Member, ARRL

‡Call sign has been re-issued through the vanity call sign program.

Note: Silent Key reports must confirm the death by one of the following means: a letter or note from a family member, a copy of a newspaper obituary notice, a copy of the death certificate, or a letter from the family lawyer or the executor. Please be sure to include the amateur's name, address and call sign. Allow several months for the listing to appear in this column.

Many hams remember a Silent Key with a memorial contribution to the ARRL Foundation. If you wish to make a contribution in a friend or relative's memory, you can designate it for an existing youth scholarship, the Jesse A. Bieberman Meritorious Membership Fund, the Victor C. Clark Youth Incentive Program Fund, or 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. QST

Kathy Capodicasa, N1GZO ♦ Silent Key Administrator

NEW PRODUCTS

IAMBIC KEY/KEYER FROM PADDLETTE

◊ Paddlette Co now offers a miniature integrated Iambic electronic keyer and paddle—the KP-4.

The KP-4 consists of a $^3/_4 \times 1^1/_2 \times 2$-inch PVC box with a Paddlette miniature key mounted on top. It weighs a mere 1 oz. Simply connect a jumper from your radio's keying input to the 3.5 mm **XMTR** jack, and you're ready to go—power for the keyer is provided by an internal 3 V/540 mAh lithium cell. Paddlette estimates the typical battery life at approximately four years.

A magnetic hold-down system is built into the enclosure's base. Two adhesive-backed magnets for mounting the unit are included.

The KP-4 will key virtually any solid state transceiver. A built-in piezo speaker can provide CW sidetone, if desired.

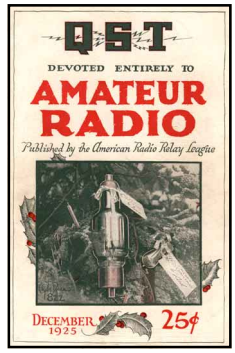
An Embedded Research TiCK-4 CMOS keyer IC is used as the heart of the KP-4 and offers two message memories, Iambic A or B operation, a straight key mode and beacon type keying. The speed, memory contents, mode, paddle sense and sidetone state (on or off) are non-volatile.

Price: $94. Shipping and handling by first class mail, $3.75. For additional information contact the Paddlette Co, PO Box 6036, Edmonds, WA 98026; tel 425-743-1429; **bham379627@aol.com**; **home.att.net/~goodroe/paddlette**. QST

Next New Product

75, 50 AND 25 YEARS AGO

December 1925

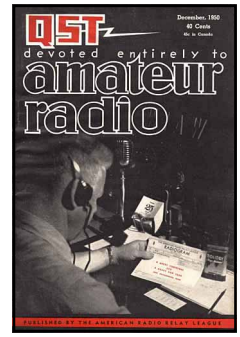


◊ Clyde Darr, 8ZZ, presents a cover illustration in keeping with the spirit of the season—a Christmas tree on which are displayed a large transmitting tube with the tag, "To Son," and a small receiving tube "To Dad!" The editorial announces that "A plan of affiliation between the Signal Corps of the U. S. Army and the transmitting amateurs of the country…was approved by the War Department and went into effect on November 1st, the American Radio Relay League being named…as the representative of the amateur thereunder."

"Toroids," by F. J. Marco, tells about the new scheme of toroidal winding of coils for radio work. Thornton Dewhirst discusses "Practical Picture Transmission" using the two most popular commercial devices for transmitting and receiving still photos via radio. Burton Synnott of the Bronx tells about his ham station in "Low Power Station 2BBX," which has been working DX as far away as Australia and New Zealand using 10 to 25 watts input on 40 meters. T. T. Greenwood's article, "Frequency Doubling in Vacuum Tubes," describes "…a novel and recently patented scheme of a German engineer for doubling the frequency of electrical oscillations by means of a vacuum tube." Rufus Turner tells how to build "An Inexpensive Low Power Transmitter from Receiving Parts." Dave Ablowich, 5DW, describes "A Three-Tube Neutrodyne for Short Waves."

Assistant Technical Editor John Clayton, in "Speaking of Low Power Work," tells the story of American ham Clair Foster, u6HM, going to Canada's Vancouver Island and setting up a temporary ham station as Canadian 9CK. The first incoming signal heard was Australian a3YX on 40 meters, whom Clair worked with only 10 watts input. During a contact with Australian a5BG, Clair used only one tube for both transmitter and receiver, moving the tube between the transmitter and receiver at each "over"!

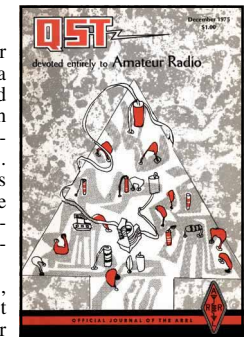
December 1950



◊ The cover photo shows W1AW operator W1BUD holding a radiogram to "radio amateurs everywhere," with the text "A merry Christmas and a happy new year—ARRL Headquarters Gang." The editorial discusses "Amateur Radio in Civil Defense," saying, "Will we be used? As we see it at this stage, the answer is: Yes—if we show we can do the job."

By Goodman, W1DX, tells about his 50-kc. "QRM-Dodger" in the article "A Sharp I.F. Amplifier for 'Phone or C.W." Wyn McGee, ZL3LR, describes "A Ham-Shack Frequency Standard," a 100-kc. Oscillator and 10-kc. Multivibrator in a single package. "Monument Honors Historic 1BCG" describes the dedication of a stone monument in Greenwich, Connecticut, to commemorate the transmission of the first message across the Atlantic Ocean on short waves, in December 1921. The text notes that "The overwhelming success of the [Transatlantic] Tests is a bright spot in the history of amateur radio." George Grammer, W1DF, describes "Universal S.W.R. Measurements with a Coaxial Bridge." Oswald Villard, W6QYT, discusses principles and design factors in "'Supermodulation—An Evaluation and Explanation." Under the heading, "Two Unusual 144-Mc. Antennas," two unorthodox designs that produce good results are presented: "A Lightweight Flop-over Array," by Walter Bain, W2WFB, and "The Houston Hayrake—A Compact 12-Element Array," by W. E. Leverkuhn, W5KFY. "DX Century Club" publishes the current country totals for all holders of the Postwar DXCC award, with W1FH leading the pack on mixed modes, with 236 confirmed countries, and also on radiotelephone, with 195 confirmed.

December 1975



◊ The whimsical cover drawing shows a Christmas-tree-shaped circuit board, with "decorations" of resistors, capacitors, etc. The editorial discusses a common charge made of Amateur Radio operators today, in "Appliance Operators?"

James Bowen, WA4ZRP, tells about "A Calorimeter for VHF and UHF Power Measurements." Antenna guru John Belrose discusses "Transmission-Line Low-Profile Antennas." Wilson Anderson, WB6RIV, tells about "A Universal Transistor Tester." Dick Bingham, WB6BDR/W7KWR, describes how to build "A Modular Transceiver for 1296 MHz." Ken Cavcey, W0YOR, tells how to "Read Capacitance with Your VOM." HQ's own Jerry Hall, K1PLP, details "A Tuning Aid for SSTV."

Larry Shima, W0PAN, reports on "The ARRL Foundation…On the Move," noting that the foundation is almost three years old.

QST

Al Brogdon, W1AB ♦ Contributing Editor

W1AW Schedule

PACIFIC	MTN	CENT	EAST	MON	TUE	WED	THU	FRI
6 AM	7 AM	8 AM	9 AM		FAST CODE	SLOW CODE	FAST CODE	SLOW CODE
7 AM-1 PM	8 AM-2 PM	9 AM-3 PM	10 AM-4 PM	VISITING OPERATOR TIME (12 PM - 1 PM CLOSED FOR LUNCH)				
1 PM	2 PM	3 PM	4 PM	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE
2 PM	3 PM	4 PM	5 PM	CODE BULLETIN				
3 PM	4 PM	5 PM	6 PM	TELEPRINTER BULLETIN				
4 PM	5 PM	6 PM	7 PM	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE
5 PM	6 PM	7 PM	8 PM	CODE BULLETIN				
6 PM	7 PM	8 PM	9 PM	TELEPRINTER BULLETIN				
6^{45} PM	7^{45} PM	8^{45} PM	9^{45} PM	VOICE BULLETIN				
7 PM	8 PM	9 PM	10 PM	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE
8 PM	9 PM	10 PM	11 PM	CODE BULLETIN				

W1AW's schedule is at the same local time throughout the year. The schedule according to your local time will change if your local time does not have seasonal adjustments that are made at the same time as North American time changes between standard time and daylight time. From the first Sunday in April to the last Sunday in October, UTC = Eastern Time + 4 hours. For the rest of the year, UTC = Eastern Time + 5 hours.

♦ **Morse code transmissions:**

Frequencies are 1.818, 3.5815, 7.0475, 14.0475, 18.0975, 21.0675, 28.0675 and 147.555 MHz.

Slow Code = practice sent at 5, $7^1/_2$, 10, 13 and 15 wpm.

Fast Code = practice sent at 35, 30, 25, 20, 15, 13 and 10 wpm.

Code practice text is from the pages of *QST*. The source is given at the beginning of each practice session and alternate speeds within each session. For example, "Text is from July 1992 *QST*, pages 9 and 81," indicates that the plain text is from the article on page 9 and mixed number/letter groups are from page 81.

Code bulletins are sent at 18 wpm.

W1AW qualifying runs are sent on the same frequencies as the Morse code transmissions. West Coast qualifying runs are transmitted on approximately 3.590 MHz by K6YR. At the beginning of each code practice session, the schedule for the next qualifying run is presented. Underline one minute of the highest speed you copied, certify that your copy was made without aid, and send it to ARRL for grading. Please include your name, call sign (if any) and complete mailing address. Send a 9×12-inch SASE for a certificate, or a business-size SASE for an endorsement.

♦ **Teleprinter transmissions:**

Frequencies are 3.625, 7.095, 14.095, 18.1025, 21.095, 28.095 and 147.555 MHz.

Bulletins are sent at 45.45-baud Baudot and 100-baud AMTOR, FEC Mode B. 110-baud ASCII will be sent only as time allows.

On Tuesdays and Fridays at 6:30 PM Eastern Time, Keplerian elements for many amateur satellites are sent on the regular teleprinter frequencies.

♦ **Voice transmissions:**

Frequencies are 1.855, 3.99, 7.29, 14.29, 18.16, 21.39, 28.59 and 147.555 MHz.

♦ **Miscellanea:**

On Fridays, UTC, a DX bulletin replaces the regular bulletins.

W1AW is open to visitors from 10 AM until noon and from 1 PM until 3:45 PM on Monday through Friday. FCC licensed amateurs may operate the station during that time. Be sure to bring your current FCC amateur license or a photocopy.

In a communication emergency, monitor W1AW for special bulletins as follows: voice on the hour, teleprinter at 15 minutes past the hour, and CW on the half hour.

Headquarters and W1AW are closed on New Year's Day, President's Day, Good Friday, Memorial Day, Independence Day, Labor Day, Thanksgiving and the following Friday, and Christmas Day.

HAMFEST CALENDAR

Attention: The deadline for receipt of items for this column is the **1st of the second month preceding publication date**. For example, your information must arrive at HQ by **December 1** to be listed in the **February** issue. 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 or any kind of games of chance such as raffles or bingo.

(Abbreviations: *Spr* = Sponsor, *TI* = Talk-in frequency, *Adm* = Admission.)

†**Arizona (Mesa)—Dec 2,** 6 AM to 2 PM. *Sprs:* AR Council of Arizona and Scorpion ARC. Mesa Community College, 1833 W Southern Ave; N of Hwy 60 and Dobson Rd. Swapmeet, commercial vendors ($10), tailgating ($5), VE sessions (registration 8 AM, testing 9 AM, walk-ins only; must have original and one copy of your license and any applicable CSCEs, photo ID required), ARCA meeting (11 AM), QRP on the air, refreshments. *TI:* 146.46. *Adm:* $2 (general parking). Bob Hightower, NK7M, 1905 N Pennington, Chandler, AZ 85224, 480-732-0058, **nk7m@extremezone.com**; or Brian Kassel, K7RE, 623-486-1542.

Florida (Okeechobee)—Dec 2. Bill Gastle, N2BXH, 863-467-9974.

Georgia (Lyons)—Dec 2. Jonah Riner, KE4PMP, 912-538-1152.

Illinois (Wheaton)—Nov 26. James Burke, KB9UBX, 815-436-7090 or 630-393-3937.

Indiana (Greenfield)—Dec 3. Tom Donaldson, N9LFU, **n9lfu@home.com.**

†**Louisiana (Minden)—Dec 2,** 8:30 AM to 2 PM. *Spr:* Minden ARA. Minden Civic Center, 520 Broadway St; from I-20 take Minden-Sibley Exit 47, turn N on US Hwy 371, 1.5 miles to US Hwy 79/80 E, turn right, Civic Center is 1/4 mile on right. Flea market, dealers, equipment, VE sessions (all elements), refreshments. *TI:* 147.3, 145.43. *Adm:* $4, under 12 free. Tables: flea market $5, dealers $10. Jimmy White, KB5SUE, 1259 Sand Plant Rd, Dubberly, LA 71024, 318-377-2501, **kb5sue@microgear.net**; or Dusty Collins, KB5WFE, **dusty1@microgear.net**; **www.bayou.com/~k5dlh/fest.html**.

New York (Patchogue)—Nov 26. Mike Grant, N2OX, 631-924-3535.

Tennessee (Morristown)—Jan 6. John Ellenburg, KE4QIH, 423-581-5645.

†**Wisconsin (Waukesha)—Jan 6,** 8 AM to 2 PM. *Spr:* West Allis RAC. Waukesha County Expo Center Forum, I-94 W to Exit 294 (Cty J), S to Cty FT, W to Expo Center. Ham Radio, Computer, and Electronics Swapfest; VE sessions (AMF Waukesha Lanes, across from Expo; bring your original license with photocopy, CSCEs with 2 photocopies, 2 IDs, 1 must be photo ID); refreshments. *Adm:* advance $4, door $5. Tables: advance $12 per 8-ft, door $14 (if available); electrical outlet $13 (advance only). Send Business SASE by Dec 30 to WARAC Swapfest, Box 1072, Milwaukee, WI 53201. Phil Gural, W9NAW, 414-425-3649. QST

†ARRL Hamfest

Attention All Hamfest Committees!

Get official ARRL sanction for your event and receive special benefits such as free prizes, handouts, and other support.

It's easy to become sanctioned. Contact the Convention and Hamfest Branch at ARRL Headquarters, 225 Main St, Newington, CT 06111. Or send e-mail to **giannone@arrl.org**.

COMING CONVENTIONS

2000
December 2-3
West Central Florida Section, Palmetto/Bradenton*

2001
January 21
New York City/Long Island Section, North Babylon
Virginia Section, Richmond

February 2-3
Mississippi State, Jackson

February 3-4
Florida State, Miami

February 9-11
Northern Florida Section, Orlando

February 10-11
Tennessee State, Memphis

***See November *QST* for details.**

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're encouraged to register your event with HQ as far in advance as your planning permits. Hamfest and convention approval procedures for ARRL sanction are separate and distinct from the date register. Registering dates with ARRL HQ doesn't 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 by the executive committee. Application forms can be obtained by writing to or calling the ARRL convention program manager, tel 860-594-0262.

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. QST

Gail Iannone ♦ Convention Program Manager

STRAYS

HAM RADIO UNIVERSITY 2001

◊ The second annual Ham Radio University, a special day of education for Amateur Radio, will be held on Long Island, NY on Sunday, January 21, 2001. This year the number and length of the forums have been expanded and there will be a special series of forums for the newly licensed ham. HRU 2001 will include technical forums on all aspects of amateur radio. It is *not* a fleamarket or hamfest. There will be no items for sale. Ham Radio University is strictly an educational event. A sample of some of the forums are: antennas, DXing, contesting, purchasing Amateur Radio equipment, packet FLEXNET, ARES, APRS, the new digital modes, satellite communications, QRP (low power), emergency communications, a special "Ask the Experts" forum and more. In addition, there will be information booths manned by over 20 participating Amateur Radio clubs in the New York City/ Long Island area as well as booths for the ARRL, QCWA and DXCC/WAS card checking.

Ham Radio University will take place at the Babylon Town Hall Annex, Phelps Lane, Babylon, NY from 9 AM to 4 PM. Admission is $2; spouses and children under 12 will be admitted free. For more information, e-mail Phil Lewis, N2MUN, at **N2MUN@optonline.net**, or call 631-226-0698; See the Ham Radio University site on the Web at **www.arrlhudson.org/nli/hru2001.htm**.

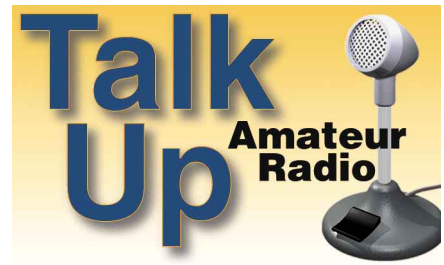
OSCAR STRAIGHT KEY NIGHT 2001

◊ All radio amateurs worldwide are cordially invited to participate in AMSAT-NA's 29th annual Straight Key Night on OSCAR, to be held from 0000 to 2400 UTC on 1 January 2001. There are no rules, no scoring and no need to submit a log. Just have fun operating Morse with a straight hand key via any Amateur Radio satellite (including the Moon). Call CQ SKN or answer such calls from other stations. In keeping with the friendly tradition of this event, each participant is encouraged to nominate someone he or she worked for "Best Fist." Those nominated will be listed in an AMSAT News Service bulletin and in *The AMSAT Journal*. Please send all Best Fist nominations to W2RS at 60 Waldron Ave, Glen Rock, NJ 07452-2831; **w2rs@amsat.org**.

LOOKING FOR A-TRONIX SCHEMATIC

◊ I am looking for a manual or schematic for an A-TRONIX CW keyboard. This is circa 1977-79 product that was made in California. I am willing to pay reproduction costs. Contact: Dave Ritchie, N4DJS, 3302 Devaughn Dr, Marietta, GA 30066; **deritchie@yahoo.com**.

Next Stray



CONTEST CORRAL

Feedback

In the **1999 ARRL 160-Meter Contest**, **N2NFG** should be shown as the 10th place finisher among W/VE Single Op, Lower-Power entrants with a score of 91,080 based on 619 QSOs and 72 multipliers.

In the **2000 ARRL International DX Phone Contest**, a file data problem caused the log of **SK0UX** to be under-reported. The final score should be 3,409,380 based on 4836 QSOs and 235 QSOs.

In the **1999 ARRL January VHF Sweepstakes**, **VE3CWJ** should be listed as a Single Op, Low Power entry from the Ontario section with a score of 1184.

W1AW Qualifying Runs are 10 PM EST, Friday, December 8, and 9 AM EST Wednesday, December 27. The K6YR West Coast Qualifying Run will be at 9 PM PST on Wednesday, December 6 (10-40 WPM). Check the W1AW schedule for details.

December

1-3

ARRL 160-Meter Contest. See Nov *QST*, page 98.

QRP ARCI Holiday Spirits Homebrew Sprint, CW, sponsored by QRP ARCI, 2000-2400Z December 3. CW only. Single band, all band, high band (20, 15, 10, 6 meters) or low band (160, 80, and 40 meters). Work stations once per band. Exchange RST, state/province/DXCC entity, and QRP ARCI number if member (nonmembers send power output). 1.810 3.560 3.710 7.040 7.110 14.060 21.060 21.110 28.060 28.110 50.060. Score 5 pts/QSO with ARCI member, 2 pts/QSO w/nonmembers in the same continent and 4pts/QSO with nonmembers in different continents. Bonus points: add 2000 pts/band for each homebrew transmitter, 3000 pts/band for each homebrew receiver, and 5000 pts/band for each homebrew transceiver used. Final score is QSO points × states/provinces/DXCC entities worked per band × power multiplier (>5 W, ×1; <5 W, ×7; <1 W, × 10; <250 mW, ×15), plus bonus points. Send entries within 30 days to QRP ARCI Contest Manager, Randy Foltz, K7TQ, ATTN: HB Sprint, 809 Leith St, Moscow, ID 83843; **rfoltz@turbonet.com**; **www.qrparci.org/**.

9th Annual TARA RTTY Sprint sponsored by the Troy Amateur Radio Association. RTTY only. 1800Z Dec 2 to 0200Z Dec 3. 80 40 20 15 10 meters, work stations once per band. Single op all band or multiop single transmitter. Exchange RST US state or Canadian province; DX send RST and serial number. Score one point for each QSO. Multipliers are US states (except KH6 and KL7), Canadian provinces (plus VE8 and VY1) and each DXCC entity. KH6 and KL7 count only as separate DXCC entities. The US and Canada do not count as DXCC entities. Multipliers count only once regardless of band. Send logs by Dec 31 to William J. Eddy, NY2U, 2404 - 22 St, Troy, NY 12180-1901; **rtty@n2ty.org**; **www.n2ty.org/.**

TOPS Activity 3.5 MHz CW Contest, 1800Z Dec 2 until 1800Z Dec 3. 80 meters only, 3.510-3.560. Single operator, single operator QRP (<5 W), multioperator. Exchange RST and serial number; TOPS members also give membership number. Score 1 pt/QSO with your own country (W/VE/VK/PY/JA/U call areas count as separate countries); 2 pts/QSO with other countries on your continent, 6 pts/QSO with other continents or maritime stations. Add 2 bonus pts/QSO w/TOPS member; 6 pts/QSO between TOPS members; and 10 pts/QSO w/GB6AQ. Multipliers are prefixes. Final score is QSO points + bonus points × multipliers. Awards. Send logs by Jan 31 to Helmut Klein, OE1TKW, Nauseagasse 24/26, A-1160 Wien, Austria; **helmut.klein@siemens.at**.

9-10

ARRL 10-Meter Contest. see *QST*, page 97.

28 MHz SWL Contest 2000, runs concurrent with the ARRL 10-Meter Contest, 0000Z Dec 9 to 2359Z Dec 10. Single op, multiop, CW or SSB. Any SWL with access to the Web or a PacketCluster must enter as multiop. Log only one station from each DXCC entity, US state or Canadian province. Count 3 points for each DXCC entity. Multipliers are US states and Canadian provinces. Send logs before January 31 to Franck Parisot SWL F-14368, PO Box 6, 92173 Vanves Cedex, France; **franckparisot@minitel.net**; **www.chez.com /swlcontest/**

16-17

Croatian CW Contest, sponsored by Hrvatski Radioamaterski Savez, 1400 UTC Dec 16 to 1400 UTC Dec 17. CW only. Categories, single operator all band and single band (high power, low power <100 W), single op all band QRP (< 5 W), multio-single and SWL. Stations must remain on a band for 10 minutes, but can change bands to work a new multiplier. Exchange is RST + serial number. Scoring: 10 pts for contacts with 9A stations on 1.8/3.5/7 MHz; 6 points for contacts on 14/21/28 MHz; 6 points for contacts with other continents on 1.8/3.5/7 MHz; 3 points for contacts on 14/21/28 MHz; 2 points for contacts with station within your own continent on 1.8/3.5/7 MHz; 1 point for contacts on 14/21/28 MHz. Multipliers: DXCC countries plus WAE list on each band. Final score is the sum of QSO points from all bands ´ sum of multipliers from all bands. Awards. Mail logs within 30 days to: Hrvatski Radioamaterski Savez, Croatian CW Contest, Dalmatinska 12, 10000 Zagreb, Croatia; **hrs@hztk.tel.hr**.

OK DX RTTY Contest, sponsored by Czech Radio club, RTTY, 0000-2400Z Dec 16, 80 40 20 15 10 meters. Single op all bands; single op single band, multiop all band and SWL. Exchange RST and CQ zone. On 10, 15 and 20 meters, count 1 pts/QSO with your own continent, 2 pts/QSO outside of your continent. On 40 and 80 meters, count 3 pts/QSO with your own continent, 6 pts/QSO outside your continent. Multipliers are DXCC entities and OK stations on each band. Final score is total QSO points × total DXCC entities on all bands × total OK stations on all bands. Awards. Send logs by Jan 15 to Czech Radio Club, OK DX RTTY Contest, PO Box 69, 113 27 Praha 1, Czech Republic; **milos@testcom.cz**; **crk.mlp.cz/eng/dxconte.htm**.

30-31

RAC Winter Contest, sponsored by Radio Amateurs of Canada, 0000-2400Z Dec 30. CW and phone. 160 80 40 20 15 10 6 2 meters. Work stations once per band and mode. QSOs must be made in their respective subbands. No repeater QSOs. Single operator, Single operator QRP (maximum 5 W output) all band or single band; single operator, all band low power (100 W); multioperator. Send RS(T) and serial number (VE stations exchange RS(T) and Province or Territory). CW—25 kHz up from the band edges; phone—1.850 3.775 7.225 14.175 21.250 28.500. Score 2pts/QSO outside VE; 10 pts/QSO with VE; and 10 pts/QSO with RAC official stations using "RAC" suffix (ie,VE2RAC, VE6RAC, VY2RAC, etc). Multipliers are Canadian provinces and territories (maximum 12) per mode per band. Final score is QSO pts × multipliers. Awards. Send logs by Jan 31 to RAC Contest Committee, 720 Belfast Rd, #217, Ottawa ON K1G 0Z5, Canada. See the Winter Contest site at **www.rac.ca/CANWIN.htm**.

Stew Perry Topband Distance Challenge, sponsored by The Boring Amateur Radio Club, 1500Z Dec 30 until 1500Z Dec 31. 160 meters, CW only. Single operator, multioperator single transmitter. Operate for a maximum of 14 hours. Remote or packet spotting shall not be used. Transmitting and receiving antennas must be located at the same QTH. Off time is intended to be taken during your daylight hours. Only one break may be taken between your first and last QSO, and must be at least 30 minutes. Exchange is your grid square. Count a minimum of one point per QSO and an additional point for every 500 kilometers distance. If your logging software does not support this scoring method, the sponsor will compute your score for you if you submit your log electronically. No additional distance given for long path. Final score is QSO points × power multiplier (>100 W, ×1; <100 W, ×2; <5 W, ×4). Awards. Send log by Jan 31 to Boring ARC, 15125 SE Bartell Rd, Boring, OR 97009; **tbdc@contesting.com**; **jzap.com/k7rat/stew.html**

ARRL Straight Key Night, 24-hour period UTC (from 7 PM EDT Dec 31 until 7 PM EST Jan 1). See the announcement on page 99 in this issue.

George Fremin III, K5TR ♦ 624 Lost Oak Trail, Johnson City, TX 78636 ♦ k5tr@arrl.org

VHF/UHF CENTURY CLUB AWARDS

Bill Moore, NC1L
Century Club Supervisor

The ARRL VUCC numbered certificate is awarded to amateurs who submit written confirmations for contacts with the minimum number of Maidenhead grid-square locators (indicated in *italics*) for each band listing. The numbers preceding the call signs indicate total grid squares claimed. The numbers following the call signs indicate the claimed endorsement levels. The totals shown are for credits given from August 3 to October 13, 2000.

The VUCC application form, field sheets and complete list of VHF Awards Managers can be found on the Web at **http://www.arrl.org/awards/vucc/**. Please send an SASE if you cannot download the forms online. If you have questions relating to VUCC, send an e-mail to **vucc@arrl.org**.

50 MHz
100

*1075	W6VFA
1076	AC5DK
1077	N3TBB
1078	AJ6T
1079	K9FOH
1080	KE5K
1081	K4SO
1082	N3WCM
1083	K5IQ
1084	N8II
1085	N8GHZ
1086	AF4HX
1087	NG4C
KB0LGB	200
WA1ECF	400
K1TEO	550
W2GKR	325
K2CS	250
WB2WIH	275
KB2TGU	275
K3CWH	275
K3AX	425
*W3EP	650
W3UQH	125
W4LTJ	325
W4DR	775
N4MM	700
NG4C	200
AF4HX	125
W4WTA	525
AA5XE	400
K5ER	175
N5WD	150
KJ5RC	300
K5IQ	175
KM5TY	125
K5TN	450
AJ6T	125
WA7PDC	250
N7CNH	150
N8II	175
W9OBG	200
K9FOH	225

144 MHz
100

585	K5VH
586	NG4C
W4DR	150
WA5RT	125
K5VH	150

222 MHz
50

W0JRP	70

432 MHz
50

283	WA5RT
W7HAH	190

902 MHz
25

WW8M	55

2.3 GHz
10

WW8M	30

3.4 GHz
5

WW8M	15

10 GHz
5

WW8M	15

Satellite
100

N7SFI	625
KC7QFS	400
N8GHZ	275

* = Correction from October *QST*.

FEEDBACK

◊ The Web site for *NEC4WIN* that was mentioned in L. B. Cebik's article, "A Beginner's Guide to Modeling with *NEC*" in the November *QST* has changed. It is now **www.orionmicro.com/**.

SPECIAL EVENTS

Waimea/Kamuela, HI: HWARS, W4A, 2000Z **Nov 24** to 1000Z **Dec 7**, celebrating 21 years of astronomy at the Canada-France-Hawaii Telescope. 14.210 21.321. QSL. Christian Veillet, PO Box 2124, Kamuela, HI 96743.

Ennis, TX: Ellis County Amateur Radio Club, WD5DDH, 1400 to 2200Z **Dec 2**, during the Christmas celebration at the Ennis Railroad Museum. 28.450 14.265. QSL. ECARC, 218 Virginia Ave, Waxahachie, TX 75165.

Huntington, WV: Tri-State Amateur Radio Association, W8VA, 1400 to 2100Z **Dec 2**, during the Mid-American Conference Football Championship game at Marshall University. 10.125 14.235 21.325 28.325. Certificate. Gregg Hendry, 237 Carper Lane, Barboursville, WV 25504-1130.

Homestead, FL: Everglades Amateur Radio Club, W4SVI, 1300 to 2300Z **Dec 2** and **3**, commemorating the dedication of Everglades National Park by Harry S. Truman. 80 or 2 meters; General class subbands. Certificate. W4SVI, PO Box 900113, Homestead, FL 33090-0113.

Greenville, SC: Experimenters Group ARC, N4ISS, 1500Z **Dec 2** to 2000Z **Dec 3**, celebrating the manning of the International Space Station. 7.297 14.297 28.497 AO-27. Certificate. Albert K. Lark, KD4SFF, 301 Shannon Dr, Greenville, SC 29615.

West Lafayette, IN: Purdue University ARC, W9YB, 1200Z **Dec 2** to 2400Z **Dec 3**, for the 80th anniversary of 9YB, first licensed in 1920. 14.260 3.920 146.76. QSL. Purdue University Amateur Radio Club, W9YB, Purdue Memorial Union—West Tower (Rm 370), West Lafayette, IN 47907-3584.

Baton Rouge, LA: USS *Kidd* Amateur Radio Club, W5KID, 1500 to 2300Z **Dec 7**, operating from aboard the USS *Kidd* commemorating the 1941 attack on Pearl Harbor. 28.400 21.320 14.240. QSL. Baton Rouge Amateur Radio Club, Box 4004, Baton Rouge, LA 70821.

Norfolk, VA: USS *Wisconsin* Radio Club, N4WIS, 1500Z **Dec 7** to 0200Z **Dec 8**, as the USS *Wisconsin* moves to Nauticus National Maritime Center. 7.035 7.235 14.035 14.235. QSL. Carey Brown, KT4P, 4821 Rosecroft St, Virginia Beach, VA 23464.

Bethlehem, IN: Clark County ARC, W9WWI, 1500Z **Dec 8** to 2200Z **Dec 9**, celebrating the Christmas season. 80 40 20 meters. Certificate. W9WWI, 1805 E 8th St, Jeffersonville, IN 47130.

Marion, IN: Grant County ARC, W9EBN, 1500 to 2400Z **Dec 9**, to celebrate the Christmas City Walkway of Lights (over two million lights). 7.235 14.310 28.410 146.79. Certificate. L.B. Nickerson, K9NQW, 517 N Hendricks Ave, Marion, IN 46952.

St. Johnsbury, VT: St. Johnsbury Academy Wireless Club, W1SJA, 1400 to 2000Z **Dec 9**, celebrating high school ham radio clubs. 14.250 28.350. Certificate. Bruce Burk, St. Johnsbury Academy, 1000 Main St, St Johnsbury, VT 05819.

Baltimore, MD: Historical Electronics Museum Amateur Radio Club, W2W, 1400Z **Dec 9** to 2200Z **Dec 10**, commemorating the December 7, 1941 attack on Pearl Harbor. 7.115 7.245 14.045 14.245. Certificate. HEMARC W2W, PO Box 746 MS 4015, Baltimore, MD 21203.

Seneca, IL: Starved Rock Radio Club, W9MKS, 1500Z **Dec 9** to 0300Z **Dec 10**, to commemorate the 58th anniversary of the launch of the first LST at Seneca Prairie Shipyard. 14.310 28.510 7.280. Certificate. SRRC, PO Box 198, Leonore, IL 61332.

Cobb Island, MD: The Charles County ARC, W3T, and the Southern Maryland ARC, W3F, 1500 to 2300Z **Dec 16**, during the centennial celebration of the world's first phone/voice contact by Aubrey Fesseden, which was done from Cobb Island. 7.250, 14.275, 21.350, 28.500. Certificate. CCARC, PO Box 668, White Plains, MD 20695.

Nazareth, PA: Christmas City ARC and Delaware-Lehigh ARC, WX3MAS, 1200Z **Dec 16** to 2400Z **Dec 17**, for the annual Christmas Greetings from the Twin Christmas Cities. 28.465 21.365 14.265 7.270. Certificate. CCARC/DLARC WX3MAS, Greystone Building—Gracedale Complex, RR 8, Nazareth, PA 18064-9211.

Bethlehem, NM: Valencia County Amateur Radio Association, KC5OUR, 1500Z **Dec 16** to 0000Z **Dec 25**, celebrating the Christmas season from Bethlehem, New Mexico. 7.150 14.250 21.350 28.350. QSL. VCARA, PO Box 268, Peralta, NM 87042.

Worldwide: Amateur Radio Lighthouse Society (ARLS), CQ/LH, 0001 **Dec 18**, 2000 to 2359Z **Jan 2**, 2001, during "ARLS Lighthouse Christmas Lights." 7.270 14.270 21.370 28.370. Certificate. Amateur Radio Lighthouse Society, PO Box 2178, Cinnaminson, NJ 08077.

Boyd, TX: Signal Hill ARC, KM5NT, 0000Z **Dec 28** to 1500Z **Dec 31**, during the DL88 rare grid square VHF DXpedition at Big Bend National Park. 50.125 144.200 432.100 14.225. QSL. Ed Lee, 210 Monica, Glenn Heights, TX 75154. QST

George Fremin III, K5TR ♦ 624 Lost Oak Trail, Johnson City, TX 78636 ♦ k5tr@arrl.org

STRAYS

WORLD SHORT-WAVE DX MONITOR CERTIFICATION

◊ The Hallicrafters Collectors Association is sponsoring this award for those who log and verify international short-wave stations from 25, 50, 75, 100, 125 or more countries. Confirmation may be by QSL, post card or letter. The award period began October 15, 1999 and will end April 15, 2001.

Applicants may use 50% old and 50% new station verifications. In other words, if you are trying for a 50-country certificate, 25 countries may be dated prior to October 15, 1999 and 25 must be dated later than October 15, 1999.

All entrants are encouraged to use a vintage tube-type receiver such as a Hallicrafters, Drake, Hammarlund etc. However, there is a category for solid-state modern receivers also.

Submit logs via e-mail to: **w8dbf@hallicrafters.org**. Logs may also be submitted via postal mail to: Duane Fischer, W8DBF, 5028 Merit Dr, Flint, MI 48506-2127.

Once an entry is confirmed, a personalized certificate will be issued bearing the listener's name, date of submission, type of receiver used, number of countries certified and entry number. All applicants should include a check or money order for $7.50 to cover the printing, handling and return postage costs of their certificates.

The names of all listeners receiving a certificate will be published on the SWL reflector: **swl@qth.net**, and the HCA Web site at: **www.hallicrafters.org**.

Next Stray

NEW PRODUCTS

NEOPRENE H-T POUCHES FROM CUTTING EDGE ENTERPRISES

◊ Cutting Edge Enterprises has expanded their offerings of H-T and radio pouches with the addition of a new line of high-cushion neoprene H-T pouches.

The *Hold-It NEO* pouches are available in several different versions designed to fit the majority of today's more popular hand-helds. Color choices are "Can't-Lose-It" red and "Covert" black.

Prices start at $14.49. For more information contact Cutting Edge Enterprises, 1803 Mission Street, Suite 546, Santa Cruz, CA 95060; tel 800-206-0115, fax 831-426-0115, **cee@cruzio.com**.

OHR100A NOW AVAILABLE FOR 15 METERS

◊ Oak Hills Research has added a 15-meter version of the OHR100A QRP CW transceiver to their line of low power radio and operating accessories kits.

Their OHR100A series now includes single band QRP CW transceiver kits for 40, 30, 20 and 15 meters. "Built to order" service is also available.

Features include variable RF power (from milliwatts to approximately 4.5 W for the 15-meter version); a single-signal superhet receiver; RIT; variable bandwidth 4-pole crystal filtering; sine-wave CW sidetone; and QSK. The radio can be aligned for the Technician or General portions of the band. An optional internal electronic keyer is available.

The transceiver measures around $2\frac{1}{2} \times 6 \times 6$ inches and weights approximately 24 oz. Power requirements are specified at 80 mA on receive and 850 mA on transmit (at 13.8 V dc). The kit comes complete with an enclosure, a PC board, all components and instructions.

Price, $129.95 (in kit form). For more information contact Oak Hills Research, a division of Milestone Technologies, 2460 S Moline Way, Aurora, CO 80014; tel 800-238-8205, 303-752-3382; fax 303-745-6792; **qrp@ohr.com**; **www.ohr.com**. QST

Next New Product

ARRL Straight Key Night 2001

As the third millennium begins at 0000 UTC January 1, 2001, many will stop and reflect on days gone by, and on the various interests that have occupied us over the years. For many, the comic books, AM radio and television of our youth were supplanted by an interest in this wonderful hobby we call Amateur Radio. And most of us oldtimers—and many of the next generation as well—can find our roots in the hobby in our days as "brass pounders."

In this era where digital communication, keyboarding, FM and electronic keys are in vogue, once a year many excellent operators bring the past to the present and participate in the annual ARRL Straight Key Night. For one 24 hour period, we put away the "modern" advances and go back to hand-keys. For some, it is a trip to a nostalgic time, much the same way an old soldier tries on his old uniform. For others, it is an excellent opportunity to try their hand much as their Elmers did in the past.

The object of this friendly event is to enjoy some good, old fashioned QSO fun, using straight keys. The emphasis is on ragchewing rather than fast contest-type exchanges. **SKN 2001 begins at 7 PM EST December 31 and runs for 24 hours through 7 PM EST January 1 (0000–2400 UTC January 1, 2001).**

Many participants will end up qualifying for the "Rag Chewers Club." All it takes is one 30-minute QSO. When you send your SKN report to Headquarters, if you send along a secondary report of your RCC qualifying QSO and the $3 certificate fee, we'll be happy to send along your RCC certificate—signed by "The Old Sock" himself!

When participating in SKN 2001, instead of sending RST before sending the signal report send the letters SKN, to indicate your participation, and to clue in passers-by who may be listening. Following SKN, send the Contest Branch a list of stations worked, plus your vote for the best fist you heard (it doesn't have to be one you worked). Also, include your vote for the most interesting QSO you enjoyed or monitored, as well as any interesting comments you have for the SKN 2001 write-up. Entries may be e-mailed to the Contest Branch at **StraightKey@arrl.org**, or may be sent via regular mail to SKN, ARRL, 225 Main St, Newington, CT 06111.

Entries for SKN 2001 must be received by January 31, 2001. Votes for "Best Fist" and "Most Interesting QSO" will be tabulated and included in the April 2001 issue of *QST*. If you have questions about SKN, please visit the Contest Branch Web page at **www.arrl.org/contests** or contact **n1nd@arrl.org**. QST

HOLIDAY GREETINGS

From the ARRL Staff and Contributing Editors!

Katherine Allison, KA1RWY
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Lynne Anderson
Rich Arland, K7SZ
John Bee, N1GNV
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Shelly Bloom, WB1ENT
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Steve Ford, WB8IMY
Janie Foy
George Fremin, K5TR
Scott Gee, WB9RRU
Tim Giles
Jennifer Hagy, N1TDY
Ed Hare, W1RFI
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Karen Isakson
Bart Jahnke, W9JJ
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Joel Kleinman, N1BKE
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Kathy Kostek
Tammy Krauss, K1TLK
Lisa Kustosik, KA1UFZ
Greg Kwasowski
Paul Lappen
Mary Lau, N7IAL
Zachary Lau, W1VT
Rose-Anne Lawrence, KB1DMW
Monique Levesque
Robert Lincoln
Rick Lindquist, N1RL
Maryann Macdonald
Nonie Madone
Steve Mansfield, N1MZA
Bernie McClenny, W3UR
Dan Miller, K3UFG
Judy Miller
Wayne Mills, N7NG
Bill Moore, NC1L
Jodi Morin, KA1JPA
Dennis Motschenbacher, K7BV
Diane Ortiz, K2DO
Paul Pagel, N1FB
Carol Patton
Dave Patton, NT1N
Tom Pavdi
Kristy Perillo
David Pingree, N1NAS
Ann-Marie Pinto
Emil Pocock, W3EP
Jayne Pratt-Lovelace
Brennan Price, N4QX
John Proctor
Hanan Rayyashi, KB1AFX
Paul Rinaldo, W4RI
Kim Rochette
Dyanna Rumstay
Eileen Sapko
Linda Saede
Daniel Sayad
Cathy Scharr
Bob Schetgen, KU7G
Joe Shea
Andrew Shefrin
Barry Shelley, N1VXY
H. Ward Silver, N0AX
Jon Siverling, WB3ERA
Daniel Small
Doug Smith, KF6DX
Maria Somma
Cathy Stepina
Dean Straw, N6BV
Dave Sumner, K1ZZ
Sharon Taratula
Lisa Tardette
Paul Theodoratos
Mike Tracy, KC1SX
John Troster, W6ISQ
Ed Vibert
Pete Warner
Maty Weinberg, KB1EIB
Rosalie White, K1STO
Mark Wilson, K1RO
Dan Wolfgang
Jean Wolfgang, WB3IOS
Larry Wolfgang, WR1B
Janice Wytas
Melissa Yrayta

By Dan Henderson, N1ND
Contest Branch Manager

Field Day 2000 Results

Certain annual events are always tied to the seasons. If you hear the ringing of bells and see Salvation Army kettles at the mall, you know it is Christmas and winter. When you see the plethora of football on the television, you know fall is just around the corner. Budding crocuses and the Masters golf tournament are seen to mark the beginning of spring. And when people's attentions turn to generators, portable antennas and covered-dish suppers, you can bet it's summer and the ARRL Field Day—the largest Amateur Radio event in any calendar year—is at hand.

"The first Field Day was pronounced an unqualified success, according to about 50 accounts of station participation received. The gang who took part are looking forward to more similar occasions for the practical testing of portable (potential emergency) equipment, combined with a good time for all." With these words, the legendary Ed Handy, W1BDI, stalwart Communications Manager of the ARRL for many years, began the very first Field Day report in the September, 1933 issue of *QST*. The same words can certainly be used to describe the Field Day 2000.

Once again hundreds of clubs, groups and individuals flocked to parks, campsites, and just about every location imaginable to participate in what has become, for the average ham, one of the focal points of the year. A total of 2,043 log entries were received representing 30,151 participants. The total number of QSOs dropped slightly—1,421,816, down 3.3 % from 1999. Interest in digital communications was up as demonstrated by a more than twofold increase in the number of digital QSOs—10,385 (up from 4,410 in 1999). The phone QSO total dropped a modest 2.7% to 901,869 while the CW total decreased 5.5 % to 509,562 in FD2000.

Emergency power/portable stations again accounted for 90% of the total entries received. Field Day proved to be a popular follow-up exercise for the hundreds of stations and groups that had participated in the nationwide Y2K standby on December 31 and January 1. The Amateur Radio Emergency Service continues to be a strong supplement to local and state officials and agencies. From the hundreds of photographs received at the ARRL, Field Day continues to be an outstanding demonstration of what ARES members have to offer to their communities.

One of the principal goals of almost every Field Day operation is to "do better than we did last year." Many groups reported setting club or personal best scores during Field Day 2000. Leading the way in points was the joint effort of the Potomac Valley Radio Club and Columbia Amateur Radio Association. Sending a report of 30A, their total score of 31,534 broke the previous overall high total of 30,150 set in 1994 by the Conejo Valley ARC. Congratulations on an overall record setting performance. Also set-

Field Day Entries By Class

1A	215	14A	1	1D	190
2A	517	16A	1	2D	12
3A	344	17A	1	3D	8
4A	154	18A	1	4D	2
5A	90	30A	1	7D	1
6A	32	35A	1	8D	1
7A	23	1B1	120	1E	113
8A	14	2B1	2	2E	17
9A	4	1B2	61	3E	6
10A	1	2B2	32	4E	3
11A	3	1C	47	5E	4
12A	1	2C	1	6E	1
13A	1	4C	1	9E	1

Top 10 Scores

Call Sign	*Score*	*Class*
W3AO	31,534	30 A
W4IY	24,904	14 A
KK8M	22,835	17 A Battery
W2GD	20,628	6 A
N1FD	19,614	18 A
N6ME	18,702	7 A
W0GG	17,306	3 A
K4BFT	15,426	5 A
W0CQC	15,025	2 A Battery
W6NWG	13,506	5 A

In spite of a deluge from Mother Nature, Glenn, VE3GLN, and a few of the over 200 participants at the VA3RAC National Capital FD2000 35A record-setting operation celebrate the successful completion of Field Day.

Did the Field Day signals act as homing beacons, or are the hot air balloons assisting in the antenna-raising party at the W0MXW Rochester ARC Field Day locale?

Bonus Points the Really Hard Way

By Chip Margelli, K7JA

At the first planning meeting for the Field Day effort of the Western Amateur Radio Association (N6ME) from Orange County, California, I was "volunteered" to handle our satellite contact. Seeking to provide more for our club than just 100 points, I set out to demonstrate just how far Amateur Radio has come in the year 2000. The objective: make a QSO using OSCAR-0, Earth's "natural" satellite—our Moon!

Having always had a preference for "sticks and wire" antennas, I chose to construct a pair of 11-element quagis, following a design by W5UN that is posted on his Web site (**www.wt.net/~w5un**). These quagis are designed for a very clean pattern, and for ease of matching. I procured four 12-foot closet poles and some wood dowel (for the quad spreaders) from my local home-supply store, and scrounged some $^{3}/_{16}$-inch rod from earlier 2-meter beam projects. With a little adjustment of the shapes of the quad loops used for the driven element and reflector, I was able to achieve 51 + *j* 0Ω on each beam and this resulted in very easy combining of the two quagis. The two beams were mounted side-by-side, horizontally polarized, on a wood/aluminum spreader, with all rotation in both azimuth and elevation being accomplished via the "Armstrong" method (thanks to deliberately loose **U**-bolts).

At the appointed time (1200 UTC Sunday; 5:00 AM local time), I had everything warmed up and ready to go. The Timewave DSP-59+ audio filter was set for a bandwidth of 25 Hz, and I had the headphones crammed against my ears in the hope of hearing even the tiniest peep from W5UN while using my portable, untested setup. The RF Concepts RFC2-317 "brick" amplifier waited in anticipation, ready to create about 120 W of "thunder" which, I was sure, would push the orbit of the Moon outward by at least one micron.

About three seconds after 1200 UTC, I heard a curious thumping in the headphones; tuning the Yaesu FT-736R downward in frequency a few dozen Hertz, there was W5UN, about 15 to 20 dB out of the noise! I threw the headphones down onto the operating table and turned up the volume so others gathered around could hear how loud Dave was! In the five-minute CW QSO that followed, Dave and I exchanged full Field Day reports, as well as RST and some banter; throughout the contact, I don't believe I missed a single dot nor a dash...there was solid copy of W5UN throughout.

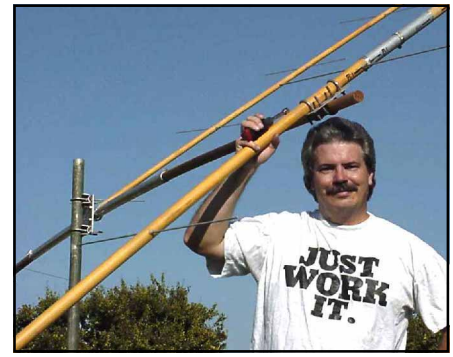
Dave Blaschke, W5UN, utilizes a 480-element array that is world renowned as an Amateur Radio engineering marvel (see the September 2000 issue of *QST*). What's more, Dave is a wonderful mentor for new EME operators, and he is always willing to run schedu2les, even with very small stations. The very high antenna gain and careful receiver system design at W5UN have made hundreds of VHF operators delighted to make a QSO via "The Ultimate Long Path" on the ham bands.

And one early Sunday morning in June of the year 2000, W5UN thrilled the operators and support crew at N6ME by providing us with the most rewarding 100 bonus points our club has ever earned on Field Day! Thanks, Dave!

ting category scoring marks were: the East Tennessee Contesters N4IR (1A Battery), the Pikes Peak DX Group W0GG (3A), the Illinois Valley Radio Association K9AVE (5A Commercial), the Cherryville Repeater Association W2GD (6A), the Alameda County Radio Club N6WG (8A Battery), the Conejo Valley ARC AA6CV (12A Battery), Woodbridge Wireless W4IY (14A), the Nashua Area RC N1FD (18A), AB7E (1B-2 Op Battery), K7MK (2B-2 Op Commercial), WA5FRF (4C), W7GG (3E), W6YX (5E), W4WVP (9E), and the Capital Region FD2000 VA3RAC (35A).

The Capital Region effort was one of

Larry W4SAT (right) explains the satellite tracking program that the Montgomery (Alabama) Amateur Radio Club used during Field Day 2000 to Rik, KU4PY, Dennis KS4UO and Carole, KR4VR.



Chip, K7JA, displays the antenna and the motto for his EME efforts in Field Day 2000 at the Western Amateur Radio Association N6ME.

A No Coder's Field Day

By Ted Allison, N0NKG

This year I decided to set up my own Field Day Station. I had some work to do around the house, so I didn't get equipment loaded and on the road until about 11 AM Saturday. I arrived at the site on Rampart Range Road, at 9500 feet elevation, exactly at noon—just as the rain began.

The rain didn't amount to much, so I proceeded to set up the 2-meter and 6-meter Yagis, supported by 15 feet of 1-inch electrical conduit tied to a fence post. With my ICOM IC-706 MkII transceiver ready to go, I started on 2-meter SSB, but couldn't get stations to hear me. I realized there was RF feedback when my 150-W amplifier was on. After trying different grounding schemes without much success, I ended up operating barefoot.

After making 10 contacts on 2-meter SSB, I moved to 6 meters just as the band opened to California. Within 14 minutes I completed 10 QSOs! I also got a few into Florida and Mississippi, which were considerably harder. (I tried calling one station for nearly half an hour. You can imagine my excitement when he finally returned my call!)

After operating for two hours I had logged 14 contacts on 6 meters, 13 on 2 meters and 1 on 70-cm FM. I broke down the station and went down the hill to the Pikes Peak Radio Amateur Association and Mountain Amateur Radio Club Field Day site. I had been in touch with them throughout the day on simplex. It was good to compare notes and see a slightly larger Field Day operation. The delicious food they had on hand was an added bonus!

All in all, it was a great Field Day and I accomplished all seven of my Field Day goals:

1. To practice and test emergency preparedness.
2. To find out what needs fixing (ie, the RF feedback problem).
3. Demonstrate ham radio (I had a visitor at my site).
4. Make radio contact with other hams.
5. Have fun on the radio.
6. Socialize with other hams.
7. Make yourself tired so you sleep like a log.

Ashley, KC2GDT, handled the Technician station while her dad David, KF2EW, operated one of the HF stations for W2GZJ—the County Line ARA.

We all know that YLs on the air are sure to get a lot of calls. Rose, KC6KPA and Chat, KD6VIV (what a great name for an SSB operator!) pitched in at the AF6DX Spider ARC 20-meter phone station.

the most outstanding operations ever attempted during an ARRL Field Day. Six months in planning brought together seven clubs in the Ottawa–Hull, Canada area to put together a record-setting number of transmitters in simultaneous operation during the Field Day event. When VA3RAC was officially declared operational at 1800 UTC on Saturday June 24, 35 stations went on the air simultaneously from the grounds of the Canadian Museum of Science and Technology in Ottawa, the Canadian national capital. In addition, a qualifying Technician station and VHF station were also operational from the beginning of the event. A total of over 190 operators, governmental and agency officials, and visitors participated in a one-of-a-kind experience. Their story is briefly shared in this article, along with a sampling of other Field Day 2000 efforts—plus a few of the *thousands* of Field Day photographs we received.

New to Field Day 2000 was the addition of a 100-point bonus for the demonstration of one of the newer "non traditional" modes of amateur communication. Reports from across the US and Canada show this was a popular addition to Field Day, with APRS and ATV leading the way as popular demonstration stations. This category will be revised slightly in Field Day 2001, with provisions made to include more than one demonstration station for additional bonus credit. Be sure to check the Field Day rules for 2001 when they are posted to the ARRL Contest Web Page

Seven Clubs + 2 Languages + 6 Months of Planning + A Pinch of Craziness = Success

By Glenn McLeod, VE3GLN

What started as a wild idea at a New Year's day celebration, turned out to be one of the best Field Day efforts ever attempted, any way you look at it.

According to the old saying, anytime you have three hams in one community you end up with two clubs. Imagine the networking necessary to bring seven active clubs together for a Field Day extravaganza. But through long hours of hard work and cooperation, seven clubs—the Capital Region DX Club, the Ottawa Amateur Radio Club, the Ottawa Valley Mobile Radio Club, the Pioneer Amateur Radio Club, the West Carleton Amateur Radio Club, Emergency Measures Radio Group, and Le Club de Radio Amateur d' l'Outaouais —came together to organize, plan and execute the largest Field Day operation ever—35A. When all the dust had settled, over 200 persons—planners, operators, support personal—had contributed to the event.

We paid great attention to small details during the planning. Many think it is an RFI nightmare to put a 3A station on the air within a 300-meter circle. Well, try managing three transmitters (CW, phone and digital) on the air simultaneously on 1.8 MHz through 432 MHz. Now throw in various assorted UHF bands, a satellite station, a Technician station, and APRS and ATV demonstration stations!

One of the early tasks was securing the support of various agencies and corporations within the Ottawa–Hull area. The national Museum of Science and Technology (which houses a permanent communications exhibit including an operational Amateur Radio station) agreed to allow the group to use their grounds. Agencies of the Canadian Federal Government became involved, providing Canadian Forces tents to house transmitter sites, and the Communications Research Centre, which allowed the group to borrow enough tower sections to set up 22 10-meter towers across the site. The CRC also provided the power-distribution system. The Defence Research Establishment—Ottawa, provided the satellite antennas. Other support was also provided by many commercial concerns. Finally, the cities of Ottawa, Hull and Gatneau all recognized the event by declaring Amateur Radio week in their communities.

Site planners Brice, VE3EDR, Ernie, VE3EJJ, and Clare, VE3NPC, developed a workable station layout. Near-field radiation patterns were plotted and used to avoid any transmitter being placed in another near field. Getting three 160-meter antennas into a small area is not an easy task. (We finally decided to erect two dipoles at right angles at the far ends of the site, and a 160-meter GAP vertical.) In addition, band pass filters were used to further reduce RFI.

At 1800 UTC on Saturday June 24, under the watchful eye of Michael Binder, the Assistant Deputy Minister of Industry Canada, Capital Region Field Day 2000 was declared open. All 35 transmitters were on the air at the start of the operation and remained operational for the Field Day period. A total of 152 operators participated.

Yes, Murphy did participate, too, but his challenges were met. Mother Nature decided to make certain things went along "swimmingly" as well (with several inches of overnight rainfall). But nothing could diminish the outcome of what was truly an extraordinary Field Day. The Capital Region Field Day 2000 will stand for quite a while as a tribute to the ingenuity and planning skills of the operators "north of the border" in Ontario and Quebec.

With Emphasis On The Next Generation—W4UG

By John Errington K2JE

One of the great areas of emphasis recently has been on attracting young people into the hobby. The Virginia Beach Amateur Radio Club has been "putting its money where its mouth is" for about a dozen years with an amateur radio youth group as part of their club. As part of their club structure, they have several members designated as "youth advisors"—a tangible means of actively Elmering to the next generation.

Many groups indoctrinate their younger operators by having them handle the Novice/Technician station. When planning their Field Day 2000 operation, the VBARC made the decision to have their youth group handle operations at one of the club's primary transmitters—their first SSB station. Many clubs use this principal transmitter as their "bread and butter" points station for Field Day.

Led by Youth Advisor Mike, KD4NFX, Ed, KN4KL, Charlie, W1WTG and others, the youth group accepted the challenge and hit a home run. Their 345 QSOs on 20 Meters was the club's highest QSO total on any band or mode and their 248 Qs on 80 meters finished third. All totaled, their 593 QSOs accounted for almost one third of the club's QSO total and almost 25% of the club's total score (before bonus points). When you include the club's QSOs and points from the KC4JGC Novice/Tech station, the "next generation" of hams from the Virginia Beach ARC posted 35% of the club's outstanding effort. Add to this great exposure from the media, a visit from Virginia's Second District Congressman Owen Pickett, and the usual Field Day food and excitement and it is easy to understand why Field Day 2000 stands out as one of our most successful events ever.

Enabling the new members and younger hams by presenting them a challenge and giving them the opportunity and assistance to be successful was an excellent idea. Perhaps this is one more tool we can all add to our "bag of tricks" to help encourage the growth of our hobby.

In addition to setting an all-time record score for Field Day, the W3AO operation certainly placed near the top when it came to outstanding operating locale.

Cristop, DL7CHR, takes a break while John, ND4N, enjoys making a few contacts in Landrum, SC for the Greenville, SC Blue Ridge ARS.

Tranquility isn't often the case for Field Day, but Charlie, W4MEC, certainly couldn't have asked for anything better at the W4YK Blue Ridge ARC site in Hendersonville, North Carolina.

(www.arrl.org/contest) after the first of the year, or when they appear in the May issue of *QST*.

Once again, the Field Day 2000 pins proved to be a popular item. If your group didn't order pins, it is not too late. There is a small supply of Field Day 2000 pins available for $5 each from the ARRL Contest Branch. They will be sold on a first-come first-served basis until they are gone.

In his report of the very first Field Day, Ed Handy wrote "There is hardly space for more than a resume of the highlights here, but the enthusiasm greeting our first Field Day augurs well for future similar occasions. What shall we call our next Field Day to give it more of a 'preparedness for emergency' significance? Suggestions will be welcomed. Bearing in mind that the new amateur station regulations make every licensee a potential operator of portable equipment, *every amateur* should now take steps to make himself ready to render constructive service in any time of emergency."

We can safely assume no suitable new name was found; 67 years later, the name Field Day is still in use. Field Day 2001 is set for the weekend of June 23-24. The most important part of Field Day isn't the number of points your group scores or the number of transmitters that you employ. Field Day's strength lies in the fact that tens of thousands of Amateur Radio operators across the US and Canada come together to put on a tangible display of our hobby's role in our communities and our ability to be effective public servants. As your group prepares for the first Field Day of the new millennium, remember: keep the focus on Ed Handy's call to be ready to service. This annual emergency preparedness exercise is always open to innovation and challenge. The preparations made during the cold months of winter will pay off when the annual "rite of passage into summer" happens, known as Field Day 2001.

Scores

Class A stations are clubs or groups operating with more than two operators. Score listings are grouped according to the number of transmitters in simultaneous operation. The listings show club or group name, call sign(s) used, total number of QSOs, number indicating power output used (5 is less than 5 W, 2 is less than 150 W; 1 is more than 150 W), number of participants and total score including bonus points and ARRL section. Scores are listed from highest to lowest in each class. Class B stations are portables manned by one or two operators. When there are two operators, the other operator's call is listed in parentheses, if it is known. Class C stations are mobiles. Class D stations are home stations using commercial power. Class E stations are home stations using emergency power.

1A Battery

East Tennessee Contesters
N4IR 1020 5 5 10,900 TN
Chew's Ridge Gang
K6MI 938 5 6 10,030 SCV
Non-Club Group
W1ECH 826 5 6 8,435 VT
Guano Reef
N4BP 771 5 4 8,415 SFL
Corn Fed Ant. Farmers
KE9R 725 5 3 7,350 IN
Manti Contest Club
NC7X 659 5 3 7,290 UT
Flying Beers Intl
WY8W 649 5 3 6,440 MI
CW-R-US
W0GI 561 5 4 5,810 KS
Non-Club Group
NN7S (+N7JKF)
509 5 3 5,650 MT
Radio Amateur Megacyle Society
W9DY 521 5 4 5,495 IL
Williamsburg Area ARC
K4RC 596 5 20 5,235 VA
Hams With an Altitude
AA7QU 512 5 3 5,220 OR
Radio Oregon
K7RO 1320 2 10 4,038 OR
NABRC
K4NAB 383 5 15 3,685 SC
Austin (TX) QRP Club
KQ5RP 307 5 3 3,270 STX
Neurosa's Gopher Munchers
AE6C 313 5 3 3,000 SV
Ham Radio Fellowship
WK6O 749 2 3 2,912 ORG
Thomson ARC
W9RCA 1125 2 13 2,550 IN
Bear Mtn QRP Group
KK5AR 322 5 4 2,535 NM
Tamaqua Area ARA
W3SX 276 5 7 2,355 EPA
Parma RC
W8PRC 634 2 9 2,278 OH
SCAN-RAA
WA6P 845 2 15 2,152 LAX
Hawaii QRP Club & Hilo ARC
KH6IN 132 5 7 2,095 HI
Tickbit Trio
K4RET 337 5 3 2,020 VA
Non-Club Group
WN0G 948 2 3 1,996 IA
Nanaimo ARA
VE7NA 554 2 20 1,936 BC
Tidelands ARS
K5BS 209 5 20 1,850 STX
Venturer Crew 73
K5BSA 504 2 15 1,708 NTX
New Cuyama Quad Hoppers
N6PC 438 2 3 1,578 SB
Wailua ARA
KH6KWS 524 2 11 1,516 HI
Surly Temple Solar Society
WB8TGY 121 5 3 1,410 MI
Kona Harbor Rats
NH6DR 395 2 10 1,390 HI
Southwest Mississippi ARC
KF5CE 545 2 12 1,390 MS
Lincoln Gap Radio & Social Club
K1GAP 125 5 4 1,350 VT
Renfrew Cty ARC
VA3EEE 374 2 10 1,330 ON
Independent ARC
W0CXX 89 5 3 1,190 IA
Catoctin Crazies
KD3FG 244 2 4 1,128 MDC
Hilljerks Urban Radio League
KF4ZDC 239 2 7 1,088 SC
Lea Cty Red Cross
K5Z 234 2 5 968 NM
Team Toman
AA9YL 337 2 4 874 IL
Socorro Am. Radio Association
KC5OLJ 282 2 10 864 NM
Non-Club Group
KB8MFV 226 2 4 852 OH
ARES Jackson Cty
AD4XV 172 2 11 844 NC
Beauregard Parish Repeater Club
W5GTF 310 2 5 820 LA
Eastern Oregon ARS
W7NYW 152 2 10 810 OR
Tonto ARS
KC7YYM 183 2 21 766 AZ
Flying Cheetahs ARC
KD7GKN 58 5 3 680 UT
Non-Club Group
KK7PX 286 2 4 672 EWA
Albemarle ARC
WA4TFZ 196 2 11 662 VA
CRAB
W7MCF 279 2 7 658 AZ
Great Lakes Amateur Radio Rovers
KC8ELY 274 2 10 648 MI
Ozone Pioneers
N0AR 428 1 5 585 MN
Non-Club Group
N0ATH 120 2 20 540 MO
Northcoast Naturists
KI8JV 163 2 5 532 WPA
9-0-4 ARC
K9IM 96 2 4 462 IL
Concordia University ARC
VE2CUA 175 2 4 450 QC
MARA
WB7AFP 67 2 8 446 AZ
Sherburne Cty E-Comm Team
WB0VAD 15 2 10 430 MN
Brookings Radio Research Club
W0BXO 69 2 5 338 SD
Scratch & Sniff RC
W1QWT 66 5 5 330 EMA
Non-Club Group
KK7GG 18 5 7 280 MT
Watertown ARC
N9HR 90 2 14 280 WI
Non-Club Group
WA7VHF 26 2 3 152 AZ

1A

Utah Contest Club
NC7J 1699 2 4 6,520 UT
Metro DX Club
W9TY 1728 2 8 6,320 IL
McMinn Cty ARC
NA4K 1744 2 10 6,220 TN
Boomer Contest Club
NN5Z 1502 2 4 6,104 OK
Arrowhead Radio Amateurs
W0GKP 1657 2 10 5,766 MN
Panama City ARC
W4RYZ 1909 2 14 5,732 NFL
Bozo and the Lids
W9TG 1172 2 6 5,382 IN
Central NC DX Chasers
N4OL 1266 2 10 5,186 NC
Beverly Contest Group
K1EO 1501 2 5 5,142 EMA
Thibodaux ARC
W5YL 1423 2 25 5,100 LA
Case ARC
W8EDU 1165 2 3 4,452 OH
Buster's Beach Bums
K4IX 945 2 5 4,380 VA
Liberty Repeater Association
K8AJR 1497 2 11 4,146 OH
Northwest St. Louis ARC
K0AXU 1641 2 7 4,054 MO
ARES Calgary
VE6GR 872 2 25 3,894 AB
Koolau ARC
KH6J 930 2 28 3,848 HI
Mt Juliet Ham Operators
NI4M 1004 2 10 3,822 TN
Florida Boys
AF4Z 1203 2 8 3,800 SFL
East Alabama ARC
W4LEE 1255 2 10 3,740 AL
TMCARC
KK9H 1475 2 18 3,664 IL
Boy Scout Troop 566 ARC
K6BSA 1211 2 5 3,486 SV
Valley Center ARC
N0NB 1262 2 14 3,424 KS
ARASNE
W1AQ 1089 2 18 3,412 RI
Dinosaur Valley DX Society
K5XB 2389 1 7 3,328 NTX
Kilocycle Club of Fort Worth
W5SH 1027 2 10 3,304 NTX
Dr. Loomis Memorial Jr Mechanics Lg
W3KDR 1195 2 18 3,280 MDC
Forsyth ARC
W4NC 1000 2 13 3,010 NC
Clear Channel Communicators
KB4VC 1058 2 5 2,988 WCF
Stanly Cty ARC
KD4OZI 949 2 28 2,944 NC
Owensboro ARC
K4HY 864 2 20 2,916 KY
look Bear Bunch
KE8NK 808 2 5 2,910 WV
Dixie RC & Upstate Amateurs
W4IT 602 2 10 2,748 SC
Eastern Michigan ARC
K8EPV 805 2 8 2,718 MI
Hawk's Memorial
N9AU 2437 1 4 2,637 WI
West Texas ARC
K5EG 1153 2 8 2,570 WTX
Loudon Cty ARES & FLOG
W4FLO 974 2 15 2,548 TN
Wind River Contesters
N7IX 529 2 8 2,416 WY
Crashing Tower Group
KD2A 776 2 4 2,362 WNY
Trailer Buddies
WB6TIK 756 2 3 2,346 LAX
Hunter's Ridge Hams
K4BEH 542 2 10 2,174 GA
Sam Houston Amateur Radio Klub, Inc
N5AK 568 2 17 2,144 STX
Southern Plains ARC
N0RZ 745 2 23 2,128 KS
Lake Cty ARC
W9LJ 499 2 12 2,116 IN
Reno Cty Kansas ARA
W0WR 611 2 8 2,088 KS
Hanover Area Hamming Assoc.
N3WD 703 2 8 2,068 MDC
Saskatoon ARC
VE5AA 422 2 22 1,976 SK
Lanark Cty ARES
VE3LCA 433 2 18 1,964 ON
Hot Springs Village ARC
K5ID 415 2 7 1,958 AR
ARCUA
W5YM 489 2 13 1,934 AR
Looped Group
K4QXX 904 2 5 1,908 WCF
MIT RS
W1MX 734 2 7 1,896 EMA
Shelby ARC
NC4NC 748 2 8 1,896 NC
Smoky Mountains Amateur Radio Team
KD4TPO 342 2 8 1,868 NC
Rock River ARC
W9DXN 544 2 8 1,846 IL
We Rock Radio
WB8RFB 443 2 6 1,844 MI
Westside ARC
W5ABD 535 2 16 1,770 LA
Merrymeeting ARA
KS1R 453 2 6 1,758 ME
USS JURASSIC
K8SSJ 163 2 5 1,710 OH
Club de Radioamateur de Beauce
VE2CRB 439 2 15 1,652 QC
Fishing Party
KD8CP 560 2 5 1,640 MI
Non-Club Group
W0YL 632 2 1 1,620 IA
TVDXA
W4FOA 469 2 10 1,560 GA
Harrisburg Radio Amateurs Club
W3UU 502 2 19 1,546 EPA
West Desert ARC
W7EO 617 2 12 1,544 UT
BIARC
KH6EJ 885 1 45 1,536 HI
Freelance AR Technical Society
N8LGQ 441 2 10 1,482 OH
Non-Club Group
N1PP 322 2 9 1,468 NH
YID'S of N Texas ARC
N5LS 416 2 3 1,452 NTX
Benson Cty ARC
KF0HR 456 2 11 1,412 ND
Amateur Radio & Youth Club
WA8RAY 500 2 25 1,400 MI
Lima Area ARC, Inc
W8EQ 376 2 12 1,372 OH
Lake of the Woods ARS
VE3JJF 482 2 20 1,364 ON
Soper Hill ARC
NN7N 364 2 5 1,350 EWA
Non-Club Group
W8IHX 312 2 3 1,308 MI
North Coast Contest Club
AA8BV 552 2 6 1,304 OH
Bryan ARC
W5DZ 400 2 15 1,300 STX
Woodchuck ARC
KC8KLU 389 2 25 1,278 OH
Raytheon Falls Church ARC
KU4MH 197 2 4 1,278 VA
Nevada Cty ARC
W6DD 702 1 14 1,266 SV
Non-Club Group
AB7YB 424 2 5 1,260 ID
Peninsula ARC
W4HZL 377 2 15 1,234 VA
Lagunatics
K6PD 243 2 3 1,232 SDG
NORWESCO
K9LX 262 2 14 1,224 WI
Salkehatchie ARS
AF4QZ 361 2 15 1,222 SC
Butte ARC
W7FO 455 2 12 1,210 MT
Barron Cty ARC
W9MP 477 2 8 1,176 WI
Flying Dinosaurs
VE6FD 488 1 7 1,164 AB
Bawating ARC
VE3LSC 407 2 12 1,114 ON
Halton ARC
VE3OD 106 2 12 1,094 ON
TCARES
K6YV 337 2 15 1,084 SJV
Radio Free Yorkville
W6TLK 437 2 5 1,074 SF
West Point LDS ERRS
K7NM 291 2 5 1,072 UT
Hidden Valleys ARC
KC9KQ 330 2 16 1,060 WI
Non-Club Group
KK5IJ 237 2 3 1,034 STX
Metchosin Emergency Comm. Team
VE7MEP 202 2 5 1,028 BC
Picco Party Operators
WA3RNB 452 2 9 1,024 MDC
Rim Cty ARC
W7RIM 401 2 12 1,002 AZ
Team TEAM
KB8KRF 500 2 4 1,000 MI
Jamestown ARC
W0FX 244 2 12 996 ND
No Name Radio Gang
KE1C 309 2 8 972 CT
Laguna Beach ACT-RACES
KE6GFI 234 2 4 968 ORG
Non-Club Group
W7FD 481 2 3 962 SJV
ARROW
W8UM 237 2 6 958 MI
Sullivan ARC
KC0DBS 271 2 10 942 MO
Non-Club Group
VE6DN 210 2 5 940 AB
Manhatton Illinois Project
W9RVP 369 2 3 938 IL
Edisto ARS
AD4U 361 2 28 922 SC
250 Sig Bn MRS
WB2JIU 255 2 3 918 NNJ
Club Radio Amateur du Madawaska
VE9CRM 100 2 23 910 NB
Non-Club Group
W0AIH 371 2 3 906 WI
Cass-Hubard ARC
K0TIW 159 2 12 902 MN
CERTS
VE3BPQ 396 2 5 892 ON
Adams Cty ARC, Inc
W9DU 122 2 10 888 WI
Mountain Valley ARC
K1PV 239 2 3 878 ME
Juneau ARC
KL7IG 144 2 10 870 AK
Last Mountain RC
VE5LM 187 2 3 854 SK
Battlefords ARA
VE5ARS 187 2 9 836 SK
Grant Cty ARC
W9EBN 156 2 10 812 IN
Gulf Coast ARC
WA4GDN 205 2 18 810 WCF
Rural Amateur RA
N7R 154 2 13 808 NV
West Nebraska ARC
W0AFG 251 2 15 802 NE
Hot Shot DX
KD5HPT 392 2 3 784 LA
Truro ARC
VE1RAC 342 2 10 784 MAR
North Island Amateur Island Society
VE7ARK 191 2 20 782 BC
Central Wisconsin RA
W9NN 282 2 12 776 WI
Mallard Lake Wouff Hong Society
WB9UYR 228 2 4 756 IL
Hickory Amateur Radio Team
N3EHY 123 2 4 746 EPA
Richardson Wireless Klub
K5RWK 139 2 12 728 NTX
Area 51 Communications Group
KD8UJ 330 2 6 660 OH
Murphy's Match
K0OJ 522 1 7 622 CO
Hualapai ARC
WB6RER 140 2 5 580 AZ
Jasper Cty ARC
W9SPC 139 2 4 578 IN
Non-Club Group
KI0QM 173 2 3 568 STX
So. Hill Brass Pounders & Modulator
KB3BUE 165 2 5 530 WPA
Non-Club Group
N4TII 206 2 6 512 GA
Raytheon St. Pete ECHO
WA1VUG 205 2 4 510 WCF
Non-Club Group
K8IAT 200 2 6 500 IN
Bitterroot ARC
W7FTX 109 2 13 418 MT
Jackson Hole Area ARC
KS7WY 152 2 4 404 WY
Shelburne Cty ARC
VE1SLC 143 2 4 394 NS
Elmira ARC
VE3ERC 136 2 10 372 ON
Justin n Mike
K8MJH 121 2 3 342 OH
US Center ARC
K0IEU 96 2 3 292 KS
73 Contest & DX Club
N6IP 41 2 4 264 SB
The Girls
W2ABS 36 2 4 228 NNJ
Patio Radio Network
W7PRN 62 2 3 224 OR
Michigan Guns 'N' Radio Club
KB8KNM 44 2 4 188 MI
El Dordal Park
N6TCZ 3 2 2 6 LAX

1A Commercial

Non-Club Group
AE5T 1392 2 6 3,166 LA
The Chameleons
K1WD 427 2 3 1,634
CRA De Contrecoeur
VE2CKC 190 2 25 772 QC
Non-Club Group
KD4YLR 281 2 4 662 IL
Streator ARC
K9CAU 71 2 19 442 IL

2A Battery

Colorado QRP Club
W0CQC (+KA5WET)
1688 5 12 15,025 CO
WV-CW-NUTS
W8DL 1300 5 6 10,665 WV
West Park Radiops ARC
W8VM 1018 5 18 8,980 OH
Minnesota Wireless Association
W0AA 710 5 5 6,765 MN
Paulding County ARC
W4TIY 787 5 17 6,700 GA
Fauquier ARA
W4VA (+N3KTU)
2006 2 20 6,650 VA
Walton RA
W2LZ 602 5 9 6,620 WNY
Oregon High Desert Contest Club
K7AW 655 5 3 6,155 OR
New Mexico State Univ. ARC
W5GB 632 5 15 5,655 NM
Redmond Top Key Contest Club
N7KE 1454 2 23 5,582 WWA
Athens RC
N4ALE (+KG4GKH)
645 5 38 5,555 GA
Lockheed Martin ARC
W5IU 572 5 24 5,450 NTX
University ARC
N7UW 561 5 12 5,425 WY
Motorola ARC of Azonia
W7MOT (+KB7PXA)
1694 2 20 5,016 AZ
SW Louisiana ARC
W5BII (+WA5QZN)
2018 2 52 5,008 LA
Eastern PA QRP Club
N3EPA 534 5 8 4,470 EPA
SEL
N7CE 1077 2 5 4,220 ID
Southern Polytechnic ARC
K4K (+KF4BMG)
539 5 8 3,890 GA
Three Generations of Hams
AC3V (+N3XXP)
507 5 6 3,575 EPA
Independent Radio Assoc.
K8KTY 499 5 25 3,430 OH
PolarFab ARC
NF9K 374 5 4 3,290 MN
North Country ARC
K1NCR 713 2 16 3,258 NH
Austin TX ARC
W5KA 395 5 77 3,130 STX
Algoma ARC
VE3SOO 818 2 22 3,122 ON
Non-Club Group
KO6TD 381 5 50 3,060 LAX
Islip ARES Group
W2PB 721 2 10 2,932 NLI
Pine State ARC
N1ME 909 2 32 2,828 ME
HEMARC
W3GR (+KB3EKJ)
625 2 10 2,502 MDC
Sun Country ARS
N4KIM 318 5 3 2,380 NFL
Westside ARC
WA6RC 618 2 28 2,310 LAX
Alamo Area Radio Organization, Inc
KC5NTN (+KC5QIG)
458 2 21 2,258 STX
North Ark ARS
AE5K 722 2 65 2,248 AR
High Desert DX Assoc.
W6DDX 287 5 12 2,235 SJV
Olive Branch ARC
K5K 704 2 18 2,234 MS
Natchaug ARC
N1EI 201 5 8 2,125 CT
Wireless Assoc of South Hills
N3SH 548 2 20 2,012 WPA
LARC
N6SJV 300 5 12 1,935 SJV
Garland ARC
K5QHD 604 2 60 1,916 NTX
Chickasaw ARA
W5GWD 642 2 26 1,884 MS
Grand Rapids ARS
W8DC 615 2 35 1,776 MI
Cascade Radio Group
WB7DHC 568 2 4 1,760 WWA
Pennyroyal ARS
K4DMW 471 2 15 1,732 KY
Cross Cty Simplex Group
KG9IY 583 2 15 1,668 IL
Renegades
K5CNZ 292 2 4 1,522 STX
Benzie Amateur Radio Friends
AA4R (+KC8JJL)
427 2 20 1,454 MI
Cross Cty ARC
KK5YN 349 2 24 1,298 AR
Issaquah ARC
W7RQT 341 2 10 1,282 WWA
Hambone Group
W6BIV 260 2 3 1,250 LAX
VCARA
KC5OUR 268 2 20 1,240 NM
Certfiable Radio Maniacs
AA7IH 107 5 6 1,215 OR
Maple Valley ARC
KC7KEY 290 2 28 1,176 WWA
Athens ARC
AA5TI 247 2 17 1,056 NTX
Tesaro
W1IM 287 2 4 1,052 NH
The Classic Bud Net
WA3KEY 214 2 5 1,036 EPA
Morsecateers
W7TF 122 5 7 995 ID
SEWFARS
K9ABC 294 2 11 988 WI
Hamsters
W8HF 217 2 6 972 OH
Shelby Cty ARC
W4SHL 207 2 25 924 AL
Sheridan Radio Amateur League
W7GUX 254 2 5 908 WY
Chisolm Trail ARC
WD5IYF 142 2 14 884 OK
Medina Cty ARC
KD5BFV 121 2 9 842 STX
Non-Club Group
AE6FD 263 2 2 826 SJV
Sooland ARA
KB0SYB 148 2 31 796 IA
Virginia Digital Emerg Network ARC
K4VON 37 5 4 785 VA
Bishop Hams
W5LWR 25 5 7 725 STX
Mountaintop ARA
WB2UYR 82 5 4 710 ENY
Wilderness Road ARC
WD4DZC 28 2 14 658 KY
Woodford Cty ARC
KF4INN 127 2 11 654 KY
Northern Ohio ARS
K8KRG 20 5 35 600 OH
Border Amateur Radio Federation
KB1BRN (+KA1KHA)
143 2 15 586 VT
Central Virginia ARA
KU4TN 107 2 5 416 VA
Monterey Park ARC
K6GIP 91 2 3 386 LAX

2A

Eastern AZ ARS
K7EAR (+K7JEM)
1351 5 14 11,010 AZ
Radio Amateurs of Northern VT
W1NVT (+N1YWB)
3363 2 14 10,202 VT
Mad River Radio Club
K8MAD 3094 2 7 9,994 OH
Motorola ARC
K9MOT (+K9SGR)
3356 2 29 9,950 IL
Albuquerque DX Association
W5UR (+N7LPV)
2961 2 15 9,692 NM
ARVARF
N5A (+KC5KLS)
2937 2 14 9,258 AR
Schaumburg ARC
N9RJV (+K9IIM)
2764 2 34 9,232 IL
Northwest ARS
W5NC (+KB5SGV)
3264 2 74 9,212 STX
Federation of AR Operators
K9BGL 2808 2 9 9,064 IL

Tucson IBM ARC
W7IBM 2777 2 13 8,864 AZ
Hoosier DXERS & Contesters
N9NS 2811 2 10 8,680 IN
Massanutten and Valley ARA
N4XU (+KD4FKT)
2789 2 34 8,396 VA
Raytown ARC
K0GQ (+KC0DEA)
2747 2 24 8,148 MO
Sarasota Emergency RC
K4WCF 2405 2 26 8,030 WCF
TCDXA
N0XB 2643 2 10 7,940 MN
BARC/NCAARS/SCARC
AB5ER (+KD5ATN)
2566 2 33 7,892 AR
Cape Fear ARS
N4NG (+KF4ZPI)
2428 2 30 7,834 NC
Montrose ARC
K0SX (+N0XMI)
2328 2 20 7,740 CO
Big Bend ARC
K5FD 2486 2 17 7,730 WTX
Twin City FM Club
W0EF (+KB0LIV)
2373 2 32 7,648 MN
Mid-MO ARC
N0SS (+WB0TPN)
1952 2 30 7,412 MO
Tallahassee ARS
K4TLH (+KG4CJT)
2627 2 50 7,368 NFL
Antelope Valley ARC
K6OX (+KG6AUR)
2124 2 40 7,276 LAX
Delta DX Assn & GNOARC
W5RU 2128 2 19 7,134 LA
W/K ARC of Greater Milwaukee
N9AW (+KB9NDA)
1863 2 13 7,032 WI
Benton ARS
K5CU (+KC5UUL)
2061 2 14 6,976 AR
Falmouth ARA
K1RK (+N1LTX)
2052 2 65 6,688 EMA
Motor City RC
W8MRM (+KB8EXV)
1843 2 123 6,636 MI
Palo Alto ARA
W6OTX 1985 2 38 6,584 SCV
Randallstown ARC
N3IC 2005 2 9 6,526 MDC
Clairemont Repeater Assn.
W6VLD (+KD6FFF)
2004 2 70 6,482 ORG
Fidelity ARC
WF1A (+N1ULJ)
1919 2 20 6,240 RI
CLARA
W2GZJ (+KC2GDT)
1462 2 20 6,190 NNJ
Tampa ARC
N4TP (+KG4GIQ)
1651 2 55 6,188 WCF
SMARC
W0EBE 1962 2 45 6,172 MO
Halifax ARC
VE1FO (+VE1INN)
2065 2 70 6,080 NS
Old Man's FDGroup
W8LX 1837 2 11 6,052 OH
Southeastern DX Club
W4NT 1907 2 5 6,050 GA
Northern AZ DX Ass'n & Coconino ARC
NN7A 1728 2 25 6,026 AZ
Buckhead Contest Club
W4JO 2378 2 5 5,894 GA
Shelby Cty ARES & Honda Lifeline
NO8C (+KC8KAX)
1877 2 27 5,828 OH
Fond Du Lac ARC
W9EBV 1753 2 15 5,798 WI
Green River Valley ARS
K9WM 1884 2 15 5,774 IL
SPARC
N3PX 1744 2 11 5,760 MDC
Massillon ARC
W8NP 1709 2 47 5,728 OH
Hannibal MO ARC, Inc
W0KEM 1473 2 16 5,702 MO
N1SF RC with CIRC
N1SF (+KB9PXL)
1563 2 25 5,684 IL
Northern Ohio DX Association
W8DXA 1681 2 25 5,682 OH
Norwood ARC
N1OP (+WA1ZJE)
1525 2 17 5,676 EMA
Meriden ARC
W1NRG (+K1TDO)
1426 2 32 5,674 CT
The Sakonnet 49'ers
KD1MW 1727 2 15 5,674 RI
Cary ARC
N4NC 1672 2 19 5,654 NC
Heart of America RC
W0RR 1651 2 15 5,616 KS
Vienna Wireless Society
K4HTA 1294 2 33 5,584 VA
Anderson RC
N4AW 1389 2 21 5,570 SC
Eli Lilly ARC
W9ELI 1371 2 7 5,534 IN
Amateur Radio Comm. Support Group
K3FT 1543 2 11 5,490 MDC
HP/Agilent ARC
W1HP 1367 2 11 5,392 EMA
Western Washington DX Club
W7DX 1889 2 10 5,392 WWA
St. Louis ARC, Inc
K0LIR (+WA0EEZ)
1558 2 15 5,332 MO
Bethel ARS
KU8O 1653 2 16 5,330 OH
West Essex ARC
W2EF 1418 2 10 5,008 NNJ
Smith Chart ARS
K4SCS 1388 2 6 5,000 VA
MARC
W5EJK (+N5ICR)
2018 2 13 4,988 OK
East Bay ARC
W6CUS (+KD6JCT)
1319 2 75 4,964 EB
Peninsula ARC
W4MT (+KF4POD)
1659 2 28 4,918 VA
Trojan ARC
W0WOB (+KB0LGX)
1567 2 16 4,866 KS
Lynchburg ARC
K4CQ 1391 2 23 4,832 VA
QCWA Chapter 17
W3GS (@W3TDF) (+WA3MQY)
1620 2 10 4,820 EPA
Montgomery ARC
K8AJX (+N4WVW)
1269 2 25 4,778 AL
Lake Cty RACES
K9KM (+N9IHW)
1490 2 25 4,764 IL
Paso Robles ARC
W6L 2912 1 42 4,759 SB
AZ Mountain Moguls
W7YE (+WA7DTJ)
1138 2 9 4,700 AZ
San Mateo RC
W6UQ 1369 2 10 4,668 SCV
MARC/PPRAA
WA0VTU 1436 2 30 4,624 CO
Clinton Cty ARC
W9PC 1122 2 25 4,624 IN
Aironet ARC
N8FA 1134 2 7 4,618 OH
Tri-County ARC
W8YEK 1939 2 21 4,578 OH
Albuquerque ARC/AR Caravan Club
N5VA 1137 2 86 4,560 NM
Fort Madison ARC
WF0RT 1280 2 14 4,486 IA
Morris RC
W2YD (+K2EMJ)
1172 2 26 4,460 NNJ
Richmond ARC
VE7RAR 1012 2 18 4,428 BC
Southwest Dallas Cty ARC
W5AUY 1401 2 56 4,372 NTX
Tippecanoe ARA
W9REG (+WB9SWD)
1175 2 25 4,372 IN
M2M
K8FH 1189 2 9 4,348 OH
North Shore ARC
VE7NSR 1370 2 59 4,314 BC
West Island ARC
VE2CWI 1300 2 27 4,312 QC
Hiawatha ARA
K8LOD 1132 2 30 4,308 MI
Candlewood ARA
W1QK 1264 2 19 4,292 CT
Edmond ARS
N5NA 1043 2 13 4,288 OK
Stafford ARA
N4NW 1228 2 25 4,246 VA
Canton ARC
W8AL (+KB8FZX)
1224 2 50 4,240 OH
Iowa City ARC
W0JV 1186 2 21 4,200 IA
Mile High DX Association
K0AB 1381 2 13 4,196 WY
Yellowstone RC
K7EFA (+KA7QQW)
1314 2 37 4,138 MT
Ocean Monmouth ARC
N2MO (+KC2GGA)
1016 2 25 4,136 NNJ
Loveland Repeater Association
N0BF (+K0BJS)
1218 2 30 4,040 CO
San Angelo ARC
W5GX 1768 2 16 4,036 WTX
3M Club ARC
W0JH (+KA0ZIA)
1107 2 12 4,018 MN
Straits Area ARC
W8GQN 958 2 17 3,972 MI
Nightly Talk Around Net
KT8J (+KC8IET)
1622 2 25 3,944 WV
Johnson Cty RAC
W0ERH (+KB0ZGU)
1045 2 31 3,858 KS
Montreal ARC
VE2ARC 1417 2 13 3,836 QC
Baltimore ARC
W3FT 1061 2 17 3,812 MDC
Green Mountain Wireless Society
WG1Q (+KB1APN)
1160 2 20 3,806 VT
Osgoode/Rideau ARS Group
VE3XL 859 2 8 3,790 ON
Monroe CO Radio Communications
W8PI 1163 2 13 3,764 MI
Palas Verdes ARC
K6JW 1289 2 20 3,740 LAX
Lakeland ARC
K4LKL 1010 2 55 3,726 WCF
West Virginia Amateur Radio Inc
WV8AR 1131 2 21 3,702 WV
Escondido ARS
N6WB 956 2 8 3,682 SDG
MARA Bunch
N5RD 1240 2 20 3,676 LA
Chicago FM Club/SRO
W9EJ 1376 2 40 3,660 IL
Red River Radio Amateurs
W0ILO 1517 2 37 3,656 ND
Charleston ARS
WA4USN (+KG4BEJ)
1200 2 3 3,646 SC
Foothills ARS
K6YA 1000 2 35 3,636 SCV
Hancock ARC
W9ATG (+N9HQO)
976 2 37 3,594 IN
Drake ARC
K8UU 1114 2 10 3,588 OH
Brightleaf ARC
W4AMC (+KG4CCX)
1120 2 34 3,522 NC
Eastern Washington CC
N7MO 946 2 6 3,520 EWA
North Franklin ARS
NF2AR 944 2 6 3,504 NNY
Sterling Park ARC
W4RW (+KD4RSL)
912 2 15 3,496 VA
Nashville ARC
K4L (+KC4TMV)
1192 2 46 3,486 TN
West Allis RAC
W9FK (+KB9VGH)
1462 2 15 3,474 WI
East Bay All-Banders
KR6AE 1199 2 10 3,460 EB
Winchester ARS
WA4RS 1011 2 16 3,430 VA
Rochester ARC
W0MXW (+KC0CJP)
1999 1 30 3,355 MN
Laurel ARC
N5PA (+KC5QZW)
1056 2 20 3,342 MS
Ham Association of Mesquite
WJ5J (+N5RET)
1152 2 20 3,332 NTX
OURS
VE3PAM 949 2 4 3,328 ON
New River Valley ARC
WB3S 733 2 10 3,276 VA
Bishop ARC
N6OV 864 2 19 3,250 ORG
Northrop Grumman ARC
N9EW 782 2 7 3,244 IL
Polk Ham Club
W4TJM (+KA1MDI)
659 2 20 3,236 WCF
Metropolitian ARC
AE5AA (+KC5NLK)
769 2 8 3,220 AR
Grand Strand ARC
W4GS 932 2 20 3,204 SC
Coast Side ARC
WA6TOW1073 2 15 3,186 SCV
BEARONS
W7FLY 712 2 16 3,176 WWA
Arlington ARC
K5SLD (+N5JWB)
996 2 15 3,176 NTX
Tri-County Repeater Association
K9FYZ 1176 2 15 3,168 WI
Sante Fe Trail ARC
KS0KS (+KC0GAP)
815 2 19 3,162 KS
FDWS
W9UR 1020 2 4 3,160 IN
Radio Central ARC
W2RC 849 2 18 3,120 NLI
Johnson City ARA
W4ABR 883 2 26 3,118 TN
Durango ARC
K0EP 803 2 12 3,112 CO
St. Paul RC
K0AGF 856 2 35 3,100 MN
Sand Hills ARC
W0MI 1036 2 10 3,080 KS
Gaston Cty Inc
N4GAS 841 2 20 3,080 NC
GARA
W4GSO (+KG4BHY)
889 2 35 3,068 NC
Tri-State RG
KT4XA 1134 2 11 3,030 MS
Gallatin Ham RC
W7ED 897 2 10 3,028 MT
Murray State Univ ARC
K4MSU 1009 2 18 2,992 KY
Thomasville ARC
W4UCJ (+KE4URL)
985 2 55 2,980 GA
KB Contesters
K0VA 794 2 5 2,952 SDG
St. Clair Cty A.R.E.S
K4SCC (+KF4HFE)
1074 2 55 2,948 AL
Bullitt ARS
KY4KY (+KE4AWY)
794 2 27 2,936 KY
Placentia RACES
AC6MV (+KF6RVK)
845 2 30 2,912 ORG
CMRA
K0SI 765 2 16 2,906 MO
Boulder ARC
W0DK 868 2 25 2,894 CO
Hoosier Lakes RC
N9AR 797 2 25 2,888 IN
North Kitsap ARC
KC7Z (+KC7DAT)
580 2 26 2,876 WWA
Collin Cty Community College
K5CCC 728 2 10 2,874 NTX
Cedar Valley ARC
W0GQ 1276 1 20 2,853 IA
Souris Valley ARC
K0AJW 934 2 25 2,828 ND
New Providence ARC
N2XJ 754 2 23 2,828 NNJ
Fort Smith Area ARC
W5ANR (+KD5CAM)
954 2 25 2,826 AR
Elgin ARS
W9IKN (+KB9PLA)
1061 2 13 2,822 IL
Blue Ridge ARS
K4CLT 955 2 30 2,822 NC
Staten Island ARA
W2CWW 688 2 17 2,818 NLI
Blossomland ARA
W8MAI 769 2 20 2,802 MI
Fresno ARC
W6TO 703 2 10 2,802 SJV
Rockwall ARC
K5RN 1017 2 17 2,792 NTX
Decatur ARC
W4ATD (+KB4CAY)
924 2 16 2,780 AL
Newington Amateur Radio League
W1OKY 808 2 12 2,774 CT
Alameda Cty Sheriff's Comm. Team
W6VOM (+KE6NCX)
745 2 15 2,748 EB
Vernon RACES
W2VER 760 2 10 2,748 NNJ
Overlook Mountain ARC
N2LL 686 2 8 2,732 ENY
Cosumnes River SSB & BBQ Society
KN6OX 1102 2 9 2,712 SV
Henderson ARC
W4KVK 843 2 12 2,712 KY
Dial RC
K8PI 1557 1 10 2,707 OH
Matagorda Cty ARC
WA5SNL 896 2 12 2,700 STX
New Orleans ARES
N5O 1048 2 12 2,696 LA
OCARS
KN4WK 774 2 20 2,692 GA
Kootenai ARC
K7ID 621 2 8 2,682 ID
Northrop Grumman RC
K6HF 935 2 15 2,640 LAX
West Chester ARA
KD8C (+KB8NWN)
924 2 15 2,640 OH
Saratoga ARA
N6RC 678 2 13 2,628 SCV
STARS
W9SRC (+KB4NEN)
783 2 10 2,588 IL
Genesee Radio Amateurs
W2RCX 572 2 16 2,560 WNY
York Radio Club
W9PCS 527 2 15 2,552 IL
Quad Sounds ARC
VO1BC 767 2 8 2,552 NL
Quad Counties Amateur Club, Inc
N3QC 590 2 3 2,550 WPA
First State ARC
K3QBD 641 2 18 2,542 DE
Hot Springs ARC
K0HS 680 2 16 2,542 SD
Eastern Pennsylvania ARS
N3IS (+N3ROL)
741 2 15 2,540 EPA
Green Bay Mike & Key Club Inc
K9EAM (+KB9SNE)
1564 1 3 2,513 WI
Maui ARC
KH6RS 1080 2 35 2,484 HI
Pershing County ARES/RACES
N7WVZ 735 2 6 2,460 NV
PART
KD1D 534 2 20 2,450 EMA
Chesco ARA
K3BKG 709 2 10 2,434 EPA
Chaparral ARS
W6MV 823 2 10 2,434 SB
St. Clair ARC
K9GXU 477 2 12 2,408 IL
Waterbury ARC
K1EC 743 2 15 2,386 CT
Heart O'Texas ARC
W5ZDN 625 2 20 2,334 NTX
Non-Club Group
VE7CRC 541 2 10 2,320 BC
Non-Club Group
N7DOE 767 2 3 2,314 WWA
Martin Cty ARES/RACES
N4BG (+KG4HVC)
976 2 14 2,294 SFL
Thompson River ARC
VA7TRS 457 2 7 2,288 BC
CRES ARC
W8ZPF 685 2 19 2,280 OH
Aroostook ARA
K1FS (+KB1EBH)
750 2 30 2,274 ME
Tusco RC
W8ZX 666 2 23 2,272 OH
Milpitas ARES/RACES
AA6NX (+KE6UZL)
724 2 10 2,250 SCV
South Lyon Area ARC
N8SL 593 2 10 2,248 MI
Hiawatha Valley ARC
N0DH 839 2 22 2,242 MN
Sun City ARC
K5WPH (+KB5KYN)
607 2 35 2,240 WTX
Delaware Valley RA
W2ZQ (+KB2SYB)
599 2 20 2,228 SNJ
Bloomington ARC & IN Univ. RC
W9INL (+KB9RBW)
542 2 75 2,210 IN
Oldham Cty ARC
K4EF 523 2 17 2,186 KY
N. Mason ARES & Mason Cty Club
NM7E 536 2 20 2,176 WWA
Albert Lea ARC
NX0C 522 2 10 2,152 MN
Kingsport ARC
W4TRC 680 2 14 2,146 TN
Northern RI RC
W1NRI (+KA1RCY)
931 1 13 2,140 RI
Mountain ARC
W6BW 726 2 24 2,136 SJV
Mills Cty Ham Operators
WA5NQR (+KD5DCZ)
702 2 10 2,114 NTX
Non-Club Group
VE2CVR (+VE2CWZ)
635 2 20 2,100 QC
Adams County ARC
W8EKG 509 2 5 2,094 OH
Central Kansas ARC
W0CY 529 2 21 2,070 KS
Hellgate ARC
W7PX 539 2 21 2,062 MT
HDSCS
K6EW 659 2 14 2,058 ORG
Fox Cities ARC
W9ZL 489 2 15 2,048 WI
Three Rivers ARC
W0BRN 653 2 20 2,036 MO
AF4LL Contest Group
AF4LL (+KA4TOT)
803 2 8 2,028 KY
Ashtabula Cty ARC
K8CY (+KC8FCZ)
484 2 14 2,022 OH
North Georgia ARC
W4QQ 900 2 5 2,010 GA
Wantagh ARC
W2VA 484 2 17 2,004 NLI
Palouse Hills ARC
W7NGI 670 2 8 2,000 ID
Los Alamos/Northern NM ARC
W5PDO 425 2 10 1,996 NM
Navarro ARC
N5DDC 790 2 18 1,992 NTX
St. Peter Area Radio Club
AK0T 405 2 38 1,974 MN
WRECS
N8PT 724 2 10 1,966 OH
NBARA
K6LI 433 2 12 1,962 EB
Non-Club Group
WF2V 542 2 10 1,948 WNY
Old Post ARS
W9EOC 723 2 15 1,946 IN
Non-Club Group
K3WJV 625 2 5 1,934 DE
Chain O'lakes ARC
NZ8F 508 2 30 1,928 MI
Suburban UHF ARS
K9IJ 759 2 15 1,918 IL
SONRA
VO1AA 443 2 11 1,906 NL
Eastern New Mexico ARC
KA5B 549 2 5 1,898 NM
Brockville Amateur Radio Group
VA3EWP 465 2 10 1,894 ON
Clark County ARC
W9WWI (+N9RMR)
482 2 15 1,890 IN
VECTOR
VE7VCT 503 2 18 1,868 BC
Okanogan Cty ARC
KD7JGR 425 2 18 1,858 EWA
Santa Clara Cty ARA
W6UW (+KC6SPV)
510 2 25 1,844 SCV
LARC/Tin Lizzy
K8UTT (+K8UNS)
717 2 19 1,834 MI
Land of Lakes ARC
K9HD 592 2 25 1,832 IN
Carbon Cty ARS
KC7OZU 506 2 10 1,832 WY
Key West ARC
W4LLO 462 2 16 1,824 SFL
Jupiter/Tequesta Repeater Group
KE4PPI 544 2 20 1,818 SFL
Dixie ARC
K7SG 592 2 15 1,814 UT
Suncoast ARC
WA4T 502 2 20 1,804 WCF
SEMARG
W1CG 765 2 6 1,798 RI
Azalea Coast ARC
AC4RC 437 2 38 1,784 NC
Champaign/Logan Cty ARC
W8EBG 409 2 7 1,778 OH
Headwaters ARC
N3PC 539 2 9 1,770 WPA
RACC
N8WB 682 2 15 1,764 MI
Snohomish Cty Ham Club
WA7LAW 510 2 11 1,764 WWA
Boone Amateur Radio Klub
W0FS (+WB0HDO)
470 2 14 1,756 IA
Laurel ARC
W3LRC 407 2 12 1,724 MDC
De Forest Amateur Club
K8GE 424 2 22 1,710 OH
Metuchen RC
K2YNT 477 2 9 1,702 NNJ
RADIO
W9GH 379 2 15 1,698 IL
Ole Virginia Hams ARC
W4OVH (+KE4NFK)
469 2 19 1,694 VA
Northeast Iowa Radio Amateur Assn
W0MG 453 2 29 1,694 IA
Fall River ARC
W1ACT 488 2 12 1,686 EMA
Ogensburg ARC
K2RUK 449 2 12 1,682 NNY
Eastern Panhandle ARC
WV8E 985 1 10 1,672 WV
BARSC
NW7US 713 2 7 1,670 WWA
Justa Buncha Hams
N5JL 529 2 9 1,668 NTX
Non-Club Group
KD8SQ 783 2 6 1,666 OH
Englewood ARS
K8ONV 398 2 15 1,660 WCF
Seaway Valley ARC
VE3VSW 371 2 5 1,654 ON
Phillips Cty ARC
KB0VBL 675 2 7 1,650 KS
Fayette ARA
N8EMZ 399 2 8 1,644 OH
Non-Club Group
K9JQE 571 2 4 1,642 WI
Greenwood ARC
VE1ARC 560 2 25 1,630 NS
Explorer Post 599
WA2DFI 535 2 10 1,628 AZ
Transylvania Cty ARC
K4HXZ 517 2 20 1,622 NC
Cookeville Rptr Assn & TN Tech ARS
K4CP 414 2 10 1,620 TN
Winchester Pioneer ARC
AC4YD 660 2 58 1,620 KY
Travis County ARES
W5TQ 352 2 10 1,616 STX
Texas A&M University ARC
W5AC 384 2 5 1,612 STX
Tahoe ARA
NX6W 540 2 22 1,600 SV
Wheat State Wireless Association
WS0WA 528 2 10 1,576 KS
Rolla Regional ARS
W0GS 545 2 25 1,576 MO
South Central Iowa FD Group
N0WK (+KA0YKL)
354 2 14 1,574 IA
Casper ARC
W7VNJ (+W7TOY)
631 2 20 1,562 WY
Penn-Ohio DX Society
N3DQU 438 2 3 1,560 WPA
Douglas ARC
W0UK 526 2 10 1,552 KS

Joplin ARC
W0IN (+N0KMP)
476 2 8 1,550 MO
Kamloops ARC
VE7UT 440 2 12 1,538 BC
Eagle Lake Group
WC2T 767 2 4 1,534 EPA
Moreno Valley ARA
W6IBR (+KC6FJC)
515 2 19 1,530 ORG
CARG
KR4IP 341 2 12 1,524 GA
Sunparlor ARC
VE3SPR 588 2 10 1,518 ON
St Cloud ARC
W0SV 479 2 14 1,492 MN
Enid ARC
W5HTK 446 2 26 1,492 OK
Aero ARC
W3PGA 345 2 15 1,486 MDC
Hocking Valley ARC
KC8EJZ 342 2 20 1,484 OH
Bradford Area ARC
KU4AY (+KG4BAH)
306 2 5 1,476 NFL
Lunenburg Cty ARC
VE0NED 482 2 15 1,470 NS
Midland ARC
W5OGG 474 2 10 1,448 WTX
Hastings ARC
W0WWV 481 2 25 1,438 NE
Bell Cty ARES
KB5UMG 466 2 15 1,432 NTX
Ocean State ARG
K1OS 463 2 10 1,426 RI
Norwalk Club
W1EE 317 2 35 1,426 CT
Huron ARC
W0NOZ 392 2 15 1,420 SD
Lake of the Ozarks ARC
W0NA 426 2 16 1,418 MO
Giles ARA & Giles Cty ARES/RACES
W4NRV 354 2 32 1,416 VA
Wells Cty ARC
W9SR 320 2 12 1,414 IN
Liebert ARC
N8ADO 606 2 6 1,412 OH
F.O.R.C.E.
K3UAV 372 2 7 1,410 MDC
Columbia ARS
WB4JEM 334 2 6 1,396 NFL
Crow River ARC
AB0LP 423 2 26 1,390 MN
Shiawassee ARA
W8QQQ 396 2 8 1,358 MI
Hopkins Cty ARS
WB4JRO 439 2 12 1,358 KY
C.R.S. Club
N9AKR 425 2 16 1,350 IL
Sandusky Radio Experimental League
W8LBZ 570 2 33 1,340 OH
Heart of Texas DX Society
KC5LDO (+KC5BFL)
417 2 10 1,334 NTX
Macedonia ARC
W8ABZ (+KB8VJF)
400 2 6 1,334 OH
Tri-State ARG
W5OKT 225 2 5 1,330 OK
JVARC
K3DNA 321 2 7 1,330 EPA
Theodore Roosevelt ARC
K0ND (+K0OLW)
443 2 30 1,328 ND
Shuswap ARC
VE7RAW 312 2 14 1,324 BC
NW Modesto DX Assn
K6VT 962 1 8 1,317 SJV
Fremont Police Volunteers
K6F 298 2 8 1,314 EB
SARES
K6GL 342 2 36 1,272 SCV
Beloit ARC
WA9EZT 434 2 3 1,268 WI
Radio Forum
N3NHX 457 2 10 1,262 WPA
Radio Wave Runners
KI4MS 327 2 16 1,254 STX
Pierre SD ARC
KB0SEY 345 2 10 1,254 SD
Butler VHF Assn
W8CCI (+KC8GAG)
376 2 18 1,252 OH
Lapeer Cty ARA
W8LAP 425 2 8 1,250 MI
Manistique Gnat Swatters
KD8DD 418 2 7 1,236 MI
Water Hammers ARC
W6EBW (+KE6OFI)
312 2 27 1,232 SJV
Finest-Kind RA Operators
N7JRP 395 2 3 1,230 AZ
NBC ARC
N2EW 414 2 3 1,228 LAX
Southern Sierra ARS
K6EO 234 2 12 1,226 SJV
Novi ARC
W8RS 138 2 10 1,212 MI
Brantford ARC
VE3BA 255 2 6 1,210 ON
Milford ARC
W8YDK 302 2 50 1,206 MI
MVARC
KF2GC 227 2 18 1,200 NNY
Fullerton Radio Club
W6ULI 346 2 25 1,192 ORG
Townshippers RAC
VE2CLD 296 2 10 1,192 QC
Los Angeles ARC
W6QET 251 2 9 1,192 LAX
Cape Ann RA
W1RK 268 2 11 1,192 EMA
DOERS
KE0YY 219 2 20 1,186 MO
HMB-ARES
WR6HMB 285 2 8 1,180 SCV
Tri-States ARC, Inc
W4GTA 390 2 10 1,180 GA
Tarsand ARC
VE6TRC 288 2 10 1,170 AB
CW Group Digital Wireless Assn
N8CWG 332 2 5 1,168 OH
Piscataquis ARC
K1PQ 284 2 13 1,162 ME
El Paso ARC
W5ES 325 2 12 1,160 WTX
Meridian ARC
W5FQ 268 2 16 1,152 MS
Anoka Cty RC
W0YFZ 248 2 9 1,132 MN
Androscoggin ARC
W1NPP 200 2 24 1,126 ME
STARS
N5TSL 237 2 47 1,126 AR
Deumlins ARC
WA2AAZ 209 2 14 1,124 WNY
Detroit Metroplitan RC
W8LXE 308 2 5 1,116 MI
Interlak ARC
VE4IAR 369 2 9 1,116 MB
Hermiston Amateur Club
KK7CG 307 2 13 1,114 OR
The Bazooka Group
AA9UF 269 2 3 1,114 IL
Fair Lawn ARC
W2NPT 300 2 17 1,106 NNJ
Mason Cty RC
K8DXF 215 2 12 1,106 MI
Apple Cty ARC
W7TD 387 2 12 1,094 EWA
Plaon City ARC
N8IJY 233 2 2 1,066 OH
The IBM RC
W4IBM 278 2 10 1,056 GA
Brandon ARS
K4TN 163 2 55 1,048 WCF
Ham Operators Group
K7HOG 483 1 15 1,033 OR
Orchard City ARC
VE7OGO 301 2 10 1,024 TN
Hamilton Cty ARES
KB9FVJ 211 2 12 1,024 IN
Huntington Cty ARS
K9HC 258 2 12 1,016 IN
Northern California Chaverim
W6ZG 176 2 10 1,014 SCV
Cascades ARS
W8JXN 257 2 15 1,014 MI
Non-Club Group
KN6SH 453 2 10 1,012 ORG
Callam County ARC
W7FEL 199 2 21 1,012 WWA
GEMA/SEMA/WEMA RACES-ARES
KB1CDL 196 2 13 992 WMA
Westminster RACES
WB6LBY 141 2 14 982 ORG
Trenton ARC
VE3YTR 221 2 12 982 ON
Piqua ARC
W8SWS 152 2 25 952 OH
Cupertino ARES
K6AB 120 2 14 950 SCV
Princeton ARS
W4KBL 158 2 12 934 KY
Okeechobee ARC
AD4RZ 256 2 12 912 SFL
Ontario RG
K2AS 306 2 4 912 WNY
Wayne ARC
W8WOO 221 2 19 896 OH
Pike Cty ARC
W9UL 96 2 11 892 IN
Tri-City ARC
NN1S 192 2 17 884 CT
Irving ARC
WA5CKF 181 2 14 874 NTX
Whitley Cty ARC
N9QCL 257 2 6 866 IN
Troy RC
W4NQ 192 2 9 862 AL
ACARC
W4YSB 210 2 10 850 NC
Brazosport ARC
N5KV 194 2 6 848 STX
Houston ECHO Society
W5ECO 277 2 7 844 STX
Corning ARA
N2IED 166 2 7 832 WNY
Alexander County ARS
KU4ZY 163 2 13 830 NC
Central Maryland ARC
KB3BLR 207 2 9 814 MDC
Moose Horn ARC
AL7LE 192 2 7 800 AK
Xerox Amateur Radio
WD6CZH 182 2 4 784 LAX
QUARK
K7VIT 139 2 10 778 OR
Carter Cty ARES
KF4ZQA 67 2 14 764 TN
Museum of Science & Industry ARC
KM0SI 74 2 12 764 WCF
Delta Cty ARS
K8ZAS 275 2 5 750 MI
Wake Tech ARC
WB4TOP 72 2 7 746 NC
Victoria ARC
W5DSC 170 2 12 740 STX
Flager-Palm Coast ARC
AF2C 62 2 10 734 NFL
Huntington Beach RACES
WB6DX 205 2 20 710 ORG
Stephen F. Austin RC
W5SFA 183 2 4 706 STX
Black Hollow Amateur Club
W4CBM 191 2 15 692 VA
MID-Land ARC
W0VHQ 185 2 10 670 MN
Non-Club Group
K7XI 232 2 3 664 OR
Hill Tops
WB6AXW 182 2 3 664 SDG
Cabarrus ARS
KT4GG 211 2 15 622 NC
Charlotte ARC
W4CQ 156 2 10 612 NC
Lucent Wedixie
WB4MZO 50 2 8 612 GA
Skyways Radio of Martinsville
W4SRM (+KF4YUT)
45 2 3 598 VA
MCARC
W9VCF 296 2 10 592 IN
96 Over The Hill Gang
W3PS 146 2 5 592 EPA
Salem Area ARA
K8BTP 22 2 22 546 OH
NARS
WB6ZPB 215 2 7 530 ORG
Grand Island ARS
W0CUO 152 2 6 520 NE
Mountain State Transmitter Inc
K8VNQ 136 2 4 474 WV
Lakes Area ARC
KB9LBR 66 2 7 432 WI

2A Commercial

Mountaineer ARA
W8SP 1067 2 15 3,496 WV
Carolina CW Ops
AA4NN 682 2 3 2,928 SC
Tyler ARC
K5TYR 730 2 20 2,186 NTX
GREAT
N4VU 660 2 7 1,520 GA
Virtual RC
VA3VR 619 2 14 1,518 ON
Lynn C Wilson Mem Venturing Crew 80
W3BSA 613 2 13 1,426 DE
Tri-Lakes ARC
W2TLR 287 2 26 1,302 NNY
Olympia ARS
NT7H 452 1 23 952 WWA
Pendleton ARC
W7PL 359 2 14 770 OR
Somerset County ARC
K3SMT 352 2 12 704 WPA
Capital ARS
KF4AAV 230 2 15 660 KY
Emporia ARS
N0YNN 127 2 4 508 KS
Adams Cty ARS
WB3JKT 163 2 7 352 EPA
Peninsula Radio Society
N3ETP 100 2 15 332 MDC
Yadkin Valley ARC
N4AAD 57 2 4 114 NC

3A Battery

Eleven Dudes
KO4PY 1411 5 11 13,345 NC
Summit ARA
K3ZZ (+N3DPB)
1313 5 9 10,000 MDC
Ski Cty ARC
K0RV (+KC0HGA)
2946 2 18 7,692 CO
Wyoming Valley QRP Commandos
K7SZ 544 5 3 5,375 EPA
Geezer/Natomas ARC
K6LQ 1370 2 22 4,890 SV
Barston ARC
WA6TST (+KC6IIH)
473 5 30 4,775 ORG
Montachusett ARA
W1GZ (+N1MGO)
360 5 11 4,040 WMA
Endless Mountains ARC
N3EP 1321 2 11 3,744 EPA
ARATS
W2SEX 438 5 35 3,710 WNY
Virginia QRP Society
W4VQS 447 5 12 3,480 VA
North Penn ARC
W3BTN 330 5 3 3,455 VA
Pecos Valley ARC
W5ZU 1005 2 30 3,354 NM
Playground ARC
W4ZBB 797 2 31 3,134 NFL
Mystic Valley ARG
N2MV 641 2 12 2,882 EMA
Bankhead ARC
N4IDX 553 5 9 2,765 AL
Brockport Amateur Radio Klub
K2BRK 276 5 13 2,670 WNY
BARC
K0HX 662 2 23 2,512 MO
St Charles ARC
NF0Q 641 2 22 2,482 MO
West Branch ARA
W3AVK 551 2 6 2,202 EPA
Southern Counties Amateur Network
AA9TD 745 2 29 2,130 IL
Worldradio Staff ARC
WR6WR 735 2 9 2,086 SV
QCWA 162
K9AKG 168 5 12 2,080 WI
Wireless Operators of Winsted
K1BCI 490 2 7 2,030 CT
Alamance ARC
K4EG 474 2 12 1,940 NC
North Country ARC
W2LCA 340 2 9 1,824 NNY
ROARS
W5NVH 338 2 18 1,762 SDG
Diamond Bar ARS
K6EOC 513 2 23 1,726 LAX
GENESIS ARS
WF1M 288 2 16 1,720 EMA
Northside ARC
AA0NC 517 2 12 1,690 MO
Alexandria RC
W4HFH 552 2 20 1,604 VA
River Cty ARCS
N6NA 344 2 25 1,534 SV
Northern Virginia QRP Club
WA4MM 84 5 15 1,340 VA
Sunset Empire ARC
W7BU 185 2 15 1,170 WWA
Badger ARS
W9YT 342 2 12 1,102 WI
Prosser Youth Radio Org.
KC7QHH 244 2 6 1,060 EWA
Wolseley Repeater Group
VE5WRG 167 2 5 920 SK
Santa Maria ARES
W6VO 102 2 7 890 SB
Bobcat ARC
KG6BYT 180 2 12 860 SB
Western PA Hilltoppers
W3PAH 144 5 4 790 WPA

3A

Pikes Peak DX Group
W0GG (+KC0RDJ)
5825 2 17 17,306 CO
McHenry Cty Wireless Assoc
N9BR 4613 2 30 12,920 IL
MDXA/WJCARC/KARC
K5MDX (+KB5FSV)
4112 2 20 12,660 MS
Rochester (NY) DX Assn
W2RDX (+N2TWI)
4234 2 23 12,520 WNY
JPL ARC/Caltech ARC
W6VIO (+KC6HUR)
3618 2 42 11,316 LAX
Carroll Cty ARC
K3PZN (+N3JIA)
3354 2 27 9,876 MDC
Vicksburg ARC
W5XX (+KC5DNY)
3233 2 20 9,762 MS
OCARS
W8TNO (+K8SEW)
3342 2 25 9,706 MI
Redwood Empire DX Assoc.
W6KB 3104 2 22 9,318 SF
Old Barney ARC
N2OB 3152 2 10 9,246 SNJ
Stones River ARC
K4FUN 2402 2 65 9,094 TN
PEARL
K2PUT (+KA2TDN)
2789 2 35 9,048 ENY
Fannin Amateur Contest Team
N5YA 3087 2 21 8,802 NTX
Roanoke Valley ARC
W4CA (+KG4HOA)
3199 2 35 8,704 VA
Poughkeepsie ARC
N2YL (+KB2SSP)
2580 2 30 8,608 ENY
Twin Cities Repeater Club
W0BU (+K0ZDA)
3053 2 77 8,546 MN
Garden State ARA
W2GSA (+KC2GFZ)
2682 2 43 8,456 NNJ
Capeway RC
W1AA (+W1ARO)
2617 2 20 8,346 EMA
Providence RA
W1OP 2826 2 14 8,252 RI
Hattiesburg ARC
AG5Z 2806 2 17 8,206 MS
North Florida ARS
W4IZ 3165 2 30 8,024 NFL
ARC of Parker Cty TX
W5PC 2077 2 10 7,990 NTX
West Jersey DX Group
W2EN 2221 2 9 7,924 NNJ
Amateur Radio For Youth
W0YH 2984 2 4 7,562 CO
Contoocook Valley RC
K1BKE (+WA1VKO)
2701 2 52 7,520 NH
Santa Barbara ARC
K6TZ 2067 2 35 7,436 SB
Loudoun ARG
K4LRG 1827 2 59 7,406 VA
McKinney ARC
W5MRC 2732 2 27 7,238 NTX
Springhill ARC
N5II 2442 2 12 7,058 LA
Tar River ARC
W4DCG 2843 2 12 6,818 NC
North Shore RC
NS9RC (+N9WAT)
1966 2 45 6,772 IL
Framingham ARA
W1FY 2134 2 30 6,636 EMA
Indian River ARC
W4NLX 667 5 35 6,535 SFL
Baton Rouge ARC
W5GIX (+KD5JEH)
1840 2 49 6,366 LA
SOAR
K6SOA (+KE6EER)
1771 2 55 6,320 ORG
SPARC INC
K3IR 2140 2 24 6,248 EPA
Blue Ridge ARC
W4YK 1702 2 10 6,226 NC
Reading RC
W3BN (+N3TLY)
1676 2 93 6,202 EPA
Regina ARS
VE5NN 1837 2 17 6,102 SK
Virginia DX Century Club
W4DZ 1574 2 12 6,048 VA
L'Anse Creuse ARC
K8AYZ (+N8PYN)
1798 2 21 6,046 MI
Delta ARC
W4BS (+KE4DXN)
2047 2 40 6,028 TN
Virginia Beach ARC
W4UG (+KC4JGC)
1804 2 83 5,946 VA
Smoky Mt. ARC
W4OLB (+KC4PDQ)
1968 2 25 5,740 TN
Montana FD2000
K7MT (+KD7FMT)
1618 2 27 5,690 MT
Aiken Contest Club
N2ZZ 1638 2 6 5,676 SC
Vintage Iron RC
N3KR 2108 2 8 5,602 EPA
Franklin Cty ARC
W4FCR 1335 2 26 5,548 VA
South Georgia ARC
N4BIM (+KF4NAT)
1834 2 13 5,540 GA
OH-KY-IN ARS
K8SCH (+KA8LAB)
1901 2 37 5,500 OH
Spider ARC
AF6DX 2458 2 14 5,416 SDG
PHD ARA
W0TE 1485 2 25 5,394 MO
Livingston Amateur Radio Klub
W8TI 1649 2 10 5,370 MI
Kankakee Area RS
W9AZ 1574 2 19 5,274 IL
Kent Cty ARC
W3W 1515 2 34 5,250 DE
Jefferson Cty ARC
W7JCR (+KC7SUF)
1237 2 15 5,148 WWA
Florida West Coast DX Ring
AA4G 1492 2 6 5,046 WCF
Orange Cty ARC
W6ZE 1888 2 28 4,990 ORG
Michigan Radio Alliance
W8USA 1637 2 15 4,922 MI
Central OR DX Club
K7ZM 1412 2 8 4,698 OR
Orange Park ARC
K4BT 1286 2 49 4,690 NFL
Puerto Rico ARL
KP4ES 1299 2 21 4,678 PR
Stu Rockafellow ARS
W8NJH 1275 2 15 4,604 MI
Lincoln Cty ARC
K1LX 1452 2 34 4,574 ME
Xerox ARC
W2XRX 1157 2 18 4,570 WNY
WestArk Amateur Radio Council
K5A 1477 2 45 4,564 AR
Mercer Cty ARC
W3LIF 1170 2 10 4,430 WPA
Southern VT ARC
WT1B (+N1HSJ)
1562 2 25 4,340 VT
Maryland Mobileers ARC
W3CU 1060 2 17 4,338 MDC
Kishwaukee ARC
WA9CJN 989 2 30 4,332 IL
Southern CA Transmitting Society
WB6LRU 1448 2 30 4,244 LAX
Mecklenburg ARS
W4BFB 1066 2 25 4,228 NC
Jackson ARC
W5PFC 1492 2 35 4,218 MS
Atchafalaya Amateur DX Assoc.
WA5MC (+KC5RFO)
1107 2 11 4,192 LA
Genesee Cty Radio Club
W8ACW 1060 2 6 4,124 MI
Tri-Town ARC
W9VT 1142 2 28 4,066 IL
D-CAT TX
KK5CA 1467 2 9 4,022 STX
Non-Club Group
K4KJ 1148 2 18 3,998 GA
Larkefield ARC
W2LRC 1059 2 24 3,968 NLI
Parkersburg Amateur Radio Klub
N8NBL 875 2 23 3,960 WV
Pocatello ARC
N7PI 1165 2 21 3,928 ID
Amer. Red Cross Emerg. Comm. Svc
WB2QBP 1559 2 28 3,922 NLI
Nittany ARC
W3YA 2526 1 20 3,825 WPA
Troy ARA
N2TY (+KB2UUC)
1341 2 55 3,804 ENY
Suburban RC
W0SRC (+WD6EZQ)
1021 2 46 3,798 MO
Brazos Valley ARC
W5DPA (+N0JAA)
1285 2 25 3,790 STX
Franklin Cty ARC
AC1L 917 2 27 3,770 WMA
MITRE Bedford ARC
W1ON (+KB1EUB)
1261 2 20 3,766 EMA
Fraser Valley Field Day Group
VA7FVR 1097 2 30 3,714 BC
Corona/Norco ARC
W6PWT (+KE6DQL)
1307 2 15 3,714 ORG
San Fernando Valley ARC
W6SD 1061 2 86 3,712 LAX
Nacogdoches ARC
W5NAC 1071 2 22 3,694 NTX
Tri-County RA
W2LI 955 2 20 3,648 NNJ
Arapahoe ARES
N0AUS (+KB0HRX)
1009 2 30 3,638 CO
Mt Baker ARC
K7ZC 986 2 35 3,620 WWA
YCCC
AD1T 1153 2 10 3,590 NH
Bill Hoehl Memorial FD Group
W4UOT (+KG4BOO)
1222 2 27 3,568 TN
Mid-Atlantic ARC
W3NWA 1206 2 36 3,566 EPA
Royal Gorge ARC
NC0A 910 2 25 3,548 CO
Oklahoma City Autopatch Assoc
W5MEL 1161 2 47 3,532 OK
Temple ARC
W5LM 961 2 30 3,506 NTX
Madison Oneida ARC Inc
W2MO (+WB2WNV)
764 2 29 3,470 WNY
Citrus Belt ARC
W6JBT 945 2 100 3,436 ORG
Santa Clarita ARC
W6JW (+N6ZXJ)
1118 2 120 3,416 LAX
LIMARC
W2VL 1063 2 93 3,410 NLI
Lebanon ARC
K0LH 776 2 26 3,320 MO
Greater Norwalk ARC
W1NLK (+KA1TZR)
975 2 30 3,314 CT
ARASWF
K4YHB 1135 2 11 3,304 SFL
South Canadian ARS
W5OU (+KC5YWM)
791 2 19 3,206 OK
South Bay ARC
W6SBA (+KD6IDL)
773 2 25 3,198 LAX
MADRAS
WK3X 912 2 19 3,104 MDC
Pasadena RC
W6KA (+KD6JOU)
1144 2 57 3,068 LAX
QSY Society ARC
K2QS (+KB2NPR)
774 2 44 3,034 ENY
South Baldwin ARC
W4INU (+WB4YMV)
893 2 15 3,032 AL

Hamfesters RC
W9AA (+KB9VPJ)
1001 2 31 3,018 IL
Fredericton Amateur Radio Club
VE9ND 663 2 16 3,006 NB
Cambell Cty ARC & Tri Cty ARC
W7CW 800 2 20 2,990 WY
Disney Emergency ARS
WD4WDW 868 2 21 2,984 NFL
Walla Walla Valley ARC
W7DP 768 2 20 2,974 EWA
Peconic ARC
W2AMC 777 2 36 2,970 NLI
Bluff City ARC
W5KHB 1092 2 19 2,920 MS
Nutley Amateur Society
W2GLQ 900 2 15 2,888 NNJ
Chester County ARES/RACES
W3EOC 690 2 23 2,884 EPA
Goddard ARC
WA3NAN 767 2 12 2,880 MDC
The 440 Group
N9WV 769 2 18 2,878 IN
Neptune ARC
W2NRC 698 2 30 2,870 NNJ
Massasoit ARA
W1MV 688 2 16 2,858 EMA
BARC
W4UD 806 2 73 2,852 VA
McDowell ARA
W4HOG 989 2 35 2,770 NC
Kawartha Amateur Radio Group
VE3KRG 598 2 22 2,760 ON
Saratoga Cty RACES Assn
WA2UMX 1052 2 20 2,698 ENY
Jones Cty ARC
NN0L 942 2 12 2,686 IA
Scranton Pocono Amateur Radio Klub
K3CSG 711 2 50 2,680 EPA
Cambridge ARA
W8VP 607 2 20 2,656 OH
The Winnipeg ARC
VE4BB 593 2 25 2,576 MB
Copper Country Radio Amateur Assn
W8CDZ 608 2 14 2,550 MI
David Sarnoff RC
N2RE 576 2 30 2,546 SNJ
Burlington County RC
K2TD 690 2 18 2,530 SNJ
146.76 Repeater Group
K4YNZ 581 2 11 2,522 AL
Jayhawk ARC
W0LB 585 2 17 2,512 KS
Northeast Missouri ARC
W0CBL (+KB0QNH)
776 2 17 2,496 MO
Southern Peninsula Radio Klub
W4QR (+KC4WTT)
820 2 26 2,494 VA
Park Cty RC
AB0PC 594 2 29 2,460 CO
Peoria Area ARC
W9UVI 844 2 20 2,450 IL
The Magic Net
K9KE 812 2 19 2,450 IL
Kennehooche ARC
W4BTI 625 2 27 2,442 GA
Westside Hamsters ARC
AB0MO (+KC0EEH)
964 2 8 2,428 MO
Milton ARC
W4VY 535 2 25 2,426 NFL
Rowan ARS
W4EXU 703 2 15 2,420 NC
Indiana Cty ARC
W3BMD 695 2 20 2,386 WPA
443.475 UHF ARS
KE9GM 575 2 18 2,378 IN
Zero Beaters ARC
WA0FYA 619 2 20 2,370 MO
BARC/BARK
VE3GCB 882 2 19 2,330 ON
RFPARC
W6NQ (+K6NDG)
962 2 4 2,324 SDG
Non-Club Group
KB9ROB 541 2 4 2,306 WI
Monessen ARC
W3CSL 611 2 38 2,270 WPA
Seneca RC
W8ID 412 2 15 2,268 OH
Yonkers ARC
W2YRC (+N2ROD)
512 2 36 2,262 NLI
Portsmouth ARC
W4POX 482 2 25 2,254 VA
Crawford ARS
W3MIE 875 2 31 2,250 WPA
Lake Area Radio Klub
W0WTN 510 2 16 2,242 SD
Ciras/Tars
N0RKX 707 2 10 2,206 IA
Skyline ARC
K2DN 542 2 31 2,182 WNY
Tamaqua Wireless Assoc
W3CMA 462 2 11 2,180 EPA
TEAC
W5SI 587 2 12 2,148 STX
South Brevard ARC
K2CZT (+KD4JRJ)
539 2 14 2,148 SFL
Bloomfield ARC
W1CWA 576 2 20 2,100 CT
ARC of Augusta
W4DV 584 2 25 2,084 GA
Jersey Shore ARS
W2DOR 639 2 22 2,080 SNJ
Greene Cty ARA
N3GC 258 5 12 2,075 WPA
SCARES Club
N4CO 743 2 17 2,056 KY
Peace River Repeater Association
KK2L 528 2 58 2,034 WCF
Palestone/Anderson Co. ARC
K5PAL 593 2 20 2,028 NTX
Columbia AR Project
W7OJ 445 2 8 2,024 EWA
FD RACES/WCARC
W6WC (+KF6LHX)
522 2 20 1,948 ORG
Bluestone ARC
W8KBM (+KB8IKW)
622 2 16 1,944 WV
Rhea Cty ARS
K4DPD 409 2 10 1,936 TN
SMCARA
K3NAL 536 2 15 1,908 MDC
Fulton Cty ARC
K9ILS 496 2 21 1,896 IL
Tuned & Loaded DX Club
N7KR 646 2 4 1,892 EWA
Fort Venango Mike & Key
W3ZIC (+N3VNL)
389 2 12 1,882 WPA
Pearland ARC
K5PLD 674 2 55 1,882 STX
SCRA
W6LFJ (+W2JAB)
395 2 86 1,878 SF
Columbus ARC
N9KVX 603 2 20 1,868 IN
Middle GA Radio Assoc.
WR4MG 472 2 40 1,864 GA
Roberson Cty EOC
KS4S 589 2 31 1,858 NC
North Shores ARC
K6HAI 375 2 20 1,850 SDG
Bellbrook ARC
W8DGN 421 2 10 1,842 OH
Powderhouse FD Group
AA1TF 557 2 8 1,832 ME
Burlington ARC
W1KOO 372 2 11 1,830 VT
4 State ARC
NI0W 431 2 32 1,824 MO
Victoria-Haliburton ARA
VA3LNZ 459 2 32 1,818 ON
Blue Springs ARC
KB0VBN 373 2 23 1,792 MO
ARA of the Southern Tier
W2ZJ 351 2 15 1,786 WNY
App.ARG & Leb. Val. SRA
AA3RG 713 2 48 1,786 EPA
Prairie Dog ARC
W0OJY 578 2 18 1,782 SD
South Hills ARC
KS3R 355 2 8 1,760 WPA

The Fidelity ARC, WF1A, of Rhode Island took advantage of a high-profile guest operator.

Kaw Valley ARC
W0CET 553 2 15 1,728 KS
Plateau ARC
W4CV (+W4EKG)
424 2 14 1,726 TN
Every ARS
KB0YHB (+KC0EUJ)
428 2 12 1,718 MO
Wabash Valley ARA
W9UUU (+K9GBO)
404 2 49 1,712 IN
West Virginia ARES
W8V 448 2 5 1,712 WV
Coos Cty RC
K7CCH 446 2 50 1,706 OR
Reservoir ARA
K8QYL (+N8VHM)
537 2 20 1,694 OH
Santa Barbara West Cty ARES
W9EC 399 2 12 1,688 SB
Intercity ARC
W8WE 304 2 40 1,680 OH
Manhattan Area ARS
KS0MAN 357 2 20 1,678 KS
ARA of Bremerton
W7VE 399 2 10 1,674 WWA
Dallas Cty React ARC
W5DCR 461 2 25 1,660 NTX
Okaw Valley ARC
N9JOY (+KB9ENS)
606 2 12 1,648 IL
North Shore RA
N1UEC 323 2 38 1,646 EMA
Benton Cty ARES/OSU Amateur Radio
K7CVO 301 2 15 1,614 OR
Chat-Hams
NW4T 503 2 24 1,606 NC
Quinte & Tri-County Radio Clubs
VE3RL 427 2 20 1,602 ON
Cumberland Valley ARC
W3ACH 346 2 17 1,592 WPA
Kansas Nebraska ARC
K0KSN 328 2 21 1,580 KS
Irvine Disaster Emerg. Comm.
N6IPD 414 2 35 1,576 ORG
Alhambra High School ARC
K6R 306 2 3 1,562 LAX
Randolph ARC
KO4SN (+KG4DBT)
428 2 13 1,556 NC
Wood Cty Emergency Comm. Inc
WC8EC 454 2 12 1,538 WV
Non-Club Group
K7PVT 320 2 3 1,532 WWA
Ionia County ARC
N8PFK 475 2 9 1,524 MI
Austin Area ARC
W0AZR 301 2 22 1,518 MN
Tazewell Cty ARES
KU4RK 459 2 6 1,518 VA
Fallbrook ARC
N6FQ 506 2 9 1,512 SDG
Carteret Cty ARS
W4YMI (+K9REB)
455 2 14 1,510 NC
Naval Research Lab ARC
W3NKF 262 2 16 1,484 MDC
Surrey ARC
VE7SAR 377 2 10 1,464 BC
Indy Midtown ARC
NE9T 469 2 9 1,458 IN
OIDAR ARC
KK5GY 377 2 12 1,432 OK
Alamogordo ARC
K5LRW 292 2 59 1,390 NM
Pen Bay ARC
W1PBR 268 2 10 1,364 ME
Mountain ARC
W3YMW 374 2 12 1,354 MDC
High Desert Hams
AB7VL 323 2 5 1,352 NV
ARPSA
KC8EO 325 2 6 1,350 MI
New Bern ARC
WD4JMS 262 2 10 1,346 NC
Cherokee Capital ARS
K4WOC 199 2 26 1,346 GA
Tulsa Repeater Org
WA5LVT 321 2 20 1,342 OK
Non-Club Group
K8TKA 356 2 10 1,330 OH
Cass Cty ARC
W9VMW 364 2 15 1,328 IN
Three Men in the Tub
VE3ERA 306 2 3 1,308 ON
Natchaug ARC
WE1Y 400 2 20 1,300 CT
Meewasin ARS/Lakland ARA
VE5DR 337 2 10 1,300 SK
Falls Amateur Radio Club
K9RHH 487 2 7 1,274 WI
Yellow Thunder ARC
WB9FDZ 350 2 12 1,270 WI
Radio Afficianados Latinos Int'l
N5MG 321 2 15 1,244 STX
Greers Ferry ARC
W5GFC 169 2 19 1,226 AR
UHF Associates
WB6ZOD 374 2 7 1,224 ORG
Yarmouth ARC
VE1GX 313 2 18 1,216 NS
Deuel Cty ARC
W0GC 195 2 4 1,194 SD
Boeing ARS
KA0MR 310 2 14 1,178 KS
NNARS
KE7R 342 2 20 1,178 NV
Georgian Bay ARC
VE3HXX 564 2 20 1,176 ON
Holmesburg ARC
K3CJ 146 2 36 1,164 EPA
Non-Club Group
W7YH 230 2 3 1,160 EWA
Gloucester City ARC
N3JAH (+KC2GEF)
180 2 30 1,142 SNJ
WCARC Inc
W0RRZ 276 2 30 1,138 CO
McPherson ARC
W0TWU 366 2 6 1,132 KS
Lincoln Hams
KJ7TR 200 2 8 1,112 MT
Bagley ARC
KA1EKS 148 2 6 1,096 ME
Rathway OEM
N2VEX 592 1 10 1,092 NNJ
Lower Columbia ARC
W7DG 271 2 8 1,090 WWA
Champlain Valley ARC
W2UXC 133 2 33 1,084 NNY
Davies Co. EMA Club
KB9TYR 132 2 22 1,064 IN
Toronto ARC
VE3TNC 378 2 12 1,056 ON
Wexaukee ARC
K8CAD 302 2 16 1,054 MI
Titusville ARC
KE4ZPA 164 2 22 1,052 NFL
Pueblo HAM Club
KR0K 219 2 10 1,038 CO
Lawton-Ft Sill ARC
W5KS 115 2 17 1,030 OK
Thunder Bay ARC
K8PA 213 2 16 1,026 MI
Maple Ridge ARC
VE7CML 288 2 8 1,018 BC
Corona PD Comm. Specialist Volt.
KN6KH 103 2 18 1,006 ORG
DeSoto ARC
W4MIN 149 2 9 998 WCF
Mountain Repeater Assoc.
K6VE 389 2 11 990 LAX
Southeast Arkansas RC
W5HTY 235 2 19 984 AR
Elgin ARS
VE3RSE 170 2 25 944 ON
The Woodlands Irregulars
KD5ELA 171 2 6 938 STX
Bluegrass ARS
K4KJQ 202 2 15 932 KY
Area Amateur Radio Operators
W9YPS 463 2 9 928 IL
Laurel Highlands VHF Society
AA3SO 245 2 7 828 WPA
Southwest Ar RC
N0QEV 134 2 20 768 AR
Macon ARC
W4BKM 130 2 10 694 GA
Disney EARS
WD6MM 139 2 6 678 LAX
Metro Politan ARC
K8NOW 248 2 7 672 MI
Delco Dug
WB4WPF 97 2 8 618 NC
SADFAR
K9SAD 100 2 10 600 IL
The Dalles Repeater Club
W7FIO 135 2 12 596 OR
Int. Assoc for Astromonical Studies
KB0UAA 184 2 9 568 CO
Mechanicsburg Marauders
AB8DU 84 2 6 518 OH
NKDXE
KD4EVB 54 2 4 508 KY
Pahrump NV Group
AC7EL 112 2 14 424 NV
Hurst TX Stake Emerg. Comm. Network
W7YC 57 2 16 414 NTX
RVARC
KF4BAN 30 2 2 360 VA
CARUN
KJ6QA 95 2 9 304 SCV
Whitewater Valley ARC
N9JM 88 2 10 304 IN
Puget ARS
K7PAR 108 2 12 216 WWA

3A Commercial

Split Rock ARA
K2RF 1074 2 34 3,250 NNJ
Gratiot Cty ARA
WA8AEG 587 2 10 1,692 MI
Milwaukee Radio Amateurs' Club
W9RH 463 2 25 1,506 WI
Orange Cty RACES
K6ES 579 2 14 1,426 ORG
Lincoln Cty Volunteer Comm.
NC4LC 432 2 10 1,266 NC
Hernando Cty ARA
WB4NOB 272 2 20 1,224 NFL
Ellis Cty ARC
WD5DDH (+KD5FJG)
189 2 26 978 NTX
High Point ARC
W4UA 277 2 16 920 NC
Quaboag Valley ARC
W1NP 150 2 10 602 WMA

4A Battery

Portland ARC
W7LT (+KD7IZM)
1102 5 40 9,690 OR
Dickson Cty ARC
NY4N (+KG4ABM)
1073 5 10 8,270 TN
Peel ARC
VE3XR 2502 2 59 7,228 ON
San Andreas Faultline Survivors
W6SW 2304 2 23 6,912 SJV
ARCA/SCARS
NC6I 1704 2 60 6,052 SV
Lake Monroe ARS
N4EH 1457 2 35 5,500 NFL
The Six Meter Club of Chicago
K9ONA 1573 2 25 5,278 IL
DeKalb Cty ARC
K4AKC 634 5 14 4,895 AL
RACCC
K5RAC 524 5 15 4,370 NTX
Lassen ARC
K6LRC 611 2 16 2,310 SV
Durham FM Assoc.
WR4AGC 658 2 8 2,292 NC
ARC of Savannah
W4HBB 441 2 24 1,966 GA
Starved Rock RC
W9MKS 374 2 12 1,958 IL
West Marin ARS
W6RSI 403 2 8 1,776 SF
SARA/So. IL. Univ. ARC
W9UIH 349 2 34 1,446 IL
Lee De Forest ARC
W6OB 318 2 20 1,336 ORG
Altus Area ARA
AJ5Q 290 2 57 1,264 OK

4A

Kettle Moraine Radio Amateurs
N9KS 3766 2 18 11,990 WI
Sussex Cty ARC
W2LV 3996 2 35 11,968 NNJ
Delaware ARA
K8ES (+KC8CNT)
3186 2 25 10,750 OH
Red Cedar/Red Ryder
N8BU 3127 2 15 10,044 MI
PCARC/GBRA
W1WQM 2888 2 17 9,896 NH
Twin State RC
W1FN (+KB1BYP)
3009 2 31 9,708 NH
Sturdy Memorial Hospital ARC
W1SMH (+N1OFC)
2718 2 32 9,230 EMA
Willamson Cty ARC
N4TT 3049 2 36 8,916 STX
WECA
N2SF (+KC2FKY)
2625 2 55 8,424 ENY
Ozaukee RC
W9LO (+KA9DDN)
2516 2 33 8,144 WI
TAARS
NO4Y 2415 2 39 7,656 NC
Penn Wireless Association
W3SK 2046 2 10 7,140 EPA
Nassau ARC
K2VN 1638 2 54 6,112 NLI
Golden Triangle ARC
W6GTR 1761 2 26 5,980 ORG
Two Rivers ARC
W3OC (+WB3ROX)
1694 2 34 5,970 WPA
Hams Having Fun in KY
AA4NJ (+KC8AXF)
1745 2 25 5,418 KY
Delaware-Lehigh Amateur Radio
W3OK (+KB3CLQ)
1873 2 10 5,276 EPA
Alford Memorial RC
W4BOC (+KC4AJF)
1720 2 59 5,260 GA
Island Cty ARC
W7AVM 1223 2 22 5,208 WWA
CMARC
W8MAA (+KB8PSF)
1365 2 32 5,200 MI
Columbia-Montour ARC
WC3A 1339 2 35 5,148 EPA
BARC Jr
K0DE 1606 2 25 4,972 CO
Riverside Cty ARS
W6TJ 1468 2 66 4,844 ORG
Santa Fe community College ARS
K4EAC 1201 2 7 4,842 NFL
North Ottawa ARC
W8CSO 1449 2 30 4,650 MI
Goshen ARC
K9WJU 1099 2 16 4,622 IN
Downey ARC
W6TOI 1599 2 26 4,330 LAX
Stonewall Jackson ARA
K8FD 1713 2 12 4,306 WV
Ft. Myers ARC
W4LX (+KC4QAY)
1259 2 50 4,274 SFL
Kokomo ARC
W9GO 948 2 23 4,264 IN
Antietam RA
W3CWC 1280 2 20 4,256 MDC
Sioux Empire ARC
W0ZWY 1084 2 25 4,230 SD
Key City ARC & Dyess ARC
AE5B (+KC5FFQ)
1385 2 52 4,146 WTX
Albany ARA
K2CT 1096 2 27 4,140 ENY
Greater Vancouver Radio Group
VE7LMR 1188 2 48 4,116 BC
Gainesville ARS
W4SH 1175 2 10 4,078 NFL
Arizona ARC
W7IO 994 2 20 4,072 AZ
Jug Southgate Bunch
N2EY 951 2 40 4,018 EPA
Non-Club Group
VE3LAC 1116 2 25 3,846 ON
Sangabriel Valley RC
W6FU 879 2 15 3,760 LAX
Maurt ARC
W4GGM (+KG4GCZ)
1063 2 96 3,732 TN
Burnaby & New Westminster ARC
VE7BAR 1391 2 23 3,718 BC
Grumman ARC
WA2LQO 1085 2 25 3,702 NLI
Van Wert ARC
W8FY 1057 2 19 3,688 OH
M-STARS
W7O (+KC7MWJ)
2019 1 100 3,459 OR
Montgomery ARC
KV3B 919 2 34 3,368 MDC
Twin City Ham Club
W5EA 1206 2 16 3,358 LA
Tri-County ARC
WC5C 1045 2 17 3,286 NTX
RASON
N1NW 792 2 15 3,226 CT
Greater Grand Forks ARES
N0GF 955 2 15 3,210 ND
Chesapeake Bay RA
W3YR 646 2 15 3,172 MDC
BCARA
W3UDX 1020 2 9 3,122 WPA
Scottsdale ARC
K7TR (+N7TUV)
814 2 10 3,092 AZ
Radio Association of Erie
W3GV 702 2 18 3,088 WPA
Southborough Rod & Gun Club ARC
W1SRG 856 2 17 3,022 WMA
Hill Country ARC
N5HR 883 2 33 3,016 STX
Piscataway ARC
K2VOA 1149 2 28 3,004 NNJ
RAMS
NV7RM 882 2 22 2,896 NV

Alliance ARC
W8LKY 784 2 13 2,888 OH
Naval Post Graduate School ARC
K6LY 787 2 24 2,850 SCV
Federal Way ARC
WA7FW (+KC7RRH)
680 2 45 2,842 WWA
MARC/YCARES
K7FM 705 2 21 2,840 OR
Marin ARS
W6SG 560 2 35 2,790 SF
Pilot Knob ARC
AA0LV 807 2 27 2,690 KS
Broward Cty ARES/RACES
N4CU 563 2 34 2,680 SFL
BCARPSG
K3PSG (+KB3BSD)
810 2 25 2,680 WPA
Anchorage ARC & South Central ARC
KL7AA 1433 1 50 2,665 AK
Fort Wayne RC
W9TE 681 2 38 2,662 IN
Southern Pennsylvania Comm Group
K3AE (+N3ZQM)
851 2 37 2,638 EPA
Peninsula Electronic ARS
WR4H 1012 2 13 2,624 VA
Palisades ARC
W9BPT 813 2 30 2,616 IL
Silvercreek ARA
KI8B (+K8RMR)
826 2 9 2,588 OH
Pioneer Amateur Radio Fellowship
KB8ZAM 680 2 36 2,584 OH
Kent ARS
K3ARS 567 2 12 2,556 MDC
Victor Valley ARC
K6QWR 834 2 43 2,554 ORG
Foothills ARC
KO4MZ 843 2 15 2,516 SC
Southern Cty ARA
K2BR 537 2 37 2,508 SNJ
South Berkshire ARC
W1BAA/2 575 2 14 2,438 ENY
Am Red Cross Disaster Radio Group
W9ZY 567 2 25 2,430 IN
CATS
KF4L 636 2 36 2,418 TN
ORCA
W6LL 702 2 20 2,386 EB
XWARN
WS8G 474 2 60 2,372 OH
ICARS
KE4GEK 713 2 30 2,368 NC
Sojourners
W6SOJ 450 2 18 2,284 SV
Waterville Area Wireless Assn
WA1WA 451 2 11 2,238 ME
Coastal ARS
K4NLX 758 2 35 2,224 GA
San Jose ARES/RACES
W6IO 525 2 25 2,152 SCV
Non-Club Group
W7AQ 731 2 11 2,068 EWA
Tri-State ARA
W8VA 518 2 30 2,048 WV
Sweetwater ARC
WY7U 373 2 10 2,042 WY
Golden Empire ARS
W6RHC 660 2 18 2,026 SV
National ARC
K9UXZ (+KB9VKS)
580 2 15 2,022 IL
Hazleton Amateur Radio
W3JJI 519 2 15 2,020 EPA
E. Central Minn ARC
K0ECM 459 2 11 1,876 MN
Tazewell County ARS
W9TAZ 508 2 8 1,784 IL
Coocella Valley ARC
K6BSC 473 2 34 1,770 ORG
SMARTS/CCARES
N0EN 467 2 13 1,722 MN
Fulton Cty ARC
K8BXQ 412 2 12 1,666 OH
SPEARS
W5SPC 316 2 6 1,660 STX
Campbell Cty ARC
W4OGJ 579 2 10 1,658 TN
Three Rivers Amateur Society
NO4Q 453 2 12 1,606 TN
Grays Harbor Cty ARC
W7ZA 363 2 15 1,586 WWA
Radio Amateurs of Greater Syracuse
W2AE 275 2 20 1,584 WNY
Kimberling ARC
K0EI 323 2 25 1,580 MO
Non-Club Group
K9OC 425 2 11 1,550 WI
Fort Armstrong Wireless Assoc
N3VA 469 2 22 1,538 WPA
Stephenson Cty Repeater Assn
K9PAG 409 2 14 1,518 IL
Nortown ARC
VE3NAR 540 2 11 1,514 ON
OES California
W6SIG 250 2 15 1,500 SV
Orange Cty ARC, Inc
W2HO 220 2 17 1,498 ENY
Clark Cty ARC
W7AIA 340 2 10 1,496 WWA
Central Massachusetts ARA
W1BIM 403 2 7 1,488 WMA
Elkhorn Valley ARC
W0OFK 367 2 12 1,434 NE
Millbrae ARC
KB6TR 338 2 10 1,426 SCV
St Croix ARC
VE1IE 309 2 8 1,418 MAR
Sussex ARC
N3IOD 274 2 13 1,356 DE
Russell Cty ARC
KK4MW 376 2 25 1,352 VA
Union City ARES/RACES
KG6MH 309 2 12 1,306 EB
Pine Log Repeater Group
K4PLM 399 2 15 1,298 GA
Tompkins Cty ARC
KC2EOS 336 2 13 1,232 WNY
Whidbey Island ARC
W7PN 175 2 7 1,220 WWA
Sierra Foothills ARC
W6RFF (+KC6RVO)
243 2 21 1,214 SV
HCARS
KC9JV (+N9CNJ)
367 1 15 1,167 IN
Amateur Radio League - Lawrence Cty
NC3C 166 2 12 1,132 WPA
Radio Amateurs of the Gorge
KC7KLB 124 2 16 1,130 OR
Cenois ARC
K9HGX 423 2 10 1,106 IL
Lincoln Cty ARC
K7AM 125 2 11 1,088 OR
ARAHH
N8AHZ 241 2 10 1,082 MI
Katy ARS
W5HZ 107 2 10 1,070 STX
Gladwin Area ARC
KB8ZML 281 2 22 1,062 MI
Ebonaire ARS
K2EAR 257 2 36 1,014 NLI
Boot Heel ARC
KB0UFL 133 2 11 966 MO
San Antonio RC
W5SC 431 2 10 962 STX
Burlington ARC
VE3RAB 165 2 10 932 ON

4A Commercial

Radio Assn of Western NY
W2PE 756 2 17 2,554 WNY
Plateau/Black Diamond RA
NM8T (+KB8MQN)
866 2 26 2,344 WV
LaGrange ARC
KD4BWK 557 2 15 1,660 GA

5A Battery

Zuni Loop Mountain Expedit Force
K6ZNI 983 5 15 8,610 LAX
TLARC & Explorer Post 30
KC0M 1882 2 18 7,566 MO
Orange Cty Radio Amateurs
N4C 761 5 31 6,255 NC
St Louis QRP Society
NF0R 474 5 20 5,440 MO
North Coast ARC
N8NC 589 5 22 4,080 OH
NJ QRP Club
WQ2RP 332 5 15 3,885 SNJ
Sisters Repeater Group & CORA
KK7TT 519 5 10 3,525 OR
Mother Lode DX Contest Club & ACARC
K6AO 379 2 25 1,620 SV
Hall of Science ARC
WB2JSM 214 2 21 1,428 NLI

5A

Huntsville ARC
K4BFT 5054 2 95 15,426 AL
Non-Club Group
W6NWG (+WD6FWE)
4448 2 10 13,506 SDG
Wanna Bee Contest Lodge
NA5TX (+KD5IIX)
3904 2 10 11,960 STX
AK-SAR-BEN ARC
K0USA 4057 2 62 11,388 NE
The Udder Club
W1MOO 3548 2 34 10,876 VT
Hoodview ARC
W7Q 3004 2 50 9,470 OR
RF Hill ARC
W3AI 2781 2 16 8,836 EPA
TCARC
W9YR 2670 2 35 8,528 IL
Mt Vernon ARC
K4US 2179 2 37 7,532 VA
Schenectady ARA
K2AE 1883 2 95 7,162 ENY
Hazel Park ARC
W8HP (+N8WIQ)
2300 2 50 7,160 MI
Murgas ARC
K3YTL (+KA3VQR)
2033 2 39 6,854 EPA
Phil-Mont Mobile Radio Club
W3EM 1932 2 40 6,462 EPA
AARC
W3VPR (+KB3EXY)
1636 2 40 5,962 MDC
United Radio Amateur Club
K6AA (+KF6RQY)
2164 2 30 5,814 LAX
Boeing Employees ARS
K7NWS (+N7YKH)
1428 2 21 5,648 WWA
Burley ARC
W7JO (+KC7DRR)
1522 2 25 5,598 WWA
Great South Bay ARC
W2GSB 1542 2 38 5,300 NLI
Amateur Radio Transmitting Society
W4CN (+KC4TBC)
1244 2 39 4,868 KY
Bergen ARA
K2BAR 1554 2 10 4,794 NNJ
Mt Diablo ARC
W6CX 1517 2 10 4,702 EB
Queen City Emergency Net
W8VND 1475 2 31 4,634 OH
Western IL ARC
W9AWE 1438 2 10 4,554 IL
METRO/SPARC/CARS/Boy Scots
W4C 1507 2 30 4,550 WCF
WCARS
W4MOE 1652 2 95 4,506 NC
South Bay ARA
KU6S (+KD6TKV)
1119 2 120 4,504 EB
Cambridge ARC
VE3SWA 1373 2 5 4,232 ON
Warminster ARC
K3DN (+KA2VJO)
1382 2 35 4,106 EPA
Illinois Valley ARC
K9JX 1030 2 10 4,090 IL
Hamilton ARC
VE3DC 1233 2 13 3,944 ON
Simi Settlers ARC
W6SVS 997 2 51 3,816 SB
Clear Lake ARC
K5HOU 1105 2 130 3,784 STX
RVARC
K4TS 803 2 13 3,746 VA
Highlands Cty ARC
K4W 844 2 8 3,688 WCF
SCJHC
K6JP (+KC6TQR)
1036 2 15 3,640 LAX
Catalina RC
W7SA 1010 2 25 3,634 AZ
Milledgeville ARC
W4PCF 1269 2 21 3,600 GA
4 County ARES
N4NCK 905 2 15 3,574 NC
Wisconsin Valley RA
W9SM 764 2 15 3,572 WI
York Region ARC
VE3YRA 1051 2 24 3,508 ON
Big Rapids Area ARC
WI8W 832 2 52 3,410 MI
Frontier ARS
N7W 936 2 95 3,340 NV
Monongalia Wireless Association
W8MWA 731 2 18 3,262 WV
BEARS of Manchester
W1BRS 1077 2 12 3,078 CT
Tri-County CW ARC
KB3CMW 756 2 22 3,034 WPA
Everglades ARC
W4SVI 843 2 45 2,972 SFL
415 Wireless Society
KQ6AR 755 2 11 2,944 SCV
ARCS/DMRAA
W0AK (+KC0AHQ)
749 2 75 2,938 IA
NPARC
VE3VM 775 2 25 2,934 ON
RAC of Knoxville
W4BBB 551 2 58 2,928 TN
Inland Empire ARC
W6IER (+WB9MJQ)
602 2 37 2,858 ORG
Strangers & Pilgrims ARK
N3SWH 725 2 45 2,700 EPA
Sun Parlour Retirees' ARC
VE3WRC 776 2 18 2,560 ON
North Hills ARC
W3EXW 478 2 68 2,558 WPA
Shenandoah Valley ARC
W4RKC 740 2 17 2,508 VA
Rock River RC
W9TCH 686 2 22 2,380 WI
Quannapowitt RA
N1YQV 680 2 21 2,284 EMA
Shoreline ARC
W1BCG 573 2 15 2,264 CT
Non-Club Group
KV4EB 606 2 12 2,218 TN
Bellevue ARC
W0WYV 572 2 16 2,178 NE
Sheboygan Cty ARC
K9SJ 771 2 15 2,062 WI
Arlington Communications League
KC9IL 513 2 12 2,016 IL
Kamiak Butte Amateur Repeater Assn
KB7ARA 561 2 35 1,974 EWA
The Eastern Ontario ARC
VE3SAU 457 2 12 1,914 ON
Roane Cty ARC
AJ4B 468 2 10 1,794 TN
Armadillo Gang
W5LEX 496 2 18 1,792 STX
SARS
W6CO 376 2 18 1,712 EB
Statesboro ARS
KF4DG 474 2 18 1,562 GA
Non-Club Group
VE6ARC 352 2 10 1,512 AB
Lower Yakima Valley ARC
W7ZZV 409 2 12 1,430 EWA
Bridgerland ARC
W7IVM 318 2 77 1,368 UT
Portage ARC
KJ3O 314 2 26 1,282 OH
Toledo Mobile RA
W8HHF 132 2 30 1,216 OH
Amateur Radio Experimentrs
W9YPC 423 2 10 1,008 IL
Rio Hondo ARC
W6GNS 169 2 24 962 LAX
Radio Amateur Educational Society
VE6RES 87 2 12 874 AB
Lilac City ARC
N7LC 228 2 10 868 EWA

5A Commercial

Illinois Valley Radio Assoc.
K9AVE 1761 2 11 5,502 IL
UWF & Five Flags ARA
K4UWF 829 2 12 2,394 NFL
Iowa Great Lakes ARC
WD0HHK 315 2 19 1,108 IA
Midway ARC
W0KY 442 2 10 1,084 NE

6A Battery

Dorham Region QRP Club
VE3QDR 832 5 9 8,500 ON
Honeywell Hams
N9AV 1119 2 20 3,260 AZ
Stanislaus ARA
W6ERE 1054 2 25 2,908 SJV
Guelph ARC
VE3ZM 987 2 10 2,574 ON

6A

Cherryville Repeater Assoc. II
W2GD (+KB2ERI)
6694 2 43 20,628 NNJ
SJRA
K2AA 3220 2 45 10,576 SNJ
Cherryland ARC
W8TCM 3555 2 34 9,612 MI
Fox River Radio League
W9CEQ (+KB9WBW)
2787 2 50 9,334 IL
Mike and Key ARC
K7LED 2847 2 26 9,252 WWA
Eastern CT ARA
K1MUJ (+N1NUY)
1997 2 17 6,918 CT
Utah ARC
W7SP 2015 2 161 6,880 UT
Santa Cruz Cty ARC
K6BJ 2114 2 46 6,422 SCV
MTARA & HCRA
WM1FD 1646 2 16 4,954 WMA
Plattsmouth ARC
KB0SMX (+KC0HYF)
1332 2 33 4,646 NE
North Fulton Amateur Radio League
K4BB 1259 2 30 4,108 GA
Lancaster & Fairfield Cty ARC
K8QIK 1359 2 50 3,982 OH
Tuscola Bay Arenac
N8ZE 1034 2 66 3,828 MI
Holland ARC
K8PAA 996 2 94 3,532 MI
Big Bear ARC
K6BB 907 2 26 3,406 ORG
Huber Heights ARC
NO8I 784 2 10 3,302 OH
Midland ARC
W8KEA 708 2 10 2,920 MI
Whitman ARC
WA1NPO 604 2 25 2,820 EMA
Hoosier Hills Ham Club
W9QYQ 760 2 14 2,636 IN
Calaveras ARS
WA6YGA 587 2 14 2,532 SJV
Southern Michigan AES
W8DF 691 2 40 2,352 MI
Boston ARC
W1BOS 333 2 10 1,856 EMA
Branchburg OEM
NU2W 438 2 6 1,684 NNJ
East River ARC
W8MOP 360 2 35 1,640 VA
Skywide ARC
VA3SKY 322 2 10 1,536 ON
Ellwood City ARA
N3EC 330 2 32 1,508 WPA
The Villages ARC
K4VRC 243 2 14 1,496 NFL
Foundation ARS
W4FBC 160 2 14 1,220 NC

7A Battery

Scarborough ARC Inc.
VE3WE 721 5 25 6,000 ON
Sangamon Valley RC
W9DUA 1249 2 25 4,132 IL

7A

Western ARA
N6ME 6132 2 30 18,702 ORG
Lake Cty ARA
N8BC (+N8GAK)
3575 2 14 11,638 OH
Four Lakes ARC
W9JZ 2139 2 20 8,602 WI
South Florida 6
W4SS 3004 2 95 8,576 SFL
Non-Club Group
W6TRW 2838 2 10 6,686 LAX
ARC Of El Cajon, Inc
WA6BGS 2414 2 50 6,600 SDG
Kalamazoo ARC
W8VY (+KC8DEI)
1499 2 30 5,642 MI
NOBARC
N1WM 1453 2 35 5,390 WMA
Radio Club of Tacoma
W7DK (+KC7VUQ)
1524 2 50 5,370 WWA
Guyahoga Falls ARC Inc
W8VPV (+W8RJG)
1708 2 25 5,344 OH
CNHARC
W1JV 1463 2 39 5,254 NH
Kanawha ARC
W8GK 1101 2 45 3,548 WV
Sudbury ARC
VE3ZI 744 2 14 3,524 ON
KARS
KB5TX (+KC5FSP)
1009 2 27 3,258 STX
SOBARS
K6QM (+KA6PSG)
906 2 9 2,808 SF
Tri-County ARC
NC4AR 808 2 15 2,730 NC
Non-Club Group
N8DXR 617 2 10 2,234 MI
Keuka Lake ARA
KV2W 300 2 10 2,036 WNY
Yolo ARS
K6UO 244 2 15 1,832 SV
Allegan County ARC
KC8ITV (+KC8LXN)
388 2 19 1,576 MI
Seattle Aux Comm.Service
W7ACS 218 2 15 1,442 WWA

8A Battery

Alameda Cty RC
N6WG (+KC6LVI)
1305 5 25 10,850 EB
Ventura Cty ARS
N6ZE 750 5 13 6,080 SB
Tri-Columbia ARC
W4MN 646 2 86 3,078 SC

8A

Raleigh ARS
W4DW (+W2BYV)
4064 2 42 12,510 NC
Birmingham ARC
W4CUE 3814 2 63 11,730 AL
Gwinnett ARS
W4GR 2498 2 185 7,510 GA
Mississauga ARC
VE3MIS 1240 2 18 6,360 ON
NOMADS ARC
N0TM (+WB0WUR)
1179 2 10 4,472 NE
Warren ARA
W8VTD 1204 2 9 4,306 OH
Mahoning Valley ARA
W8QLY 1776 2 50 4,190 OH
Kitchener-Waterloo ARC
VE3IC 1101 2 10 4,172 ON
Triple "A" ARA
AC3J (+KB3BQR)
469 2 70 2,186 WPA
Cleveland ARC
W4GZX 335 2 20 1,992 TN
Spa ARA
WB5SPA 410 2 10 1,920 AR

9A Battery

APA/BEARS
W6APA 230 5 23 2,910 LAX

9A

Gloucester Cty ARC
W2MMD 2722 2 26 10,350 SNJ
Rockford ARA
W9AXD 1359 2 24 6,100 IL
Crawford Cty ARC
W8BAE 881 2 65 3,064 OH

10A

Wheaton Commity Radio Amateurs
W9CCU (+N9GYF)
3931 2 75 12,454 IL

11A

10-70 Repeater Association, Inc
N2SE 2161 2 62 8,982 NNJ
El Dorado ARC
AG6AU 1401 2 53 5,612 SV
UMS
VE2UMS 797 2 220 4,086 QC

12A Battery

Conejo Valley ARC
AA6CV 1340 5 38 11,490 SB

13A

West Valley ARA
W6PIY 3737 2 70 13,014 SCV

14A

Woodbridge Wireless
W4IY (+KC4RFM)
8064 2 83 24,904 VA

16A

South Pickering ARC
VE3SPC 2450 2 160 9,322 ON

17A Battery

USECA
KK8M 2925 5 183 22,835 MI

18A

Nashua Area RC
N1FD (+KB1EFF)
6246 2 100 19,614 NH

30A

PVRC & CARA
W3AO (+W3AMY)
9908 2 50 31,534 MDC

35A

Capital Region FD2000
VA3RAC (+VA2GPF)
1940 2 190 10,136 ON

1B-1 Op Battery

N0UR 632 5 1 6,455 MN
K0MF 593 5 1 5,880 CO
K3ONW 555 5 1 5,650 EPA
W3TS 430 5 1 4,600 EPA
KE0UI 378 5 1 3,975 MN
WA7LNW 423 5 1 3,585 UT
W9NJP 355 5 1 3,485 IL
K3WGR 309 5 1 3,045 EPA
N6VZ 255 5 1 2,740 OR
W3CB 211 5 1 2,710 MDC
WU0L 218 5 1 2,480 CO
AC4XO 210 5 1 2,400 VA
AC7A 229 5 1 2,390 AZ
KD6RDO 193 5 1 2,330 SB
K4RDU 203 5 1 2,130 VA
AB4EL 198 5 1 1,980 NC
N7RVD 172 5 1 1,920 WWA
WD7Y 171 5 1 1,910 NV
K8ZT 191 5 1 1,840 OH
W3ANX 174 5 1 1,840 WPA
W7POE 373 2 2 1,792 MT
KB9IVB 327 5 1 1,735 IN
WS8H 218 5 1 1,730 WV
K5SI 161 5 1 1,710 STX
WC7F 137 5 1 1,645 ID
AA2QO 164 5 2 1,625 NLI
N4IY 139 5 1 1,595 IN
N7WS/0 192 5 1 1,590 SD
N0FKC 270 2 1 1,580 MN
KF0UU 108 5 1 1,580 MN
N1IE 136 5 1 1,560 SV
N2TO 188 5 2 1,530 EPA
WA0NLK 146 5 1 1,460 CO
AE6N 101 5 1 1,335 AZ
WA3NNA 121 5 1 1,310 EPA
AB0GO 120 5 1 1,300 CO
WA9STI/6 376 2 1 1,258 LAX
WA9PYH 105 5 1 1,250 IN
K1YZ 186 5 1 1,230 EMA
VE3FFK 240 2 2 1,160 ON
AE4EC 92 5 1 1,120 NC
W1EUY 107 5 1 1,070 EMA
KC2BEK 238 2 1 1,052 NLI
AB2JL 141 5 1 1,005 WNY
WB8N 180 2 1 990 OH
AB2AN 76 5 1 960 NNJ
WK3M 300 2 1 956 WPA
W3WT 87 5 1 955 EPA
N3HFS 377 2 1 954 VA
W8EO 83 5 1 930 MI
NI0A 79 5 1 890 MN
WD6DX 75 5 1 850 SCV
WB2DLA 63 5 1 830 NLI
KE6LBX 50 5 1 800 SDG
W2HLI 59 5 1 790 NLI
N7CVW 230 2 1 760 EWA
W3MWY 55 5 1 750 MDC
W2UX 65 5 1 750 SC
KT6DM 224 2 1 748 SJV
KK7GB 102 5 1 710 ID
N7CFO 204 2 1 708 OR
KD5LX 116 5 1 680 CO
KU4OS 111 5 1 660 SFL
K3TJM 252 2 1 604 WPA
N8XA 86 5 1 560 OH
KJ7YN 46 5 1 560 AZ
WS2N 122 2 1 542 NLI
KE4W 34 5 1 540 WY
WB6EDY 258 2 1 516 UT
K0HCV 157 2 1 514 KS
KS4GW 81 5 1 505 SFL
VE4KU 81 5 1 505 MB
AC6XK 55 5 1 480 ORG
WA0CBW 132 2 1 464 KS
W9FHA 90 2 1 460 IN
WD0K 72 5 1 460 MN
KB2PLW 34 5 1 440 WNY
K6EEN 33 5 1 430 NM
WB6VIC 113 2 1 426 LAX

WA0AUS 32 5 1 360 SDG
W9TQV 65 2 1 330 WI
WB1ENV 112 2 1 324 NH
N6SL 107 2 1 314 ID
KE4D 105 2 1 310 AK
K0WRZ 34 5 1 295 KS
KD5JAA 87 2 1 274 NM
NO7UP 33 2 1 208 EWA
NZ5A 58 2 1 150 WY
KE2UK 18 2 1 142 NLI
WB2PUH 9 2 1 136 ENY
KA6FBB 2 5 1 120 ORG
W4QDV 4 2 2 108 GA
N8LOC 23 2 1 46 MI

1B-1 Op

N0AT 947 2 1 4,044 MN
VE6KC 587 2 1 2,448 AB
K1DC/MM 515 2 1 1,924 RI
N2MR 437 2 1 1,848 SNJ
NE9U 468 2 1 1,568 WI
KU7K 455 2 1 1,514 OR
W1VR 305 2 1 1,116 NFL
KA0CW 97 5 1 1,070 CO
KE7CU (+N7RET)
250 2 2 900 WWA
NS9E 278 2 1 826 WNY
WB7D 314 2 1 728 KY
W4CHQ 183 2 1 714 SC
WB2AXF 126 2 1 692 ENY
VE3CVG 115 2 1 630 ON
AB7QG 215 2 1 530 UT
N2TMT 121 2 1 242 ENY
W4VG 28 2 1 156 VA
N7WUB/3 12 2 2 24 MDC
KI0HZ 9 2 1 18 HI

1B-1 Op Commercial

W8UE 504 2 1 2,016 MI
N8IA 394 2 1 1,434 MI
N6NF 158 2 1 482 SCV
N0DLS 113 2 1 326 MN
KB1CKT 12 2 1 24 CT

2B-1 Op Battery

WO8R 280 5 1 2,830 OH
WA6DLM 110 2 1 620 ORG

1B-2 Op Battery

AB7E (+K7ZB)
970 5 2 10,000 AZ
W9HB (+KF9D)
543 5 2 5,730 IL
W5YA 532 5 2 5,690 NM
W4NI 345 5 2 3,955 TN
KC4D (+K4OAQ)
944 2 2 3,876 VA
WD8RIF (+AA8EB)
284 5 2 2,940 OH
W6GL 750 2 2 2,852 ID
W5CGH 232 5 2 2,620 NTX
K0IW (+AC6SL)
232 5 2 2,620 CO
K8RL (+N8BL)
226 5 2 2,560 WV
K6BUM (+N6LXU)
1170 2 2 2,340 LAX
WB0RXF (+WA0ZPT)
201 5 2 2,090 SD
W3PNL 189 5 2 1,990 EPA
VE3EQP (+VE3IMG)
287 5 2 1,735 ON
KA2BEO (+KB2RAR)
357 2 2 1,470 SNJ
KA8EZT (+WA3THA)
97 5 2 1,470 OH
W7IS (+K7WQ)
129 5 2 1,390 WWA
WB5LYJ (+WA5WHN)
369 2 1 1,256 NM
VE3ESN(VA3ESN)
359 2 2 1,218 ON
K7BFL (+WA7LNC)
100 5 2 1,175 EWA
W1EQO 143 5 2 1,170 VT
WA7NCL (+KC7WNB)
354 2 2 1,160 EWA
AA3S 98 5 2 1,050 EPA
VE3CG 102 5 2 980 ON
K3SS/7 (+WF4U)
212 2 2 776 UT
N5RKE (+N5RKE)
20 5 2 680 NM
N2JGU 84 5 2 650 WNY
KI6WX (+K6GK)
50 5 2 645 SCV
N4RNJ (+KE4WRA)
189 2 2 596 NFL
WB3IOS (+WR1B)
22 5 2 570 EPA
N7TX (+KC7OMT)
50 5 2 525 AZ
K4SSC (+KC5GEV)
227 2 2 454 CO
W0PTU (+N0PCV)
173 2 2 446 CO
AA7LE (+KC7VWT)
57 5 2 440 OR
KF6RGW (+KF6RGV)
43 5 2 415 LAX
AA7VT (+KB7AIL)
109 2 2 358 WWA
K9HTL 25 5 2 350 IN
K3RXK 73 2 2 346 KY
K5ZP (+KM5KF)
14 5 2 270 STX
K2QR (+K2OH)
1 5 2 210 WNY
WA9LKZ 18 2 2 136 IL
WD4NIT 12 2 2 124 GA
VE3/VA2ADB (+VE3CBJ)
6 2 2 20 ON

1B-2 Op

W8TK (+K4LT)
1468 2 2 6,572 OH
W2BC (N2DC,K2KIR,ops)
1128 2 2 4,912 WNY
K8RYU (+N8NMA)
1154 2 2 4,520 OH
KB0MCG (+K0VE)
608 2 2 2,308 IA
W8OK 468 2 2 1,744 OH
NY1S 390 2 2 1,740 ME
WB9JIC 429 2 2 1,230 WI

K4SSC 227 2 2 654 CO
AC7GL 271 2 2 642 ID
K7GGG (+N7IHI)
254 2 2 608 AZ
N8KZG 301 2 2 602 MI
K8AO (+KA8WOI)
175 2 2 550 MI
WB5OAP (+WB5OAO)
223 2 2 454 AZ
AB4LO (+KV4BB)
55 1 2 255 NFL
WA2EZG (+KC2APD)
27 2 2 154 NNJ

1B-2 Op Commercial

K3EQ (+K8TPH)
415 2 2 1,230 WV
AK2S 284 2 2 1,136 EPA
AB2BY (+KC2DFD)
266 2 2 532 NH
KI5UD (+KI5SQ)
119 2 2 338 OK
KB9REU 146 2 2 294 IL
WB7RBN (+K7MMS)
135 2 2 270 WWA

2B-2 Op Battery

K3MD (+N3POR)
2138 2 2 6,802 NH
AJ4Y (+N4DL)
523 5 2 5,705 WCF
K7PJT (+KC7MPH)
512 5 2 5,420 OR
K2EI (+K0CCM)
534 5 2 4,630 NM
W0QE (+W0JZ)
1170 2 2 3,792 CO
KH7YO (+N4SL)
284 5 2 2,655 WWA
N8EFO 280 5 2 2,495 OH
AA1PL 675 2 2 2,310 RI
N6MBY (+K6RHB)
238 5 2 1,890 SB
VE3FAL (+VE3AVS)
132 5 2 1,620 ON
K7EL (+K7RK)
117 5 2 1,235 OR
W5MHM (+AA5BI)
86 5 2 1,140 AR
VE6VH (+VE6ZC)
92 5 2 990 AB
AA1VL (+N2CZL)
102 5 2 930 WNY
NT1M (+WO1G)
36 5 2 845 EMA
KJ6CA 125 2 2 698 SV
KJ7SJ (+KA7JAS)
173 2 2 546 AZ
N7SEL (+KC7RCK)
21 2 2 242 EWA

2B-2 Op

KW8N 1698 2 1 6,374 OH
N3IXR (+WA3SES)
1387 2 2 4,972 WPA
KB9S 1176 2 2 4,952 WI
N4IQ (+KW4J)
523 2 2 1,736 SC
KF8JW (+K8CAV)
487 2 2 1,718 OH
KK7OW (+N9EUC)
570 2 2 1,684 IN
KK7UV (+KE7NO)
602 2 2 1,570 MT
KE0RR (+NR0T)
310 2 2 1,266 MN
WB4YDL 247 2 2 1,062 TN
K2NDR (+W2TTG)
362 2 2 1,024 SNJ
KG8HZ (+N8LUK)
269 2 2 858 MI
K9HE (+AA3QA)
249 2 2 686 TN
KC8HLD (+KG8CW)
120 2 2 478 MI

2B-2 Op Commercial

K7MK (+K7ZO)
1261 2 2 2,956 ID

Mobile Stations

1C

AA6DP 935 2 5 3,206 LAX
K7RE 272 5 1 2,720 AZ
AA0PO 1162 2 1 2,324 MO
NX0X 536 2 5 1,796 MN
VE3FGU/MM
315 2 1 1,132 ON
N0IVN 409 2 1 818 CO
VE2AWR 193 2 1 600 QC
N9YYM/3 255 2 2 510 MDC
K1HI 141 2 1 488 MT
WA4NXN/MM
87 5 1 435 AL
KG9PQ 182 2 1 396 IL
K0PFV 179 2 1 358 NE
K6SEA 154 2 3 308 AZ
K5VHH 148 2 1 296 STX
WA3COS 140 2 1 280 CO
K8TL 78 2 2 230 OH
KG0QR 112 2 1 224 MT
N0CQI 111 2 2 222 NE
KN4Y 54 2 1 216 VA
W7ON 104 2 2 208 AZ
N3DER 103 2 1 206 VA
WO8L 102 2 1 204 NC
KA5FQA 94 2 1 188 OR
K7GDN 74 2 1 160 WWA
N5UW 39 2 1 156 OK
K1DS 71 2 1 144 EPA
WA6NGH 66 2 2 132 SB
WA4CHJ 12 5 1 120 VA
N1BCL 54 2 1 108 VT
W8KNO 53 2 1 106 OH
KD7EAF 49 2 1 98 EWA
KG9CA 49 2 1 98 WI
N6MIP 49 2 1 98 ORG
WA5BOW 48 2 1 96 KS
W5WIA 46 2 1 92 STX
VE3AAZ 45 2 1 90 ON
K3GV 42 2 1 84 MDC
WA3LGG 25 2 1 78 EPA
K6LRN 30 2 2 60 SV
K0YB 27 2 3 54 CO
KA3AUX 21 2 1 42 WPA
WA7OK 17 2 1 34 WWA
KD6MOG 16 2 1 32 SCV

K6PZB/7 12 2 1 24 OR
N8ZR 11 2 1 22 OH
K6TKD 8 2 1 16 SV
N3XRV 4 2 1 10 MDC

2C

W7SAW 271 5 2 2,080 WWA

4C

WA5FRF/MM301 5 5 2,525 STX

Home Stations Commercial Power 1D

K7NV 1270 2 1 5,080 NV
VE6JO 1182 2 1 3,856 AB
AB0MV 1207 2 2 3,658 CO
K4JNY 1456 2 2 2,912 TN
N8OO 1850 1 1 2,817 LA
N8AGU 691 2 1 2,764 OH
KG4BIG 619 2 1 2,476 KY
WZ3AR 1148 2 1 2,296 MDC
KB4KA 1020 2 4 2,040 TN
AB5YY 579 2 1 2,030 MS
AA2MF 963 2 2 1,926 NLI
VE6EZ 428 2 1 1,712 AB
W0UI 674 2 2 1,708 CO
K8CI 415 2 1 1,660 OH
VE2GB 383 2 3 1,532 QC
W6VM 376 2 1 1,504 SB
NN2L 371 2 1 1,478 NNY
W6TK 357 2 1 1,428 SB
KC4Q 367 2 1 1,380 VA
KC7KFF 552 2 5 1,278 AZ
AD4MV 599 2 1 1,198 NFL
W4NTI 300 2 1 1,196 AL
W5IG 505 2 20 1,184 NTX
KC2GMU 357 2 4 1,176 WNY
KG4FPK (K4VUD,op)
1108 1 1 1,108 NFL
NU7Y 262 2 1 1,048 AZ
VA3SY (VE3TDG,op)
522 1 2 1,033 ON
N4MM 379 2 1 1,026 VA
K7FU 257 2 1 1,006 OR
N1IWT 244 2 2 976 CT
KS7T 533 1 1 972 MT
WA2QKF 274 2 1 968 WNY
KC8GMT 246 2 1 916 MI
N6VT 226 2 1 904 SCV
K4RZ 446 1 1 892 NC
N3CU 209 2 1 836 EPA
N9LZ 409 2 5 818 IL
N6GL 204 2 1 816 LAX
VE2CQ 237 2 1 800 QC
W6NKR 198 2 1 792 SV
KE5C 188 2 1 752 NTX
N7UVH 355 2 1 710 ID
N6SR 174 2 1 696 SB
KD7CJN 345 2 1 690 AZ
KJ7UN 338 2 1 676 MT
K9PPW 168 2 1 670 IL
VE2FC 157 2 1 628 QC
WM6J 157 2 1 628 ORG
WA5VKS 309 2 1 618 NTX
NQ7X 154 2 1 616 AZ
KC9JS 308 2 1 616 WI
AA9NF 146 2 1 584 IL
AA7RT 292 2 3 584 EWA
W9BJ 259 2 1 568 IN
W6AFA 559 1 1 559 LAX
WO3T 275 2 2 550 WPA
N0XW 134 2 1 536 MN
N4SG 122 2 1 488 TN
W4CU 119 2 1 476 NFL
W3DP 134 2 1 468 EPA
W7SRB 230 2 1 460 AZ
K6CSL 135 2 1 446 SJV
W7YS 111 2 1 444 AZ
WA0RAC 221 2 2 442 SFL
WD9GWH 108 2 1 432 WI
W1WIU 133 2 1 428 RI
KC7RAD 206 2 1 428 NV
W7HD 206 2 1 424 AZ
K8CPA 195 2 1 390 MI
KS0M 95 2 1 380 MO
WA7YNU 177 2 1 378 MT
K0ID 92 2 1 368 WI
W8WOJ 117 2 1 360 MI
K1D 178 2 2 356 NH
W6ORZ 108 2 1 346 EPA
WB9MII 84 2 1 336 IL
AD6KB 99 2 1 326 SF
N9ZWY 162 2 2 324 WI
K8VFR 80 2 1 320 MI
KO6OP 159 2 1 318 SJV
WD9DJD 158 2 1 316 IL
WA9DBJ 152 2 4 304 IN
WD5CNC 152 2 1 304 AR
N5UWY/9 149 2 2 298 IL
W6PRI 87 2 1 292 SCV
AC5OY 140 2 1 280 NTX
WA7ND 225 1 1 279 OR
N8TCP 68 2 1 272 OH
K4SRD 134 2 1 268 VA
WA3HR 130 2 1 260 EPA
WA1SVS 129 2 1 258 NNJ
K5FSB 128 2 1 256 NM
N9TJG 127 2 6 254 IN
KB9AFW 114 2 1 228 MI
AC5QJ 95 2 9 218 MS
N8KIE 109 2 1 218 MI
N0EBN 108 2 1 216 IA
VE3FME 76 2 2 212 ON
K8JMC 105 2 2 210 MI
WA6RND 51 2 1 204 ORG
KX8D 102 2 2 204 MI
KB4XE 102 2 1 204 SFL
KC4CMR 100 2 1 200 VA
N3FRB 100 2 1 200 WPA
KB5VPR 98 2 1 196 NTX
K0BL 61 2 1 192 IA
KO8S 48 2 1 192 MI
AA3II 76 2 1 188 WPA
AB8AG 89 2 1 178 OH
W2DWR 88 2 1 176 NFL
VE2DWE 87 2 1 174 QC
WD4PTJ 78 2 1 174 TN
KC7ZFP 49 2 1 166 OR
K4RFK 82 2 1 164 SFL
WA6GFR 51 2 1 164 ORG
KO4A 40 2 1 160 MDC
KE4FSX 48 2 1 158 NFL
AA1EA 78 2 1 158 EMA
NP2DJ 77 2 1 154 VI
N2LQQ 73 2 1 146 WNY
VE2GWL 71 2 1 142 QC
N3CXB 14 5 1 140 EPA
N4EF 69 2 2 138 NFL

AC5XD 67 2 1 134 STX
KB3CRG 67 2 1 134 EPA
N4YMY 66 2 1 132 VA
K2MZ 66 2 1 132 SFL
VO1TY 66 2 1 132 MAR
AE6Z 46 2 1 124 SCV
WP4LNY 61 2 1 122 PR
K9HS 51 2 1 120 IL
KE9SA 49 2 2 120 WI
KA1DSQ 117 1 1 117 CT
WA3YTI 58 2 1 116 SDG
KM5VY 27 2 1 108 NM
W0SAS 54 2 1 108 KS
K4IJK 52 2 1 104 NC
N0LL 50 2 1 100 KS
K9UQN 50 1 1 100 IL
K4AAL 48 2 1 98 TN
W1MP 44 2 1 94 VT
WD9EWK 29 2 1 92 AZ
KC0EOE 44 2 1 88 CO
WA9JAV 39 2 1 86 AZ
AB0LJ 42 2 1 84 MO
KC0GXX 31 2 1 84 NE
K7AMR 41 2 1 82 AZ
W7DMI 20 2 1 80 MT
WB9FJO 39 2 1 78 MI
W3EAZ 38 2 1 76 EPA
KB8TWM 38 2 1 76 MI
W7ZMD 19 2 24 76 AZ
KC0FUD 35 2 1 70 NE
KC0FFR 34 2 2 68 MO
WA2BKN 68 1 1 68 NNJ
K3DI 21 2 1 62 MDC
WA9LAY 31 2 1 62 IL
KF3BT 15 2 1 60 DE
KB8YHV 15 2 1 60 NM
KA2TAM 28 2 1 58 NNJ
N6YBZ 28 2 1 56 SV
WA2KFB 28 2 1 56 NFL
KD4RCW (+KB9WFW)
18 2 2 48 IN
N3SZW 24 2 1 48 MDC
WA6UCT 22 2 1 44 AR
KB4CJS 20 2 1 40 TN
K0LWV 11 2 1 38 MO
W2CYW 17 2 1 38 NNJ
VE7SSJ 19 2 1 38 BC
K5QNM (+KN5TTN)
15 2 2 36 OK
AD6CH 18 2 1 36 SCV
AC5DI 18 2 1 36 NTX
KC5OZT 18 2 1 36 NTX
KB3EHL 17 2 1 34 VA
KB1DOR 17 2 1 34 NH
K7II 17 2 1 34 WWA
KC3LE 10 2 1 32 EPA
W2BVH 8 2 1 32 NNJ
KK9MM 14 2 1 28 SB
N8WEL 13 2 1 26 OH
N9RG 13 2 1 26 IN
KG4ICD 25 1 1 25 SFL
N6MMM 11 2 2 22 SCV
KQ6OT 10 2 1 20 SCV
AC7CJ 8 2 1 16 EWA
K3BRJ 8 2 1 16 VT
N2KYP 6 2 1 12 NLI
WA3OHI 5 2 1 12 MDC
K4ZRH 11 1 1 11 SFL
KG6F 5 1 1 5 SJV

2D

W9DA 722 2 5 2,790 IL
N3IM 683 2 10 1,886 WPA
KE4QCY 853 2 8 1,706 AL
K3QB 394 2 10 920 NTX
N7KQ 401 2 3 828 AZ
W5DAR 299 2 28 692 NM
AF4XT 337 2 3 674 GA
W8TNX 203 2 6 556 OH
N2EZY 191 2 2 494 IN
KC0ATG 37 2 3 74 IA
W2MTA 26 2 1 52 WNY
N9TDX (+K4DJS)
16 2 3 32 WCF

3D

W9UDU 720 2 18 2,006
W1AW 709 2 9 1,730 CT
W3KWH 707 2 18 1,678 WPA
W1ORS 727 2 10 1,454 CT
N6EM 464 2 3 1,382 SJV
W5SLA 375 2 25 970 LA
W3VPJ 300 2 18 772 EPA
K3IEC 174 2 10 428 EPA
W4CW 154 2 10 308 SC

4D

W8BAP 609 2 6 1,962 OH
W4PE 514 2 31 1,038 NFL

7D

W4WD 310 2 12 728 NC

8D

N4T 2465 2 10 6,034 AL

Home Stations Emergency Power 1E

KN7Y 856 5 2 8,345 AZ
K7ON 1918 2 1 7,672 AZ
W6JTI 727 5 1 7,270 SF
AA3B 1361 2 1 5,444 EPA
NT4A 467 5 1 4,670 TN
K7ABC 1306 2 3 4,394 AZ
W8CAR 978 2 1 3,880 OH
K5MC 959 2 1 3,836 LA
N2PK 335 5 1 3,350 SFL
N2NB 1587 2 1 3,174 NLI
K5HP 788 2 1 3,152 OK
K4YTZ 1044 2 18 3,118 SC
N6ZZ 1124 2 1 2,808 NM
N6MI (@N6NB)
1067 2 1 2,692 SJV
VE7UBC 1253 2 4 2,658 BC
K2ZR 260 5 1 2,600 WNY
WD5ICQ 238 5 1 2,380 NTX
NA5S 1171 2 3 2,342 NM
NT4P 203 5 1 2,020 NC
NS8O 520 2 1 1,752 OH
W9DZ 175 5 1 1,750 IN
KB3WN 290 5 2 1,620 SC
KM4FO 400 2 1 1,600 KY
N8RN 153 5 1 1,530 OH
AA1O 143 5 1 1,430 EMA
K4WW 616 2 2 1,342 KY
N4DU 300 2 1 1,200 GA
W3GN 286 2 10 1,144 MDC
WG1Z 110 5 1 1,100 EMA
KV8X 270 2 1 1,080 MI

WA0GNC 517 2 1 1,034 NTX
N0FPE 508 2 1 1,018 MO
K1EEE 303 2 2 1,006 NH
KB0SWK 393 2 7 996 MO
K3IVO 485 2 4 970 MDC
N7CEE 94 5 1 940 AZ
WN3C 207 2 1 928 MDC
N5KU 248 2 2 774 STX
N0IBT 72 5 1 720 CO
WB7POD 359 2 3 718 AZ
KE3PL 353 2 1 706 NNJ
W6MOT 132 5 1 680 SDG
KB1EHE 334 2 3 668 CT
W1CZD 166 2 1 664 RI
N0FCD 313 2 1 626 IA
KS4YX 197 2 1 616 SC
KI5FJ 609 1 1 609 NM
W3IA 150 2 1 600 WPA
AC6TU 60 5 1 600 LAX
KB9LGJ 62 5 1 595 MN
K7SAM 255 2 1 588 MT
K6UF 210 2 1 562 SCV
N2MTG 278 2 1 556 ENY
W4AMP (+WA4SEX)
259 2 2 518 GA
W2FR 122 2 1 488 WNY
W7DPB 112 2 1 448 WY
KF4SIR 106 2 1 424 NFL
AA8WJ 197 2 1 394 OH
N8BK 189 2 1 382 MI
N1NUA 188 2 1 376 ME
KG9JP 185 2 1 370 IL
N2LK 95 2 1 370 NNJ
K4OE 180 2 2 360 AL
W9CM 89 2 1 356 IN
WA3WAW 35 5 1 350 WPA
W9LM 169 2 2 338 IL
K0YG 138 2 1 300 CO
VE7FB 143 2 2 286 BC
AC7GM 128 2 1 264 MT
WA6LCN 130 2 1 260 SF
WA2SCB 126 2 1 252 WCF
W7DRA 61 2 1 244 WWA
WB6DAC 115 2 1 230 ORG
KA0AIG 114 2 1 228 MO
N1ZMZ 113 2 2 226 CT
N6DPL 110 2 1 220 ORG
K8GVK 22 5 1 220 MI
KB7N 53 2 1 212 WWA
W9EMT 105 2 1 210 IN
N4DG 42 5 1 210 OR
KS6Q 103 2 1 206 EB
K6TY 103 2 2 206 LAX
AF4ET 101 2 2 202 SC
NJ6A 101 2 1 202 ORG
KA3AVB 100 2 1 200 WPA
WA0UNB 98 2 1 196 MN
K9NO 63 2 1 188 IL
N8COQ 91 2 2 182 MI
NF1A 67 2 1 172 EMA
KB0RQE 84 2 1 168 MO
N5BF 52 2 1 162 LAX
KE3FL 15 5 1 150 MDC
K2HT 65 2 1 142 MO
W5MOT 34 2 2 136 STX
WD5AGO 27 5 1 135 OK
WB0SNL 67 2 1 134 IA
NW0ED 66 2 1 132 MN
WA4BNO 13 5 1 130 NC
KC0CCR 62 2 2 126 KS
N3AWS 24 5 1 120 MS
W9KI 50 2 1 100 SC
W0JF 14 5 1 100 CO
N2BBG 47 2 1 94 WNY
W1AFV 26 2 1 82 MN
WB6CGZ 38 2 1 76 AZ
KI0NY 37 2 1 74 CO
KB4BKZ 34 2 1 68 GA
NH0H 30 2 1 60 KH0
KF6IIU 27 2 1 54 SCV
N2JRS 15 2 1 30 WNY
KB9JIF 14 2 1 28 WI
KB8POA 2 5 2 15 MI
KI6GD 4 2 1 8 SDG

2E

K5DX 2948 2 7 10,212 STX
K2QMF 1668 2 3 5,476 NLI
K4CMS 643 5 6 4,660 KY
K9YHB 404 5 5 3,405 IL
VE6FI 1657 2 4 3,314 AB
W3PC 1352 2 12 3,104 NTX
W9OG 765 2 35 2,410 IN
WB2ELW 747 2 38 1,606 WNY
W1KVI 632 2 21 1,482 ME
N5AT 615 2 16 1,330 AR
KE8PX 428 2 5 1,158 OH
W4UEA 440 2 3 880 NFL
W9JOZ 278 2 7 642 IN
W4BEJ 174 2 20 502 KY
AA5OB 223 2 3 446 LA
N4QLX 205 2 9 410 NC
KB1DGY 57 2 1 182 CT
KB9STQ 56 2 1 118 IN

3E

W7GG 3842 2 9 10,194 OR
W4UFO 1538 2 5 3,076 NC
W8PIF 592 2 11 1,700 WI
K6SS 349 2 7 1,070 ORG
W8LRC 494 2 10 988 MI
N8ICH 327 2 20 800 OH

4E

W0MA 1595 2 20 4,876 MO
KZ1O 771 2 3 2,020 NH
K0ASH 794 2 8 1,588 NE

5E

W6YX 3059 2 10 8,932 SCV
N0LM 2788 2 25 7,478 CO
K5ER 1742 2 5 3,650 LA
W7PXL 1116 2 25 3,550 OR

6E

W3MRC 1065 2 13 2,328 STX

9E

W4WVP 284 2 8 848 VA

Checklogs:

KW9T, WA0OTV, F/K3TW, WA2ZWM, OK2BHE, YU7SF, WA2BMH, K4VUD, KE6QCB, WA3GQU, W2RJ, KA6T, VE3KLM, PY2NY,VE3/VA2ADB

2001 ARRL International DX Contest Rules

1. Object:

1.1. W/VE amateurs work as many amateur stations in as many DXCC entities of the world as possible on 160, 80, 40, 20, 15, and 10 meter bands.

1.2. Foreign amateurs (also including KH6, KL7, CY9, and CY0) work as many W/VE stations in as many of the 48 contiguous states and provinces as possible.

2. Date and Contest Period:

2.1. CW: Third full weekend in February (**February 17-18, 2001**).

2.2. Phone: First full weekend in March (**March 3-4, 2001**).

2.3. Contest Period: 48 hours each mode (separate contests). Starts 0000 UTC Saturday; ends 2400 UTC Sunday.

3. Entry Categories:

3.1. Single Operator:

3.1.1. All Band:

3.1.1.1. QRP

3.1.1.2. Low Power

3.1.1.3. High Power

3.1.2. Single Band

3.1.2.1. A participant may submit only one single band entry. If contacts are made on other bands, they should be submitted in a separate log file as a check log.

3.1.2.2. The same call sign may not be used by a different operator(s) to generate additional single band entries.

3.1.3. Single Operator Assisted

3.2. Multioperator:

3.2.1. Single Transmitter

3.2.2. Two Transmitter.

3.2.3. Multi-transmitter.

4. Contest Exchange:

4.1. W/VE stations in the 48 contiguous United States and Canada (except in the islands of St Paul and Sable) send signal report and state or province.

4.2. DX stations send signal report and power (number indicating approximate transmitter output power).

5. Scoring:

5.1. QSO Points—W/VE stations count three points per DX QSO. DX stations count three points per W/VE QSO.

5.2. Multipliers

5.2.1. W/VE stations: Sum of DXCC entities (except US and Canada) worked per band.

5.2.2. DX stations: Sum of US states (except KH6/KL7), District of Columbia (DC), and Canadian provinces/territories: NB (VE1, 9), NS (VE1), QC (VE2), ON (VE3), MB (VE4), SK (VE5), AB (VE6), BC (VE7), NT (VE8), NF (VO1), LB (VO2), VY0 (NU), YT (VY1), PE (VY2) worked per band (maximum of 63 per band).

5.3. Final Score: QSO points × multipliers = final score.

6. Miscellaneous:

6.1. Your call sign must indicate your DXCC station location (KH6XYZ/W1 in Maine, KG4/W1INF at Guantanamo Bay, etc).

6.2. The same station may be worked only once per band: no cross-mode or repeater contacts.

6.3. Aeronautical and maritime mobile stations outside the US and Canada may be worked by W/VE stations for QSO credit only.

7. Submissions:

7.1. Entries for the CW competition must be e-mailed or postmarked by March 20, 2001.

7.2. Entries for the Phone competition must be e-mailed or postmarked by April 3, 2001.

7.3. Electronic entries for the CW competition must be e-mailed to **DXCW@arrl.org**.

7.4. Electronic entries for the Phone competition must be e-mailed to **DXPhone@arrl.org**.

7.5. Any submission that is created electronically must include a combined summary sheet and log file in Cabrillo file format. Paper copies of electronic logs are not an acceptable substitute for the electronic data file. Paper logs that are entered into an electronic medium after the contest are considered electronic logs.

7.5.1. Guidelines for the acceptable Cabrillo electronic file format may be found in the "General Rules for All ARRL Contests" as printed in the November 2000 *QST*, or found on the Contest Web page at **www.arrl.org/contests**.

7.6. Handwritten paper entries or diskettes should be marked on the envelope as either DX Phone or DX CW entries and mailed to: ARRL, 225 Main St, Newington, CT 06111.

7.6.1. Entries for the CW and Phone portions of the competition are considered separate contests and should be submitted in separate e-mails or envelopes to the appropriate contest address.

7.7 Forms for all ARRL contests may be downloaded from the Contest Home Page at: **www.arrl.org/contests**.

7.8 Contest forms and rules may be requested from the ARRL InfoServer by sending an e-mail to **info@arrl.org** with the following text:

SEND DXCW.frm
SEND DXPhone.frm
SEND DX.rls

8. Awards:

8.1. Plaques (if sponsored) will be awarded in the following categories for both the CW and phone contests:

8.1.1. Top W/VE scorer in each entry category—single operator-all band-QRP, single operator-all band-low power, single operator-all band-high power, single operator-single band (160-10 meters), single operator assisted, multi-operator-single transmitter, multi-operator-two transmitter, multi-operator-multi-transmitter.

8.1.2. Top scorer in the single operator-all band category worldwide and on each continent. In addition, worldwide leaders in the single operator-all band-QRP, single operator-all band-low power, single operator-single band, single-operator assisted, multioperator-single transmitter, multi-operator-two transmitter and multioperator multi-transmitter categories will receive plaques.

8.1.3. Additional special plaques will be awarded as sponsored.

8.2. Certificates will be awarded to:

8.2.1. Top single operator-all band entries (QRP, low power, and high power) from each DXCC entity and ARRL/RAC section.

8.2.2. Top single-band entries in each US call area and each DXCC entity

8.2.3. Top single operator assisted entries in each DXCC entity, US call area and in Canada

8.2.4. Top multi-operator entries (single, two and multi-transmitter) in each DXCC entity, US call area and in Canada.

8.2.5. DX entrants making more than 500 QSOs on either mode will receive certificates.

8.2.6. Additional single-band and multioperator certificates will be awarded if significant effort or competition is displayed.

9. Other:

9.1. See "General Rules for All ARRL Contests" and "General Rules for ARRL Contests on bands below 30 MHz (HF)" in the November 2000 *QST*.

9.2. For contest information contact **n1nd@arrl.org**; 860-594-0232. QST

2001 ARRL International DX Pins

To celebrate the new Millennium, the ARRL Contest Branch is offering for the first time an International DX Contest pin. The sharp four-color design will prominently display the year 2001—symbolic of your participation in the first major DX Contest of the Third Millennium.

To earn the inaugural International DX Contest pin, all you need to do is complete 100 QSOs in either the CW or phone contest weekends. You may contact the same station on different bands. The cost is $5 (US) in the US, its possessions and Canada, and $8 for others (postage included). Your pins will be shipped once all logs for the contest have been processed and verified by the log checking team for publication in *QST*.

To purchase your pin, send a copy of the first page of your Cabrillo log file along with your payment to: DX Contest Pins, ARRL, 225 Main St, Newington, CT 06111.

STRAYS

LIGHTHOUSE CHRISTMAS LIGHTS

◊ The Amateur Radio Lighthouse Society is sponsoring the "Lighthouse Christmas Lights" operating event from 0001 UTC December 18 through 2359 UTC January 2. Stations *do not* have to operate from lighthouses to participate. All modes and bands are eligible. ARLS members give call sign, ARLS membership number, name and state or province. Nonmembers exchange call sign, name and state or province. Certificates will be available to stations working 10 or more lighthouses/ships, or 5 or more ARLS member stations. Send your log information, along with $1 and a self-addressed 9 × 12-inch envelope with two units of First Class postage to: ARLS, PO Box 2178, Cinnaminson, NJ 08077. You'll find more information on the Web at **ARLS.k2jxw.com**. QST

Next Stray

2001 ARRL RTTY Roundup Rules

1. Object: Amateurs worldwide contact and exchange QSO information with other amateurs using digital modes (Baudot RTTY, ASCII, AMTOR, PSK31, and Packet—attended operation only) on 80, 40, 20, 15, and 10 meter bands. Any station may work any other station.

2. Date and Contest Period: First full weekend of January, but never on January 1. Begins 1800 UTC Saturday, ends 2400 UTC Sunday **(January 6-7, 2001).**

2.1. Operate no more than 24 hours.

2.2. The six hours of off time must be taken in no more than two blocks.

3. Entry Categories:

3.1. Single Operator:

3.1.1. Low Power.

3.1.2. High Power.

3.2. Multioperator, Single Transmitter:

3.2.1. Power:

3.2.1.1. Low Power

3.2.1.2. High Power

3.2.2. Stations are allowed only one transmitted signal at any given time.

3.2.3. Includes those single operators that use any form of spotting assistance such as from nets or packet.

3.2.4. Includes those that receive assistance with logging or relief operators, etc.

3.2.5. Limited to 6 band changes (maximum) in any clock hour.

3.2.6. The clock hour is from zero through 59 minutes.

3.2.7. Band changes are defined so that, for example, a change from 20 meters to 15 meters and then back to 20 meters constitutes two band changes

4. Exchange:

4.1. United States: Signal report and State.

4.2. Canada: Signal report and Province.

4.3. DX: Signal report and serial number, starting with 001.

5. Scoring:

5.1. QSO Points: Count one point for each completed QSO.

5.2. Multipliers: Each US state (except KH6 and KL7), each VE province (plus VE8 and VY1 and VY0) and each DXCC entity. KH6 and KL7 count only as separate DXCC entities.

5.2.1. Count only once (not once per band).

5.2.2. The US and Canada do not count as DXCC entities.

6. Reporting:

6.1 All entries must be postmarked or e-mailed by February 6, 2001.

6.2. Entries in electronic format may be e-mailed to **RTTYRU@arrl.org** or submitted on 3.5-inch diskette to: RTTY Roundup, ARRL, 225 Main St, Newington, CT 06111.

6.3. All logs that are created electronically are required to submit a copy of the electronic log file, in Cabrillo file format. A printout of an electronically generated log is not an acceptable substitute. A handwritten log that is later entered into a logging or other electronic program is considered an electronically generated log and must meet electronic file requirements.

6.4. The electronic Cabrillo format entries must include the summary sheet header and the complete log list.

6.5. Hand-logged entries may be submitted to RTTY Roundup, ARRL, 225 Main St, Newington, CT 06111.

7. Miscellaneous:

7.1. Packet radio contacts made through digipeaters or gateways are not permitted.

7.2. All ARRL Contest rules and forms may be downloaded from the ARRL Contest Web page at **www.arrl.org/contests/forms**.

7.3. Forms may be requested from the ARRL InfoServer by sending the following message (with no additional text) to **info@arrl.org**:

SEND RTTY.frm

SEND RTTY.rls

7.4. For contest information contact **N1ND@arrl.org**; 860-594-0232

8. Awards:

8.1. Certificates will be awarded to:

8.1.1. Top high power and low power Single Operator and Multioperator scorers in each ARRL/RAC section.

8.1.2. Top high power and low power Single Operator and Multioperator scorers in each DXCC entity (other than W/VE).

8.2. Plaques, if sponsored, will be awarded to the top scoring low and high power entrant in each category overall, each ARRL Division, and Canada.

8.2.1. Unsponsored plaques may be purchased from the ARRL.

9. Other: See "General Rules for All ARRL Contests" and "General Rules for ARRL Contests on bands below 30 MHz (HF)" in the November 2000 *QST*. QST

RTTY Roundup Plaques

Plaques are available for Division or overall winners in their entry categories. These attractive plaques may be ordered for previous RTTY Roundup victories, or sponsored for the upcoming event. The cost is $60. Sponsors for the previous year are given first chance to continue sponsorship for the coming year. Contact N1ND at 860-594-0232 or **n1nd@arrl.org** for information on participating in this exciting program. Winners may also purchase unsponsored plaques.

A special PSK31 Plaque will once again be awarded for the highest score submitted using PSK31 during the RTTY Roundup. A separate log and summary sheet showing only your PSK31 QSOs must be submitted to be eligible for this plaque. E-mail your PSK31 log only to **PSK31plaque@arrl.org** or by mail to PSK31 Plaque Contest, ARRL, 225 Main St, Newington CT 06111.

RTTY Round-Up 2001 Pins

For the first time, the ARRL is pleased to make available participation pins for the ARRL RTTY Roundup. The attractive pins will be a unique symbol of the first ARRL contest of the year and sell for $5 each. To qualify for the pin just complete 50 QSOs during the ARRL RTTY Roundup January 6 – 7, 2001. If you submit via US mail, enclose a check for $5 per pin attached to your entry summary sheet. If you submit your entry electronically, send your check along with a note ordering the pin to: RTTY Pins, ARRL, 225 Main St, Newington, CT 06111. Pins orders will be shipped once the logs for the contest have been processed.

Recommended HF Digital Operating Frequencies (MHz)

North and South America	*Europe/Africa*
3.590 RTTY DX	3.580-3.620
3.605-3.645	
7.040 RTTY DX	7.035-7.045
7.080-7.100[1]	
14.070-14.099.5	14.080-14.099
21.070-21.100	21.080-21.120
28.050-28.150	

[1]Digital operators should avoid interfering with hams outside the continental US who have phone privileges in this portion of 40 meters.

Recommended Novice/Technician Digital Operating Frequencies (MHz)

10 meters: 28.100-28.150*
Suggested simplex packet-radio frequencies:
28.102.3
28.104.3
*Authorized power output 200-W maximum for Novices/Technician only in the 10-meter Novice/Technician sub-band.

STRAYS

CODE PRACTICE COLLECTION

◊ Many amateurs learned code by practicing on a code practice oscillator (CPO), either homebrew or commercially made. In 1999, Dave Meier, N4MW set out to gather a collection of commercial CPOs that would capture the progression of types through the years. The collection has quickly grown to include over 60 models. His "N4MW Code Practice Oscillator Museum" is available for viewing on the Internet at **n4mw.com**. Dave would appreciate any information or comments on items in the museum, as well as help in identifying and acquiring additional items. Contact him at **n4mw@n4mw.com**.

QST Congratulates...

◊ Allen M. Solomon, KI7JT (ex WD4GYI, KC4YQ, OE1ZOU, OE3ZOU, and KF8WL) who was assigned to the White House Office of Science and Technology Policy as a Senior Analyst in Global Change earlier this year.

2001 ARRL January VHF Sweepstakes

1. Object: To work as many amateur stations in as many different 2° × 1° grid squares as possible using authorized frequencies above 50 MHz. Foreign stations work W/VE amateurs only.

2. Date and Contest Period: The weekend before the NFL Super Bowl. Begins 1900 UTC Saturday, ends 0400 UTC Monday (**January 20-22, 2001**).

3. Entry Categories:

3.1 Single Operator.

3.1.1. Low Power

3.1.2. High Power

3.2. **Single Operator Portable** (See "General Rules for ARRL Contests above 50 MHz" in November 2000 *QST* for changes in this category.)

3.3. Rover.

3.4. Multioperator.

3.5. Limited Multioperator.

4. Exchange: Grid-square locator (see April 1994 *QST*, p 86).

4.1. Exchange of signal report is optional.

5. Scoring:

5.1. QSO points:

5.1.1. Count one point for each complete 50- or 144-MHz QSO.

5.1.2. Count two points for each 222- or 432-MHz QSO.

5.1.3. Count four points for each 902- or 1296-MHz QSO.

5.1.4. Count eight points for each 2.3 GHz (or higher) QSO.

5.2. 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.

5.3. Final score: Multiply the total number of QSO points from all bands operated by the total number of multipliers for final score.

5.4. Rovers only: The final score consists of the total number of QSO points from all bands times the sum of unique multipliers (grid squares) worked per band (regardless of which grid square they were made in) plus one additional multiplier for every grid square from which they successfully completed a contact.

5.4.1. Rovers are listed in the contest score listings under the Division from which the most QSOs were made.

6. Reporting:

6.1. Electronic submissions may be e-mailed to **JanuaryVHF@arrl.org**. Handwritten paper logs or diskettes must be mailed to January VHF, ARRL, 225 Main St, Newington, CT 06111.

6.2. Entries that have been electronically generated must submit their log file in acceptable Cabrillo file format. Paper printouts of electronic files are not acceptable substitutes.

6.3. Entries must be e-mailed or postmarked no later than February 21, 2001.

6.4. Rovers who submit scores for the club competition must submit a second log and summary sheet indicating QSOs and score *if they make any contacts from outside of the club territory.* Indicate clearly on the summary sheet, and in log, if the log is the total entry or that portion to be counted for the club score.

7. Miscellaneous:

7.1. 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 as a Rover).

7.2. Only permitted one signal per band (6, 2, 1¼, etc) at any given time is permitted, regardless of mode.

7.3. Multi-operator stations may not include QSOs with their own operators except on frequencies higher than 2.3 GHz. Even then, a complete, different station (transmitter, receiver and antenna) must exist for each QSO made under these conditions.

8. Awards: Certificates will be awarded in the following categories:

8.1. Single operator.

8.1.1. Top single operator in each ARRL/RAC Section.

8.1.2. Top single operator on each band (50, 144, 222, 432, 902, 1296 and 2304-and-up categories) in each ARRL/RAC Section where significant effort or competition is evident. (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 endorsements.) For example, if W1INF has the highest single-operator all-band score in the CT section, and his 50- and 222-MHz scores are higher than any other CT single operator's, he will earn a certificate for being the single-operator Section leader and endorsements for 50 and 222 MHz.

8.2. Top Single-Operator, Portable in each ARRL/RAC section, where significant effort or competition is evident. (Single-Operator, Portable entries are not eligible for single-band awards.)

8.3. Top rover in each ARRL Division and Canada where significant effort or competition is evident. (Rover entries are not eligible for single-band awards.)

8.4. Top multi-operator score in each ARRL/RAC section where significant effort or competition is evident. (Multioperator entries are not eligible for single-band awards.)

8.5. Top limited multioperator in each ARRL/RAC Section where significant effort or competition is evident. (Limited multioperator entries are not eligible for single-band awards.)

9. Other:

9.1. See "General Rules for All ARRL Contests" and "General Rules for ARRL Contests on bands above 50 MHz (VHF)" in the November 2000 *QST*.

9.2. For more information contact **n1nd@arrl.org**; 860-594-0232.

QST

NEW PRODUCTS

SWEDISH PUMP KEY FROM MORSE EXPRESS

◊ Morse Express has announced the availability of two versions of the "Swedish Pump Key"—a classic telegraph key design often found in key reference literature.

The original maker, Lennart Pettersson & Co of Hoverberg, Sweden, is still manufacturing these keys. Morse Express has decided to bring them to the US.

The Original Swedish Key is a large, long-lever European style key. The mechanism is machined from solid brass stock and is mounted on a polished hardwood base. The overall dimensions are approximately 2¾×2 ×7½-inches, the weight is around 31 oz.

Tension is provided by a single leaf spring or "torsion bar" at the front of the key and is controlled by a large top-mounted knob. Contacts are located at the rear of the key, and are set up for either traditional "on-off" or "make-and-break" keying (where the receive circuit is opened when the transmit circuit is closed).

The key comes packed in a small wooden crate, prominently marked "Made in Sweden."

The Miniature Swedish Key is a special version of the Original Swedish Key. The mechanism is highly polished brass and the base is made of teak with a black finish. This key measures approximately 2½×3¼ ×5¾-inches and weighs 14 oz.

The long lever design is said to give the key a distinctive and precise feel that is "…most unusual in a miniature key."

The key is described as "presentation quality" and comes packed in an attractive wooden box with brass hardware and green felt lining.

The price for the Original Swedish Key is $189.95. The Miniature Swedish Key sells for $249.95. For more information contact Morse Express, 3140 S Peoria St, Unit K-156, Aurora, CO 80014; tel 800-238-8205; fax 303-745-6792; **info@MorseX.com**; **www.MorseX.com**.

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Assistant Technical Editor

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SECTION NEWS

The ARRL Field Organization Forum

ATLANTIC DIVISION

DELAWARE: SM, Randall Carlson, WB0JJX—If one thinks about it, you realize that Amateur Radio is awful hard to do by yourself. After all, no matter what aspect interests you, eventually you will need someone to talk to at the other end. Similarly, it's very hard to run an effective net if there is no one at the other end. The Delaware Traffic Net and the Delaware Emergency Phone Net need additional check-ins, particularly from Kent and New Castle Counties. In the event of an emergency in the Section these nets will provide the means by which messages will be passed into and out of the Section. If you would like to find out more about how the NTS works check out the public service communications manual on the ARRL Web site. You can find it at http://www.arrl.org/field/pscm/. The Delaware Traffic Net meets every M - F at 18:30 local time on 3905 kHz. The Delaware Emergency Phone Net meets Sat. at 18:00 local time on 3905 kHz. Traffic (Sept) DTN: QNI 163 QTC 12 in 21 sess. DEPN: QNI 35 QTC 2 in 5 sess. K3JL 38. 73, Randall.

EASTERN PENNSYLVANIA: SM, Allen R. Breiner, W3TI—Eric Olena, WB3FPL. SEC: Steve Maslin, N3ORH. ACC: N3EA. OOC: Paul Craig, N3YSI. STM: Allen Breiner, W3ZRQ. SGL: Lawrence Thomas, AA3PX. TC: ASMs: Ron Creitz, KB3DFV, Vince Banville, WB3YGA, Dave Heller, K3TX, George Law, N3KYZ, J. Yogi Bear, WB3FQY, Harry Thomas, W3KOD. As your Section Manager, I have just completed two terms and part of a third. During the 5-year tenure, I was instrumental in cleaning up a number of problems in the section that came with the territory. At present, every one of the section's volunteer services programs are in pretty good condition. April 1996, we had 184 appointments and 69 affiliated clubs in the section. The 1st of December 2000, we had 210 appointments and 75 affiliated clubs. I, alone, cannot claim credit for all these improvements. In the above heading, there are 12 amateurs who accepted an appointment to oversee or or more of the volunteer services programs. They attend two sessions a year to review and improve these programs. Spend hours on various proposals, approve and disapprove these programs. Without their expertise, knowledge and input, those improvements could not have been accomplished. The Section's Happenings column is always written two months in advance. At the time of this entry, the cabinet will have held their second annual session on October 1. If you have been reading this column, you may have noticed a number of "firsts" attained in the past six years. All came about through the assistance and efforts of that group. W3TJ, out in Los Alamos, NM, reads this column to keep in touch with what's going on back home in EPA. In 1959, I was elected to a similar position known as the Section Communications Manger, same job, different title. I was re-elected as SCM for 12 consecutive years and declined the seventh term because I wanted to get a college education. Teaching electronic technology for 15 years, I retired in 1982. The year is now 2000, and I believe I've had sufficient time in Amateur Radio politics and would like to retire for the third time. I don't plan to quit Ham Radio all together, and will be available for a rag chew any time on 75 meters. The shack door will still be open, so stop in for a chat anytime you're passing through Tamaqua. This will be by final entry of the Eastern Pennsylvania Section Happenings column in QST. I would like to thank the club bulletin editors for their monthly contributions and anyone who participated in any way to make this position easier. A very special thanks to those faithful traffickers who are there 365 days a year. My thanks and appreciation to the 12 members of my official staff for their 5 years of faithful service. Beginning with January 2001 QST, this column will be written by Eric Olena, WB3FPL, who accepted the SM position for the remainder of my term. All future correspondence to the SM should be sent to Eric Olena, WB3FPL, RR 5, Box 5687, Mohnton, PA, 19540. From the XYL, Evie, K3NZD, and myself, we wish each and everyone a very Merry Christmas, Good Health, and a prosperous New Year. As with every editor in closing my final report to you, 30. Good Luck es DX 73 W3TI.

MARYLAND/DC: SM, Bill Howard, WB3V, 410-551-6775 **wb3v@arrl.org**. MDC Section Web homepage **http://users.erols.com/wb3v/mdc/**. **CA** EC N3JIA reports 64 members, 5 sessions of the CARET (Carroll Amateur Radio Emergency Team) Net which meets on 145.410 MHz with liaison to MEPN, MDD, and MSN by KE3FL, and to BTN, WVPN, DTN, MEPN, Central Net, and Western Net by W3VK. Initial contact has been made with the organizers of the Maryland Wine Festival Bike Tour (American Lung Association). An AEC report was received from W3V, and OES reports received from: KE3FL WX3F N3JIA N3TOT N3SOK. **PG** EC WI3N reports 11 ARES/RACES members, including KB3EFS, N3XKJ, WB3KXJ, N3TZA, WI3N, N3JMK, W3FUO, W3YD, KB3DVC, K3HDM, and KB3BWR, provided comms for an event sponsored by the DC Roadrunners. The K3GXF/146.88 repeater was used to provide communications along the course in Greenbelt, MD and the USDA Beltsville Agricultural Research Center. **AA** EC N3QXW reports 38 members, four net sessions of the AA ARES/RACES Net that maintains liaison with EPA, NCAC, MEPN, WVA, BTN and MDD, 1 training session, and one HF COMMEX exercise during September. N3QXW attended a training session on the new EAS system recently installed at the EOC. On 30 September, N3QXW, N3GT, W3NI, W3VVN and N3UXD provided communications for a NOAA Habitat Diver training session on the Magothy River. They manned boats operated by NOAA, USCGA and the AA Fire Department, and coordinated communications during the SCUBA diving exercise. Oyster beds were also measured and seeded with new oysters during the dive. AA OES reports: N3QXW NU3D W3VVN. Congratulations to all who participated in the SET. We were successful in having some MARS members participate as well. Good work! To all, please have a safe and happy holiday season. To Bruce, here are the two letter county designators you suggested. 73 – Bill WB3V and with the nets: With the nets - Net/NM/QND/QTC/QNI: MSN/KC3Y/30/47/262, MEPN/N3WKE/30/71/486, MDD/WJ3K/56/291/757, MDD Top Brass/KJ3E/ 162/K3JL/149/AA3SB/156. Tfc: KK3F 1227, N3QA 441, KJ3E 427, AA3SB 130, W3YVQ 93, AA3GV 74, W3CB 63, N3WKE 59, KB3AMO 54, N3KGM 50, KC3Y 45, N3WK 39, K3CSX 23, WA1QAA 15, N3EGF 15, W3VK 12, WA3WRT 6, WA3GYW 1, KE3FL 0, PSHR: KJ3E 279, KK3F 201, W3YVQ 148, N3WKE 132, AA3SB 132, W3VK 129, W3CB 122, N3WK 118, KC3Y 103, KB3AMO 99, AA3GV 95, WA1QAA 82, KE3FL 80, K3CSX 74.

NORTHERN NEW YORK: SM, Thomas A. Dick, KF2GC, **http://www.northnet.org/nnyham**—The Schroon Lake Marathon went well, the many Amateurs from the CVARC, MVARC and TLARC all NNY Clubs teamed up to make this event go so well. After pulling off a great Public Event just two weekends before in Saranac Lake-The 90 Miler Canoe Race, we joined forces again and did a 26.2 marathon in Schroon Lake. Great Job everyone! It has been a learning experience for many amateurs and a great experience to better prepare for emergency communications. You see first hand what radios, antennas, repeaters and simplex frequencies are needed to do the job. We made plans to do JOTA with the TLARC in Saranac Lake at the Red Cross. These TLARC have worked very hard to bring ARES and Emergency Services back to Franklin Co. Local Boy Scouts get Amateur Radio introduction at a first rate station - W2TLR. Controls it really has made this an important event. Nov 9th a SKYWARN presentation by Steve Hogan from the National Weather Service will be given at the Essex Co EOC - 7 PM. Thomas Dick, KF2GC.

SOUTHERN NEW JERSEY: SM, Jean Priestley, KA2YKN (@K2AA), e-mail ka2ykn@voicenet.com. ASM: W2BE K2WB W2OB N2OO N2YAJ SEC: N2SRO. STM: K2UL. ACC: KB2ADL. SGL: KB2WKY. OOC: K2PSC. TC: W2EKB. TS: W2PAU WB2MNF AA2BN KD4HZW WB3IJB WA2NBL KA1AOR N2QNX N2XFM. A big thanks to everyone, and once again I hope to meet more new people next year. Everyone made it a great year by all the fine hospitality as I traveled thru SNJ and to the various clubs. Now that the Battleship New Jersey is firmly planted in our area, Joe Cramer, N2XYZ, is looking to form a club of Amateurs to operate a permanent station in the Battleship New Jersey after the renovations are complete. To do this, Joe must have operators committed to the idea of keeping the Good name of the Battleship New Jersey on the airwaves. To keep a schedule, he will need operators dedicated to this idea. For details, Call Joe at 1-609 242-9601 or n2xyz@juno.com. October. QNI Reports: W2CC NJPN 167 K2PB NJSN 156 WA2OPY NJM 146 AG2R NJN/E 209 AG2R NJN/L 191 JSARS WA2ATQ 387 WB2UVB SJVN 281 K2UL 85 KB2RTZ 81 AA2SV 75 K2UL-4 55 WB2UVB 52WA2CUW 32 KA2CQX 14 N2VQA 8 KB2VYZ 2 KB2VSR KB2YBM KC2ETU 1. PSHR K2UL 200, WB2UVB 176, KB2RTZ 175, KA2CQX 141, AA2SV 120, WA2CUW 97, N2VQA 44.

WESTERN NEW YORK: SM, Scott Bauer, W2LC— Nat, K2DYB, has resigned as OOC and EC for Madison and Oneida Ctys. I'm sorry to see him go, but understand the demands that Nat and all of us have, that limit our time to do the volunteer work so desperately needed. Nat will be active as an OES and an OO, and I am sure will find time to help out when he can. Nat, thank you for all your hard work! Merry Christmas to everyone in WNY. I hope everyone receives a nice radio related gift this year in your stocking, a new transceiver, HT, amplifier or yagi? I guess the amplifier goes under the tree. The yagi goes on top of the tree. Where does the Angel go? On top of your tower of course! The ARRL 160m contest is Dec 1-3, and the 10m contest is Dec 9-10, two great operating events, don't miss them. The Liverpool ARC W2CM, had a nice Amateur Radio exhibit at the NY State Fair here in Syracuse. The unique location was in the caboose parked on the tracks bordering the fair grounds! 95 licensed hams participated or visited. Next week (I'm writing this in early October) I and many others are meeting at the Museum of Science and Technology here in Syracuse to discuss the Amateur Radio exhibit (KC2APG) and how to make it more visible and enjoyable not just for the kids but also the parents and teachers who bring them to the museum. I'll let you know how it goes. How is everything in your area of WNY?

Net	*NM*	*Sess*	*QNI*	*QSP*
BRVSN	WB2OFU	30	189	6
CNYTN	WA2PUU	30	349	55
NYPHONE	N2LTC	30	217	229
NYS/E	WB2QIX	30	316	143
NYS/M	KA2GJV	30	162	55
NYSPTEN	WB3CUF	30	352	44
OCTEN/E	KA2ZNZ	30	1506	195
OMEN	K2DYB	2	13	0
STTHN	KC2AWA	8	413	3
WDN/E	N2JRS	30	531	70
WDN/M	KB2VVD	30	553	60

Net	*NM*	*Sess*	*QNI*	*QSP*
CHN	W2EAG	30	152	43
EBN	WB2IJZ	21	353	0
NYPON	N2YJZ	30	328	111
NYS/L	W2YGW	30	246	173
NYSCN	W2MTA	4	17	3
OARCN	N2KPR	4	40	5
OCTEN/L	KA2ZNZ	30	609	186
STAR	N2NCB	28	238	8
TIGARDS	W2MTA	4	20	4
WDN/L	W2GUT	30	528	42

Traffic (September 00), * indicates PSHR, # for BPL: N2LTC*# 691, KA2ZNZ* 429, W2MTA* 363, KA2GJV* 331, NN2H* 177, W2FR* 134, WI2G* 131, N2KPR* 113, WB2QIX* 104, NY2V* 87, W2PII* 75, KC2EOT* 59, W2LC* 58, KA2DBD* 55, KB2VVD* 54, KG2D* 51, N2WDS* 40, AF2K* 39, W2GUT* 36, N2CCN* 31, N2JRS* 26, WA2UKX* 15, W2RH 13, K2DN* 12, KB2ETO* 11, KB2WII* 4. Digital; Stn Rx/Tx: N2LTC 164/131, KA2GJV 33/14, K2DN 1/0, NY2V 1/0.

WESTERN PENNSYLVANIA: SM, John Rodgers, N3MSE. ASM-ARES: WB3KGT. SEC: N3SRJ. ASM-Packet: KE3ED. OOC: W3ZPI. PIC: W3CG. STM: N3WAV. TC:WR4W. DEC-SO: KD3OH. DEC-N1: N3QCR. DEC-N2: KA3UVC. DEC-S1: KA3HUK. DEC-S2: N3BZW. DEC-Rapid Response: N3HJY. DEC-OES: K3TB. Year 2000 is winding to a close. We have been fortunate in that we dodged the Y2K bug and had few emergency situations. To the countless people in the section that volunteered time to assist in the many activities, a big thank you. This year saw many counties celebrating their bicentennial events and amateurs were instrumental in making those festivities successful. I also would like to thank everyone who helped me as I transitioned into the section manager's position. I look forward to working with you during the next two years as well. Usually at this time of the year we reflect on the past year and make resolutions for the upcoming one. A resolution I would ask each of you to make is to bring at least one new person into the hobby during 2001. I would also hope that each of us would work to bring a new young person into the service. These people will be very important in building the future of amateur radio. There are many exciting aspects of amateur radio that can revitalize the enjoyment and interest in the service. I recently tried PSK-31 and SSTV and found a whole new part of this hobby to operate. I am looking forward to the various opportunities to talk to you. Whether on the air or at the hamfests and club events I attend. I am working on my schedule for the upcoming year so if interested in having me speak at your club event let me know. Wishing each of you and your families a very Happy Holiday season. 73 John Rodgers, N3MSE, WPA-SM n3mse@arrl.org.

CENTRAL DIVISION

ILLINOIS: SM, Bruce Boston, KD9UL—SEC: W9QBH. ACC: N9KP. STM: K9CNP. PIC: N9EWA. TC: N9RF. OOC: KB9FBI. DEC-Central: N9FNP. DEC-S/W: KB9AIL. Members of the Kishwaukee ARC put on an Amateur Radio demonstration with HF and two-meter equipment for school children at the Northern Illinois Steam Show. Some 50-60 kids had a great time talking on the radio and asking questions about ham radio. Macoupin Co ARES EC WA9RUM reports his team participated in a drill organized by the Litchfield and Hillsboro hospitals. The drill involved children on a baseball diamond who where caught in the open during a severe storm. A team from Scott Air Force Base also participated. The York RC held their annual auction Oct. 20. The YRC has resumed operation of their 20 meter net near 14.256 each Tuesday at noon central time. The club also operates a ten-meter net every Monday at 7:30 PM central time on 28.430 MHz. All check-ins are welcome. AMSAT Regional Coordinator KA0SNL presented a very interesting program on Phase 3D during a meeting of the Sangamon Valley RC. The presentation consisted of slides and equipment needed to operate the new satellite. The group also discussed moving its club station to a new location and adding UHF equipment. The SVRC also reports the National Weather Service office in Lincoln is looking for more Amateurs to operate their two-meter station during severe weather. The North Shore RC reports the Prairie DX Group was completing plans to operate a DXpedition from Vanuatu (formerly known as New Hebrides) in the South Pacific from November 16-28. Members of the Sangamon Valley ARES team conducted a drill on September 10. Fourteen members rolled out as early at 5:30 AM to support the Capitol City Century Bike Ride. This ride started at the Lake Springfield beach house and consisted of a 100 mile course through Athens and Petersburg. ARES coordinator Jim Dunn, K9CNP, said the purpose of the drill was to check operating skills, conduct equipment tests and perform map reading exercises. The members provided safety for the riders by being positioned along the course and reporting any incidents. "We had the normal number of skinned knees and flat tires, but no serious injuries," Dunn said "Our people did their usual outstanding job. We greatly appreciate people willing to give up an entire day to sharpen their skills and help other people." Sept traffic: K9CNP 124, NN9M 50, W9HLX 34, WB9TVD 32, KA9IMX 23, W9FIF 16, NC9T 16, WA9RUM 6. ISN report de WB9TVD QNI 198, QTC 88, sessions 29. 9RN report de KF4UBX sessions 60, traffic 207, average 3.45, rate 3.5, IL rep 93% by NN9M, W9HLX, N9PLM, N9GGH, NS9F, K9TU, W9DNI. W9VEY Memorial Net report de K9AXS 6 with 199 check-ins.

INDIANA: SM, Peggy Coulter, W9JUJ—ASM for Resources & Recruitment, W9IH—SEC: K9ZBM. ASEC: WA9ZCE. STM: W9FU. OOC: KC9V. TC: W9MWY. BM: KA9QWC. ACC: N9RG. Sympathy extended to the families and friends of Silent Keys: Aug unknown, Charles F. Theamann, WA9IGW, Plainfield; Sep 9, Norman D. Woodward, KB9MZW, Anderson; Sep 19, Donald E. Wurster, KC9YX, Indpls; Sep 25 Charles Hoag Marks, W9SQD, Fort Wayne. They will be missed. The Fall IRCC meeting held election of officers. It was a great meeting and you really missed it by not being there. New officers elected were Chairman, Vicki Rudicel, KB9OME; V.Chairman, Jack Parker, W8ISH; Sec. Russell Simpson, WA0JTL; Trea. Jay Sissom, KA9OKT; Two Dirs, Ray Andrew, K9DUR and Kellie Edwards-Smith, KB9MOH. Congrats to Marv, W9KT for 60 yrs as an amateur. An interesting article in Lake Co ARC "Short Skip" about Ken, NB9I and his son Paul, N9HVD talking on a beam of light. They used a Laser Beam a little over 1/4 mile apart. The following names were nominated, listed alphabetical, were received by the IRCC for Indiana Amateur of the Year. The award will be presented at the Fort Wayne Hamfest on Sunday. Raymond

Continued on page 128.

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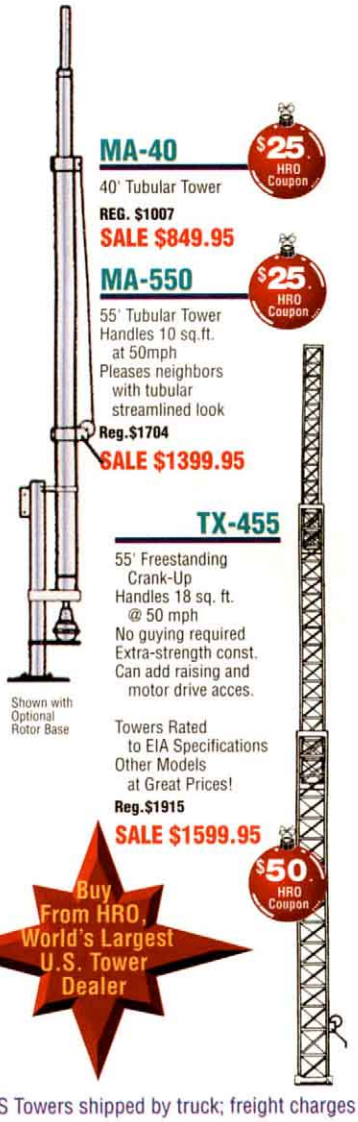

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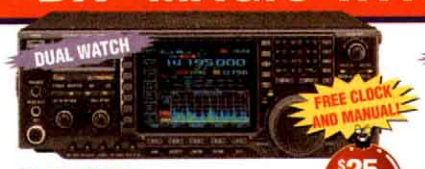

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40M-70cm Mobile Antenna

$5 HRO Coupon

40/*20/15/10/6/2M/70cm
* optional coil

A 6M/2M/70cm whip that accepts 1,2 or 3 HF coils for up to 6 band operation. Simply screw on any combination of HF coils you choose.

Standard PL-259 connector allows easy mounting. Convenient fold-over hinge for entering garages, parking structures, etc...

HF/VHF/UHF on a single antenna!! Contact any Ham Radio Outlet store for duplexer/ triplexer options.

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High Sunspots= Great HF Mobiling!

MSG Series

2M/70cm Mobile Antennas with spring-loaded whip to absorb impacts. Fold-over hinge included as well.

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MSG-1000C	MSG-1100C
Length: 39 inches	Length: 43 inches
Max Pwr: 150W	Max Pwr: 150w
Conn: PL-259	Conn: PL-259

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NEW!

MH-510

6/2M/70cm HT Antenna w/SMA Connector

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  - Compact, Mobile Meter
  - Cross Needle Design
  - Mounting Bracket Included

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Look for the HRO Home Page on the World Wide Web
http://www.hamradio.com

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- DSP in I.F. Stage! • 100W, 12V DC
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TM-261A 2M Mobile

- 50W + Mid and Low • Mil-Spec
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- 100w HF, (100w on 6M TS-570SG only)
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- RCP2 Radio Control Program Compatible

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TM-D700A 2M//440 Dualband

- 50w VHF 35w UHF • Opt. Voice Synthesizer
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- Advanced APRS Features
- Dx Packet Cluster
- Tone Scan • GPS/VC-H1/PC Ports

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TS-50S HF Transceiver

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- 105 db dynamic range, 100 Mems.
- Opt. ext. ant. tuners available

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- Optional 3rd band available • Back-lit mic
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AL-811H
$795
Suggested Retail

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A quiet, powerful computer grade blower draws in plenty of cool air. It *pressurizes* the cabinet and efficiently cools your 811A tubes. Our air flow is so quiet, you'll hardly know it's there--unlike noisy, poorly chosen blowers.

You also get efficient full size heavy duty tank coils, full height computer grade capacitors, heavy duty high silicon core power transformer, slug tuned input coils, operate/standby switch, transmit LED, ALC, dual meters, QSK compatibility with QSK-5 plus much more.

AL-811 has three 811A tubes and gives 600 Watts ouptut for only $649.

Near Legal Limit ™ Amplifier

AL-572
$1395
Suggested Retail

New class of *Near Legal Limit*™ amplifier gives you 1300 Watt PEP SSB power output for *65%* of price of a full legal limit amp! Four rugged *Svetlana* Russian 572B tubes. Instant 3-second warm-up, plugs into 120 VAC. Compact 8½Hx 15½Dx14½W in. 160-15 Meters. 1000 Watt CW output. Tuned input, instantaneous RF Bias, dynamic ALC, parasitic killer, inrush protection, two lighted cross-needle meters, multi-voltage transformer.

HF Linears with Eimac 3CX800A7

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$2495
Two tubes, 1500 W plus

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Single tube, 1250 Watts

These HF linears with *Eimac*® 3CX800A7 tubes cover 160-15 Meters including WARC bands. Adjustable slug tuned input circuit, grid protection, front panel ALC control, vernier reduction drives, heavy duty 32 lb. grain oriented silicone steel core transformer and high capacitance computer grade filter capacitors. Multi-voltage operation, dual illuminated cross-needle meters.

AL-80B . . . Desktop Killowatt 3-500ZG Amplifier

Ameritron's AL-80B kilowatt output desktop linear amplifier can double your average SSB power output with high level RF processing using Ameritron's exclusive *Dynamic ALC*™!

AL-80B
$1299
Suggested Retail

You get cooler operation because the AL-80B's exclusive *Instantaneous RF Bias*™ completely turns off the 3-500ZG tube between words and dots and dashes. It saves hundreds of watts wasted as heat for cooler operation and longer component life.

You get a full kilowatt PEP output from a whisper quiet desktop linear. It's a compact 8½Hx14Dx15½ inches and plugs into your nearest 120 VAC outlet. Covers 160 to 15 Meters, including WARC and MARS (user modified for 10/12 Meters with license).

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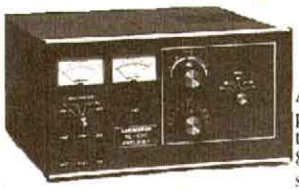
AMERITRON offers the best selection of legal limit amplifiers

AMERITRON's legal limit amplifiers use a super heavy duty Hypersil® power transformer capable of 2500 Watts!

Ameritron's most powerful Linear

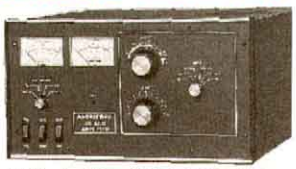


AL-1500
$2945
Suggested Retail

Ameritron's super powerful amplifier uses the herculean *Eimac*® 8877 ceramic tube. It's so powerful that 65 watts drive gives you the full legal output -- and it's just loafing because the power supply is capable of 2500 Watts PEP.

Ameritron's 3CX1200A7 linear Amp

AL-1200
$2495
Suggested Retail



Get ham radio's toughest tube with the Ameritron AL-1200 -- the EimacR 3cx1200A7. It has a 50 Watt control grid dissipation. What makes the Ameritron AL-1200 stand out from other legal limit amplifiers? The answer: A super heavy duty power supply that loafs at full legal power -- it can deliver the power of more than 2500 Watts PEP two tone output for a half hour.

Ameritron's dual 3-500 linear

AL-82
$2395
Suggested Retail

This linear gives you full legal output using a pair of 3-500s. Most competing linears using 3-500s can't give you 1500 Watts because their lightweight power supplies can't use these tubes to their full potential.

AMERITRON no tune Solid State Amplifiers

ALS-500M 500 Watt Mobile Amp

AL-500M
$799
Suggested Retail

Ideal Mobile amplifier uses 13.8 VDC mobile electrical system, very compact 31/2x9x15 inches, extremely quiet, 500 Watts output, 1.5-22 MHz coverage, instant bandswitching, no tuning, no warm-up, no tubes, SWR protected.

ALS-600 Base 600 Watt Amp

AL-600
$1299
Suggested Retail

No tuning, no fuss, no worries -- just turn it on and operate. Includes AC power supply, 600 Watts output, continuous 1.5 to 22 MHz coverage, instant bandswitching, fully SWR protected, extremely quiet, very compact. Amp is 6x9½x12 inches.

AMERITRON brings you the finest high power accessories!

RCS-8V Remote Coax Switch . . . $149

Replace 5 coax feedlines with a single coax. 1.2 SWR at 250 MHz. Useable to 450 MHz. 1 kW at 150 MHz. **RCS-4, $139**. 4 position remote HF switch.

ADL-1500 Dummy Load with oil . . . $59.95

Oil cooled 50 Ohm dummy load handles 1500 Watts for 5 minutes. SWR under 1.2 up to 30 MHz. Low SWR to 400 MHz.

ICP-120/240 Inrush Current Protector . . . $79

Stops power-up inrush current and absorbs momentary high voltage spikes to your amplifier. ICP-120 for 110 to 120V, ICP-240 for 220-240 V.

ATR-20 (1.2kW) Antenna Tuner . . . $459

Handles a full 1.2 kW SSB and 600 Watts CW. It's designed to safely handle the full legal SSB power of the AL-811/811H/80B/ALS-500M/ALS-600 and others.

ARB-702 (I,K,Y) amp-to-radio interface . . . $39.95

Protects your costly transceiver from damage by keying line transients, steady state current and excessive voltages.

QSK-5 Pin Diode T/R Switch . . . $349

Self-contained, connects externally to most HF amps. Handles 2.5 kW PEP, 2 kW CW. Six times faster than vacuum relay. 6x4x9½ in.

ATP-100 Tuning Pulser lets you safely tune your amplifier . . . $49.95 Pulse tuning lets you safely tune up your amplifier for full power output and best linearity. Keeps average power to low safe level to prevent overheating, tube damage, power supply stress and premature component failure.

ADL-2500 Fan cooled 2500W dry dummy load ...$199.95 Whisper quiet fan. Handles any legal limit amplifier -- 2500 Watts average power for 1 minute on, ten off. 300 Watts continuous. SWR below 1.25 to 30 MHz and SWR below 1.4 to 60 MHz.

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Andrews, K9DUR, Kurt Crispe, WB9ZEZ, Chuck Crist, W9IH, Bert Baltus, N9LQP, Kevin McNeely, KB9CRA, Jack Parker, W8ISH, David Pifer, N9YNF and Gale Wuollet, AA9WU. Congrats to them all. The Indpls Red Cross Radio Club was involved in an Airport Simulated Disaster Exercise. Thanks to the following for supporting the exercise. Bill, K9DBY, Bill K9RFK, Merle KB9PDM, Jeff KB9PJT, Mark W9HBO, and Rick, KB9NZY. NMs ITN/W9ZY, QIN/KJ9J/K9PUI, ICN/K8LEN, WN/AB9AA, VHF/W9FU.

Net	*Freq*	*Time/Daily/UTC*	*QNI*	*QTC*	*QTR*	*Sess*
ITN	3910	1330/2130/2300	2352	516	1531	90
QIN	3656	1430/0000	103	48	467	41
ICN	3705	2315	89	18	310	26
IWN	3910	1310	2167	—	600	30
IWN VHF Bloomington				498	—	450
30						
IWN VHF Kokomo			602	—	150	30
IWN VHF Northeast			1223	—	600	30
Hoosier VHF nets(11 nets)			414	54	804	40

D9RN QTC 207 in 60 sessions IN represented by W9UEM, WB9QPA, KB9NPU, N9KNJ, K9GBR and W9FU. 9RN QTC 198 in 60 sessions IN represented by KJ9J, KO9D, K9PUI, WB9UYU and W9FC. Tfc: W9FC 246, KJ9J 109, W9ZY 96, W9FU 94, W9UEM 84, WB9QPA 78, KO9D 71, AB9AA 57, K9PUI 56, N9KNJ 50, W9JUJ 45, KB9NPU 44, KA9EIV 40, KA9QWC 26, K9GBR 26, K8LEN 18, K9DIY 13, K9ZBM 9, K9RPZ 8, W9EHY 8, N9HZ 6, WB9NCE 6, K9OUP 5, W9KT 5, K9CUN 2.

WISCONSIN: SM, Don Michalski, W9IXG, BWN 3985 0600 W9RCW. BEN 3985 1200 KE9VU. WSBN 3985 1730 K9FHI. WNN 3723 1800 KB9ROB . WSSN 3645 1830 N9BDL. WIN-E 3662 1900 WB9ICH. WIN-L 3662 2200 W9UW. Interested in bringing new life to club meetings? Consider field trips to local agencies; for instance, emergency management center, official communications centers, etc. Some members may already be involved with them so take a tour, introduce the club, and set the tone for future joint ventures that might need Hams! For openers, I have greased the skids for your club to get a tour of the Sullivan weather station. Contact Tom Fleming, N9SZF, n9szf@arrl.net 608-246-0282 or Tom Kucharski, KA9EWJ, tjkuch@execpc.com to arrange a tour of this interesting facility that we use as hub in our SKYWARN system. The MRAC repeater, 147.045, has been relocated to 27th and Capitol. Tune it in! All Wisconsin nets are now listed on the section Website. Some have had trouble reaching the section Website. Suggest using www.eboard.com/w9ixg. John Offerdahl, W9XH (SK), was honored in the recent Walk to Cure Diabetes 2000 that raised $380K. The new WNA officers are WB9ICH, chairman; KB9ROB, secretary; W9UW, treasurer; K9LGU, training officer. Thanks for stepping up to the plate! The September 9RN report shows 100% Wisconsin participation! There will be the annual EC meeting at WEM on December 2. Hope to see all ECs there! NØJHS has changed to W9JHS. Reminder to contact the FCC and get your FRN NOW!! The next weekend Technician class in Madison will be January 20, 21. Get your family into the hobby! Contact me or register at: www.sal.wisc.edu/spaceplace/sparc. 73, Don, W9IXG. Tfc: W9IHW 1008, K9JPS 930, W9YPY 568, N9TVT 389, K9GU 383, WZ7V 382, N9VE 298, W9CBE 152, N9BDL 130, K9FHI 84, KG9B 82, K9LGU 79, W9YCV 71, N9CK 66, AG9G 62, W9UW 60, KE9VU 51,AA9BB 37, KB9ROB 35, W9BHL 32, N9KHD 27, K9HDF 26, KA9FVX 24, WB9ICH 22, WD9FLJ 17, W9PVD 7, K9UTQ 5.

DAKOTA DIVISION

MINNESOTA: SM, Randy "Max" Wendel, KMØD—A reminder: If you receive ARRL e-mails (bulletins, ARRL Letter, etc) via ARRL e-mail distribution, and you wish to receive MN news, you must go to your member-data-page and check the appropriate box which was added late this summer. The 7th annual SKYWARN spotters (and spouses) Appreciation Banquet was held Nov 4 in Byron by host-with-the-most Dave Carr-WØEAS. This entertaining evening included some great chow and was rounded out with a dance and Dave's chance to strut his stuff to his rendition of the "tornado twist." And you thought the Tazmanian Devil could spin! MN ARES participated in the annual ARES SET on Oct 7. ARES ECs were asked to have a representative from their group check-in to the statewide net which was running informally. The groups were asked to use voice and/or digital modes and pass messages during the SET. While no formal drill or exercise was planned beyond that, ARES groups are encouraged to conduct communication drills and on-air emergency-related exercises. We hope to conduct a more formal statewide communications exercise on an annual basis. If you wish to participate in ARES, please contact your ARRL appointed ARES EC for the county in which you reside. Contact me (QST page 12) for more info. ARES EC's are a key player in orchestrating communications preparedness. Amateur radio is an important resource for local gov'ts and disaster- relief agencies. The State of MN Emergency Management is just one of our "customers," and is more reason to keep aiming high with our mission in ARES. We host a weekly HF ARES net and require monthly reports from all EC's in order to keep continuity among ARES groups in MN. Your ARRL appointed ARES EC is the key to an organized and effective ARES group in your local area. 73 de KMØD.

Net	*Freq*	*Time*	*QNI/QTC/Sess*	*Mgr*
MSPN/E	3860	5:30 P	680/84/30	WØWVO
MSPN/N	3860	12 P	410/98/30	WAØTFC
MSSN	3710	6 P	N/A	vacant
MSN/1	3605	6:30 P	222/92/30	KØWPK
MSN/2	3605	10 P	138/33/28	KØPIZ
PAW	3925	9A-5P	2083/90/72	KAØIZA

Tfc: WØLAW, WOØA, WAØTFC, KØPIZ, KBØOHI, KBØAII, WØHPD, KØWPK, KBØAIJ, WØWVO, KØPSH, KAØIZA, KN9U, WDØGUF, KØIKO, NØJP.

NORTH DAKOTA: SM, Bill Kurtti, WCØM—I'm sad to report that KBØCH is a Silent key. Mel was very active in our nets and acted as net a control for many years. He was not active for several years because of declining health but left a place in our hearts. It was a quiet year for SKYWARN this summer.

MFJ *Speech Intelligibility* Enhancer™
gave me back my Ham Radio hobby

MFJ-616 **$169.95**

"As I got older, my high frequency hearing loss was destroying my ham radio for me . . ."

-- Martin F. Jue, K5FLU
President and Founder
MFJ Enterprises, Inc.

I know I'm not the only ham who can't understand all the speech in a QSO caused by high frequency hearing loss. I developed a solution that I want to share with my fellow hams.

I almost gave up my ham radio hobby

I have been a passionate ham radio operator for over 40 years ever since I was a teenager. I loved every minute of it. Still do, but I almost had to give it up.

As I grew older (I'm 56 now) I found myself asking "*What did you say?*" so often it got downright embarrassing. I can hear pretty good most of the time. I just can't always understand what people are saying and my left ear is weaker than my right ear.

It got to where I was having trouble carrying on QSOs. I could hear, but I just couldn't quite make out all the words.

My hearing problem almost put a stop to my lifelong hobby.

There was no way I was going to give up ham radio . . .

Research showed me what to do

I searched the literature and spoke to hearing and speech experts.

According to their research on the intelligibility of speech in hearing English words:

1. The frequencies important for speech intelligibility are the consonant sounds from 500 to 4000 Hz. They contribute 83% of word intelligibility.

Frequencies from 500 to 1000 Hz contributes 35% of word intelligibility and 35% of sound energy.

Frequencies from 1000 to 4000 Hz contributes *48% of intelligibility* but has *only 4% of sound energy!*

2. In contrast, frequencies from 125 to 500 Hz contributes 55% of sound energy but only 4% to word intelligibility.

***In** other words, nearly half the speech intelligibility is contained in 1000 to 4000 Hz frequency range with only 4% of the speech sound energy.*

On the other hand, the low frequencies 125 to 500 Hz have most of the speech energy but contribute very little to intelligibility.

How I improved my ability to hear and understand QSOs

The research showed me what to do.

First, drastically increase the speech energy above 500 Hz where 83% of intelligibility is concentrated.

Second, drastically reduce the speech energy below 500 Hz that contributes only 4% of intelligibility.

Amateur radio communications limit audio to about 300 to 2700 Hz.

I split the audio band into four overlapping octave ranges centered at 300, 600, 1200, 2400 Hz.

I could boost or cut each range by nearly 20 db to give me full control. This let me maximize speech intelligibility for most kinds of frequency loss.

My left ear is weaker than my right ear so I split the output audio into left and right channels with separate 2½ watt amplifiers. A balance control lets me equalize the perceived loudness to each ear. *Now both ears help in improving speech intelligibility!*

I couldn't believe my ears!

I built one and hooked it to my rig.

I boosted the high frequencies, cut the low frequencies, set the volume and adjusted the balanced control so I could hear each side equally loud.

I couldn't believe my ears! Speech that I could hear but barely understand before was now highly understandable. I got my ham radio back!

With this concept, you'll *understand* QSOs better and enjoy ragchewing and contesting more, even if you don't have high frequency hearing loss.

It helped me so much I wanted to share this with my fellow hams

I developed this into an accessory that any ham can use.

I made it immune to RFI, added a front panel phone jack, on/off speaker switch, two selectable transceiver inputs, a bypass switch for in/out comparison and built it into 10Wx2½Hx6D inch aluminum enclosure. Needs 12 VDC.

Other Uses

Replace your rig's audio section for superb audio. Eliminate hum, buzzes, poor frequency response, low audio power.

Works with SSB, FM, AM, CW -- any voice mode. Use any rig -- ham, marine, aircraft, CB. Use for PA systems, internet phone, radio talk shows.

MFJ-616 Accessories

MFJ-392, $19.95. Matching high performance communication headphones.

MFJ-281, $12.95. Mylar cone speaker emphasizes 600-4000 Hz for crystal clear speech fidelity. Requires two.

MFJ-1316, $19.95. For 110 VAC operation. Provides 12 VDC/1.5 Amps.

MFJ-72, $58.80. *All-in-one MFJ-616 Accessory Pack.* Includes MFJ-392 headphones, two MFJ-281 speakers and MFJ-1316 power supply. ***Save $7!***

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Order from MFJ and try it -- no obligation. If not delighted, return it within 30 days for refund less shipping.

No Matter What™ Warranty

You get MFJ's famous one year *No Matter What*™ limited warranty. We will repair or replace your MFJ-616 (at our option) no matter what for a full year.

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Biggest event was the disaster in Fargo with heavy rains and flooding all around Fargo. After that, things quieted down except for very heavy rains north & west of Grand Forks. Fargo hams were active this summer again helping in many events including Hamfest, Boy Scout food drive, M S walk, Crop walk, Field Day and the Alzheimer's walk. Grand Forks Hams Field Day was very interesting because it was preceded by the heavy flood in their county. However, they got 4 stations on the air under the callsign of N0GF. Also GF hams were called out for 5 SKYWARN sessions and a downed airplane by the Civil Air Patrol. I was real impressed to see, K Zero Uncle Bill, working so hard at the 146.64 repeater site. I just wonder how a fellow that old can stand the strain. Net reports: Goose River 1895 kc 8:30 AM Sunday 4/39/0 Data 3937 kc 6:30 PM daily 29/649/10. Wx net 3937 kc 8:30 AM. Mon - Sat 24/676/22. By KB0XT. HF net Mgr.

SOUTH DAKOTA: SM, R.L. Cory, W0YMB—ASM: Jerry Garthright, WN0Y. STM: Glenn Edland, W6IVV. PIO: Roger Kehm, W**ROG. If you would like to be part of our team, contact W0YMB. We have a lot of openings for volunteers to work with us for the good of Amateur Radio. Sioux Empire ARC put on an excellent convention on Sept 30 at Sioux Falls. We had a great time. SD evening NM K0ZBJ is in critical condition after an injury in an auto accident. KA0KPY has also been ill and not able to get on the air. I hope these fellows are recovered and back on the air when you read this. Our sympathy goes out to Roger Kehm, K0ROG, who lost his daughter and to the family of W0VQC, Frank Curtis, who became a Silent Key. He was a long-time Amateur Radio operator, and he will be missed by us all. Merry Christmas and a Happy New Year.

DELTA DIVISION

ARKANSAS: SM, Roger Gray, N5QS, e-mail n5qs@arrl.org — This month, I had the pleasure of attending the CAREN hamfest. We had a lot of fun, found an antenna that I have been looking for over the past 2 years, and had a very good ARRL Forum. During the forum, we discussed some of the best news I have received since becoming Section Manager. E. J. Dixon, N5QC, Assistant Section Manager for school clubs, announced that we now have a dedicated Amateur Radio class at Dunbar International Magnet School in Little Rock. This class will run for a full school year and require a license to pass the course. To receive an A will require an Extra class license, a B will require a General class license, and a C will require a Technician class license. Since that announcement at least 3 more schools are being approached for a similar program next year. This class falls in line with my goals for my 2nd term as Section Manager and the new programs Jim Haynie is working on at ARRL HQ on a nationwide basis. I want to personally thank everyone who has had any part in setting up this program and hope to have more information for next month's QST. Tfc and nets: KC5TMU 185, K7ZQR 95, K5BOC 61, AB5AU 26, W5RXU 15, KO5E 10, KA5MGL 6, ARN 88, APN 22, AMN 15, OZK 8.

LOUISIANA: SM, Mickey Cox, K5MC — ACC: KM5YL. OOC: WB5CXJ. PIC: K5IQ. SEC: AC5TM. STM: KG5GE. LCW NM: W4DLZ. LTN NM: WB5ZED. Thanks to the Twin City Ham Club (TCHC) our section had its first QSO Party in many years. Among the more active LA stations participating in the contest were W5DDX (operated by WD8LLR and WM9M), K5IQ, W5WMU, K1DW, W5LA, and W5WZ. The TCHC appreciates the feedback received from the contest community and will probably "fine tune" the rules for next year. I want to pay a special thanks to W5WZ for all of his hard work in making this year's LA QSO Party successful. Our SEC is in the process of contacting all LA EC's and DEC's regarding emergency communications planning and training. AC5TM was also able to quickly put together a short SET exercise for the ARES leaders around the section and is already making plans for next year's SET. An important goal is to build stronger ties between the ARES and traffic handling groups within our section so that we can be more effective in providing communications during emergencies and public service events. We still need volunteers for the section leadership positions of State Government Liaison, Technical Coordinator, and Bulletin Manager. Tfc: WB5ZED 760 (BPL), W5CDX 170, K5IQZ 133, K5MC 75, KG5GE 43, K5DPG 22, KM5YL 5. PSHR: WB5ZED 206, K5DPG 131, K5IQZ 129, W5CDX 120, K5MC 108, KG5GE 97, KM5YL 55. Net Reports: sessions/QNI/QTC. LTN: 30/386/68. LCW: 24/176/35. NELA: 4/74/1.

MISSISSIPPI: SM, Malcolm Keown, W5XX— Section Web Site: www.arrlmiss.org. The Y2K SET was a roaring success with over 300 Mississippi hams participating. Based on after-action information, the Red Cross, NWS-Jackson, NWS-Memphis, Mississippi DOT, and the Corps of Engineers are certainly glad that hams in Mississippi are up to the challenge of providing well-organized emergency communications. As a result of the SET JARC got TV coverage on WLBT, and MARC had a front page article in the Sunday Meridian Star. Kudos to AB5WF and W5KWB for their write up on JARC communications support for the U.S. Olympic Cycling Trials which was printed on page 84 of the October *QST*. JARC also provided communications for the Mississippi Walk for Diabetes. Those helping were AB5WF, KM5WN, KD5GRQ, W5QW, KC5OSM, KM5GE, K5VU, KK5RF, KB5PFY and W5PFR. MARC set up HF/VHF/packet stations at the Bonita Lakes Mall in Meridian for Amateur Radio Awareness Day. Don't forget Hamfest 2000 sponsored by the West Jackson ARC on November 17-18 at the St. Martin Community Center. Net Reports: sessions/QNI/QTC. MSPN 30/2852/55, MTN 30/109/44, MSN 30/1130/11, PBRA 30/585/12, Jackson Co ARES/RACES 30/566/15, MSSN 21/89/2, West Coast MS ARES 13/118/3, JARCEN 5/71/6, MCARES 4/52/0, Stone Co ARES 4/29/0, NW MS ARES 4/35/0, Lowndes Co 4/50/0, LARC 4/44/0, MBHN 3/24/0. PSHR: KB5W 142, K5VV 139, KJ5YY 83, W5XX 77. Traffic: KB5W 591 (BPL), K5VV 73, W5XX 6.

TENNESSEE: SM, O.D. Keaton, WA4GLS—ACC: WA4GLS. ASM: WB4DYJ. PIC: KE4CES. SEC: WD4JJ. STM: WA4HKU. TC: KB4LJV. Dave Goggio, W4OGG, makes DXCC Honor Roll after chasing DX for 30 years. BSFARC's station, W4BSF, won first place in Tennessee's multioperator station in the 1999 10 Meter Contest. RACK has been one of the most active clubs in public service, but here of late the participation has dropped off. Sheila, KB4G, is requesting your help in this part of RACK's program, so everyone join in as Sheila orga-

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Reads complex impedance . . . Super easy-to-use

New MFJ-259B reads antenna SWR . . . Complex RF Impedance: Resistance(R) and Reactance(X) or Magnitude(Z) and Phase(degrees) . . . Coax cable loss(dB) . . . Coax cable length and Distance to fault . . . Return Loss . . . Reflection Coefficient . . . Inductance . . . Capacitance . . . Battery Voltage. LCD digital readout . . . covers 1.8-170 MHz . . . built-in frequency counter . . . side-by-side meters . . . Ni-Cad charger circuit . . . battery saver . . . low battery warning . . . smooth reduction drive tuning . . . and much more!

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You can read Complex Impedance as series resistance and reactance (R+jX) or as magnitude (Z) and phase (degrees).

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You can read SWR, return loss and reflection coefficient at any frequency simultaneously at a single glance.

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Large easy-to-read two line LCD screen and side-by-side meters clearly display your information.

It has built-in frequency counter, Ni-Cad charger circuit, battery saver, low battery warning and smooth reduction drive tuning.

Super easy to use! Just set the bandswitch and tune the dial -- just like your transceiver. SWR and Complex Impedance are displayed instantly!

Here's what you can do

Find your antenna's true resonant frequency. Trim dipoles and verticals.

Adjust your Yagi, quad, loop and other antennas, change antenna spacing and height and watch SWR, resistance and reactance change instantly. You'll know exactly what to do by simply watching the display.

Perfectly tune critical HF mobile antennas in seconds for super DX -- without subjecting your transceiver to high SWR.

Measure your antenna's 2:1 SWR bandwidth on one band, or analyze multiband performance over the entire spectrum 1.8-170 MHz!

Check SWR outside the ham bands without violating FCC rules.

Take the guesswork out of building and adjusting matching networks and baluns.

Accurately measure distance to a short or open in a failed coax. Measure length of a roll of coax, coax loss, velocity factor and impedance.

Measure inductance and capacitance. Troubleshoot and measure resonant frequency and approximate Q of traps, stubs, transmission lines, RF chokes, tuned circuits and baluns.

Adjust your antenna tuner for a perfect 1:1 match without creating QRM.

And this is only the beginning! The MFJ-259B is a complete ham radio test station including -- frequency counter, RF signal generator, *SWR Analyzer*™, RF Resistance and Reactance Analyzer, Coax Analyzer, Capacitance and Inductance Meter and much more!

Call your favorite dealer for your best price!

MFJ-259B **$259.95**

Call or write for Free Manual

MFJ's comprehensive instruction manual is packed with useful applications -- all explained in simple language you can understand.

Take it anywhere

Fully portable, take it anywhere -- remote sites, up towers, on DX-peditions. It uses 10 AA or Ni-Cad batteries (not included) or 110 VAC with MFJ-1315, $14.95. Its rugged all metal cabinet is a compact 4x2x6¼ inches.

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MFJ *SWR Analyzers*™ work so good, many antenna manufacturers use them in their lab and on the production line -- saving thousands of dollars in instrumentation costs! Used worldwide by professionals everywhere.

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MFJ-249B, $229.95. Like MFJ-259B, but reads SWR, true impedance magnitude and frequency only on LCD. No meters.

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MFJ-219B, $99.95. UHF *SWR Analyzer*™ covers 420-450 MHz. Jack for external frequency counter. 7½x2½ x2¼ inches. Use two 9 volt batteries or 110 VAC with MFJ-1312B, $12.95. *Free* "N" to SO-239 adapter.

SWR Analyzer Accessories

Dip Meter Adapter

MFJ-66, $19.95. Plug a dip meter coupling coil into your MFJ *SWR Analyzer*™ and turn it into a sensitive and accurate bandswitched dip meter. Save time and take the guesswork out of winding coils and determining resonant frequency of tuned circuits and Q of coils. Set of two coils cover 1.8-170 MHz depending on your *SWR Analyzer*™.

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MFJ-29C, $24.95. Tote your MFJ-259B anywhere with this *genuine* MFJ custom carrying case. Has back pocket with security cover for carrying dip coils, adaptors and accessories.

Made of special foam-filled fabric, the MFJ-29C cushions blows, deflects scrapes, and protects knobs, meters and displays from harm.

Wear it around your waist, over your shoulder, or clip it onto the tower while you work -- the fully-adjustable webbed-fabric carrying strap has snap hooks on both ends.

Has clear protective window for frequency display and cutouts for knobs and connectors so you can use your MFJ *SWR Analyzer*™ without taking it out of your case. *Look for the MFJ logo for genuine authenticity!*

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Measure signal strength over 60 dB range, check and set FM deviation, measure antenna gain, beamwidth, front-to-back ratio, sidelobes, feedline loss in dB. Plot field strength patterns, position antennas, measure preamp gain, detect feedline faults, track down hidden transmitters, tune transmitters and filters. Plug in scope to analyze modulation wave forms, measure audio distortion, noise and instantaneous peak deviation. Covers 143.5 to 148.5 MHz. Headphone jack, battery check function. Uses 9V battery. 4x2½x6¾ in.

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nizes the various activities. Ed, WX4S, is looking for a replacement editor of the "Feedline." He thinks it's time to step aside since he has held that post since 1989. MARC News has a very interesting feature that is a radio biography of one of its members. Other clubs may want to include something like that. BARC's special event station W4B was a real success again this year thanks to all who helped make this possible. Congratulations to DARC for organizing an Elmer system. It's called "the W4BS Elmer Shack." W4BS is the club's call sign. This group of 11 hams must be able to give assistance in about all facets of Amateur Radio. Further information is available from Arlene at AA4GX@aol.com. CARC also have elmers available. If you need more info, contact N4GAW at gwreece@juno.com. CARC is sponsoring a series of technical sessions. Concact ad4f@juno.com for more info. WAVES did not list the hams that participated in the Diabetes Bike Ride, but according to funds raised, there must have been a great turnout. Net sess/QTC/QNI: TMPN 30/21/2143. TCWN 22/22/147; TEMPN21/44/653; TEPN 23/40/2183; TSCWN 27/20/162. Tfc: N4PU 70, WA4HKU 39, KE4GYR 25, WB4DYJ 24, W4SYE 12, WD4JJ 7, WA4GLS 1.

GREAT LAKES DIVISION

KENTUCKY: SM, Bill Uschan, K4MIS—The SET went well and many thanks to those who participated. With out the Hams in the field and those manning local EOCs, ARES would not work in the professional manner that it does in the Kentucky Section. It takes a lot of hard work but the job gets done, and done right. Soon new equipment and new antennae will be installed at the Ky. EOC. Dates are already coming in for scheduling of Hamfests for 2001. More on that next time. In this issue, it is proper for the SM to wish everyone a Merry Christmas and a Happy New Year. If you travel do so safely. John Farler has told me that he wants to retire as STM. Is there anyone who would like to have this Section Cabinet position. If there is e-mail me at k4mis@arrl.org with a brief description of your qualifications and why you would like to have the position. Winter is just around the corner. In the last issue, there was a typo in the listing of the Scott Co ARES special awards. The correct spelling is Eric Westerfield as one of the recipients.

Net	*QNI*	*QTC*	*Sess*	*NM*
KTN-E	982	28	29	K4LID
KTN	1088	47	30	K4LID
KSN	207	30	30	KO4OL
TSTMN	437	28	29	KG4EAB
CARN	369	30	29	AD4EI
4ARES	455	30	30	WA4RRR

Tfc: K4AVX 33, WD4JAW 33, AE4NW 23, KO4OL 27. K4YKI 4. PSHR: KO4OL 91.

MICHIGAN: SM, Dick Mondro, W8FQT—(w8fqt@arrl.org). ASM: Roger Edwards, WB8WJV (wb8wjv@arrl.net). ASM: John Freeman, N8ZE (n8ze@arrl.net). SEC: Deborah Kirkbride, KA8YKK (ka8ykk@arrl.net). STM: James Wades, WB8SIW (wb8siw@arrl.net). ACC: Sandra Mondro, KG8HM (kg8hm@arrl.net). OOC: Donald Sefcik, N8NJE (n8nje@arrl.net). PIC/SNE: David Colangelo, KB8RJI (dcolangelo@ameritech.net). SGL: John LaRock, K8XD (k8xd@arrl.net). TC: Dave Smith (DSmith@smithassoc.com). Youth Activities: Steve Lendzion, KC8MCQ (kc8mcq@arrl.net). BM: Thomas Durfee, Jr.,WI8W (wi8w@arrl.net). Please remember to get your Club Annual Report in to ARRL HQ. This is an important report and your response is important to us. Please don't risk the loss of your clubs affiliation. To submit your club's Annual Report online, simply locate your club in the ARRL database using the Web Club Search page. Once you've located your club there, click on the club name to get to the detail page for your club. At the bottom of that page is a link you can click to update the detailed data. Submitting that update constitutes your annual report, although you can submit an update whenever you need to. If you have misplaced your form or have questions, please contact your Affiliated Clubs Coordinator Sandy Mondro KG8HM at the above email address. It is time once again to begin to enjoy the festivities of our Holiday Season and Sandy and I wish joyful Seasons Greetings to each of you and offer our sincerest thanks for you involvement in our Michigan Section Programs. Traffic reports for September 2000: KB8ZYY 233, AA8PI 169, WX8Y 156, K8AE 129, K8GA 124, N8FPN 107, K8LJG 91, K8KV 88, W8RTN 83, AA8SN 67, KA9EIZ 63, WI8K 57, W8RNQ 52, W8YIQ 34, K8UPE 31, KC8GMT 27, K8ZJU 25, N8TDE 25, K3UWO 23, WA8DHB 21, K8KIR 17, K8AI 15, K8JN 14, KI8GR 9, N8EXS 3. Please support the following Section Nets:

Net	*NM*	*Freq*	*Time*	*Day*
QMN	WB8SIW	3.663	6:30&10 PM	Daily
MACS	W8RNQ	3.953	11 AM	Daily (1 PM Sun.)
MITN	N8FPN	3.952	7 PM	Daily
UPN	AA8SN	3.921	5 PM	Daily (Noon Sun.)
GLETN	VE3SCY	3.932	9 PM	Daily
SEMTN	WI8K	145.330	10:15 PM	Daily
ARAHH	K8LAT	145.130	8 PM	Wed
NCN	WD7G	146.940	7:30 PM	M-F
MI-ARPSC	W8FQT	3.932	5 PM	Sunday

OHIO: SM, Joe Phillips, K8QOE, Fairfield, (to contact me, see page 12)— In the November *QST*, we reported on September tornado at Xenia and the Greene County ARES activities as reported by EC Fred Stone, W8LLY. But there were other weather-related activities across Ohio that day. Pickaway County EC Charles Knaak, KB8WSG, reported hams tracked funnel clouds which cause enough damage to halt athletic events in progress. Union County EC Brad Conley, KG8S, reported electric outages and downed trees the same night. These are the reports we know of although SEC Larry Rain, WD8IHP, Mansfield, said hundreds of hams were ready to serve as weather alerts were sounded across all of Ohio....The Pioneer Radiator newsletter of Akron recently published a list of hams about to be lost from club membership. Good idea as a dues due reminder - everyone likes to see his or her name in the newsletter, but I'll bet a number of club renewals occurred to get off that list. OHIO CONDOLENCES to the family of John Heil, KA8GGM (sk), who founded Doctors Hospital, Massillion. He was a trustee

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MFJ-989C *Legal Limit* Antenna Tuner

MFJ uses super heavy duty components to make the world's finest legal limit tuner

MFJ uses super heavy duty components -- roller inductor, variable capacitors, antenna switch and balun -- to build the world's most popular high power antenna tuner.

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MFJ's *AirCore*™ roller inductor, new *gear-driven* turns counter and weighted spinner knob gives you exact inductance control for absolute minimum SWR.

You can match dipoles, verticals, inverted vees, random wires, beams, mobile whips, shortwave -- nearly any antenna. Use coax, random wire or balanced lines.

MFJ-989C **$359.95**

You get everything you've ever wanted in a high power, full featured antenna tuner -- widest matching range, lighted Cross-Needle SWR/Wattmeter, massive transmitting variable capacitors, ceramic antenna switch, built-in dummy load, *TrueCurrent*™ Balun, *scratch-proof* Lexan front panel -- all in a sleek compact cabinet (10¾Wx4½Hx15D in).

MFJ AirCore™ Roller Inductor gives high-Q, low loss, high efficiency and high power handling.

MFJ's exclusive *Self-Resonance Killer*™ keeps damaging self-resonances away from your operating frequency.

Large, self-cleaning wiping contact gives good low-resistance connection. Solid 1/4 inch brass shaft, self-align bearings give smooth non-binding rotation.

MFJ *No Matter What*™ Warranty

MFJ will repair or replace your MFJ-989C (at our option) *no matter what* for one year.

More hams use MFJ tuners than all other tuners in the world!

MFJ-986 Two knob *Differential-T*™

MFJ-986 **$329.95**

Two knob tuning (differential capacitor and *AirCore*™ roller inductor) makes tuning foolproof and easier than ever. Gives minimum SWR at only one setting. Handles 3 KW PEP SSB amplifier input power (1.5 KW output). Gear-driven turns counter, lighted peak/average Cross-Needle SWR/Wattmeter, antenna switch, balun. 1.8 to 30 MHz. 10¾Wx4½Hx15 in.

MFJ-962D *compact* Tuner for Amps

MFJ-962D **$269.95**

A few more dollars steps you up to a KW tuner for an amp later. Handles 1.5 KW PEP SSB amplifier input power (800W output). Ideal for Ameritron's AL-811H! *AirCore*™ roller inductor, gear-driven turns counter, pk/avg lighted Cross-Needle SWR/Wattmeter, antenna switch, balun, Lexan front, 1.8-30MHz. 10¾x4½ x10⅞ in.

MFJ-969 300W *Roller Inductor* Tuner

MFJ-969 **$199.95**

Superb *AirCore*™ Roller Inductor tuning. Covers *6 Meters* thru 160 Meters! 300 Watts PEP SSB. *Active* true peak reading lighted Cross-Needle SWR Wattmeter, *QRM-Free PreTune*™, antenna switch, dummy load, 4:1 balun, Lexan front panel. 3½Hx10½Wx9½D inches.

MFJ-949E *deluxe* 300 Watt Tuner

MFJ-949E **$149.95**

More hams use MFJ-949s than any other antenna tuner in the world! Handles 300 Watts. Full 1.8 to 30 MHz coverage, 48 position *Precision48*™ inductor, 1000 Volt tuning capacitors, *full size* peak/average lighted Cross-Needle SWR/Wattmeter, 8 position antenna switch, dummy load, *QRM-Free PreTune*™, scratch proof Lexan front panel. 3½Hx10⅝Wx7D inches. **MFJ-948, $129.95.** Economy version of MFJ-949E, less dummy load, Lexan front panel.

MFJ-941E *super value* Tuner

MFJ-941E **$129.95**

The most for your money! Handles 300 Watts PEP, covers 1.8-30 MHz, *lighted* Cross-Needle SWR/Wattmeter, 8 position antenna switch, 4:1 balun, 1000 volt capacitors, Lexan front panel. Sleek 10½Wx2½Hx7D in.

MFJ-945E HF+6 Meter *mobile* Tuner

MFJ-945E **$119.95**

Extends your mobile antenna bandwidth so you don't have to stop, go outside and adjust your antenna. Tiny 8x2x6 in. *Lighted* Cross-Needle SWR/Wattmeter. Lamp and bypass switches. Covers 1.8-30 MHz *and* 6 Meters. 300 Watts PEP. **MFJ-20, $4.95,** mobile mount.

MFJ-971 *portable/QRP* Tuner

MFJ-971 **$99.95**

Tunes coax, balanced lines, random wire 1.8-30 MHz. Cross-Needle Meter. SWR, 30/300 or 6 Watt QRP ranges. Matches popular MFJ transceivers. Tiny 6x6½x2½ inches.

MFJ-901B *smallest* Versa Tuner

MFJ-901B **$79.95**

MFJ's smallest (5x2x6 in.) and most affordable wide range 200 Watt PEP Versa tuner. Covers 1.8 to 30 MHz. Great for matching solid state rigs to linear amps.

MFJ-16010 *random* wire Tuner

MFJ-16010 **$49.95**

Operate all bands anywhere with MFJ's reversible L-network. Turns random wire into powerful transmitting antenna. 1.8-30 MHz. 200 Watts PEP. Tiny 2x3x4 in.

MFJ-906/903 *6 Meter* Tuners

MFJ-906 **$79.95**

MFJ-906 has lighted Cross-Needle SWR/wattmeter, bypass switch. Handles 100 W FM, 200W SSB. **MFJ-903, $49.95**, Like MFJ-906, less SWR/Wattmeter, bypass switch.

MFJ-921/924 *VHF/UHF* Tuners

MFJ-921 or MFJ-924 **$69.95**

MFJ-921 covers 2 Meters/220 MHz. **MFJ-924** covers 440 MHz. SWR/Wattmeter. 8x2½x3 inches. Simple 2-knob tuning for mobile or base.

MFJ-922 144/440 MHz Tuner

MFJ-922 **$79.95**

Ultra tiny 4x2½x1¼ inch tuner covers VHF 136-175 MHz and UHF 420-460 MHz. SWR/Wattmeter reads 60/150 Watts.

MFJ-931 *artificial* RF Ground

MFJ-931 **$89.95**

Creates artificial RF ground. Also electrically places a far away RF ground directly at your rig by tuning out reactance of connecting wire. Eliminates RF hot spots, RF feedback, TVI/RFI, weak signals caused by poor RF grounding. **MFJ-934, $169.95**, Artificial ground/300 Watt Tuner/Cross-Needle SWR/Wattmeter.

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of Christian Radio WCRF, and was well known to the ham radio missionary community. OHIO SECTION CONGRATS. (A) To John Ackermann, N8UR, Bellbrook, for his recent election as president of Tuscon Amateur Packet Radio (TAPR). (B) To Mike Kehr, WA8SYD, Toledo as he was selected TMRA Ham of 2000, (C) To Jim Linn, WB8RRR, Milford, for his continuing series on ham radio history in the Milford ARC newsletter, and (D) To Newsletter editors in Ohio who have more pictures published then ever before. If your Ohio ham radio club isn't a Special Service Club of the ARRL, contact ACC Brenda Kurkowski, KB8IUP, (kb8iup@arrl.net) and see if your group qualifies and you wish to enjoy its special privileges. Due to the holiday season, why not consider a specialty book from one of the many available from the ARRL. Check the ads in *QST*. de K8QOE. Now for September traffic reports - Some September reports will be published in January *QST* due to vacations.

Net	QNI	QTC	QTR	Sess	Time	Freq	NM
BN (E)	124	52	229	30	1845	3.577	WD8KFN
BN (L)					2200	3.577	NY8V
OSN	144	51	539	30	1810	3.708	WB8KQJ
OSSBN					1030, 1615, 1845	3.9725	N8IO
OH Section ARES					1700 Sn	3.875	WD8IHP

Tfc: N8IXF 168, N8IO 166, W8STX 146, N8TNV 82, N8BV 82, KA8FCC 76, N8DD 75, WA8SSI 74, KA8CXG 71, WA8HED 56, W8BO 55, WB8HHZ 48, W8PBX 46, WA8EYQ 46, KI8IM 46, KC8HJL 41, KD9K 40, NS8C 32, WD8KBW 32, N8CW 30, WB8PMG 28, N8YWV 28, WB8SIQ 27, 27, KC8JKE 25, N8GOB 19, KC4IYD 19, N8YWK 19, KI8O 17, K8PJ 16, W8RG 15, N8GP 14, KC8HPR 13, AA8XS 13, N8IBR 12, N7CEU 9, KB8SBK 8, KC8PDY 6, W8RPS 6, KB8WSG 6, WA8JCU 5, W8GDQ 3, W8DYF 2, KE8FK 2, K8RDK 2, N8HIA 1, K8WC 1, K8QIT 1 (Aug) WB8PMG 8.

HUDSON DIVISION

EASTERN NEW YORK: SM, Rob Leiden, KR2L— STM: Pete Cecere, N2YJZ. SEC: Ken Akasofu, KL7JCQ. ACC: Shirley Dahlgren, N2SKP. SGL: Herb Sweet, K2GBH. PIC: John Farina, WA2QCY. BM: Ed Rubin, N2JBA. OOC: Hal Post, AK2E. TC: Rudy Dehn, W2JVF. ASM: Tom Raffaelli, WB2NHC. ASM: Bob Chamberlain, N2KBC. ASM: Andrew Schmidt, N2FTR. ASM: Richard Sandell, WK6R. ASM: Phil Bradway, KB2HQ. Net Reports (September 2000) Check-ins (QNI)/Traffic handled (QTC+QSP): AES 36/2 CDN 331/116 CGESN 39/4 ESS NR HVN 596/143 SDN 351/167 NYPHONE 217/458 NYPON 328/222 NYS/E 316/300 NYS/M 162/121 NYS/L 246/364 NYSPTEN 352/88. December is holiday party time. Invite the community and get new folks into ham radio! Get "in the loop" - email to subscribe@hudson-loop.org. 73 de KR2L. PSHR: N2YJZ 172, N2JBA 157, WA2YBM 140, WB2ZCM 139, W2AKT 121, KC2DAA 112, W2JHO 108. Tfc: N2YJZ 157, N2JBA 75, KC2BUV 62, WB2IIV 54, WB2ZCM 45, KC2DAA 24, WA2YBM 17,W2JHO 16, W2AKT 15, W2CJO 15, K2AVV 6, N2AWI 5, WA2BSS 2, KL7JCQ 1, KC2BUW 1.

NEW YORK CITY / LONG ISLAND: SM, George Tranos, N2GA—ASM: KA2D, N1XL, K2YEW, W2FX, KB2SCS. SGL: N2TX. SEC: KA2D. ACC: N2MUN. PIC-East: N2RBU. PIC-West: K2DO. TC: K2LJH. BM: W2IW. OOC: N1XL. STM: WA2YOW. I have been reelected as SM for another 2 year term - thank you for your support. Section staff meeting was held on Oct. 7, next section staff meeting will be March 18, 2001, and will be open to all ARRL section appointees. Ham Radio University 2001 (and the NLI Section Convention) is NEXT month on Sunday, January 21, 2001, at Babylon Town Hall Annex in North Babylon. There will be many new forums and an expanded program. Congrats to Public Service Honor Roll stations for Sept: KB2KLH, W2RJL, N2AKZ, WB2GTG and WA2YOW. Check the NLI Webpage at www.arrlhudson.org/nli for more information on upcoming events. Can't believe it's that time of year again - Happy Holidays to all! NYC/LI VE exam list follows: Manhattan: BEARS, ABC Cafeteria, 125 West End Ave at 66th Street, Contact Jerry Cudmore W2JRC at 212-456-5224 for dates & times; East Village ARC, 2nd Friday at 7 PM, Laguardia HS, Amsterdam Ave and West 65th Street, Manhattan. Contact Robina Asti KD2IZ at 212-838-5995; Columbia University VE Team, 3rd Monday at 6:30 PM, Watson Lab, 6th Floor, 612 West 115th Street, Manhattan. Contact Alan Crosswell, N2YGK, at 212-854-3754; Queens: Hellenic ARC, 4th Tuesday at 6:30 PM, Pontion Society, 31-25 23rd Ave, Astoria, NY. Contact George Anastasiadis, KF2PG, at 516-937-0775. Nassau County: Grumman ARC (W5YI), 2nd Tuesday at 5 PM, Northrop-Grumman Plant 5, South Oyster Bay Road via Hazel Street, Bethpage, NY. Contact Bob Wexelbaum, W2ILP, at 631-499-2214; LIMARC, 2nd Saturday at 9 AM, NY Institute of Technology, 300 Building, Room 311, Northern Blvd, Greenvale, NY. Contact Al Bender W2QZ at 516-623-6449. Suffolk County: Great South Bay ARC (No VE session in December) Normally, 4th Sunday at 12 noon, Babylon Town Hall, ARES/RACES Room, 200 East Sunrise Hwy, North Lindenhurst. Contact Tom Carrubba at 631-422-9594; Larkfield ARC, 2nd Saturday in Feb, May, Sep, Nov, Huntington Town Hall, Room 114. Contact Stan Mehlman, N2YKT, at 631-423-7132; Peconic ARC, exams held January, April, July, and October on next to last Friday at 6:30 PM at Southold School, Oaklawn Ave, Southold, NY. Contact Ralph Williams N3VT at 631-323-3646. Mid Island ARC, last Weds of each month at 7 PM at 36 Dew Flag Rd, Ridge NY 11961, Contact: Mike Christopher W2IW at 631-924-3535. Report all changes to N2GA before the 12th of the month. Tfc: WB2GTG 267, N2AKZ 136, KB2KLH 100, W2RJL 76, WA2YOW 30, KA2D 4.

NORTHERN NEW JERSEY: SM, Jeff Friedman, K3JF—If you are wondering why there wasn't an article for the NNJ Section the last couple of months, it's not because I gave up. It was a combination of events overshadowed by my work schedule. Several things have occurred over the last several months: The License Plate Bill A-1593, assembly, and S-1341, Senate, I am happy to say are alive and well although they are at a crossroad. Due to Senator Bucco's support, we have passed the Senate Committee unscathed. It is now up to the Senate to pass. Thank you Senator Bucco! We have not cleared the Assembly Transportation Committee as yet; they meet in October/November. We need everyone's support at this time. Write your Assemblyman NOW! Supporting A-1593. There is some opposition to it. You need to make the point that this Bill

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MFJ's new adjustable voltage switching power supplies do it all! Power your HF or 2M/440 MHz radio and accessories.

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No more picking up and hauling around heavy, bulky supplies that can give you a painful backache, pulled muscle or hernia.

MFJ's 25 Amp *MightyLite*™ weighs just 3.7 lbs. -- that's *5 times lighter* than an equivalent conventional power supply. MFJ's 45 Amp is even more dramatic -- *8 times lighter* and weighs just 5.5 pounds!

No RF hash!

These babies are clean . . . Your buddies won't hear *any* RF hash on your signal! *None* in your receiver either!

Some competing switching power supplies generate objectionable RF hash in your transmitted and received signal.

These super clean MFJ *MightyLites*™ meet all FCC Class B regulations.

Low Ripple . . . Highly Regulated

Less than 35 mV peak-to-peak ripple under 25 or 45 amp full load. Load regulation is better than 1.5% under full load.

Fully Protected

You won't burn up our power supplies!

No RF Hash!

MFJ-4225MV
25 Amp
$149.95
plus s&h

MFJ-4245MV
45 Amp
$199.95
plus s&h

No RF Hash!

They are fully protected with Over Voltage and Over Current protection circuits.

Worldwide Versatility

MFJ *MightyLites*™ can be used anywhere in the world! They have switchable AC input voltage and work from 85 to 135 VAC or 170 to 260 VAC. Replaceable fuse.

MightyLites™ . . . Mighty Features

Front-panel control lets you vary output from 9 to 15 Volts DC.

Front-panel has easy access five-way binding posts for heavy duty use and cigarette lighter socket for mobile accessories. MFJ-4245MV has two sets of quick-connects on the rear for accessories.

Brightly illuminated 3 inch meters let you monitor load voltage and current.

A whisper quiet internal fan efficiently cools your power supply for long life.

Two models to choose from . . .

MFJ-4225MV, $149.95. 25 Amps maximum or 22 Amps continuous. Weighs 3.7 pounds. Measures 5¾Wx4½Hx6D in.

MFJ-4245MV, $199.95. 45 Amps maximum or 40 Amps continuous. Weighs 5.5 pounds. Measures 7½Wx4¾Hx9D in.

***NEW!* 25 Amp *MightyLite*™**

Super light, super compact switching power supply delivers 25 Amps maximum/ 22 Amps continuous

MFJ-4125
25 Amp
$109.95
plus s&h

at 13.8 Volts DC. Low ripple, highly regulated. ***No RF Hash!*** Five-way binding posts for high current. Quick connects for accessories. Over voltage/current protection. 110 or 220 VAC operation. Meets FCC Class B regs. 3.5 lbs. 5½Wx2½Hx10¾D in.

MFJ 35/30 Amp Adjustable Regulated DC Power Supply

Massive 19.2 pound transformer . . . No RF hash . . . Adjustable 1 to 14 VDC . . .

MFJ-4035MV
$149.95
plus s&h

MFJ's heavy duty conventional power supply is excellent for powering HF or 2 Meter/440 MHz transceiver/accessories.

A massive 19.2 pound transformer makes this power supply super heavy duty! It delivers 35 amps maximum and 30 amps continuous without even flexing its muscles. Plugs into any 110 VAC wall outlet.

It's highly regulated with load regulation better than 1%. Ripple voltage is less than 30 mV. *No RF hash* -- it's super clean!

Fully protected -- has over voltage protection, fold back short circuit protection and over-temperature protection.

You get front panel adjustable voltage from 1 to 14 VDC with a convenient detent set at 13.8 VDC. A pair of front-panel meters let you monitor voltage and current.

Three sets of output terminals include a pair of heavy duty five-way binding posts for HF/VHF radios, two pairs of quick-connects for accessories and a covered cigarette lighter socket for mobile accessories.

A front-panel fuse holder makes fuse replacement easy. Whisper quiet fan speed increases as load current increases -- keeps components cool. 9½Wx6Hx9¾D inches.

MFJ *High Current* Multiple DC Power Outlets

Power two HF/VHF transceivers and six or more accessories from your 12 VDC power supply

MFJ-1118
$74.95
plus s&h

MFJ-1116
$49.95
plus s&h

MFJ-1112
$34.95
plus s&h

New!
MFJ-1117
$54.95

MFJ-1118, $74.95. This is MFJ's most versatile and highest current *Deluxe Multiple DC Power Outlet*. Lets you power two HF and/or VHF transceivers and six or more accessories from your transceiver's main 12 VDC supply.

Two pairs of super heavy duty 30 amp 5-way binding posts connect your transceivers. Each pair is fused and RF bypassed. Handles 35 Amps total.Six pairs of heavy duty, RF bypassed 5-way binding posts let you power your accessories. They handle 15 Amps total, are protected by a master fuse and have an ON/OFF switch with "ON" LED indicator.

Built-in 0-25 VDC voltmeter. Six feet super heavy duty eight gauge color-coded cable with ring tongue terminals. Binding posts are spaced for standard dual banana plugs. Heavy duty aluminum construction. 12½x2¾x2½ in.

MFJ-1116, $49.95. Similar to MFJ-1118. No 30 amp posts. Has "ON" LED and 0-25 VDC voltmeter. 15 amps total.

MFJ-1112, $34.95. Similar to MFJ-1116. No on/off switch, LED, meter, fuse.

NEW! **MFJ-1117, $54.95.** For powering four HF /VHF radios (two at 35 Amps each and two at 35 Amps combined) simultaneously. Tiny 8x2x3 inches.

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will help identify Radio Operators during Emergency Conditions. Oct 7, Mike Hoeft, K2MPH, our NNJ SEC, put on a great "Emergency Communications" Seminar at the Red Cross building in Fairfield, NJ with the help of Bob Cirri, KA2OTD, and Dave Streubel, WB2FTX. A great amount of research and preparation went into this event. The slides will be downloadable from the NNJ Website, http://www.arrlhudson.org/nnj. We are looking for each DEC to bring this presentation to their respective counties. The only disappointment was that several individuals who signed-up were "no shows". You really missed a good one. Thank you Mike and Team! For those of you who have not heard as yet, we have a new organization in the New York Metropolitan Area which has taken on the responsibility for coordinating Repeater Frequencies. They are incorporated in the State of New York as Metro Corp and are now the recognized organization, in this area, by the FCC. Congratulations and best wishes to the organizers, as we all know this took a lot of hard work and compromise. They are at this moment trying to inventory our geographical area. Those who have repeaters please give them your support. To help young people in communications etiquette and try to promote the hobby to our "up and coming" hobbyists, a "Youth Hour" has been established on the Morris County Repeater 146.895 from 3:00 PM to 4:00 PM daily. Let's talk this one up and get our young people involved. Tfc: K2VX 102, KC2AHS 50, W2MTO 49, N2OPJ 46, N2RPI 33, KB2VRO 26, K2PB 19, W2JG 18, W2CC 15, K2DBK KB2VVB 2.

MIDWEST DIVISION

IOWA: SM, Jim Lasley, N0JL—ASM: N0LDD—SEC: NA0R. ACC: N0IJP @ KE0BX. BM: K0IIR @ W0CXX. SGL: K0KD. CVARC did a very nice article entitled "What If There Was No ARRL?" Something to think about. DMRAA has four pages of FD pictures in their newsletter. Is it not amazing what can be done with software and a good printer! There were about a dozen amateurs that help the MS Cycle for the Cure this year. There are 18 listed helping the State Fair parade. Looks like DSM was busy on Sep 30 with several events going at one time! You always hate to lose friends. This month, I must report that K0JGI, KB0ODH, and K0GP are Silent Keys. Hey! Did you see that the Board honored W0PRF, Jack Landis? Jack has been busy. He has Elmered over 600 hams! Wow, that is quite an accomplishment, Jack! Congratulations on the well deserved honor. Have you seen that HQ is looking for monitoring reports for 10 and 12 meters? Check ARLB039. I understand that things are happening in Story County. New hams on the nets; programs on contesting, ARES, and a show and tell. Cyclone ARC was involved with a BSA Jamboree. SCARC is working with the local EMA on a storm spotting net. In contrast, FMARC has gone NOWHERE again. You had better check with them. NIARC had a program on SETI. By now many of you have had you holiday dinner meeting. It is just a little hard to believe that another year has come and gone. Looks like it is time to wish all of you a Merry Christmas and a Happy New Year as well as a belated Happy Thanksgiving! Time flies when you are having fun! 73 and/or 88 es cu nxt year. De N0JL. Newsletters were received from Midwest Division, SEITS, CVARC, DMRAA, FMARC, NIARC, SASW, OARC. Tfc: W0SS 204, WB0B 6, N0JL 3, (Jul) WB0B 4.

KANSAS: SM, Orlan Cook, W0OYH—ASM/ACC/OCC: Robert Summers, K0BXF. SEC: Joseph Plankinton, WD0DM. STM: Ron Cowan, KB0DTI. PIC: Scott Slocum, KC0DYA, and TC: Frank Neal, N8FN. Please welcome our new appointees. Don, W0PEA, has joined the ARRL Field Service as a Technical Specialist. You will find him at w0pea@arrl.net. Bud, N0APJ, is the new District 1 Zone 12A Emergency Coordinator at Lawrence (twaugh@ukan s.edu). Thanks to John, N0AOL, for all the years he held this appointment. Kevin, KB0YGL (kevin_r55@yahoo.com), has swapped his EC for a District Emergency Coordinator appointment and Sid, N0OBM (sashen@swbell.net) has taken the Emergency Coordinators apt. Both live in Salina. AA0GL, Marshall, has resigned his appointment as SGL. Tks for the many years of service. I want to recognize EC Nolan, KB0TLM, and TS Larry, WN8P, for the exceptional reports. Aug. Kansas Nets: sessions/QNI/QTC, KSBN 31/1021/86 KPN 21/264/23 KMWN 31/559/432 KWN31/788/496 CSTN27/2010/102 QKS 58/233/45 QKS-SS vacation SEC40/414/14 QNS KB0AMY N0BTH KC0CIQ WD0DDG WD0DVM AA0IQ N0LKK W0PBV WA0SSR TEN 318 msgs 62 sessions Kans 66% w/KB0DTI AA0OF KX0I K0PY W0WWR NB0Z WB0ZNY W0SS mgr. BBS W1AW BBS Bul/Per/NTS AA0HJ 9/392/0. Ks Stns tfc W0WWR 81, WB0ZNY 57, NB0Z 38, W0OYH 32, KB0DTI 25, KX0I 16, N0RZ 12, N0ZIZ 8, OBS WA0DTH 12.

MISSOURI: SM, Dale Bagley, K0KY—ASM: John Seals, WR0R. ASM: Bill Coby, KB0MWG. ACC: Keith Haye, WE0G. BM: Brian Smith, KI0MB, OOC: Mike Musick, N0QBF. PIC: Dennis McCarthy, AA0A. SGL: E.B. DeCamp, KD0UD. STM: Charles Boyd, KE0K. SEC: Patrick Boyle, K0JPB. TC: Wayland McKenzie, K4CHS. Cliff Ahrens, KA0CA, DXCC Card Checker. Check Webpage http:/www.qsl.net/arrl-mo for the latest news. MO Traffic Nets Daily: SSB 3.963 MHz 5:45 PM. CW 3.585 MHz 7:00 PM and 9:45 PM. Dewey Bennett, WM0H, was presented a Merit Award for his efforts as Chairman of the CMRA Hamfest / ARRL MO State Convention. The Central Missouri Radio Assn. President Phil Urquiola, K0DAT, was presented a Merit Award for the club's efforts in hosting the ARRL MO State Convention. Patrick Boyle, SEC, reports that Ken Bareman, W0KRB, will be the EC for Green County and Kevin Brown, KC0CZI, will serve as the EC for Cole County. Bill Klein, N0MNT, has moved from New Madrid and is giving up the DEC position for District E. Patrick, K0JPB, and I really appeciate all the work that bill has done for the MO Section ARES program in Southeast MO. The MO Valley ARC and the Ray Clay ARC are sponsoring the NWMO Hamfest in St Joseph, MO, January 20, 2001. The St Louis Repeater Inc, will sponsor Winterfest 2001 in the St Charles MO Exposition Center on January 27, 2001. Both Hamfests are ARRL Sanctioned and are always fun events. Best wishes to everyone for a great Holiday Season and an outstanding 2001. Net/Sess/QNI/QTC/NM: N0ATH 4/ 78/ 0/ N0ATH. MTN 30/393/33/ K0IPM. WARRCI 4/75/0/KB0ZVP; Rollabillboard 29/402/11/ NA0V. Jackson Co ARES 6/50/0 K0UAA.Ten for Sept 65% 30/609/289 with W0SS, W2RRX, KA5NNG, K9ZTV, KA0P, K0VNB, WO0X. Tfc: KE0K 48. PSHR: 86.

NEBRASKA: SM, Bill McCollum, KE0XQ—ASMs: W0KVM, N0MT, WY0F, WB0ULH & WB0YWO. I regret to inform you that KB0ZDH became a Silent Key on Sept. 12. I have been "re-elected" to a 4th term as your Section Manager. I had no opposition. I want to thank all the appointees for a "Job Well Done' and their continued support. Congratulations to Rick O'Malley, KC0HLJ. He is blind and recently upgraded to General. Greg, KT0K, picked up the highest Nebraska score in the ARRL International DX contest. I am seeking nominations for "Nebraska Ham of the Year." If you have someone in mind, send me a letter or e-mail stating why this person should be nominated. The deadline is Jan. 31 2001. The ARRL has approved the Nebraska State Convention, March 30-31 in Norfolk. Hams across the state provided communications for Crop Walk 2000 on Oct. 8. Net Reports: MARES: QNI 199, QTC 2 & 4 sessions. NE 40M Net: QNI 390, QTC 5 & 28 sessions. NE Storm Net: QNI 713, QTC 8 & 30 sessions. MID NE ARES: QNI 337, QTC 8 & 30 sessions. NMPN: QNI 1588, QTC 30 & 30 sessions. Tfc: K0PTK 105, KE0XQ 20, WY0F 6, KA0DBK 5, KA0DOC 2, W0EXK 2, W0UJI 2, N0UUZ 2. PSHR: KA0DBK 88, KB0YTM 28, KB0YTO 34.

NEW ENGLAND DIVISION

CONNECTICUT: SM: Betsey Doane, K1EIC— BM: KD1YV. OOC: W1GC. PIC: W1FXQ. SEC: WA1D. SGL: K1AH. STM: K1HEJ. TC: W1FAI. BRAVO to the Meriden and Middlesex Clubs for a fantastic hamfest at Mountain Side! I spent quite a bit of time near the organizers that day and you'd never know anything different was going on—they were really wonderfully organized! Gosh and they even had time to check into the SET exercises the day before. The Simulated Emergency Test (SET) went well this year; we heard from newcomers and had volunteers to serve as control stations. Team work is what it's all about folks—congrats! Special thanks to SEC WA1D, STM K1HEJ and ASM K1STM for their coordination and ongoing recruitment efforts. Candlewood ARA reported that the Worked All Connecticut Counties (WACC) award was issued to HS1NGR (Thailand). The Waterbury Amateur Radio Club provided communications for the annual Tour de Tribury, a bicycle road rally to benefit the Southbury Fuel Bank. Five hams turn out for this event: Steve N1AOB, Bill W7YY, Mike N1ZKX, Ed N1YLN and Joe KA2BDZ, the group leader. Thanks and congrats to you all for a fb job! The Greater Norwalk ARC ran a special event in Norwalk Oct 12-15 to commemorate the display of the Traveling Viet Nam Healing Wall to the greater Norwalk area. The operation took place at Veterans Park in Norwalk. Just another example of a vy fb PR event! Net sess/QNI/QTC: WESCON 30/225/78; ECTN 29/ 219/33; NVTN 25/119/57; CPN 30/246/90; CN 25/81/32. Tfc: NM1K 3147, KA1VEC 520, KA1GWE 192, KE1AI 136, KB1CTC 126, WA4QXT 52, KB1ETO 10.

EASTERN MASSACHUSETTS: SM, Joel Magid, WU1F— Nets and traffic submitted by STM Bill, NZ1D—

Net	*Sess*	*QTC*	*QNI*	*QTR*	*NM*
EMRI	60	122	212	573	K1SEC
EMRIPN	30	136	183	536	WA1FNM
EM2MN	30	152	282	532	N1LKJ
HHTN	30	31	235	340	N1IST
CITN	30	76	259	526	N1SGL
WARPSN	4	14	49	NA	K1BZD
NEEPN	4	5	8	NA	WA1FNM
CHN	30	43	152	323	W2EAG

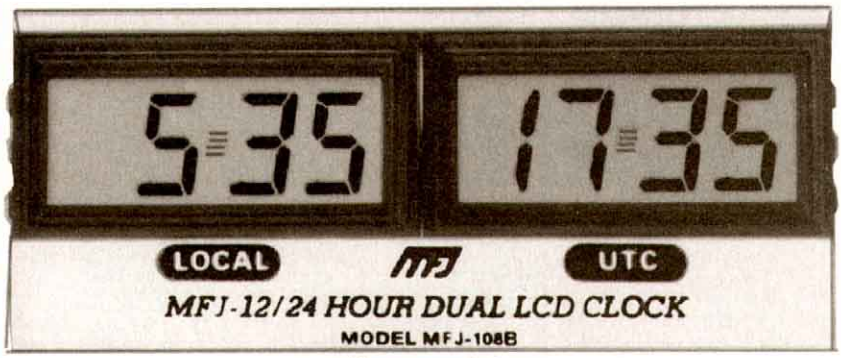
Tfc: N1LKJ 351, W2EAG 170, NZ1D 126, WA1FNM 70, WA1LPM 53, K1SEC 51, N1LAH 50, N1AJJ 50, N1SGB 49, NG1A 49, K1BZD 45, KD1LE 39, N1TDF 36, N1IST 29, N1TPU 25, KB1EB 16, N1BNG 16, WA1VRB 13, N1XQC 4.

MAINE: SM, Bill Woodhead, N1KAT— ASMs: WA1YNZ, KA1TKS. STM: N1JBD. BM: W1JTH. SGL: W1AO. ACC: KA1RFD. PIC: KD1OW. SEC: N1KGS. Asst. Dirs: W1KX, KA1TKS, K1NIT. Web Site: N1WFO. On Oct 4, I attended the monthly meeting of the Port City ARC in Portsmouth, NH. They graciously gave me time to ask about Hams in the most southern part of Maine. Also attending was AI2Q, who invited me to visit the Southern Maine ARC, on the 2nd Tues. of each month at 7 PM at the River Ridge Rehabilitation Center in Kennebunk. I did and I would encourage local Hams to do so, as well. The SMARC has made a donation to the Center in memory of N1HLW, and they are also working with young students at the local school. Keep up the good work! Congratulations to all the Hams in the greater Bangor area, who are celebrating the 25th anniversary of the Pine State ARC. KA1RFD and KD1OW deserve a pat on the back and an "Atta boy!" for all the time they've spent instructing new and upgrading Hams. This type of committment is to be commended. With the Holiday seasons fast approaching, my best wishes go out to all of you for a joyous time. 73, Bill, N1KAT. Tfc: W1KX 147, W1QU 47, W1JTH 35, W1BLT 30, N1JBD 29, KA1RFD 25, K1UNQ 24, W1JX 23, KA2ZKM 22.

NEW HAMPSHIRE: SM, Al Shuman, N1FIK (n1fik@arrl.org) —NH web site (www.arrl/nhradio.org) Oct. Welcome to my first column since returning as your SM. Thanks to the countless who called/wrote wishing me luck, including Linda, W1MP, from VT writing that she always enjoyed reading my columns. The first 2 weeks has been busy as I assemble a strategic Field Organization Management team. Returning is Gary Okula, N3CLZ (SEC), and Reese Fowler, N1KIM, as (ASM) as the Webmaster. Staying on is Rich, WB1ASL, (ASM) for North Country - Tom, WA1JVV (STM) - Dale AA1QD (ACC) - Ralph, K1KM (SGL) - Dennis, WA1HOG (TC) and Mort, KH6GR (BM). As of this writing, I have not yet confirmed or filled other positions. This should be completed by month's end and announced in the Jan 2001 column. After assessing current NH programs, it is obvious that a dedicated focus is necessary to attract new volunteers and rebuild ARES, but not at the expense of other programs. We will need additional dedicated people to fill various positions. If interested in volunteering please e-mail me or call at 603-487-3333 with your strengths and interests. Thanks to the many who held it together while I was gone and for your support.73, Al. Net NM/ sess/QNI/QTC: GSFM N1RCQ 30/212/28; GSPN WB1GXM 29/124/79; VTNH WA1JVV 30/140/165. Tfc: W1PEX 899, N1NH 166, WA1JVV 135, K1STV 53, W1ALE 33, N1CPX 28, WB1GXM 28.

RHODE ISLAND: SM, Armand Lambert, K1FLD—Boxboro - Great weather. The talk by Riley Hollingsworth emphasized the FCC presence in favor of amateur radio, however, men-

MFJ 24/12 Hour Clocks



Shown actual size

Dual 24/12 hour LCD Clock

MFJ-108B
$19.95 plus s&h

MFJ-108B dual clock has separate 24 hour and 12 hour displays. Lets you read both UTC and local time simultaneously. Features huge high-contrast 5/8 inch LCD numerals that makes it easy to read across the room. Mounted in solid brushed aluminum frame with sloped face for easy viewing. Synchronizable to WWV for split-second timing. Quartz controlled for excellent accuracy. Long life battery included. 4½Wx1D x2H in. MFJ's famous *No Matter What*™ one year limited warranty. *$6 s&h.*

DXer's Wall Clocks

MFJ-125, $29.95. 12 inch DXer's Quartz wall clock gives 24 hour time plus more. Has three smaller independently settable dials for 12 hour time, day of week and date. No more day/date confusion when logging DX! Highly visible, easy-to-read dials! Has Seconds hand.

MFJ-115, $24.95. Set this 24 hour clock to UTC/ GMT and you can determine the time in any time zone of the world at any time of the day. Premier world cities encircle its colorful world map face to indicate time zone. 12 inch face is easy to see across room. Has Seconds hand.

MFJ-105C, $19.95. *World's most popular ham radio wall clock!* True 24 hour Quartz movement. Huge 12 inch black face with large white numerals give excellent visibility across room. Attractive gold colored hour, minute and seconds hands.

MFJ-126, $24.95. 12 hour Quartz movement gives 12 hour time on inner dial (for XYL) and 1200 to 2400 hour time on its outer dial (for you). Attractive clean, white face is highly visible. Real glass cover! Handsome hunter green trim. Has seconds hand.

Hi-Contrast LCD Clocks

MFJ-119B, $49.95. Giant LCD Display 24/12 Hour Clock. Has *giant* see-across-the-shack 2¼ inch time digits. Digital calendar or clock modes. Displays inside temperature (F/C), relative humidity, month, date and day of week. Handsome hunter green and tan color. Wall mount. 8½x9 inches.

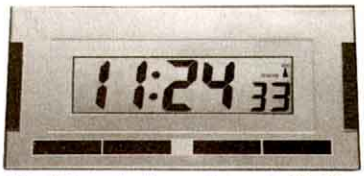
MFJ-118, $24.95. 24/12 hour clock has jumbo 1¼ inch LCD digits. Displays 24 or 12 hour time, year, month, date, and day of week. 100 year full calendar. Hang on wall or desk mount. 5¾Wx2½Hx½D in.

MFJ-107B, $9.95. 24 hour UTC Clock has large 5/8 inch LCD numerals. Synchronizable to WWV. Solid brushed aluminum frame lasts for years. Long life battery included. 2¼x1x2 in.

MFJ-112, $24.95. 24/12 Hour World Map LCD Clock displays time in *every time zone in the world*. Selected time zone flashes on LCD world map. Displays 24 or 12 hours, minutes, seconds, year, month, date, day, time zones, cities. Single button accesses pre-set second time zone. Alarms for two time zones. Adjusts for daylight savings time.

MFJ-152, $24.95. Read Indoor *and* Outdoor temperatures *and* 24/12 Hour time at-a-glance on huge 3/4 inch LCD digits! Choose F or C. Stores minimum and maximum temperature readings. Has backlight for in-the-dark viewing, outdoor temperature sensor with ten foot cable.

Solar Atomic Clock



MFJ-123, $79.95. **MFJ's** *exclusive* solar powered *Eternity Atomic Clock*™ works for an "*eternity*"! Never need batteries! Never need to set time! **Whopping** LCD display is 2 inches tall and 6¾ inch wide -- clearly visible across the room. **Choose** 24 or 12 hour time.

MFJ-116, $14.95. Big bright 5/8 inch LED digits. 24 or 12 hour, 9 min. ID timer, battery back up. Black. 110VAC.
MFJ-116DC, $19.95. 12 VDC, plugs in cigarette lighter. *Great for motorhomes and truckers!* 12 hour only.

Monster Display *Atomic Clock* with PinPointAccuracy™

MFJ-120, $69.95. 24/12 hour *Atomic Clock* automatically receives WWVB for millisecond accuracy. Monster 2 inch LCD characters. Reads relative humidity and temperature (F or C). Has alarm. Attractive metallic copper color. Use on desk or mount on wall. Giant 8x10½Wx¾D inch showpiece.

MFJ-388 **$29.95** **MFJ *CyberEAR*™** **Tiny** powerful MFJ *CyberEar*™ plugs in and loops over ear -- captures and amplifies sounds by 12 dB! Extends your hearing range, helps you hear every word at hamfests and club talks -- even if you're on the back row! Great for eyeball QSOs. 30 day money back if not absolutely delighted. *Not a hearing aid.*

7 Band WeatherAlert

MFJ-8200 **$29.95** plus s&h

Receive continuous weather info/ warnings on all 7 weather channels: 162.4/.425/.45/.475/.5/.525/.55 MHz from 380 U.S. locations 24 hours/day. Also includes AM/FM radio, spotlight, siren, flashing light for emergencies. Water resistant cabinet. Shoulder strap. Great for hamfests, DXpeditions, camping.

14-in-1 *HamTool*™

MFJ-7604 **$19.95** plus s&h

Ham Radio's most versatile tool! This 14-in-1 tool pocket-size toolbox is all you need for putting up antennas or working on rigs. Includes needle-nose pliers with wire cutters and jaws for gripping. Has flathead and Phillips screw drivers, knife, ruler, file, punch, more! Stainless steel, belt carrying case.

HamGear™ Waistpak

MFJ-6200 **$15.95** plus s&h

MFJ's *Ham Gear*™ *WaistPak*™ is the perfect hamfest, DXpedition or field day hands-free carry-all. Has amazing 9 spots to put your ham radio gear, tools, accessories and refreshments. Foam padded and comfortable. Made of heavy duty twill burlap for long life. Features tough webbed belting with solid plastic buckle.

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tioning that we must do the walk not just the talk. Be active and occupy frequencies, basically, use them or lose them. The FCC looks even more favorably on amateur radio due to our involvement in community service. Getting out there using Amateur Radio and being visible in the community will benefit us all. // Big E was great fun this year for participating hams. We even got to be in one of the parades using the ARRL banner. Tnx to Simone, KA1YVF, for making arrangements. Tnx to Al, N1JWF, and many local hams who were the mainstay for the presence we had. Lots of people got to know more about Amateur Radio this way. // We log the passing of Fred Coyle, Jr., W1MZB, who was licensed since 1937. Thanks to David, K1ANT, for letting us know. // NCRC had the opportunity of hosting a special event station at the Norman Bird Sanctuary during the Harvest Fair 2000. Hope you were able to work them. See Oct *QST* for details. // New OSARG Website: www.members.home.net/n1vdf.

VERMONT: SM, Bob DeVarney, WE1U— As promised, I am catching up on some NTS stats. Hope everyone had a super month, and it's not too late to get those last minute requests into Santa (or Mrs Claus...) 73 de WE1U. July, 2000, Net/ Sessions/Check-in's/Traffic/ Minutes/Net Manager, VTYL Net/5/59/2/190/KA1LDS, GM Net/26/667/18/2079/N1HXC, VT/NH Net/31/150/158/494/WA1JVV, August, 2000 Net/Sessions/Check-in's/Traffic/ Minutes/Net Manager, VTYL Net/4/46/2/140/KA1LDS, GM Net/27/736/20/2386/N1HXC, VT/NH Net/31/160/193/451/WA1JVV, VTPEN/4/24/1/168/WA1DLA, September, 2000 Net/Sessions/Check-in's/Traffic/ Minutes/Net Manager, VTYL Net/4/41/1/125/KA1LDS, GM Net/26/718/19/2242/N1HXC, VT/NH Net/30/140/165/427/WA1JVV, VTPEN/3/24/2/145/WA1DLA, VTPTN/17/89/22/281/KB1DSB. Tfc (Sept): KB1DSB 166, N1XOA 32, KB1EYP 28, KB1EPQ 16, W1DEC 16, K1YLB 3.

WESTERN MASSACHUSETTS: SM, William C. Voedisch, W1UD, w1ud@arrl.org— ASM: N1LZC. ASM (digital) KD1SM. STM: W1SJV. SEC: K1VSG. OOC: WT1W. All the clubs have had their first meetings and another season of ham radio is underway. MARA and the Mohawk Club, under the guidance of Paul, W1SEX, has started a ham radio course at Montachusett Technical High School. This will be an evening course, and will be open to the public as well as the students of the high school. Volunteer instructors are W1SEX, K1JHC, WA1FIA, KD1SM, KD1YY, N1QDX and N1ZYG. This course should increase the Amateur Radio ranks in northern Worcester County. NOBARC annual flea market was another great success. N1LZH, W1BS, and N1XHR were tri-chairmen of the event and everything went smoothly. Most people don't realize what is involved in an undertaking like that. They are to be commended. I'm looking for an STM. Cliff Ey, W1SJV, has submitted his resignation after many years of gathering reports and supervising our traffic nets. Thanks, Cliff, for doing a marvelous job. Tfc: N1ISB 13, KD1SM 8, N1WAS 81, K1TMA 298, W1SJV 16, W1UD 207.

NORTHWESTERN DIVISION

ALASKA: SM, Kent Petty, KL5T—The Alaska field organization is still in need of Boy and Girl Scout liaisons — please contact KL5T if you feel up to the task...it's awfully important. We are still looking for a sponsor for our state PRB-1 effort. Will your state representative be willing to help? Contact your State Government Liaison, Rob Wilson, AL7KK for input. Repeater owners: Have you coordinated your repeater's operation with our frequency coordinator, KL7GG? Did you know Mel requests you update your coordination annually? Please take the time to protect your operation and to get your repeater listed in the ARRL repeater guide by sending your paperwork to Mel. HF nets: Sniper's Net 3920 1800 AST, Bush Net 7093 2000 AST, Motley Group 3933 2100 AST, and Alaska Pacific Net 14292 M-F 0830 AST. Please report communication drills and exercises, emergency communication activations, and public service activities on FSD-157 to KL5T.

EASTERN WASHINGTON: SM, Kyle Pugh, KA7CSP—I hope many of you participated in this year's Simulated Emergency Test (SET). SEC Gordon Grove WA7LNC again organized a state-wide 24-hour drill on October 7-8 involving Vancouver and several counties in Eastern and Central Washington and Northern Idaho, handling formal traffic "round robin" style. STM Don, W7GB, reported handling about 70 formal messages from the WWA Fair in Puyallup from W7DK. In Memoriam: Sig Elaeson W7GTJ of Electric City became a Silent Key. All 9 OO stations reported monitoring activity for September. 73/KA7CSP. Net Activity: WSN: QNI 851, tfc 255; Noontime Net: QNI 8613, tfc 312; WARTS: QNI 2982, tfc 154. Tfc: K7GXZ 312, W7GB 249, KA7EKL 70, K7BFL 53, KK7T 30. PSHR: W7GB 138, K7GXZ 120.

IDAHO: SM, M.P. Elliott, K7BOI — OOC: N7GHV. SEC: AA7VR. STM: W7GHT. CW was again demonstrated at Museum Days in Boise thanks to Rich Dees, W7BOI. Remember, the Bureau of Disaster Services hold a ARES/RACES net the first Thurs. of the month at 7:30 PM (Mtn.) on 3.990 and 7.290 MHz. They are making an effort to establish ham contact with each Idaho county. The Section now has a Web site! The site has current ARRL news, staff listing, club listing, educational programming ideas, net info and other useful items. If you think of something that should be added to the web site let me know. 73 — Mike, K7BOI. Tfc: W7GHT 467, KB7GZU 88, WB7VYH 51, and N7MPS 12. PSHR: W7GHT 127, WB7VYH 105, and N7MPS 55. Net (SESS/QNI/QTC/ Mgr.): FARM-30/2522/28/ W7WJH; NWTN-30/1094/44/ KC7UND; IDACD-21/ 423/23/K7UBC. Web page: http:// id_arrl.homestead. com/mainpage.html.

MONTANA: SM, Darrell Thomas, N7KOR— After a busy August to supporting the wildfire situation moisture finally arrived in the State relieving the serious situation and allowing the many hams involved to return to their own shack and get back to the hobby. Enough thanks can not be said for all of those who volunteered their time in support of the fire suppression efforts. During recent months since the restructuring went into effect many upgrades to general and extra have taken place. The mystery is where are these folks as we are still not hearing them using the new privileges? I urge all have upgraded to get active, join the nets and start enjoying your new privileges. As a reminder the Montana Traffic Net meets daily at 0030 UTC on 3880. The Montana Section Net meets every Sunday at 0800 local time also on 3880. Looking forward to hearing more of you there. Net/QNI/QTC MTN 1707/ 42 N7AIK, MSN 103/1 W7OW. PSHR: N7AIK 129.

MFJ *RuffRider*™ High Gain Mobile Antennas

A. B. C. D.
Shown on mini mag mounts, not included.

Each MFJ RuffRider™ mobile antenna comes with MFJ's unique 90 degree "fold-over" feature -- lets you pull into your garage without knocking your antenna over!

MFJ's heavy duty bases are extremely strong to handle super rugged rides and day-to-day highway abuse.

MFJ's *RuffRider*™ High Gain dual band 144/440 MHz mobile antenna series is for the serious mobile ham who demands the highest quality, premium products at reasonable prices.

They feature the finest quality construction using precision machined components. *RuffRiders*™ battle the elements, handle rugged rides and day-to-day highway abuse.

Stacked elements with high-Q phasing coils give you outstanding gain. Stay in solid contact!

Phased Radiators

Phased radiators flattens the radiation pattern and concentrates your power to give you *super gain.*

High-Q phasing coils are housed in weather proof high-tech plastic insulation. They're attached to stainless steel stacked radiators by solid metal end sections.

Heavy Duty Base

Rigid, heavy duty solid metal base reduces SWR flutter due to wind vibration. Two Allen set screws securely fastens radiator.

Specially treated center pin provides excellent electrical connection.

Quickly screws off -- helps prevents theft of your expensive rig.

Use SO-239 or NMO Mounts

RuffRiders™ have a PL-259 base mount for quick installation to your heavy duty SO-239 magnet, trunk/hatch, gutter or mirror mount.

A *free* NMO adapter is included for use with an NMO mount.

MFJ mounts are recommended.

All MFJ *RuffRiders*™ are dual band 144/440 MHz antennas and factory tuned for SWR less than 1.5:1 and have 50 Ohm impedance.

MFJ's *No Matter What*™ Warranty

All *RuffRider*™s are covered by MFJ's famous *No Matter What*™ one year limited warranty. MFJ will repair or replace (at our option) your antenna for one full year.

Choose from several different length and gain antennas . . .

A. ***RuffRider Junior*™.** Premium, short 16½" antenna fits in any garage on any auto. ¼ Wave on 2 Meters, ½ Wave, 3 dB gain on 440 MHz. 100 Watts. No fold-over.
MFJ-1402 **$34.95** add s/h

B. ***RuffRider High Power*™.** Just 40" long handles full *200 Watts.* Great for high power mobile amp. ½ Wave, 3 dB gain on 2 Meters, ⅝ Wave, 5.5 dB gain on 440 MHz.
MFJ-1412 **$49.95** add s/h

C. ***RuffRider High Gain*™.** 41½" long antenna gives extra gain with little height increase. Handles 150 Watts. ½ Wave, 3.2 dB gain on 2 Meters, ⅝ Wave, 5.7 dB gain on 440 MHz.
MFJ-1422 **$49.95** add s/h

D. ***RuffRider Hyper Gain*™.** 62½" brute gives a whopping 5 dB gain on ⅞ Wave 2 Meters, ⅝ Wave, 7.6 dB gain on 440 MHz. Our highest gain antenna. Handles 150 Watts.
MFJ-1432 **$69.95** add s/h

144/440 MHz Antenna Tuner with *built-in SWR/Wattmeter*
Covers 136 to 175 MHz. Handles 150 Watts. Compact 4x2½x1½". *New!* MFJ-922 **$79.95**

MFJ *RuffRider*™ super heavy duty Antenna Mounts

MFJ-345 Lip Mount is shown mounted vertically to a mini-van's angled hatchback lip. Note extra-wide mount with reinforcing tab at right -- safely secures heavy antennas. Swivel mount is adjusted so antenna is near vertical away from mini-van to clear luggage rack.

Trunk/Hatchback *Lip* Mount

MFJ-345 **$34.95** add s/h

MFJ's *RuffRider*™ super heavy duty solid steel Trunk/Hatchback *Lip* Mount mounts to any lip on your vehicle.

Extra-wide *four* inch lip and large reinforcing tabs on each side safely distributes the load over your vehicle's lip.

Two large set screws on each end of the mounting lip locks your mount in place. A scratch-proof rubber guard protects your vehicle's finish.

Secures large VHF, UHF and medium size HF antennas even at highway speeds.

Mounts on lips at any angle. Two axis of rotation lets you position your antenna vertically, horizontally or at any desired angle. Serrated swivel joints locks securely in place with huge 3/8 inch set screw.

Has SO-239 base mount. Use adapter for NMO. Includes low loss coax with PL-259 connector, Allen wrenches and protection caps for SO-239 and locking screw, One year MFJ *No Matter What*™ limited warranty.

Mirror/Luggage *Pipe Clamp* Mount

MFJ-340 Pipe Clamp Mount is shown clamped solidly to vertical mirror support rod on a pickup truck. Antenna is slightly swiveled to the left and positioned about 30 degrees from vertical to clear cab of the pickup truck.

MFJ-340 **$34.95** add s/h

MFJ's *RuffRider*™ Mirror/Luggage *Pipe Clamp* Mount mounts on support rod of mirror, luggage rack or spare tire carrier of your truck, van, RV or SUV. Mounts on any horizontal, vertical or angled rod or pipe up to 5/8 inches in diameter.

Secures VHF, UHF and medium size HF antennas even at highway speeds.

Two axis of rotation lets you position your antenna to any desired angle. Serrated swivel joints locks securely in place with huge 3/8 inch set screw.

Convenient *Thumb and Finger* turn knob makes fold-over operation quick and easy. Locks in twelve positions.

Fold down your antenna at night when pulling into your garage and quickly put it back up to its operating position in the morning.

Has SO-239 base mount. Use adapter for NMO. Includes low loss coax with PL-259 connector, Allen wrenches and protection caps for SO-239 base mount and locking screw, MFJ's famous One year *No Matter What*™ limited warranty.

MFJ's *MaxStrength*™ Hi-Flux Antenna Magnet Mounts

MFJ's *MaxStrength*™ high-flux magnet mounts give you maximum pull strength -- your antenna stays on top of your vehicle at highway speeds.

MFJ-333 **$14.95** add s/h
MFJ-335 **$19.95** add s/h

Base is *Euro-style*, black poly or chrome finish with a Mylar protective undersheet.

MFJ magnet mounts come with 17 feet of tough RG-58 coax with a PL-259 connector. Easily reaches operating position.

Choose your favorite antenna to go with these fabulous low-profile mounts for outstanding mobile performance.

MFJ-333 BS/BM, $14.95. Light to medium duty magnet mount. Low profile 3.5 inch diameter black base weighs 1½ lbs. For small to medium size antennas.

MFJ-335 BS/BM, $19.95. Medium to heavy duty magnet mount. Super strong 5 inch diameter *chrome* base weighs a husky 2½ pounds. For medium to large size antennas. It's perfect for MFJ's *RuffRider*™ High Gain mobile antennas.

Order BS for SO-239 connector.
Order BM for NMO connector.

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OREGON: SM, Bill Sawders, K7ZM—ASM: KK7CW. SEC: WB7NML. STM: W7IZ. SGL: N7QQU. OOC: NB7J. STC: AB7HB. ACC: K7SQ. Special "thanks" to those call signs listed above. It's these people who make my job much easier. With over 13,000 Amateur Radio Operators in Oregon, the leadership from these people is awesome. And, with the growth of our hobby, more and more clubs are forming. Clubs with over 100 members, are now forming new clubs, with specialized interests including repeaters, dxing and contesting, emergency communications, traffic handling, and more. In the old days, clubs had committees for these special interests. Take Bend, for instance. Ten years ago, there was CORA, The Central Oregon Radio Amateurs. Nearly 130 members strong. Today, it's less than half that. In the meantime, new clubs have sprouted up, including the Central Oregon DX Club, the Central Oregon Contest Club, the High Desert Emergency Radio (repeater) Group, and the ARES group, who hold regularly scheduled monthly meetings. Many Sisters, Oregon hams also belonged to CORA, but now have their own Sisters Radio Club. Is all this good for ham radio? You bet! Many local hams belong to several different clubs and attend up to 5 and 6 meetings a month. No one said you have to belong to just one club. For information on starting a new club, contact the ARRL Oregon Section Affiliated Club Coordinator, Joe Barry, K7SQ. Happy holidays and keep in touch. NTS traffic totals for September: N7DRP 180, W7IZ 149, W7VSE 148, N7YSS 105, K6AGD 66, KC7SRL 48, KC7ZZB 45, KC7SGM 20, KK1A 8.

WESTERN WASHINGTON: SM, Harry Lewis, W7JWJ—From World Vision and the pen of Roger Schrage, a new Community Organizations Active in Disaster (COAD) document has been written that defines the mission of COAD and what actually comprises a disaster. Such is equally applicable to Amateur Radio. To quote the disaster definition. "A disaster is an event such as a flood, tornado, earthquake, hurricane, fire, explosion, etc., that causes human suffering and creates survivors who need immediate assistance to meet their basic human needs." It is the mission of COAD to, "Organize and deploy community resources, in an effective and timely manner, in response to the needs of community disaster survivors." If the lights go out in your home this evening, how long will it take to find your handheld, and can you program it in the dark? SEC N7NVP reports: change 2 to the WA. State RACES Plan is on the street. The most significant impact of the change is the appointment of the DECs as RACES Region Coordinators (RRC). This is a significant step in the integration of ARES into the state plan. Allan Josue, KC7GPB of WA Emergency Management Division and Jim Sutton, WA7PHD, State RACES Officer have visited all the state regions to explain the ramifications of the change. Please contact your DEC or EC to find out how the change affects the RACES resources and regional nets. In Clallam Co, Don Haubrick, KC7LTW, was pivotal in facilitating a marine rescue. Don responded to a Canadian Ham via the Clallam Co ARC's repeater, who had heard a distress call, from an American boat, on his CB. Don relayed the distress traffic via landline to USCG Group Port Angeles who arranged for the boater's rescue. International cooperation at its finest. Thank you and congratulations Don! And speaking of such cooperation, a recent request from Industry Canada to the Kirkland FCC's Enforcement Bureau to help resolve interference to a Canadian repeater resulted in the formation of a local interference by this SM and we note that the alleged offender is now in receipt of a letter from Mr Hollingsworth. Thanks to the Field Auxiliary and others who participated. 73 and keep your batteries charged.

PACIFIC DIVISION

EAST BAY: SM: Andy Oppel, KF6RCO—ASMs: KC6TYB, KE6QJV. SEC: KE6NVU. DECs: WA6TGF/Alameda County, KO6JR/Contra Costa County, WA7IND/Napa County, K6HEW/Solano County, N6UOW/Training, W6CPO/Technical Services, KQ6TM/Section Plans and Administration. OOC: KD6FFN. EB Web Page: http://www.pdarrl.org/ebsec/ . Webmaster is KB6MP. ORCA planned a picnic at the conclusion of the SET as a way of getting families and friends involved. I enjoyed speaking at the CCRA breakfast meeting. SARS welcomed new member KG6CWU. Congratulations to W6QJJ (now AD6SJ) on his upgrade to Extra. K6USW of CCCC reports that 60% of the club newsletters are delivered via e-mail, a definite sign of changing times. EBARC had a great picnic thanks to the efforts of KC6VLL, KF6MVH and KD6OKJ. VVRC had a full program at their September meeting with N6WVF presenting a HandiHams video and K6HEW demonstrating PSK31 with help from KF6VBJ and W6OMF. ROVARC celebrated the two-year anniversary of the arrival of their ship in Richmond. SARS members demonstrated ham radio at Napa's 11th Annual National Fire Prevention Week. Tfc: W6DOB 643. PSHR: W6DOB. BPL: W6DOB. Tfc nets: NCN1/3630/7PM; NCN2-Slow Session/3705/9 PM; NCN-VHF/145.21/7:30PM; RN6/3655/7:45 PM & 9:30 PM; PAN/3651/7052/8:30 PM. Your check-ins are always welcome.

NEVADA:SM, Jan Welsh, NK7N—ASM: Dick, W6OLD. TC: Jim, NW7O. SEC: Paul Cavnar, NN7B. Welcome aboard AEC: James Tully, N7ENB, and AEC: Julian Rhinehart, W7JFR. Busy month and many checkins for NM: Bobby Eason, AB7WZ. The MS bike ride between Henderson and Laughlin was quite an event, and their APRS tracking worked well. The newer modes used by amateurs are also attractive to newcomers to our hobby. The Silver State road race between Lund and Hiko went well too. They're also using the tracking systems. With some of the participants vehicles going over 200 mph that can be important if one is off the track. LVRACs *QST* machine menu lists everything from relay of space shuttle audio, newsline, announcements, activities and code practice etc. Most useful for visitors. Participants in SET activities this month are to be congratulated. All have obligations at home and yet found themselves working on behalf of others. Thanks to all! Newsletters from FARS, RARA, SNARS, LVRAC, SIERA, and Nellis ARA. From me, thanks for all the cards and good wishes. I'm doing well, getting back to normal (as I can be), 73, Jan. Tfc: N7CPP 18, WB6WCY 2.

PACIFIC: SM, Ron Phillips, AH6HN—Lee Wical, reports that ex-Islander, K6GFJ, Ross, ex-KH6GJW, returned to the islands on vacation with his bride, Mary, for a restful stay in Honolulu. Ross admitted that Honolulu has changed in 20 plus years! They did all the Waikiki touristy things, visiting Pearl Harbor, USS Arizona and the USS Missouri, (BB-63), the Big Mo's club station KH6BB, then around-the-island of Oahu visiting old friends and hams stations. Hope you had a good visit, Ross. Dale Fajardo, AH7D, is the NM for the Emergency ARC Net that meets on the 146.88 Diamond Head repeater on a nightly basis. EARC Net stats (Aug): QNI: 407, Total net time: 767 minutes. Thanks for the info, Dale. Dean Manley reports that the monthly Hilo Hamfest and Tail Gate Swap Meet at Hilo's Wailoa State Park Sept 16 was attended by KH6HME, KH6BMM, KH6KT, AH6NK, AH6HB, NH7D, KH6AVF, W6ORS and KH6B. Kenny Bell, KH6AFQ, was re-elected president of the Hilo ARC. BIARC elected its nominating committee for 2001 officers and directors. They will be presented at the Oct meeting. In accordance with the new DXCC policy, the section now has two DXCC card checkers. They are John Peters, K1ER, on Oahu and Harry Nishiyama, KH6FKG, on Hawaii. Hope that works out to our advantage. Thanks to all for your inputs to this report. 73 and Mahalo, Ron, AH6HN.

SACRAMENTO VALLEY: SM, Jerry Boyd, K6BZ—STM: WA6WJZ. OOC: WY6O. PIC: WA6OWH. SEC/N: K6SOJ. SEC/S: WA6SLA. LGL: WA6ISC. Congrats to KE6GLA for his work on coordinating communications in the Section relative to the 43rd JOTA. If you haven't yet checked out the ARRL's new Emergency Communications Webpage, I suggest you do so. Lots of good information. Thanks to all amateurs in the Section who assisted during the fire season which just concluded. Except for the tragic "Concow Incident" in Butte County, we dodged the bullet this year unlike our comrades in many of the western states. Now it's time to be prepared for winter storm activity. I encourage those active on 2 meter FM to monitor the national calling frequency 146.520. I have tried to do so, and there are hams traveling through our Section on I-5 who do try to make contacts on that frequency to ask directions, etc. It is amazing how far FM simplex will cover in our Section. If all of us with 2 meters monitored .52 there would be significant activity and an incentive to use the frequency and other simplex frequencies as well. In times of emergency, .52 can serve as a good informational "intercom." Once a desired contact is made it is important to move off to another simplex frequency to keep .52 available. Have a safe and blessed Holiday Season. 73 de K6BZ.

SAN FRANCISCO: SM, Len Gwinn, WA6KLK— ASM: KH6GJV. SEC: KE6EAQ. Public service has always been a mainstay of the Sonoma County Radio Association and it paid off big when the Santa Rosa Cycling Club presented them with a very large check to help upgrade their repeaters. Thanks Cycling Club and SCRA! REDXA had a great video of the Heard Island Dxpedition. It came from the NCDX group and they have more that are available to ham clubs for viewing. Lambda of San Francisco had a fantastic ATV demonstration at their last meeting, and also had the Section Officers as guests. Fort Bragg is forming an emergency group besides their twice weekly get togethers. Anyone in that area should join. Ukiah is also trying to expand their membership. K6MHE gave a presentation to the WARS group on the Skeleton Sleeve Fed Monopole antenna. PSK-31 is building in activity in the section and several are using it on the vhf bands also. Many clubs are electing new officers so support them and your club. Now is the time to start changing over the ready bags and emergency plans to the winter mode. Be prepared for rain, wind, and poor travel conditions. KF6STC SK Del Norte, CO.

SAN JOAQUIN VALLEY: SM, Donald Costello, W7WN—SM, Mike Siegel, KI6PR. ASM: John Lee, K6YK— ASM: Pat Fennacy, W6YEP. ASM: Kent LeBarts, K6IN. SEC: Victor Magana, N1VM. OOC: Charles McConnell, W6DPD. ACC: Those of you who use the 6th District QSL Bureau be advised that Steve Frick, N6QEK, is the new Bureau Manager. The Bureau is being moved from Sun Valley to San Diego. The new address is: ARRL W6 Incoming QSL Bureau - P.O. Box 900069 - San Diego, CA - 92190-0069. I would like to remind all in SJV Section interested in DX that the Central California DX Club, Inc. serves DXers of the Valley. If you are serious about DX join the ranks of this fine DX organization. Central California DX Club, 1658 W. Mesa, Fresno, CA 93711-1944. Chet Jensen, W6XK, has been appointed to DXCC card checker, pending approval at League HQ at the time of the writing of this column. Chet can be reached via e-mail at: w6xk@arrl.net. Thanks, Chet, for assuming this task. If you would be interested in serving the amateur radio community by volunteering for an appointment with the ARRL SJV Section please check the Field Organization portion of the League Website for descriptions of positions available. There is an online form to apply. Packet has been displaced by e-mail through the Internet but, APRS is growing by leaps and bounds in the Valley. You only have to watch the APRS traffic on the new national frequency 144.390 to know that packet is not dead, just different. The DX spotting network and APRS are good examples of the continued good use of amateur digital communications. Check out the TAPR web site for the latest on digital communications and downloadable APRS software. http://www.tapr.org.

SANTA CLARA VALLEY: SM, Glenn Thomas, WB6W—SEC: KM6GE. BM: WB6MRQ. TC: WA6PWW. OOC: KB6FPW. My apologies for missing last month's column. I cleverly managed to break my arm. The section news looked somewhat unusual with every other character wrong! The Naval Postgraduate School ARC meets the 2nd Thursday of the month at 7 PM local in Spanagel Hall Room 400 at the school. They also have a monthly "Eyeball Breakfast" (!?!) 0800 on the first Saturday at the Marina Village Restaurant in Monterey. WVARC meets the 3rd Wednesday, 7 PM at the Campbell Community Center. See http://www.wvara.org for details. The Saratoga ARA meets at 7:30 PM every second Wednesday at the Saratoga Fire Station. The club/ARES net meets every Tuesday at 7:30 PM on 28.4 MHz (SSB) and 146.655-(114.8pl). The Santa Cruz County ARC has a new URL for their Website, www.k6bj.org. SCCARC meets at 7:30 PM on the third Friday at the Dominican Hospital, 1515 Soquel DR, Santa Cruz. The Lockheed-Martin ARC may operate a small effort in the CQP contest. They meet at the Sunnyvale Town & Country Round Table on fourth Thursdays, 5 PM for dinner, 6 PM for meetings. Contact Terry, WB6PVU, for details. The SCARES (South San Mateo County ARES group) meets third Thursdays, 7:30 PM at the San Carlos city hall. The Garlic Valley ARC meets at 8 AM on the LAST Saturday of each month, at the Little House Restaurant in Gilroy on Monterey Avenue. The South County ARES net is held each Tuesday at 7:30 PM on K6THR/R (147.825 -.600, no PL). The Palo Alto

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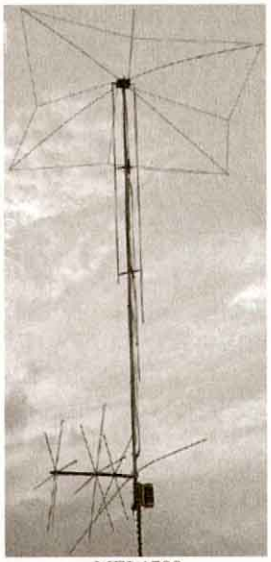

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You can mount it from ground level to roof top and get awesome performance.

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The feedline is decoupled and isolated from the antenna with MFJ's exclusive *AirCore*™ high power current balun. It's wound with *Teflon*® coax and can't saturate, no matter how high your power.

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Incredibly strong solid fiberglass rod and large diameter 6061 T-6 aircraft strength aluminum tubing is in the main structure.

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MFJ's *tiny* 36 inch diameter loop antenna lets you operate 10 through 30 MHz *continuously* -- including the WARC bands!

Ideal for limited space -- apartments, small lots, motor homes, attics, or mobile homes.

Enjoy both DX and local contacts mounted vertically. Get both low angle radiation for excellent DX and high angle radiation for local, close-in contacts. Handles 150 watts.

Super easy-to-use! Only MFJ's super remote control has *Auto Band Selection*™. It auto-tunes to desired band, then beeps to let you know. No control cable is needed.

Fast/slow tune buttons and built-in two range Cross-Needle SWR/Wattmeter lets you quickly tune to your exact frequency.

All welded construction, no mechanical joints, welded butterfly capacitor with no rotating contacts, large 1.050 inch diameter round radiator -- not a lossy thin flat-strip -- *gives you highest possible efficiency.*

Each plate in MFJ's tuning capacitor is welded for low loss and polished to prevent high voltage arcing, welded to the radiator, has nylon bearing, anti-backlash mechanism, limit switches, continuous no-step DC motor -- gives smooth precision tuning.

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MFJ-1782, $339.95. Like MFJ-1786 but control has only fast/slow tune buttons.

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MFJ-1621 **$89.95** Ship Code A

MFJ-1621 lets you operate in most any electrically free area -- apartment, campsite, hotel, the beach, etc. DXCC, WAZ, WAC, WAS have been won with MFJ-1621! Work 40, 30, 20, 17, 15, 12 and 10 Meters with a telescopic whip that extends to 54 inches. Mounted on a sturdy 6x3x6 inch cabinet. Built-in antenna tuner, field strength meter, and 50 feet of RG-58 coax cable. Handles 200 Watts.

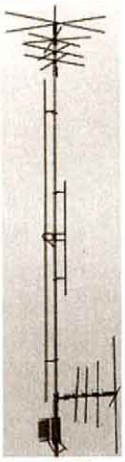
MFJ's G5RV Antenna

MFJ-1778, Ship Code A **$39.95**

Covers all bands, 160-10 Meters with antenna tuner. 102 feet long, shorter than 80 Meter dipole. Use as inverted vee or sloper to be more compact. Use on 160 Meters as Marconi with tuner and ground. Handles full legal limit power. Add coax feedline and some rope or other nonconductor and you're *on the air!*

MFJ halfwave vertical

6 bands: 40, 20, 15, 10, 6, 2 Meters . . . No radials or ground needed



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ARA meets on the first Friday at 7:30 PM in the Menlo Park Recreation Center, 700 Alma Street, Menlo Park. The Millbrae ARC (1st Thursday of the month, 7 PM in the community room of the Millbrae library at #1 Library Ave). See you next month! 73 de Glenn WB6W. Tfc: (Aug) W6PRI 2, (Sep) W6PRI 2.

ROANOKE DIVISION

NORTH CAROLINA: SM, John Covington, W4CC— SEC: KE4JHJ. STM: NØSU. BM: KD4YTU. TC: K4ITL. PIC: KN4AQ. OOC: W4ZRA. SGL: AB4W: ACC: vacant. http://www.ncarrl.org. This month I would like to recognize one of our outstanding operators. Joe Henderson, WD4MRD of Morehead City has been active on our section traffic nets for many years, both as a net manager, net control and regular participant. Joe has been one of our most dependable operators, and he exhibits good manners and a friendly style that makes newcomers and old-timers alike feel welcome on our nets. He has been a tremendous asset for Amateur Radio and the National Traffic System. To recognize Joe's contributions, I am issuing an ARRL Public Service Commendation. Joe recently underwent surgery and will be off of the air for some time. The phone nets, especially on Wednesdays, just don't sound the same without him. I hope with some careful thought and some ingenuity we can find a way to get Joe back on the air very soon. On other matters, I visited a very friendly meeting of the Raleigh Amateur Radio Society in October, and am planning to visit several other clubs in the next couple of months. Thanks to the many clubs that send newsletters each month. I enjoy reading them. If your club has an e-mail version, I am happy to receive that and save you the postage. Sad to report some Silent Keys: Bobby AE4ZQ, Spence WA4ORE. September traffic: W4EAT 431, NC4ML 253, AB4E 213, AA4YW 161, KI4YV 143, K4IWW 93, W3HL 54, KE4AHC 36, WA4SRD 31, W4CC 23, AD4XV 21, WA2EDN 12, KB8VCZ 9, N0SU 8, AE4HJ 8, NT4K 8, KE4YMA 5, N8UTY 3, KF4YHG 3, KT4CD 3, KR4OE 2.

SOUTH CAROLINA: SM, Patricia Hensley, N4ROS—The results of the SM election should be announced any day. Regardless of the outcome, we need to congratulate and support the selectee. It is unfortunate, however, that only about one-fourth of the 6300 licensed amateurs are ARRL members and eligible to vote. Moreover, past history indicates that less than one-half of those actually cast ballots. If this is true, then only 12 percent of SC amateurs participated in the SM selection process. This statistic is unacceptable if SC ARRL attempts to represent the wishes of the majority of amateur operators in the state. The future of Amateur Radio is too uncertain, and this necessitates that the ARRL speaks with a unified voice when defending our avocation rather than expressing the thoughts of a minority segment. The ARRL has already given us two challenges: improving emergency communications and utilization of amateur radio as a teaching resource in our elementary schools. Now, we have a third challenge: increasing ARRL membership in SC. Our new SM will be responsible for multiple Field appointments. May I respectfully suggest that individuals be chosen based upon prior performance and dedication to the purposes of the ARRL. Each should also be required to include membership recruitment as part of their duties. Merry Christmas and Happy Holidays to all. Tfc: KA4UIV 71, W4DRF 65, AF4QZ 61, KA4LRM 48, WA4UGD 41, K4BG 29, WD4BUH 20, KF4HAV 2.

VIRGINIA: SM, Lynn Gahagan, AF4CD—SEC: OOC. KR4UQ. STM: W4CAC. ASM/A: KE4MBX. ASM/B: W4TLM. ASM/C. TC: W4IN. ASM/D: KC4ASF. PIC: W2MG. Obie, WA4DOX, our Net Manager for all of the CW nets reports that new interest in the VSN has taken off. Obie is looking for a volunteer to NCS the VSN on Tuesdays. Obie states, "It's a lot more fun 'being in charge' than 'waiting in the wings.' I am developing a CW net training program to help lesser-experienced CW traffic handlers to improve their proficiency. Should any of you wish to NCS a Virginia Net, I will gladly sit on the sidelines and coach, if necessary, while you take the reins over the Virginia Slow Net, which meets every Tuesday evening - just let me know!" The VSN starts at 7:00pm Tuesdays on 3.680 MHz. For more information contact Obie at wa4dox@arrl.net. Just a reminder that all of the PSHR reports go to W4CAC our Section Traffic Manager. Some are still sending their reports in the wrong direction. These reports should be separate. Do not combine this report with any other. The 2001 Virginia Section ARRL State Convention will be held January 21 at the Frostfest in Richmond. The RATS organization sponsors this event and they always put on a great fest. The City of Franklin had their annual "Fall Fest" located on Main Street in the downtown area. The scene reminded me of a huge block party. Main Street was barricaded off and there were many displays from all types of organizations from the surrounding areas. The Southampton County ARES/RACES group along with others from D10 had the amateur equipment on display complete with all hardware and antennas which the City of Franklin had purchased for their EOC and shelters. It had been over a year almost to date since I had been to the downtown area. It was hard to imagine that where the display was on Main Street that a year earlier, it was covered with about twelve feet of water from Hurricane Floyd. All the amateurs that where there were greeted with warm and kind conversation by the police chief and others from the department. We had all worked together side by side a year earlier. Well, it appears that this year's hurricane season is winding down without any storms approaching Virginia. Let's hope this winter doesn't bring any severe weather. Very 73 de AF4CD. Tfc: W3BBQ 192, KØIBS 136, WA4DOX 110, KQ4ET 104, K4MTX 93, KR4MU 42, W4CAC 84, KV4AP 77, AA4AT 74, WB4ZNB 50, N4ABM 50, KE4PAP 46, K4YVX 30, AF4CD 20, KR4MA 19, W4UQ 18, W4SEE 13, W4JLS 7, W4YE 7, WB4UHC 6, KB4CAU 4, W4MWC 4, K4JM 3, W4IN 2, N4FNT 2, W4VIC 1.

WEST VIRGINIA: SM, O.N.(Olie) Rinehart , WD8V—STM: KC8CON. SEC: W8XF. ASEC: KA8ZOO. SGL: K8BS. TC: K8LG. OOC: N8OYY. ACC: WD8MKS. APRSC: W8XF. PIC: N8TMW. Ann, KA8ZGY, and I were very fortunate to have had dinner with Riley Hollingsworth, K4ZDH, Friday evening in Virginia Beach. He was there to speak to those attending the Roanoke Division ARRL Convention on Saturday and Sunday. He is very interested in talking to people at all levels in the ARRL organization and in Amateur Radio. He does listen intently and even makes notes. You surely can expect to hear from him and the FCC in the future! The FCC has, without fanfare, opened the Multiple Use Radio Service (MURS) in

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MFJ-9606, $159.95. Use Voice or Packet with MFJ's new 6 Meter *FM Communicator*™ Transceiver. Perfect for No Code Techs and Veterans alike. Crystalled for 52.525 MHz calling frequency. Easy to re-channel. **MFJ-9606X, $169.95.** Includes Mic.

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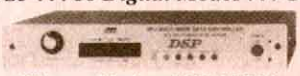

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Alinco[9]/Stdrd HT	MFJ-5022	MFJ-5022YV	MFJ-5022X	MFJ-5022
Icom[1]/Yaesu/ Radio ShackHTs	MFJ-5024	MFJ-5024YV	MFJ-5024X	MFJ-5024B
Kenwood[2] HTs	MFJ-5026	MFJ-5026YV	MFJ-5026X	MFJ-5026
Yaesu 8-pin	MFJ-5080	MFJ-5080YV MFJ-5080YH	MFJ-5080X	MFJ-5080Z
Icom[3] 8-pin	MFJ-5084	MFJ-5084YV MFJ-5084YH	MFJ-5084X	MFJ-5084Z
Kenwood/Alinco 8-pin	MFJ-5086	MFJ-5086YV MFJ-5086YH	MFJ-5086X	MFJ-5086Z
Yaesu 8-pin modular	MFJ-5080M	MFJ-5080MYV	MFJ-5080MX	MFJ-5080MZ
Icom[4] 8-pin modular	MFJ-5084M	MFJ-5084MYV	MFJ-5084MX	MFJ-5084MZ
Kenwood 8-pin modular	MFJ-5086	MFJ-5086MYV	MFJ-5086MX	MFJ-5086MZ
Radio Shack 8-pin modular	MFJ-5088M	MFJ-5088MYV	MFJ-5088MX	MFJ-5088M

1. does not include IC-W2A
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5. YV for KAM VHF port, YH for KAM HF port. Other Kantronics use YV models
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the 150 MHz bracket, just above the amateur 2 meter band, to all. Wonder how long it will take for us to see a repeater here? At least once a year, I make an appeal so please if you have news of Amateur Radio in WV that is beneficial, or of value to others, or some group, club, individual has accomplished something worth while, please let me know by land, sea or on the air, so that I may include in this column. Contact me at WVFN 3.865 6:00 PM local; phone (304)768-9534; fax 304-766-1068; cell 304-541-WD8V (9388) or e-mail wd8v@arrl.org. MERRY CHRISTMAS and a HAPPY NEW YEAR - 2001. 73. Tfc: KA8WNO 261, WD8V 61, W8YS 139, W8WWF 74, KC8CON 43; N8BP 8, WD8DHC 154, WW8D 23; PSHR: WD8V 234, WD8DHC 128, KC8CON 126, KA8WNO 118; W8YS 158, N8MNA 44; WVFN 1018/75//30 KC8CON; WVMDN 733/32/30 WW8D; WVN E 142/89/30 W8WWF; WVN L 135/38/30 W8WWF.

ROCKY MOUNTAIN DIVISION

COLORADO: SM, Tim Armagost, WB0TUB— ASM: Jeff Ryan, N0WPA. SEC: Mike Morgan, N5LPZ. STM: Mike Stansberry, K0TER. ACC: Ron Deutsch, NK0P. PIC: Erik Dyce, W0ERX. OOC: Karen Schultz, KA0CDN & Glenn Schultz, W0IJR. SGL: Mark Baker, KG0PA. TC: Bob Armstrong, AE0B. BM: Jerry Cassidy, N0MYY. ARRL has appointed a new RM division vice director to replace Marshall: he is Rev Morton, WS7W. Rev hails from Casper, WY, and for those who may not be aware, he served as Wyoming SM from 1993 through 1997. Look to see him at Colorado swapfests- and make him feel welcome as he travels around our section. I attended the annual BARCfest in Longmont a couple of weeks ago and was disappointed with the low turnout- both attendees and vendors. I attend to see folks from around the section, and for the various forums and demonstrations that are offered. I've noticed this downward trend in attendance, and I wonder what's the cause? E-mail me at the address below and tell me why you don't attend swapfests, and what you would like to see in order to attend? A slow-speed CW traffic net has been started: The Mountain States Net is for NTS traffic to/from AZ, CO, NM, UT and WY and will have liaisons to TWN. Check in on 3715 at 7:45 PM MDT (0245Z). The net will move to 7115 during daylight savings time. Contact Pete Hills, W0HXB, for more info. Packet radio seems to have gone the way of the dodo. In the Springs, the last primary station moving traffic out of the area (N0DAJ) has gone off the air. There are still the three PacketClusters (DX, ARES and RACES) and several individual stations still on the air, but most of the local packet interest has moved from BBS/Node/Traffic to APRS. What about the rest of Colorado? E-mail me: n0wpa@arrl.net. 73, de N0WPA. NTS traffic: AD0A 160, KI0RP 54, K0TER 40. CAWN: W0WPD 936, W0GGP 487, N0NMP 480, K0HBZ 459, W0NCD 420, W0LVI 396, WB0VET 377, N0JUS 312, K4ARM 290, AA0ZR 286, N0FCR 194, N0DKK 141, WD0CKP 120, KI0ND 105, KB0QBF 43.

NEW MEXICO: SM, Joe T. Knight, W5PDY—ASM: K5BIS & N5ART. SEC: K6YEJ. STM: N7IOM . NMs: WA5UNO & W5UWY. TC: W8GY. ACC: N5ART. New Mexico Roadrunner Net handled 124 msgs with 1285 checkins. New Mexico Breakfast Club handled 231 msgs with 1082 checkins. Yucca Net handled 30 msgs with 577 checkins. Caravan Club net handled 9 msgs with 490 checkins. SCAT Net handled 18 msgs with 479 checkins. Four Corners Net handled 22 msgs with 374 checkins. GARS Net handled 9 msgs with 28 checkins. Rusty's Net handled 92 msgs with 720 checkins. Valencia County Net handled 8 msgs with 39 checkins. Deming ARC Net handled 16 msgs with 71 checkins. Our Duke City Marathon 2000 went extremely well, and it was a real pleasure to have over 40 amateurs out so early on a beautiful fall morning. Over 4,000 participated in the races. Nice to see our NM Governor coming in about 22nd in the full marathon! Ed Ricco, K5LI, and his crew certainly deserve our thanks for a job well done. K5QQ & K5HAB deserve a big vote of thanks for supplying the APRS unti used in the race and for the APRS units in the upcoming International Gas Balloon Race in October! So very sorry to report the passing of W5OLN (a charter member of the ABQ DX Association and a personal friend for over 52 years), KC5DUT, W5FMM, KC5ERA, KA5LDT, KA7CNR and N5YPN. They will all certainly be missed! Best 73, W5PDY.

UTAH: SM, Mel Parkes, AC7CP—I would like to wish everyone a Happy Holiday Season! Hey did any one notice the blooper in my column last month? If you did, send me an e-mail with the error I made and I'll send the first correct response a neat surprise! Most of our Utah clubs will be holding elections in December. This is your chance to make a difference by running for office or nominating someone who you know will help your club in the next year. The Utah Hamfest will be at Ruby's Inn in July so start making plans now we have some very special guest speakers already lined up and you won't want to miss hearing from them. Well 2000 has sure gone by fast, and I hope you all get the special goodies you have been waiting for under the tree on Christmas day. 73 de AC7CP.

WYOMING: SM, Bob Williams, N7KLH—Winter approaches rapidly, but with the long winter come many opportunities to sharpen communications skills. A communications exercise being planned for all Wyoming hams will be explained to Wyo Ham clubs via e-mail. To ensure that all clubs are notified, please drop an e-mail to nn7h@trib.com for full details. Several of the Wyo nets need net control stations. Contact WB7S, WB7K, W7TOY, and WB7FFK and lend-a-hand! A slow speed CW net now meets on 3715 at 1915 local. Several Wyo hams are already active. Remember the warnings now being issued about the ham frequencies: use them or lose them! Sunday mornings, beginning at 0800 on or near 3923 is a great time to meet other Wyo hams and also the time to volunteer! September Traffic: Wyo Cowboy Net: Sess 21 QNI 788 QTC 3; Pony Express Net: Sess 4 QNI 160 QNI 0; Wyo Jackalope Net: Sess 26 QNI 440 QTC 0; Wyo HERC Net: Sess 4 QNI 106 QTC 0. Tfc: NN7H 282. PSHR: NN7H 198. Let's have some fun with the communications exercise...PARTICIPATE. 73 de NN7H.

SOUTHEASTERN DIVISION

ALABAMA: SM, Bill Cleveland, KR4TZ — ASMs: W4XI WB4GM KB4KOY. SEC: KC4PZA. STM: K4JSJ. BM: KA4ZXL. OOC: WB4GM. SGL: KU4PY. ACC: KV4CX. TC: W4OZK. PIC: KA4MGE. Happy Holidays! I hope your enjoying your time with family and friends. Since this is the end of 2000, I thought it would be appropriate to look back at the events that shaped the year in the Alabama Section. Well, January started the year with a Y2K net. Nothing happened, but we were ready and Michael Glennon (KB4JHU) and Walter Verney (AF4HE) received a certificate recognizing their efforts from Governor Don Siegelman. In April, ham radio as we know it changed when the FCC dropped the 13 WPM and 20 WPM code tests and lower the number of operator classes to three. In May, during the Birmingham Hamfest, we had our first meeting of the Alabama Amateur Radio Clubs. And in August, Christopher Arthur (KT4XA), a former ASM in the Alabama Section, was awarded the Newsline Young Ham of the Year for 2000. When it comes to the Alabama Section during 2000, these highlights are just the tip of an iceberg. It is with fond memories that I look back at the wonderful year we had. Again Happy Holidays and before I end this column, let's take a few minutes to remember all our friends who became Silent Keys during 2000. We'll never forget them. God bless & 73, Bill Cleveland KR4TZ.

GEORGIA: SM: Sandy Donahue, W4RU—ASM/South Ga: Marshall Thigpen, W4IS. ASM/Legal: Jim Altman, W4UCK. SEC: Lowry Rouse, KM4Z. STM: Jim Hanna, AF4NS. SGL: Charles Griffin, WB4UVW. BM: Eddie Kosobucki, K4JNL. ACC: Susan Swiderski, AF4FO, OOC: Mike Swiderski, K4HBI. TC: Fred Runkle, K4KAZ. PIC: Matt Cook, KG4CAA. The Georgia Section staff hopes you have a safe and fulfilling holiday season. I hope you all received that state-of-the-art HF transceiver you asked Santa for. The hamfest scheduled for Dec 2 in Claxton has been cancelled. The Four Rivers club in Vidalia has picked up the slack by scheduling a tail-gate party in Lyons, Ga in Parton Park. Contact WD4BBK for details. Cliff Watson, KR4M, Columbus, became a SK on Oct 2. Our condolences to his family. In Sept, I gave the program at the Lanierland ARC in Gainesville. Their 2001 hamfest is July 14. In keeping with the tradition of the best way to an SMs heart is through his stomach, I enjoyed food and hospitality at the Alford ARC picnic at W4EPI's house and the annual Ga Cracker Net picnic in Ellijay. Looking forward to the Christmas party season. By the time you read this, the new Phase 3D satellite should have been launched by AMSAT. Their 2001 Space Symposium has been scheduled at the Holiday Inn Select in Decatur, Oct 5-6. 73, Sandy. Tfc (Sept) W4WXA 141, AF4NS 85, WU4C 46, AF4PX 39, K4WKT 38, W4AET 35, WB4GGS 25, K4ZC 17, K4BEH 13, K4BAI 2.

NORTHERN FLORIDA: SM, Rudy Hubbard, WA4PUP—ASM Capital District:K4VRT. ASM East Central District: K1CE. ASM West Central 42F, ASM FL Crown District: N4UF. ASM Suwannee District: W2DWR. ASM: E Panhandle District: WA4NDA. ASM: W Panhandle District: KO4TT. ASM APRS: WY8O. ACC: WA4B. BM: N4GMU. OOC: W4QV. PIC: KF4HFC. SEC: WA4NDA. SGL: KC4N. STM: WX4H. TC: KO4TT. Packet: :N4GMU. Here is wishing everyone a healthy, and Happy Holiday. May the coming year be real good to you and your family. At time of writing this, the politicians are making promises that cannot be kept. But let me borrow one from the past, do not ask what ARRL or Northern Florida Section can do for you, but what can you do for the ARRL and the NFL Section? Your views and comments are welcomed. All amateurs must register with the ULS in order to file applications the FCC. FCC has begun implementing the new Commission Registration System, or CORES. For further information check the FCC Web site, FCC, gov and click on ULS. The OO program is very active, as the FCC has been busy especially in Florida. A ham in Jupiter was taken into custody and faces a $20,000 fine, and has been released on $100,000 bond. The agents seized items related to the alleged offenses, including radio equipment. ARRL casts only vote in favor or retaining Morse code. The IARU conference requested to remove Morse code proficiency as qualifying criteria, and the ARRL casts the only dissenting vote. The FRC has designated a PL tone in the hopes repeater owners will standardize on a particular one. They are: Northwest 100.0, North Central 123.0, Northeast 127.3, West Central 146.2, Cent 103.5, West Central 107.2, Southwest 136.5, South Central 206.5, Southeast 110.9, Deep South 114.8. de 73 Rudy. Tfc: WX4H 1676, KF4NFP250, KE4DNO 250, K1JPG 185, AF4PU 137, KE4PRB 129, KG4EZQ 115, NR2F 107, AB4PG 50, AF4GF 46, K4DMH 45, WB2FGL 43, KB4DXN 36, K4JTD 34, KM4WC 28, W4KIX 27, N9MN 20, W8IM 16, N4JAQ 15, WX4J 14, KJ4HS 12, KF4WIJ 11, WA1VOP 9, WB9GIU 4, WA4EYU 4, WB2IMO 3, KG4HBN 3.

PUERTO RICO: SM, Víctor Madera, KP4PQ— La FRA celebró su Asamblea Anual el domingo, 29 de octubre de 2000 en Arecibo. En nuestro próximo informe les daré detalles de la nueva directiva. Ya se formalizó la fecha para la actividad que conmemora la instalación del primer telégrafo por Samuel Morse en Arroyo, P.R. Será el 2 y 3 de diciembre. Auspicia la FRA y el PRARL. El ARRL/VEC de Puerto Rico ya publicó su calendario de exámenes para el 2001. Habrá sesiones en toda la isla los segundos jueves de cada mes. Los exámenes de fin de mes en la UPR continúan sin cambios. Información visitando http://prarl.org/examenes.html. El JOTA se celebró en toda la isla. Entre los participantes estuvieron el PRARL en Bayamón a cargo de Héctor Pérez, NP4FW operando KP4ES; en Cayey José Vega, KP4VP, en Hatillo Angel Vázquez, WP3R operando KP4AO, en Ciales, Cesar Mora, KP4RZ operando K2BSA/KP4 y en Salinas Angel Padilla, WP4G. Felicitamos a todos los que participaron en el Jamboree-on-the-Air 2000. Envíen información sobre sus intereses vía email a kp4pq@arrl.org.

SOUTHERN FLORIDA: SM, Phyllisan West, KA4FZI —Thanks to Collier ARA, Dade ARC, Dade ARPSC, Ft. Myers ARC, Hollywood ARC, Indian River ARC, Martin SKYWARN, Orlando ARC, Osceola ARES, St Lucie Repeater Assoc, Vero Beach ARC, Wellington ARC, and section EC's for the newsletters and activity information. The Division Director, Frank Butler, recently approved Bill Shisler Sr, W3DHN, as our new section DXCC card checker. Bill is also able to check WAS, 5BWAS, and VUCC Cards. You can contact him at: wshisler @bellsouth.net or at 561-46-5648. The Broward ARES/RACES plans to participate in a required area nighttime airport drill using packet, voice, SSTV, and FSTV. The Collier newsletter listed Web access for RF Safety information: http://www.arrl.org/news/rfsafety/, and http://n5xu.ae.utexas.edu/rfsafety, which has an online calculator to do the evaluation for you. Dade volunteers are gearing up for the circumnavigation of Biscayne Bay event Oct. 21 and planning for an Open House/Field Day in January. The ARPSC in Miami is beefing up emergency preparedness. W4HN, has signed up a group for the Spanish version of "CERT" from the America RC. With a high Spanish-speaking population, this

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training will be invaluable if a disaster should strike that area. Best wishes for success in all endeavors. KF4UTH organized a digital seminar in Ft. Myers that was well attended and had demonstrations, hands on tryouts, Q&A session, and equipment check. KD4DQY, plans a seminar for Indian River County on packet and APRS to be given by KE4YEK for the Vero Beach ARC. Kudos to Palm Beach ARC as the 20 students in their last radio class all earned licenses. The South Palm Beach County/K4FAU Club was invited by the FL Atlantic Univ. Police to assist in the first ever FAU Football team scrimmage. The Indian River ARC has just announced its $1,000 scholarship for the year 2001. This memorial scholarship fund encourages young people to become amateurs as well as pursue college degrees or certification as electronic technicians. Martin SKYWARN was busy this month when a tornado warning was issued as three funnel clouds were reported and confirmed. Monroe County's EC, WA4JFK, notes that ALL repeaters in the keys are linked during nets and any emergencies. Osceola thanks N4ZIQ for rescuing the SKYWARN net this month. Their repeater had been put out of service by a lightning strike, so Joe used his equipment and tall tower to cross-band the 444.100 to the output if the 145.350 (publicized freq) to achieve excellent coverage. They are trying to obtain a new repeater and thank the Kissimmee Fire Department Chief for funding replacement of the destroyed antenna. The Wellington ARC, known for unique meetings, will congregate in the EOC parking lot where hams can have their equipment checked for frequency deviation, power output, and antenna SWR. Sept tfc by Jan, KJ4N: WA9VND 581, KA4FZI 311, KB4WBY 308, KJ4N 259, KC4ZHF 238, KD4HGU 162, KD4GR 152, K4VMC 134, WB4PAM 130, KE4IFD 121, K4FQU 92, KD4JMV 63, W8SZU 62, KT4XK 43, KN4JN 38, WA4EIC 34, WA4CSQ 34, AA4BN 31, KF4IDG 27, KE4UOF 24, KG4CHW 20, W4WYR 15, K4OVC 9, KE4WBI 5, K4ENA 2, W3JI 2.

VIRGIN ISLANDS: SM, John Ellis, NP2B, St Croix. ASM: Drew, NP2E, St Thomas. ASM: Mal, NP2L, St John: SEC: Duane, NP2CY. St Thomas. PIC: Lou KV4JC, St. Croix. ACC: Debbie, NP2DJ, St Thomas. NM: Bob, VP2VI/WØDX, Tortola. The St John ARC provided communications for the 2nd St John Triathalon on Labor Day, Jim, KP2L, Bill, NP2JC, Tony, KP2Z, and Paul, NP2JF, provided race details from selected locations along the race route. George, KP2G, was at race communications control at the bicycle-to-runner staging area and the finish line in Coral Bay. A minimum of 8 people expected to upgrade or take initial exams on St Croix at next session. 10M has been in excellent shape recently - hope that is a good indication of what we can expect this winter. Team "Ritty", operating KP2D, staffed by veterans Drew, NP2E, Ron, KP2N, Carl, NP2BT, Debbie, NP2DJ, and Bernie, NP2W, provided a respectable (if not winning) score for the CQWW RTTY contest from St Thomas. Visit the VI Section Website maintained by Jeanette NP2C (XYL of NP2B) (**http://www.viaccess.net/~jellis**). Repeaters on St. John 146.63, St Thomas 146.81, St. Croix 147.25. 73 to all, John, NP2B.

WEST CENTRAL FLORIDA: SM, Dave Armbrust, AE4MR ae4mr@arrl.org http://www.wcfarrl.org. The 1st annual West Central Florida Section Convention is Dec 2nd & 3rd at the Tampa Bay Hamfest. Highlands County ARES provided 159 man-hours for the **Tour of Sebring Bike Rally.** Special thanks are extended to those that helped with Hurricane Gordon**.** The section needs more Public Information Officers please consider applying for this important position. August**:**

Net/NM	*QNI*	*QTC*	*Bulls*	*QND*	*Sess*
AIN/WA4ATF	96	6	7	124	4
Polk ARES/KE4VBA	96	0	11	121	6
SPARC/KF4FCW	441	31	0	780	30
Turtle/KT4TD	358	125	0	505	30
HCAN/KD4CQG	59	4	5	62	4
FMSN/KT4PM	263	54	0	421	30
TPTN/AD4IH	665	83	0	379	30
QFNS/KF4KSN	185	38	0	660	30
QFN/AB4XK	819	324	0	1,044	30

PSHR: AD4IH 459, K4SCL 169, AB4XK 141, K4RBR 140, KT4PM 139, W4AUN 118, WB2LEZ 117, KF4KSN 111, KT4TD 110, KE4VBA 104, AE4MR 72, Tfc: AD4IH 762, AB4XK 307, K4SCL 262, KT4PM 74, KE4VBA 53, KF4KSN 40, KT4TD 34, K4RBR 20, W4AUN 19, WB2LEZ 6, W4HCS 3, AE4MR 2. 73, Dave, AE4MR.

SOUTHWESTERN DIVISION

ARIZONA: SM, Clifford Hauser, KD6XH—We now have an Arizona Web site. Tom Fagan, WB7NXH, has developed a Web site for the Arizona section. The address is www.qsl.net/arrlaz/. As this Web site progresses, we will add more items of interest. If you have questions or ideas on how to improve the site, contact Tom at www.wb7nxh@arrl.net. The SW Convention is over, and I heard many good comments (many from California hams) about the various presentations. All the presentations were well attended with many having standing room only. The banquet with Riley Hollingworth as a speaker was sold out, and the DX breakfast with Vince Thompson, K5VT, on his trip to Bhutan, was well attended with standing room only for the program. Next year the SW Convention will be in Riverside at the Holiday Inn. The next event here in Arizona is the Fall Hamfest on 2 December 2000, at Mesa Community College. Rick Paquette, W7RAP, has been appointed as an assistant section manager with the purpose of coordination of VE examinations through the state. I get many calls each month asking for the next scheduled VE testing and normally don't have the up-to-date information. Rick will be the state's single point of contact for this activity and will be able to provide the necessary information. He can also get a VE team together to help with examinations. Please give him all the help he needs to do this important function. Rick can be reached at 520-794-0387. ARRL headquarters has approved Ned Stearns, AA7A, for DXCC card checking. He is a member of the Central Arizona DX Association and will be available for card checking during major hamfest and other times as necessary. 73, Clifford Hauser, KD6XH. ATEN: 888 QNI, 25 QTC, 30 sess. Tfc: K7VVC 960, W7EP 80.

LOS ANGELES: SM, Phineas J. Icenbice, Jr., W6BF — ARES, Amateur Radio Emergency Service, is a great organization operated in our LA Section by SEC Hank Magid, K6YMJ and (A)SEC/DEC, Dennis Smith, KA6GSE. We have received

several donations this month for our Emergency Van. Anyone, who would like to donate equipment or money for our ARES Van Project can receive an (IRS) Charitable Contribution Certificate from Hank. The ARRL Section volunteers would like to send our appreciation to all of those Amateurs who have contributed to our ARES program. Thank you! Thank you again! Our new ACC (Affiliated Club Coordinator) Bill Leslie, WA6POK, would like you to know that the LAACARC has purchased the ARRL set of 11 Educational Videotapes for use of LAACARC member Clubs. Bill is the custodian of these great ARRL videotapes. These are just what the Doctor ordered when your Club Program fails to show or you need a good training aid. All you need to do is, contact, Bill at wa6pok@moonlink.net for action and service. Bill might even deliver the tapes if you buy his lunch or dinner. The web sites provided by our Section are qsl.net/arrlsw/lax. This will link you to the division Web site and the Division (Fried) which in turn will link you to ARRL HQ. You will be excited when you find out just how much information is available on these Web sites. We are always looking for more information. So don't be bashful. E-mail us your new information or interests. The ARRL convention in Scottsdale, AZ, was great, we were able to spend a lot of time with our new go-go ARRL President Jim Haynie, W5JBP, who I assure you is working the Washington Circuit for the benefit of us all. (u-all) I am convinced that we have a real winner with W5JBP, and we should be very proud that, "Jim was nominated for President by our own Director Fried Heyn". We stopped in Quartzsite for re-fueling on the way home where we were accosted by a group of extremely friendly local Hams at one of their favorite eateries. The first words that I heard were," we know you and we read your *QST* column every month and love it". Now you know anyone who reads my column must be listed. They are WA7HIF, Jim, KC7BUC, Elmer, WB6WYU, Bill, and KA7DSC, Mel. These rock hounds appear to eat, drink, dig and communicate with each other on a regular daily basis. The Quartzsite ham population, they told me, sometimes during the winter months, explodes to an estimated 300 hams. Many are also rock hounds. Vy 73 de W6BF, Phineas.

ORANGE: SM, Joe Brown, W6UBQ, 909-687-8394. We enjoyed the SW Div Convention in Scottsdale, Chairman Walt, N7IZM, and his staff did a fantastic job. The Orange Section Semi-Annual Staff meeting was attended by Jim, W5JBP, ARRL President and Dave, K1ZZ, ARRL Executive Vice President. Thoughts and concerns regarding the Amateur Radio Service were shared by all. It was an honor to have the top ARRL Officials observe our Section Staff in action, along with Fried, WA6WZO, SW Div Director and XYL Sandy, WA6WZN, ACC, who were in the middle of it all. Nick, KA6GVY, has retired after many years of outstanding service as OOC and John, KC6TFS, has been appointed as our new coordinator. He has some great ideas to apply to the OO and FCC Auxiliary activity. From CLARA's Smoke Signals. From RCARA's Monitor: When a wild land fire broke out east of Temecula, Riv Co RACES was activated to support the Red Cross. Over 20 Amateurs responded to the Radio Communication need, and operated under the direction of Duane Arnold, KD6MVW. From C-Bar-C's Modulator: The Route 66 Rendezvous was a PR dream. We spoke to many people about Ham Radio, our Club and classes. Over 1000 contacts by our Special Event Station K6K were made. From AARA's Squelch: Let a Club Board member know if we are not meeting your needs as a club. Any suggestions? Your support is needed. From TASMA's NEWS: Local hams are not getting involved with frequency coordination bodies. We need more members to become active and to serve as board and committee members. The LA Council of ARCs, The Orange Council and the Inland Empire Council of AROs should become involved. B.C.W.S and CNARC news: Both clubs are using basic construction as a club meeting activity. A great idea. SM's Words of Wisdom: Invite a newly upgraded ham over to use your HF station ... like chicken soup, it couldn't hurt. NTS Traffic: W6QZ 168, KC6SKK 144, W6JPH 125, K6CTW 56, W6QZ NTS BBS QTC 224. PSHR W6QZ 159, W6JPH 123, KC6SKK 108. SCNV Net 2 Sessions, QNI 170. QTC 52.

SAN DIEGO: SM, Tuck Miller, NZ6T, 619-475-7333— Jingle Bells, Jingle Bells, is it that time of year already? I cannot believe how fast time flies when you are having fun. As for me, it really goes fast. Some very important items to start off with. Gayle Olson, K6GO, has had some problems with her small San Diego community of Poway and her antenna "structure". For some oddball reason, some of the powers to be considered all her antennas to be one structure, and when and if she ever wanted to put up another, she would once again have to ask the Poway folks for permission to do so. By doing that, she once again would have to open up Pandora's box, and have everything for review. They made her take several antennas down, including an R7 vertical, and a 40/80-meter dipole. The Poway city council had a meeting on October 10, where hams virtually filled the room. The council was overwhelmed, and agreed to look more into the matter, and to draft an ordinance that dealt with, and is friendlier towards Amateur Radio. Let's hope this is this case. Good luck to Poway, and to other communities that are experiencing the same type of problems. On a very sad note, the San Diego section has lost a long time ham, a person who was very active not only in the club scene, but in net control procedures for our section 80 meter net. Nick Callas, K6DBJ, an outstanding example of how nets should be run will be sorely missed. Elections will be taking place all over the sections at various club meetings during the next few months, and I ask that you please keep me informed of any new officers, and contact folks. Traffic: KT6A 564, KD6YJB 128, KF6YVQ 31, WA6IIK 3. BPL:KT6A 564 PSHR: KT6A 138 KD6YJB 54. Until next month... Remember, Helping Others.....Always Worthwhile!! 73, Tuck, NZ6T.

SANTA BARBARA: SM, Robert Griffin, K6YR, (k6yr@arrl.org or **k6yr@arrl.net**)—SEC: Jack Hunter, KD6HHG (kd6hhg@arrl.net). STM: Ed Shaw, KF6SHU (kf6shu@arrl.net). SGL: Paul Lonnquist, NS6V (paul@dock.net). ACC: Michael Atmore, KE6DKU (jatmore@telis.org). OOC: Howard Coleman, W6HQA (w6hqa@arrl.net). PIC: Jeff Reinhardt, AA6JR (jreinh@ix.netcom.com). TC: Warren Glenn, KM6RZ, (wglennrz@ix.netcom.com). ASMs-Ventura, Don Milbury, W6YN (w6yn@arrl.net). San Luis Obisipo, Bill Palmerston, K6BWJ & for Internet, Jack Bankson, AD6AD (ad6ad@arrl.net); & DECs: Santa Barb-Dave Lamb, WA6BRW (wa6brw@arrl.net); SLO- Bill Peirce, KE6FKS (ke6fks@arrl.net) & Ven-Dave Gilmore, AA6VH (aa6vh@arrl.net). Our SEC, Jack Hunter, KD6HHG, was selected the 1999 ARRL Southwestern Division Volunteer of Year & his award was presented at the Scottsdale Convention. Congrats! Join the Section Reflector: Send a blank e-mail: arrlsb-subscribe@ egroups.com and be part of the Info Hotline. Receive instant updates on Section news-FREE! SB Sec Web: www.qsl.net/arrlsb/. Join in our Section NTS traffic nets: SCN slow speed NTS Net, M-F, at 1915 local on 3598 kHz & SCN/SB at 2100 local on 147.000+(131.8), 224.90- (131.8) & 449.300-(131.8). PSHR/Tfc: K6YR 168/278, KF6OIF 118/68, KC6NBI 112/29, W6VIF -/12 & AD6LW 114/-. Rob, K6YR.

WEST GULF DIVISION

NORTH TEXAS: SM, Don Mathis, KB5YAM—STM: KC5OZT. BM: KC5OZT. SEC: K5MWC. SGL: N5GAR. OOC: WB5UDA .ACC: WN5PFI. ASMs: KX5K, K5RE, KK5QA, KK5NA, N5JZ, KB5LWZ, KD5HIS, AD5X, W5GPO. Visit the section Web page at (http://www.lsic.net/net/ntexas.html) for the most current information. Well, as I am entering this in we are approaching the Denton Hamfest once again. When this appears, it will be getting close to Christmas, and the deadline for the Section Manager elections. See *QST* for rules and dates. If anyone is interested in running, I would be glad to talk or meet with you to discuss any details of the job. I sure would like to see a good election. I look forward to working with whoever is elected. May you all have a safe and merry holiday season. Again, I would like to thank all the members of my staff and the other section appointees for all of the efforts that they have done for the section in the last year. Tfc: N5JZ 702, K5NHJ 640, KC5OZT 505, KB5WEE 284, K5AO 178, W5AYX 130, KC5VLW 92, WA5I 81, KB5TCH 77, N5GG 45, AC5UZ 12, AC5Z 9, N8QVT 1, KB5YAM 0. BPL: N5JZ 702, K5NHJ 640, KC5OZT 505, KB5WEE 117 originations/deliveries. 73, Don, KB5YAM.

OKLAHOMA: SM, Charlie Calhoun, K5TTT—ASMs: N6CL, W6CL, W5ZTN. SEC: KA7GLA. ACC: KB5BOB. PIC: WA9AFM. OOC: WA9VMY. SGL: W5NZS. STM: K5KXL. Congratulations to Callen Gilbert, AB6JY, on his appointment to ASEC. Callen will be serving as training officer for Oklahoma ARES. I attended Enid Hamfest while our Director attended the Lawton hamfest. Both were well attended. We had a great ARES meeting with our new SEC in Enid. Look forward to a new section on the Web devoted to Oklahoma ARES. I'll post that address next month. TARC held their fall ice cream social and swap meet and great fun. They also have a new repeater in their 440 link system that covers the east half of the state. It is in Muskogee on 443.100 with 88.5 PL. New CORA officers are Pres Tom Miller, KD5ENL, VP Jerry Sproul, WA5JS, Treas Hal Miller, KB1ZQ, Sec Forrest Rush, N5VWF. OKDXA new officers are Pres Larry Shima, WØPAN, VP Clif Sikes, N5UW, VP Dick Stricker, NJ5S, Sec/Treas Jerry Chouinard, K5YAA. OCAPA officers are Pres. Mark Hamblin, WL7FT, VP Ron McCubbin, KC5QCV, Treas. Mark Watkins, NM5W, Sec Clay Mayrose, WA6LBU. The Broken Arrow Club set up a station for the JOTA event at Camp Russell and had a lot of fun with the boys. Section Web site http://www.busprod.com/k5ttt. 73 and Happy Holidays. Charlie. Tfc: N5IKN 581, KK5GY 514, WA5OUV 484, KF5A 287, K5KXL 165, WB5NKC 147, W5REC 26, KI5LQ 76, KE5JE 73, WB5NKD 71, KM5VA 62, WA5IMO 59, N5FM 2.

SOUTH TEXAS: SM, Ray Taylor, N5NAV—ASMs: NR5ED, N5WSW, W5GKH, K5DG, N5LYG, WA5UZB, KK5CA, K5EJL, W5ZX,WA5TUM, KB5AWM, WA5JYK, K5PFE, K5PNV, and K5SBU. STM: W5GKH. SEC: W5ZX. ACC: N5WSW. TC: KJ5YN. BM: W5KLV. OOC: W5JAM. SGL: K5PNV. December is upon us, and what have we done this past year for the betterment of mankind? Government Agencies are beginning to recognize the value of ham radio operators in our area for their backup communications. Are we as ham operators doing our best? We need many more that will volunteer time in first, learning the system before disaster strikes, then practice so you will be ready to be a net control or go to the field. We have to man the agency's locations, shelters, and many more assignments in order to be of any value. Don't forget we are not there to tell them how to run their business or to interfere. We're there to furnish communications. It's of the utmost importance that you be trained in advance. The training is the responsibility of our clubs. The FCC has stated that the only way they can justify some of our frequencies is the communications we provide during a disaster. We must start coming up with new ideas to advance the technical side of the art, and promote international good will. Riley praised our work in disasters and the National Traffic System. The upper 100 kHz of our 40-meter band is one of the prime targets. The Brazosport ARC had their 18th annual Brazosport Relay Triathlon September 20th. Swim-run, run-run, and bike run. There were 12 operators that provided communications. They were WB8PHO, KD5CMN, WA5OJZ, KM5AS, KB5OTE, WD5AAH, KB5SQH, WB5YPW, N5WHJ, KD5CXD, N5KV, and W5GKH. If your club has done something you would like for me to add to the SM News, I must have it by the first of the month. It will appear 3 months later. This is the time of year when you have your Christmas parties. Enjoy, but do drive safely. We want you around for next year. I hope you get the rig of your choice or a tie and a pair of socks for this Christmas. Remember though, it's better to give. Find someone you can help. Have a Very Merry Christmas and God Bless. Tfc: W5SEG 909, KA5KLU 128, W5KLV 154, W5TUK 128, N5OUJ 108, W5GKH 102, N5NAV 77, W5ZX 72, KØYNW 40, KD5GM 14, N5JUU 1.

WEST TEXAS: SM, Charlie Royall, WB5T, 915-944-0469, WB5T@arrl.org—ASMs: Cley, K5TRW. Ron, KB5HGM, Jerome, K5IS, Fred, W6VPI, Sandy, W5MVJ. SEC: Alex, N5LRH. OOC: John, KO5D. OBM: Frank, N5WT. Lubbock ARC operated K5L Special Event Station Sep 22-30 at the South Plains Panhandle Fair. Key City ARC, Abilene, has a new newsletter Editor-Stephen Sheasby, KD5DRM. REACT has not taken over operation of ARES, but has been invited to provide a cooperative effort, while retaining separate identities. New Techs in Midland: Jerry Hearn, KD5LRD, William Lawless, KD5LRF, and Bradley Kuhn/KD5LRE. Congratulations and welcome! FCC issued a warning to N5OGD in Abilene for harassment of Key City ARC repeater users. He was given 20 days to respond or face revocation of his license. Silent Key-Bryant Saxon, KD5C, Extra Class from Midland. He was an educator with the public school system, Ham Xtrodinare, and a VE Team Leader. He will certainly be missed! Wishing you and your families the very best during this Holiday Season, and hope you enjoy a fun-filed and safe Happy New Year. Until next time, 73 de Charlie, WB5T.

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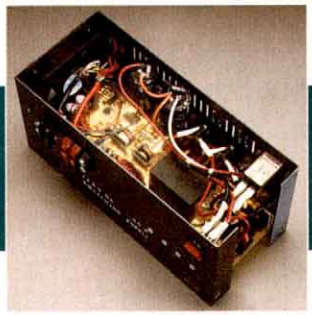

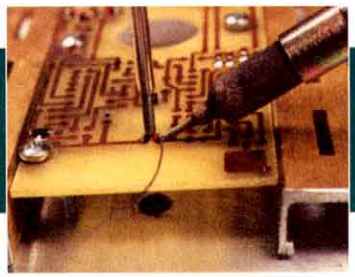

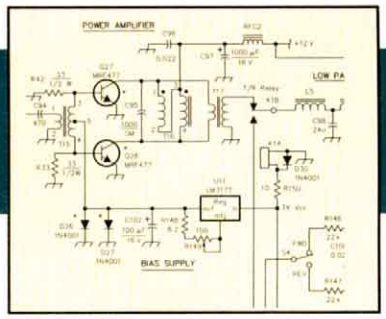

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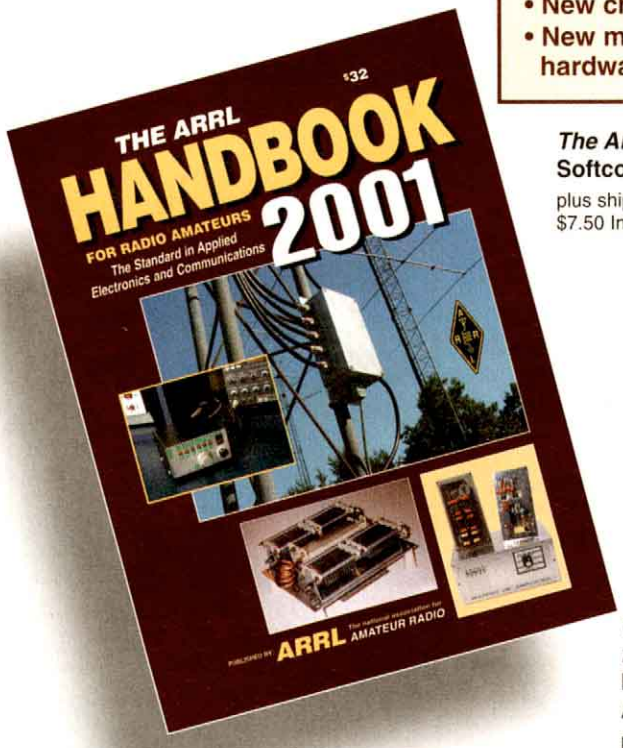

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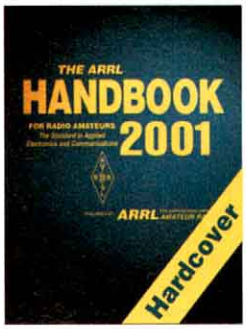

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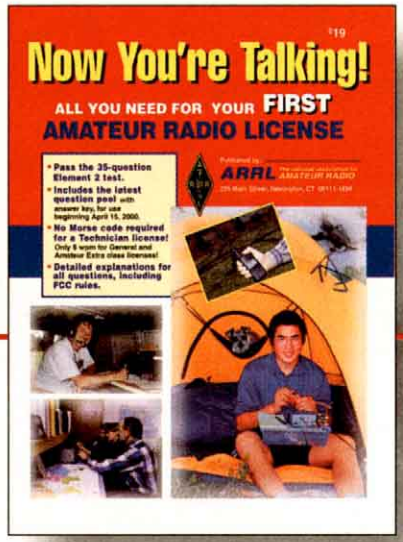

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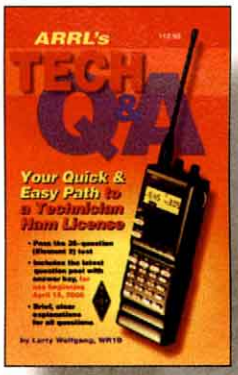

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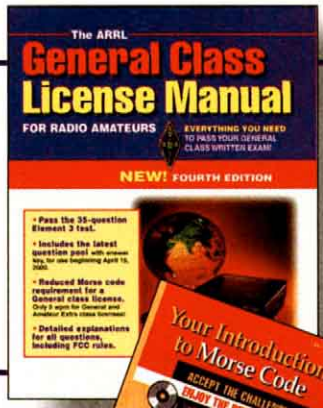

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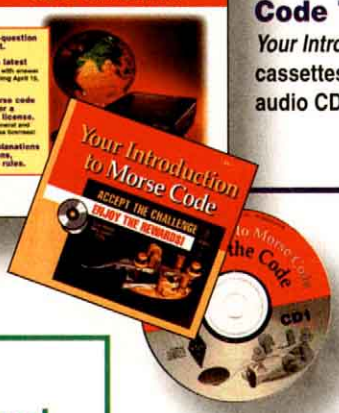

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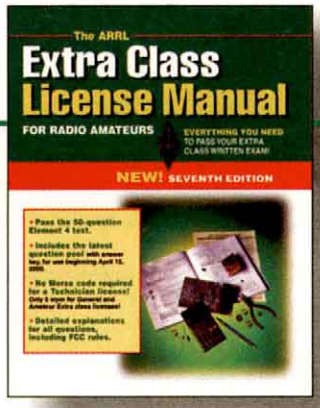

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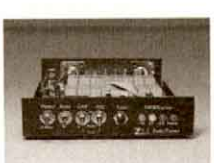

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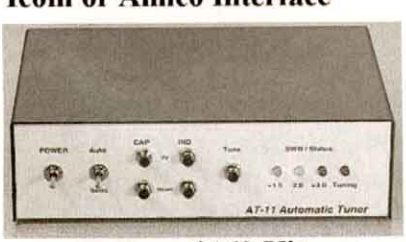

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1) Advertising must pertain to products and services which are related to Amateur Radio.

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4) Send ads to: the ARRL, 225 Main St., Newington, CT 06111 ATTN: Ham Ads. Or via fax 860-594-0259 or e-mail: hamads@arrl.org Submitted ads should be typed or clearly printed. Payment must be included with ads (check or any major credit card accepted).

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500ft spool of double braid polyester

Size	Strength	Price
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(On this special only UPS shipping and handling included within the 48 states only) Shipping and handling applies to all other products and destinations listed herein. Minimum order: $30.00 in product. Prices subject to change without notice. Sorry, No COD's. Illinois residents 8.25% sales tax added. offer expires 12/31/00.

COAX (50 OHM"LOW LOSS" GROUP)

	100FT/UP	500FT	1000FT
"FLEXIBLE" 9913 STRD BC CNTR FOIL + 95% BRAID 2.7dB@ 400MHz NC/DB/UV JKT	.60/FT	.58/FT	.56/FT
LMR 400 SOLID CCA CNTR FOIL + BRAID 2.7dB @ 450MHz WP/UV JKT	.64/FT	.62/FT	.60/FT
LMR 400 "ULTRA-FLEX" STRD BC CNTR FOIL + BRAID 3.1dB @ 450 MHz TPE JKT	.89/FT	.87/FT	.85/FT
LMR 600 (OD.590") SOLID CCA CNTR FOIL + BRAID 1.72dB @ 450 MHz WP/UV JK T	1.27/FT	1.25/FT	1.23/FT
LMR 600 "ULTRA-FLEX" STRD BC CNTR FOIL + BRAID 2.1dB @ 450MHz TPE JKT	1.95/FT	1.93/FT	1.90/FT

COAX (50 OHM "HF" GROUP)

	100FT/UP	500FT	1000FT
RG213/U STRD BC MIL-SPEC NC/DB/UV JACKET 1.2 dB/2500WATTS @ 30MHz	.40/FT	.38/FT	.36/FT
RG8/U STRD BC FOAM 95% BRAID UV RESISTANT JKT 0.9dB/1350WATTS @ 30MHz	.34/FT	.32/FT	.30/FT
RG8 MINI(X)95% BRAID UV RESISTANT JACKET 2.0dB/875 WATTS @ 30MHz	.18/FT	.16/FT	.14/FT
RG58/U 95% BRAID UV RESISTANT JACKET 2.5dB/400 WATTS@ 30MHz	.18/FT	.16/FT	.14/FT
RG58A/U STRD CENTER 95% TC BRD UV RESISTANT JKT 2.6dB/350 WATTS @ 30MHz	.19/FT	.17/FT	.15/FT
RG214/U STRD SC 2 95% BRD NC/DB/UV JKT 1.2dB/1800WATTS @ 30MHz	.25FT/UP	1.75/FT.	
RG142/U SOLID SCCS 2-95% SILVER BRAIDS *Teflon®* JKT 8.2dB/1100WATTS @ 400MHz	.25FT/UP	1.50/FT.	

COAX (75 OHM GROUP)

	100FT/UP	500FT	1000FT
RG11A/U STRD BC (VP-66%) 95% BRAID NC/DB/UV JKT 1.3dB/1000WATTS	.44/FT	.42/FT	.40/FT
RG6/U CATV FOAM 18GA CW FOIL + 60% ALUM BRAID	.20/FT	.13/FT	.11/FT
RG6/U CATV FOAM 18GA CW FOIL *QUAD SHIELD*	.25/FT	.18/FT	.16/FT

LADDER LINE GROUP

	100FT/UP	500FT	1000FT
"FLEXIBLE" 450 OHM 16GA COMPRESSED STRD CCS(PWR-FULL LEGAL LIMIT+)	.23/FT	.21/FT	.19/FT
"FLEXIBLE" 450 OHM 14GA COMPRESSED STRD CCS(PWR-FULL LEGAL LIMIT++)	.28/FT	.26/FT	.24/FT
300 OHM 20GA STRD (POWER: FULL LEGAL LIMIT)	.15/FT	.13/FT	.12/FT

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	100FT/UP	500FT	1000FT
5971 8/COND (2/18 6/22) BLK UV RES JKT. Recommended up to 125ft	.22/FT	.20/FT	.18/FT
1618 8/COND (2/16 6/18) BLK UV RES JKT. Recommended up to 200ft	.37/FT	.36/FT	.34/FT
1418 8/COND (2/14 6/18) BLK UV RES JKT. Recommended up to 300ft	.49/FT	.47/FT	.45/FT
1216 8/COND (2/12 6/16) BLK UV RES JKT. Recommended up to 500ft	.80/FT	.76/FT	.72/FT
1806 18GA STRD 6/COND PVC JACKET Recommended for Yaesu Rotors	.25/FT	.23/FT	.21/FT

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	100FT	300FT	500FT	1000FT
14GA 168 STRD *"SUPERFLEX" (great for Quads & Portable set-ups etc.)*	19.00ea	48.00ea	60.00ea	100.00ea
14GA 7 STRD *"HARD DRAWN" (perfect for permanent Dipoles etc.)*	15.00ea	36.00ea	40.00ea	60.00ea
14GA SOLID *"COPPERWELD" (for long spans etc.)*	15.00ea	36.00ea	40.00ea	60.00ea
14GA SOLID *"SOFT DRAWN" (for ground radials etc.)*	15.00ea	36.00ea	40.00ea	60.00ea

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	100FT	250FT	500FT	1000FT
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8GA (rated:40 amps)	50FT $24.50	100FT $44.50	250FT $107.50
10GA (rated:30 amps)	50FT $15.50	100FT $28.00	250FT $65.00
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16GA (rated:12 amps)	50FT $5.50	100FT $10.00	250FT $22.50
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COAX CABLE ASSEMBLIES

with USA made Silver/Teflon® Gold Pin PL259 connectors.

FLEXIBLE 9913 strd BC cntr foil+95% braid 2.7dB 400MHz NC/DB/UV JKT.
200' $136.95 175' $120.95 150' $104.95 125' $88.95 100' $73.95 75' $57.95 50' $41.95
25' $25.95 15' $22.95 10' $19.95 6' $13.95 3' $12.95 1' $11.95

Assemblies now available at all AES locations

RG213/U strd BC Mil-Spec NC/BD/UV JKT. 1.2dB 2500 watts @ 30MHz.
200' $94.95 175' $83.95 150' $73.95 125' $62.95 100' $52.95 75' $41.95 60' $36.95
50' $31.95 25' $20.95 15' $18.95 10' $16.95 6' $12.95 3' $10.95 1' $9.95

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RG8/U strd BC foam 95% braid UV resistant JKT. 0.9dB 1350 watts @ 30MHz.
175' $78.95 150' $67.95 125' $57.95 100' $46.95 75' $36.95 50' $25.95
25' $18.95 15' $16.95 10' $14.95 6' $12.95 3' $10.95 1' $9.95

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Assemblies now available at all AES locations

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35' $46.95 25' $40.95 15' $33.95 10' $26.95 6' $17.95 3' $16.95 1' $15.95

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With USA made Silver/Teflon®/Gold Pin PL259 to male "N"

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200' $146.95 175' $126.95 150' $107.95 125' $92.95 100' $76.95 75' $61.95
50' $45.95 25' $30.95 15' $27.95 10' $24.95 6' $15.95 3' $14.95 1' $13.95

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RG142/U 50 OHM COAX ASSEMBLIES

Double Silver Braid Shields, High Power Teflon® Dielectric & Jacket

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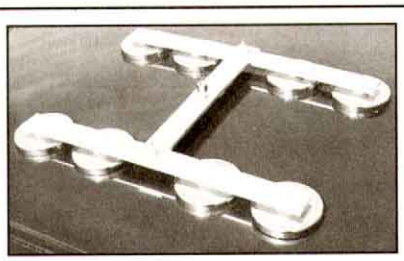

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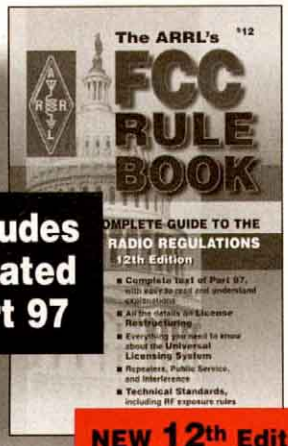

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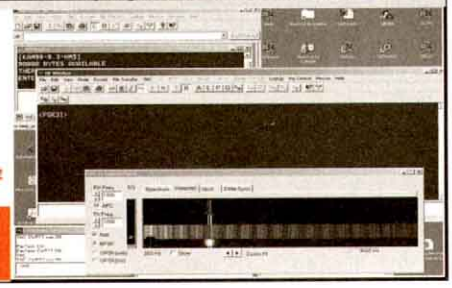

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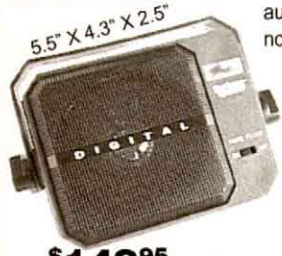

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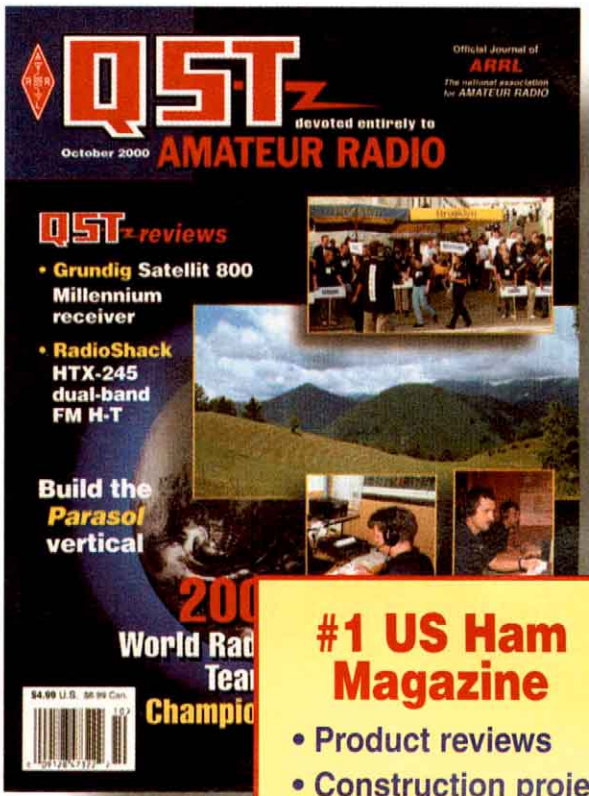

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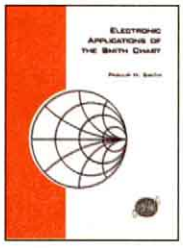

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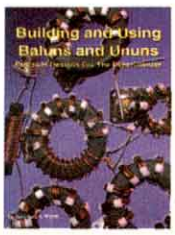

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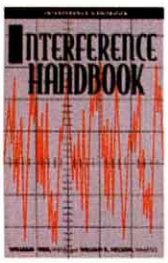

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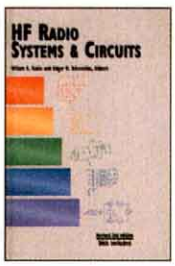

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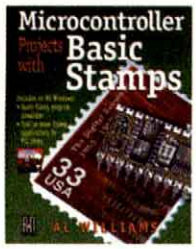

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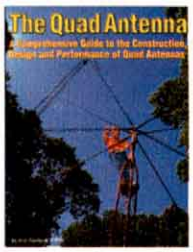

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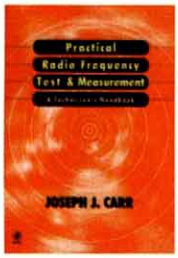

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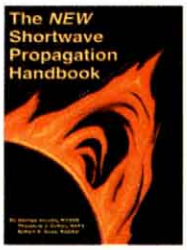

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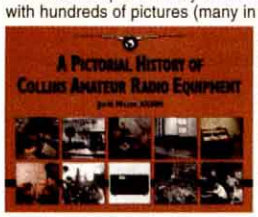

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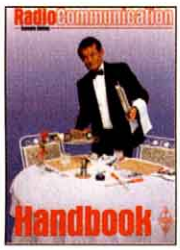

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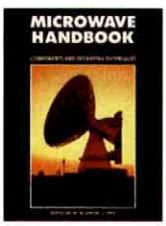

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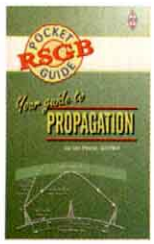

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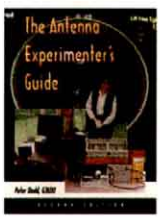

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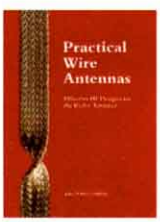

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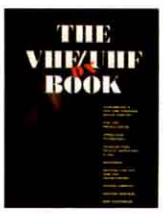

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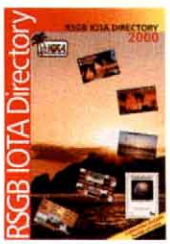

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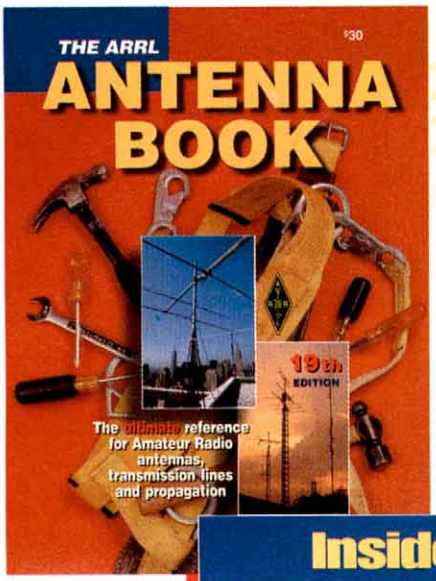

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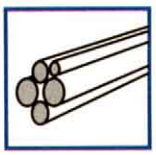
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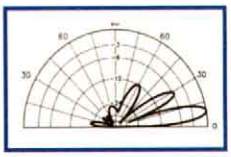
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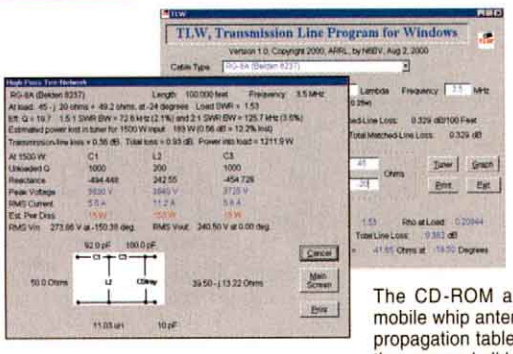

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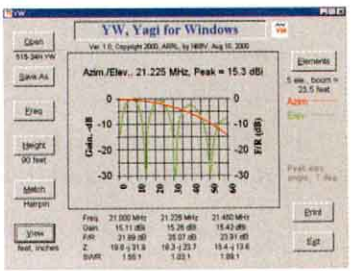

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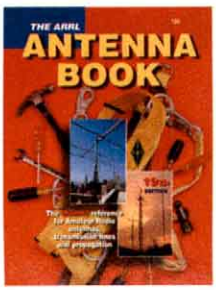

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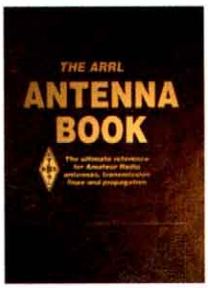

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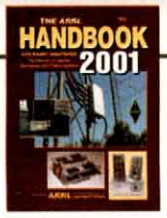

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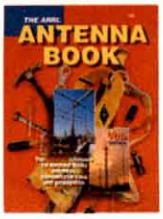

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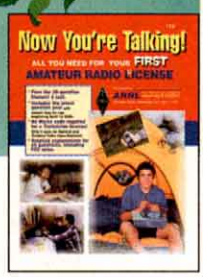

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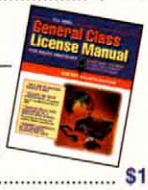

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F22A/F23A	$89/119
NR72BNMO/NR73BNMO	$39/54
NR770HBNMO/NR770RA	$55/49
X200A/X300A	$129/159
X500HNA/700HNA	$229/369
X510MA/510NA	$189/189
X50A/V2000A	$99/149
CR627B/SG2000HD	$99/79
SG7500NMO/SG7900A	$75/112

More Diamond antennas in stock

GAP ANTENNAS

Challenger DX	$259
Challenger Counterpoise	$25
Challenger Guy Kit	$14
Eagle DX	$269
Eagle Guy Kit	$22
Titan DX	$299
Titan Guy Kit	$22
Voyager DX	$389
Voyager Counterpoise	$49
Voyager Guy Kit	$38

Please Call for Delivery Information

CUSHCRAFT ANTENNAS

X7/X9	$569/819
XM240	$599
R6000/R8	$269/389
A50-3S/5S/6S	$89/139/219
AR2/ARX2B	$45/65
AR270/AR270B	$69/99
ARX270U/ARX270N	$219/219
13B2/17B2/26B2	$119/199/329
719B/729B	$115/179
A270-6S/A270-10S	$59/79

Please call for more Cushcraft items

M2 VHF/UHF ANTENNAS

144–148 MHz

2M4/2M7/2M9	$89/109/119
2M12/2M5WL	$149/189
2M5-440XP, 2m/70cm	$149

420–450 MHz

420-470-5W/420-450-11	$119/89
432-9WL/432-13WL	$169/219
440-18/440-21ATV	$119/139

Satellite Antennas

2MCP14/2MCP22	$155/209
436CP30/436CP42UG	$209/259

M2 ANTENNAS

50–54 MHz

6M5X/6M7JHV	$199/239
6M2WLC/6M2.5WLC	$419/529

10/12/15/17/20m HF

10M4DX, 4 Element 10m	$379
12M4DX, 4 Element 12m	$379
15M4DX, 4 Element 15m	$419
17M3DX, 3 Element 17m	$379
20M4DX, 4 Element 20m	$499

More M2 models in stock–please call

MFJ ANTENNAS

259B Antenna Analyzer	$219
1798, 80–2m Vertical	$239
1796, 40/20/15/10/6/2m Vert.	$179
1793, 80/40/20m Vertical	$159
1792, 80/40m Vertical	$145
1788, 40–15m Loop	$399
1786, 30–10m Loop	$349
1780, 14–30 MHz Loop	$229
1768, 2m/70cm Beam	$65
1762, 3 Element 6m Beam	$65

Big MFJ inventory–please call

LAKEVIEW HAMSTICKS

9106	6m	9115	15m	9130	30m
9110	10m	9117	17m	9140	40m
9112	12m	9120	20m	9175	75m

All handle 600W, 7' approximate length, 2:1 typical VSWR ... $24.95

HUSTLER ANTENNAS

4BTV/5BTV/6BTV	$129/169/189
G6-270R, 2m/70cm Vertical	$149
G6-144B/G7-144B	$109/159

Hustler Resonators in stock–call

FORCE 12–MULTIBAND

C3	10/12/15/17/20m, 7 el	$559
C3E	10/12/15/17/20m, 8 el	$599
C3S	10/12/15/17/20m, 6 el	$479
C3SS	10/12/15/17/20m, 6 el	$479
C4	10/12/15/17/20/40m, 8 el	$699
C4S	10/12/15/17/20/40m, 7 el	$629
C4SXL	10/12/15/17/20/40m, 8 el	$899
C4XL	10/12/15/17/20/40m, 9 el	$999
C19XR	10/15/20m, 11 el	$879
C31XR	10/15/20m, 14 el	$1169

Please call for more Force 12 items

ROHN TOWER

25G/45G/55G	$79/179/229
AS25G/AS455G	$39/89
GA25GD/45/55	$68/89/115
GAR30/GAS604	$35/24
SB25G/45/55	$39/89/109
TB3/TB4	$85/99
HBX32/HBX40	$349/439
HBX48/HBX56	$589/699
HDBX40/HDBX48	$549/699
BXB5/6/7/8	$39/49/59/59

Please call for more Rohn prices

GLEN MARTIN ENGINEERING

Hazer Elevators for 25G

H2, Aluminum Hazer, 12 sq ft	$359
H3, Aluminum Hazer, 8 sq ft	$269
H4, HD Steel Hazer, 16 sq ft	$339

Aluminum Roof Towers

RT424, 4 Foot, 6 sq ft	$159
RT832, 8 Foot, 8 sq ft	$229
RT936, 9 Foot, 18 sq ft	$389
RT1832, 17 Foot, 12 sq ft	$499

Please call for Glen Martin info

COAX CABLE

RG-213/U, (#8267 Equiv.)	$.36/ft
RG-8X, Mini RG-8 Foam	$.19/ft
RG-213/U Jumpers	Please Call
RG-8X Jumpers	Please Call

Please call for more coax/connectors

TIMES MICROWAVE LMR® COAX

LMR-400	$.59/ft
LMR-400 Ultraflex	$.89/ft
LMR-600	$1.19/ft
LMR600 Ultraflex	$1.95/ft

ANTENNA ROTATORS

M2 OR-2800P	$1095
Yaesu G-450A	$239
Yaesu G-800SA/DXA	$319/399
Yaesu G-1000DXA	$479
Yaesu G-2800SDX	$1069
Yaesu G-550/G-5500	$289/589

ROTATOR CABLE

R51(#20)/R52 (#18)	$.22/.32/ft
R61 (#20)/R62 (#18)	$.28/32/ft.
R81/82/83/84	$.25/.39/.52/.85/ft

TRYLON "TITAN" TOWERS

SELF-SUPPORTING STEEL TOWERS

T200-64	64', 15 square feet	$989
T200-72	72', 15 square feet	$1199
T200-80	80', 15 square feet	$1439
T200-88	88', 15 square feet	$1689
T200-96	96', 15 square feet	$1999
T300-88	88', 22 square feet	$1989
T400-80	80', 34 square feet	$1939
T500-72	72', 45 square feet	$1879
T600-64	64', 60 square feet	$1799

Many more Trylon towers in stock!

US TOWER

MA40/MA550	$849/1399
MA770/MA850	$2359/3649
TMM433SS/HD	$1139/1379
TMM541SS	$1499
TX438/TX455	$1069/1599
TX472/TX489	$2649/4599
HDX538/HDX555	$1379/2399
HDX572MDPL	$6329

Please call for help selecting a US Tower for your needs. Shipped factory direct to save you money!

UNIVERSAL ALUMINUM TOWERS

4-40'/50'/60'	$519/739/1049
7-50'/60'/70'	$939/1369/1789
9-40'/50'/60'	$729/1049/1469
12-30'/40'	$559/869
15-40'/50'	$969/1399
23-30'/40'	$859/1289
35-30'/40'	$979/1509

Bold in part number shows wind-load capacity. Please call for more Universal models. All are shipped factory direct to save you money!

TOWER HARDWARE

3/8"EE / EJ Turnbuckle	$10/11
1/2"x9"EE / EJ Turnbuckle	$15/16
1/2"x12"EE / EJ Turnbuckle	$17/18
3/16" / 1/4" Preformed Grips	$4/5

Please call for more hardware items

HIGH CARBON STEEL MASTS

5 FTx .12" / .18"	$35/59
10 FT x .12" / .18"	$65/110
15 FT x .12" / 17 FT x .18"	$95/180
20 FT x .12" / 22 FT x .18"	$120/219
12 FT x .25" / 17 FT x .25"	$189/267

PHILYSTRAN GUY CABLE

HPTG1200I	$.39/ft
HPTG2100I	$.52/ft
PLP2738 Big Grip (2100)	$5.50
HPTG4000I	$.79/ft
PLP2739 Big Grip (4000)	$7.65
HPTG6700I	$1.15/ft
PLP2755 Big Grip (6700)	$10.95
HPTG11200	$1.55/ft
PLP2558 Big Grip (11200)	$16.50

Please call for more info or help selecting the Phillystran size you need.

WEEKDAY HOURS: 9AM–5PM CST

SATURDAY HOURS: 9AM–1PM CST

CREDIT CARDS: M/C, VISA, DISCOVER

TEXAS TOWERS

A Division of Texas RF Distributors, Inc. • 1108 Summit Avenue, Suite #4 • Plano, TX 75074

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HUGE ICOM DEALS ★ HUGE YAESU DEALS

IC-775 DSP.. New Lower Price!
The Icom IC-775DSP is a competition class HF transceiver featuring 200 watt RF output, digital signal processing, automatic antenna tuner, true dual RX, CW memory keyer, CTCSS tone encode, twin pass band tuning, dual antenna inputs, 101 memory chanels, built-in power supply, and much more. Supplied with AC power cord.

PW-1 ..... New Lower Price!
The Icom PW-1 is a 1000 watt solid state linear amplifier for HF and 6m operation, featuring a high power automatic antenna tuner, built-in power supply, and a removable front control panel, and more.

IC-746 ..... Icom Special!
The Icom IC-746 is an all mode transceiver covering HF/6m/2m. The radio features digital signal processing, 100 watt RF output on all bands, twin PBT, a 4.9"multifunction LCD display with band scope, automatic antenna tuner, and more. Supplied with a hand mic and DC power cord.

IC-756PRO ..... New!
The Icom IC-756 PRO is an all mode HF/6m transceiver featuring DSP, automatic antenna tuner, 100 watts RF output, digital twin PBT, a 5" multifunction LCD display with band scope function, and more. Supplied with hand mic and DC power cord.

FT-1000MP Mark-V ..... New!
The Yaesu FT-1000MP Mark-V is a competition class HF DSP transceiver with auto tuner, 200 Watts RF output, and more!

FT-1000MP ..... In Stock!
Competition class HF DSP transceiver.

FT-1000D ..... In Stock!
The FT-1000D is a competition class HF XCVR featuring true dual RX, automatic tuner, 200 watts RF output, and more.

Quadra System ...Lower Price!
Solid state 1 kW autotuning amplifier.

FT-847 ..... Yaesu Special!
The Yaesu FT-847 is an all mode transceiver covering HF/6m/2m/70cm! The radio is perfect for satellite operation, and features digital signal processing, built-in RS-232 interface, tone encode/decode, and more. Supplied with an up/down microphone and DC power cord.

FT-920 ..... Yaesu Special!
The Yaesu FT-920 is an all mode HF/6m transceiver featuring digital signal processing, automatic antenna tuner, CW memory keyer, CTCSS tone encode/decode, 127 memories, and more. Supplied with up/down hand mic and DC power cord.

IC-706MK2G ..... Icom Special!
The Icom IC-706MK2G is a compact HF/6m/2m/70cm all mode transceiver with digital signal processing, automatic repeater offset, built-in CW keyer, built-in CTCSS tone encode/decode/scan, 107 memory channels and more. A detachable front panel offers convenient mounting, even in compact vehicles.

IC-718 ..... New!
The Icom IC-718 is an all mode HF transceiver featuring a front panel mounted speaker, IF shift, optional DSP module, multiple scanning modes, noise blanker, RIT, and more.

IC-2800H..... Icom Special!
The Icom IC-2800H is a 2m/70cm dual band mobile FM transceiver with a 3" color TFT display. The radio features a separate control face, video input, bandscope display, 9600 bps Packet jack, CTCSS tone encode/decode/scan, 232 memories, cross band duplex, and more. With DTMF hand mic, mounting brackets, and power cord.

IC-2100H..... Great Low Price!
The IC-2100H is a rugged 2m mobile XCVR with CTCSS tone encode/decode/scan, DTMF paging/squelch, 113 memory channels, switchable display color and more.

FT-90R ..... New!
New ultra-compact 2m/70cm dual band mobile transceiver with detachable control panel, and huge extended RX range.

FT-2600M .. New Lower Price!
Rugged 2m mobile with intermod-proof receiver, big display, and an illuminated DTMF mic. Built to MIL-STD 810.

FT-8100 ..... New Lower Price!
Great 2m/70cm dual band mobile, 45/35 Watts, removable front panel, and more!

FT-100D ..... New!
The Yaesu FT-100D is an ultra-compact all mode transceiver for HF/6m/2m/70cm operation. The radio features a removable control panel, digital signal processing, CW memory keyer, built-in RS-232 interface, tone encode, 200 memory channels, VOX, and more. Supplied with a DTMF hand mic, DC power cord and mounting bracket.

FT-840 ..... New Lower Price!
The Yaesu FT-840 is an all mode HF transceiver with 100 watt output, optional FM unit.

IC-W32A ..... New Lower Price!
IC-Q7A ..... Icom Special!
IC-T7H ..... Icom Special!
IC-T81A ..... New QuadBand HT!
IC-T2H ..... Amazing Low Price!
IC-R3 . Video RX, Coming Soon!

IC-207H ..... Great Low Price!
The Icom IC-207H is a 2m/70cm dual band mobile transceiver featuring CTCSS tone encode/decode, 182 memory channels, removable front control panel, and more. Supplied with a back-lit DTMF hand mic, mounting bracket, and a DC power cord.

IC-PCR1000 ..... Icom Special!
IC-PCR100 ..... Icom Special!
IC-R8500 ..... In Stock!
IC-R75 ..... New, In Stock!
IC-R2 ..... In Stock!
IC-R10 ..... Icom Special!

G-2800SDX $1069
Heavy duty antenna rotator handles 34 sq. ft. of antenna load, and features 450° rotation, preset and variable speed.

G-1000DXA $479
G-800SA/DXA $319/399
G-450A $239
G-5500 ..... $589
G-550 ..... $289

VX-5R ..... Now In Stock!
Tiny 6m/2m/70cm triband HT, with CTCSS tone encode/decode/scan, high capacity Lithium-Ion battery pack, extended RX with AM/FM and FW Wide modes, and more.

FT-50RD ..... Yaesu Special!
VX-1R ..... Yaesu Special!

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The Ultimate Backpacker!

Ham Radio in the Great Outdoors: It's the Best with Yaesu's FT-817!

Actual Size

Bring Ham Radio along on your next hiking, camping, or business trip with Yaesu's amazing new FT-817 Multimode HF/VHF/UHF Portable Transceiver!

●**ULTRA COMPACT:** Measuring just 5.3" x 1.5" x 6.5" WHD (135 x 38 x 165 mm) and weighing about 2 1/2 pounds (1.17 kg, including the supplied antenna and alkaline cells), the FT-817 is small and light enough to take along wherever you're going.

●**WIDE FREQUENCY COVERAGE:** 160-10 meters on HF, plus the 50, 144, and 430 MHz Amateur bands. Plus FM Broadcast, AM Aircraft, and Public Safety receiver coverage.

●**MULTIMODE DESIGN:** Ready for action on SSB, CW, AM, FM, FM-Wide (Rx), 1200/9600 bps Packet, and Digital, including dedicated USB and LSB PSK-31 configurations.

●**5 WATTS POWER OUTPUT:** Using a new-technology all-band MOS FET power amplifier, the FT-817 provides 5 Watts of power output when using a 13.8 Volt DC source. When using Alkaline batteries or the optional FNB-72 Ni-Cd Battery Pack, power is automatically set to 2.5 Watts; via Menu, this can be changed to 0.5 Watt, 1 Watt, or up to 5 Watts.

●**WIDE CHOICE OF POWER SOURCES:** The FT-817 is equipped with an alkaline "AA" cell battery case, and a 13.8 volt DC cable is also supplied. Available as an option is the FNB-72 Ni-Cd Battery Pack (9.6 V, 1000 mAh), which can be recharged using a 13.8 Volt power supply while the radio is being operated.

●**TWO ANTENNA PORTS:** A "BNC" connector is provided on the front panel, and a type "M" connector on the rear panel, with Menu selection of which connector will be assigned for operation on HF, 50 MHz, 144 MHz, and 430 MHz.

●**OPTIONAL 10-POLE COLLINS MECHANICAL FILTERS:** An optional filter slot is provided, accommodating either the YF-122S (2.3 kHz) SSB filter or the YF-122C(500 Hz) CW filter. You get "base station" performance even from a mountain top.

●**INCREDIBLE MEMORY RESOURCES:** You get a total of 208 memories, including 200 "regular" memories which may be separated into ten groups of up to 20 channels each. And you can append an Alpha-Numeric "Tag" to each memory to aid in channel identification.

●**A CW OPERATOR'S DREAM MACHINE:** You get a built-in Electronic Keyer with adjustable weighting, adjustable CW Pitch, CW Normal/Reverse frequency tuning, and you can even use the microphone's UP and DOWN keys to send CW via the Keyer.

●**BUILT-IN CTCSS AND DCS:** The built-in CTCSS and DCS Encoder/Decoder systems provide you with the versatility you need for repeater access or selective calling.

●**DUAL - COLOR LIQUID CRYSTAL DISPLAY:** Select from Blue or Amber display illumination, which can also be switched off to conserve battery life. And while you're away, the Spectrum Scope will provide you with a visual record of activity ±5 channels from your current operating frequency.

ALL MODE PORTABLE TRANSCEIVER

FT-817

HF/50/144/430 MHz Multimode Transceiver

YAESU
Choice of the World's Top DX'ers℠

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See the exciting new FT-817 at your Yaesu Dealer's showroom today!

TS-2000

Then There Was Light...

World's 1st HF Backlit Front Key Panel

...The All New TS-2000 Multi Band/Multi Mode Transceiver **Coming Soon!**

The all new Kenwood **TS-2000** series transceiver offers today's demanding Amateur operator high performance standards without the compromising limitations found in other similar multi-band, multi-mode transceivers. The **TS-2000** offers users three distinct operation platforms, the traditional transceiver with full function front panel, or the high-tech looking "silver box" version that allows mobile operation with the new RC-2000 compact control head, or the ARCP-2000 computer control program making the **TS-2000B** functional from your personal computer. The new **TS-2000** offers 100 watts on HF, 6 meters and 2 meters, 50 watts on 70cm, and when you install the optional UT-20 1.2 GHz module at 10 watts, you will have assembled the most complete dual receiver multi-mode transceiver ever produced. If you are waiting for PH3D, you will be happy to know the **TS-2000** is transverter frequency display function ready to work the latest satellite frequencies available.

IF stage DSP in the main band and AF stage DSP in the sub-band provide unparalleled noise reduction performance. Because the **TS-2000** has a built-in TNC, DX Packet cluster is available on the sub-band and can automatically shift the desired HF or 6 Meter frequencies direct to the main band for instant contacts. A weekend DXer's dream come true. You will also be sure to enjoy the built-in antenna tuner, 5+1 antenna ports, RS-232 terminal and the world's first HF fully backlighted front control panel.

The **TS-2000** multi-band multi-mode transceiver, the most high performance Amateur Radio ever produced.

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COMMUNICATIONS CORPORATION

AMATEUR RADIO PRODUCTS GROUP
3975 Johns Creek Court, Suwanee, GA 30024
P.O. Box 22745, Long Beach, CA 90801-5745, U.S.A.
Customer Support: (310) 639-5300 Fax: (310) 537-8235
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