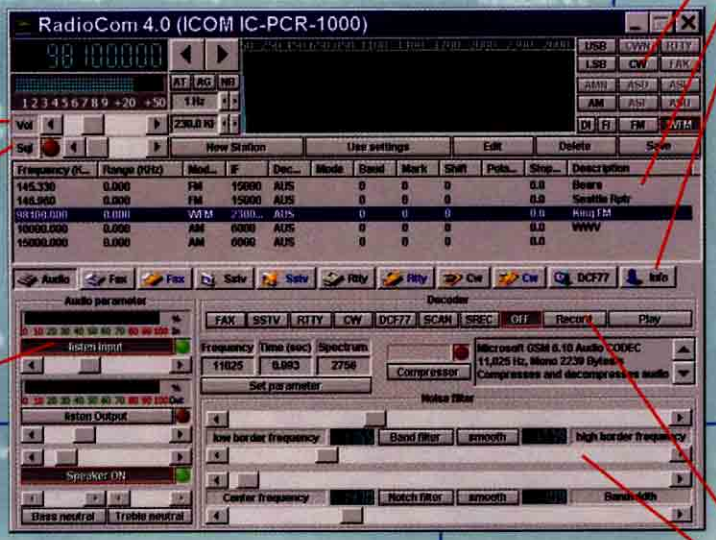
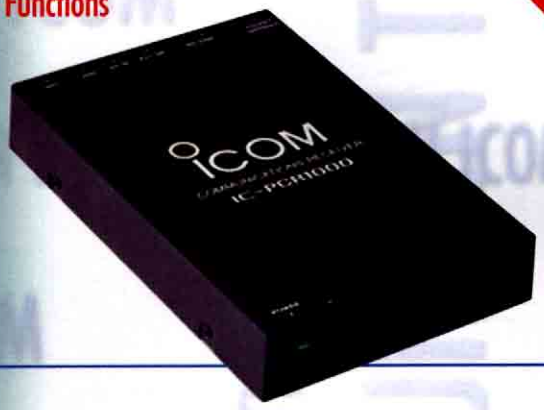

Official Journal of
ARRL
The national association
for AMATEUR RADIO
QST
devoted entirely to
AMATEUR RADIO
June 2003
HAM-COM
2003
Arlington, Texas
Hosting the ARRL National Convention
ARRL
FIELD DAY
2003
June 28/29
$4.99 U.S. $6.99 Can.
06
19260
0 843655 9

IC-PCR1000

TURN YOUR PC INTO A WIDE BAND RECEIVER WITH ICOM'S LITTLE BLACK BOX!

Now with Bonito Software!





100 kHz – 1.3 GHz†

AM, FM, WFM, USB, LSB, CW

Unlimited Memory Channels

Real Time Band Scope

IF Shift

Noise Blanker

Digital AFC

Voice Scan Control

Attenuator

Tunable Bandpass Filters

AGC Function

S Meter Squelch

CTCSS Tone Squelch

Computer Controlled DSP

download frequencies right from the web

www.icomreceivers.com

Turn your PC into a Wide Band Receiver! ICOM's IC-PCR1000 uses the power of your computer to open a new world of listening and viewing pleasure. Compatible with most PCs and laptops running Windows™ software, the 'PCR1000 connects externally – in just minutes! The new Bonito software (BON CS40) expands and enhances the 'PCR1000's versatility with the following features:

Basic Radio Control functions with spectrum scope

Computer Controlled DSP for tailoring your audio with separate bass & treble controls

Filter Smoothing for the upper and lower ends of the audio spectrum

Notch Filter reduces annoying pops, buzzes, & other interference for a crisp, clear signal. Use the power of your computer's sound card DSP to bring out the beauty of the signal for hours of enjoyable listening

Digital Decoding Package transforms your computer into a decoding machine. You no longer have to purchase an external decoder for receiving non-encrypted digital modes. Digital Decoding allows you to decode: **RTTY**, **FAX** *with Zoom, Synchronize, Slant Correction, Cut a Picture, Picture Invert and Rotate,* **CW**, **SSTV** *with Auto Sync, Slant Corrections,* **Sitor-B**, **PSK31**

Audio Record function allows you to record your favorite radio programs, local traffic, or almost anything else with your computer's sound card and hard drive. Save for friends and family to listen at a later time

See your authorized ICOM dealer for more details.

New Windows™ OS? No problem! Updated ICOM software is now available for free download! Download at www.icomamerica.com. Click Receivers>IC-PCR1000>IC-PCR1000 software (updated)

The world is waiting

www.icomamerica.com

ICOM®

Kid Brother. With Attitude.

Now Available! IC-208H

Think of it as the '2720H's kid brother - *WITH ATTITUDE!*

Get more power, wider RX, and a whopping 500 alphanumeric memory channels with this space saving performer.

High Power Rating • While 55 Watts on VHF is common, 50 Watts of UHF is not! The '208H packs a punch!

Wide Band Receiver • Keep up with all that is going on in the neighborhood! The receiver in the IC-208H covers 118-173, 230-549 and 810-999 MHz*.

Plenty of Memory • What to do with all that frequency coverage? Store it! With 500 alphanumeric memory channels, the IC-208H is a scanning enthusiasts dream!

Dynamic Memory Scan (DMS) • 10 banks, store 2-100 channels per bank, however you want them to be listed. Then, with Icom's NEW bank linking capability, you can select what banks you want to scan.

CTCSS/DTCS • This little box will allow you to operate either with the "Old Tones" (CTCSS) as well as the "NEW Codes" (DTCS).

One or Two Piece • You choose how you want to configure your rig! The remote head attached to the rig, or remote mounted with the included OPC-600R cable.

Wide or Narrow Operation • Whether operating through a traditional repeater, or trying to squeeze more spectrum efficiency, the IC-208H will quickly switch from Wide FM to Narrow FM operation.

Weather or Not • The IC-208H includes a Weather Alert function to keep you on top of any emergency announcement from the National Weather Service.

Don't be Afraid of the Dark • The IC-208H sports backlit keys for night or low light operations. Also, the front panel and tuning knob are color selectable! Choose from Green, Orange, or Amber.

See your authorized Icom dealer today!

Why not? You deserve it!

www.icomamerica.com

ICOM®

*Cellular frequencies blocked.

hy-gain Rotators

. . . the first choice of hams around the world!

Hy-Gain rotators are the first choice of hams around the world!

Hy-Gain's world famous Bell Shaped Rotator™ design is the standard that other rotators are measured against.

Its bell construction gives you total weather protection for super reliable operation. Its super heavy duty steel gear drive gives you years of superior and trouble-free performance. Many Hy-Gain rotators still provide excellent service after over 25 years of outstanding performance.

The last thing you want to fall apart is your rotator that's mounted on the top of your tower. You won't make any compromises when you buy and install high quality Hy-Gain rotators.

And we're the only manufacturer to offer a full line of rotators that are completely MADE IN THE USA.

HAM-IV, $559.95. *The heavy duty Ham-IV is the most popular rotator in the world!* It is designed for medium size antenna arrays up to 15 square feet wind load area when mounted in-tower, or 7.5 square feet when mast mounted with an optional lower mast bracket. New alloy ring gear gives extra strength up to 100,000 PSI for maximum reliability. New low temperature grease permits normal operation down to -30 degrees Fahrenheit. New wire-wound potentiometer gives reliable and precision directional indication, new ferrite beads reduce RF susceptibility, new Cinch plug connector plus 8-pin plug at control box (no screwdriver needed). Dual 98 ball bearing race for load bearing strength. Strong electric locking steel wedge brake prevents wind induced antenna movement. Easy-to-use Control Box has illuminated directional meter with North or South center of rotation scale, separate snap-action brake and rotation switches. Uses low voltage control for safe operation. Accepts masts up to $2^{1}/_{16}$ inches diameter. Rotator size is $13^{1}/_{2}$Hx8D inches.

T-2X, $649.95. *Extra heavy duty Tailtwister antenna rotator!* For large antennas up to 20 square feet wind load when mounted in-tower, or 10 square feet when mast mounted with optional support bracket. Triple 138 ball bearing race, strong electric locking steel wedge brake. Control Box has an illuminated directional indicator with North or South center of rotation scale, separate snap-action brake and rotation control switches. Accepts masts up to $2^{1}/_{16}$ inches diameter. Rotator size is $14^{1}/_{16}$Hx$9^{3}/_{16}$D in.

CD-45II, $389.95. *Medium duty antenna rotator.* Handles antenna arrays up to 8.5 square feet windload area when mounted in-tower, or 5 square feet when mast mounted with supplied lower support. Dual 48 ball bearing race, disc brake system. Control Box has an illuminated directional indicator with North or South center of rotation scale, separate snap-action brake and rotation control switches with disc brake release. Accepts mast sizes up to $2^{1}/_{8}$ diameter. Includes light duty lower mast support, Rotator size is $17^{3}/_{8}$Hx8 D inches.

AR-40, $289.95. *Lightweight antenna rotator.* Handles smaller ham antennas and large TV/FM antennas up to 3.0 square feet windload area when mounted in-tower, or 1.5 square feet when mast mounted using the supplied lower support bracket. Dual 12 ball bearing race, disc brake system. Silent, automatic control box -- just dial and touch for desired direction. Accepts mast sizes up to $2^{1}/_{8}$ diameter. Includes light duty mast support. Rotator size is $17^{3}/_{8}$Hx8D inches.

Call your dealer for your best price!

Rotator Specifications	T2X	HAM-IV	CD-45II	AR-40
Wind Load capacity (inside tower)	20 sq. ft.	15 sq. ft.	8.5 sq. ft.	3.0 sq. ft.
Wind Load (with mast adapter)	10 sq. ft.	7.5 sq. ft.	5.0 sq. ft.	1.5 sq. ft.
Turning Power (in pounds)	1000	800	600	350
Brake Power (in pounds)	9000	5000	800	450
Brake Construction	Electric wedge	Electric wedge	Disc brake	Disc brake
Bearing Assembly/How many	Tripl race/138	Dual Race/96	Dual race/48	Dual race/12
Mounting Hardware	Clamp plate	Clamp plate	Clamp plate	Clamp plate
Control Cable Conductors	8	8	8	5
Shipping Weight (pounds)	28	24	22	14
Effective Moment (in tower)	3400 ft/lbs.	2800 ft/lbs.	1200 ft/lbs.	300 ft/lbs.

HAM IV

$559.95
Suggested Retail

T-2X

$649.95
Suggested Retail

CD-45II

$389.95
Suggested Retail

AR-40

$289.95
Suggested Retail

Free Hy-Gain Catalog
Nearest Dealer/Free Catalog . . . 800-973-6572

hy-gain.

Antennas, Rotators & Towers
308 Industrial Park Road, Starkville, MS 39759 USA
Toll-free Customer Sales Hotline: 800-973-6572
• **TECH:** 662-323-9538 • **FAX:** 662-323-6551
http://www.hy-gain.com

Prices and specifications subject to change without notice or obligation.

DIAMOND ANTENNAS

The Standard By Which All Others Are Judged.

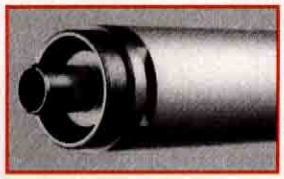
Acclaimed as the technological leader in single & multiband antennas

- Wide-band Performance • Factory Adjusted–No Tuning Required • Highest Gain
- UPS Shippable • High Wind Rating • Fiberglass Radome • DC Grounded • Stainless Hardware

X500HA (UHF-Conn.)
X500HNA (Type-N Conn.)

Dayton Booth 365

Ruggedized Base/Repeater Antenna



COAX CONNECTION AT BASE END

HEAVY DUTY BASE/ RADIAL ASSEMBLY

STRONG JOINT COUPLINGS

X50NA

The X50NA is an excellent choice where ruggedness is required in a medium–gain, dual-band, base/repeater application.

Features

- Wide frequency bandwidth
- Heavy duty fiberglass radome
- Stainless steel mounting hardware and radials
- Type–N Cable connection
- Compact size for easy mounting/ installation

Specifications:

Freq.: 2m: 144–148MHz
70cm: 440-450MHz
Power: 200 watts
Wind Rating: 135 MPH (no ice)
Height: 5.6 feet

X500HNA

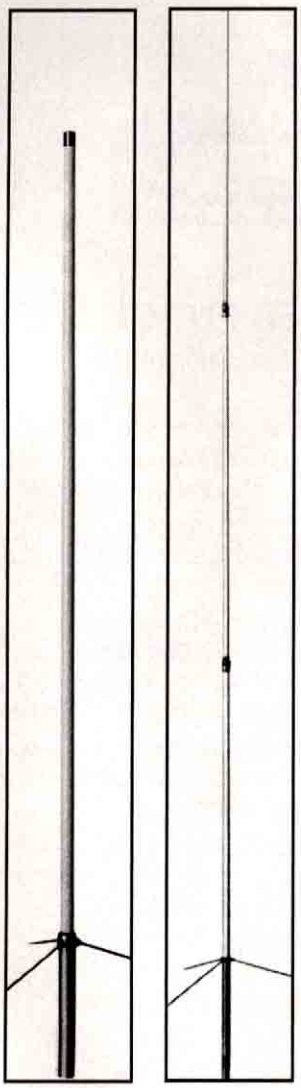
Diamond Antenna's best base station repeater antenna. Designed for strength and performance, the X500HNA is pretuned to achieve maximum gain in both the 2m and 70cm amateur bands.

Features

- Heavy duty fiberglass radome
- Overlapping outer shells for added strength
- Stainless steel mounting hardware and radials
- Strong–waterproof joint couplings
- Type–N Cable connection
- Wide band performance

Specifications:

Freq.: 2m: 144–148MHz
70cm: 440-450MHz
Power: 200 watts
Wind Rating: 90 MPH (no ice)
Height: 17.8 feet



X50NA ***X500HNA***

DIAMOND Mono-Band Base/Repeater Antennas

MODEL	BAND (MHz)	WATTS	CONN.	HT. FT.	RATED WIND MPH (No. ice)
CP22E [1]	144	200	UHF	9.0	90
DPGH62 [1,6]	50	200	UHF	21.0	78
F22A	144	200	UHF	10.5	112
F23A	144	200	UHF	15.0	90
F718A [2]	440	250	N	15.0	90

DIAMOND Dual-Band Base/Repeater Antennas

MODEL	BAND (MHz)	WATTS	CONN.	HT. FT.	RATED WIND MPH (No. ice)
X50A	144/440	200	UHF	5.6	135
X50NA	144/440	200	N	5.6	135
X200A	144/440	200	UHF	8.3	112
X510NA [3]	144/440	200	N	17.2	90
X510MA	144/440	200	UHF	17.2	90
X500HNA	144/440	200	N	17.8	90+
X700HNA	144/440	200	N	24.0	90
X2200A	144/222	150	UHF	11.5	112
U200	440/1240	100	N	5.9	135

DIAMOND Tri-Band Base/Repeater Antennas

MODEL	BAND (MHz)	WATTS	CONN.	HT. FT.	RATED WIND MPH (No. ice)
U5000A	144/440/1240	100	N	5.9	135
V2000A [4,6]	52/144/440	150	UHF	8.3	110
X3200A [5]	146/222/440	100/200	UHF	10.5	112
X6000A	144/440/1240	100/60	N	10.5	112

1 Heavy duty aluminum construction.
2 F-718A: 440-450MHz., F718L: 420-430MHz.
3 X510NJ: 144-147/430-440MHz.
4 1/4λ rated in dBi. Most requirement: 1.4"-2.4".
5 2m: 146-148; 100 watts
6 52-54MHz. only; DPGH62 adjustable from 50-54MHz.

BAND: 144=144-148MHz., 222=222-225MHz., 420=420-430MHz.,430=430-440MHz., 440=440 450MHz., 1240=1240-1300MHz.

www.rfparts.com/diamond

Diamond Antenna Division of RF Parts Co. Tel: (760) 744-0900 • FAX: (760) 744-1943 • E-mail: rfp@rfparts.com

June 2003 ♦ Volume 87 Number 6

CONTENTS

Technical

News and Features

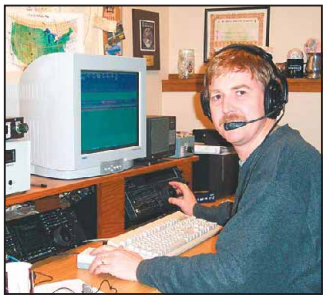
QST (ISSN:0033-4812) is published monthly as its official journal by the American Radio Relay League, 225 Main Street, Newington, CT 06111-1494, USA. Periodicals postage paid at Hartford, CT, USA and at additional mailing offices. POSTMASTER: Send address changes to: *QST*, 225 Main St, Newington, CT 06111-1494, USA

In order to ensure prompt delivery, we ask that you periodically check the address information on your mailing label. If you find any inaccuracies, please contact the Circulation Department immediately. Thank you for your assistance.

See page 15 for detailed contact information.

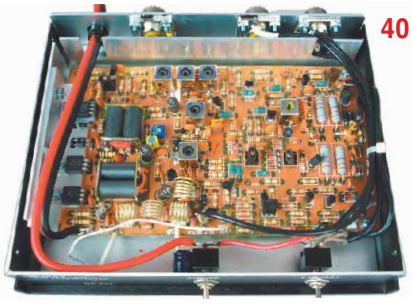
Telephone: 860-594-0200
Fax: 860-594-0259

QST Workbench



97

55

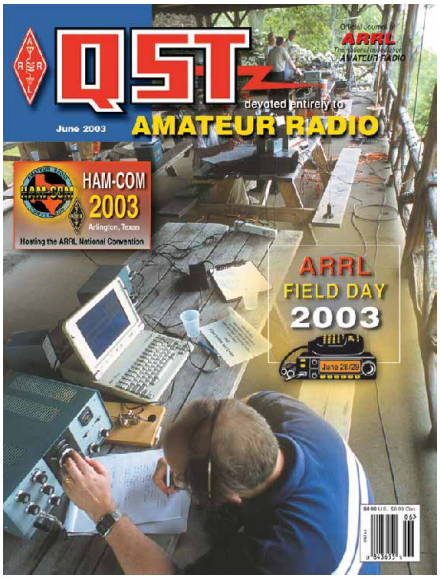


40

49

Operating

Departments



Our Cover
The Bloomfield (Connecticut) ARC headed to a nearby state park for its FD2002 operation. From front to back: Jeff Gross, NY1P; Skip Colton, W1FTE (hidden behind the *QST* logo); Harv Broverman, K1PZS; Ash Lane, WA1ICN; Don Moore, K1QPN, and Woody Lewis, W1SL (partially hidden). There's more on Field Day throughout this issue. The FD announcement appears in May *QST*. And don't forget the 2003 National Convention, to be held in Dallas June 20-22. Photo by Dan Wolfgang.

US & Possessions: Membership in the ARRL, including a one year subscription to *QST*, is available to individuals at $39. Age 65 and over, with proof of age, $34. Licensed radio amateurs age 21 and under and the eldest licensee in the household may qualify for the rate of $20. Life Membership, including a subscription to *QST* is available at $975.* Age 65 and over, $850.* Membership and *QST* cannot be separated. Libraries and institutions, $39 per year. Single copies $5.

International
To compensate for additional postage for mailing outside the US, the following rates apply:
Canada: Membership in the ARRL, including a one year subscription to *QST*, $49, payable in US funds. Life Membership, including a subscription to *QST* is available at $1225.* Libraries and institutions, $49 per year.
All Other Countries: Membership in the ARRL, including a one year subscription to *QST*, $62, payable in US funds. Life Membership, including a subscription to *QST* is available at $1550.* Libraries and institutions, $62 per year.

*Payment arrangements available. Please write for details.

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 $8 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.

For nearly ten years, when Filaments are dark, the feedlines are cold, and the operators are smiling.

All of the winners praise their Heil Pro Set!

1st Place

2nd Place

3rd Place

The incomparable Heil Boomsets were chosen for each of the 52 teams at the recent WRTC competition. We are proud to be a part of the major operations world wide.

Congrats to all of the WRTC 2002 Winners!

HEiL SOUND

5800 North Illinois
Fairview Heights, IL. 62208
www.heilsound.com
618-257-300

"Defining The Standards For Amateur Radio Communications"

TH-G71A / TM-G707A

If great value is what you are looking for in a new dual-band handheld or mobile, look no further. The Kenwood TH-G71A and TM-G707A have what you need. The moment you pick up the TH-G71A you will realize the tremendous quality it offers! The polycarbonate case, large one-piece heat sink, high quality antenna and connector, help make it exceed high MIL-SPECS for shock, dust and water. The large, easy to read and "understand" keypad, makes the TH-G71A the handheld of choice.

The TM-G707A mobile offers the highest quality also, with a one piece die-cast heat-sink, one of the world's smallest detachable front panels for difficult mounting situations and the largest, easiest to read character displays available anywhere. Of course each of these models offer built-in CTCSS en-code/de-code, 200 total memory frequencies on the 144/440 MHz bands, FREE PC programming software and complete operators manual over the internet . Oh, and let's not forget the best customer support in the industry to help both new and old Hams alike.

Experience *The G-Force;* because the *"G"* stands for *GREAT* value!

KENWOOD
COMMUNICATIONS

AMATEUR RADIO PRODUCTS
3975 Johns Creek Court, Suwanee, GA 30024
P.O. Box 22745, Long Beach, CA 90801-5745, U.S.A.
Customer Support: (310) 639-4200 Fax: (310) 537-8235
03ARD-2247 #042403

ISO 9001
JQA-1205
Communications Equipment Division
Kenwood Corporation
ISO9001 certification

INTERNET
Kenwood Website
http://www.kenwood.net
Kenwood Information
*ftp://ftp.kenwood.net

QST is the official journal of **ARRL** *The national association for* ***AMATEUR RADIO*** **Join or renew today.**

TOLL-FREE **888/277-5289** 8 AM to 8 PM Eastern time, Mon-Fri ONLINE **WWW.ARRL.ORG/JOIN.HTML**

225 Main Street, Newington, CT 06111-1494 USA

In the US, **ARRL membership is only $39/year** and just $34/year if you are age 65 or older. Multi-year, family, youth, blind and international rates are available.

One-year memberships include $15 for a one-year subscription to *QST*. Memberships and *QST* cannot be separated.

"IT SEEMS TO US..."

Regulators or Cheerleaders?

No one should doubt that the Federal Communications Commission (FCC) has a difficult job. Its roots lie in the establishment of the Federal Radio Commission (FRC) in 1927. The force behind the creation of the FRC was chaotic interference that threatened to destroy the fledgling broadcasting industry by driving listeners away. Too many stations were being put on the air with inadequate coordination. In other words, the marketplace alone was inadequate to control individual broadcasters' behavior; regulations were needed to protect the industry from itself.

One of the FCC's obligations under the Communications Act is to "generally encourage the larger and more effective use of radio in the public interest." Like any resource, the radio spectrum is finite. One way to ensure that the largest and most effective use of the spectrum can be made is to prohibit unnecessary emissions. Thus, minimizing interference remains a fundamental regulatory mission of the FCC.

On the other hand, U.S. policy is to encourage the provision of new technologies and services to the public. FCC Chairman Michael Powell's interpretation of this policy is that his Commission should be a "cheerleader" for new technologies. On April 23 during an Open Meeting he used that very word to describe the FCC's role with regard to the deployment of a technology that gives us grave concern: broadband power line communications, generally referred to as PLC but now dubbed BPL, for Broadband over Power Line, by the FCC.

The reason for our concern is simple. "Access BPL" involves the introduction of RF energy in the range from 2 to 80 MHz onto so-called "medium voltage" power lines that run along nearly every road and street and into every neighborhood. They are the lines that connect the transformer feeding your home to the nearest substation. According to industry sources, data rates of up to 20 MB/s are possible for distances of up to 2000 feet, and of up to 3 MB/s for distances of up to 4000 feet. Because the power lines are already in place in existing rights-of-way, this makes the technology potentially attractive for delivering broadband services such as Internet access. "In-House BPL" involves much the same thing for LANs using the existing ac wiring in the walls of homes and offices.

BPL does not require that this RF energy be radiated. However, as most of you reading this page no doubt already have realized to your horror, it *will* radiate for the simple reason that there's nothing to stop it. Power lines are unshielded. They are designed to be transmission lines at 60 Hz, not at HF or VHF. For a radio service such as ours that relies for its very existence on the ability to detect and decipher weak signals, including from our automobiles as we drive under these very power lines, BPL could be an intolerable polluter of the radio spectrum. That this would be merely an unintended consequence of BPL deployment—collateral damage, if you will—does not ameliorate the situation.

What the FCC did at its April 23 meeting was to adopt a Notice of Inquiry (NOI) regarding "Carrier Current Systems, including Broadband over Power Line Systems" (ET Docket No. 03-104). In the words of the NOI:

> Through this inquiry, we seek information and technical data so that we may evaluate the current state of BPL technology and determine whether changes to Part 15 of the Commission's rules are necessary to facilitate the deployment of this technology. While BPL may be deployed under our existing Part 15 rules, the rules do not specifically provide measurement procedures that apply to systems using the power line as a transmission medium. We therefore seek comment on what changes, if any, we should make to our Part 15 rules to promote and encourage the new BPL technology and to our measurement procedures for all types of carrier current systems. We further encourage present deployment of BPL that complies with our existing rules, noting that if, or when, our rules are modified, those rules will address prospective compliance.

The Commissioners were rather effusive in their praise of BPL technology as an additional competitor, along with cable and DSL, in the delivery of broadband services to the public. Their favorable impressions were based largely on a single carefully orchestrated "dog and pony show" to which they had been invited in suburban Maryland. (Needless to say, we weren't invited. We'd have brought along an HF receiver for them to listen to.) The NOI does at least raise interference as an issue [emphasis added]:

> In both Access and In-House high-speed BPL technologies, multiple carriers spread signals over a broad range of frequencies that are used by other services that must be protected from interference. In the spectrum below 30 MHz, incumbent authorized operations include fixed, land mobile, aeronautical mobile, maritime mobile, radiolocation, broadcast radio, **amateur radio terrestrial and satellite**, and radioastronomy. In the spectrum from 30 to 300 MHz, incumbent authorized operations include fixed land mobile, aeronautical mobile, maritime mobile and mobile satellite, radioastronomy, **amateur radio terrestrial and satellite**, broadcast TV and radio. This spectrum is also used for public safety and law enforcement, and Federal government aeronautical radionavigation, radionavigation satellite and radiolocation. **Each of these authorized services in the spectrum must be protected from harmful interference.**

Rest assured that the ARRL will do everything in its power to hold the FCC to that promise.

The deadline for comments was not set at press time but probably will be in the latter half of June. We will be posting as much information as possible, as quickly as possible, on the ARRL Web site for use by members and others interested in filing their own comments.

We have a long, hard fight ahead of us.
—*David Sumner, K1ZZ*

Effective Atmospheric Surge Voltage Protection!

Dangerous static charges measuring 1000s of volts can be developed from local thunderstorms, high wind driven snow or sand; so potent, they can actually puncture the dielectric of coaxial cable. Solid-state transceivers and other equipment in your hamshack are very vulnerable to these high-voltage charges so you should take every precaution to protect your equipment and shack from possible serious damage... and, ALPHA DELTA has the answer!

Special Arc-Plugs are used in ALPHA DELTA's Coax Switches, Surge Protectors and DELTA-C Center Insulator which "bleed off" slow rising static electricity charges from the feed line, routing them harmlessly to ground. This is far more effective than DC grounded baluns or chokes. But, even as effective as these devices are, you still need to pay attention to proper grounding procedures as outlined in the ARRL Handbook and other technical publications.

Lightning/EMP Surge Protectors

UL LISTED – Certified protection for your equipment from lightning and static charges much more effectively than low-cost air-gap types.

The heart of this protector is an Arc-Plug™, two electrodes hermetically sealed in a gas filled ceramic cylinder. Acting like a voltage dependent switch, the Arc-Plug™ can repeatedly carry large currents for brief periods of time. If an excessive voltage appears on the feedline line, due to lightning or static charges, the Arc-Plug™ is energized forming a momentary arc and discharge path to ground which protects your valuable equipment from damage.

After repeated zaps, the Arc-Plug™ may need replacing as indicated by an increased VSWR or reduced receive signal strength. A top mounted "O" ring sealed knurled knob allows easy access and replacement of the Arc-Plug™ without tools.

If you are running control voltages through the coax, the impedance compensated thru-line cavity design allows it to pass thru, instead of having to "wire around" as with some other *DC-blocked* designs.

Wide Frequency Range: DC thru 3 GHz, much wider than narrow band DC blocked or stub designs.

Low Insertion Loss: 0.1dB @ 1 GHz, 0.2dB @ 2 GHz, and only 0.5dB @ 3GHz, typical.

4 Models:

ATT-3G50* has Type-N females connectors, rated up to 3.0 GHz and 200 Watts $59.95

ATT-3G50U* has UHF female connectors, rated up to 500MHz and 200 Watts $49.95

**2000 Watt (HP) version available at No Extra Cost*

PathFINDER Digital Auto Tuner

The ONLY auto tuner on the market that has front panel switching and circuitry for BOTH Hi-Z (wire type antennas) and Low-Z (coax fed antennas) and full digital readout for SWR, power and tuner functions. Huge 10:1 tuning range will match a wider variety of antenna than "built-in" tuners. Covers 1.8 thru 30 MHz plus 6 meters. Requires 12VDC @ 1 amp. **$399.95**

Lightning Surge Protected Coaxial Switches

A high quality custom design. Features a rugged cast aluminum housing with Internal micro-strip cavities that provide constant impedance with very low-loss and high isolation between ports all the way through the UHF frequencies. A solid, positive detent roller bearing switch snaps positively into each position. Uses the famous Alpha Delta Arc-Plug™ cartridge which provides continuous surge protection, and if needed, it is easily replaced from the front without disassembly. Unused ports are automatically grounded to reduce antenna interaction, noise and the effects of lightning on your expensive equipment. Easily handles the full legal amateur power limit.

4 models:

DELTA-2 2-position, with SO-239 connectors and rated for operation up to 500MHz..... $49.95

DELTA-2/N 2-position, with N-type connectors, rated for operation up to 1.3GHz..... $64.95

DELTA-4 4-position, with SO-239 connectors, rated for operation up to 500MHz..... $79.95

DELTA-4/N 4-position, with N-type connectors, rated for operation up to 1.3GHz $89.95

PathMINDER Digital Desktop Coax Switch

A six-position digitally controlled coaxial switch. It can switch up to 6 coax outputs with the press of soft-touch front panel buttons. Internal relays handle up to 1500W with very little insertion loss over the 1.8 thru 54 MHz range. Uses SO-239 type connectors. Will not "hot switch" at RF levels above 50W protecting relay contacts or equipment from damage. A microprocessor monitors a radio sensing input and will automatically ground ports, with several grounding options. Requires 12VDC @ 250 mA ... **$149.95**

Limited Space Sloper Antennas

- Proven 1/4 -wave sloper DX Performance
- Alpha Delta "ISO-RES" inductors replace lossy traps and capacitors • Full Power operation
- Factory assembled using insulated #12 copper wire, stainless hardware and 50 ft. of nylon rope.
- Direct 50Ω coaxial feed, no tuner required. See our web site for sloper installation requirements.

DX-A A top performing 1/4-wave Twin Sloper 160, 80 and 40 meter DX antenna. Combines the DX firepower of the 1/4-wave sloper with the wide bandwidth of a 1/2-wave dipole. Installs like an Inverted-V. The length of the legs are only 67 ft. and 55 ft. long **$59.95**

DX-B A single wire high performance 1/4-wave DX Sloper for 160, 80, 40 and 30 meters. Limited space. installation requires only 60 ft. of space for amazing DX performance with the feed-end at 35 ft. and the low end only 8 ft. above ground **$69.95**

Shortened Multibanders

- Alpha Delta "ISO-RES" inductors replace lossy traps and capacitors • Full Power operation
- Direct 50Ω coaxial feed, no tuner required except for extended frequency coverage.
- Factory assembled with insulated #12 copper wire, stainless hardware and 50 ft. of nylon rope.
- Uses a DELTA-C Static Protected center insulator and DELTA-CIN end insulators.
- Install Horizontally or as an Inverted-V.

5 Models:

DX-CC Covers 80-40-20-15-10M, 82 ft. long..... $119.95

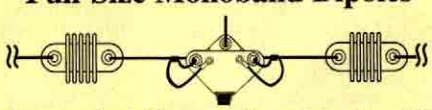
DX-DD Covers 80-40 M,82 ft. long..... $89.95

DX-EE Covers 40-20-15-10M plus 30-17-12M using a wide range antenna tuner, 40 ft. long $99.95

DX-LB 160-80-40M, 100 ft. long. Typical bandwidth for 2:1 VSWR: 160M-20kHz, 80M-40kHz, 40M-300kHz. Full coverage using a wide range antenna tuner..... $119.95

DX-LB PLUS 160-80-40-20-15-10M..... $149.95

Full-Size Monoband Dipoles



50Ω coax feed, full power • Horizontal or inverted V

- Factory assembled with #12 insulated copper wire, DELTA-C static protected center insulator, DELTA-CIN end insulators and 50 ft. nylon support rope.

3 Models:

DX-80 75/80 meters, 134 ft. long..... $49.95

DX-40 40 meters, 67 ft. long $39.95

DX-20 20 meters, 34 ft. long $39.95

MasterCard

Available thru Alpha Delta Dealers or Direct (Add $8 S/H in U.S. – exports quoted)

Toll Free Order Line: (888) 302-8777

VISA

ALPHA DELTA COMMUNICATIONS, INC. AA

P.O. Box 620, Manchester, KY 40962 • Phone (606) 598-2029 • Fax (606)-598-4413

www.alphadeltacom.com

HF EXCITEMENT

INTRODUCING YAESU'S ALL NEW HF MOBILE

Blending leading-edge technologies developed on the FT-897 and MARK-V FT-1000MP transceivers, the FT-857 is the world's smallest* HF/VHF/UHF Multimode Transceiver, and it's available now!

*Jan. 2003

FT-857 DESIGN HIGHLIGHTS

The FT-857 is a high-performance, ultra-compact transceiver operating on the 160-10 meter HF bands, plus the 50, 144, and 430 MHz VHF/UHF bands. Providing 100 Watts of power on HF/6 meters, 50 Watts on 2 meters, and 20 Watts on 70 cm, the FT-857 is ideal for mobile, vacation, DX-pedition, or home use when space is at a premium.

Utilizing the renowned receiver performance of the FT-897 and MARK-V FT-1000MP, the FT-857 features wide dynamic range, optional Digital Signal Processing, and outstanding audio.

The wide array of convenience features includes a 32-color display; Spectrum Scope; built-in keyer with memory and beacon mode; U.S. Weather Band reception; 200 memories with Alpha-Numeric labels; AM Aircraft reception; detachable front panel (optional YSK-857 required); and much, much more.

You've asked for it, and it's here today: the FT-857 New Mobile. . .from the engineers at Yaesu!

New Remote Control DTMF Microphone MH-59A8J (Option)

The optional MH-59A8J Remote Microphone provides control of the major functions of the FT-857 from the microphone's keypad. The MH-59A8J includes a rotary control knob for adjusting the operating frequency and the receiver volume level.

Actual Size

March 2003 VP6DIA Ducie Island Expedition Utilizing Mark-V Field, FT-857, FT-847

The 2nd Ducie Island DX-pedition (VP6DIA) was active March 5 - 13, 2003 from this rare DXCC Entity near Pitcairn Island. Operators VP6MW, VP6DB, VP6AZ, JA1SLS, DK9KX, JR2KDN, DJ9ON, N6TQS, and FO3BM generated over 25,000 QSOs on SSB, CW, and RTTY using YAESU Mark-V Field and FT-857 rigs, and provided the first-ever AO-40 Satellite contacts using the FT-847. The excellent ergonomics, high performance, and compact size of the FT-857s yielded no-compromise pile-up performance on all HF bands.

QSL via JR2KDN. VP6DIA Home Page: http://www.qsl.net/wd4ngb/ducie.htm

FT-857

ULTRA-COMPACT HF/VHF/UHF 100 W* ALL-MODE TRANSCEIVER

(HF/6 m 100 W, 2 m 50 W, 70 cm 20 W)

YAESU
Choice of the World's top DX'ers

Vertex Standard
US Headquarters
10900 Walker Street
Cypress, CA 90630 (714)827-7600

For the latest Yaesu news, visit us on the Internet:
http://www.vxstdusa.com

Specifications subject to change without notice. Some accessories and/or options may be standard in certain areas. Frequency coverage may differ in some countries. Check with your local Yaesu Dealer for specific details.

ARRL in ACTION

YOUR membership at work

By Dave Hassler, K7CCC, dhassler@arrl.org

Weekend Exam Classes Prove Successful

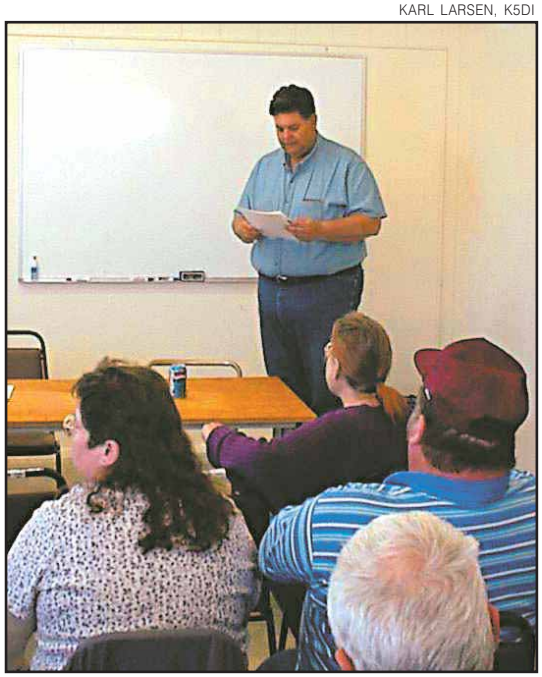
In this busy, 21st century world of ours, sometimes it's hard to make an eight-week commitment, especially for an Amateur Radio night class. But what if you could set aside just one weekend—a Friday evening, Saturday and a Sunday morning—and pass a Technician, General or Morse test element? Given some lead-time, that's something most folks can manage. Just such a program exists in Las Cruces, New Mexico, originated in 1995 by John Pierce, W5FXA, and based on some material from Don Thomas, KA1CWM.

"We used [the eight-week Technician course] for many years, thinking it was about as good as it gets," said Mesilla Valley (NM) Radio Club member Karl Larsen, K5DI. "But it was hard getting another teacher to fill in if work had me away from home and I also remember the high dropout rate among students. It was not unusual to have 10 people start and four take the exam eight weeks later. With the weekend format, we have had no student just not show up to class or quit on Saturday."

With announcements of a course going out months in advance, a class leader finds teachers and organizes class material such as the manuals written by Steve Horan, AC5RI, and the appropriate ARRL video for the license class. The class leader is at the site most of the time, with individual teachers coming in to do their particular section of the class. The class centers on the videos and the various subelements of the question pool, with extensive Q-and-A and explanation. After a practice exam and more study Saturday, an open VEC session ensues Sunday, typically with a perfect passing rate. Both the Technician and General class follow the above formula, while the section on Morse code involves some prior "homework" and the Extra sessions are two-week affairs without video.

A more in-depth discussion of the program, with comments, can be found on ARRL's Educational Activities Forum Web page at **www.arrl.org/FandES/newsletters/EAF/**. The manuals used by the program can be found on Horan's Web site at **telemetry.nmsu.edu/~shoran/radio.htm**.

KARL LARSEN, K5DI

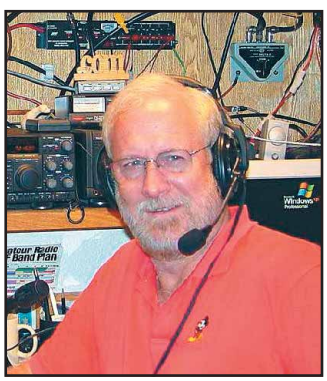


Cash Olsen, KD5SSJ, discusses a fine point in the material during an Amateur Extra weekend class session, held at the MVRC's clubhouse. By condensing the time spent in study, the student is immersed in many aspects of ham radio before a VEC exam.

Montana Hams Campaign for Spectrum Protection Act

ARRL members in Montana wanted to make sure their congressional delegation was well aware of the proposed Amateur Radio Spectrum Protection Act. To that end, the Yellowstone Radio Club in Billings, an ARRL Special Service Club, set up a special Web page to make it as easy as possible for their members to have a voice in the legislative process.

"I think anyone could do what we did and it's no different than what other Amateur Radio operators can do," said club member Terry Whiteside, W7WWW. The club mounted a letter-writing campaign aimed at Sen Conrad Burns, Sen Max Baucus and Rep Dennis Rehberg to inform them of the act and urge their support of it and Amateur Radio in general. The campaign paid off, as Sen Burns agreed to co-sponsor the senate version of the bill. Burns holds the chair of the Senate Communications Subcommittee and he's expected to be the architect of the Senate's future spectrum management legislation. See "Happenings" on page 71 of this issue for a closer look at Sen Burns and the Spectrum Protection Act.



Terry Whiteside, W7WWW, helped put together a letter-writing campaign in the Montana section.

Whiteside, a transportation attorney, helped prepare properly formatted letters in PDF and Word formats to each legislator and placed them on the club's Web site at **www.k7efa.org/letters.htm**. Then, with the help of Montana Section Manager Doug Dunn, K7YD, word about the letters got out on the Sunday Section Net. Quickly, clubs and amateurs all over the state were aware of the project.

Often traveling to Washington, DC, for business, Whiteside was able to utilize the ARRL office there and plan meetings with the Montana delegation's chief communications staffers. "It was key having the ARRL resources in Washington, DC, available to follow through with our efforts, and then we are assured that professional service is made on each contact," he said. A comprehensive look at communicating with your representative in Washington, DC, is on pages 46-48 of the April 2003 issue of *QST*.

Whiteside said that what the Montana section has achieved is completely due to the grassroots efforts back at home. "Without Montana amateurs sending in a lot of letters and e-mails, anything I would do might not be effective, but with those letters and expressions of concern, the job of convincing the senators and our congressman is much easier," he said.

ARRL Message Reaches Thousands at NAB

With so many hams employed in broadcasting, it was a natural that ARRL would be well represented at the annual National Association of Broadcasters convention April 5 through 10 in Las Vegas, Nevada, where almost 90,000 conventioneers gathered. ARRL President Jim Haynie, W5JBP, said it was impressive to note that many in the throng were Amateur Radio operators.

"I got a chance to meet with quite a number of people, including some SBE [Society of Broadcast Engineers] members, and tell them about The Big Project," Haynie said, referring to the League's Education and Technology Program. "My job is to go to these things and develop closer ties with these folks and let them know that Amateur Radio is a resource they can draw from in terms of finding the next generation of engineers."

Haynie said he also got to meet with FCC Chairman Michael Powell and was introduced to the newest FCC Commissioner, Jonathan Adelstein. He also got a chance to converse with National Telecommunications and Information Administration Assistant Secretary Nancy J. Victory. "We want to keep an ARRL presence in front of the FCC and the NTIA, and this was a great opportunity accomplish that," Haynie said.

Also at NAB to represent ARRL were Vice President Fried Heyn, WA6WZO; Pacific Division Director Bob Vallio, W6RGG, and Vice Director Andy Oppel, N6AJO; Southeastern Division Vice Director Sandy Donahue, W4RU; and Nevada Section Manager Dick Flanagan, W6OLD. In addition to meeting with groups and officials, they helped staff an ARRL booth that was coordinated and set up by Las Vegas Amateur Radio Club members Bill Cornelius, K8XC, and Carolyn Cornelius, K9XC. Seventeen Las Vegas-area hams pitched in to make sure the booth was fully staffed during the convention.

"We staffed the booth for four days, promoting ARRL to about 90,000 convention attendees," Bill Cornelius said "We were able to spread the ARRL message pretty wide."

COURTESY BILL CORNELIUS, K8XC

Bill and Carolyn Cornelius—K8XC and K9XC, respectively—set up an informational ARRL booth at the NAB convention that could hardly go unnoticed. A number of ARRL division, section-level and Las Vegas volunteers helped them staff the booth throughout the five-day conference.

At the NAB Amateur Radio Operators Reception on April 9, Haynie addressed the assembled amateurs packed into the ballroom at the Las Vegas Hilton. Bill Cornelius estimated there were close to 800 hams in attendance at the reception. The annual event acknowledges the many contributions of amateurs to the radio and television arts.

League Aims at Greater Membership Promotion

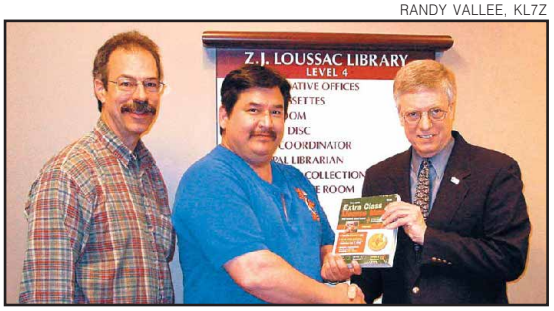
ARRL personnel took the opportunity to try out some new ideas in membership promotion April 4 and 5 at Amateur Electronic Supply's SuperFest show in Milwaukee, Wisconsin. For the show, ARRL Marketing Manager Bob Inderbitzen, NQ1R, assembled a special League exhibit as a platform to test the new ideas. He said the experiences gained at SuperFest will be shared with Field Organization managers at ARRL Headquarters as part of the League's ongoing efforts to look for new and effective ways to support membership recruitment efforts among ARRL volunteers.

"We nearly doubled the membership sign-ups this year," Inderbitzen said, noting that 41 members joined or renewed their ARRL membership at this year's SuperFest, versus 24 in 2002. Also helping out with the ARRL exhibit were Central Division Director Dick Isely, W9GIG; Wisconsin Section Manager Don Michalski, W9IXG, and Dennis Motschenbacher, K7BV.

Alaska Club Presents ARRL Book Sets to Libraries

If there's one thing that the Anchorage Amateur Radio Club understands, it's that information and knowledge are empowering. And it's why the club purchased a number of sets of ham radio books from ARRL to distribute to seven libraries in south-central Alaska.

RANDY VALLEE, KL7Z



From left, Steve Jensen, KLØVZ, and Randy Vallee, KL7Z, present part of a book set the AARC purchased to Art Weeks, Municipal Librarian at Z. J. Loussac Public Library, Anchorage's main branch. Four other sets will go to branch libraries, while two more are destined for outlying areas in south-central Alaska.

AARC treasurer Steve Jensen, KLØVZ, said his club earned the money from running a number of fundraisers in the community. "We've bought single book sets in the past, but never as many as this at one time," Jensen said. "This year we had $1500 to spend on books and our national organization, ARRL, made the books available at a very attractive cost so we could reach as many communities as possible."

The sets were purchased with the help of the ARRL Publications Branch. Publications Fulfillment Supervisor Zoe Belliveau worked with Jensen to put together sets that are made up of a wide range of League publications, including the *2003 ARRL Handbook for Radio Amateurs*, the 19th edition of the *The ARRL Antenna Book*, *The ARRL RFI Book*, *Understanding Basic Electronics* and other ham-oriented books. "The dedication of these sets to the libraries around Anchorage is a great step in broadening the interest and promotion of Amateur Radio in Alaska," Belliveau said. She noted that any club or individual can purchase book sets for donation to a library or school. Visit **www.arrl.org/FandES/field/club/libookset.html** on the ARRL Web site to get started.

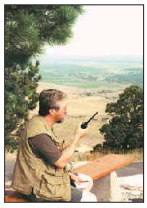
The sets went to five branch libraries in the Greater Anchorage area, and one set each went to the libraries in Wasilla and Soldotna. AARC president Randy Vallee, KL7Z, said that Art Weeks, the librarian at the Z. J. Loussac Public Library in Anchorage, was very happy to receive the book donation from the club.

"Art used to listen to shortwave radio when he was a kid, most notably Radio Moscow and its propaganda of years gone by. He was also excited about Amateur Radio using the Internet for things like IRLP. Maybe he will become an amateur operator someday. The library now has the books for him and everyone else to check out," Vallee said.

"We want to function as a vehicle for people to get involved with radio," Jensen said. "Purchasing the ham radio book sets for the libraries meets that mission."

Guide to ARRL Member Services

ARRL, 225 Main Street, Newington, CT 06111-1494



www.arrl.org/services.html/ **860-594-0200**

Technical and Regulatory Information Services

A wealth of problem-solving information is available to you on the ARRLWeb at **www.arrl.org/tis/**. Can't find the answer there? Call the Technical Information Service at 860-594-0214 from 9 AM to 4 PM Eastern Time, or e-mail **tis@arrl.org**.

Do you have a question about FCC Rules or local antenna restrictions? See the Regulatory Information Branch on the Web, call 860-594-0236 or e-mail **reginfo@arrl.org**.

ARRLWeb www.arrl.org

Log on for news, information and ARRL services. Members have access to special ARRL Web site features. Place free classified ads. Download and view *QST* product reviews and search the on-line periodicals index.

ARRL E-mail Forwarding

Life in cyberspace is easier when you have your own **arrl.net** e-mail address. When you switch Internet Service Providers, all you have to do is let us know and we'll change your e-mail forwarding automatically. You're spared the hassle of having to tell everyone that you've changed addresses! Sign up on the Web at **www.arrl.org/members-only/emailfwd.html**.

ARRL News

The ARRL News service is the most credible source of news for the amateur community. Breaking stories are available on the ARRLWeb. You can also listen to ARRL Audio News on the Web, or by telephone at 860-594-0384. Have a news tip? E-mail **n1rl@arrl.org**.

QSL Service

The most economical way to send and receive QSL cards throughout the world is through the ARRL QSL Service.

Educational Materials

A complete line of educational materials are available to schools, clubs and individuals.

Books, Software and Operating Resources

You can rely on ARRL for the very best publications and products: license manuals, circuit design and project resources, antenna construction ideas, and more. Shop online or locate a dealer near you at **www.arrl.org/shop**. What's the secret for making great publications even better?—**We listen to you!** E-mail your publications feedback, suggestions and product ideas to **pubsfdbk@arrl.org**.

Insurance

The ARRL "All Risk" Ham Radio Equipment Insurance Plan provides protection from loss or damage to your amateur station and mobile equipment by theft, accident, fire, flood, tornado, and other natural disasters. Antennas rotators and towers can be insured too. Call 860-594-0211.

DXCC/VUCC

The DX Century Club and VHF/UHF Century Club award programs are among the most popular Amateur Radio awards in the world.

Volunteer Examiner Coordinator (VEC)

Are you looking for a place to take your license exam? Do you have questions about the examination process? The ARRL VEC network is the largest in the nation.

Trust in Advertising

ARRL's advertising acceptance process is a unique and respected service provided to both members and advertisers. The ARRL Lab regularly evaluates products for acceptable construction quality, safety, compliance with FCC requirements and performance claims. Members rely on *QST* and other ARRL publications to locate reputable suppliers of Amateur Radio equipment and services.

ARRL Foundation

This is your source for scholarships and other financial grant programs to support Amateur Radio. See **www.arrl.org/arrlf/** on the Web or call 860-594-0230.

Write for *QST*

We're always looking for articles of interest to amateurs. See our Author's Guide at **www.arrl.org/qst/aguide/**. If you have questions, or wish to submit an article for consideration, send an e-mail to **qst@arrl.org** or simply mail your article to *QST* c/o ARRL Hq.

Interested in Becoming a Ham?

Phone toll free 1-800-326-3942, or e-mail **newham@arrl.org**. We'll provide helpful advice on obtaining an Amateur Radio license. See **www.arrl.org/hamradio.html**.

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're in Connecticut, stop by ARRL Headquarters for a visit and tour. Located at 225 Main St, Newington, CT 06111, HQ offers tours at 9, 10 and 11 AM, and 1, 2 and 3 PM Monday through Friday, except holidays. Bring your license and operate W1AW anytime between 10 AM and noon, and 1 to 3:45 PM.

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

	Contact	*Telephone*	*Electronic Mail*
Joining ARRL	Membership Desk	860-594-0338	**membership@arrl.org**
***QST* Delivery**	Circulation Desk	860-594-0338	**circulation@arrl.org**
Permission Requests	Maty Weinberg	860-594-0229	**permission@arrl.org**
Publication Orders	Sales Desk	860-594-0355	**pubsales@arrl.org**
Amateur Radio News	Rick Lindquist, N1RL	860-594-0222	**n1rl@arrl.org**
Regulatory Info	John Hennessee	860-594-0236	**reginfo@arrl.org**
Exams	VEC	860-594-0300	**vec@arrl.org**
Educational Materials	Educational Services	860-594-0267	**ead@arrl.org**
Contests	Dan Henderson	860-594-0232	**contests@arrl.org**
Technical Questions	ARRL Lab	860-594-0214	**tis@arrl.org**
DXCC	Bill Moore	860-594-0234	**dxcc@arrl.org**
Awards/VUCC	Eileen Sapko	860-594-0288	**awards@arrl.org**
Development Office	Mary Hobart	860-594-0397	**mhobart@arrl.org**
Advertising	Advertising Desk	860-594-0207	**ads@arrl.org**
Media Relations	Jennifer Hagy	860-594-0328	**newsmedia@arrl.org**
QSL Service	Martin Cook	860-594-0274	**buro@arrl.org**
Scholarships	Mary Lau	860-594-0230	**foundation@arrl.org**
Emergency Comm	Steve Ewald	860-594-0265	**emergency@arrl.org**
Clubs	Field Services	860-594-0267	**clubs@arrl.org**
Hamfests	Gail Iannone	860-594-0262	**hamfests@arrl.org**
Write for QST	Joel Kleinman	860-594-0273	**qst@arrl.org**

Can't find the department you're looking for? Call 860-594-0200 or e-mail **hq@arrl.org**. Sending e-mail to any ARRL Headquarters staff member is a snap. Just put his or her call sign (or first initial and last name) in front of **@arrl.org**. For example, to send mail to Martin Cook, QSL Service Manager, use **n1foc@arrl.org** or **mcook@arrl.org**. If all else fails, send a message to **hq@arrl.org** and it will get routed to the right person or department.

ARRL Division Directors

As an ARRL member, you elect the directors and vice directors who represent your division on ARRL policy matters. If you have a question or comment about ARRL policies, contact your representatives at the addresses shown.

Atlantic Division

BERNIE FULLER, N3EFN*
17668 Price Rd, Saegertown, PA 16433
(814-763-1529); **n3efn@arrl.org**
Vice Director: Bill Edgar, N3LLR
22 Jackson Ave, Bradford, PA 16701
(814-362-1250); **n3llr@arrl.org**

Central Division

GEORGE R. ISELY, W9GIG
736 Fellows St, St Charles, IL 60174
(630-584-3510); **w9gig@arrl.org**
Vice Director: Howard S. Huntington, K9KM
25350 N Marilyn Ln, Hawthorn Woods, IL 60047
(847-438-3452); **k9km@arrl.org**

Dakota Division

JAY BELLOWS, KØQB
997 Portland Ave, St Paul, MN 55104
(651-238-4444); **k0qb@arrl.org**
Vice Director: Twila Greenheck, NØJPH
3333 Owasso Heights Rd, Shoreview, MN 55126
(651-483-1214); **n0jph@arrl.org**

Delta Division

RICK RODERICK, K5UR*
PO Box 1463, Little Rock, AR 72203
(501-988-2527); **k5ur@arrl.org**
Vice Director: Henry R. Leggette, WD4Q
7335 Ginger Snap Cove, Memphis, TN
38125-4732 (901-757-0444); **wd4q@arrl.org**

Great Lakes Division

JIM WEAVER, K8JE
5065 Bethany Rd, Mason, OH 45040-9660
(513-459-0142); **k8je@arrl.org**
Vice Director: Richard Mondro, W8FQT
800 Dover St, Dearborn Heights, MI 48127
(313-730-2111); **w8fqt@arrl.org**

*Executive Committee member

Hudson Division

FRANK FALLON, N2FF
30 E Williston Ave, East Williston, NY 11596
(516-746-7652); **n2ff@arrl.org**
Vice Director: Stephen A. Mendelsohn, W2ML
318 New Milford Ave, Dumont, NJ 07628
(201-384-0570); **w2ml@arrl.org**

Midwest Division

WADE WALSTROM, WØEJ
7431 Macon Dr, Cedar Rapids, IA 52411
(319-393-8982); **w0ej@arrl.org**
Vice Director: Bruce Frahm, KØBJ
PO Box DX, Colby, KS 67701
(785-462-7388); **k0bj@arrl.org**

New England Division

TOM FRENAYE, K1KI*
PO Box J, West Suffield, CT 06093
(860-668-5444); **k1ki@arrl.org**
Vice Director: Mike Raisbeck, K1TWF
85 High St, Chelmsford, MA 01824
(978-250-1235); **k1twf@arrl.org**

Northwestern Division

GREG MILNES, W7OZ
740 SE 24th Ave, Hillsboro, OR 97123-7286
(503-648-6990); **w7oz@arrl.org**
Vice Director: Jim Fenstermaker, K9JF
10312 NE 161st Ave, Vancouver, WA 98682
(360-256-1716); **k9jf@arrl.org**

Pacific Division

BOB VALLIO, W6RGG
18655 Sheffield Rd, Castro Valley, CA 94546
(510-537-6704); **w6rgg@arrl.org**
Vice Director: Andy Oppel, N6AJO,
1308 Burbank St, Alameda, CA 94501-3946
(510-864-2299); **n6ajo@arrl.org**

Roanoke Division

DENNIS BODSON, W4PWF*
233 N Columbus St, Arlington, VA 22203
(703-243-3743); **w4pwf@arrl.org**
Vice Director: Rev Leslie Shattuck, K4NK
2312 E Ashton St, Seneca, SC 29678
(864-882-3985); **k4nk@arrl.org**

Rocky Mountain Division

WALT STINSON, WØCP
5295 E Evans Ave, Denver, CO 80222-5221
(303-770-3926); **w0cp@arrl.org**
Vice Director: Warren G. "Rev" Morton, WS7W
1341 Trojan Dr, Casper, WY 82609
(307-235-2799); **ws7w@arrl.org**

Southeastern Division

FRANK M. BUTLER JR, W4RH
323 Elliott Rd SE, Ft Walton Beach, FL 32548
(850-244-5425); **w4rh@arrl.org**
Vice Director: Sandy Donahue, W4RU
222 Briarhill Ln, Atlanta, GA 30324
(404-315-1443); **w4ru@arrl.org**

Southwestern Division

ART GODDARD, W6XD
2901 Palau Pl, Costa Mesa, CA 92626
(714-556-4396); **w6xd@arrl.org**
Vice Director: Tuck Miller, NZ6T
3122 E 2nd St, National City, CA 91950
(619-434-4211); **nz6t@arrl.org**

West Gulf Division

COY C. DAY, N5OK
RR 1, Box 254, Union City, OK 73090-9726
(405-483-5632); **n5ok@arrl.org**
Vice Director: Dr David Woolweaver, K5RAV
2210 S 77 Sunshine Strip, Harlingen, TX 78550
(956-425-3128); **k5rav@arrl.org**

ARRL Section Managers

The 15 divisions of ARRL 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. 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. Visit your section page on the Web at **www.arrl.org/sections/**.

Atlantic Division (DE, EPA, MDC, NNY, SNJ, WNY, WPA)

Delaware: Randall K. Carlson, WB0JJX, 121 Scarborough Park Dr, No. 10, Wilmington, DE 19804 (302-655-6179); **wb0jjx@arrl.org**

Eastern Pennsylvania: Eric Olena, WB3FPL, 284 Blimline Rd, Mohnton, PA 19540 (610-775-0526); **wb3fpl@arrl.org**

Maryland-DC: Tom Abernethy, W3TOM, PO Box 73, Accokeek, MD 20607 (301-292-6263); **w3tom@arrl.org**

Northern New York: Thomas Dick, KF2GC, 4 Jenkins St, Saranac Lake, NY 12983 (518-891-0508); **kf2gc@arrl.org**

Southern New Jersey: Jean Priestley, KA2YKN, 7158 Chandler Ave, Pennsauken, NJ 08110 (856-662-3587); **ka2ykn@arrl.org**

Western New York: Scott Bauer, W2LC, 1964 Connors Rd, Baldwinsville, NY 13027 (315-638-7551); **w2lc@arrl.org**

Western Pennsylvania: John V. Rodgers, N3MSE, 803 S Main St, Butler, PA 16001-6326 (724-287-0424); **n3mse@arrl.org**

Central Division (IL, IN, WI)

Illinois: Sharon Harlan, N9SH, 5931 Alma Dr, Rockford, IL 61108 (815-398-2683); **n9sh@arrl.org**

Indiana: James S. Sellers, K9ZBM, 54676 County Road 8, Middlebury, IN 46540-8710 (574-825-5425); **k9zbm@arrl.org**

Wisconsin: Donald Michalski, W9IXG, 4214 Mohawk Dr, Madison, WI 53711 (608-274-1886); **w9ixg@arrl.org**

Dakota Division (MN, ND, SD)

Minnesota: Randy "Max" Wendel, KM0D, 8539 Bryant Ave S, Bloomington, MN 55420-2147 (952-888-5953); **km0d@arrl.org**

North Dakota: Kent Olson, KA0LDG, 7702 Forest River Rd, Fargo, ND 58104-8004 (701-298-0956); **ka0ldg@arrl.org**

South Dakota: Richard L. Beebe, N0PV, 913 S Gordon Dr, Sioux Falls, SD 57110-3151 (605-332-1434); **n0pv@arrl.org**

Delta Division (AR, LA, MS, TN)

Arkansas: Dennis Schaefer, W5RZ, 181 Schaefer Dr, Dover, AR 72837-7923 (479-967-4372); **w5rz@arrl.org**

Louisiana: Mickey Cox, K5MC, 754 Cheniere-Drew Rd, West Monroe, LA 71291 (318-397-1980); **k5mc@arrl.org**

Mississippi: Malcolm Keown, W5XX, 14 Lake Circle Dr, Vicksburg, MS 39180 (601-636-0827); **w5xx@arrl.org**

Tennessee: Terry Cox, KB4KA, 110 Fisherville Rd, Collierville, TN 38017 (901-854-4191); **kb4ka@arrl.org**

Great Lakes Division (KY, MI, OH)

Kentucky: John D. Meyers, NB4K, 218 Cory Ln, Butler, KY 41006-9740 (859-472-6690); **nb4k@arrl.org**

Michigan: Debbie Kirkbride, KA8YKK, Apt 1, 1315 Center Ave, Bay City, MI 48708-6107 (989-892-1212); **ka8ykk@arrl.org**

Ohio: Joseph J. Phillips, K8QOE, 2800 Jupiter Dr, Fairfield, OH 45014-5022 (513-874-0006); **k8qoe@arrl.org**

Hudson Division (ENY, NLI, NNJ)

Eastern New York: Pete Cecere, N2YJZ, 378 Ohayo Mtn Rd, Woodstock, NY 12498 (845-679-9846); **n2yjz@arrl.org**

NYC-Long Island: George Tranos, N2GA, PO Box 296, Bellport, NY 11713 (631-286-7562); **n2ga@arrl.org**

Northern New Jersey: William Hudzik, W2UDT, 111 Preston Dr, Gillette, NJ 07933 (908-580-0493); **w2udt@arrl.org**

Midwest Division (IA, KS, MO, NE)

Iowa: Jim Lasley, N0JL, PO Box 5, Chillicothe, IA 52548 (641-935-4337); **n0jl@arrl.org**

Kansas: Ronald D. Cowan, KB0DTI, PO Box 36, LaCygne, KS 66040 (913-757-4455); **kb0dti@arrl.org**

Missouri: Dale C. Bagley, K0KY, PO Box 13, Macon, MO 63552-1822 (660-385-3629); **k0ky@arrl.org**

Nebraska: Bill McCollum, KE0XQ, 1314 Deer Park Blvd, Omaha, NE 68108 (402-734-3316); **ke0xq@arrl.org**

New England Division (CT, EMA, ME, NH, RI, VT, WMA)

Connecticut: Betsey Doane, K1EIC, 92 Mohegan Rd, Shelton, CT 06484-2448 (203-929-7759); **k1eic@arrl.org**

Eastern Massachusetts: Phil Temples, K9HI, Apt. 803, 125 Coolidge Ave, Watertown, MA 02472-2875 (617-331-0183); **k9hi@arrl.org**

Maine: William Woodhead, N1KAT, 68 Madison St, Auburn, ME 04210 (207-782-4862); **n1kat@arrl.org**

New Hampshire: Al Shuman, N1FIK, PO Box 119, Goffstown, NH 03045-0119 (603-487-3333); **n1fik@nhradio.org**

Rhode Island: Bob Beaudet, W1YRC, 30 Rocky Crest Rd, Cumberland, RI 02864 (401-333-2129); **w1yrc@arrl.org**

Vermont: Paul N. Gayet, AA1SU, 124 Macrae Rd, Colchester, VT 05446 (802-860-1134); **aa1su@arrl.org**

Western Massachusetts: William Voedisch, W1UD, 240 Main St, Leominster, MA 01453 (978-537-2502); **w1ud@arrl.org**

Northwestern Division (AK, EWA, ID, MT, OR, WWA)

Alaska: David Stevens, KL7EB, PO Box 113242, Anchorage, AK 99511 (907-345-6506); **kl7eb@arrl.org**

Eastern Washington: Kyle Pugh, KA7CSP, 5006 W Houston Ave, Spokane, WA 99208 (509-327-5039); **ka7csp@arrl.org**

Idaho: John J. Cline, K7BDS, 1475 Oriole Way, Boise, ID 83709 (208-376-6045); **k7bds@arrl.org**

Montana: Doug Dunn, K7YD, 216 Fiddle Creek Rd, Livingston, MT 59047-4116 (406-686-9100); **k7yd@arrl.org**

Oregon: Marshall D. Johnson Sr, KK7CW, 1645 9th Ave SE #171, Albany, OR 97322 (541-990-3127); **kk7cw@arrl.org**

Western Washington: Harry Lewis, W7JWJ, 10352 Sand Point Way NE, Seattle, WA 98125 (206-523-9117); **w7jwj@arrl.org**

Pacific Division (EB, NV, PAC, SV, SF, SJV, SCV)

East Bay: Dennis G. Franklin, K6DF, 4658 Capitan Dr, Fremont, CA 94536-5448 (510-791-0954); **k6df@arrl.org**

Nevada: Dick Flanagan, W6OLD, 2851 Esaw St, Minden, NV 89423 (775-267-4900); **w6old@arrl.org**

Pacific: Bob Schneider, AH6J, PO Box 131, Keaau, HI 96749 (808-966-8146); **ah6j@arrl.org**

Sacramento Valley: Jettie Hill, W6RFF, 306 Saint Charles Ct, Roseville, CA 95661-5008 (916-783-0383); **w6rff@arrl.org**

San Francisco: Leonard Gwinn, WA6KLK, 2960 Blackhawk Dr, Willits, CA 95490-9704 (707-459-1871); **wa6klk@arrl.org**

San Joaquin Valley: Charles P. McConnell, W6DPD, 1658 W Mesa Ave, Fresno, CA 93711-1944 (559-431-2038); **w6dpd@arrl.org**

Santa Clara Valley: Glenn Thomas, WB6W, 502 Walnut Dr, Milpitas, CA 95035-4133 (408-263-9450); **wb6w@arrl.org**

Roanoke Division (NC, SC, VA, WVA)

North Carolina: John Covington, W4CC, PO Box 1604, Belmont, NC 28012 (704-577-9405); **w4cc@arrl.org**

South Carolina: James F. Boehner, N2ZZ, 525 Barnwell Ave NW, Aiken, SC 29801-3939 (803-641-9140); **n2zz@arrl.org**

Virginia: Carl Clements, W4CAC, 4405 Wake Forest Rd, Portsmouth, VA 23703 (757-484-0569); **w4cac@arrl.org**

West Virginia: Hal L. Turley, KC8FS, 6 Ives Dr, Huntington, WV 25705 (304-736-2790); **kc8fs@arrl.org**

Rocky Mountain Division (CO, NM, UT, WY)

Colorado: Jeff Ryan, K0RM, 6721 Northface Ln, Colorado Springs, CO 80919-1508 (719-260-6826); **k0rm@arrl.org**

New Mexico: Joe Knight, W5PDY, 10408 Snow Heights Blvd NE, Albuquerque, NM 87112 (505-299-4581); **w5pdy@arrl.org**

Utah: Mel Parkes, AC7CP, 2166 E 2100 North, Layton, UT 84040 (801-547-1753); **ac7cp@arrl.org**

Wyoming: Jay Ostrem, W7CW, PO Box 1993, Gillette, WY 82717-1993 (307-682-7839); **w7cw@arrl.org**

Southeastern Division (AL, GA, NFL, PR, SFL, VI, WCF)

Alabama: Bill Cleveland, KR4TZ, 2113 Wildwood Pl, Mobile, AL 36609-2583 (251-661-3892); **kr4tz@arrl.org**

Georgia: Susan Swiderski, AF4FO, 772 Camelot Way, Norcross, GA 30071 (770-449-0369); **af4fo@arrl.org**

Northern Florida: Rudy Hubbard, WA4PUP, PO Box 843, Milton, FL 32572-0843 (850-626-0620); **wa4pup@arrl.org**

Puerto Rico: Victor Madera, KP4PQ, PO Box 191917, San Juan, PR 00919-1917 (787-789-4998); **kp4pq@arrl.org**

Southern Florida: Sharon T. "Sherri" Brower, W4STB, 736 34th Ter, Vero Beach, FL 32968-1226 (772-562-3240); **w4stb@arrl.org**

Virgin Islands: John Ellis, NP2B, PO Box 24492, Christiansted, St Croix, VI 00824 (340-773-9643); **np2b@arrl.org**

West Central Florida: Dave Armbrust, AE4MR, 3024 Salem Ave, Sarasota, FL 34232 (941-685-2081); **ae4mr@arrl.org**

Southwestern Division (AZ, LAX, ORG, SDG, SB)

Arizona: Clifford Hauser, KD6XH, 8741 N Hollybrook Ave, Tucson, AZ 85742 (520-744-9095); **kd6xh@arrl.org**

Los Angeles: Phineas J. Icenbice Jr, W6BF, 19323 Halsted St, Northridge, CA 91324 (818-349-3186); **w6bf@arrl.org**

Orange: Joe H. Brown, W6UBQ, 5444 La Sierra, Riverside, CA 92505 (909-687-8394); **w6ubq@arrl.org**

San Diego: Kent Tiburski, K6FQ, 1405 Greenbay St, San Diego, CA 92154 (619-575-1964); **k6fq@arrl.org**

Santa Barbara: Robert Griffin, K6YR, 1436 Johnson Ave, San Luis Obispo, CA 93401-3734 (805-543-3346); **k6yr@arrl.org**

West Gulf Division (NTX, OK, STX, WTX)

North Texas: Roy Rabey, AD5KZ, 600 Morning Glory Ln, Bedford, TX 76021-2207 (214-507-4450); **ad5kz@arrl.org**

Oklahoma: John Thomason, WB5SYT, 1517 Oak Dr, Edmond, OK 73034-7408 (405-844-1800); **wb5syt@arrl.org**

South Texas: E. Ray Taylor, N5NAV, 688 Comal Ave, New Braunfels, TX 78130 (830-625-1683); **n5nav@arrl.org**

West Texas: John C. Dyer, AE5B, 9124 CR 301, Cisco, TX 76437-9525 (254-442-4936); **ae5b@arrl.org**

Alinco Unleashes the Power in Hand-held Communications!

Try the DJ-596 dual bander that can communicate in analog or optional digital modes! Check out the powerful DJ-196/296/496 monoband units. Pick up the "Gen2" DJ-S40 pocket HT. No matter which you choose, you'll get a transceiver that's rugged, easy to program and built for years of dependable operation. You expect more value from Alinco and we deliver!

DJ-596T VHF/UHF Dual-band HT with Digital Voice Option*

Loaded with features! The breakthrough design supports optional digital voice communications and you can easily switch the unit between analog and digital modes!

- Full 4.5 watts output VHF/4w UHF
- Powerful NiMH battery
- 100 memories in any combination of VHF or UHF channels
- Direct frequency input from keypad
- Each memory capable of "odd split" operation.
- Alphanumeric channel labels
- CTCSS and DCS encode+decode plus tone bursts
- Full 2m and 440 band coverage
- Accepts 6 ~ 16 VDC direct input
- Three scan modes
- Illuminated keys and display
- Wide and narrow FM modes
- 10 autodial memories
- Theft alarm feature
- Optional EJ-43U Digital Voice Board!*

DJ-196T (2m), DJ-296T (222 MHz), DJ-496T (440 MHz)

These sturdy, full-featured monobanders are priced low and ready to go!

- 5 watts DJ-196 / 4 watts DJ-296 and DJ-496
- Long-lasting NiMH battery
- 40 memory channels
- Keypad frequency input
- CTCSS and DCS encode+decode
- Alphanumeric display
- 13.8 VDC direct input
- Wide and narrow FM modes
- Illuminated keys and display
- Autodial memories
- S-meter

DJ-S40T 440 MHz Pocket HT

Our Gen2 pocket transceiver packs a powerful punch!

- 100 Memories
- Up to 1 watt output, 500 mw on AA batteries
- Uses AA batteries, optional battery pack or external DC
- Covers 420 ~ 450 MHz
- CTCSS encode + decode
- SMA antenna and connector
- VFO and Memory scan modes
- Hidden speaker produces loud, clear audio
- Wide choice of accessories
- Low Alinco price!

IronHorse.

Great Accessories for Alinco and other radios!

Iron Horse antennas and accessories extend the use of your transceivers and scanners. BNC connections make it easy to take your HT mobile for BIG signals in and out!

IHC 19 car window mount

BNC connectors, window mount, sets up in just seconds!

IHMM270 Compact VHF/UHF Magnetic Mount Antenna

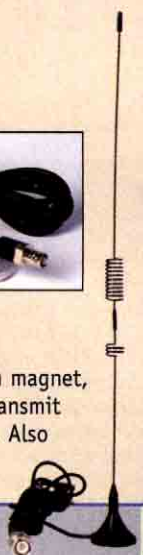
BNC connector, 9 feet of RG-174 cable and a powerful magnet. Less than 20 inches high, SWR less than 1.5:1 throughout either band. Max power: 50w/VHF; 25w UHF.

IHC 20 glass suction-cup mount

Extension BNC suction mount keeps your antenna inside but against the glass for a true "window on the world." For mobile or base use, includes 6 feet of RG-58U cable.

IHMM3 Magnetic Scanner Antenna

BNC connector, just 13.5 inches high. Powerful rare-earth magnet, 9 feet of RG-174 cable. Receives 100 ~ 1200 MHz, can transmit on 2m, 440~ 450 MHz and 824~ 896 cellular frequencies. Also available with Motorola-style antenna connector.



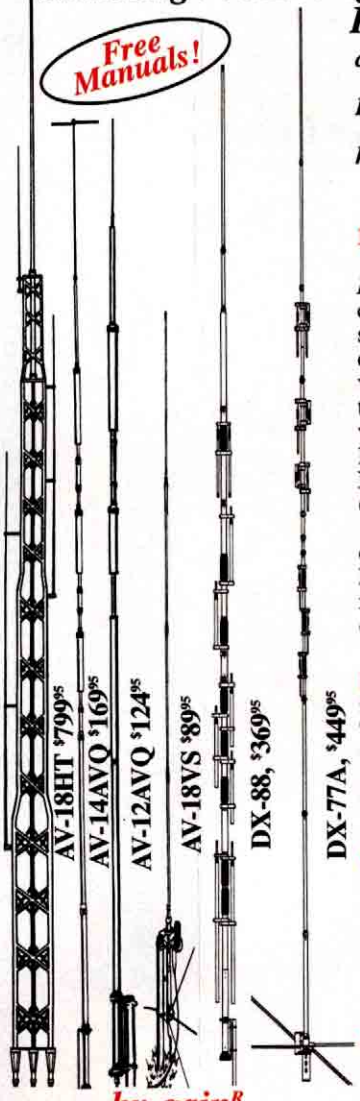
www.ALINCO.com

Distributed in North America by ATOC Amateur Distributing LLC • 23 S. High St., Covington, OH 45318 • (937) 473-2840

hy-gain HF VERTICALS...

Self-supporting -- no guys required . . . Remarkable DX performance -- low angle radiation, omnidirectional . . . Handles 1500 Watts . . . Low SWR . . . Automatic band switching . . . Aircraft quality aluminum tubing . . . Stainless steel hardware . . . Recessed SO-239 connector . . . Two year limited Warranty . . .

Free Manuals!



hy-gain[R] Classics

All hy-gain multi-band vertical antennas are entirely self supporting -- no guys required.

They offer remarkable DX performance with their extremely low angle of radiation and omnidirectional pattern.

All handle 1500 Watts PEP SSB, have low SWR, automatic bandswitching (except AV-18VS) and include a 12-inch heavy duty mast support bracket (except AV-18HT).

Heavy duty, slotted, tapered swaged, aircraft quality aluminum tubing with full circumference compression clamps is used for radiators. Includes all stainless steel hardware. Recessed SO-239 prevents moisture damage. Hy-gain verticals go up easily with just hand tools and their cost is surprisingly low. Two year limited warranty.

AV-18HT, $799.95. (10,12,15,20,40,80 M, 160, 17 Meters optional). 53 ft., 114 lbs. **Standing** 53 feet tall, the famous *Hy-Gain HyTower* is the world's best performing vertical! The AV-18HT features automatic band selection achieved through a unique stub-decoupling system which effectively isolates various sections of the antenna so that an electrical 1/4 wavelength (or odd multiple of a 1/4 wavelength) exists on all bands. Approximately 250 kHz bandwidth at 2:1 VSWR on 80 Meters. The addition of a base loading coil (**LC-160Q, $109.95**), provides exceptional 160 Meter performance. **MK-17, $89.95**. Add-on 17 Meter kit. 24 foot tower is all rugged, hot-dip galvanized steel and all hardware is iridited for corrosion resistance. Special tilt-over hinged base for easy raising & lowering.

AV-14AVQ, $169.95. (10,15,20,40 Meters). 18 ft., 9 lbs. The Hy-Gain AV-14AVQ uses the same trap design as the famous Hy-Gain Thunderbird beams. Three separate air dielectric Hy-Q traps with oversize coils give superb stability and 1/4 wave resonance on all bands. Roof mount with Hy-Gain AV-14RMQ kit, $89.95.

AV-12AVQ, $124.95. (10, 15, 20 Meters). 13 ft., 9 lbs. The AV-12AVQ also uses Thunderbird beam design air dielectric traps for extremely Hy-Q performance. This is the way to go for inexpensive tri-band performance in limited space. Roof mount with AV-14RMQ kit, $89.95.

AV-18VS, $89.95. (10,12,15,17,20,30,40,80 Meters). 18 ft., 4 lbs. High quality construction and low cost make the AV-18VS an exceptional value. Easily tuned to any band by adjusting feed point at the base loading coil. Roof mount with Hy-Gain AV-14RMQ kit, $89.95.

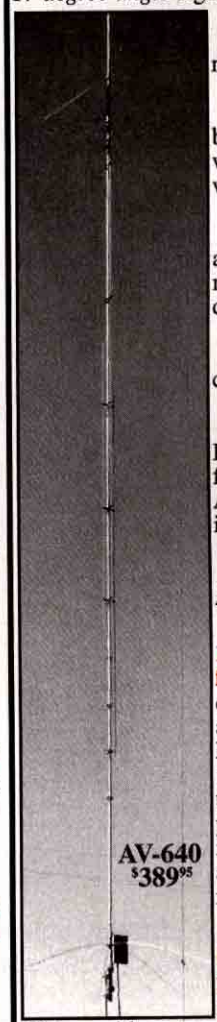
DX-88, $369.95. (10, 12, 15,17,20,30,40,80 Meters, 160 Meters optional). 25 ft., 18 lbs. All bands are *easily* tuned with the DX-88's *exclusive* adjustable capacitors. 80 and 40 Meters can even be tuned from the ground without having to lower the antenna. Super heavy-duty construction. DX-88 OPTIONS: 160 Meter add-on kit, KIT-160-88, $189.95. Ground Radial System, GRK-88, $99.95. Roof Radial System, RRK-88, $99.95.

DX-77A, $449.95. (10, 12, 15, 17, 20, 30, 40 Meters). 29 ft., 25 lbs. *No ground radials required!* Off-center-fed Windom has 55% greater bandwidth than competitive verticals. Heavy-duty tiltable base. Each band independently tunable.

Model #	Price	Bands	Max Power	Height	Weight	Wind Surv.	Rec. Mast
AV-18HT	$799.95	10,15,20,40,80	1500 W PEP	53 feet	114 pounds	75 MPH	------
AV-14AVQ	**$169.95**	**10,15,20,40**	**1500 W PEP**	**18 feet**	**9 pounds**	**80 MPH**	**1.5-1.625"**
AV-12AVQ	$134.95	10/15/20 M	1500 W PEP	13 feet	9 pounds	80 MPH	1.5-1.625"
AV-18VS	**$89.95**	**10 - 80 M**	**1500 W PEP**	**18 feet**	**4 pounds**	**80 MPH**	**1.5-1.625"**
DX-88	$369.95	10 - 40 M	1500 W PEP	25 feet	18 pounds	75 mph no guy	1.5-1.625"
DX-77A	**$449.95**	**10 - 80 M**	**1500 W PEP**	**29 feet**	**25 pounds**	**60 mph no guy**	**1.5-1.625"**

hy-gain[R] PATRIOT

Hy-Gain's new **PATRIOT** HF verticals are the best built, best performing and best priced multiband verticals available today. For exciting DX make full use of your sunspot cycle with the **PATRIOT's** *low 17 degree angle* signal.



No ground or radials needed
Effective counterpoise replaces radials and ground.

Automatic bandswitching
Single coax cable feed. Each band is individually tunable. Extra wide VSWR bandwidth. End fed with broadband matching unit.

Sleek and low-profile
Low 2.5 sq. ft. wind surface area. Small area required for mounting. Mounts easily on decks, roofs and patios.

Full legal limit
Handles 1500 Watts key down continuous for two minutes.

Built-to-last
High wind survival of 80 mph. Broadband matching unit made from all *Teflon*[R] insulated wire. Aircraft quality aluminum tubing, stainless steel hardware.

hy-gain[R] warranty
Two year limited warranty. All replacement parts in stock.

AV-640, $359.95. (6,10,12, 15,17,20,30,40 Meters). 25.5 ft., 17.5 lbs. The AV-640 uses quarter wave stubs on 6, 10, 12 and 17 meters and efficient end loading coil and capacity hats on 15, 20, 30 and 40 meters -- no traps. Resonators are placed in parallel not in series. End loading of the lower HF bands allows efficient operation with a manageable antenna height.

AV-620, $289.95. (6,10,12,15,17,20 Meters). 22.5 ft., 10.5 lbs. The AV-620 covers all bands 6 through 20 Meters with no traps, no coils, no radials yielding an uncompromised signal across all bands.

Free Hy-Gain Catalog
and Nearest Dealer . . . 800-973-6572
Call your dealer for your best price!

hy-gain®

Antennas, Rotators & Towers

308 Industrial Park Road, Starkville, MS 39759 USA
Toll-free Customer Sales Hotline: 800-973-6572
• **TECH:** 662-323-9538 • **FAX:** 662-323-6551
http://www.hy-gain.com

the next best thing to a Ten-Tec Transceiver is a Ten-Tec Accessory

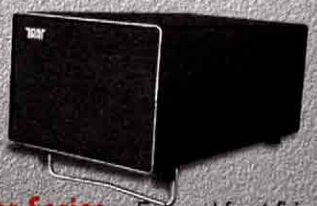
High Power Tuner – Superior matching capability with an L-network tuner assures correct match every time. 2000 watts CW or SSB PEP power rating. ***$475.***

Titan III – NEW! Two 4CX800A tubes, massive power supply, solid overdrive protection. Peak reading wattmeter and QSK standard. Titan III loafs at 1500 watts with 65 watts of drive. ***$3,495.***

Centurion – In its 14th year, this proven dual 3-500ZG design busts the pileups but won't bust your wallet. Peak reading wattmeter and QSK standard. 1300 watts. ***$2,195.***

Studio One – Manufactured with a unique mic element for Ten-Tec by Heil sound, STUDIO ONE is fast becoming the new standard for high quality SSB transmission. ***$129.95.***
Cord and stand sold separately.

705 Desk Mic – Our standard communications desk mic comes ready to plug into any 4-pin-equipped Ten-Tec transceiver. Quality audio with plenty of punch. ***$99.95.***



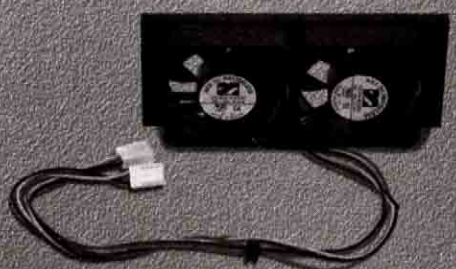
307 Speaker Series – External front-firing communications speakers, available in light grey (307G), black (307B), or charcoal grey (307C), are a terrific addition to any receiver or transceiver. Cabinet and large 4-inch speaker designed specifically for amateur radio use. ***$98.***

963 Power Supply – Hash-free switching design. 13.8 Vdc at 25 amps continuous, 30 amps peak. Small, lightweight (4 lbs!) and 90-264 VAC, 50/60 Hz input make 963 usable from just about anywhere. ***$169.***

937 Power Supply – 13.8 Vdc at 11 amps for powering HF or VHF transceivers of up to 50 watts output. 115 VAC input. ***$89.***

302 Series Tuning Knobs – Armchair tuning and direct frequency entry for your Jupiter (302J), Pegasus (302), RX-350 or Orion (302R). Function buttons allow control of some radio features. ***$139.***

310 Fan Kit – NEW! Hole-free allen screw attachment to transceiver heat sink. 13.8 Vdc powered. Use with Orion, Jupiter, Pegasus, all Omnis, Corsairs, Tritons, Paragons. ***$39.95.***



308 Fan Kit – Slide-on attachment to the Argonaut V transceiver. ***$15.***

TEN-TEC

1185 Dolly Parton Parkway
Sevierville, TN 37862
Sales Dept: 800-833-7373
Sales Dept: sales@tentec.com
Mon. – Fri. 8:00 – 5:30 EST
We accept VISA, Mastercard, Discover, and American Express

Office: (865) 453-7172 • FAX: (865) 428-4483 • Repair Dept.: (865) 428-0364 (8 - 5 EST)

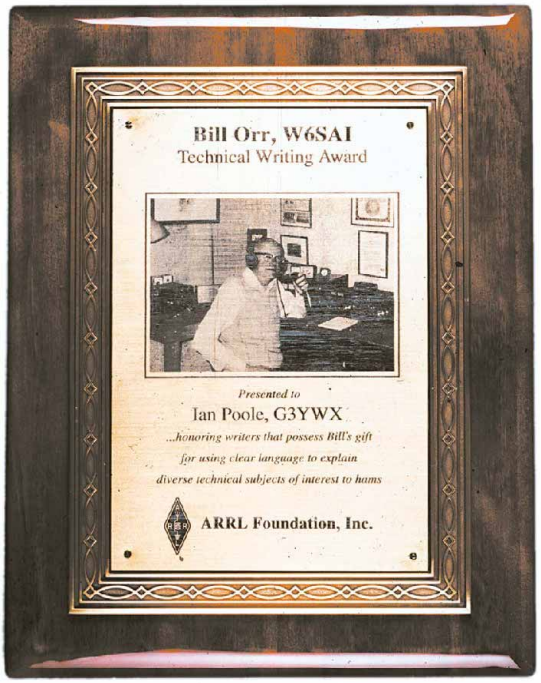
UP FRONT IN QST

DEBBIE HOCKRIDGE

When Ronnie Milsap, WB4KCG, came to Traverse City, Michigan, on Valentine's Day, a group of hams from the Cherryland Amateur Radio Club came out to hear the singer perform at the Leelanau Sands Showroom. From the left: Chuck Mellberg, W8SGR; WB4KCG; Joe Novak, W8TVT, and Rick Houston, K8WZS (a local radio personality with WTCM, one of the show's sponsors). With 40 number 1 hits and six Grammys to his credit, Ronnie has been a country star since the mid '70s.

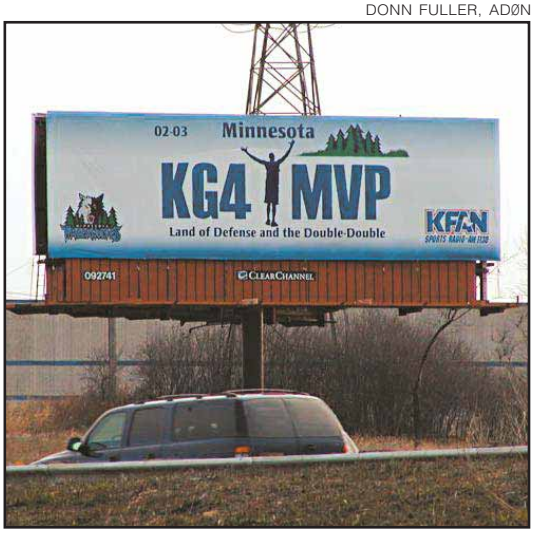
JOHN REISENAUER, JR, KL7JR

John Reisenauer, Jr, KL7JR, of West Richland, Washington, was looking for an easy-to-install loop for his portable island operations when he came across "One Stealthy Delta" by *QST* Editor Steve Ford, WB8IMY, in May 2002 *QST*. "I did modify Steve's design a bit to more fit my needs.... My portable loop is 150 feet long (50 feet per side) and includes a 4:1 balun at the feed-point midway on the horizontal side. The loop took only a few hours to make and the cost was about $20 for wire."



Congratulations, G3YWX!: The coveted Bill Orr, W6SAI, Technical Writing Award, is sponsored and administered by the ARRL Foundation. Orr was an engineer, educator and communicator of extraordinary ability and a frequent contributor to *QST* and other ham radio magazines from the 1940s through the 1980s. The article chosen each year by the *QST* editorial staff exemplifies the writing philosophy of Orr, who died two years ago. The first winner of the Award plaque was Ian Poole, G3YWX, on the basis of his article "Understanding Solar Indices," which appeared in the September 2002 issue of *QST*. For more on the Award, see "At the Foundation," *QST,* Jan 2003, p 91.

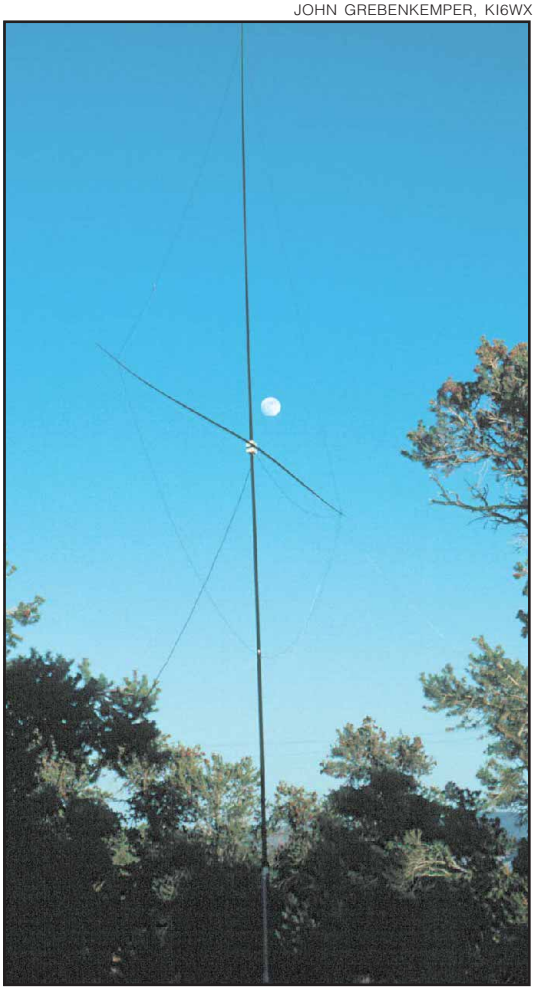
DONN FULLER, ADØN



Donn Fuller, ADØN, of Brooklyn Park, Minnesota, spotted this interesting billboard. Turns out that it's promoting Kevin Garnett (KG to his friends and fans) of the Minnesota Timberwolves as NBA Most Valuable Player (4MVP).

Field Day Fun 2002

JOHN GREBENKEMPER, KI6WX

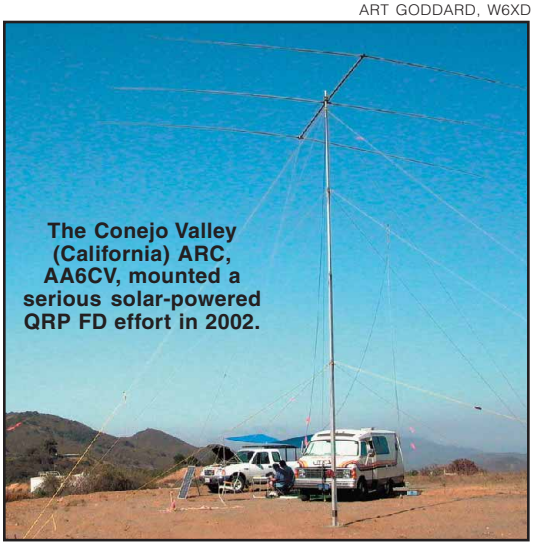


Lunar Field Day: **John Grebenkemper, KI6WX, of Saratoga, California, headed for the Ancient Bristlecone Pine Forest on White Mountain Peak near the California/Nevada border for his solo FD2002 operation. "Some of the trees here are over 4700 years old," he observes.**

LEROY SKALSTAD, WD9HOT

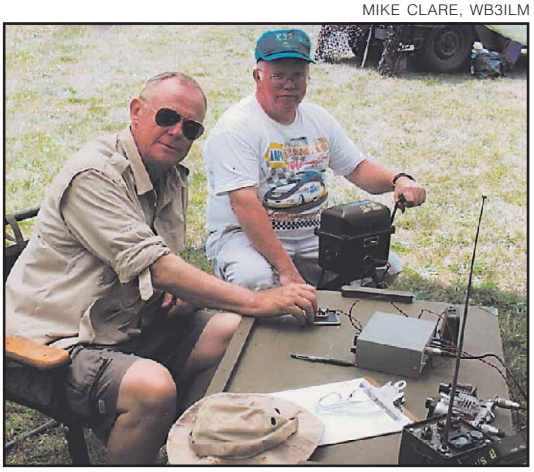
We got a big one, here! **Members of the Milwaukee (Wisconsin) Repeater Club install their impressive FD antenna.**

ART GODDARD, W6XD



The Conejo Valley (California) ARC, AA6CV, mounted a serious solar-powered QRP FD effort in 2002.

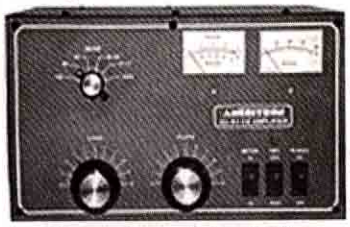
MIKE CLARE, WB3ILM



W3HZW's natural-power FD: **The Kent County ARC in Dover, Delaware, organized a natural power FD effort. That's Breck Smith, K4CHE, pounding brass while "volunteer" Russ Ranum, K3RVR, cranks the military G-77 generator providing 20 V to a bank of six capacitors. The group operated (sans batteries) under a surplus T-10 parachute tent. The QRP transceiver was an EMTECH NW-40 kit with a homebrew tuner.**

AMERITRON . . . 800 Watts . . . $799

Ameritron gives you four 811A tubes, 800 Watts and far better quality -- for less money than the competitor's 3 tube 600 watt unit . . . Why settle for less power, less quality and pay more money?



AL-811H
$799
Suggested Retail

AL-811
$649
Suggested Retail

Only the Ameritron AL-811H gives you four *fully neutralized* 811A transmitting tubes. You get absolute stability and superb performance on higher bands that can't be matched by un-neutralized tubes.

Ameritron mounts the 811A tubes vertically -- not horizontally -- to prevent hot tube elements from sagging and shorting out. Others, using *potentially damaging horizontal mounting*, require special 811A tubes to retard sagging and shorting.

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

AL-800H
$2595
Two tubes, 1500 W plus

AL-800
$1775
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

AL-80B
$1299
Suggested Retail

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*™!

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).

You get 850 Watts output on CW, 500 Watts output on RTTY, an extra heavy duty power supply, genuine *CLASSIC*® 3-500ZG tube, nearly 70% efficiency, tuned input, Pi/Pi-L output, inrush current protection, multi-voltage transformer, dual Cross-Needle meters, QSK compatability, two-year warranty, plus much, much more! **Made in the U.S.A.**

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
$2995
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
$2545
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
$2445
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 . . . $69.95

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 1.2 kW SSB Antenna Tuner . . . $459

Designed to handle the full SSB power of Ameritron's AL-811/811H/80B/500M/600 and other 1.2 kW SSB amplifiers. Cross-Needle meter, roller inductor, more!

ARB-704 amp-to-radio interface . . . $49.95

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.

Call your dealer for your best price! • Free Catalog: 800-713-3550

AMERITRON®

. . . the world's high power leader!

116 Willow Road, Starkville, MS 39759
TECH (662) 323-8211 • **FAX** (662) 323-6551
8 a.m. - 4:30 p.m. CST Monday - Friday
For power amplifier components call (662) 323-8211
http://www.ameritron.com

The Ultimate Portable QRP Rig!

Why do we call the '703 the ultimate portable QRP rig?

- **IC-706MKIIG Operations.** Anyone who has a '706 will know how to operate without the manual!
- **HF or HF & 6M only.** Icom's engineers focused on the bands that really mean the most to QRP operators.
- **Internal Antenna Tuner.** 160-10M or 160-6M, depending on the version. Internal, automatic and designed with latching relays so no current draw when the match is achieved.
- **DSP.** Thats right, Automatic Notch and Noise Reduction is included.
- **Smart Power Mode.** The '703 is one smart radio! It knows when to throttle back the current to prolong the life of your battery.
- **Low Current Consumption.** This QRP rig will rival some handheld radios, as the current drain is as low as 300mA when on 9.6VDC
- **CW Memory Keyer.** Contest QRP is so sweet with the internal CW Memory Keyer. 3 memories capable of holding 50 characters each.
- **Big Ears.** Sensitivity of 0.16uV at 10dB S/N rivals some of the big rigs. This helps compensate for antenna compromises when you're in the field!
- **Cold Hands.** Don't worry, the '703 comes with the TXCO, so your frequency will not drift when you touch the knob with cold hands. Ready foroutdoors!
- **No Assembly Required.** The '703 is ready to go when you are!
- **Way Cool Optional Backpack.** A must have accessory! So cool, '706 owners will have to own one!

Call your authorized Icom dealer for details!

Why not? You deserve it!

www.icomamerica.com

ICOM®

CORRESPONDENCE

Your opinions count! Send your letters to "Correspondence," ARRL, 225 Main St, Newington, CT 06111.
You can also submit letters by fax at 860-594-0259, or via e-mail to: **qst@arrl.org.**
We read every letter received, but we can only publish a few each month. We reserve the right to edit your letter for clarity, and to fit the available page space. Of course, the publishers of *QST* assume no responsibility for statements made by correspondents.

WX HR FB

♦ I've heard a few comments like, "Gee, I hope the weather's nice for Field Day." We must keep in mind that Field Day is a simulated emergency, and chances are that if it was the real thing it would probably not be a bright sunny day.—*Paul J. Kelly, WB1ANT, Johnston, Rhode Island*

FCC CANCELS AMATEUR SERVICE

♦ Okay, are you awake yet?

Anyone naive enough to believe that this could never happen should get their head out of the clouds. Like any good amateur operator, I do a lot of listening. My observations over the last 10 years have shown a drop-off of activity on all bands. The fact that there are many repeaters coordinated on our VHF and UHF bands is not going to be enough to prove we are using our spectrum wisely.

The repeater activity you hear in your area may seem like a lot. And throughout a region, it probably is. But as the battle for spectrum heats up in this decade, telcom giants like Verizon and SBC are going to resort to any tactic they can to get their hands on *any* frequency band, including ours. They have the money to set up scanners at any and all cell sites to monitor the bands for potential hostile takeover.

I've never contributed to the Amateur Radio Spectrum Protection Fund before, mostly because, like others, I'm financially strapped. But I will ignore the envelope no more.

The Fund isn't the only place we can help our cause. Try to get on the air at least once a week. Meet someone new on the air. And while you are surfing the Internet, turn on *Echolink*. Make a few CQs on a random link. Know someone who hasn't been on the air in ages? Contact them to find out why they abandoned their mics and invite them back.

And the next time I hear an unknown call sign on the repeater saying that they are listening, I'm going to come right back with: "KC8*** from N8VES. Hi, I'm Sam. Howya doin' on this fine day?" What about you, Mr Joe Amateur?—*Sam Anderson N8VES, Dayton, Ohio*

SLAM THE SPAMMERS

♦ All that's needed to get rid of spam [S. Ford, "You've Got Spam," May 2003, p 42] is a 1 cent per e-mail tax. The cost to individuals and to legitimate commercial and organizational mailers would be small, but would devastate real spammers since the "get rich quick," porn and other "long shots" require mailings in the millions to get a return.—*David L. Wiesen, K2VX, Reston, Virginia*

HOW ABOUT SEMI-QRP AMPS?

♦ I have read with great interest the fantastic articles and QRP homebrew gear being written up in *QST* the past few years. The quality of these QRP rigs is impressive to say the least. Dave Benson, K1SWL is indeed a "gifted engineer."

However, what I find missing in the amateur fraternity are "gifted engineers" who can design PSK transceivers or CW transceivers with an output of at least 8-10 W.

QRP is a great facet of ham radio but I would venture to say for every QRP operator there are 10 that would like to have a small transceiver to carry when away from home, either on vacation or visiting for several days. Battery power isn't a consideration. It would be nice to have a small transceiver, one for PSK and one for CW, that would enable me to enjoy leisurely QSOs without breaking a sweat. Ten watts of power would do this and miniscule modifications to the existing fantastic QRP rigs are all that is needed.

I have read the arguments that "X" watts gives you only 1 or 2 S units more than "Y" watts or "X" watts will give you only "Y" dB more signal. This is nothing but book math. The fact of the matter is, more signal, no matter how much more, means better copy. I believe the success of QRP has depended totally on the receive operator's patience and tolerance. This is why there are QRP calling frequencies and or the /QRP used at the end of a call.

Isn't it time for *QST* to solicit construction articles that address the low power that portable operations need?—*Allen Poland K8AXW, Keyser, West Virginia*

[As it happens, a 30-W amplifier project appears elsewhere in this issue.—*Ed.*]

ON 802.11 NETWORKS

♦ I am concerned that the article I read in the April 2003 issue [K. Mraz, "High Speed Multimedia Radio," p 28] did not sufficiently address the issues of implementing a ham radio 802.11 network. For instance, how do we limit the connectivity to ham traffic only? Unlike packet radio, there are thousands of non-hams with the gear to connect. Additionally, link level access control and encryption protocols (WEP) are ineffective for this at best. With our licenses, we have the capability to use a high power level with an omnidirectional radiator. I don't feel that is responsible given the numerous groups deploying non-ham lower power 802.11 networks. We can quickly make enemies of our colleagues, and most of the time a directional antenna is cheaper and will not require as much power. If we ever make gateways to connect these networks to the Internet, how do we ensure that IP traffic traveling on our 802.11 devices meets the ham radio standards? It is so simple to go to a bad Web page by mistake. With high speed access comes the ability to violate FCC rules at a rapid pace. I urge all hams to proceed, but with caution and respect for the spirit of the amateur rules.—*Todd Hansen, KD6YPS, San Diego, California*

♦ I would like to add a comment to N5KM's excellent microwave article. Since this band is a shared resource, it would be very prudent for hams planning to use it to first read the FCC rules regarding "unlicensed" operation in the 2.4 GHz band. These are available on the Web at **www.fcc.gov/oet/info/rules/**. The "formal" name for the regulation set is *Title 47, Code of Federal Regulations, Part 15*, typically shortened to *CFR47, Part 15*.

In particular, Section 15.9 should be noted. It is a prohibition against eavesdropping on Wi-Fi transmissions. No mention of WAP of other encryption techniques is noted. While one would not expect to see FCC agents peering to your shack window to see if you are reading the Wi-Fi mail, hams should be careful what they say, and especially what they write, concerning overhead information. You could easily find yourself in violation of federal regulations, with a none-too-happy mob of Wi-Fi users hot after your soul…and your wallet.

This Section seems to have been overlooked by the Electronics Industry press, where there have been articles providing detailed reports of eavesdropping for fun and profit. I haven't seen any widespread use of warnings in the trades, or even in the instruction manuals that accompany these Wi-Fi products.

Remember that non-ham users of these frequencies outnumber us by a wide margin, and that they can influence the FCC, if enough examples of inconsiderate of illegal actions by hams are presented.—*Bill Parrott, Thousand Oaks, California*

"WHY WOULD IT?"

♦ "Now that we have cell phones and

e-mail, I guess Amateur Radio is outdated. Modern techno toys have eliminated the excitement for ham radio."

We have all heard friends and acquaintances tell us that recently. My answer is always the same: "Why would it?"

What is outdated?

No excitement?

Nonsense.

For us it is not the completed contact but completing the contact that counts. In DXing and contesting, a lengthy QSO is 20 seconds. Get the call, name, zone and signal report, and then it is on to QRZ? and the next contact.

For those in public service and emergency communications, the key goal is making sure available equipment operates in *all* disaster situations. (I just love asking my friends how dependable their cell phones would have been during the 9/11 attacks.)

The technically oriented ham radio operator skips QSOs altogether. He or she prefers to spend time improving modes like packet, PACTOR, PSK-31, MFSK-16, AMSAT, digital signal processing, moonbounce and the like.—*Joe Phillips, K8QOE, ARRL Ohio Section Manager, Fairfield, Ohio*

VALUABLE TOOL

♦ In response to a couple of letters in the Correspondence section of the April 2003 issue ["Valuable Tool" and "Traffic: You Can Handle It," p 24]: I'd say those operators active in handling actual real-life messages are much more equipped to take care of actual emergency situations than those who just participate in contests, because they gain real life experience. Contesting, on the other hand, is usually just an exercise in passing such non-information as a signal report that is always 599 or a never-changing ARRL section abbreviation. I do enjoy contests, though, and will continue to participate in them.—*Brett Carter, N7ZX, Fire/Police Dispatcher, Sparks, Nevada*

♦ You really did a good job when you decided to hide this year's "gotcha" in the Correspondence section ["Valuable Tool"]. I've read some of the "contester" myths that talk about how contests help you to do this and that to build a better station. Yeah, right.... Mostly from guys who only get on during contests! Good "April Fools," guys!—*Michael Moreland, KD5BBC, Fort Worth, Texas*

WHERE IT'S @

♦ You may recall me making an inquiry to several ARRL departments a year or so ago about the Morse sequence for the @ sign as used in e-mail addresses. I was told at the time that there was no such sequence. [See Correspondence, Feb 2003, p 24.]

I have learned that the French use *di-dah-dah-di-dah*, (à (French for "at"), and this seems an obvious choice. I have used *di-dah-dah-di-dah* on two occasions when giving my e-mail address over the air and it was understood perfectly at the other end.—*David Pratt, G4DMP/KK7GL, Leeds, UK*

ARE WE REALLY AMATEURS?

♦ I suggest we (ARRL) standardize the color and type of jacket, vest and caps we use along with the print and layout [Op-Ed, Feb 2003, p 95]. By having one national color and layout whenever and wherever we show up for an emergency or community service, we would be recognized for who we are—Amateur Radio operators helping our community.—*Larry Mallory, WB6HTV, Lodi, California*

♦ "Great article!" "Right on the money!" "Exactly my thoughts!" These are just a few of the hundreds of comments I received via email in response to my Op-Ed article. Over 95% were in favor of a national ID. In addition, almost all agreed that the vast conglomeration of jackets and hats displaying club logos, ARES, RACES, Amateur Radio, etc, is self-diluting.

The fact that *we* have called ourselves amateurs for over 75 years does not mean we should not have a nationwide ID for jackets, hats, vests and comm vans. An ID on a jacket is not designed to gain spur of the moment professional acceptance. Nor is it to make ourselves look like policemen. The *uniform* nationwide ID is for the general public to recognize us when we are doing public service.

I received many suggestions. Some creative fellows even made professional looking logos. It seems there is a wide consensus that we should let the public know that we are FCC licensed. After much discussion, the most preferred out of over 50 suggestions is for the back of jackets and vests to display COM in large 6 to 8 inch high letters. Additionally, the words FCC LICENSED in small letters placed over the front left upper quadrant. Of course, one could customize his own personal vest or jacket by placing their call sign in small letters above the words FCC LICENSED.

It is not my contention to eliminate the word AMATEUR from official FCC documentation or international treaties. Nor do I wish to force us to identify ourselves in a different way. But no matter how you look at it, or try to explain it away, labeling our jackets, hats, Com Vans and ourselves with the word AMATEUR does indeed lower the expectations of the general public. Imagine going to your local hospital's emergency room. Two doctors come forward to treat you. One's jacket says DOCTOR while the other's says AMATEUR DOCTOR.

If we really want the general public to gain more awareness of us, they should at least see the exact same label all over the country.—*Jay Kolinsky NE2Q, Pound Ridge, New York* QST

ARRL PUBLICATIONS

SHOP DIRECT or call for a dealer near you.

ONLINE WWW.ARRL.ORG ORDER TOLL-FREE 888/277-5289 (US)

License Study Materials

Technician Class

Exam:

- 35-question Technician test (Element 2)
- No Morse Code Exam

Now You're Talking! Amateur Radio's most popular FIRST license manual.

4th edition, for exams through June 30, 2003.
Order No. 7970 ..... SOLD OUT

NEW! **5th edition**, for exams beginning July 1, 2003.
Order No. 8810 ..... $19.95

ARRL's Tech Q&A. Review from the entire Technician question pool. Brief explanations follow each question. Quick & Easy!

2nd edition, for exams through June 30, 2003.
Order No. 7873 ..... SOLD OUT

NEW! **3rd edition**, for exams beginning July 1, 2003.
Order No. 8829 ..... $12.95

ARRL Technician Class Video Course. Ace your first license exam—the fast, easy, fun way! Complete course includes 3 videotapes, coursebook, and practice exam software (CD-ROM, requires Microsoft *Windows*). For exams through June 30, 2003
Order No. 8330 ..... $149 plus $8 s&h

General Class (upgrade from Technician)

Exams:

- 35-question General test (Element 3)
- 5 WPM Morse code test (Element 1)

ARRL General Class License Manual—4th edition
Order No. 8004 ..... $15

ARRL's General Q & A. Make upgrading to General class Quick & Easy! Review from the entire question pool. Brief explanations follow each question. Order No. 8586 ..... $12.95

ARRL General Class Video Course.
Passing your General written exam has never been easier! Complete course includes 3 videotapes, coursebook, and practice exam software (CD-ROM, requires Microsoft *Windows*).
Order No. 8349 ..... $149 plus $8 s&h

Your Introduction to Morse Code. Pass the 5 WPM code test. Set includes two cassette tapes or two audio CDs with nearly 2-1/2 hours of practice.
cassettes #8322 ..... $14.95
audio CDs #8314 ..... $14.95

Ham University. Learn Morse code with this feature packed easy-to-use software (for Microsoft *Windows* 95-XP). Includes a written exam quiz generator with all three question pools.
Order No. 8735 ..... $39.95

Extra Class (upgrade from General)

Exam:

- 50-question Extra test (Element 4)

ARRL Extra Class License Manual—8th edition
Order No. 8659 ..... $24.95

ARRL's Extra Q & A.
Order No. 8888 ..... $17.95 NEW!

Operating and Reference

NEW! **ARRL Repeater Directory®—2003/2004 edition.** The authoritative source of VHF/UHF repeater listings. Order No. 8918 ..... $9.95

TravelPlus for Repeaters™—2003-2004 edition.
Map your travel route, locate repeaters, and tune in! More data! Inludes *The ARRL Repeater DataBase*, IRLP nodes, AM/FM radio, broadcast television, and NOAA weather stations. Supports GPS. CD-ROM, version 7.0. Order No. 8985 ..... $39.95

The Radio Amateur's World Atlas. Full-color maps showing country boundaries, CQ zones, and more. Order No. 5226 ..... $9.95

The ARRL Operating Manual—7th Edition
Turn to your copy anytime you need information about a new band, mode, or activity. Includes a pull-out Ham Desktop Reference booklet.

Softcover book, #7938 ..... $25

Library Edition book, leather hardcover, #L793 ~~$70~~ $50

ARRL Operating Manual CD-ROM 1.0, #8098 ..... $39.95

On the Air with Ham Radio. Your guide to the fascinating ways hams communicate. FM and repeaters, worldwide HF operating, digital, and more. Get radio-active! Order No. 8276 ..... $17.95

NØAX's Radio Puzzler. Order No. 8225 ..... $7.95

NEW! **The ARRL DXCC List** (May 2003 ed.) Order No. 8942 ..... $4

ARRL's FCC Rule Book-12th Edition. **Sold Out!** New edition coming soon.

The ARRL Net Directory—2001/2002 Edition. Order No. 8357 ..... $5

ARES Field Resources Manual. Order No. 5439 ..... $8.95

The ARRL Emergency Coordinator's Manual. Order No. FSD9 .. $5

Best of the New Ham Companion. Order No. 6001 ..... $12

Stealth Amateur Radio. Order No. 7571 ..... $14.95

DXing on the Edge—The Thrill of 160 Meters. Operating tips and fascinating history. Book with audio CD! Order No. 6354 ..... $29.95

The ARRL RFI Book. Real Answers and Real Cures to your radio frequency interference problems. Order No. 6834 ..... $20

RF Exposure and You. Meet the FCC RF exposure regulations. It's not complicated! Order No. 6621 ..... $19.95

QRP Power shows just how much fun it is to operate with 5 W or less. Order No. 5617 ..... $12

Hints & Kinks for the Radio Amateur
15th Edition. Order No. 7903 ..... $12
16th Edition. Order No. 8926 ..... $15.95 NEW!

Ham Radio FAQ. Order No. 8268 ..... $14.95

Your Mobile Companion. Order No. 5129 ..... $12

Electronic Publication Library

QST on CD-ROM! **QST View CD-ROM** includes back issues of *QST* in convenient, space-saving CD-ROM format. ..... $39.95 per set.

$39.95 per set!

Years		
1995-99	Order No. 8497	1965-69 Order No. 6451
1990-94	Order No. 5749	1960-64 Order No. 6443
1985-89	Order No. 5757	1950-59 Order No. 6435
1980-84	Order No. 5765	1940-49 Order No. 6648
1975-79	Order No. 5773	1930-39 Order No. 6710
1970-74	Order No. 5781	1915-29 Order No. 7008

QST View Collection. SAVE $80.40 when you order all 12 CD-ROM sets! Order No. QSTV ~~$479.40~~ ..... Only $399

ARRL Periodicals CD-ROM is a compilation of all *QST*, *QEX* and *NCJ* issues on one CD. ..... $19.95 per set.

2002 Edition, Order No. 8802	**1998 Edition,** Order No. 7377
2001 Edition, Order No. 8632	**1997 Edition**, Order No. 6729
2000 Edition, Order No. 8209	**1996 Edition**, Order No. 6109
1999 Edition, Order No. 7881	**1995 Edition**, Order No. 5579

QEX Collection CD-ROM. For Communications Experimenters! Includes all issues from ARRL's technical journal, *QEX*, from its beginning in 1981 through 1998. Order No. 7660 ..... **$39.95**

NCJ Collection CD-ROM. Contesters! Enjoy all the back issues of ARRL's popular contesting journal, *NCJ* from 1973 through 1998. Order No. 7733 ..... **$39.95**

Communications Quarterly CD-ROM. Access advanced technical topics in articles which cover transmitter, receiver and transceiver projects, theory, antennas, troubleshooting and more. Includes all issues published from 1990-1999. Order No. 8780 ..... **$39.95**

Ham Radio CD-ROM. Quick access to back issues of ham radio magazine, published from March 1968 to June 1990. Covers a variety of technical interests: projects, theory, antennas, transmitters, receivers, SSB, FM, CW, visual and digital modes, and more .... **$59.95 per set.**

Years 1968-1976 Order No. 8381
1977-1983 Order No. 8403
1984-1990 Order No. 8411

SAVE $30 when you order all 3 sets (1968-1990) Order No. HRCD $149.85

HamCall™ CD-ROM. Features complete US and extensive international listings. Over 1,700,000 call signs. Updated regularly. Requires Microsoft *Windows*. Order No. 8642 ..... **$49.95**

Antennas and Transmission Lines

Edition Closeout

The ARRL Antenna Book—19th Edition
The ultimate reference for antennas, transmission lines and propagation. Construction projects for all types of high performance antennas. Book includes CD-ROM with antenna-related programs and propagation forecasts. Softcover, #8047 ~~$30~~ ..... **Closeout $24.95**

Library Edition book, leather hardcover, #L804 ~~$70~~ ..... **Closeout $47.85**

ARRL Antenna Book CD-ROM 2.0, #8179 ..... **$39.95**

Antenna Zoning for the Radio Amateur. Everything you and your attorney need to know to obtain a permit for your antenna support system. CD-ROM included with additional legal material and forms. Order No. 8217 ..... **$49.95**

ON4UN's Low-Band DXing. Antennas, Equipment and Techniques for *DXcitement* on 160, 80 and 40 Meters. Order No. 7040 ..... **$28**

Simple and Fun Antennas for Hams. Order No. 8624 ..... **$22.95**

ARRL's Yagi Antenna Classics. Yagis, Quads, Loops and other Beam Antennas. Order No. 8187 ..... **$17.95**

ARRL's Wire Antenna Classics. Order No. 7075 ..... **$14**

More Wire Antenna Classics—Volume 2. More dipoles, more loops, more collinears, and more wire beams and verticals! Order No. 7709 ..... **$14**

Vertical Antenna Classics. Order No. 5218 ..... **$12**

ARRL Antenna Compendium series—Practical antenna designs, and other articles covering a wide range of antenna-related topics.

Volume 7. Order No. 8608 **$24.95**
Volume 6. Order No. 7431 **$22.95**
Volume 5. Order No. 5625 **$20**
Volume 3. Order No. 4017 **$14**
Volume 2. Order No. 2545 **$14**
Volume 1. Order No. 0194 **$10**

Practical Circuits and Design

The ARRL Handbook—2003.
The comprehensive RF engineering reference. Always revised! 80th Edition.
Softcover, Order No. 1921 ..... **$34.95**
Hardcover, Order No. 1948 ..... **$49.95**

ARRL Handbook CD-ROM 7.0,
Order No. 1956 ..... **$39.95**

Experimental Methods in RF Design. Design, build and measure equipment at both the circuit and the system level. Explore wide dynamic range, low distortion radio equipment, the use of direct conversion and phasing methods, and digital signal processing. CD-ROM included. Order No. 8799 ..... **$49.95**

Understanding Basic Electronics. Order No. 3983 ..... **$20**

Digital Signal Processing Technology—Essentials of the Communications Revolution. Order No. 8195 ..... **$44.95**

Introduction to Radio Frequency Design. The fundamental methods of radio frequency design using mathematics as needed to develop intuition for RF circuits and systems. CD-ROM Included. Order No. 4920 ..... **$39.95**

ARRL's Low Power Communication—The Art and Science of QRP. Kit sources, gear, antennas and more! Order No. 7334 ..... **$14.95**

W1FB's QRP Notebook is packed with construction projects for QRP transmitters, receivers and accessories. Order No. 3657 ..... **$10**

The ARRL Spread Spectrum Sourcebook. Order No. 3177 ... **$20**

Digital and Image Communications

ARRL's HF Digital Handbook. 2nd Edition. Operate PSK31 and MFSK16—and many of the other popular digital modes. Order No. 8233 ..... **$17.95**

The ARRL Image Communications Handbook. See and talk with other hams! CD-ROM included with software utilities. Order No. 8616 ..... **$25.95**

Space and VHF/UHF/Microwave Communications

The Radio Amateur's Satellite Handbook. The most complete book for every satellite operator and beginner! Revised First Edition. Order No. 6583 ..... **SOLD OUT**

Tune in the Universe! Amateur Radio and the Search for Extraterrestrial Intelligence (SETI). Interactive book on CD-ROM. Order No. 8543 ..... **$24.95**

The ARRL Satellite Anthology—5th Edition. Includes specific satellite operating details. Order No. 7369 ..... **$15**

Weather Satellite Handbook. Order No. 4483 ..... **$20**

The ARRL UHF/Microwave Experimenter's Manual includes information on design and fabrication techniques, propagation, antennas and much more. Order No. 3126 ..... **$20**

NEW!

The ARRL UHF/Microwave Projects CD. Construction articles for transverters, preamplifiers, power amplifiers, high performance antennas, and test and measurement equipment. CD-ROM includes Volumes 1 and 2 of *The ARRL UHF/Microwave Projects Manuals*. Order No. 8853 ..... **$24.95**

International Microwave Handbook. Reference information and designs for the microwave experimenter. Order No. 8739 ..... **$39.95**

If you'd like a complete publications listing or would like to place an order, please contact us:

1. To order or obtain the address of an ARRL Dealer near you, call toll-free (US): 1-888-277-5289 (non-US call 860-594-0355) 8 AM-8 PM Eastern time, Monday-Friday.
2. Fax 1-860-594-0303 24 hours a day, 7 days a week.
3. By mail to: ARRL, 225 Main St, Newington CT 06111-1494
4. Visit our World Wide Web site: http://www.arrl.org/shop

Shipping and Handling Information

In the US, add the following amounts to your order to cover shipping and handling (S/H). Add an additional $2.00 to the US rate for shipment outside the US. US orders will be handled via UPS or comparable service where UPS delivery is not possible. International Air and other specialty forwarding methods are available. Please call or write for information. Sales Tax is required for shipments to CT 6% (including S/H), VA 4.5% (excluding S/H), CA (add applicable tax, excluding S/H). Canadian Provinces NS, NB and NF add 15% HST, all other Provinces add 7% GST (excluding shipping/handling).

Amount of Order	Add	Amount of Order	Add
$10.00 or less	$4.00	40.01 - 50.00	8.00
10.01 - 20.00	5.00	50.01 - 75.00	9.00
20.01 - 30.00	6.00	Over $75.00	10.00
30.01 - 40.00	7.00	CD-ROM only	5.00

We accept the following major credit cards: American Express, MasterCard, Visa and Discover. Prices and product availability are subject to change without notice.

QST 6/2003

By Lilburn Smith, W5KQJ

An Affordable Az-El Positioner for Small Antennas

Build yourself an az-el antenna positioner for one third the cost of a commercial unit and make it easy to point that antenna.

Why an Az-El Positioner?

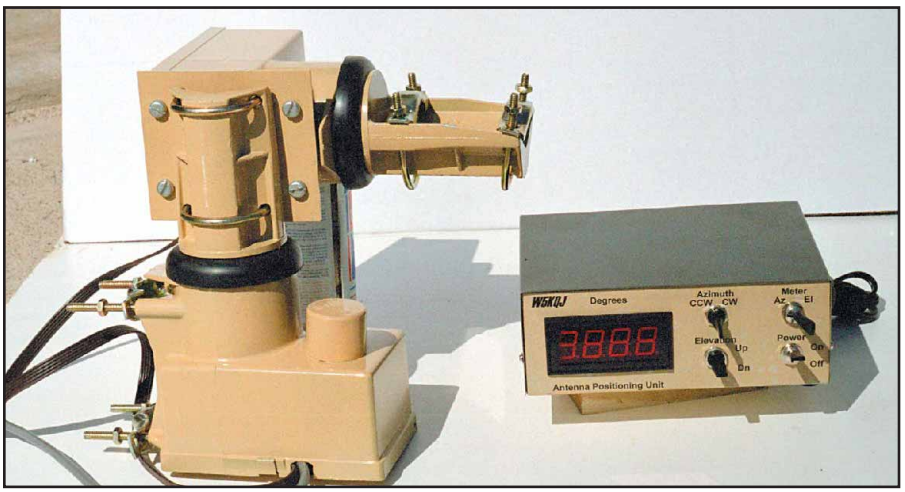
Interest in the UHF and microwave bands is at an all-time high. This is probably due to AO-40 and other satellites, and to the increased offering of commercial gear that includes the frequencies through 1296 MHz. In addition, several firms now market transverters for amateur use up to 10 GHz. The surplus market has yielded a number of 10 GHz and 24 GHz components. More technically minded amateurs are experimenting with even higher frequencies.

All the bands above 430 MHz benefit from small, directional antennas. Although it is possible to make microwave contacts without positioning a high-gain antenna accurately, it is too much work to be fun. When you get above 10 GHz, it is almost impossible to make contacts reliably without an antenna positioner.

The AO-40 satellite has two working transmitters: S band (2.4 GHz) and K band (24 GHz). It utilizes two receivers: U (435 MHz) and L (1260 MHz). Although the AO-40 orbit is such that it does not move in azimuth and elevation rapidly, accurate aiming of the antenna is preferred. A small az-el antenna rotator that can handle a UHF or an L band transmit antenna and an S band or K band receive antenna adds to the enjoyment of working the satellite. And, for polar LEO satellites, an az-el positioner is a must.

Why Build Your Own Rotator?

An affordable azimuth antenna rotator is not difficult to find. Cornell-Dubilier Electronics (CDE) and its successors built thousands of the *AR* and *Ham* series rotators. Rugged and reliable, they are practically indestructible, as long as water does not get into the case. Parts are readily available, although expensive. Every hamfest has a few rotators and control boxes. Used, the rotator and box sell for about $100, and a new set of bearings and a new position potentiometer bring the cost up to around $150. The elevation axis is a different story. Although many good rotators were manufactured that allowed the mast to extend all the way through the rotator, they are now practically impossible to find, even used. New az-el antenna rotators are available, but expensive. For example, the Yaesu 5500 is convenient and works well, but will set you back $700.



One by one, the former rotator manufacturers ceased to manufacture, until all the inexpensive rotators now being sold new appear to be coming from the same factory. The approach discussed in this article is not new, but the rotators used in past years are no longer available. The RadioShack *Archerotor* and the Channel Master *Colorotor* are actually the same unit. Both models have eliminated the position potentiometer. Also, the rotator does not allow a mast to be run through the unit for the elevation axis. Although there are several ways around the mast problem, the position potentiometer is an absolute must. The rotators sold use a control box with a dial rotated by a motor that runs at the same speed as the rotator. The dial just rotates for the same time interval as the rotator. Synchronization is maintained by occasionally rotating the antenna and dial to their mechanical stops: first clockwise, then counterclockwise. The error builds up until resynchronization is necessary. Although tolerable as a TV antenna rotator, the position-indicating system is unsatisfactory for amateur use. Switching rotation directions rapidly while trying to peak on a satellite or distant station just confuses the indicator.

The latest RadioShack and Channel Master catalogs list only a remotely controlled rotator. Azimuth positions that correspond to TV channel numbers are stored in a microprocessor and are transmitted to the control box by an infrared link. Obviously, this scheme has no application to satellite tracking.

This article will address the mechanical mounting of the antennas in an az-el configuration and the addition of a position feedback potentiometer and a simple control box with a digital readout. Although limited in performance, the whole system can be built for $250 if all new parts are purchased. If flea market parts are used, the whole thing can be built for under $100. The rotators are readily available at hamfests and flea markets because they were so poorly suited to

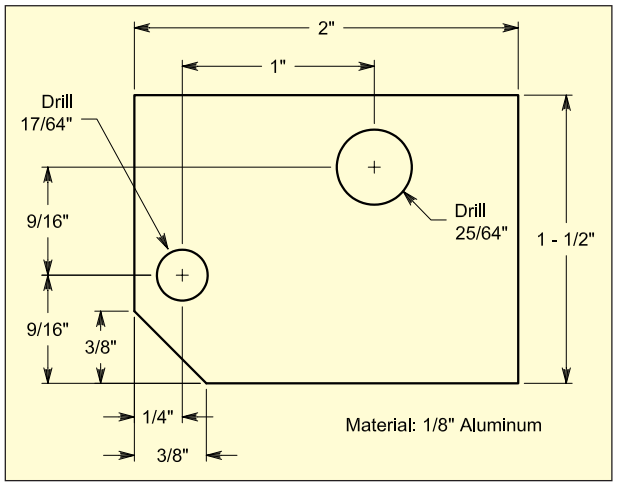


Figure 1—Potentiometer mounting plate. The position of the potentiometer mounting hole is critical for proper gear-meshing. Drill the plate accurately and mark the blank plate before drilling.

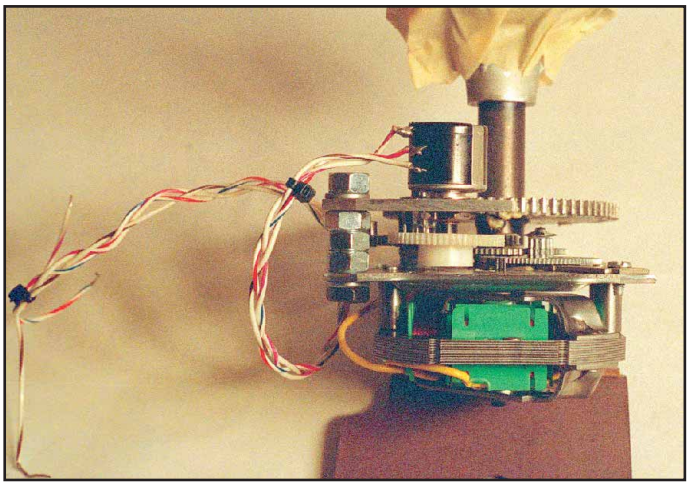


Figure 2—Potentiometer mounting details. Make sure the gears mesh properly, the potentiometer shaft turns freely and the shaft doesn't hit the potentiometer mechanical stops before the rotator shaft stops.

amateur use without the position potentiometer. I bought two brand new ones for $20 each. This az-el positioner will handle any small satellite array and the cost is reasonable.

Modifying the Rotator for Positional Feedback

The position feedback potentiometer will be added to make the rotator useful for ham radio. Without it, it has little or no application. Doug Braun, NA1DB, worked out a simple but elegant method to add a 10-turn position pot to the rotator. The potentiometer is easy to add, but it does add about $16 to the cost. The two items to be added are a gear and a 10-turn potentiometer. The gear is available for about $7 and the potentiometer for about $9.[1]

Make a potentiometer mounting plate from scrap 1/8 inch aluminum sheet to the dimensions shown in Figure 1. Take care to locate the two holes accurately. A good source of 1/8 inch aluminum for your projects is salvaged front panels from commercial gear. These are available at hamfests for practically nothing. Cut the plate to size with a hacksaw or jigsaw and drill the mounting holes. File the edges smooth and square to dress up your work and sand the plate to deburr it and remove any old paint. See the sidebar for metalworking tips.

Using the control box, rotate the rotator CW to the stop. Remove all the external mast mounting hardware from the rotator and save it for future use, including the ¼-20 mast-mounting studs. Gently remove the weather seal. The rotator is held together by three black finished hex-head bolts. One of the bolts is under a fiber insulator. Do not remove the insulator.

[1]Notes appear on page 34.

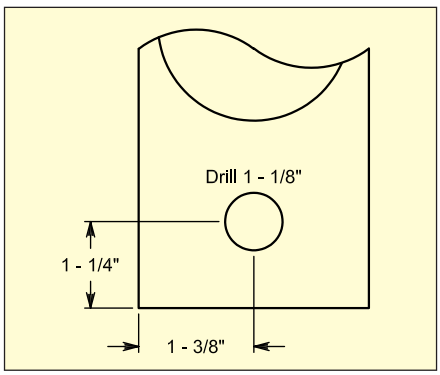


Figure 3—Cut a hole in the rotator housing to clear the potentiometer. This hole is difficult to measure. Drill a small hole after the location is marked to check the placement. Then punch a 1 1/8 inch hole and check for clearance. Finally, epoxy a 1 inch PVC pipe cap over the potentiometer and paint.

Just bend it up slightly to allow access to the third bolt. The bolts are torqued down heavily. Use a 3/8 inch socket to remove them. Remove the gear mechanism from the housing.

Rotate the 10-turn potentiometer CW to the stop and mount the potentiometer to the plate. Place the gear on the potentiometer shaft, with the hub away from the potentiometer. Then mount the plate through the existing hole, as shown in Figure 2, using a 1½ inch ¼-20 machine bolt, with extra nuts as spacers. Align the gear to engage with the existing drive gear. Once the gear is properly engaged, torque the mounting nut down until the split lock washer is fully compressed to prevent any movement of the plate. Check the gear again.

Wire the potentiometer, and route the wires down to the terminal area so that moving parts do not trap them. A dab of clear RTV will hold them in place.

Connect the rotator to the control box and rotate the rotator counterclockwise. Observe that the potentiometer gear is rotating freely. Run the rotator into the counterclockwise stop. It will be necessary to support the rotator main shaft when the rotator is turned outside the housing. The potentiometer gear should slip on the pot shaft when the pot stop is reached. The potentiometer should indicate zero just as the clockwise actuator stop is reached. Rotate the actuator from stop to stop and ensure the 10-turn potentiometer is not hitting its stops. When the potentiometer is positioned correctly, put one drop of superglue on the pot shaft and gear hub. Be careful not to get it on the potentiometer bushing, which will lock the shaft.

Cut a hole in the rotator housing to clear the potentiometer, as shown in Figure 3. Note that the walls of the casting slope slightly. Measure the location of the hole from the outside of the casting with it resting on a flat surface. Use a square to project the corner into the plane of the top of the housing and then measure from the blade of the square. Otherwise the slope will throw the hole location off a little. A couple of triangles will help. If the hole is just slightly off, it is big enough to clear the potentiometer. Mark the hole and drill it with a small drill. Then make a trial assembly of the gear mechanism into the housing and check to see if your small hole is in the center of the potentiometer. If not, move it. When you get it right, drill or punch out the small marker hole to 1 1/8 inch. If you do not have a way to drill or punch the hole, drill the biggest one you can and enlarge the hole to 1 1/8 inch with a round file. Check, from time to time, to see that the potentiometer will be centered in the hole when it is mounted.

Notice that the solder lugs will also have to clear.

Assemble the gear mechanism into the housing. Check the pot wiring to ensure it is clear of rotating parts and not crimped under something. Reinstall the black bolts and torque them down securely. Make certain the shaft is not binding on the housing and adjust the position slightly before tightening the black bolts.

Cement a 1 inch PVC pipe cap over the potentiometer, using clear epoxy cement. Check the rotator operation and the potentiometer wiper resistance. It should vary from nearly zero to about 485 Ω as the rotator goes from stop to stop. If the potentiometer resistance stops changing before the rotator hits the stop, something has gone awry and should be corrected before proceeding.

When everything has been checked, paint the rotator and the PVC pipe cap. Both the PVC and the epoxy cement will deteriorate in the sun unless they are painted. Besides, a painted rotator will make the job look more professional.

Building the Control Box

The control box has two simple jobs to do:

- Power the rotator motor in the correct direction.
- Convert the potentiometer resistance to a display in degrees.

Although a few rotators were manufactured with dc motors, all the units currently in production use split-phase ac motors. A reversible split-phase motor has two identical windings. One winding is fed with 30 V ac. The other winding is fed 30 V ac shifted in phase by 90°. The result is a rotating field with both starting and running torque. To reverse direction, simply change the windings that have the respective voltages. The 90° phase shift is obtained by putting a large value capacitor in series with the winding. A DPDT center-off switch will control the motor direction.

The voltage on the wiper of the pot represents the position of the rotator. If the voltage across the pot is adjusted so that a full rotation of the rotator represents 3.60 V, a voltmeter will read directly in degrees. A small error at zero will result because the resistance of the ground wire from the rotator to the control box is in series with the pot. The error resulting from the simplified version of the circuit is only a degree or so, at worse, with a rea-

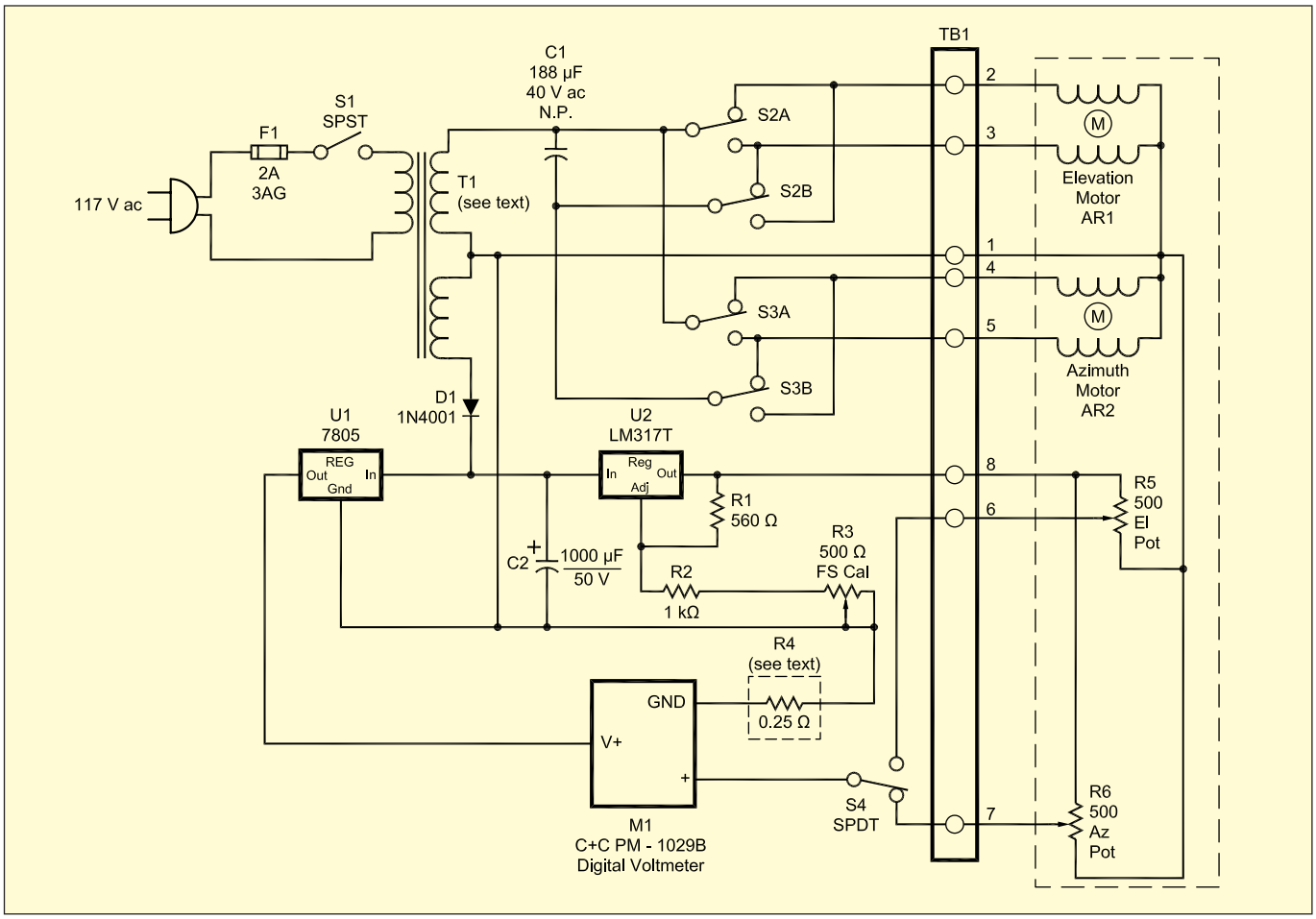


Figure 4—The control box schematic and rotator parts list. RS denotes RadioShack part numbers. Mouser Electronics, 1000 N Main St, Mansfield, TX 76063; tel 800 346-6873; www.mouser.com/.

AR1, AR2—Antenna rotators, RS 15-1245.
C1—188 µF, 40 V ac, non-polarized (salvaged from old rotator control box).
C2—1000 µF, 50 V, RS 272-1047.
D1—1N4001, 1 A, 50 V, RS 276-1101.
F1—Fuse holder, RS 270-364.
M1—Voltmeter, digital, C+C, PM-1029B (see text, Note 2).
R1—560 Ω, 1/4 W, RS 271-1116.
R2—1000 Ω, 1/4 W, RS 271-1321.
R3—500 Ω potentiometer, Mouser 31VA205.
R4—0.25 Ω (see text) #30 AWG wire on ½ W resistor.
R5, R6—500 Ω, 10 turn potentiometer, Mouser 594-53611501.
S1—Switch, SPST, toggle, RS 275-651.
S2, S3—Switch, DPDT, toggle, RS 275-709.
S4—Switch, SPDT, toggle, RS 275-652.
T1—Transformer, 117 V ac pri, 2@24 V ac, 1 A sec (salvaged from old rotator control box).
TB1, TB2—Terminal block, 8 screws, RS 274-670.
U1—Voltage regulator, 7805, RS 276-1770.
U2—Voltage regulator, LM317T, RS 276-1778.

Misc

Gears—2 @ 60 teeth, 48 pitch Delrin gears, Small Parts, Inc GD-4860 (see Note 1).
Enclosure—Project box, RS 270-274.

sonable length of rotator cable. If the zero error is unacceptable, several ways exist to null it out. These will be discussed later.

The digital panel meter used in the prototype is a C+C Model PM-1029B.[2] The C+C series of meters are based on the Intersil 7107 IC chip. Built in China, the meters are simply copies of the Intersil application note circuit. They are low cost and accurate and have numerous features including range selection, automatic polarity display and independent selection of the decimal point. The unit chosen requires +5 V dc at approximately 80 mA. The LED characters are 0.84 inch high, resulting in an easy to read display. The meter sells for about $14. The scale of the panel meter is set at 199.9 mV at the factory. The control box requires a meter with a full scale of 19.99 V. Shorting pairs of pads on the circuit board sets the scale. Carefully remove the solder on the 200 mV pads, and put a small blob of solder on the 20 V pads. Connect the +5 V power supply to the V+ pad. Connect the GND terminal to ground, and the input voltage to be measured to the V_{IN} terminal. The V– terminal and decimal point selection pads are not used.

The schematic of the control box is shown in Figure 4.

One winding of the transformer supplies the power for the motor, and the other winding is used to build a small dc power supply to excite the potentiometer circuit and supply 5 V to the meter.

The control box is built into a Radio Shack enclosure measuring approximately 3 inches tall × 8 inches wide × 6 inches deep. The enclosure is thin gauge steel, difficult to work, but producing a good-looking result. The front panel was doubled with a $^1/_{16}$ inch thick piece of aluminum to make the box sturdier when the switches are flipped. The doubler is probably not necessary. It does have the advantage of providing a pattern for the front panel, which could save a misdrill in the expensive box.

The transformer, line cord and motor capacitor were all taken from the original control box. The switches and miscellaneous parts were all purchased new. The switches have large paddles and are easy to flip. However, the paddles are plastic and may not last as long as regular metal bat-handled toggle switches.

The first thing to do before any construction is started is to put two layers of masking tape on the front and rear panels to preserve the paint. Then, drill the panels as shown in Figure 5. Deburr the holes carefully. The cutout for the meter was done with a jigsaw, then dressed with a file. Modify the cutout to fit your meter.

When all the holes are cut and deburred, apply the symbolization label shown in Figure 6. The label is made from clear sheet Mylar label material obtained at an office supply store. Print the label sheet on an ink jet or laser printer. Be careful to get the label positioned perfectly with respect to the holes and free of wrinkles or bubbles. Use a hobby knife to cut away the Mylar in the holes. Mount the front panel and rear panel components first, because they will not fit into place after the transformer is mounted. Terminal strips mounted on the transformer hold most of the miscellaneous electrical parts. See Figure 7. The voltage regulators are mounted on a small angle bracket, also on the transformer.

When everything is mounted, wire the

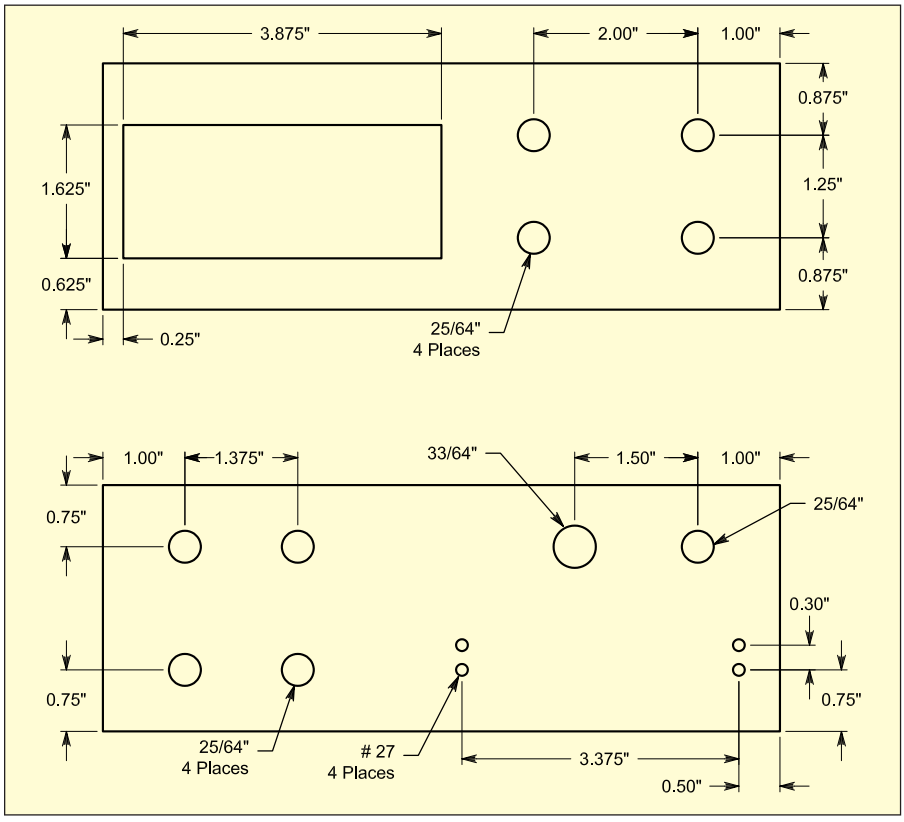


Figure 5—Drilling template for the control box front and back panel.

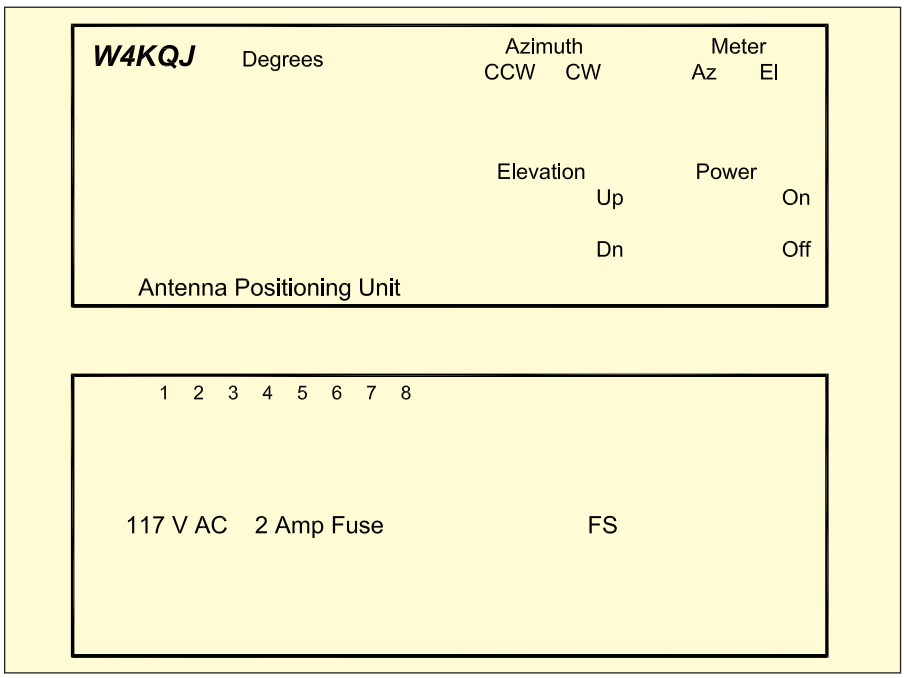


Figure 6—Control box labeling. The label can be printed on a clear sheet and then applied to the box.

box with #22 AWG or larger stranded wire. Train the wires into cable runs to keep the interior as neat as possible. Use cable ties to secure the wiring. The prototype was wired with military surplus high temperature wire in several colors.

Mounting and Wiring the Rotators

The elevation rotator can be mounted directly to the azimuth rotator by using a small adapter plate made of 1/8 inch aluminum as shown in Figure 8. Build one piece, sand to debur it and paint.

Remove the ¼ inch mast-mounting studs from the elevation rotator body with a pair of vise grips. Bolt the adapter plate to the rotator with ¼-20 machine bolts ½ inch long. Use split-lock washers under the bolt heads and tighten until the washers are compressed.

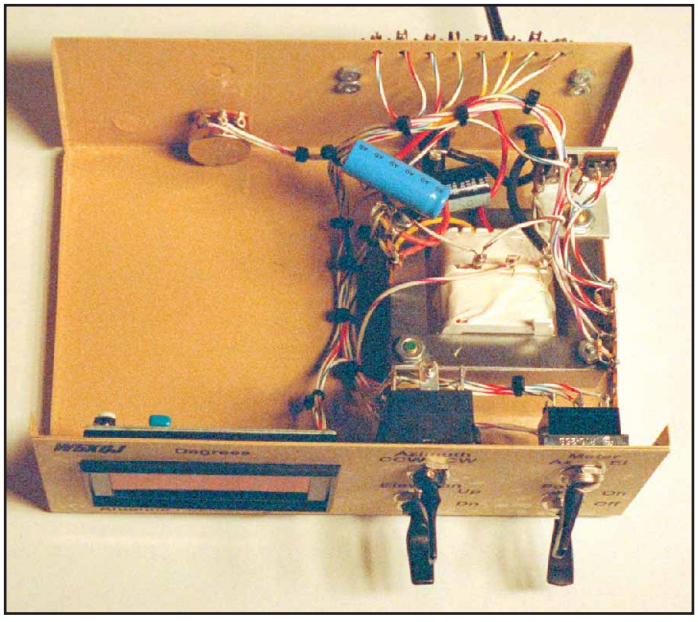


Figure 7—Control box component mounting. The components are mounted on terminal strips secured to the transformer mounting screws. Two screws mount the transformer on diagonal corners; the other corner screws secure the terminal strips.

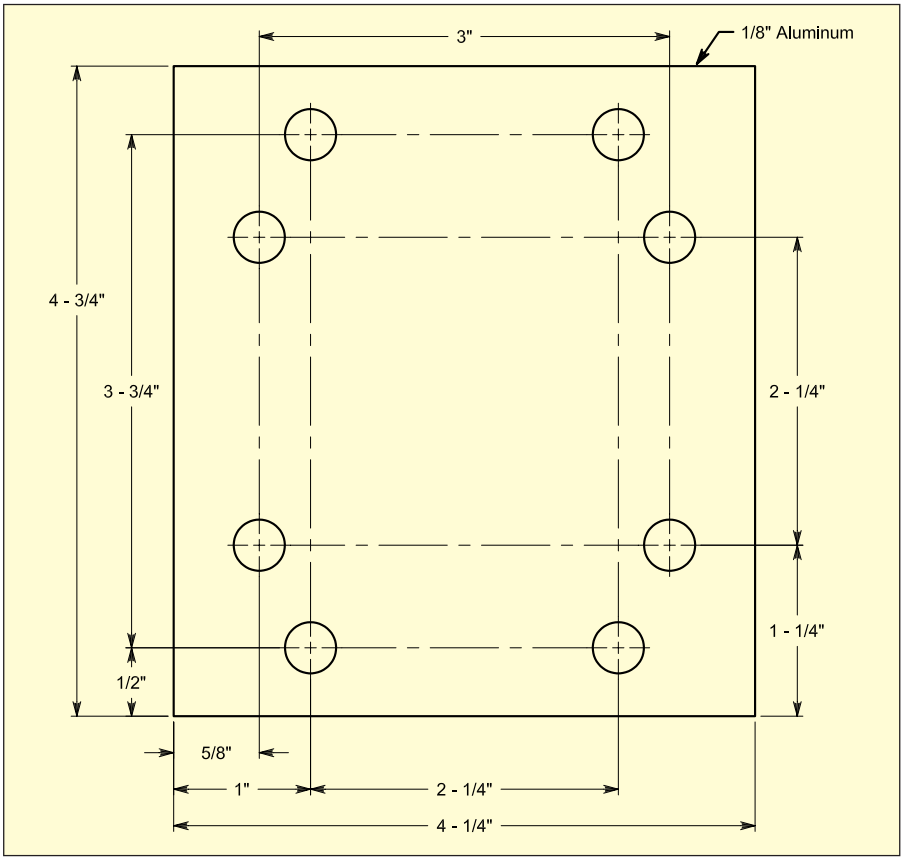


Figure 8— Adapter plate to secure the azimuth rotator to the elevation rotator.

Cut the U-bolts on the azimuth rotator shorter by ½ inch. Set the mast brackets aside. Mount the elevation rotator on the azimuth rotator shaft by the shortened U-bolts. Start all four nuts, and then tighten the bottom nuts until the split lock washers are compressed fully. Then tighten the top nuts. There will be a slight gap from the plate to the rotator shaft because the shaft is tapered slightly. Do not tighten the nuts so tightly that the plate is deformed.

A 30 inch piece of flat, 5-wire cable was used from the elevation rotator down to the azimuth rotator. Strip ¼ inch of insulation from one end of each of the wires. One wire will be silver colored and the rest will be copper colored. Put a red crimp-on lug on the silver wire and the next two wires. Put a red wire splice on the last two wires. Connect the silver colored wire to terminal 3 in the elevation rotator and the next two wires in order to terminals 2 and 1, respectively. Splice the outside wire farthermost from the silver wire to the wire going to the top of the pot. Splice the remaining wire to the wire going to the wiper. Connect the wire from the bottom terminal of the pot to terminal 3 on the rotator. Bring the 5 wire cable from the elevation rotator through the grommet and then into the azimuth rotator to an 8 screw terminal block mounted to the lid. Put red crimp-on terminals on all five wires. Connect the cable lugs to the correct screws on the terminal block as shown in Figure 9. Connect the wires from the azimuth rotator to the remaining screws. Remember that the elevation rotator will have to rotate through 360°, and leave a slack rotator loop in the cable.

The rotator assembly is connected to the control box by standard 8 wire rotator cable. The rotator cable will have two wires larger than the others. On the CDE rotators these wires were used for the ground and the brake solenoid. On this project, one is used for ground and one for the potentiometer voltage. Connect one of the two large wires, regardless of color, to pin 1 on the block. Connect the other large wire to pin 8. Connect the remainder of the wires in color code order to pins 2 through 7. Run the cable through the slot and replace the lid. The grommet is much too small for both cables, so leave it out and seal the wire entry with a glob of RTV sealant.

Connect the 8 wire cable from the azel assembly to the control box. Be sure to use the same color code in wiring the box. Test the whole project before mounting the antennas up on the tower or mast.

Rotate the azimuth rotator clockwise to the stop. Do not continue to apply power after the stop is reached. Set the FS potentiometer (R3) for a 360° reading on the display. Rotate the azimuth rotator counterclockwise to the stop. Check the zero reading. If the zero reading is too high,

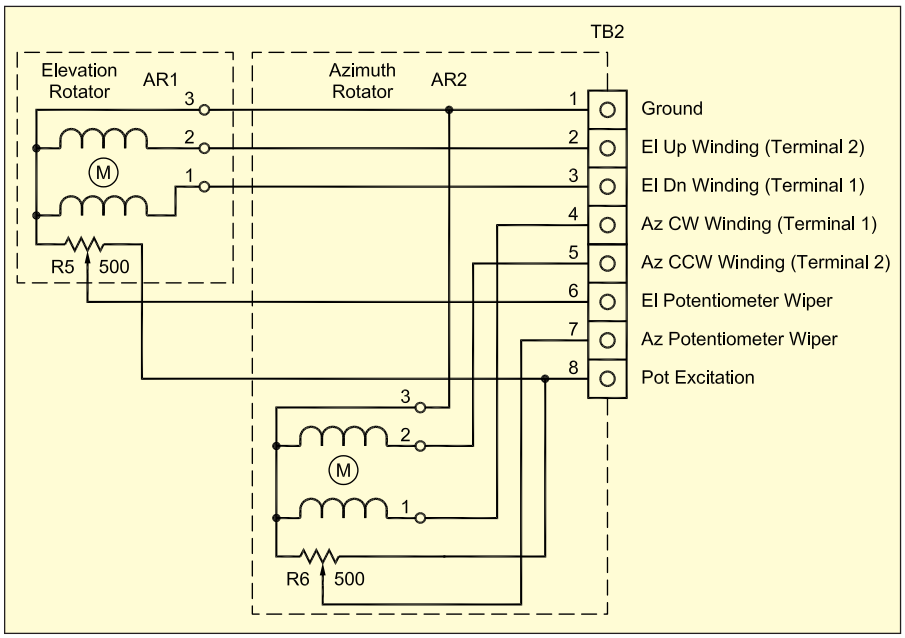


Figure 9—Rotator terminal block wiring. The elevation rotator is wired with 5-wire rotator cable, terminated at a terminal block in the azimuth rotator. The combined unit connects to the control box with 8-wire rotator cable. See Figure 4 parts list.

Figure 10—A single antenna mounted to one side. The rotator is ideal for positioning an S band antenna for receiving the AO-40 satellite.

Working Sheet Metal

Aluminum sheet metal is easy to work, but a few tips will aid you in turning out professional looking work. Mark the outline of the work piece with a square and a sharp scribe. If you do not have a metal shear, cut sheet metal with a saw where possible, as hand shears will bend the edges. The best setup is a radial arm saw with a metal cutting blade installed. Lacking that, a hacksaw with a fine-toothed blade can be used.

A couple of pieces of ¼ × 1 inch aluminum stock about a foot long are great tools. Sandwich the sheet metal work piece in a vise between the two tool pieces with the cut line barely exposed. The tools will make the sheet metal rigid and easy to cut. Use a fine file while the sandwich is still clamped to smooth out the saw marks. Sand the edges smooth and straight with a belt sander or a piece of sandpaper laid flat on the workbench. Be very careful to hold the work at 90°. A sloping edge is a dead giveaway of novice work.

When the work piece is sanded to the correct outline, mark the position of the holes with a square and sharp scribe. Lightly center punch the hole locations. Drill a small pilot hole. Use of a small first hole will insure better accuracy. If at all possible, use a small drill press and clamp the work to the table, using a scrap of material between the work piece and the clamp jaw. Clamp brass anytime you work with it. Even a small drill will turn brass sheet into a lethal weapon.

To deburr and finish the work, sand the flat sides of the aluminum sheet with a small power sander. Use ordinary 120 grit wood sandpaper. Finish with 400 grit wet metal sandpaper for a shiny surface. Use a small sanding block if you do not have a power sander. Do not use a larger drill to deburr holes. The marks will show. Sand the flat surface until the burr disappears.

see "That Pesky Zero Error," following. Now rotate the azimuth rotator to 180° and note that the arrows on the rotator housing and rotator shaft line up. These arrows will be used to set the azimuth axis to SOUTH with a compass after the assembly is in place on the tower or the mast. In a similar manner, check the calibration of the elevation axis. There is no independent adjustment for the elevation axis.

Antenna Mounting Options

If the antenna array is small and light, the elevation mast can be mounted directly to the elevation shaft, as shown in Figure 10. The antennas will then be mounted all on one side. If the wind loads reverse-drive the rotator, due to the lack of a brake, the position pot will still continue to indicate correctly and the angle can be reset.

If a larger antenna array is used, the antennas can be mounted on either side of the rotator as shown in Figure 11. Build the mast assembly shown in Figure 12. Use two 1 inch galvanized steel Ts connected with a 3 inch threaded nipple. The mast is then slid through one T and locked in place by the ¼ inch machine bolt tapped into the T. Do not use 1 inch threaded galvanized pipe for the mast. It is too heavy. Obviously, the elevation mast will hit the structure at two rotation angles, but the elevation angle covered is more than adequate. Try to keep the assembly light and as well balanced as possible. Paint the entire assembly. The galvanized pipe will rust where it was threaded.

When the antennas are all mounted, align the azimuth rotator to SOUTH with the indicator reading 180°. Check the setting of the zero and 360° positions and correct as required using the FS potentiometer. Set the elevation angle with a level so that the indicator reads correctly at 0° and at 90°.

That Pesky Zero Error

It was mentioned earlier that a small error at zero exists. This is because the resistance of the ground wire from the rotator to the control box is in series with the end resistance of the pot. The resulting error is only a degree or so, at worse, with a reasonable length of rotator cable and with the pot properly set so that the end resistance is small. However, if the error is deemed unacceptable, two methods of correction are possible. The easiest is to insert a very small resistance in series with the ground of the meter, as shown by the dashed lines in Figure 4. The resistance will be on the order of 0.25 Ω. Parallel wire 1 Ω resistors until the meter reads zero at zero rotation or use a small resistor made from #30 AWG magnet wire wound on a large value ½ W resistor body. The resistor value must be

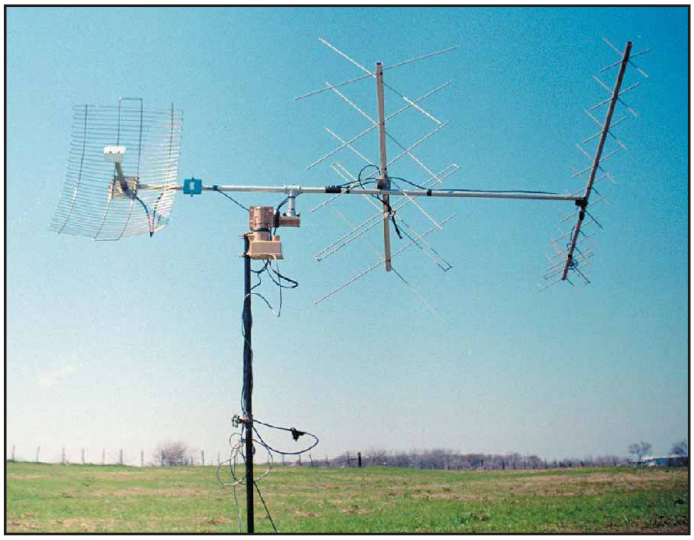


Figure 11—A balanced antenna mast. Heavier arrays should be balanced on both sides of the rotator to equalize the loading. As the elevation mast can't be run through the rotator, a pair of pipe "T"s are used.

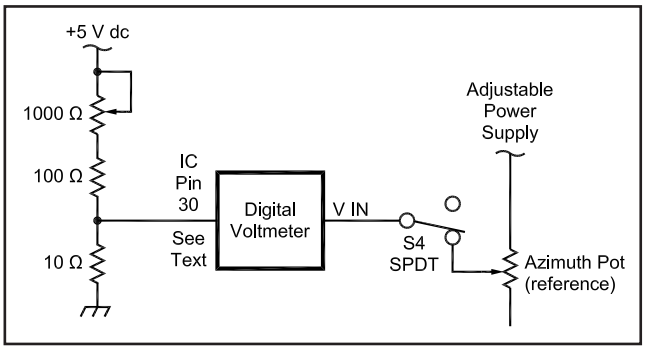


Figure 13—Control box zero error adjustment. If the small zero error is unacceptable a modification is possible. See the text.

kept very low or the excellent zero stability of the voltmeter will be compromised. The resistor represents positive feedback and if too large in value, the meter will oscillate and never settle down.

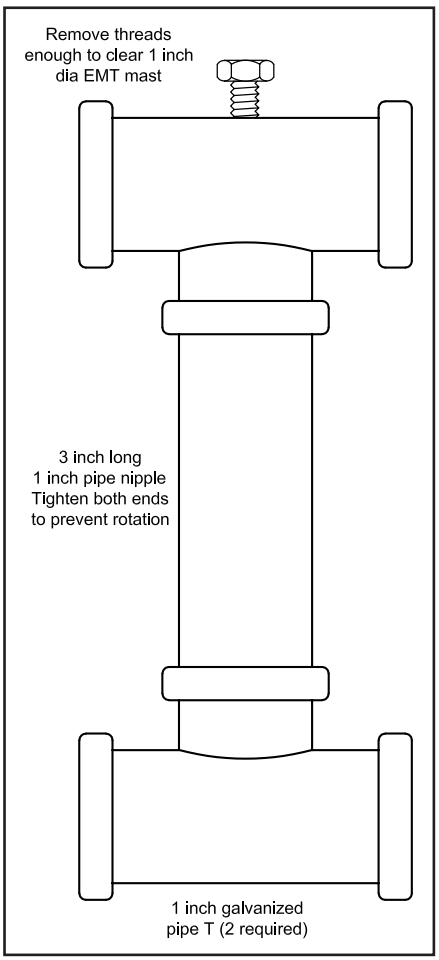


Figure 12—The pipe "T" detail. Two "T"s and a 3 inch nipple allow the mast to be balanced to equalize loading. The top "T" has a machine bolt to lock the mast.

A much better but more costly method is to establish a bridge circuit with the position potentiometers on one side and a zero pot on the other. The bridge is balanced at zero rotation and the meter then reads exactly zero. To implement this zero circuit, the plated through hole on pin 30 of the IC must be drilled out so that a wire can be attached to it. The plated through hole is accessible, but extreme care must be used due to the board layout. The schematic of the zero correction circuit is shown in Figure 13. I recommend living with the small error and not implementing either fix.

Growth Potential

These days everyone wants computer-controlled equipment. For AO-40, computer control is not necessary. The satellite apparent motion is so slow that an occasional tweak of the antenna is all that is required. For polar satellites, however, computer control would be a nice feature. To add computer control to this system, one could use any of the popular interfaces already described by others. However, adding even the simplest interface increases the project cost. The simplest, lowest cost interface is the *Fodtrack* designed by Manfred Krohmer, XQ2FOD, and distributed by *AMSAT-CE*. The printed circuit board is available from FAR Circuits.[3]

Several modern tracking programs have a *Fodtrack* driver option, including the software sold by *AMSAT-NA*.[4]

The *Fodtrack* board has four open collector outputs representing each of the directions of rotation of the rotators. Adding four small SPST relays will enable the circuit to drive the rotators. The contacts are simply paralleled across the respective switch contacts. The output of the two position potentiometers will drive the *Fodtrack* board without additional circuitry.

If that interface is added, mount the printed circuit board behind the voltmeter on spacers to the bottom of the box.

The beauty of the interface is that the meter display will continue to function. The angle displayed by the computer can be compared to the angle displayed by the meter, in order to assure that the antenna is really pointed where you think it is.

Notes

[1]The gears used in this project are available from Small Parts Inc, 13980 NW 58th Ct, Miami Lakes, FL 33014-0650; **www.smallparts.com**. Part no. GD-4860. $6.85 each plus shipping and handling.

[2]The C+C voltmeters are available from Circuit Specialists, 220 S Country Club Dr #2, Mesa, AZ 85210; **www.web-tronics.com**. Part no. PM 1029B. $15.95 plus shipping and handling.

[3]The *Fodtrack* printed circuit board is available from FAR Circuits, 18N640 Field Ct, Dundee, IL 60118-9269; **www.farcircuits.net**. Price $4.50 plus shipping and handling.

[4]*AMSAT-NA* and *AMSAT-CE* distribute *Fodtrack* software on the Web as freeware. The distribution package contains instructions for building the interface board. For more information see the extensive discussion of *Fodtrack* interfacing by Jesse Morris, W4MVB, in *The AMSAT Journal*, Mar/Apr 2002.

Lilburn R. Smith, W5KQJ, was first licensed in 1956. He holds an Extra Class license and has a BSEE degree from Texas Tech University. Lilburn has been involved in microwave, VHF and laser design and holds one US patent. He is a past president of the Central States VHF Society and the North Texas Microwave Society, and can be reached at 290 Robinson Rd, Weatherford, TX 76088; or via e-mail at **W5KQJ@arrl.net**.

By James R. Valdes, WA1GPO

The FARA HF Project

Would you like an economical and relatively easy to build 30 W HF amplifier? For about $130 worth of parts you can give that QRP rig an extra 12 dB of muscle!

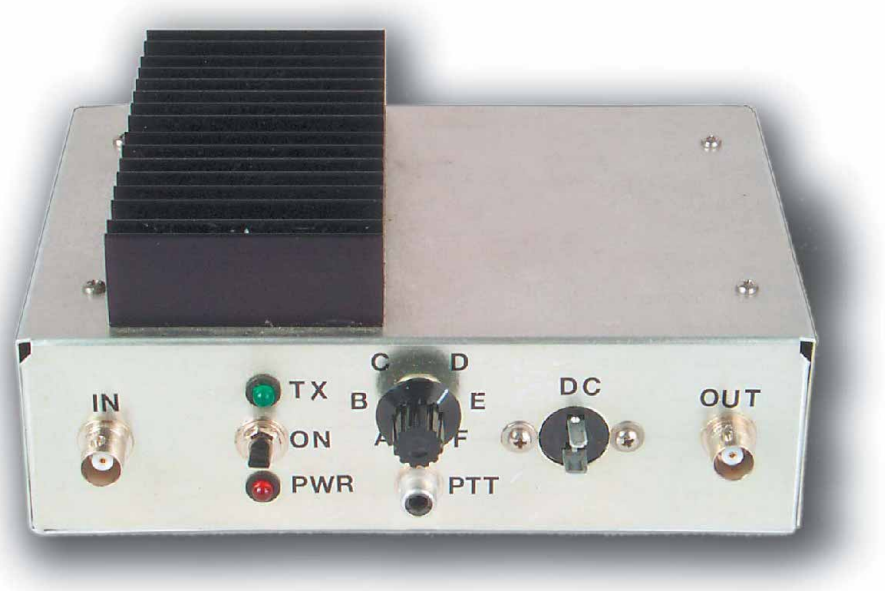


Figure 1—The completed 30 W amplifier. The band switch takes care of output low-pass filter switching.

One of the larger and more active radio clubs in the Cape Cod, Massachusetts area is the Falmouth Amateur Radio Association (FARA). Some of its members are affectionately referred to as the "hackers"—those who enjoy the construction phase of Amateur Radio. The renewed interest in low power (QRP) radios in the 2 to 5 W output range resulted in the desire for a 10 to 12 dB gain RF linear amplifier producing 30 to 40 W of output power. Commercial amplifiers capable of being driven with less than 50 W below 30 MHz are prohibited by FCC regulations.[1] As a radio amateur, you are permitted to construct one amplifier per year for your personal use. The amplifier described here is relatively easy to fabricate, given a basic knowledge of electronics and some familiarity with hand tools. This article describes in detail the construction of a 12 dB, nominal 30 W output, 1.8 to 30 MHz RF power amplifier. It is intended for 12 to 14.7 V dc operation, making it ideal for mobile use.

Amplifier Description

The design of the amplifier is based upon common engineering practices. Ideas gathered from researching the handbooks published by the ARRL and The Radio Society of Great Britain (RSGB), as well as articles published in *QST* and other journals formed the basis of the design. This amplifier uses readily available components…many of the earlier designs were based on the Motorola MRF series of RF devices that are no longer available or are prohibitively expensive.

The amplifier is housed in a 5 × 7 × 2 inch aluminum box. It consists of two stacked circuit boards—an RF amplifier and a low-pass filter. The completed amplifier is shown in Figure 1. Figure 2 is the schematic diagram of the RF assembly together with the amplifier and low-pass filter parts list and Figure 3 is the low-pass filter schematic. The amplifier can be driven by 2 to 5 W at the RF input; an input attenuator consisting of R1, R2 and R3 must be selected (as noted in Figure 2) to ensure the proper drive level (2 W) for the push-pull (2SC2312C device types) class AB amplifier stage. T1 is wound on a small binocular core with a 4:1 ratio as detailed on the schematic. The low impedance secondary is a single turn center tapped; it carries the bias voltage to the output transistors. The bias voltage is derived from the LM317 regulator, which is operated as a switched current source. The LM317 is switched on when the internal PTT line is activated. Bias voltage is developed across the FES8J diode, which is in intimate thermal contact with the output transistors. The output transformer (T2) is also wound with a 4:1 ratio; it has a single-turn sense winding. The single-turn feedback winding provides some degree of negative feedback to flatten the gain and stabilize the input impedance over the HF frequency range. The RC network in the input base circuit establishes the overall gain. The 6.8 Ω series resistors determine the gain below 14 MHz, while the 4700 pF capacitors are effective above 14 MHz.

Figure 4 shows the output power versus frequency characteristics of the amplifier, including the second and third harmonic response. All measurements were made with an IFR1600S Communications Service Monitor. In all cases, harmonics were greater than 40 dB down referenced to the fundamental frequency (–40 dBc), and the amplifier meets current FCC requirements for spectral purity.[2] Note that the gain starts to decrease above 21 MHz, rolling off from a nominal 30 W to 20 W at 29 MHz. On 10 meters this still represents 10 dB of gain, a worthwhile improvement. The dc voltage to the output transistors is decoupled by the pi network at the center-tapped

[1]Notes appear on page 39.

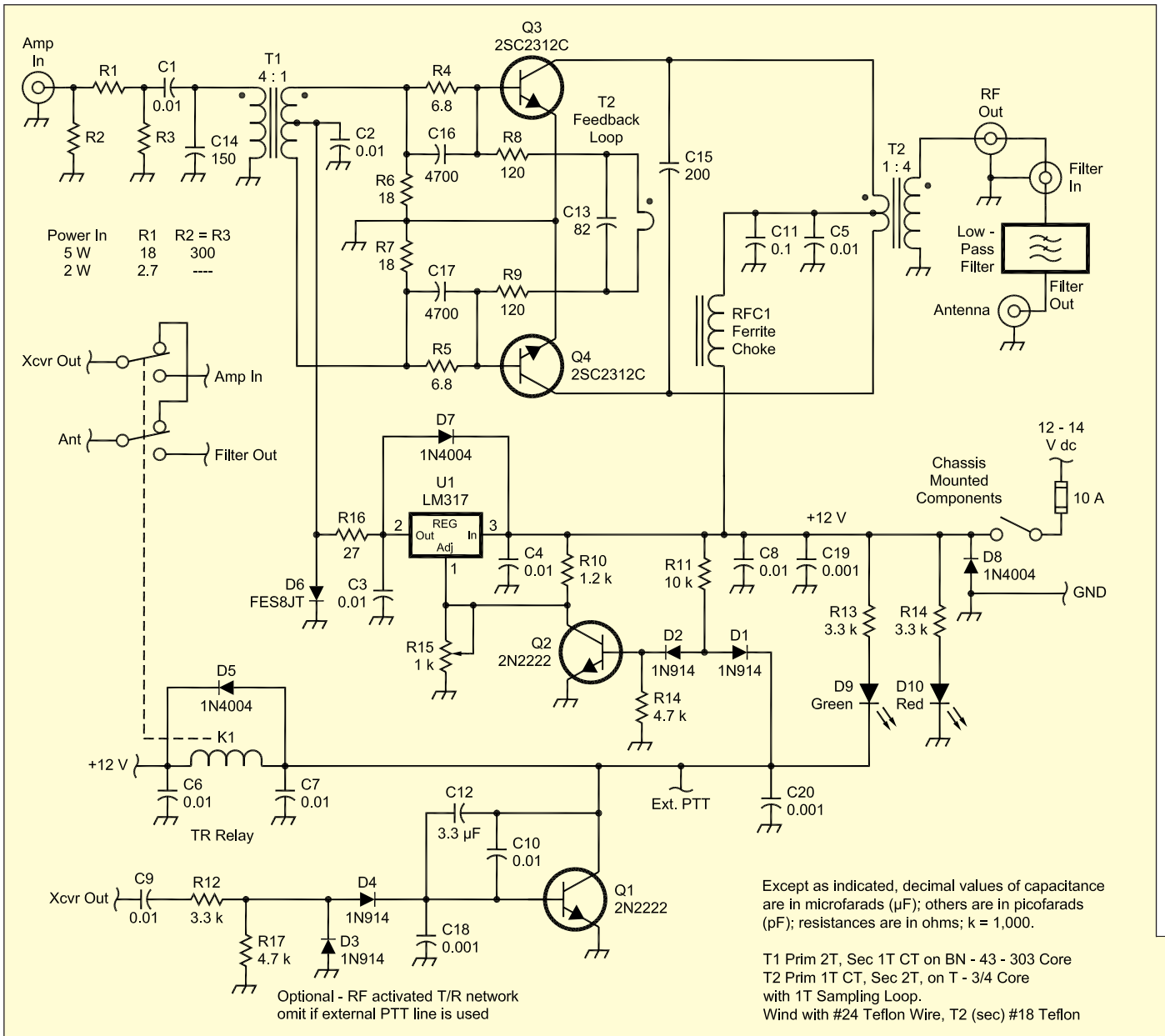


Figure 2—The RF amplifier schematic and parts list. (M) denotes Mouser Electronics, 1000 N Main St, Mansfield, TX 76063; tel 800-346-6873; www.mouser.com. (RF) denotes RF Parts Co, 435 S Pacific St, San Marcos, CA 92069; tel 800-737-2787; www.rfparts.com. (A) denotes Amidon, Inc, 240 Briggs Ave, Costa Mesa, CA 92626; tel 800-898-1883; www.amidon-inductive.com. (F) denotes FAR Circuits, 18N640 Field Ct, Dundee, IL 60118; tel 847-836-9148; www.farcircuits.net.

RF Amplifier Board
C1-10—0.01 µF capacitor, (M) 140-100Z5-103Z.
C11—0.1 µF capacitor, (M) 80-CK06BX104K.
C12—3.3 µF capacitor, (M) 80-C340C335M5U.
C13—82 pF capacitor, (M) 5982-15-500V82.
C14—150 pF capacitor, (M) 5982-15-500V150.
C15—200 pF capacitor, (M) 5982-15-500V200.
C16, 17—4700 pF capacitor, (M) 140-50P5-472K-TB.
C18-20—0.001 µF capacitor, (M) 140-100Z5-102Z.
D1-D4—1N914 diode, (M) 610-1N914.
D5, D7, D8—1N4004 diode, (M) 583-1N4004.
D6—FES8JT diode, (M) 625-FES8JT.
D9—LED, green, with mount, (M) 512-HLMP4719.
D10—LED, red, with mount, (M) 512-HLMP4700.
K1—Relay, 12 V dc coil, DPDT, (M) 551-MR-12USR.
Q1, Q2—Transistor, switching, 2N2222, (M) 511-2N2222A.
Q3, Q4—Transistor, RF, 2SC2312C, (RF) 2SC2312C.
R1—300 Ω, 1 W, (M) 281-300.
R2, R3—18 Ω, 1 W, (M) 281-18.
R4, R5—6.8 Ω, ¼ W, (M) 30BJ250-6.8.
R6, R7—18 Ω, ¼ W, (M) 30BJ250-18.
R8, R9—120 Ω, ¼ W, (M) 30BY250-120.
R10—1.2 kΩ, ¼ W, (M) 30BJ250-1.2K.
R11—10 kΩ, ¼ W, (M) 30BJ250-10K.
R12-14—3.3 kΩ, ¼ W, (M) 30BJ250-3.3K.
R15—1 kΩ, potentiometer, (M) 531-PTC10H-1K.
R16—27 Ω, 1 W, (M) 281-27.
R17—4.7 kΩ, ¼ W, (M) 30BJ250-4.7K.
RFC1—RF choke, (RF) VK-200-3R.
T1—Transformer core, (A) BN-43-303.
T2—Transformer core, (RF) T-¾ core.
U1—IC, LM317T, (M) 512-LM317T.

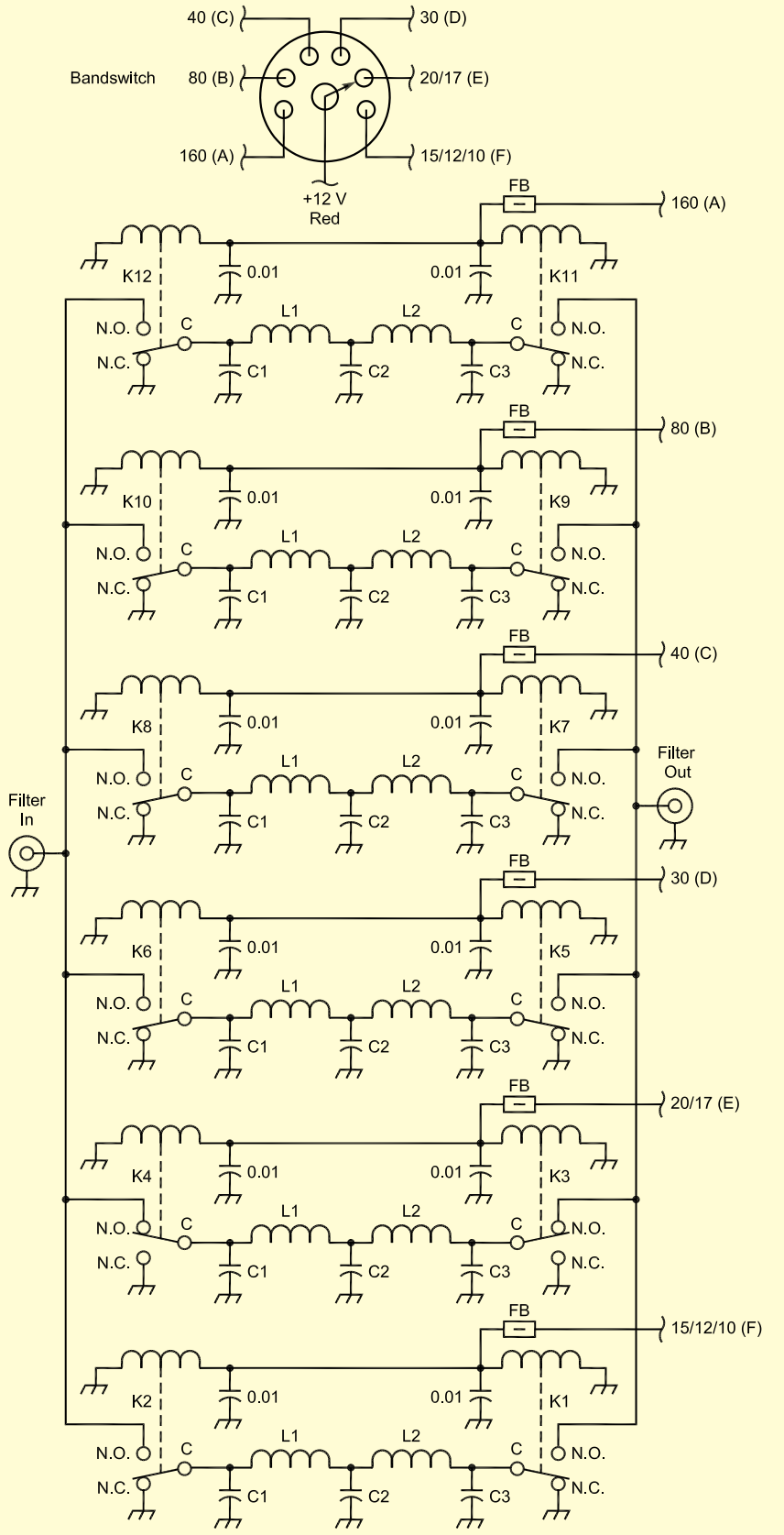
Misc
2—TO-220 mounting kit, (M) 534-4724.
2—TO-220 thermal insulator pad, (M) 526-NTETP0006.
PC board, FARA RF amplifier, (F).

Low-Pass Filter Board
(see Figure 3 for component delineation)
2—100 pF capacitor, (M) 5982-15-500V100.
3—180 pF capacitor, (M) 5982-15-500V180.
3—330 pF capacitor, (M) 5982-15-500V330.
2—430 pF capacitor, (M) 5982-15-500V430.
1—560 pF capacitor, (M) 5982-15-500V560.
3—820 pF capacitor, (M) 5982-15-500V820.
3—1500 pF capacitor, (M) 5982-19-500V1500.

Figure 3—The low pass filter (LPF) schematic.

primary of the output transformer, T2. This winding carries substantial current and should be wound with #18 Teflon covered wire. Any IR drop in the dc circuit will severely degrade the amplifier performance. TR switching is provided by relay K1. The PTT line can be operated manually (pulled to ground) or RF activated switching circuitry can be installed to eliminate the need for external keying controls. The value of C12 (3.3 µF) determines the SSB time constant for the RF activated switch.

The low-pass filter assembly utilizes relays to select the proper filter network for the various frequency ranges. Relays were chosen to simplify the RF switching and to minimize cost. The six filters cover the nine amateur bands from 1.8 to 30 MHz; the frequency ranges and circuit constants are as noted on the LPF schematic diagram. The inductor cores and wire to wind the coils are available as a kit of parts from Amidon.[3] The L/C constants are the same as those recommended by WA2EBY for the MOSFET RF amplifier in *The ARRL Handbook*.[4] The filters are not used when the amplifier is off or when the PTT line is not activated—this permits multi-band listening and limited VHF use when a wide frequency transceiver is in use (like the Yaesu FT-817). There is no provision for ALC feedback, so



Cores T - 50 - X Amidon
L in number of turns (#22)
C in pF
Band (E) Shown Selected.
K3, K4 Energized.

Band	L1/2	C1/3	C2	Core
160 (A)	30	1500	2700	2
80 (B)	22	820	1500	2
40 (C)	16	430	820	2
30 (D)	14	330	560	2
20 - 17 (E)	11	180	330	6
15 - 10 (F)	8	100	180	6

1—2700 pF capacitor, (M) 5982-19-500V2700.
12—0.01 µF capacitor, (M) 140-100Z5-102Z.
12—Relay, 12 V dc coil, DPDT, (M) 655-T7NS5D1-12.
1—Switch, 1 pole, 6 pos, (M) 10-YXX026.
HF Filter Kit, (A) HFFLT. Contains the cores and wire necessary to build the low-pass filters.
PC board, FARA LP Filter, (F).

Chassis Parts
Chassis box, Bud, (M) 563-AC-402.
Chassis cover, Bud, (M) 563-BPA-1589.
Heat sink, (M) 532-244609B02.
4—4-40 hex-type standoff, (M) 534-2201.
9—4-40 × ¼ pan head screw.
4—4-40 × ½ pan head screw.
6—4-40 flat washer.
9—4-40 lock washer.
2—4-40 nut.
2—8-32 × ¼ pan head screw.
2—8-32 lock washer.
2—BNC socket, chassis mount, (M) 161-9323.
RCA-type socket, female, chassis mount, (M) 161-1005.
Switch, toggle, SPDT, (M) 10TC320.
Jones-type socket, chassis mount, male, 2 pin, polarized, (M) 538-13023.

caution must be exercised so as not to overdrive the amplifier.

Construction Hints

Although no step-by-step instructions are provided, a few hints will ease the assembly process. The circuit boards pictured are the prototype assemblies; they are not solder-plated. However, the available circuit boards (from FAR Circuits) are plated but do not have plated through-holes, so through-holes must be pinned and soldered.[5] Detailed drawings of the PC boards, the parts layout, coil-winding data and chassis templates can be found at **www.arrl.org/files/qst-binaries/fara-amp.zip**. Saul, K1BI, the FARA Webmaster has also set up a site for the project. It can be found at **www.falara.org/tektalk/tektalkfs.html**.The circuit boards as they appear before wiring can be seen in Figure 5.

Circuit Board Preparation

• Given the large ground plane area, the boards must be clean or you will experience difficulty when soldering to the foil. Plated boards are best; they are easier to solder. Some solder flux may improve the solderability of the board, but be sure to use *only* rosin core solder and a *non-corrosive* flux.

• Carefully inspect all soldered connections for cold solder joints. Good soldering technique is crucial to the performance of the amplifier.

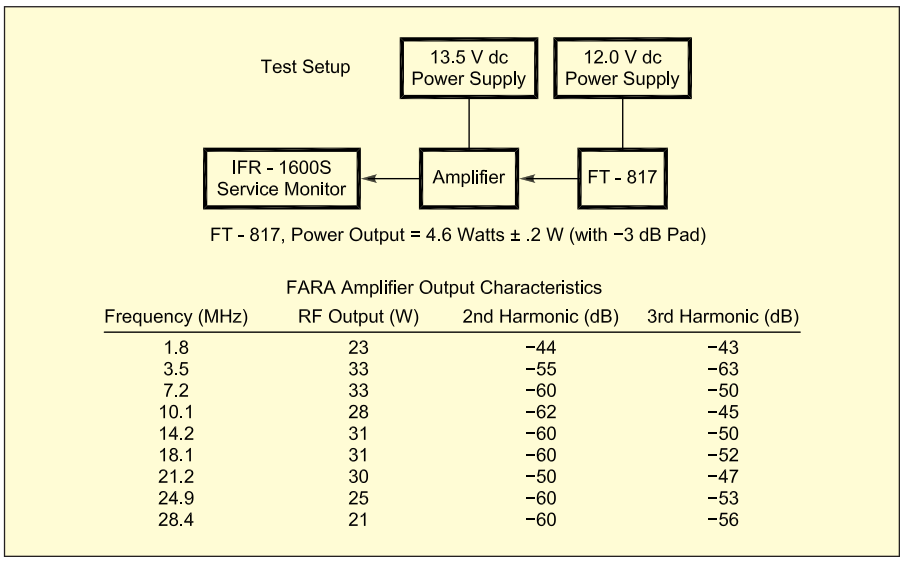
• Periodically, the flux should be removed from the board during the construction phase with a suitable chemical cleaner.

• There are a number of holes to be drilled and pinned on each board; these are noted on the parts placements diagrams. Wires should be inserted through the board, bent into the shape of a "Z," formed flat against the board, soldered and cut.

• The four corner holes on each board must be sized as a clearance hole for the 4-40 mounting hardware.

• Components should be mounted flush to the board––fixed capacitors should be mounted as close to the foil as possible.

• The large rectangular blocks on the RF board must be trimmed in order to mount the RF output transistors and the bias diode.



FT - 817, Power Output = 4.6 Watts ± .2 W (with −3 dB Pad)

FARA Amplifier Output Characteristics

Frequency (MHz)	RF Output (W)	2nd Harmonic (dB)	3rd Harmonic (dB)
1.8	23	−44	−43
3.5	33	−55	−63
7.2	33	−60	−50
10.1	28	−62	−45
14.2	31	−60	−50
18.1	31	−60	−52
21.2	30	−50	−47
24.9	25	−60	−53
28.4	21	−60	−56

Figure 4—Amplifier output data, including second and third harmonic response.

RF Amplifier Circuit Board

A view of the completed RF board can be seen in Figure 6. The following suggestions pertain to the amplifier board.

• Wind the secondary winding on T2

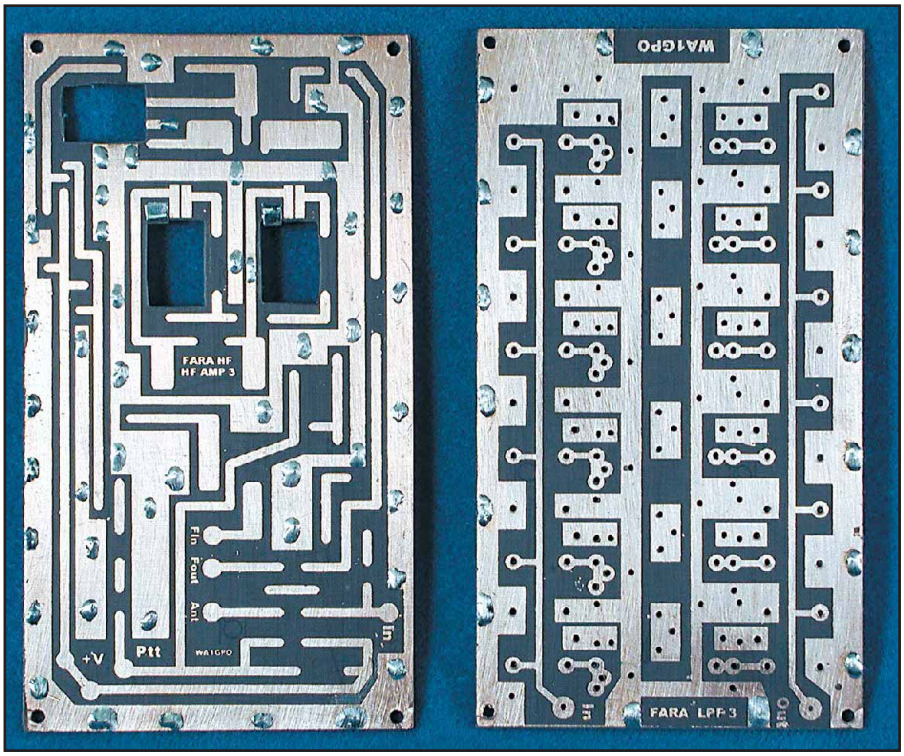


Figure 5—The circuit boards before wiring. The RF board is on the left and the LPF board is to the right. Note the pinned and soldered holes.

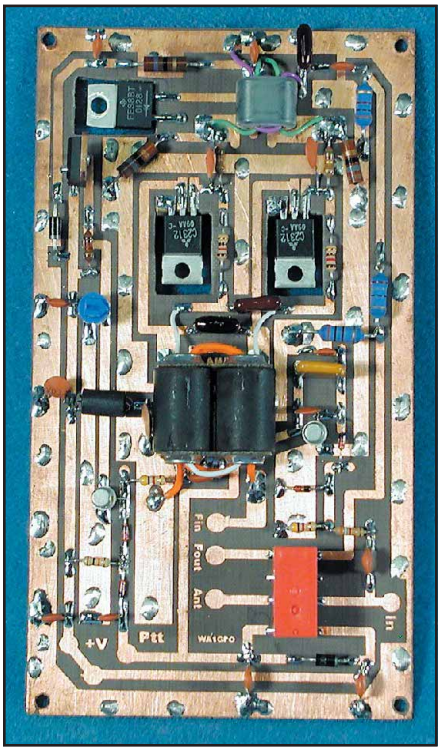


Figure 6—The completed RF assembly board.

and mount it to the circuit board first.

• The emitters of the 2SC2312s (Q3, Q4) are intended to be grounded through a hole on the pad. The following modification is advised—bend a thin brass or copper strap into a "U" shape and solder it on both sides of the board. This lowers the impedance to ground.

• Next, mount the smaller fixed components, the resistors and capacitors.

• The semiconductors and the relay mount last.

• Do not mount D6, Q3 and Q4 until the assembly is fixed in the chassis and positioned relative to the heat sink.

Low-Pass Filter Circuit Board

This is a double-sided board; the reverse side is a ground plane with clearance etches for the various components. The LPF board can be seen in Figure 7. It may be necessary to form the capacitor leads slightly to conform to the hole spacing.

• Mount the filter components first, followed by the bypass capacitors and the jumper wires. Refer to the schematic for component values by frequency range.

• The relays mount last. Do not overheat their mounting pins when soldering.

• Do not mount the LPF assembly until the initial tune-up is completed. It is recommended that you pre-wire the band switch. It mounts between the two circuit boards when they are installed in the chassis and it is difficult to get to.

Chassis, Panel and Heat Sink

Full size templates for the chassis and panel can be found on the Web site. Trim the templates to size and fold and tape them to the aluminum box and heat sink. It is important to center punch the holes and drill a small pilot hole at each location. Enlarge the holes to size according to the dimensions. Letter the panel with dry transfer lettering available at office supply stores. Spray on several light coats of clear lacquer to protect the lettering. Mount the heat sink and the panel components, but do not mount the bandswitch at this time. Mount the RF amplifier board using a couple of 4-40 flat washers as spacers between the chassis and the circuit board at each corner. Install the 4-40 standoffs to hold the assembly in place. Mount D6, Q3 and Q4, using the TO-220 thermal pads and hardware to isolate the transistor mounting tab from the chassis. It is not necessary to isolate D6. Use RG-174 miniature coaxial cable for the internal RF connections.

Tune-up and Testing

As this is a broadband design there is no tune-up; only the bias adjustment needs to be set. A 12 to 14 V dc current limited variable supply is recommended for initial adjustment and testing. Use a dummy load at the amplifier output. Drive levels refer to the attenuator output, if used.

• Connect a temporary jumper between the F_{in} and F_{out} pads on the RF board.

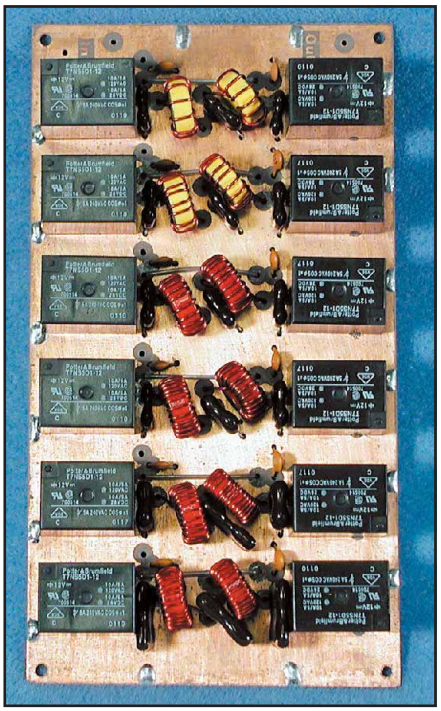


Figure 7—The completed LPF board. Note the relays that are used as filter switches—they are selected by the band switch.

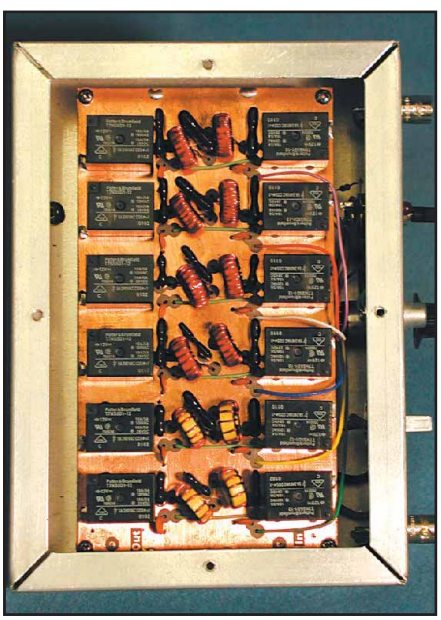


Figure 8—A bottom view inside the completed amplifier. The LPF board is mounted below the RF assembly.

• Preset R15 (1 kΩ potentiometer) so that the wiper is at ground.

• Apply 12 V dc and ground the PTT line (the relay should pull in).

• Briefly drive the input with 1 W at 14 MHz and note the power output.

• Again apply 1 W and increase bias (R15) until the output increases about 15%.

• Increase drive to 2 W and note the power output (about 25 W).

• Increase voltage to 14.7 V dc; note the output with 2 W of drive (about 35 W).

Remove power; remove the temporary jumper; mount the band switch; connect and install the LPF board. Verify that the power output over the range of 1.8 to 29 MHz is as expected. A view inside the bottom of the amplifier, with the LPF board visible, is shown in Figure 8.

Final Comments

The FCC has placed strict limitations on power amplifiers used below 30 MHz. Please review the appropriate FCC regulations before constructing this amplifier.[6] Kits offered for sale, even partial amplifier kits that require additional parts, are prohibited by current FCC regulations.[7]

Construction time, assuming that all the components are on hand and the boards are properly prepared, is about 4 hours. SSB operation results in the heat sink barely getting warm, and cooling under key-down conditions is more than adequate.

A project of this scope is more fun when others participate. Harry, W2RKB, provided the necessary prodding to get it started. He also fabricated the circuit boards and the filter assemblies for the prototype amplifiers. Dave Hosom assisted with the photographs. A generous thank you is extended to them both. Give the FARA amplifier a try… it's a practical and rewarding project!

Notes

[1]Federal Communications Commission, Sec 97.315.
[2]See Note 1.
[3]Amidon Associates, Inc, 240 Briggs Ave, Costa Mesa, CA 92626; 800-898-1883; **www.amidon-inductive.com**.
[4]*The 2003 ARRL Handbook*, pp 17.91-17.97.
[5]FAR Circuits, 18N640 Field Court, Dundee, IL 60118; tel 847-836-9148; **www.farcircuits.net**.
[6]Federal Communications Commission, Sec 97.3 (19).
[7]See Note 6.

Jim Valdes, WA1GPO, has been a ham since 1962 and holds an Extra Class license. Jim is an engineer and works for the Woods Hole Oceanographic Institution. You can contact him by e-mail at **wa1gpo@arrl.net**. QST

By Bill Wageman, K5MAT

The Transverter—An Introduction to a Useful Device

Ever wonder how a transverter works? Building one could get you on that new VHF, UHF or microwave band. You'll be better informed, too, about some of the basic building blocks and circuits used in your present transceiver.

A little background is necessary to fully understand what is meant by the term *transverter.* Modern radio receivers use a *superheterodyne* frequency conversion technique—RF amplification of the input frequency is followed by a *mixer,* which combines that signal with a local oscillator (LO). The output of the mixer (usually a sum and a difference frequency—the LO plus the input frequency and the LO minus the input frequency) feeds an intermediate frequency (IF) amplifier. This operates at a fixed frequency with a limited bandwidth to amplify the signal so it can be converted to audio for the speaker or headphones. This means that the LO must be a variable frequency oscillator if the IF amplifier is to receive signals from different frequencies as the receiver is tuned.

Band switching makes it possible to tune various bands and frequency ranges. There is an upper frequency limit to this, however, because of the complexity necessary in building a receiver that tunes from "dc to light." Today, it is not uncommon to find receivers and/or transceivers that tune from the 160 meter band up through 70 cm. Most of them don't, however, cover the fascinating VHF/UHF bands at 222, 902 or 1296 MHz and higher. So how can you get on a band that is not covered by that wonderful brand-new transceiver?

Fifty years ago, if someone wanted to listen to 6 or 2 meters, they had to homebrew a receiving *converter* to convert that VHF signal down to either a 7, 14 or 28 MHz frequency that their station receiver would tune to. [The editor is dating himself, but the names *Tecraft*, *Centimeg* and *Tapetone* come to mind!—*Ed.*] Today it is quite easy to convert 222 MHz to 28 MHz or 50 and 144 MHz to a lower frequency. Such a device is called a 135 cm receiving converter. It works exactly the way the receiver described above does, except that the LO frequency is fixed and the output amplifier (if any) is broadbanded so that the HF receiver can tune across the converted band of signals. Receiving converters are available commercially for a variety of frequencies or bands.[1]

But how can you *transmit* on 222 MHz, 902 MHz or the higher frequency bands? It is actually conceptually quite simple. Simply take a signal on 28, 50 or 144 MHz; feed it into a mixer (along with a local oscillator signal) to change the frequency to 222 MHz; filter (to get rid of the undesired mixer products) and then amplify to some reasonable power level so that other hams can hear you. The mode of the driving signal, such as SSB, is faithfully reproduced at 222 MHz. Since mixers generate many combinations of their two input frequencies, it is necessary to follow the mixer with a fairly narrow band-pass filter that allows only the desired transmit frequencies to be amplified. That is a considerable simplification of a transmitting converter but basically, that's it.

[1]Notes appear on page 42.

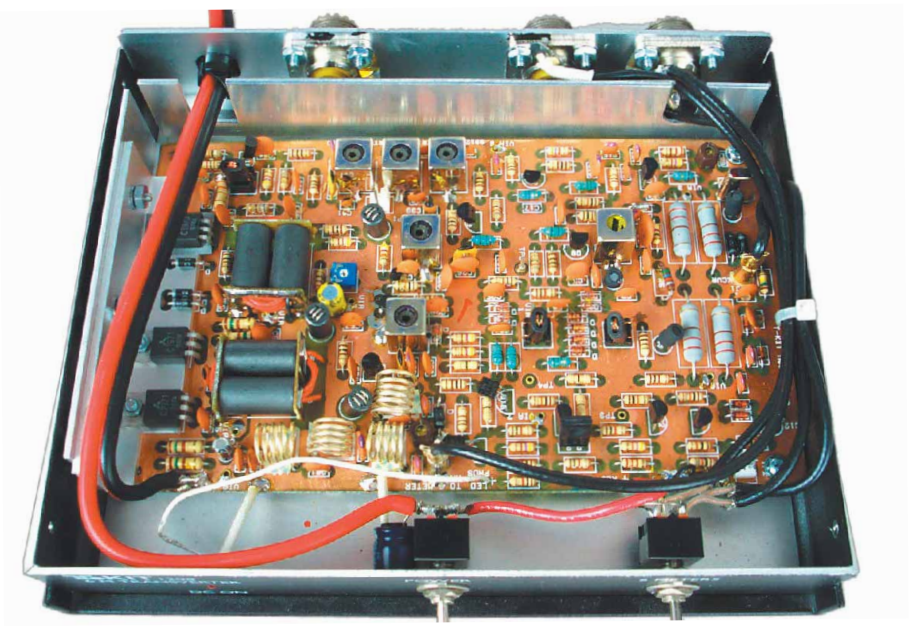


Figure 1—The Ten-Tec 1209, a commercial 20 to 6 meter transverter.

If you have both a receiving and transmitting converter, and you combine them in some way, you now have what is called a *transverter,* a contraction of the term *transceive converter*. Placing both receive and transmit converters in one enclosure can be tricky; there are good articles dealing with transverter construction and some pitfalls to be avoided.[2] A good example of a homebrew 222 MHz transverter built by P. Wade, W1GHZ, was described in January 2003 *QST*, pp 31-38.

Why Use a Transverter?

Some newer transceivers, such as the ICOM IC-706, are relatively inexpensive and go all the way up through 70 cm, but unfortunately they skip the 222 MHz band. A disadvantage of those rigs is their receiver performance. I prefer to change an old adage to read, "You don't get anything you don't pay for." Let's say you want to work 144 MHz SSB, and you have strong nearby out-of-band signals or a neighbor ham who also works that band. That receiver will probably suffer from overload and filtering problems in the presence of very strong signals. A transverter offers a possible solution, with a choice to buy, to build or both. Figure 1 shows a commercially available 20 to 6 meter transverter, the Ten-Tec 1209.

Years ago, I owned a Yaesu FT-620B single-band transceiver for 6 meters. I built a receive RF preamplifier for it. That helped my receiving ability considerably, but it also caused me a rather serious problem. A friend had a big signal on 6 and he overloaded my receiver for more than 100 kHz either side of his transmit frequency. I constructed a receiving converter to use with my Drake R-4B receiver on 10 meters and… magic—I was unable to tell he was on the air until I tuned to within 4 or 5 kHz of him! Since I had similar problems on 144 MHz, I decided to build a receiving converter for that band, as well. I benefited from the same good results, bit the bullet and built a transmitting converter, emphasizing good engineering practice in order to keep the transmitted signal as clean as I could. After completing the design and tackling its construction, I was never sorry.

Much of that circuitry was taken from a design by W1JR.[3] My design was more costly than it might have been, but it performed very well. It is only slightly more difficult to build a 222 MHz transverter than one for 144 MHz and there is no easier way to get on SSB and CW on that band without incurring a considerable outlay of money. If you have a good HF station without 144, 222 or 432 MHz capability, building your own transverter can put you on those bands and result in better performance, at less expense, than buying a commercial unit or a new transceiver.

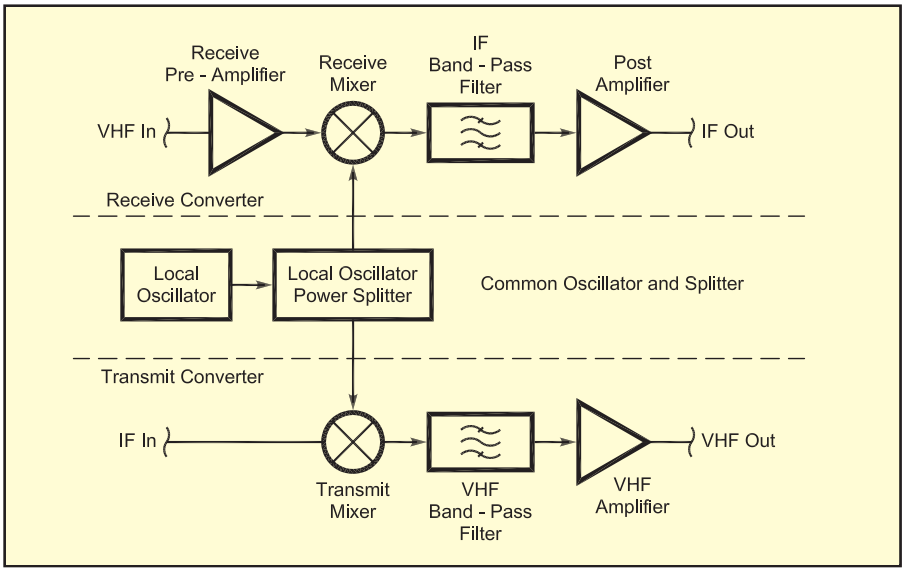


Figure 2—A block diagram for a typical transverter. The upper chain is the receiving converter, and the lower chain is the transmitting converter. Each block on the diagram has its own schematic and each can be built and tested separately—an asset during construction.

Where can you purchase a transverter? Occasionally, some Microwave Modules transverters for 144 and 432 MHz appear at flea markets. At times, the major Japanese manufacturers have made transverters that interface nicely with their own HF equipment. These are rare and they can be difficult to alter for operation with a transceiver other than the one for which they are designed. There are several manufacturers of transverters… Down East Microwave sells them completely assembled or as kits, and SSB Electronic USA sells complete transverters and kits designed in Germany.[4,5] Additionally, Hamtronics, Ten-Tec and Yaesu offer transverters and converters at various IF and input frequencies.[6,7,8] A search at the ARRL TIS database will reveal a few more (**www.arrl.org/tis/tisfind.html**).

I have built transverters for 50, 222 and 432 MHz with a 28 MHz IF and a 902 MHz kit with a 144 MHz IF.[9] Commercial transverters for amateur use are available through at least 24 GHz. There may be a limit to how high in frequency they can go—eventually components become prohibitively expensive or, given the present state of the art, are simply not available.

There are a few disadvantages to the use of transverters. First, they require a dedicated transceiver. Second, transmit-receive (T-R) switching of the transceiver and the transverter can be problematic. There are, however, "cookbook" solutions to this problem and Down East Microwave may be of some help.[10] The drive power to the transmit mixer must also be appropriate, but that isn't usually a big problem. [Many transceivers have transverter-level outputs.—*Ed.*] Interfacing to a separate transmitter/receiver duo (the scheme I have used) is usually quite easy. The milliwatts of drive power required can be obtained from a driver stage, eliminating the possibility of dumping too much power into the mixer and destroying it.

Construction

The heart of any of these converters is the LO and this is one place where scrimping to save money is going to make you pay in other ways. Use the best crystal you can buy (I recommend International Crystal Manufacturing) and treat it well.[11] Install it in an isolated enclosure of its own so other circuitry won't cause temperature-driven drift. For frequencies through 1296 MHz there is an excellent and easy-to-build published circuit for local oscillators.[12] Converters for the higher frequencies will probably require additional frequency multipliers.

If only a receiving converter is being built, there needs to be only one output from the LO. If you're building a transverter, however, it is necessary to have two LO outputs that may need to be at different power levels. Figure 2 shows a simplified block diagram of a basic transverter. Note particularly the LO and its power splitter. [Depending upon mixer level requirements, additional stages may be required before each of the mixer LO inputs.—*Ed.*]

Many kinds of mixers can be used, but,

for the best receive performance, the double-balanced mixer is a good choice. Standard units need +7 dBm (5 mW) of drive power from the local oscillator, but if you have trouble with strong signals it would be best to use a high-level mixer (+17 dBm, or 50 mW) or even a very high-level unit that needs +27 dBm (500 mW).

For receiving, double-balanced mixers have a relatively high noise level—too high for direct antenna input to the mixer—so it is almost always necessary to use a low-noise preamp ahead of the mixer. Some older receivers, when used with a receive converter, might even require another amplifier after the mixer, but it is unwise to have too much gain in the receiving system. Some sort of bandwidth limiting filter is absolutely necessary at the output of the mixer to remove unwanted mixing products. (Remember those sum and difference frequencies we spoke about earlier?) [Excessive gain compromises strong-signal and linearity performance—use the minimum amount of gain required. Band-pass filters at the converter input will also improve receiver performance by rejecting strong out-of-band signals. Some designs use only a passive mixer at the receive front end and make up gain at IF. This helps avoid front-end compression and non-linearity.—*Ed.*]

A second mixer might be used for the transmit converter, although with appropriate switching, it is possible to use one mixer for both. This saves money but is a complication that is probably not worth the effort. The transmit mixer must be followed by a good band-pass filter so that only the desired transmit frequency remains. The power level at this point might be as low as 100 µW (–10 dBm). Monolithic microwave integrated circuits (MMICs) are an almost painless way to raise the power level to 50-100 mW (+17-20 dBm).[13] Hybrid modular amplifiers can be used to easily reach the 10-25 W level. While they seem a bit expensive, they are easy to use and usually the only other components required are a few capacitors and chokes![14] It never hurts to follow the transmit converter with an appropriate low-pass or band-pass filter, but all the transverters I have built met FCC requirements without one.

There are two important issues for the constructor. It is important to control the power levels to all stages so that no device is driven into non-linearity and… tuning the band-pass filter that follows the transmit mixer can be difficult without the right test equipment. Studying construction articles carefully will help the builder determine what test equipment is needed.

Transverters can also be used in the other "direction." Suppose you would like to be active on 10 meter FM, but the only FM transceiver you own covers 2 meters. The same basic hardware can be used to convert a 10 meter SSB signal to 2 meters. The band-pass filter in the transmit side, however, would have to be tuned to 29.6 MHz rather than to 144.2 MHz. Similarly, the preamplifier on the receive side would have to be tuned to the 10 meter band. It would also be necessary to use a different crystal frequency for the LO. [Be very careful when transverting FM to HF—FM signals should be no more than 6 kHz wide on 10 meters.—*Ed.*][15]

And Finally...

This introduction to transverters isn't meant to be a construction article. Use the notes and references to get all the specifics and ask for expert advice if you don't have the background to tackle such a project. Don't be intimidated, though; building a transverter doesn't have to be a difficult project. There's a great deal of satisfaction to be had when you get on a new VHF or UHF band and you tell the person at the other end of the contact, "The transverter here is all homebrew!"

Notes

[1]AR[2] Communications Products, Box 1242, Burlington, CT 06013; tel 860-485-0311; **advancedreceiver@snet.net**; **www.advancedreceiver.com/page11.html**.

[2]J. Reisert, W1JR, "VHF/UHF World," *Ham Radio*, Mar 1984, pp 42-46.

[3]See Note 2 and J. Reisert, W1JR, "VHF/UHF World," *Ham Radio*, Apr 1984, pp 84-88.

[4]Down East Microwave, 954 Rte 519, Frenchtown, NJ 08825; tel 908-996-3584; **www.downeastmicrowave.com**.

[5]SSB Electronic USA, 124 Cherrywood Dr, Mountaintop, PA 18707; tel 570-868-5643; **www.ssbusa.com**.

[6]Hamtronics, Inc, 65-Q Moul Rd, Hilton NY 14468; tel 716-392-9430; **www.hamtronics.com**.

[7]Ten-Tec, 1185 Dolly Parton Pkwy, Sevierville, TN 37862; tel 800-833-7373; **www.tentec.com**.

[8]Vertex Standard (Yaesu), 10900 Walker St, Cypress, CA 90630; tel 714-827-7600; **www.yaesu.com**.

[9]Bill Wageman, K5MAT, *Communications Quarterly*, Winter 1999, pp 25-30.

[10]The ARRL *UHF/Microwave Experimenter's Manual*, the ARRL TIS Web page at **www.arrl.org/tis/info/microwave.html** and the ARRL *Periodicals Index Search* (**www.arrl.org/ members-only/qqnsearch.html**) have many references to transverter construction articles and product reviews.

[11]International Crystal Manufacturing, 10 N Lee Ave, Oklahoma City, OK 73102; tel 800-725-1426; **www.icmfg.com**.

[12]See Note 2.

[13]Mini-Circuits, PO Box 350166, Brooklyn, NY 11235-0003; tel 718-934-4500; **www.minicircuits.com** or some of the advertisers in *QST* and other amateur journals. MMICs are available from several retail sources that advertise with some regularity. The main manufacturers are HP and Mini-Circuits.

[14]Hybrid modules are available from RF Parts, 435 S Pacific St, San Marcos, CA 92069; tel 800-737-2787 (orders only), or 760-744-0700; **www.rfparts.com**.

[15]*The FCC Rule Book*, 12th Edition, ARRL, p 4-27; ARRL order no. 7857; **pubsales@arrl.org**; **www.arrl.org/shop/**.

Bill Wageman, K5MAT, was first licensed in 1950 as WØBUR. Two years later, he followed that with an Extra Class license. He has also held the calls KØBYY and N5EE. A physics major in college, Bill met his wife of 48 years, Carol, WNØHQH (now W5TIK) on the air. He operates CW, enjoys DX work on VHF/UHF and operates the microwave bands. Bill enjoys building his own equipment and uses homebrew transverters and antennas on 144, 222 and 432 MHz. He's had articles published in several amateur journals, including QST, ham radio, Communications Quarterly *and* CQ. *Bill comes from an all ham family and proudly says that all of his children, their spouses and even one grandchild are licensed amateurs. He can be contacted at 7309 Avenida La Costa NE, Albuquerque, NM 87109.*

FEEDBACK

♦ In "The Load Shedder," Feb 2003 *QST*, Figure 2, pins 6 and 7 were reversed for U1A, along with their plus and minus symbols.

♦ In "New Products," May 2003 *QST*, page 58, the $19.95 price applies to the recently introduced Radio Warehouse index dividers for WAS. The DXCC index divider set costs $49.95 plus shipping.

♦ There is a discrepancy in the published results for third-order intercept points in the Product Review of the IC-746PRO [May 2002 *QST*, pages 74-75]. MDS method measurements were published for seven of the eight band-spacing combinations. The ARRL standard method uses an S5 reference. Correct third-order intercept figures using the S5 method are in the table. These figures are generally more favorable.

Spacing	*20 kHz Preamp off/one/two*	*5 kHz Preamp off/one/two*
3.5 MHz	+19.2/+7.2/–2.2 dBm	–17.6/–28.7/–33.7 dBm
14 MHz	+20.0/+9.3/–1.8 dBm	–18.2/–28.2/–35.5 dBm
50 MHz	+22.5/+12.3/–1.1 dBm	–13.5/–25.2/–31.1 dBm
144 MHz	–6.5/–5.4/NA dBm	–19.9/–39.1/NA dBm

By Martti J. Laine, OH2BH

Albania Revisited

Ten years after the first ZA1A operation, a group of Finnish operators returned to assess the state of Amateur Radio in Albania.

Many DXers recall that happy occasion in 1991 when an announcement was made of the official introduction of Amateur Radio in Albania. ZA-land was about to break out of 50 years of dictatorship, and opportunities seemed ripe for the country to join the wider world community.

The announcement came at the Tokyo Ham Fair when Richard L. Baldwin, W1RU, President of the International Amateur Radio Union (IARU), and Shozo Hara, JA1AN, President of Japan Amateur Radio League (JARL), invited a telecommunications delegation from Albania to see Amateur Radio in action. To everyone's delight, a declaration was issued that an IARU Amateur Radio training course would be conducted and that the first Albania station, ZA1A, would soon hit the airwaves. At last, the only remaining European nation without an Amateur Radio service would be joining the global ham community. It was a moment of jubilation, with tears running down the cheeks of those who had worked for decades to make it happen. The rarest country of them all was about to be removed from all DX Wanted Lists, never to re-enter again.

To celebrate the anniversary, and to see how free Albania had progressed during the past 10 years, we organized a follow-up visit in November 2002 in conjunction with the CQ World Wide CW contest.

Getting There

We had an easy trip to Tirana via Budapest. Leaving in the morning, we were already in Tirana at 2 PM. Malev Hungarian Airlines flies from Budapest several times a week; from the Hungarian capital it is only a 30-minute hop to Tirana. Getting Malev to agree to extra weight meant that it was possible to take two Yaesu stations with us, along with two amplifiers. Four of us comprised the group: Pertti Simovaara, OH2PM; Tapani Nisula, OH5BM; Markku Nyyssonen, OH8SR and myself. With four operators we might be able to keep ZA active and provide some new low-band countries for those needing ZA.

Our host (and student in 1991) Geni Mema, ZA1B, met us at Tirana airport to drive us to Durres, our ultimate destination. Since the Tirana airport building looked the same, it felt like we had just left Albania yesterday. We knew some things had changed, however, when we saw Mercedes Benz automobiles on streets that had been populated by donkeys 10 years ago. Upon closer scrutiny, the cars were found to be second-hand, obviously imported from Germany at a good price.

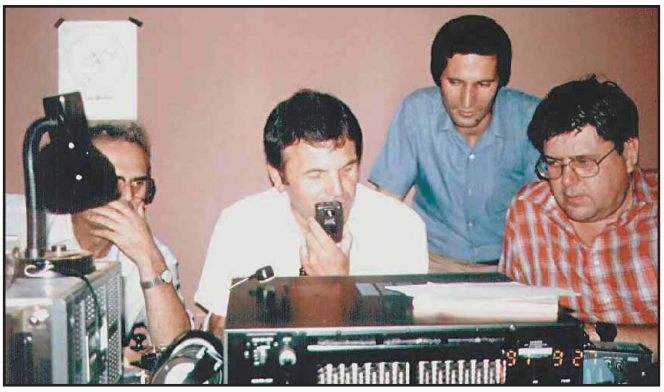
The City of Durres

What was once a thriving city on the beautiful Adriatic shoreline, the city of Durres now looked quite disturbing. Something strange had happened. The entire beach area was crowded with houses and hotels, but instead of being completed, they seemed abandoned at various stages

OH5BM

We wanted to play tourist for one day and observe many of those places that we became familiar with during our extensive stay in Tirana some 10 years ago. From left: Tapani, OH5BM; Martti, OH2BH; Markku, OH8SR; Pertti, OH2PM and Geni, ZA1B.

This historic picture was taken in 1991 when Albanian government representatives announced the establishment of Amateur Radio in Albania at Tokyo Ham Fair. OH2BH is on the left and third from left is Dajlan, now active as ZA1Z. On the right, IARU President Dick Baldwin, W1RU, and JARL President Shozo Hara, JA1AN.



This was the scene in 1991 when the first Albanian amateurs received hands-on training with the new Yaesu FT-1000D transceivers. Here we see Dajlan, on the left and Geni, at the mic, with Niko observing in the background. Instructor Martti, OH2BH (far right), watches his students. All passed their exams and became ZA1Z, ZA1B and ZA1D, respectively.

Geni, ZA1B—Project Goodwill Albania

By Dr Warren Hill, K7WX

It was the summer of 1992 and I was chatting with Martti, OH2BH, on 20-meter SSB during one of those wonderful evenings when the polar path between the United States and the northern villages opens wide. "Warren," said Martti, "I have an idea that I would like to share with you about ZA1A." Never could I have imagined what was about to follow as the "Project Goodwill Albania" would prove to be one of the most memorable experiences of my life.

To keep things in perspective, it should be remembered this was not long after that magical moment in 1991 when the ZA1A IARU training project culminated in Albania appearing on the air for the first time after more than two generations of silence. For those of us first licensed in the 1960s Albania had always represented one of several inscrutable DX enigmas. I can still remember the exact moment I worked ZA1A through a CW pileup that probably consisted of most of the radio amateurs in this hemisphere. For me that first ZA1A QSO was, and remains, the contact of a lifetime.

I soon learned from Martti that Geni Mema, ZA1B, his ZA1A student and a new friend, suffered from a familial kidney problem for which in his country there was no treatment available. And without proper attention, Geni's future was dismal. It was obvious what had to be done. A plan was quickly formed by which the DX community worldwide and the medical community of Arizona would join forces to make available for Geni a much-needed surgical procedure. And, with that, a way opened up for radio amateurs everywhere to repay ZA-land in some small way for their experience of a DX dream come true.

Don Evans, the administrator of a local hospital, unhesitatingly made available his entire facility and agreed to cover all associated costs. Dr André Mathews, a well-known urologist, and Dr Tom Grade, the top local anesthesiologist, fell all over themselves to volunteer. AHØW arranged for air transportation from Tirana to Arizona and helped to smooth some initial visa problems through the office of our United States Senator, John McCain. We should never doubt the capacity of the human heart to know and do the right thing. Before the year ended, every detail had been arranged.

By mid-January of 1993 Geni and I were standing together in my kitchen in Mesa, Arizona reminiscing about ZA1A and comparing notes like two DXers anywhere. For Geni, who had never before been outside Albania, the world had suddenly become a much larger place, full of caring people willing to extend themselves to a complete stranger. And for those of us who would come to know Geni, the world of exotic DX now had human face and would never be the same.

My own family instantly adopted Geni as one of their own.

Kelly, the youngest daughter of Warren Hill, K7WX, with Geni Mema, ZA1B.

My oldest daughter, Colleen, insisted Geni take her room during his recovery, and my youngest daughter, Kelly, decided that he was her new special friend. An astonishing coincidence came when Kelly's elementary school class decided to study Albania. Geni caused quite a stir when he agreed to visit. He was able to show them a real Albanian and tell them all about this little-known country, about its awakening after 50 years of isolation.

As countless prior arrangements all came together, the date for Geni's surgeries arrived. Everything went well and according to plan. However, following his second procedure I could see that Geni was in a fair amount of pain. I asked if he would like to have any medication and his reply was, "No thank you, I am strong like an Albanian bull." This one unforgettable statement seemed to represent the collective will and courage of the entire Albanian people.

Geni recovered so quickly, I believed that perhaps he was indeed "strong like an Albanian bull" after all. Before we knew what happened, he was off visiting as many radio amateurs as his remaining time would allow. The courage and gratitude of this man was unbelievable.

For those of us who had the rare privilege of being part of Project Goodwill Albania, knowing Geni was the embodiment of the very best aspects of the DX experience. The original members of the ZA1A IARU training project gave tens of thousands of DXers a once in a lifetime experience. Within this exercise of faith, hope and goodwill, the DX community was later allowed to represent to the whole world what it means to be truly one united race—the human race.

of construction. It was a hodgepodge of chaos with everything having been erected with no plan or infrastructure in place.

At the end of the beach, we found our hotel, one of high-rise class, right on the waterfront with comfortable rooftop space to mount the antennas on. We were soon to discover, however, that there was a shortage of electricity during daylight hours, and therefore a hotel generator and a voltage stabilizer were our best safeguards. When the mains were switched off at 9 AM, we had arrangements in place to run the stations on the generator every day. We had to wonder how the Albanian citizens coped with having no electricity for 12 hours a day and a cold winter approaching.

The hotel staff was friendly and helpful, but we were the only guests there. The reason was obvious. Albania was going through a major reconstruction phase. Tourists tend to shun instability, and Albania had plenty to offer. Hence, tourists prefer neighboring Greece and Italy. This has been a major disappointment to the Albanians.

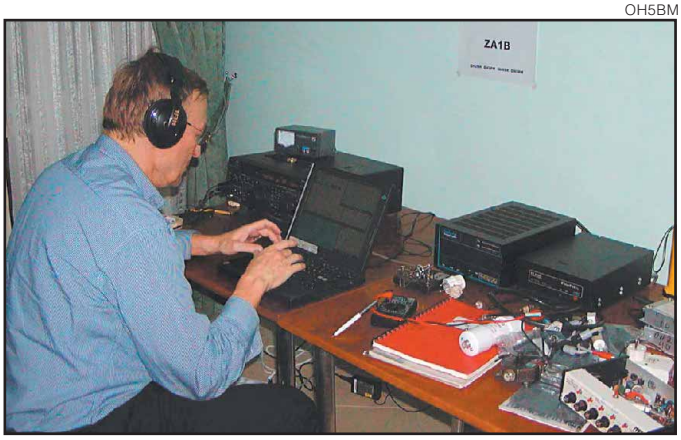
ZA1B On The Air At Last

Visitor licenses were easy to get, but we decided to honor our host and use his call sign for this memorable operation. Soon ZA1B was on the air for the contest and handing out QSOs in rapid-fire fashion. Conditions were actually quite poor, and getting our signal to Japan and the United States was a challenge. Of our 21,000 QSOs, only 921 were with Japan and 2648 with the United States.

Our antennas were truly portable. We had several fiberglass fishing rods supporting interesting wire affairs, forming single-band verticals with elevated radials on each band. Having Geni and others working with us was like going back to the original training course.

Our spirits were high, but we felt the IARU Albania Amateur Radio training project was still unfulfilled. The original supporting organization, the Northern California DX Foundation (NCDXF), had left a sizable sum of money to be used for further development of Amateur Radio in Albania in partnership with the IARU. Despite this, the neglect was painfully obvious. Could it be that we are only inter-

OH5BM



Pertti, OH2PM, busy at work at ZA1B. He's running a Yaesu FT-1000MP transceiver with a lightweight FinnFet FF-1002 carry-on amplifier.

Gent, ZA1T—An Academic Superstar

By Prof Terry Langdon W6/G3MHV

It is amazing to think that 10 years have passed since we landed at Tirana Airport on our first visit to Albania. I was a guest of the Physics Department at the University of Tirana and my wife Mady (KP3YL/W6, ex-KA6ZYF) accompanied me. Since we were following closely in the footsteps of the ZA1A operation, we brought with us a Yaesu FT-757GX transceiver with the hope of operating on the air.

We met Geni, ZA1B, shortly after arrival, obtained our ZA licenses and were active as ZA/G3MHV and ZA/KA6ZYF. Geni also introduced us to some of the newly licensed operators, including Gent, ZA1T, who was working in engineering at the University of Tirana.

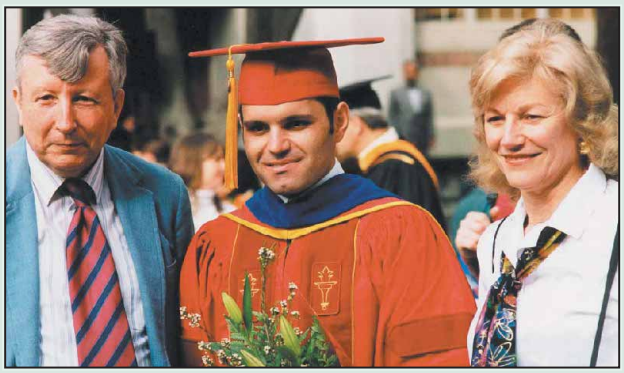
We soon discovered that Gent had recently graduated from the university after achieving a straight-A (10/10) record in all undergraduate classes. For this remarkable accomplishment he had received a special gold medal, only the second such medal given to a student of engineering since the founding of the university in 1954. We also discovered that Gent was keen to pursue a graduate degree in the US. Could I help? My area of expertise is Materials Science at the University of Southern California (USC) and Gent wanted to study Electrical Engineering, so this posed a potential problem. Nevertheless, I returned to California carrying copies of Gent's university transcripts and academic records.

Luckily, Gent's achievements were so outstanding that all at USC were in agreement we should offer a full graduate scholarship to this young man. Accordingly, Gent arrived in Los Angeles in August 1993, enrolled at USC and the rest, as they say, is history. Gent's academic performance at USC was superb and easily fulfilled our high expectations. In 1994, he obtained a US call sign—KE6MQJ—and operated for 2-3 years, although he is currently no longer active. He returned briefly to Albania in the summer of 1996 and operated again as ZA1T using the wire antennas that remained in place on the roof of his parents' home in Tirana.

Finally, the great day arrived in May 1998 when Mady and I sat next to his parents and watched proudly as Gent strode across the stage to receive his diploma—a PhD in Electrical Engineering (and the first PhD for an Albanian citizen at a US university after the fall of Communism in 1991).

Following graduation, Gent moved to a telecommunications company in San Diego, where he has remained. He married Sue, a delightful young lady from Korea, and now they are saving to buy a house where, Gent tells me, he plans to set up an HF station and start working again on the DX bands.

Dr Gent Paparisto, ZA1T/KE6MQJ, is clearly a world citizen and rapidly becoming an established authority in telecommunications technology. But even as he continues to grow in his professional environment, Gent is keeping an eye on Albania, and especially on the University of Tirana, where he is looking for an opportunity to help those who follow after him.



Terry, W6/G3MHV, Gent, ZA1T, and Mady, KP3YL/W6, on the day Gent received his PhD in Electrical Engineering.

ested in the plight of our fellow hams as long as their country is "rare"? I hope not.

Where are our Original Students?

There were 24 students at our last gathering in 1992. How many of them would we find still active? We found four still active and maybe another two we did not meet. This isn't surprising considering the turmoil Albania has suffered. Discussing this further with Vlado, ZA/Z35M, who is based permanently in Albania at a diplomatic mission, certainly put things in perspective.

Things are not well in Albania. Not yet. The progress from dictatorship to full democracy is long and painful. Albania is just at the beginning. The country has been at the beginning on several occasions, always falling back to square one.

Today Albanians are preoccupied with the essentials: what to eat and how to make a better future for their children. What little the Albanian people once had in the way of an orderly infrastructure and economy is totally broken. Amateur Radio can nevertheless continue to play a valuable role while the Albanians keep fighting for their basic survival on a very marginal monthly income.

Signs of Potential Progress

Some of our students have done very well, actually taking Amateur Radio a few steps forward. Geni Mema, ZA1B, is currently employed with the Albanian Telecommunications Authority and he is doing well after some health problems that were sorted out with the help of the amateur community (see the sidebar "Geni, ZA1B—Project Goodwill Albania"). Geni established many contacts while on a visit to the Central Arizona DX Association. Geni's son is studying in British Columbia because of these contacts.

Gent, ZA1T, was an honors student at Tirana University and became involved with our first wave of licensees in Tirana. Terry, W6/G3MHV, took Gent under his wing as a professor at the University of Southern California and now Gent has finished his PhD. He has a US call sign (KE6MQJ) and lives in the San Diego area. See the sidebar "Gent, ZA1T—An Academic Superstar."

Dajlan, ZA1Z, is the most active of them all. He spends his radio time strictly on CW. Dajlan sat on the government council that allowed the groundbreaking ZA1A to take place. I recall that Dajlan was initially concerned about how Amateur Radio would compromise Albanian security, but the ice was broken when I met him in Japan during that historic time a decade ago. Since Dajlan was often alone in his Tokyo hotel, I asked his delegation if we could offer him some entertainment. They mentioned that Dajlan was an old military telegrapher, which prompted me to go to the Akihabara electronics district to buy him an electronic keyer. Magic! He learned to use the keyer overnight and was ready to challenge me the following day. We were instantly on same wavelength with CW our common language. During our 2002 visit, I had the pleasure of checking ZA1Z's QSL cards for DXCC.

Dik, ZA1E, had developed a great set of skills on both CW and SSB, and you can find him on the bands regularly. We were delighted to see him active and even more delighted to observe that a donated Yaesu had survived the frequent power surges. Dik remains grateful to the late Sako Hasegawa, JA1MP, of Yaesu, for providing the equipment to get Amateur Radio established in Albania. Sako's mission at the time was clear: get Amateur Radio established in Albania and make them protect its future through IARU membership.

Did IARU's training project meet Sako's expectation? I believe it did. The Albanian Amateur Radio Association (AARA) was established and it obtained full membership in the International Amateur Radio Union. Dajlan, ZA1Z, is the chairman and Geni, ZA1B, the liaison officer. The Albanian telecommunications administration has changed totally, and Geni and Dajlan still need assistance to communicate the value of Amateur Radio to the current regulators.

What's Next?

The initial ZA1A IARU training project should be followed up with renewed vigor. What is needed is another session focusing on the Albanians' Amateur Radio needs as they exist today. Their efforts to grow the hobby in Albania should be supported and a new strategy formulated.

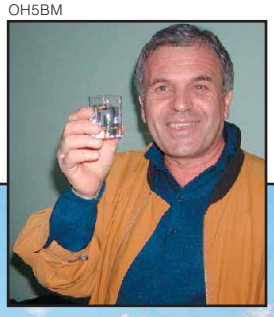
Efforts are already under way to find partners to get the project moving again. The International Amateur Radio Union has indicated its willingness to provide support.

Finding supporting partners should be possible following the good example set by Yaesu's late Sako Hasegawa, JA1MP. This is in the spirit of WRC-2003 where the Albanian Telecom delegation would likely share their interest in the Amateur Radio Service with other developing nations as an example of a meaningful activity in their emerging democracies.

Another wave of missionary DXpeditioning is necessary. I hope that those once in need of ZA feel the same way. By working together, we could soon hear ZAs on the air more often with energetic, happy voices full of hope for a better future.

Martti Laine, OH2BH, is an internationally known Amateur Radio operator, who has traveled to more than 120 DXCC entities. Through his extensive travel as a telecommunications executive with Nokia Corporation of Finland, he has unlocked many doors benefiting the hobby. Martti invented the concept of "Missionary DXpeditioning" where the goal of the visiting amateur is to encourage the growth of the hobby wherever he or she goes. The International Amateur Radio Union (IARU) recognized Martti's efforts in 1991 in connection with the initial ZA1A training/operating event in Albania. You can contact Martti at Savasundintie 4C, 02380 Espoo, Finland; **martti.laine@kolumbus.fi**.

OH5BM



Geni, ZA1B, saluted visitors and involved himself in this follow-up project. It has been far too long since the 1991 effort, and much more work will be needed to stabilize Amateur Radio in Albania.

OH5BM

New buildings under construction are found everywhere, but work seems to have stopped.

By Dan Henderson, N1ND and Bob Vallio, W6RGG

Field Day's New Addition—Class F

Part of the antenna system for the W6VOM station.

One of the operating positions at W6VOM, the John Shawver Memorial station.

A significant change happens with Field Day 2003 as the new Class F station becomes active. Class F is designed to encourage ARES, RACES or local radio club groups to develop or test existing emergency plans with their Emergency Operations Centers (EOC).

To qualify, an EOC must be associated with a federal, state, county, city or other civil government, agency or administrative entity. It may also be a chapter of a national or international served agency (Red Cross, for example) with which the local group has an established operating arrangement.

To participate as Class F, the operation must be actively planned and coordinated with representatives of the EOC being activated. Class F is not intended to be for everyone. It is designed for those groups who wish to test their existing emergency plans during the Field Day event. In light of recent events, some EOCs may limit access, and some may not be set up to accommodate a full Field Day operation. So if your group can't participate as Class F, you still can enjoy Field Day in one of the traditional categories.

One group that is gearing up for a full-bore test is the Alameda County (California) Sheriff's Communications Team, a registered RACES unit. Their long-term relationship with the county has led to a well stocked Amateur Radio room incorporated into the county EOC. The unique construction of the building (it has been made as earthquake-resistant as possible), emergency power, and permanently installed radios and antennas make this EOC a particularly good example of continuing cooperation between government and Amateur Radio resources. Planning and preparation has included addressing the matter of access to sensitive/secure areas in the EOC complex.

Dennis Jennings, KG6HYT, is the Emergency Services Coordinator with the Sheriff's Office of Emergency Services in Alameda County. Dennis and Ti Connelly, NJ6T, the chief radio officer for the ACSCT, are coordinating a full 24-hour field day presence at the EOC as a Class F. They will also be testing their secondary resources by using their communications van (located within the prescribed Field Day circle).

Be sure to listen for W6VOM, the John Shawver Memorial station, and other stations participating in the new Class F category, on the air from the ACSCT operation during Field Day June 28-29, 2003.

The John W. Grubensky and James M. Riley, Jr Building, home of the Alameda County Sheriff's Office of Emergency Services and Communications Team.

The heart of EOC. During an activation, the rooms surrounding this EOC would be staffed by representatives of various groups, including the ACSCT.

By Jean Wolfgang, WB3IOS

Kid's Day June 21, 2003

CQ, CQ, CQ Kid's Day. That's what you'll hear on several ham radio frequencies on Saturday, June 21. Kids (under the control operator's supervision) will be talking on the ham bands, looking for other kids to talk with and exchange basic information.

Although Kid's Day is not meant to be a class in ham radio, some kids may learn to log the contacts or other basics about the ham radio hobby. Set a good example by observing all Amateur Radio rules, including third party traffic agreements.

SOAPBOX

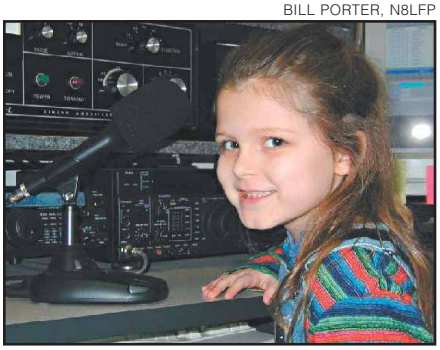
All the kids had a BLAST! The best contact was W5RRR at Johnson Space Center in Houston, Texas. The operator of the station is to be commended for his participation, patience and knowledge as he answered questions and even offered addresses for QSL cards and pictures from NASA/JSC. Thank you, for the fabulous day we all had!—*73, KO4QJ*

My 10-year-old daughter enjoyed this event very much. I let her operate the station under my supervision and she did a very good job. We actually set up a schedule with one family so the kids could chat on a weekly basis. Thank you very much for a marvelous time.—*73, Ray, NØUY*

I had lots of fun hearing people my own age on the radio. I plan to do it next Kid's Day.—*KCØLKE*

Great fun! Samantha, 9, hadn't ever operated before. I tuned, she talked. All the contacts were on 10 m, and all on the East Coast (PA, MA). Samantha observed that she could hear the station 3000 miles away but barely hear other Southern California or Washington stations. Contacts were K3OO (Mark), KB3AGZ (Justine) and W6IS (David). K5KG, K2OWG, and XE2AUB had booming signals here.—*W6RMK* QST

BILL PORTER, N8LFP



During Kid's Day in January 2003, six-year-old Chelsie was ready to go it alone after only 10 minutes of coaching from her dad, N8LFP.

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 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 their children.

Dates: Saturday, June 21, 2003 and Sunday, January 4, 2004.

Time: 1800 to 2400 UTC. 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: 28,350 to 28,400 kHz, 21,380 to 21,400, 14,270 to 14,300 kHz and 2-meter repeater frequencies with permission from your area repeater sponsor. Observe third party traffic restrictions when making DX QSOs.

Awards: All participants are eligible to receive a colorful certificate (it becomes the child's personalized sales brochure on ham radio). You can help ARRL keep track of the Kid's Day activity and responses. Please visit **www.arrl.org/FandES/ead/kids-day-survey.html** to complete a short survey and post your comments. You will then have access to download the certificate page or send a 9×12 self-addressed, stamped envelope to Boring Amateur Radio Club, PO Box 1357, Boring, OR 97009.

2003 ARRL International Humanitarian Award

Call for Nominations

Amateur Radio operators communicate daily with people from all over the world. Through Amateur Radio people can meet and talk to others while spreading goodwill across otherwise impenetrable political boundaries. At times these operators are a lifeline to medical help or provide essential communications during storms or other emergencies.

Recognizing the above, the League established the ARRL International Humanitarian Award. The award is dedicated to those amateurs who, through Amateur Radio, are devoted to promoting the welfare of mankind.

Any radio amateur, or group of amateurs, who, by use of their skills of Amateur Radio, have provided extraordinary service for the benefit of others in times of crisis or disaster, is qualified to receive the award.

The ARRL Volunteer Resources Committee will accept nominations from an Amateur Radio operator, governmental organization or any other organization that has received the benefits of the nominee's extraordinary service. In the event that no nominations are received, the committee may determine possible recipients or may decide to make no award in a given year.

Make your nomination by writing a summary of the nominee's actions that qualify the nominee for the award. This summary should include the nominee's contact information, including e-mail address. Please enclose two statements from other individuals with first-hand knowledge of these events. These statements may be written by a ham or by an official from the group that the nominee's action would benefit, such as the Red Cross, Salvation Army or a state official. Please include names and addresses for verification.

All nominations and supporting materials for 2003's award must be submitted in writing in English to ARRL International Humanitarian Award, Jean Wolfgang, WB3IOS, 225 Main St, Newington, CT 06111 in sufficient time that they are received by December 31, 2003.

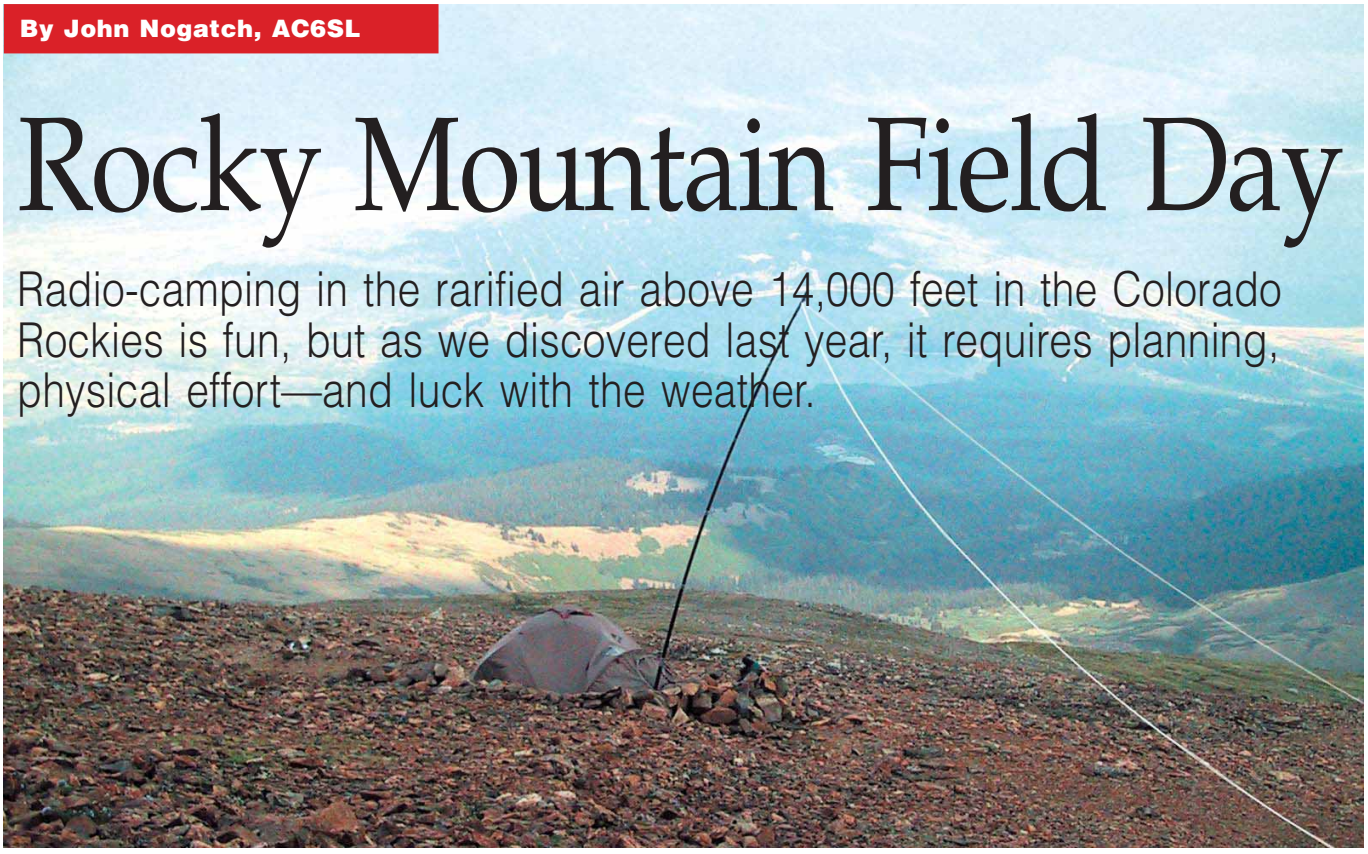
The award recipient will receive an engraved plaque and be profiled in *QST*, the ARRL Web site and in other ARRL news outlets. There's more about the award on the ARRLWeb, **www.arrl.org/FandES/field/awards/humanitarian.html**.

Jean Wolfgang, WB3IOS, is ARRL Educational Program Coordinator. She can be reached at **jwolfgang@arrl.org**. QST

By John Nogatch, AC6SL

Rocky Mountain Field Day

Radio-camping in the rarified air above 14,000 feet in the Colorado Rockies is fun, but as we discovered last year, it requires planning, physical effort—and luck with the weather.



On the Tuesday before Field Day, I flew to Denver, where George, KØIW, picked me up at the airport and drove us to his home near Nederland. Because I normally reside at only 800 feet above sea level, it was very important to spend a few days getting used to the thin air in order to avoid altitude sickness.

As I acclimated to the 9000 foot elevation, we worked on a logging program to run on George's Sharp Zaurus palmtop. We had kept paper logs in 1998 and 2000, and maintaining dupe sheets under field conditions had been difficult. The new software appeared to work okay, but we then discovered that the Zaurus required a 5 V power supply, not 12 V direct from the battery. We were up rather late on Thursday night putting together an LM3805 regulator circuit.

George's pack was heavy because he was carrying the tent and the food. The third member of our FD group, Doug, KØDUG, of Boulder, had a full pack—he was to carry the battery and the radio—a K2 QRP transceiver—and his personal gear was baled on top. I had the lightest load, 150 feet of zip cord and 30 feet of ladder line, in addition to my cold weather gear and 3 liters of water. Doug and I also carried liquid fuel for the camp stove.

We managed to leave George's house on schedule at 06:45 Friday morning for the two-hour drive south, through the Eisenhower Tunnel and then west. After breakfast in Leadville, it was a half hour drive to the Twin Lakes area. We left the paved road and entered a large aspen grove, which went on for several bumpy miles, including a ford through a good-sized stream. We changed into our heavy hiking boots, helped each other to shoulder the heavy packs and started walking around noon. After 1000 feet of climbing, the aspens gave way to pine trees.

Another 1000 feet brought us above tree line. We fixed some problems with our backpacks, and agreed to use our handhelds to keep in touch as we got stretched out along the trail. Late afternoon squalls began to blow up.

Corona Time

Upon reaching the summit about 18:15, I changed into cold weather gear, sat down in the lee of a stone wall campsite and waited. As Doug appeared, I raised my hand to wave at him, and heard a loud *zzzzzzzzt*. I retracted my hand, then raised it again, heard another corona sound, and felt a shock through the seat of my pants. Doug's hat was buzzing, and he was getting shocks through the balls of his feet at each step. We decided to use the campsite located 90 feet below the summit.

The tent was set up, snow gathered to melt for water and a dinner of oriental noodles prepared. Grappel, 1/8 inch snow pellets, was falling intermittently. We slept for several stretches of a few hours each, but I was often awakened by drops of water that collected on the inside of the tent and then fell on my face. In spite of being tired, it is difficult to sleep the first night at high altitude.

Early Saturday morning, Doug prepared oatmeal as George and I raised the antenna, a G5RV inverted V (extremely low ground conductivity precluded the use of a vertical). While we were copying the W1AW bulletin, the wind broke the mast in two places, but reception didn't change much. George and I re-raised the G5RV, setting the heavier wire elements on the upwind side and the nylon guy on the lee side. Because the mast was now shorter than planned, we found that the SWR was 2:1 on 20 meters. This was not as good as before, but we still made more QSOs on 20 than on any other band.

The crew: **George, KØIW; Doug, KØDUG, and John, AC6SL—packed and ready to go.**

Our experiences in 1998 and 2000 had shown that ground conductivity on rocky mountaintops is very poor. Vertical antennas that work when sited on dirt will not tune correctly when installed on rocks. Also, changing taps or antenna connections under windy, wet or dark conditions was not practical, so a G5RV style multiband antenna, driven by the K2's internal autotuner, is a better arrangement. Many years ago, Ron, K6TCN, showed me that wire split from zip cord resists kinking, which prevents problems in an antenna that is stowed tightly and then deployed over rough terrain.

The Noise Abates

With everything connected, George and I were disturbed to see the K2 voltmeter display fluctuating wildly. The erratic indication stopped when we unplugged the Zaurus palmtop. Fortunately, this did not appear to cause a problem. Later on, we began hearing computer birdies, but they were only on certain frequencies, for short periods, and they could be removed by pulling the charger cord out of the palmtop. Once or twice we forgot to replace the connection until the display suddenly went black, but it was a minor inconvenience and no data was lost. Starting at noon Saturday, we began to make hunt and pounce QSOs at a rate of 10 per hour. After dinner time, our rate began to improve—the bands had quieted down and our QRP signal was being answered more often. The lack of ergonomic seating was taking its toll on our backs and knees.

At first we had a logger assist the operator, but as night and the temperature fell, two of us would try to sleep and the operator would do his own logging. As we became more proficient at using the palmtop, we abandoned the paper scratch pad. Forty and 80 meters worked well for us in the late night and early morning, after the East Coast interference had settled down. Ten was not as good as in previous years, and we were often drowned out by louder signals on 20, but 15 meters with its slow fading was productive during daylight hours.

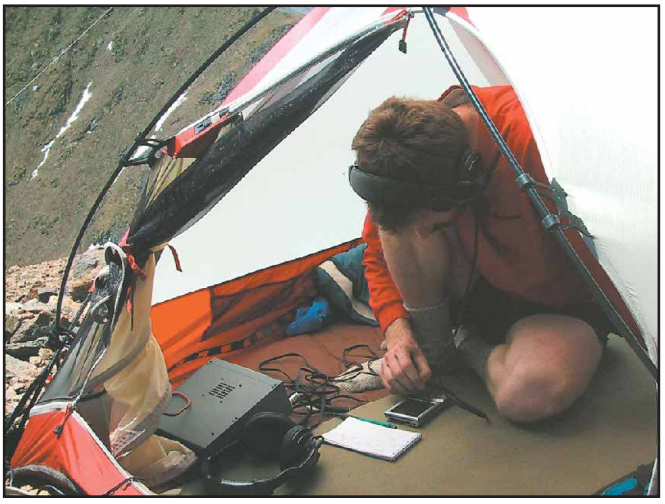
Although Saturday night was drier, it was also cooler than the night before. After a good shift, George announced that he was cold and retreated to his sleeping bag. Doug took over as operator and I assisted him as logger, until I realized that my eyes were starting to close in between contacts. Wearing all of my cold weather gear, including hat, coat and gloves, I was still a bit uncomfortable inside my sleeping bag. Sunday morning's sun rose in a mostly clear sky, and temperatures soared. By noon our cold weather gear had all been packed, and we were back in shorts for the descent.

We ceased operation at 12:00 local time, were completely packed by 12:38 and descended in 3 hours, less than half the time required for the climb up on Friday. Downhill with heavy packs is hard

Our gear: **Zaurus palmtop, NorCal paddle and Elecraft K2 transceiver.**

The author at work: **John, AC6SL, hunting and pouncing.**

George greets Sunday morning: **Three hikers are visible standing at the summit of Mount Elbert, at upper right.**



Wrapping it up: **Doug completes the last shift.**

on the feet, knees and leg muscles. We were footsore, but finally free of the headaches that are ever present at the higher elevations. All of us were pleased with this Field Day. Mount Elbert is the highest peak in Colorado, and the weather was not too bad overall. The K2 performed well, and the palmtop logging software was a success, although George and I did not pronounce it so until the data was safely copied onto his home desktop system. The instant dupe checking was especially valuable, and the preparation of our summary and dupe files was easily accomplished, without having to transcribe from paper logs.

Next Time

We knew we had had a good time when, during the walk down, we were already planning improvements for next time. Doug wants to improve his code speed, George wants to lose 20 pounds and I would like to rebuild the antenna to make it lighter—and also replace the K2 with the smaller K1 transceiver. We also agreed on several enhancements for the logging program.

It is a very satisfying feeling to complete a successful Field Day under these conditions. I thank my friends George and Doug for supplying the mountaineering expertise to make this trip possible.

Photos by the author.

John Nogatch, AC6SL, of Boulder Creek, California, is a software engineer—as are his fellow FD trekkers KØIW and KØDUG—and a member of the San Lorenzo Valley ARC. George and Doug reside in Colorado, and are experienced mountaineers. You can reach the author at **ac6sl@arrl.net**.

STRAYS

"QTH...WESTERN NEBRASKA... QTH WESTERN NEBRASKA"

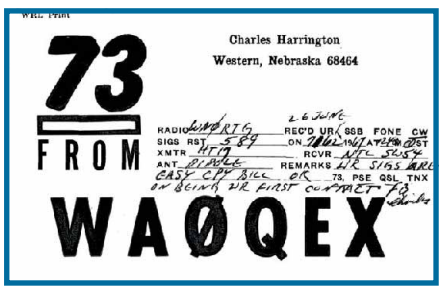
◊ To think I almost gave up Amateur Radio over western Nebraska!

On June 26, 1967 as WNØRTG, an excited newly licensed Novice, I was about to make my first contact from my QTH in Raytown, Missouri. The Heathkit DX-20 transmitter (with two crystals each for 40 and 80 meters) was loaded for 7162 kHz into my homebrewed doublet antenna. The Hallicrafters S40-B was warmed up and ready to go.

I called CQ several times and Charles Harrington, WAØQEX, answered right away. I was excited and nervous. I copied just about everything Charles sent. I had his name, RST (589), transmitter (HT17), receiver (National SW-54) and antenna (dipole). He said his QTH was in western Nebraska.

On the next go around I gave Charles all of my information and asked for his QTH. He responded RR to all and talked about the weather and in the course of the QSO again said he was in western Nebraska.

And so the QSO went; each time Charles turned it over to me, I would ask for his QTH and each time after cordial conversation he would say, QTH WESTERN NEBRASKA. Well I gave up trying to get his QTH. In fact, I was downright flustered. If all ham operators were as uncooperative as this fellow seemed to be, maybe ham radio wasn't for me! We signed off.



The QSL card for my first contact.

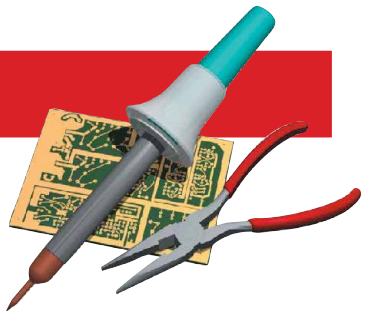
A few days later I received a QSL card from the town of *Western*, Nebraska! I didn't know whether to laugh or cry. One thing was for sure, though—I could just see Charles sitting at his station with a big grin each time he gave his QTH to anyone on the air.

On August 20, 1989, I came across Charles' QSL card and laughed again about that first contact. I gave him a call on the phone and told him who I was. He remembered our contact.

In April 2000 I was planning to attend a retreat in Nebraska and decided I would stop at Western for an eyeball QSO with Charles. I explained who I was and Charles invited us in. He went to his QSL cards and logbook for '67 and found my card and the log entry. We reminisced about my first contact.

Jim Andera, KØNK; Charles Harrington, WAØQEX, and Bill Gardner, KØUG, at Charles' home in Western, Nebraska, April 14, 2000.

Charles is still active. He showed me one of his latest antenna projects—a homebrew low-band antenna made of copper tubing. We talked about how much fun he'd had over the years operating from Western, which is actually located in south central Nebraska. We talked about our adventures, amateur and otherwise, over the years. It was a wonderful visit!—*H. Keith Haye, WEØG, as related by Bill Gardner, KØUG*



The Doctor is IN

Q Daryl Isbell, W4DAI, asks, "What antenna would you recommend for 20 meter phone operation for Field Day, 2003?"

A That is a pretty sweeping question, because the "best" antenna for Field Day depends a lot on what type of operating you intend to do. Some hams do Field Day working alone, perhaps even backpacking into a camping area and setting up a station by themselves. This will present an entirely different set of antenna challenges as opposed to the club that has a regular site with unlimited volunteers and resources.

The real fun in Field Day comes from trying different things, so don't be afraid to experiment and don't feel that you won't have a successful time unless you have the "best" antenna possible. Nearly any antenna will produce lots of Field Day contacts, so decide what you want to try and give it a go!

Some clubs have a ready-to-go antenna tower set up on a trailer. A small Yagi antenna can be easily set up and used for Field Day. For portable work, this may represent the ideal 20 meter antenna, as shown in Figure 1.

Many hams use wire antennas. For multi-operator Field Day stations, the use of separate antennas for each band can be helpful. To minimize mutual interference, these should be spaced as far apart as is reasonable.

There are a number of wire antennas that can be used on the HF bands. The simplest is a random piece of wire worked against earth ground with an antenna tuner. This antenna requires a good RF ground connection to work well. A simple ground rod is generally ineffective. Other hams use center-fed dipoles. These can be cut to a half wavelength and fed with coaxial cable. RG-58/U type coax works well for a few hundred watts, as long as the length of the feed line is not overly long. For higher power, longer coaxial runs or operation on the upper HF or VHF bands, use larger coax.

A nice multi-band HF antenna is a dipole of any length greater than a quarter wavelength on the lowest frequency to be used, fed in the center with open-wire or transmitting type ladderline. There are a lot of other interesting possibilities, from large loops to bobtail arrays to rhombics. In the past, the Meriden Amateur Radio Club of Connecticut has done quite well with 500 foot V-beams, although most hams don't have the space to put up an antenna that large.

The performance of a horizontal antenna varies a lot with its height above ground. At low heights, most of the RF signal is sent upward; relatively little is propagated at low angles, toward distant stations. But, higher is not always better! In the daytime, on 80 or 40 meters, the stations you will be working are within a few hundred miles, so those high angles may be useful. On 20 meters, however, you should put a horizontal antenna up as high as possible in order to work stations nationwide. If you can get a horizontal antenna up a half wavelength or more (33 feet on 20 meters) it will generally work well. To help you plan, Figure 2 shows an antenna elevation plot and the difference between a horizontal half wave dipole at both low and high heights. Note the low-angle radiation, concentrated at the horizon (toward distant receivers) for the high height. Conversely, note the relatively high angle of radiation, away from the horizon, for the low height.

Vertical antennas can also work well for Field Day. Most require a good ground system for the best performance, however. A simple ground rod will not usually be effective. Use one of the "end-fed" half-wave type verticals, or those fed in the center, so you can eliminate part of the grounding losses. Vertical antennas generally have a good low-angle launch, making them good DX antennas. However, that DX performance is dependent on the characteristics of the ground many wavelengths away from the antenna; impossible to control in most cases. If you are in a rocky area with poor ground, a vertical antenna may not be a good choice. In a swamp, the vertical can really work well for DX, although the mosquitoes might get you! Figure 3 shows the performance of a vertical antenna over both

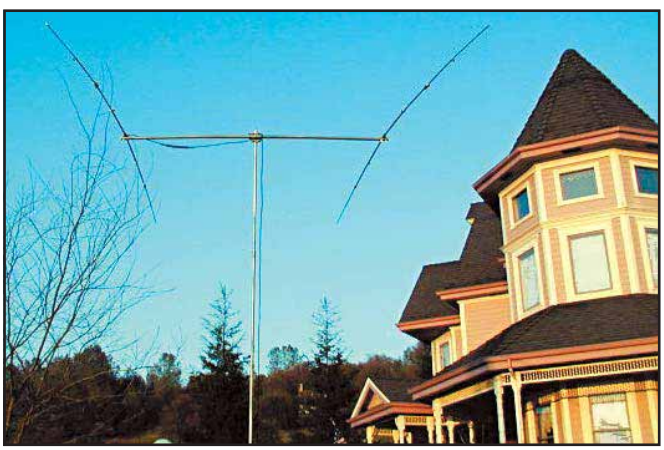


Figure 1—This small portable Yagi antenna is ideal for Field Day.

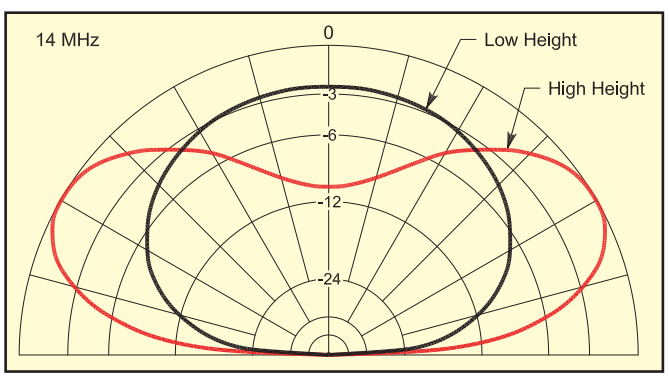


Figure 2—The low horizontal antenna is good for sky-wave communication with relatively close-by stations. As the antenna is put higher, its DX performance improves. The red line shows the performance of a half-wave dipole 33 feet in the air. The black line is the same antenna at a height of 8 feet.

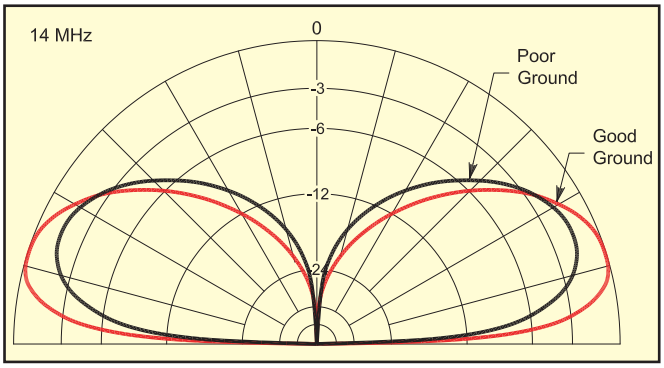


Figure 3—A vertical antenna over good ground can perform pretty well. Over poor ground, a vertical may be an omni-directional antenna that performs equally poorly in all directions. This compares the performance of a vertical with a short ground rod operated over good and poor ground. The red trace shows what can be expected over good ground.

poor and good ground.

The antenna patterns were produced using one of the several antenna-modeling software packages that are available. See **www.arrl.org/tis/info/HTML/antenna-modeling/index.html** for information and articles.

Q Ralph, W6DV, sends this in: I am considering a vertical dipole for 10 meters near my garage door—just for experimenting—not serious operating. The bottom leg will have to be near some roof flashing and on the side of a wall where there are paint cans and other metal objects. I know the radiation pattern will be poor, but my question is: How will the metal objects affect the feed-point impedance? Would it be possible to improve it by cutting that side of the dipole longer or shorter?

A When you apply RF to an antenna, an electromagnetic field is created. That field propagates away from the antenna and induces currents into other conductors. In some cases, that's a desired effect—at the antenna of a distant station, for example. If another conductor is near your antenna, however, it could become an active part of the antenna system. That could change the pattern and the feed-point impedance of the antenna. In some cases that's a desired effect, too. A Yagi, for example, achieves its gain because the reflector or director elements interact with the RF energy transmitted by the driven element, forming a pattern that concentrates signal in one direction.

How much the presence of these nearby conductors will affect your antenna depends on their proximity and dimensions and, to some extent, their orientation. Typically, long conductors within about a quarter wavelength or so—about 8 feet on 10 meters—will have a significant effect. The effect will usually be to lower the feed-point impedance and change the antenna's resonant frequency. Conductors that are at right angles to the antenna will have the least effect.

If the effect on the frequency is minor, you may be able to bring the antenna back to resonance by adjusting the side of the antenna closest to those conductors. The antenna may then be less balanced than a dipole in free space, now being fed, electrically, off center. This could cause feed line radiation and problems with RF in the shack. A 1:1 choke balun at the antenna feed point will take care of that, however.

These conductors may have only a minor effect and the SWR might be low enough so that your rig is able to reach full power. Practically speaking, most antennas for the low frequency bands do have other conductors within a quarter wavelength of their radiators and most usually work quite well. For example, on 80 meters a quarter wavelength is 66 feet. On a small residential lot it's difficult to isolate an 80 meter antenna more than 66 feet from other conductors!

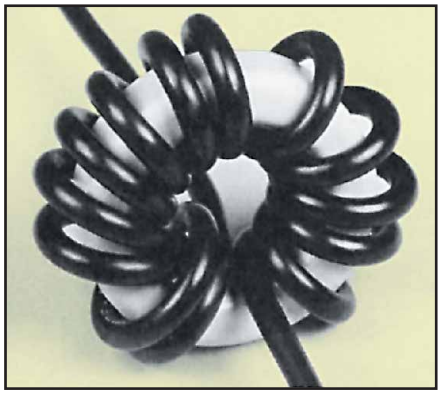


Figure 4—This common-mode choke can be made by wrapping about 10 turns of the TV coaxial cable onto a FT-240-43 ferrite core.

Q Warren, WU3Y and Tim Gruber, KB3IYJ have an RFI problem. "I recently installed a 2 meter/440 radio for my son in his room. We have installed an outside vertical antenna. This antenna is on one side of the house and the TV antenna is on the other side of the house, about 50 feet away. When my son transmits on 2 meters he totally blocks out the lower VHF channels. My belief is that the TV set is getting overloaded by the power radiated from the 2 meter transmitter. All of the other TV channels are okay. How can I fix this? Does anyone make a notch filter I can put on our TV?"

A The Doctor handed this one over to Mike Gruber, W1MG, ARRL HQ's RFI expert. "A 2 meter notch filter might help. I would first suggest disconnecting the antenna from the TV receiver. If the interference is substantially reduced, it might be coming in through the ac power cord. If so, use a "brute-force" ac line filter. Next, try touching only the shield of the cable to the shield of the TV connector, without screwing it on. If the interference to the snow on the raster is increased, you may be picking up the RF on the outside of the TV coax. Try installing a common mode choke directly at the receiver end of the coax, as shown in Figure 4.

If the TV receiver draws less than 300 W, try using a RadioShack catalog #15-1111 ac line filter. Industrial Communications Engineers, **www.arraysolutions.com/Products/ice/**, also sells ac line filters that operate at higher power.

The ARRL RFI Web site, **www.arrl.org/tis/info/rfigen.html**, contains a list of EMI/RFI materials suppliers for ferrite chokes.

If the common mode choke doesn't work, the strong 2 meter signal is probably overloading the front end of the TV set. Notch filters may help, as TV tuners typically do not have good adjacent channel rejection. Tunable notch filters will reject the amateur signal, allowing the TV receiver to function normally. Note, however, that these filters will not help when an amateur signal is interfering with cable channel 18, as cable channel 18 and the amateur 2 meter band occupy the same frequencies.

Here are two companies that sell notch filters. They can be expensive, so check the prices before ordering:

Microwave Filter Co, Inc, 6743 Kinne St, East Syracuse NY 13057; tel 800-448-1666; **www.microwavefilter.com**.

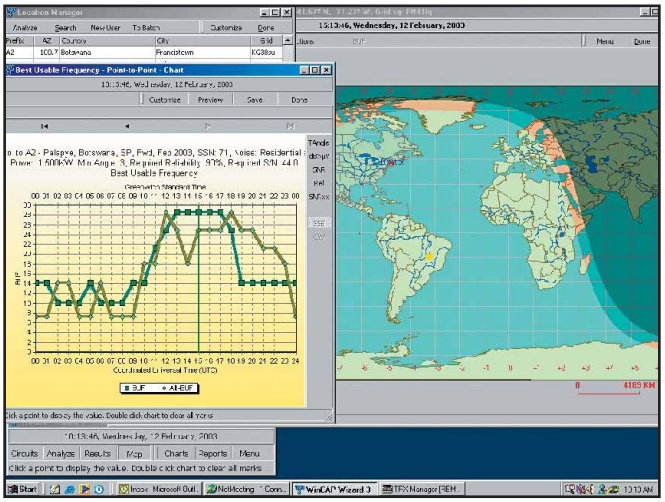
Winegard Company, 3000 Kirkwood St, Burlington, IA 52601; tel 800-247-8221; **www.winegard.com**.

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; www.arrl.org/tis/. Add your comments: "The Doctor is On-line" at www.arrl.org/members-only/qst/doctor/. QST

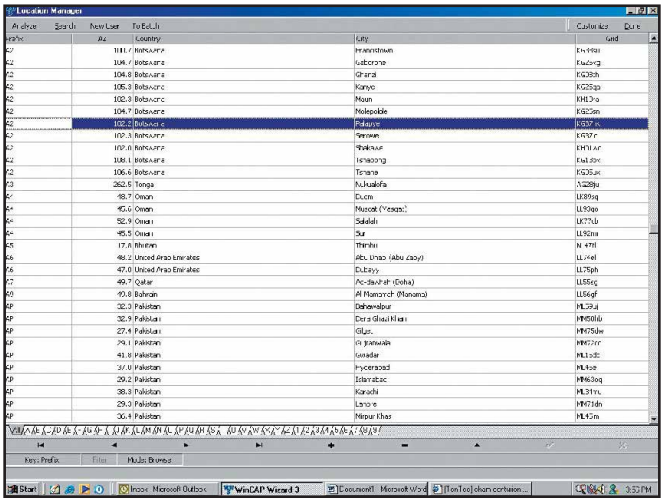
WinCAP Wizard 3

HF propagation analysis and prediction isn't an exact science, but it has achieved an impressive degree of accuracy. As a result of years of research, we now have software that can provide reliable predictions over various HF paths. The software analyzes the "circuit" using data points such as the frequency, smoothed sunspot number, time of day, time of year, local noise levels, communications modes, antenna gains and more. At the end of the process, you have a prediction of your ability to communicate.

There are two software "engines" that are the gold standard for HF analysis: *IonCAP* and *VOACAP*. *WinCAP Wizard 3* for *Windows* uses the *VOACAP* (Voice of America Coverage Analysis Program) engine to produce its predictions. *WinCAP* functions as a user interface to the *VOACAP* engine to render straightforward predictions that are easily understood. The *VOACAP* prediction engine calculates the expected performance on the "undisturbed" days of the month, when solar activity is typical. Obviously, it can't predict the effects of a sudden solar outburst, but I found *WinCAP* to be dependable and accurate.



An MUF plot and real-time map display.



The massive *WinCAP Wizard 3* location database. No matter where you live, or where you wish to communicate, chances are good that you'll find a nearby city here.

Installation and Operation

The *WinCAP Wizard* CD launched immediately when I inserted it into the drive. The installation proceeded quickly and smoothly during my tests with both *Windows 98* and *Windows XP*.

WinCAP includes a detailed help file and I strongly recommend reading it before you attempt to navigate the program. I performed my usual "acid test" of trying to use the software without reading the documentation and failed. I couldn't figure out how to obtain a path prediction until I finally gave up and consulted the help file. You'll find it under MENU, then OPTIONS.

Once I put all the puzzle pieces together, though, *WinCAP* performed as advertised. You can choose from the database of sample antenna configurations, or make your own. Using *WinCAP* you can create three types of predictions: point-to point, NCDXF/IARU International Beacon Network, and the user batch. You can also create up to 18 different circuits between any points on the globe. The location database is massive; chances are good that it includes a city near you. The prediction displays are informative and clean from a graphic standpoint. The real-time map of the world with its daylight/darkness display is particularly well-done.

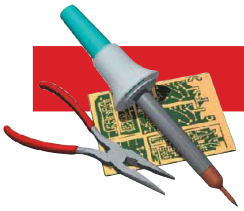
As you'd expect from something based on *VOACAP*, the predictions were accurate most of the time. For example, one evening in February I worked D44AC in Cape Verde over a difficult path on 20 meters with considerable fading. After finally making the contact, I consulted *WinCAP Wizard*. Sure enough, *WinCAP* had offered a reliability prediction of only about 30% for that circuit.

Conclusion

While the software is "friendly" to some extent, you need to have a firm technical grasp to get the most out of *WinCAP Wizard 3*. Amateurs who are knowledgeable about HF propagation will find *WinCAP* to be an outstanding tool, as will those who need highly accurate predictions for specific purposes (DXpeditioners and contesters come to mind). Casual users may find the *WinCAP Wizard 3* learning curve a bit steep—perhaps too steep to justify the cost. But, as I've recommended with other software packages, the best thing to do is download the 30-day free trial version from the Tabor Software Web site and give it a spin.

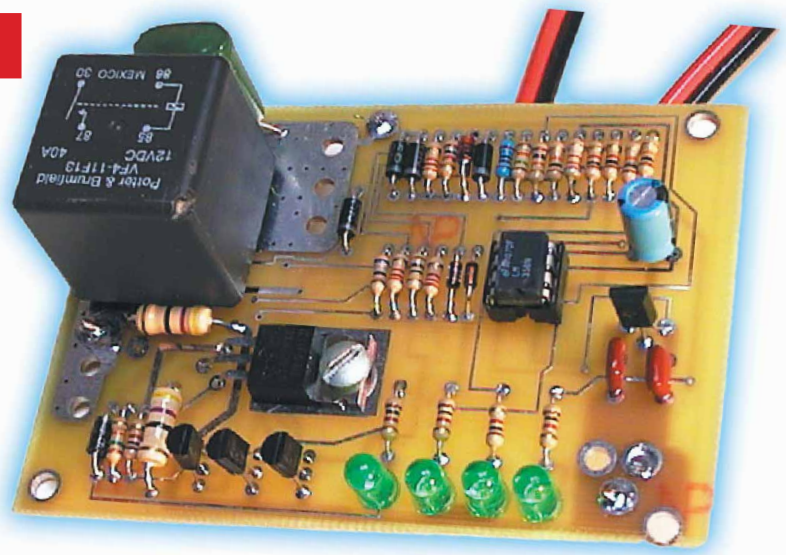
Manufacturer: Kangaroo Tabor Software, 1203 County Road 5, Farwell, TX 79325-9430; fax: 806-225-4006; **www.taborsoft.com/**. *$65. Minimum system requirements: Pentium 400 or faster PC running* Windows 98/NT/XP.

Steve Ford, WB8IMY ♦ *QST* Editor ♦ sford@arrl.org



By Mike Bryce, WB8VGE

The Protector



Have you ever connected power backward, had a power supply regulator fail or intermittently lose the dc input line to a rig? If so, you learned an expensive lesson.

Imagine you're working Field Day and unbeknownst to you, a wire comes loose from the battery that is being charged by a solar panel. Instead of the radio seeing 12 V, it's now looking at an unclamped 22 V. Can you see the smoke pouring out of the rig?

Some ac line-operated power supplies have a crowbar circuit to protect the radio from overvoltage. A common crowbar scheme uses an SCR to short the 12 V dc line to ground, blowing the output fuse in the process. The fuse pops, the radio is safe and everyone is happy. Older ac line operated supplies lack over-voltage protection. Do you really feel like digging around inside that supply to retrofit a voltage crowbar circuit?

Have you ever tried to connect your radio to a battery and forgotten to turn the radio off first? There are sparks, the radio flashes on and off and the microprocessor goes for a wild ride until the supply leads are tightened to the battery posts. Let's see… what steps are required to reset the processor and what other damage has been done to the radio?

A solution to these problems was clearly needed. I wanted to protect the radio from an overvoltage condition and from reverse polarity, as well. While I was at it, a delay start to protect the equipment from turn-on transients would also be an excellent idea. After a few weeks of tinkering, the result is a project I call The Protector.

Description

The Protector is a small circuit that can be installed between any 12 V radio and its 12 V dc power source. The power source can be anything from an ac line-operated supply to a battery. It will protect the radio against overvoltage and from reverse polarity. It will also provide a delayed start, just in case you forgot to turn the radio off before you connected it to the power source.

The Protector will protect any load against reverse polarity and over-voltage, and will do so without blowing fuses or popping circuit breakers. In either case, once the problem is fixed, The Protector will once again allow power to be sent to the load. There are no reset buttons to push, no circuit breakers to reset and no fuses to replace. By design, the operation is totally automatic and requires no user input—it is completely transparent. Best of all, The Protector is easy to build and it requires no adjustments or setup.

You should be able to assemble the circuit in about an hour. All parts mount on a double-sided PC board the size of a playing card. The circuit can be built on a piece of perforated board and hand-wired. To make building easy, however, you can purchase a complete kit of parts, including the PC board.[1]

The Circuit

Relay

The most difficult problem to overcome was switching the relatively large dc required by modern equipment. I tried all sorts of solid-state bipolar and FET switching devices. While they seemed to work, they were overly complex and expensive. I fell back to something simple, easy and inexpensive—a relay. The relay used is a high current device that can easily handle up to 40 A of contact current. With a 12 V dc coil, it's easy to drive with a power MOSFET.

When power of the correct voltage and polarity is applied to The Protector, after the delay start has timed out, transistor Q2 receives base current from diode D1. This causes Q2 to conduct and pull the base of Q3 low, which turns Q3 on. Q3 then sends 12 V to the gate of the power MOSFET, Q4. With the power MOSFET on, the relay coil is energized, the contacts close and power is sent to the radio.

Although the relay has a 12 V dc coil, the relay coil runs hot at 13.8 V. To keep it from overheating and to reduce the overall current draw, two 22 Ω, 1 W resistors are in series with the relay coil.

Overvoltage Shut Down

If the supply voltage exceeds 15 V, Zener diode D2 conducts. This applies base voltage to Q1; it conducts and deprives Q2 of base voltage. When Q2 is off, the base of Q3 goes high and no longer supplies voltage to the gate of the power MOSFET, Q4. The power relay opens, removing power from the radio. The 15 kΩ resistor between the gate of Q4 and ground ensures a speedy dropout of relay K1.

Murphy's law says that any overvoltage condition will occur when the radio is transmitting and drawing maximum current. Arc suppression when the relay contacts open is handled by C4, a 0.47 µF capacitor.

[1]Notes appear on page 58.

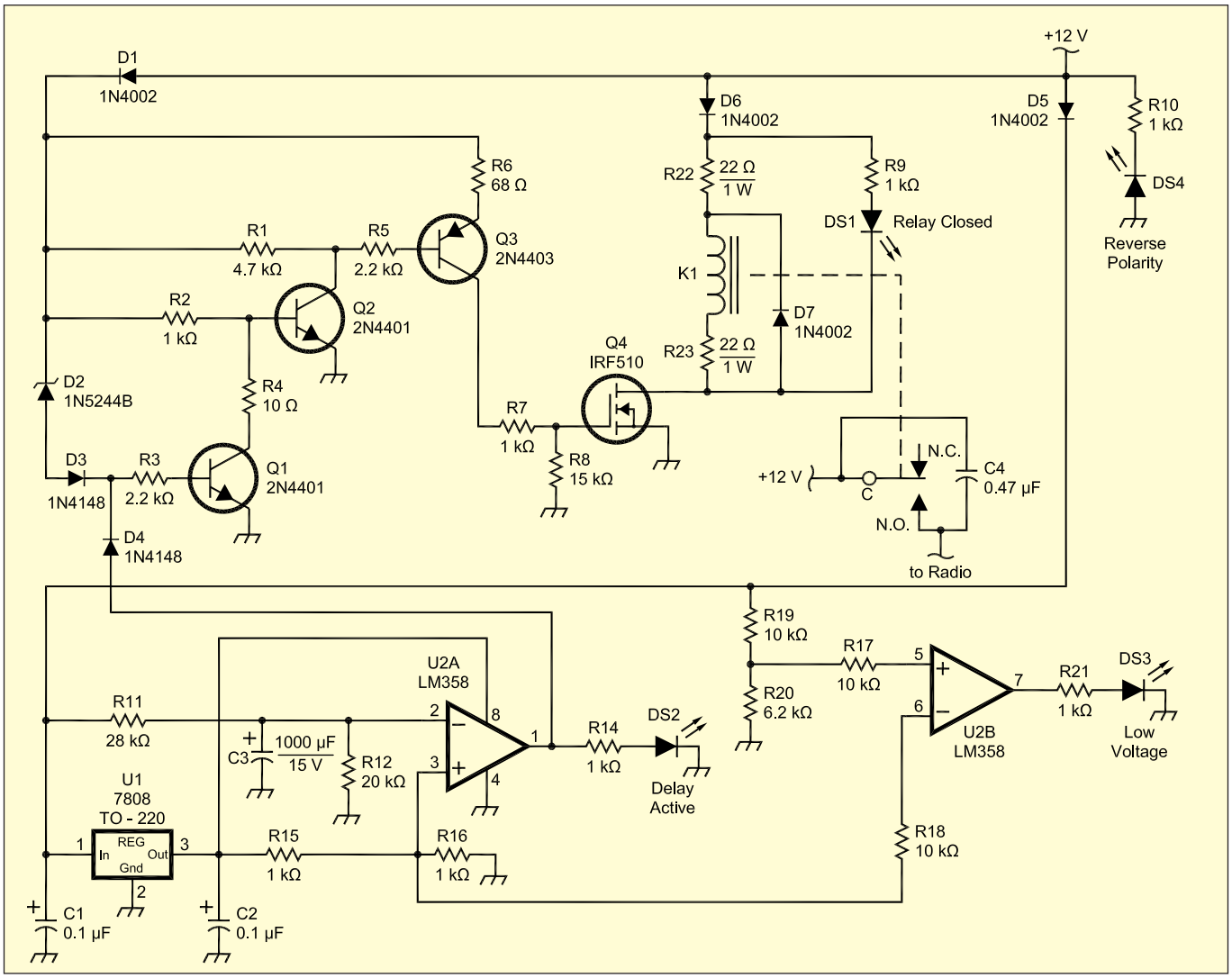


Figure 1—The Protector—a dc input watchdog and shutdown circuit. Mouser Electronics, 1000 N Main St, Mansfield, TX 76063; tel 800-346-6873; www.mouser.com. Digi-Key Corporation, 701 Brooks Ave S, Thief River Falls, MN 56701; tel 800-344-4539; www.digi-key.com.

C1, C2—Capacitor, 0.1 µF, ceramic disk, Digi-Key P4525-ND.
C3—Capacitor, electrolytic, 1000 µF, Mouser 140-XRL16V1000.
C4—Capacitor, 0.47 µF, metal film, Mouser 581-BT151K474.
DS1-DS4—LED, Mouser 351-5502.
D1, D5-D7—Diode, 1N4002, Mouser 583-1N4002.
D2—Diode, 1N5244B, Mouser 583-1N5244B.
D3, D4—Diode, 1N4148, Mouser 583-1N4148.
K1—Relay, SPDT, 12 V dc, 40 A, Digi-Key PB229-ND.
Q1, Q2—Transistor, NPN, 2N4401, Mouser 512-2N4401.
Q3—Transistor, PNP, 2N4403, Mouser 512-2N4403.
Q4—FET, power, N-channel, IRF510, Mouser 570-IRF510.
R1—Resistor, 4.7 kΩ, ¼ W.
R2, R7, R9, R10, R14-R16, R21—Resistor, 1 kΩ, ¼ W.
R3, R5—Resistor, 2.2 kΩ, ¼ W.
R4—Resistor, 10 Ω, ¼ W.
R6—Resistor, 68 Ω, ¼ W.
R8, R12—Resistor, 15 kΩ, ¼ W.
R11—Resistor, 27 kΩ, ¼ W.
R13, R17-R19—Resistor, 10 kΩ, ¼ W.
R20—Resistor, 6.2 kΩ, ¼ W.
R22, R23—Resistor, 22 Ω, 1 W.
U1—Regulator, 8 V, 7808, Mouser 513-NJM78-8FA.
U2—Dual op amp, LM358, Mouser 511-LM385AN.

Start-up Delay Circuit

When power is first applied to The Protector, diode D5 allows capacitor C3 to charge through R11. The voltage at the junction of R11 and C3 is monitored by U2A, an LM358 operational amplifier. As long as the voltage at R11 and C3 is lower than the reference voltage, U2A's output is high and applied to the base of Q1 via diode D4, keeping Q1 on. Q1 thus turns off Q2, deactivating the power relay.

When the voltage at R11 and C3 exceeds the reference voltage (established by R15 and R16), U2A's output goes low. With base voltage removed from Q1, the power relay turns on. Changing the value of C3 and/or R11 will determine the start up delay.[2] Resistor R12 provides a discharge path for C3. This ensures a new time delay whenever power is removed and then reapplied.

Low-voltage Warning

That second op amp in the LM358 would have been idle, doing nothing, so I used the leftover amplifier as a low-voltage detector.

Resistors R19 and R20 set the reference voltage for the low voltage warning. When the input voltage drops between 11 and 10 V, the output of U2B goes high and illuminates DS3—the only function of this circuit. If you wish, you can leave the associated parts out of the circuit. Since the majority of new microprocessor controlled radios shut down when the supply

voltage falls under 12 V dc, you may want to tinker with the values of R19 and R20. The relay will drop out when the supply voltage is below 9 V dc—a cheap and dirty low voltage disconnect.

Reverse Polarity Protection, Status LEDs and Power Supply

In case of reverse polarity, diodes D1, D5 and D6 keep everything off, including the delay circuits. If the supply is connected backward, DS4, the reverse polarity LED, will illuminate. DS1 illuminates when the relay coil is energized to let the user know the power relay is activated.

When power is first applied and the delay circuit is running, DS2 is illuminated. During a low voltage condition, DS3 will light.

The LM358 requires a stable supply voltage. U1, a 7808 regulator, does the job. The input and output leads are bypassed for stability.

Building The Protector

There's nothing special about the circuit layout. You can use point-to-point wiring or dead bug construction if you want. As The Protector is doing a critical job, however, it is best assembled using a printed circuit board. I suggest you forego the use of an IC socket for U2…a socket will eventually come back and haunt you with intermittencies, especially in a field environment.

The power MOSFET, Q4, is sensitive to static discharges. A wrist strap is a good idea. Don't install Q4 until the gate resistors are installed. Once Q4 is installed and on the board, it is very robust and should last forever.

Q4 should be installed so it lies flat against the board. This prevents it from moving around and possibly breaking its leads. Q4 does not require any heat sinking. A 4-40 screw, lock washer and nut hold it to the board.

The LEDs are mounted so they are flush with the board. This prevents LED movement and lead breakage. If you mount The Protector into a power supply with limited space, then I would suggest mounting it on edge. If you do, bend the leads of the LEDs 90 degrees and mount them so they are visible.

Part Substitutions

Although the schematic shows U1 as a TO-220 case, you can use a low-current 78LO8 regulator. Other voltage regulators with outputs from 5 V to 10 V can be used for U1. You would need to adjust the resistor values used in the low voltage warning and reference voltage dividers accordingly, however.

Any diode in the 1N4000 series will work in The Protector. Most common PNP and NPN transistors will work, as well.

I used green LEDs for DS1 through DS4 because I have many of them. You could use LEDs of different colors for the different functions of The Protector.

The power relay is soldered directly to the PC board. A plug-in version of the same relay is available.[3] You would need a socket, however. If you do use it, a center pin must be cut so that the socket will fit the board.

Checkout

An adjustable power supply capable of producing up to 20 V dc will be required for testing. Set the supply between 12 and 14 V. Connect the positive and negative leads of The Protector to the power supply. Just in case there is a wiring error, do not connect a radio yet.

Turn on the supply. The delay LED (DS2) should light and relay K1 should remain open. After about 10 seconds, the delay LED should go dark and you should hear K1 click on. Anytime K1 is on, the power on LED (DS1) will also light.

Increase the power supply voltage. At approximately 15 to 16 V, K1 should drop out. Lowering the voltage back down to 13 V should cause K1 to click back on and the power on LED and DS1 to illuminate.

Power down the supply and reconnect the leads backward. Apply power once more. Nothing should happen, except that the reverse polarity LED, DS4, should illuminate.

Reconnect the leads with proper polarity and reduce the supply voltage to 10 V. Between 11 and 10 V, the low voltage LED (DS3) should light. That voltage is dependent on the resistors in the two voltage dividers.

Troubleshooting

There's very little that can go wrong. If you can't get The Protector to work, check first for poor soldering and solder bridges. If the soldering is fine, look for parts installed in the wrong location. Be especially mindful of diodes D1, D5 and D6. If any one of the three is in backward, the circuit won't function.

Problems With the Delay Start

When power is first applied, monitor the C3 and R11 junction and see if the voltage increases. If it does, check pin 3 of U2—it should be 4 V. Diode D4 may be defective or installed backward.

Selecting the Overvoltage Trip Point

The voltage of Zener diode D2 determines where The Protector will trip. The voltage drop across diodes D1 and D3 adds an extra 1.4 V to the trip point. That's why a 14 V Zener is used for D2. With D1's voltage drop taken into account, the trip voltage will be about 15 V within a tolerance of 10 to 20 percent. If you want to increase the trip voltage, increase the Zener voltage. Conversely, if you want to lower the trip voltage, select a lower voltage Zener. [B-series Zeners have a 5% tolerance.—*Ed.*]

RadioShack sells a package of two 15 V Zener diodes. When the voltage drop of D1 is taken into account and if you use these,

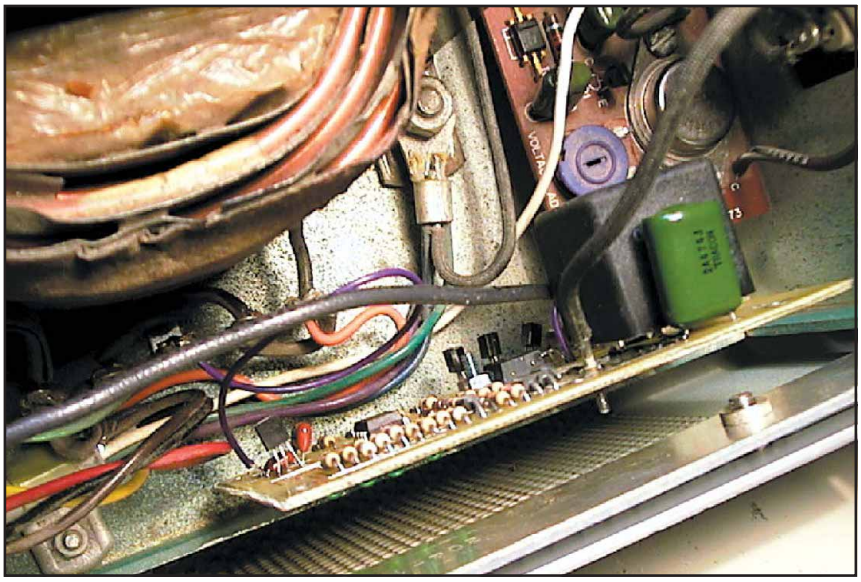


Figure 2—The Protector shoehorned into a Heathkit HP-1144 power supply.

the relay will drop out at about 16.5 V dc.

Using a 12 V Zener diode from RadioShack, the drop-out point is 13.8 V. I have one of the circuits installed in a Heathkit HWA-202 power supply. The power supply voltage is 13.5 V dc. The Protector has never falsely tripped even though its trip point is only 0.3 V above the supply voltage.

Low Power Operation

Running portable usually means operating from a battery. If you plan on using The Protector in the field with a battery, you might want to swap out the relay used for K1. The relay specified consumes about 60 mA in the circuit as shown. LED DS1 consumes another 20 mA, or so. The low power fix for the LED is simple: simply remove it or R9 from the circuit.

The relay is a bit more difficult. There is no low coil current direct replacement for K1. Instead, use a smaller relay having a lower coil current and contact rating. Most low-power rigs won't require much more than 5 A of dc input, so pick a relay with a contact rating to suit your transceiver's needs. The relay can be mounted to the board dead bug fashion using epoxy.

Life with The Protector

They say nothing is idiot proof, and The Protector is no exception. That's why there are no terminal strips to attach wires to. All the wiring is directly to and from The Protector and the wires should be soldered to the board. The use of appropriately gauged black and red power cord is recommended.

If you plan on using The Protector inside an older ac power supply, route the plus lead through The Protector and out to the radio.[4] The negative leads do not have to run through the board. However, you must supply the circuit with a ground connection. A short length of hookup wire is all you need. Connect it between the negative lead (the chassis is usually tied to ground and thus to the negative lead) and to one of the ground points on the circuit board. Figure 2 shows an example of The Protector installed in an ac to dc power supply.

If you need to isolate The Protector from the power supply chassis, use nylon hardware to mount the board.

For use in the field, I suggest you purchase or make a dedicated power cable for the radio. Install The Protector between the radio and power source.

Whether your power supply malfunctions—or *you* do by making a serious wiring mistake—The Protector will always keep an eye out for you.

Notes

[1]A complete kit of parts including a PC board is $30 + $4 shipping from SunLight Energy Systems, 955 Manchester Ave SW, North Lawrence, OH 44666; tel 330-832-3114, 888-476-5279 (orders only); **www.seslogic.com**.

[2]The 10-second delay seemed too long when used with an ac supply. You can drop the delay by a factor of 10 by swapping C3 (1000 µF) with a 100 µF capacitor. If you want no delay, remove this capacitor from the circuit.

[3]Digi-Key #PB232-ND is the socket. PB316-ND is a wiring harness so you can locate the relay off the PC board.

[4]If you install The Protector inside a Heathkit HP-1144 supply or any supply with remote voltage sense, disable the delay start. Since the remote voltage sense wire from the regulator is connected to the radio power jack and the delay circuit is active, the relay will stay open until the delay times out. Because the remote sense line is not connected to the output of the supply, the uncontrolled regulator drives the voltage up to 24 V. The Protector sees the +24 V as high and does not close after the time delay. Disabling the delay start insures that the relay pulls in before the regulator senses that the remote sense line is not connected.

You may contact the author at 955 Mancester Ave SW, North Lawrence, OH 44666; **prosolar@sssnet.com**.

NEW BOOKS

YELLOWSTONE FAREWELL

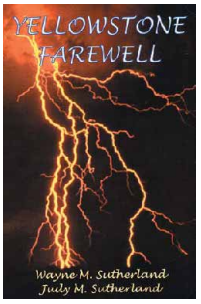
By Wayne M. Sutherland, NQ7Q, and Judy M. Sutherland

Spur Ridge Enterprises, PO Box 1719, Laramie, WY 82073. 6×9 inches, 329 pages, some B&W graphics, and for geology and Amateur Radio, references and suggested supplementary reading. Available from the ARRL at **www.arrl.org/shop**, *tel (toll free in the US) 888-277-5289. $18. ARRL Order No. 8944.*

Reviewed by Rosalie White, K1STO

◊ When you're in the mood to read a book, you go to your favorite bookstore or library. But that's not how this reviewer/book lover came upon *Yellowstone Farewell*. A year ago, I was lucky to be invited to speak at the ARRL Wyoming State Convention in Casper. What fun it was, talking with ARRL members there as it dawned on me (duh!) that many had geology-related jobs. Seeing the Wyoming terrain while driving around the day before the convention, I should've realized geology would be big. Getting to know conventioneers turned into an unusual experience due to my 10 hours of geology classes, years back.

Wayne Sutherland, NQ7Q, was one of the friendly conventioneers I met. A geologic consultant, he's explored for, and mapped, diamonds (!) and metal deposits for the Wyoming State Geological Survey. Wayne mentioned he and his wife were writing a novel encompassing geology and ham radio. I said I'd love to read it. Opening the mail last month, I found an autographed copy of Wayne and Judy's *Yellowstone Farewell*! The novel began with a bang—literally and figuratively.



Wayne's degrees in geology and education gave him a perfect background for co-authoring *Yellowstone Farewell* and nonfiction books such as *Gemstones and Other Unique Minerals*. He is an active ham who enjoys DXing, public service and his radio club. As a youth, Judy developed a passion for the outdoors; combined with her liberal arts degree, it's logical she likes assisting Wayne with geologic field work and cave exploration.

If you have even a slight interest in geology or a curiosity about what's under the earth's crust, you'll enjoy *Yellowstone Farewell*. Besides absorbing a little about these topics, you'll become engaged in the goings-on of Sam Westone, fictictious Casper Technical College professor. He meets Liddy Hill, a cameraperson at KYWN-TV—another fictional main character. Both are hams, and on occasion, radio pops up as you follow them through life's adventures.

Yellowstone Farewell is somewhat heavy on science, but you'll soak in a little geology without noticing while enjoying the story. Wayne and Judy weave in easily understood science explanations, and make your mind's eye picture the landscapes. Can't you imagine tons of fiery liquid rock turning into tons of ash deposited on Western states, as you read:

> The Lava Creek ash deposit of 600,000 years ago is estimated to represent approximately 240 cubic miles or more of molten rock, blasted into fine particles and spread across the wesern United States. This can be compared with the puny one-quarter to one-half cubic mile of material vented by Mount St. Helens in Washington on May 18, 1980.

You'll discover how a prospector physically claims land where there's potential for diamonds. You learn a little of how our country's (and the world's) first national park—Yellowstone—came to be in 1872.

If you're an environmentalist, you may find musings you don't agree with in *Yellowstone Farewell*. And some sections are critical of science education and government agencies. I won't give away the story's twists; I'll let you anticipate the surprises. If geology is something you've wondered a little about, and you enjoy a good story, pick up *Yellowstone Farewell*.

Experiment #5—The Integrated Timer

Background

Timer circuits based on the 555 chip and its many relatives are found everywhere. Although not complex, it can be used to create many different circuits. This month we'll take a look at two popular applications of the legendary 555.

Terms to Learn

- *Astable*—not stable; a circuit that cannot stay in one state.
- *Comparator*—a circuit whose output is indicative of the greater of two of its inputs.
- *Flip-flop*—a digital circuit that "flips" or "toggles" between two states.
- *Monostable*—stable in one state, these circuits stay there until perturbed, then attempt to return to the stable state.

The Integrated Circuit Timer

The 555 integrated circuit timer has proved to be incredibly popular. Inexpensive and versatile, the 555 is used in myriads of circuits. What's inside that makes it so useful?

Figure 1 shows the basic components of a 555. While it is the most complex circuit we've looked at so far, the 555 is easy to break into bite-size pieces. Let's start with the three resistors labeled "R" at the top left of Figure 1. Connected between power input (V_{cc}) and ground, they form a *voltage divider* that divides V_{cc} into two equal steps—one at $^2/_3$ V_{cc} and one at $^1/_3$ V_{cc}. These serve as reference voltages.

Connected to the reference voltages are blocks labeled *trigger comparator* and *threshold comparator*. A *comparator* is nothing more than a circuit whose output indicates which of its two inputs is greater. If the + input is greater, the output is *high*. If the – input is greater, the output is at ground or *low*.

The trigger comparator in the 555 is wired so that its output is *high* whenever the trigger input is *less* than $^1/_3$ V_{cc} and vice versa. Similarly, the threshold comparator output is *high* whenever the threshold input is *greater* than $^2/_3$ V_{cc}. These two outputs control a circuit called a *flip-flop*.

The flip-flop output, *Q*, changes to *high* or *low* when the state of its *set* and *reset* input changes. The Q output stays *high* or *low* (it *latches* or *toggles*) until the opposite input changes. When the set input changes from *low* to *high*, Q goes *high*. When reset changes from *low* to *high*, Q goes *low*. The flip-flop ignores any other changes. An inverter makes the 555 output *high* when Q is *low* and vice versa—this makes the timer circuit easier to interface with external circuits.

The transistor connected to Q acts as a *switch*. When Q is *high*, the transistor is *on* and acts as a closed switch connected to ground. When Q is *low*, the transistor is *off* and the switch is open. These simple building blocks—*voltage divider*, *comparator*, *flip-flop* and *switch*—allow us to build a surprising number of useful circuits.

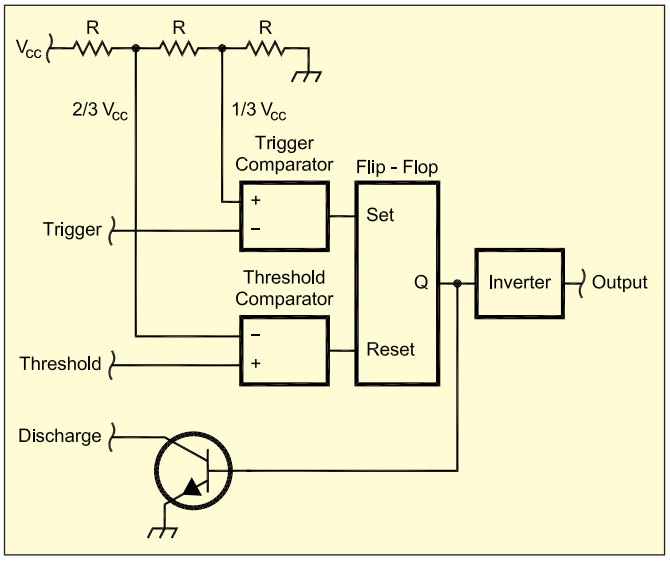


Figure 1—This schematic shows the major circuits inside the 555 timer.

The Monostable or "One-Shot" Multivibrator

The simplest 555 circuit is the *monostable* circuit. This configuration will output one fixed-length pulse when triggered by an input pulse. Figure 2 shows the connections for this circuit. How does it work?

Starting with capacitor C discharged, the flip-flop output, Q, is *high*, which keeps the discharge transistor turned on and the voltage across C below $^2/_3$ V_{cc}. The circuit is in its stable state, waiting for a trigger pulse.

When the voltage at the trigger input drops below $^1/_3$ V_{cc}, the trigger comparator output changes from *low* to *high*, which causes Q to toggle to the *low* state. This turns *off* the transistor (opens the switch) and allows C to begin charging toward V_{cc}.

When C reaches $^2/_3$ V_{cc}, the threshold comparator switches its output from *low* to *high* and that resets the flip-flop. Q returns *high*, turning *on* the transistor and discharging C. The circuit has returned to its stable state. The output pulse length is:

$$T = 1.1\ RC \qquad [1]$$

Notice that V_{cc} doesn't really matter in the timing—the out-

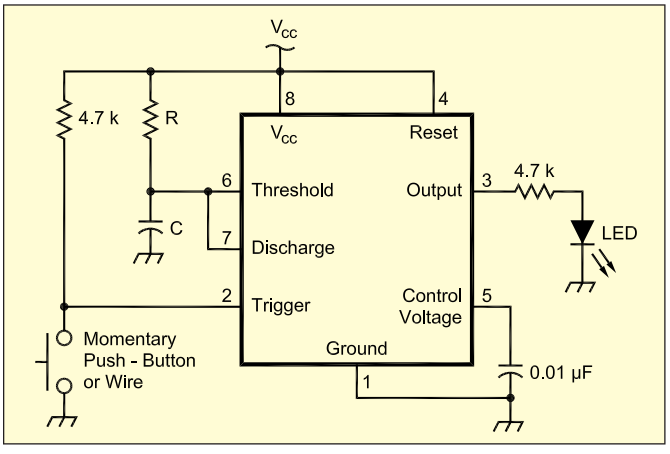


Figure 2—The monostable or "one-shot" circuit. This circuit generates a single pulse when the trigger input is shorted to ground. An LED is used to indicate whether the output is high or low.

H. Ward Silver, NØAX ♦ 22916 107th Ave SW, Vashon, WA 98070 ♦ n0ax@arrl.org

put pulse width is the same with a 5 V supply as it is with a 15 V supply. This is because the 555 design is based on ratios and not absolute voltage levels.

Testing the Monostable Multivibrator

- Use the wiring diagram of Figure 2. Let's aim for a 1 second output pulse, which requires RC = 1/1.1 = 0.91. If we choose C = 10 µF, then R = 91 kΩ.
- Connect a 4.7 kΩ resistor between V_{cc} and pin 2. The symbol at pin 2 indicates a jumper to ground—you can use a switch or a piece of wire to temporarily ground pin 2, supplying the trigger pulse.
- The 4.7 kΩ resistor and LED at the output will give a visual indication when the output is *high*.
- The 0.01 µF capacitor at pin 5 filters out any noise that might cause changes in the threshold comparator reference voltage. Pin 4 resets the flip-flop that drives the output and it can be used to prematurely force the output low, regardless of the output state. It should be connected to V_{cc} when not used, to prevent resets from noise. The power supply voltage can be any positive voltage between 4.5 and 18 V.
- With your circuit ready to go, press the switch (or insert the jumper for a brief instant) and watch the output LED light up. It should be on for about 1 second and then turn off until you retrigger the circuit.
- Change either R or C, recalculate the expected output pulse length, and give it a try. R can be a potentiometer, as well, for adjustable pulse length.

The Astable Multivibrator

The opposite of the monostable circuit is the astable circuit in Figure 3. Look carefully at the different connections of pins 2, 6 and 7. Notice, too, that the timing resistor is split into two resistors, R1 and R2. What's happening here?

Let's start from the same state as the monostable circuit, with C completely discharged. In the monostable circuit, it took a trigger signal to get the ball rolling. In the astable circuit, the trigger input is connected directly to the capacitor, so if the capacitor is discharged, then the trigger comparator output must be *high*. Q is *low*, turning *off* the discharge transistor, which allows C to immediately begin charging.

C charges toward V_{cc}, but now through the combination of R1 and R2. As the capacitor voltage passes $^2/_3$ V_{cc}, the threshold comparator output changes from *low* to *high*, resetting Q to *high*. This turns *on* the discharge transistor and the capacitor starts to discharge through R2. When the capacitor is discharged below $^1/_3$ V_{cc}, the trigger comparator changes from *high* to *low* and the cycle begins again, automatically. This happens over

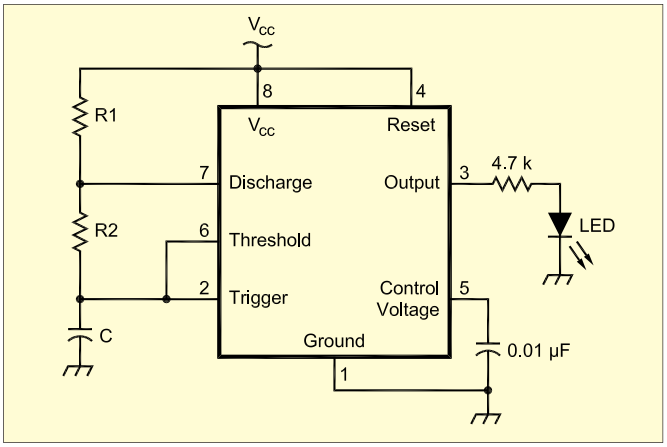


Figure 3—The astable or "free-running" circuit. This circuit generates a continuous train of output pulses.

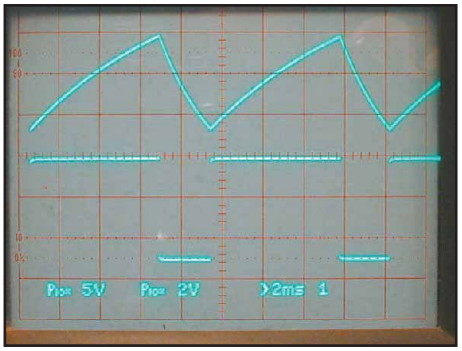


Figure 4—A photo of the oscilloscope showing the capacitor and output voltages for the astable circuit with a 0.1 µF timing capacitor for a 100 Hz oscillation frequency. The top trace shows capacitor voltage and the bottom trace the 555 output. Capacitor charging and discharging can be seen clearly.

and over, causing a train of pulses at the output while C charges and discharges between $^1/_3$ and $^2/_3$ V_{cc} as shown in Figure 4.

The design equations are a little more complex for this circuit. The total time it takes for one complete cycle is the charge time, T_c, plus the discharge time, T_d:

$$T = T_c + T_d = 0.693 (R_1 + R_2) C + 0.693 R_2C$$
$$= 0.693 (R_1 + 2R_2) C \quad [2]$$

and the output frequency is:

$$f = 1/T = 1.443 / [(R_1 + 2R_2) C] \quad [3]$$

Let's try it out!

Testing the Astable Multivibrator

- Split the original 91 kΩ resistor into a 62 kΩ for R1 and 39 kΩ for R2. Use the same 10 µF capacitor for C. The total cycle time should be close to 1 second. If you have a stopwatch, count 10 or more cycles and average for a good cycle time measurement.
- You may have noted that the LED is not on and off for equal periods—it's on longer than it is off. This is because the capacitor has to both charge and discharge through R_2. The ratio of on-time to off-time is called the *duty cycle* and is calculated as:

$$\text{duty cycle} = (R_1 + R_2) / (R_1 + 2R_2) \quad [4]$$

- Experiment with different combinations of R1 and R2 to observe the effect of their ratio on duty cycle. (Keep R1 greater than 1 kΩ to avoid overloading the discharge transistor.) If you have an oscilloscope, watch the capacitor voltage on one channel and the output voltage on the other. Figure 4 shows an example.

Suggested Reading

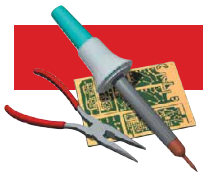
Read *The ARRL Handbook*, chapter 7, page 7.14, specifically the paragraphs starting with "Multivibrators" and the section "RC Time Constant" in chapter 6. Additionally, see *The Art of Electronics*, pages 517-522. One of the better on-line 555 application notes is **www.doctronics.co.uk/pdf_files/555an.pdf**. If you can, find a copy of Walter Jung's *IC Timer Cookbook* or Howard Berlin's *555 Timer Applications Sourcebook*. Both are excellent, although now out of print. And, remember… the ARRL Web site for this series is **www.arrl.org/tis/info/html/Hands-On-Radio/**.

Shopping List

- 555 timer IC (RadioShack 276-1723).
- 10 µF and 10 nF capacitors.
- 4.7 kΩ (2), 39 kΩ, 62 kΩ, 91 kΩ resistors, ¼ W.

Next Month

Another popular well-designed integrated device is the linear regulator. It is so easy to use that we tend to take it for granted. When you use a power supply, it's likely that one of these is integral to its design. See you next month! QST



HINTS & KINKS

A YAESU VX-5R TO KENWOOD VC-H1 INTERFACE

◊ Since SSTV is an interesting aspect of Huntington Beach RACES operations, I decided to "get into" this mode for RACES. I needed a portable SSTV system for "visual reconnaissance." My portable radio is a Yaesu VX-5R, and when it is used with the Kenwood SSTV unit, they become a "roving digital-image station" to visually report an emergency.

I could have made a simple cable to connect the two units. However, since the special 16-pin Kenwood interface cable is rather expensive, I decided to make the cable compatible with many units, rather than just my handheld. This interface box was inspired by the RS-232 breakout boxes in the computer store. You may have seen them; they are made of large back-to-back DB-25 connectors, with LEDs and a place to plug in various jumpers to go from one port to another.

Figure 1 shows what the setup looks like. The interface box sticks to the bottom of the soft case with hook and loop tape. I thought of sticking the interface box directly to the radio, but found that the box would make changing the battery cumbersome.

The Yaesu adapter (CT-44) can also be eliminated if you use the special four-way plug, but I bought it with the radio, so I used it. By breaking the cables into the 2.5-mm and 3.5-mm phone-plug configuration, other radios can be interfaced into this system (see Figure 2).

WAYNE YOSHIDA, KH6WZ

Figure 1—The VX-5R to VC-H1 setup. The interface box contains interconnecting jumpers that can change as equipment changes. The phone plugs increase versatility, enabling use with many transceivers.

WAYNE YOSHIDA, KH6WZ

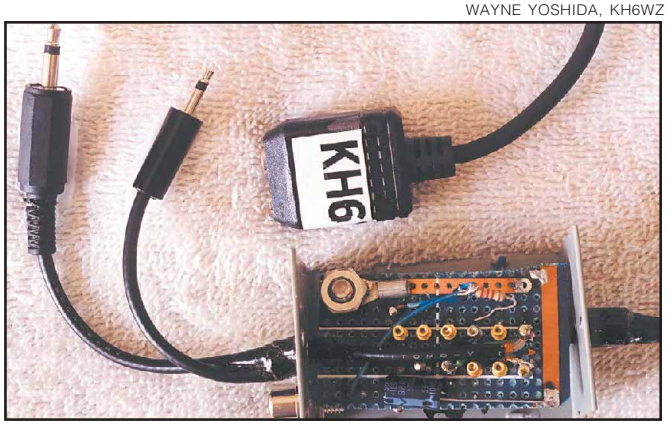


Figure 2—Each wire in the VC-H1 cable terminates in a gold-plated pin. The 11 pins provide versatility. I can easily reconfigure the pin connections if I change radios. The solder lug at the upper left provides a ground connection between the case and the ground bus on the perforated board.

WAYNE YOSHIDA, KH6WZ

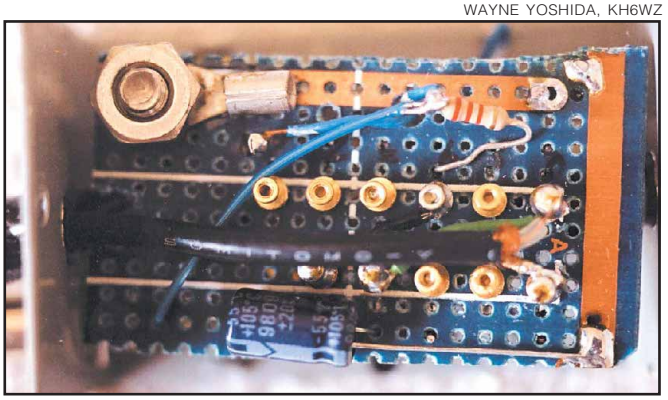


Figure 3—The "flying leads" simplify construction and keep cost down. A piece of RG-8X outer jacket and some "liquid tape" provide stress relief and prevent leads from chafing on the aluminum box.

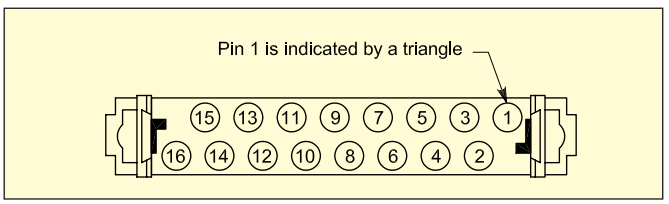


Figure 4—Pin numbering for the Kenwood VC-H1 optional cable connector #E30-3352-08.

Table 1
VC-H1 Connections for SSTV and Speaker Microphone

Wire Color	*VC-H1 Pin#*	*Connection*
Orange/Red	4	Chassis Ground
Shield	16	Chassis Ground
Yellow/Black	7	PTT
Gray/Red	11	PTT
Pink/Red	14	Audio Input (Mic)
White/Black	9	Audio Output*
Gray/Black	13	Audio Output*

*A 47-µF 16-V capacitor may be needed to avoid audio distortion.

Bob Schetgen, KU7G ♦ Senior Assistant Technical Editor ♦ h&k@arrl.org

Parts List

1 Chassis box, LMB #MOO, $1^1/_2 \times 2^1/_4 \times 1^3/_8$ inch (WDH)
1 Cable, 16-pin, Kenwood #E30-3352-08
1 Adapter, Yaesu CT-44
1 3.5-mm phone plug*
1 2.5-mm phone plug*
1 47-µF, 16-V electrolytic capacitor**
1 10-µF, 16-V electrolytic capacitor**
1 2 kΩ, 1/4 W resistor**
11 Gold-plated component pins
Miscellaneous: Shielded cable, wire, solder, etc.

*You may substitute the special Yaesu four-conductor plug. See text.
**Values not critical

Construction

This is an easy, junk-box audio project, and not much is critical here (see the Parts List). However, to prevent hum and RFI susceptibility, leads should be kept as short and direct as possible. Use miniature coax, such as RG-174 or shielded audio cables for the speaker and mike cabling. The total cost should be around five bucks. The most expensive component is the metal chassis box!

I used some gold-plated component pins on my version (see Figure 3). However, a small piece of solderless prototyping board would be ideal, so jumpers could be easily plugged in and out, without tools. My version requires a soldering iron to reconfigure the connections.

Go to **www.kenwood.net/?do=SupportFileCategory&FileCatID=6** and download or open file CONNECTOR.PDF for information on Kenwood connectors. Scroll to page five for VC-H1 connector information. I must admit the Kenwood documentation on the VC-H1 connectors confused me a bit. Notice that one table says for "SSTV and speaker microphone" and another table says "for SSTV." Now check the discrepancy between the audio input (mic) connections. This doesn't quite make sense, however; the connections for "SSTV and speaker microphone" do enable the speaker/mic function with my Yaesu VX-5R. The connection information appears in Table 1 and Figure 4.—*Wayne Yoshida, KH6WZ, 16428 Camino Canada Ln, Huntington Beach, CA 92649-5206;* **kh6wz@arrl.net**

X-RAYING A PCB WITH YOUR SCANNER

◊ Have you ever tried to draw the schematic diagram of the circuit on a medium-complexity PC board using the visual method? This is sometimes needed when you have to troubleshoot or understand a piece of equipment for which you have no schematic. The other day I was trying to do just that, and after flipping the board about 400 times, got myself thoroughly frustrated. I thought there must be a better way. A short brainstorm later, I rushed to my scanner (*not* a frequency scanner, but an HP Scanjet 6300C). Five minutes later, the problem was solved. Here's how to do it.

1. Scan *both* sides of the board, in full color and good resolution (about 120 dpi should be okay). If the board is small, you may want to enlarge the images. If the components do not allow the board to lie parallel with the scanner's glass, either hold it in the right position with your hand or place something that supports the board parallel to the glass. I found that my scanner produces excellent images from 3-D objects that are not more than an inch or so deep. (I hope yours does, too!) Save the images as .TIF files. Please note that *sometimes* it helps to save the copper side as a *grayscale* (or B/W) picture, because the traces become clearer. "Experiment" is the name of the game here!

2. Now you have the images of the copper and component sides of the board (Figures 5 and 6, respectively). For the next step I used *CorelDRAW!* (Ver 9), although any image-processing program with the ability to apply a transparency effect to an image can be used.

Start a new file, then *import* the images into it. Position one image on top of the other, but "flip" one of them horizontally, using the MIRROR button (this has been done in Figure 6). Then, apply the transparency effect to both images (this is done via the GLASS button on the left). You must apply uniform (or FLAT) transparency, and vary the intensity of the effect alternately for both of the images, until you get the most satisfactory picture (Figure 7). Also, you may bring one or the other "on top" to check which order gives the best result.

3. Done! You have successfully "X-rayed" the board, and you may now instantly and effortlessly see the connections between components. You can also see the color bands of resistors and any visible values printed on the board or the other components. If you wish, print the final image and trace the connections by hand. This way, you can produce a schematic much more quickly and accurately.

Now, *why* didn't I think of this way earlier in my life? —*Tasos Thomaidis, SV8YM/2, 10, Mitr. Chrisanthou str, GR 551 32 (Kalamaria, Thessaloniki, Greece);* **sv8ym@hotmail.com**

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 15), or via e-mail to **h&k@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.

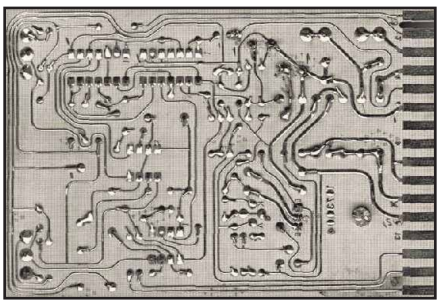


Figure 5—The copper side of the board.

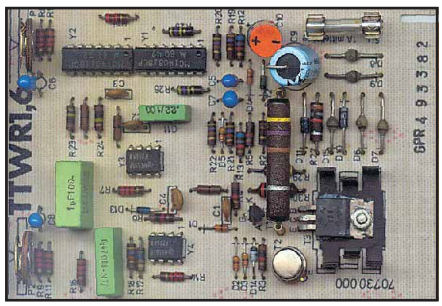


Figure 6—The component side of the board.

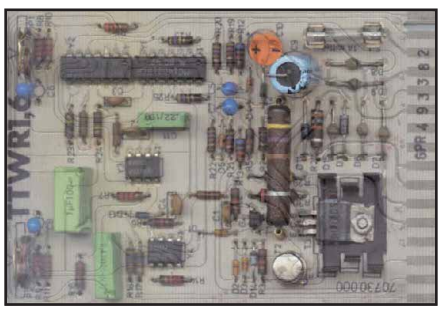


Figure 7—Superman, eat your heart out!

PRODUCT REVIEW

Yaesu FT-2800M 2-Meter FM Transceiver

Reviewed by Joe Carcia, NJ1Q
W1AW Station Manager

Yaesu produces quite a number of mobile FM radios, from single band to quad band units, with all sorts of functions and features. Some amateurs may find that all those additional bells and whistles may be too much given their particular needs. These folks may find the FT-2800M to be a radio of choice.

"A hefty transceiver that appears to be more heat sink than radio!" That's the first impression I got when I pulled the radio out of the box. The '2800M is, as stated in the manual, a "rugged" single band FM mobile transceiver, weighing in at 4 pounds. That was a bit of a jump from my own radio, the Yaesu FT-90R.

Here is a no-nonsense transceiver. It pretty much covers all the basics one would desire in a 2-meter FM transceiver, and those found in many of today's radios. This includes such features as the CTCSS encoding/decoding and DCS tone systems, automatic repeater shift, DTMF operation, programmable memory scan and so on. For those who can't get enough memories, you'll find this radio has a total of 221. (This includes the programmable band scan limits and home channel.) Each memory can have a 6-character alphanumeric label.

First Impressions

The layout is clean, with just six buttons (five backlit), well labeled for viewing ease. Reading left to right you have the Internet Connection, PWR, MHz(SET), REV(DW), LOW(A/N) and D/MR(MW) buttons. The letters in parentheses indicate those functions displayed through a menu procedure, or an additional function when depressing one of the buttons mentioned.

The Internet Connection (WIRES) and PWR buttons are pretty self-explanatory. The MHz(SET) button is used to allow for 1 MHz tuning, activation of the memory tuning mode and activating the menu system. REV(DW) does the old switcheroo with the transmit and receive frequencies, as well as activating the dual watch feature. The LOW(A/N) button is used to switch between the four power levels: 65, 25, 10 and 5 W. It's also used to toggle the display between an alphanumeric tag and the actual frequency. The D/MR(MW) button toggles between the VFO, memory and home channels. It's also used to activate the memory storage mode.

Three plastic knobs control the VOL, SQL and DIAL functions. The knobs all have a decent feel to them. I did find that using the dial took a bit getting used to. It's detented and is used to control the frequency, memory storage and menu settings, among other things. I found that if I went just a bit too fast, I flew right past a desired menu setting. It's not that the dial is loose; rather it turns very smoothly.

The LCD (measuring about 1 by 3 inches) has clear, easy to read alphanumeric characters against an orange background. The display's brightness level is controlled via a menu setting.

I found the decently sized display could be viewed at many angles. While I was sitting at my desk and looking down at the radio, the display was still quite clear and readable. I actually found myself moving my head about like a bird trying different viewing angles to see when the display would wash out. The display was clearly visible even from across the room. When operating in my truck, I was still able to see the display clearly, even with some sun glare. By the way, if you like the ability to separate the display from the transceiver body, you won't find that here—it's all one unit.

A pigtail from the back of the radio terminates to a 2-pin standard locking power plug. Next to the power line is a $^1/_8$-inch jack for an external speaker or packet radio use. The antenna connector (a standard SO-239) is chassis-mounted and rounds out the back of the radio.

A word about the antenna connector—the cabinet heat sink extends past the connector, with a portion of the heat sink also curved above the connector. I found I could barely get three fingers in there to thread on the antenna connection. You may find it desirable to connect the antenna prior to installing the radio, especially if the area is cramped.

As mentioned above, this radio looks like one big heat sink, and with a maximum output of 65 W, that kind of sinking is necessary. Unlike many other radios, this unit does not come with a cooling fan. The plus side to this is that you needn't contend with a fan that turns on and off at will. However, the radio's cabinet is used to dissipate heat. This has to be a consideration when mounting the radio, either in a mobile or base station application, and the manual describes some basic installation tips.

Bottom Line

The FT-2800M offers an impressive receiver and 65 W of 2-meter transmit power in a hefty but simple package.

Notable Features

One of the features I found most interesting was the 10 NOAA weather channels, with the weather alert option

Brennan Price, N4QX ♦ Assistant Technical Editor ♦ n4qx@arrl.org

Table 1
Yaesu FT-2800M, serial number 2M010815

Manufacturer's Claimed Specifications	Measured in the ARRL Lab
Frequency coverage: Receive, 137-174 MHz; transmit, 144-148 MHz.	Receive and transmit, as specified.
Power requirement: Receive, 0.7 A; transmit, 10 A (high power).	Receive, 0.46 A; transmit, 10.6 A. Tested at 13.8 V.
Modes of operation: FM.	As specified.
Receiver	**Receiver Dynamic Testing**
FM sensitivity, 12 dB SINAD: <0.2 μV.	For 12 dB SINAD, 0.22 μV.
FM adjacent channel rejection: Not specified.	20 kHz channel spacing: 70 dB.
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz channel spacing: 70 dB;* 10 MHz channel spacing: 95 dB.
FM two-tone, second-order IMD dynamic range: Not specified.	90 dB.
S-meter sensitivity: Not specified.	Max indication: 8.6 μV.
Squelch sensitivity: Not specified.	At threshold: 0.15 μV.
Receiver audio output: 3.0 W at 10% THD into 4 Ω.	3.2 W at 10% THD into 4 Ω.
IF and image rejection: 70 dB.	First IF rejection, 99 dB; image rejection, 92 dB.
Transmitter	**Transmitter Dynamic Testing**
Power output (H/M/L2/L1): 65 / 25 / 10 / 5 W.	VHF, 65 / 27 / 12 / 5.9 W.
Spurious-signal and harmonic suppression: ≥60 dB	72 dB. Meets FCC requirements for spectral purity.
Transmit-receive turn-around time (PTT release to 50% audio output): Not specified.	S9 signal, 144 ms.
Receive-transmit turn-around time (tx delay): Not specified.	26 ms.
Size (height, width, depth): 2.0×6.3×7.3 inches; weight, 4.0 pounds.	

*Unless otherwise noted, all dynamic range measurements are taken at the ARRL Lab standard spacing of 20 kHz.

(selectable via a menu setting). With one touch of a button (P4) on the microphone, the radio instantly changes over to the 10 available weather channels. The dial or microphone's UP/DOWN buttons are used to switch between them. Obviously, this all depends on whether the microphone buttons are being used with their default functions. If not, then this feature may not be readily available.

The severe weather alert is a feature that SKYWARN folk (or weather monitors such as myself) would find useful. In the event of an extreme weather situation, NOAA will send out a weather alert accompanied by a 1050 Hz tone, and then the following weather report. You can set the FT-2800M to monitor (or scan) the 10 weather channels for this alert tone. If the tone is received, the '2800M will emit a pair of warbling tones. To listen to the weather alert, you merely depress the PTT button on the microphone to silence the tones.

The Smart Search function allows you to load active frequencies automatically. The radio will search (without stopping) a designated bandwidth for any activity and store those active frequencies in a special memory band that consists of 31 memories. While this may be a good feature to have when traveling without a Repeater Directory, you have to be careful when you go to operate on any of these stored memories, as you might not actually be operating on the repeater's exact frequency.

For example, on a relatively quiet night I had the radio perform a single scan above and below the frequency of a repeater about 12 miles from my home. On one sweep, I found four repeaters, but 12 channels were used. The radio noted activity 5 kHz above *and* below the main repeater frequency, and recorded all this activity in memory. Perhaps the squelch was not tight enough. If you use this function and find repeaters, listening to the signal quality beforehand and adhering to the channel spacing prevalent in your area would be appropriate first steps. If you find the audio appears distorted, it may very well be because you're not on the exact repeater frequency.

The memories also appear to be temporary. I found that when I shut down the radio after the scan, the memories were cleared. I found no mention of this in the manual.

Now, suppose you have a repeater system with an odd shift (not ±600 kHz). The '2800M can accommodate for odd shifts without requiring reprogramming of the offset. The user can set up memory channels with the independent transmit and receive frequencies.

The tuning rate is selectable from 5, 10, 12.5, 15, 20, 25, 50 and 100 kHz. The default is 5 kHz. You can change this step via the menu system. The '2800M has direct keypad frequency entry via the included microphone. The tuning rate affects all frequency navigation, however, even direct keypad entry. So if you find that you can't seem to get the radio to accept a particular frequency either through the DIAL or keypad, check the tuning rate.

A Mic of Many Functions

The 16-key DTMF microphone (a stock MH-48) performed as expected.

This particular microphone can be programmed. As such, the non-numeric keys on it are not labeled with a function; they are labeled P1, P2, P3 and P4. Their default functions are Squelch Off, Smart Search, Tone Search and Weather Channel Search Recall, respectively. If you'd prefer these buttons to be used for other things, they can be reprogrammed via the menu system (each button has its own menu setting). The microphone also has the standard backlit (keypad) function, UP and DOWN keys and LOCK switch. (The LOCK switch controls the function keys, not the keypad or PTT switch.) The A, B, C and D keys mimic the functions of the four front panel buttons.

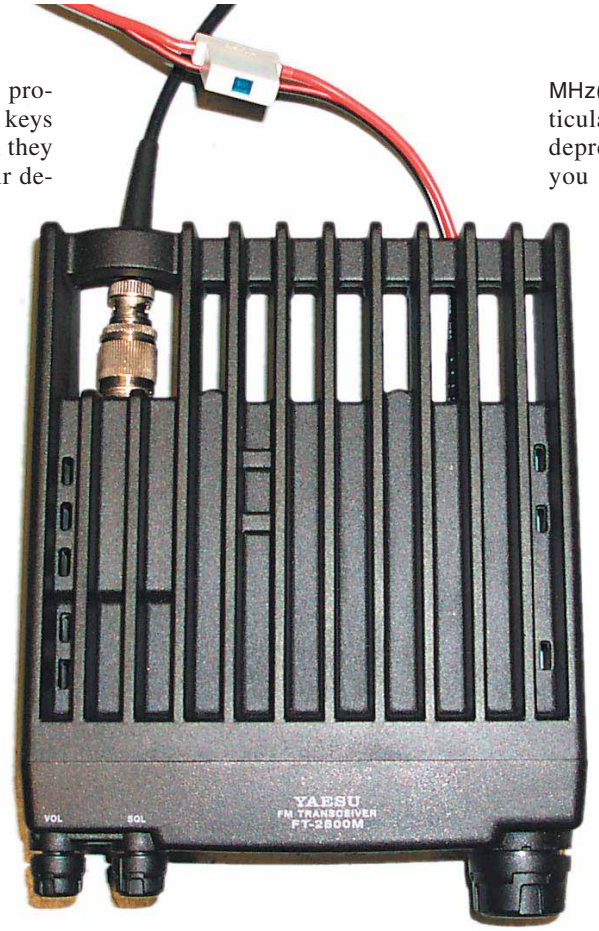


Figure 1—A top view of the Yaesu FT-2800M on the test bench of the ARRL Lab. Note the sizeable heat sink and the location of the antenna connector. Users with cramped quarters may wish to consider connecting the antenna before installing the radio.

An Impressive Receiver

I used this radio both in my truck and at home. In both instances, I found the receive audio levels to be quite sufficient. Although the speaker is mounted underneath the radio, I heard it without difficulty. If this radio is to be used in a base setting, Yaesu supplies two small plastic feet that can be installed beneath it.

Now, I have to confess I reviewed this radio during a cold New England winter, so I didn't have too many opportunities to have the truck's windows cranked all the way down while operating the radio mobile. In light of this, given road and wind noise (from a slightly cracked-open window) plus a blowing heater fan, receive audio was still clear, even with the volume turned most of the way up.

Something that did impress me was the '2800M's apparent immunity to strong nearby signals. I had this radio installed in place of my FT-90R, using the same antenna and power connectors. I found that sitting in the parking lot of W1AW, I did not hear the station's 150-W signal blast through on a repeater frequency not that far from W1AW's 2-meter bulletin transmission (147.555 MHz). I occasionally experience intermod from W1AW with the FT-90R on that same repeater frequency. Obviously, this is not a comparison between the two, but rather anecdotal evidence of the '2800M's healthy third order IMD dynamic range measurement (see Table 1).

I had the opportunity to chat through some local repeaters, as well as with a few hams on simplex. All the signal reports indicated the transmit audio sounded clean. On one occasion there was a report of white noise on my signal. I merely bumped up the power to 10 W, however, and that seemed to clear it right up.

The '2800M is capable of 1200 baud packet (9600 baud is not available in this radio. I quickly wired up a connection between the radio's microphone jack and my MFJ-1278B multimode controller. The audio to the TNC is handled via the radio's external speaker jack. I had to adjust the volume properly to avoid swamping the TNC. Once I jumped these hurdles, I found packet operation to be easy. I was able to connect to the local nodes and a few of the local BBSs.

The Automatic Power-Off and Time-Out Timer functions performed as expected. The Power-Off is adjustable from 1 to 12 hours, but this feature is turned off in the radio's factory default setting. The Time-Out Timer is adjustable from 1 to 60 minutes, in 1-minute increments, and can also be disabled. The factory default is 6 minutes.

Menus Can Be Fun!

To activate the menu system (there are 33 menus), you hold down the MHz(SET) key for one second. You select the menu number using the dial. When you need to change a menu setting, you depress the MHz(SET) button again to select a particular setting. I found that you have to depress this button quickly; otherwise, you may take yourself right out of the menu system. This is not uncommon—just something the user needs to be aware of before menus are changed and programming steps are performed.

Programming memories was not difficult. In the VFO mode, you select the desired frequency, CTCSS tones, power level, shift, etc. You press and hold the D/MR(MW) key for a second until a memory number (channel) appears. If the number is blinking, then it's empty. Use the dial to select the desired channel. Next, press the D/MR(MW) button again to write the memory contents.

As mentioned above, determining the amount of time needed to depress a button can be a bit of a challenge. I found that on a few occasions I'd miss writing the contents simply because I didn't hold the button down for the correct amount of time. But once you get used to programming, it's a breeze.

Your Buddy—The Manual!

The 57-page manual is laid out in an easy to read format. You start off with a table of contents, followed by a list of the rig's popular features. Pictorials of the display, front and back panels and microphone follow a few pages later. The manual familiarizes the user with all the basic functions before hitting the advanced ones. The later pages are devoted to menu functions and programming.

There is the installation section toward the front of the manual. There are also a few pages that are devoted to safety issues. Reviewing these pages to refresh one's memory never hurts.

A Nice Package

I was quite pleased with the performance and look of this radio. For the user looking for a simple 2 meter FM transceiver with just enough bells and whistles, this rig fits the bill. I also like that Yaesu did not crowd the front panel with all sorts of control buttons and that the display does not get too busy. While this approach requires a number of functions to be set using a variety of menu settings, it's a good trade-off.

Manufacturer: Vertex Standard USA, 10900 Walker St, Cypress, CA 90630; tel 714-827-7600; **www.vxstdusa.com**. Price: $159.95.

NCS-3240 Multi-Switcher

Reviewed by Steve Ford, WB8IMY
QST *Editor*

If chaos is the disease plaguing your station, the NCS-3240 Multi-Switcher by New Communications Solutions may be the cure. Chaos in this instance is best defined as having too many radios, too many things to plug into them, or both.

As the name implies, the Multi-Switcher is a multiple switch. The NCS-3240 puts you in complete control of which audio sources are connected to which radios. By "audio sources," I mean microphones, computer sound-card interfaces, multimode controllers—you name it. The NCS-3240 also allows you to switch a CW key (or keyer) between several radios.

If you own more than one transceiver, or more than one audio source, the benefits of the NCS-3240 are obvious. First there is the convenience of not having to fish through tangled cables and connectors when you want to jump from one radio or operating mode to another. Let's say you want to run a little CW with your QRP transceiver. Punch the appropriate RADIO SELECT button and your key is now "attached" to that rig. When it's time for a change, select your "high power" transceiver by pressing a different RADIO SELECT button and toggling MIC 1 to select your desk microphone for an SSB session. No, wait. Change your mind and press MIC 2 for your boom mic.

Contesters can put the NCS-3240 to good use, particularly for SO2R operating. For the uninitiated, SO2R means "single operator, two radios." SO2R is an intense juggling act that demands the ability to switch instantly between one radio and another as you search for contacts on different bands. With the NCS-3240, an SO2R operator can hop from one active rig to another in a fraction of a second. Not only is the microphone (and its push-to-talk keying line) selected automatically, the corresponding receive audio is automatically routed to speakers or headphones as well. You can even configure the '3240 to provide audio from one radio in the right channel and another radio in the left channel (that could lead to madness with headphones!).

Figure 2—The rear panel of the NCS-3240.

NCS-3240 Features

The NCS-3240 is housed in a compact (8.5×6.2×3.3 inch) metal enclosure with attractive "rack handles" on either side of the front panel. The front panel sports a prominent POWER switch and two switch banks containing four momentary buttons for audio and radio selections. These buttons feature LEDs that glow bright red to indicate the device you've chosen. There are two 8-pin microphone jacks along with a $^1/_4$-inch headphone jack. A row of four small potentiometers allows you to control transmit audio levels to each radio.

The rear panel of the NCS-3240 offers four 8-pin DIN jacks, one for each radio. At these jacks you'll find the connections for transmit audio, push-to-talk keying, left and right receive audio input and 12 V dc (for accessories). Above each DIN jack there are phono jacks for left and right receive audio and the CW keying output.

There are also two auxiliary inputs on the rear panel in the form of more 8-pin DIN jacks. You can use these for connecting a sound card interface, microphone, packet TNC, etc. The AUX 1 and AUX 2 buttons on the front panel select these inputs for the radio of your choice.

Finally, there are separate rear-panel inputs for a foot switch and a CW keyer. Two phono jacks provide connections to external speakers.

Pop the cover and you find that the NCS-3240 is more than a simple switcher. The audio inputs pass through two adjustable gain stages before being applied to the connected radios. This is significant when you consider that different radios have differing audio input characteristics. The microphone input level and impedance that's appropriate for a vintage transceiver, for example, might be inappropriate for a modern rig, and vice versa. The gain stages also use transformer coupling for optimum isolation. This is particularly important when one of your audio sources is a sound-card interface or multimode controller.

Bottom Line

The NCS-3240 may be of interest to amateurs with complex stations, particularly SO2R contesters.

Setup

For this review I used the NCS-3240 with an ICOM IC-706 MkII transceiver, an ancient Shure microphone, an ICOM SM-6 microphone and a sound-card interface.

I had no difficulty finding a place for the '3240 on my operating desk. It is large enough to be ergonomically efficient, yet small enough to stay out of the way. A power supply isn't provided, but NCS does include a coaxial power plug, which I used to connect to my station supply (the Multi-Switcher draws about 200 mA).

Before you begin attaching cables, the first step is to decide which microphone

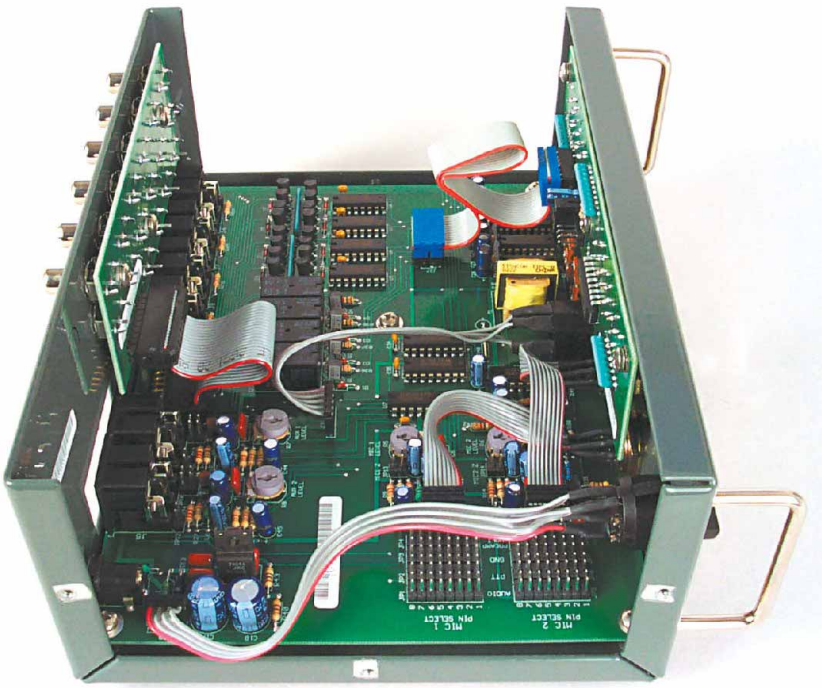


Figure 3—A look inside the NCS-3240 with the top cover removed. The front panel is at right.

and auxiliary inputs you are going to use and configure their jumpers accordingly. This involves going inside the unit and arranging the jumpers with help from the well-illustrated manual. I chose MIC 1 for my SM-6 desk microphone and MIC 2 for the Shure. It took a few minutes to configure the jumpers so that the audio and PTT for each microphone would be connected properly within the Multi-Switcher. If you own a microphone with an internal preamp, there is a jumper setting to pass power to the correct microphone pin. There are also jumpers to select "high," 200 or 600-Ω impedance. Lastly, there is an internal trimpot in the same area to adjust the audio input level, if necessary. These trimpots are conveniently accessible from the bottom of the case.

I connected my sound-card interface to AUX 1 on the rear panel. There are only a couple of impedance jumpers to set for the auxiliary inputs and level pots are available for each of these inputs as well.

I had to cobble together the appropriate cable to snake between my radio and the rear-panel RADIO 1 jack. That meant I had to create a cable with a DIN plug on one end for the NCS-3240 and an RJ45 plug on the other end for the IC-706 microphone input.

The last step was to set the microphone levels to the radio by using the controls on the front of the NCS-3240. A flick of the switch selected MIC 1 and another flick selected RADIO 1. Two more button jabs selected MIC 2 or AUX 1. A couple of test transmissions and control tweaks later, I was finished.

Impressions

Once you go through the exercise of adapting cables and setting up the '3240, you have the pleasure of sitting back and enjoying the results. I hooked up with a German amateur on 17 meters and it was interesting to hear his reports as I switched easily between the SM-6 and Shure microphones. He reported that my signal on either mike was clean and distortion-free. I jumped to 6 meters and toggled AUX 1 to run FSK441 with my computer. Once again, the NCS-3240 made it possible to switch from one audio source to another as fast as I could press a button.

The NCS-3240 is an asset to "busy" stations—contest and otherwise—that have a need to switch quickly between several radios or audio sources at a moment's notice. My wish list for a future version might include a front-panel RJ45 jack (MIC 3?) for those increasingly popular hand-held microphones. Also, it would be helpful if the NCS-3240 package included six 8-pin DIN plugs. If you don't have DIN plugs hiding in your junk box, you are faced with a journey to RadioShack (as I was) before you can set up the '3240. There is also the option to buy pre- or custom-made cables directly from New Communications Solutions.

Manufacturer: New Communications Solutions, 5363 Valley Mist Trace, Suite 101, Norcross, GA 30092; tel 888-883-5788; **www.ncsradio.com**. $279.95. NCS-1512 wall power supply, $12.95.

MFJ-461 Pocket CW Reader

Reviewed by Brennan Price, N4QX
Assistant Technical Editor

As someone who, even after years of practice, sometimes struggles to copy high speed Morse code, programs and devices that will decode and display Morse interest me. While a number of software packages for digital modes include this capability, I have yet to dedicate a computer for this purpose at my small, space-constrained station. MFJ's Model 461 Pocket CW Reader caught my attention. Very compact and functional even without a connection to the radio, the '461 seemed ideal for operation at home and on the road.

The "Pocket" designation in the '461's official name is fitting. The box measures 3¾×2¼×1 inch, slightly larger than an Altoids tin. About one-third of the volume of the box is occupied by the 9-V battery that powers the device.

Operation is theoretically very simple, and when the '461 is adjusted properly, it is. Pressing a red POWER switch on the side panel turns the unit on, and the 32-character liquid crystal display comes to life. When the user places the box with the side-panel microphone facing a speaker that sends CW, the device determines the CW speed and displays the characters as they are sent. The firmware understands a comprehensive International Morse character set, including not only the 43 characters tested during Element 1

Bottom Line

The MFJ-461 is a handy accessory for deciphering well formed Morse code, but users should have realistic expectations and carry a screwdriver.

Figure 4 (left)—Is the sender talking about activities at W5YM, the station at the University of Arkansas? No! The sender didn't leave enough space between the M and the E in *home brew*. This illustrates the limitations of the MFJ-461—or nearly any other firmware or software Morse reader—when copying imperfect code. Still, it does a pretty credible job at 30 WPM. Notice that the K in "BK" is scrolled to the next line.

Figure 5—The rear panel of the MFJ-461. The 9-V battery compartment is at right. Within the rectangle at left, there are two screwdriver controls for audio frequency (top) and input level (center). The audio frequency setting is critical for proper operation.

Figure 6—The side panel controls and jacks of the MFJ-461.

examinations in the United States, but also 14 relatively obscure characters, including the apostrophe ($\overline{WG}$), underline ($\overline{IQ}$) and dollar sign ($\overline{SX}$). All of the characters are listed on the '461's instruction sheet.

Sounds simple, right? Well, it is simple if two big conditions are met. First, the code must be very close to perfectly formed. As with many Morse-reading software programs, deviations from perfection can cause indecipherable results on the screen. The instruction sheet rightly points this out: "There is a lot of sloppy code on the air.... Do not expect this Reader to do the incredible when it comes to copying Morse code." Even very good code can have minor flaws. See Figure 4, which shows the MFJ-461 while deciphering a QSO heard at the W1HQ club station in the ARRL Headquarters. The sender was asking about the receiver's *home brew* activities. The M and the E were run too closely together, and the '461 heard a G, resulting in the somewhat humorous display.

The second critical condition is that the '461 must be set for the audio frequency at which the Morse is being sounded. The box will detect audio anywhere from 500 to 1000 Hz, but only at one frequency. One of two back-panel screwdriver controls (see Figure 5) adjusts the frequency to anywhere within that range; the factory setting is approximately 700 Hz. If the frequency does not match, either no code or nonsensical code is displayed. Even after the LOCK indicator on the side panel flashes in rhythm with the code, a slight disparity in frequency caused a display full of Es and Ts, as the '461 would only determine dots and dashes.

If your radio has the capability, it is often easier to adjust the RIT control or VFO frequency in order to match the radio to the '461, instead of the other way around. For MCW transmissions, however, this is not an option. This screwdriver control is somewhat awkward for two reasons: it requires a screwdriver, and the control is rotated clockwise to *decrease* frequency. If I have a complaint with this product, it's that these two controls (the other governs audio input level) are not governed by very small knobs. Then again, external knobs are as easy to misadjust as they are to adjust, and these are critical controls. Reasonable users may differ on whether they like MFJ's approach.

The side panel controls are shown in Figure 6. The black REPEAT button, when pressed momentarily, will redisplay the last 140 characters received. This can be helpful, for instance, to double check a contest exchange or an item of traffic received. Pressing and holding the REPEAT button toggles between one of four display modes. In Figure 4, the default mode is shown. Incoming text is displayed along the bottom line, and when the line is full, the line is scrolled to the top line. The speed is shown at right. In other modes, the user can elect to dispense with the speed display or scroll incoming text from right to left. The AUDIO IN 3.5-mm jack disables the microphone to its left and allows input from another audio source. The SERIAL OUT 3.5-mm jack allows output to a terminal program, in case a more substantial display is needed. To the left of the microphone, the LOCK indicator blinks in harmony with the sounded elements when the Morse is at (or near) the selected audio frequency.

Users should be aware that Farnsworth spaced Morse will display as individual letters at the character rate, not whole words at the overall rate. When listening to a W1AW slow code practice session, for instance, QST, when sent at a 15 WPM character rate and a 5 WPM overall rate, will be deciphered as 15 WPM and displayed as "Q S T" by the '461.

There is no substitute for hours of sending and receiving when building Morse speed and proficiency. To the extent that I am a proficient CW operator, I owe a debt of gratitude to the many operators of the Georgia State CW Net, who put up with months of my slow, sloppy sending and receiving. For someone trying to learn Morse, the '461 is no substitute for practice, and MFJ has other products available that would better fit the bill, such as their MFJ-418 Morse Code Tutor.

During a fast-paced traffic net or contest, however, or when trying to copy a CW bulletin, even the best-trained operator can miss a character, and in such situations, it is critical to avoid doing so. Amateurs in these situations can find electronic backup helpful, and the MFJ-461 is worthy of consideration, particularly if portability is critical.

Manufacturer: MFJ Enterprises, PO Box 494, Mississippi State, MS 39762, tel 800-647-1800; fax 662-323-6551; **www.mfjenterprises.com**. Price: $79.95. MFJ-5161 serial cable with DB-9 connector: $14.95; MFJ-5162 audio input cable: $5.95; MFJ-26B carrying case with belt clip: $6.95. QST

TECHNICAL CORRESPONDENCE

MORE ON THE RIBBON J-POLE ANTENNA

By John S. (Jack) Belrose, VE2CV
ARRL TA, 17 rue de Tadoussac, Aylmer
QC J9J 1G1, Canada
john.belrose@crc.ca

◊ Edison Fong, WB6IQN, in the February issue of *QST*, has described a dual-band ribbon-J. His dual band-version is interesting, but I would prefer to use two ribbon-Js, one for each band. While a 146-MHz ribbon-J can have an acceptable SWR on 435 MHz, the horizontal lobe is a minor lobe. [Actually, Fong's antenna does not operate this way; that's the point of the article.—*Ed.*]

The purpose of this TC is to correct an incorrect statement made by WB6IQN. In this article, his claim that there is *"minimal interaction with the feed line"* is wrong. [In context, Fong's statement is true; the pattern he observed was not disturbed by interaction.—*Ed.*] It is curious that in the course of his experiments he did not notice that there is a strong interaction [with nearby objects—*Ed.*]. One need only run a hand along the coaxial feeder of a ribbon-J without a balun and observe that on receive the signal strength indicated by the S-meter will change, and on transmit the SWR will change. In fact, it can be difficult to measure SWR reliably, depending on the length of the coaxial cable. For my experiments, I used a coaxial cable length that was an integral multiple of half-wavelengths, so as not to introduce impedance changes due to the initially mismatched coaxial feeder.

I would also like to place the chronological development of this antenna into perspective. The ribbon-J is a version of the J-pole or Flag-pole antenna developed about 70-years ago,[1] but fabricated out of 300-Ω twin-lead or ribbon. The ribbon version was described independently by Fred Judd, G2BCX,[2] and I[3] more than two decades ago. His "Slim Jim" had a jumper wire shorting the two conductors of ribbon at their top ends. My design, which I refer to as a ribbon-J, was open at the top. The original designs, and most designs to follow, connected the coaxial feeder directly to the antenna (as did WB6IQN). My later design employed a choke balun λ/4 down from the antenna end of the coax.[4] The feeder itself (using small coax) is coiled to form a 6-turn inductor, with a 1-inch diameter (see Figure 1). This not only effectively decouples the coaxial feeder from the J-pole, but improves the performance of the antenna, since current on the outer surface of the coaxial feeder above the choke contributes to the radiation performance of the antenna.

The ribbon J-pole continues to attract interest and comment. It seems everyone who has made such an antenna has arrived at different dimensions for it,[5] and some have found difficulty in obtaining a good match (see for example Lew McCoy, W1ICP[6]). Another problem is dimensioning the antenna. If you compare my Figure 1 and Note 1 below with the discussion given for example in the *QST* article by Jim Reynante, KD6GLS,[7] there is a clear difference of opinion on how to dimension the ribbon-J.

This antenna is a coupled system. If the dimension of the radiating element is too long or too short for half-wave resonance, adjusting the length of the stub can tune the antenna to resonance. Nevertheless, maximum bandwidth is obtained if both dimensions (the λ/2-radiator and the λ/4-stub) are the right length. The SWR for my ribbon-J is shown in Figure 2.

Concerning difficulties in resonating the antenna, reasons for this are (at least) five fold:

1. Concerning dimensioning the antenna, the λ/4-stub should be dimensioned by taking into account the velocity of propagation factor for the 300-Ω ribbon used (v = 0.83 for the ribbon used by the author). However, the λ/2-radiator should be dimensioned with a suitable antenna factor (k = 0.95 was used by the author), see Figure 1. Some versions of the ribbon-J have been dimensioned using the same

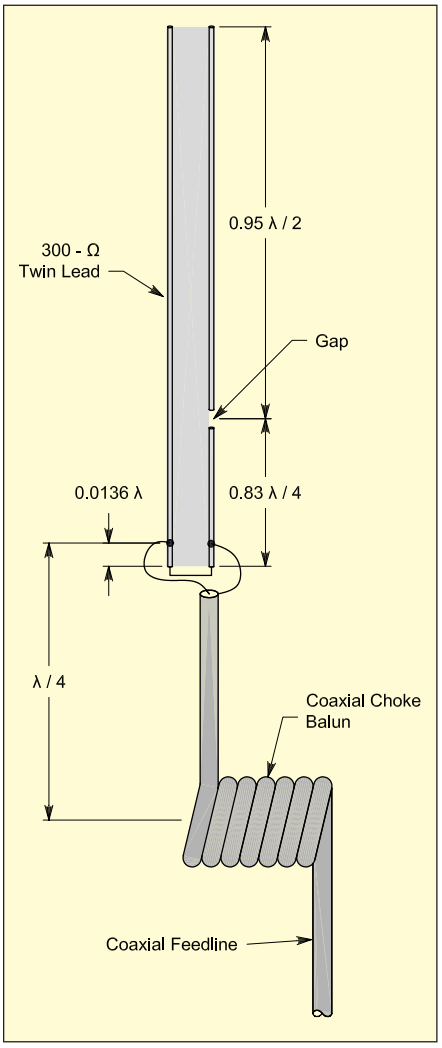


Figure 1—VE2CV's version of a ribbon-J.

[1]W. C. Tinus, "Ultra-high-frequency Antenna Terminations," *Electronics*, Vol 8, Aug 1935, p 239. Reference given by F. E. Terman, *Radio Engineers' Handbook* (New York: McGraw-Hill, 1944), pp 856-857.

[2]F. C. Judd, "Slim Jim 2-Metre Aerial," *Practical Wireless*, Apr 1978, pp 899-901.

[3]J. S. Belrose, "A Roll-Up and Put in Your Pocket Type Vertical J Antenna," *TCA*, Sep 1979, pp 25-26. See also *QST*, Apr 1982, pp 43-45.

[4]J. S. Belrose, "A Deluxe Ribbon Antenna (for Two)," *QST Canada*, Nov 1989, p 15. See also "More on the 144 MHz Ribbon J-Pole Antenna," in Pat Hawker, G3VA's Tech Topics Column, *RadCom*, May 1995, pp 61-62.

[5]P. Hawker, "144 MHz J-Pole and Slim Jim Antennas," Tech Topics Column, *RadCom*, Dec 1994, pp 62-63.

[6]L. McCoy, "More Bang for the Buck—How to build a really cheap antenna for 2 meters," *CQ*, Jul 1994, pp 50-51.

[7]J. Reynante, "An Easy Dual-Band VHF/UHF Antenna," *QST*, Sep 1994, pp 61-62.

Table 1
J-Pole Dimensions
Calculated in inches from Figure 1 by the Editor, KU7G

f (MHz)	*λ*	*0.95 λ/2*	*0.83 λ/4*	*0.0136 λ*	*λ/4*
146.00	80.88	38.42	16.78	1.10	20.22
445.00	26.53	12.60	5.51	0.36	6.63

Bob Schetgen, KU7G ♦ Senior Assistant Technical Editor ♦ tc@arrl.org

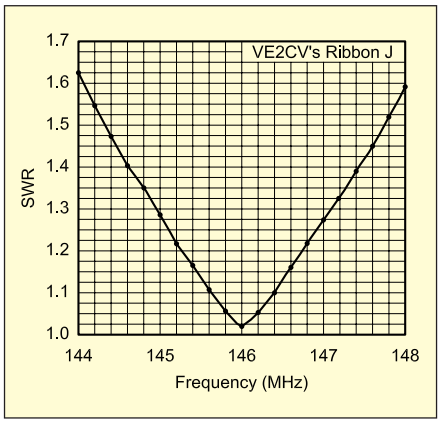


Figure 2—SWR versus frequency for the antenna in Figure 1.

shortening factor for *both* the radiator element and the stub (see Note 7).

2. There are three dimensions to trim and adjust, as we have said above: the length of the λ/2-radiator, the length of the λ/4-stub and the tap point on the stub.

3. If no balun is used, the transmission line becomes a part of the radiating antenna system since induced currents can flow on the outer surface of the shield of the coax feeder.

4. The presence of the floating wire, a part of the ribbon-J, and the gap width (3 mm used by the author) change the resonant frequency of the antenna system.

5. While the ribbon J-pole antenna can certainly be slipped inside a PVC pipe to form a more-permanent base-station antenna, it then requires a significant change in the dimensions.

Notwithstanding, the ribbon J-pole is a very good antenna: It is easy to fabricate, and is an excellent antenna for portable use. Hang it from the branch of a tree, the light fixture in a hotel room, wherever, but not against a wall or even against a wooden pole to support it.

Author Ed Fong, WB6IQN, Responds

My antenna has advantages over a J-pole operated on its third harmonic: The bands can be tuned independently, and it does not have the unwanted lobes. I agree that a balun is useful for stability in matching. Nonetheless, if you do not go running your hands up and down the matching section, it is fine. When measured with a spectrum analyzer 100 yards away, we found no measurable difference in performance with or without ferrites in the coax. The baluns certainly did not hurt the performance in our measurements.

ACCURATE FREQUENCY MEASUREMENTS

By Neill Fry, K4AYD, 1303 Royal Tr, Manchester, TN 37355
nbfry@charter.net

◊ An accurate frequency measurement can be made using a PSK31 or *WSJT* program and tuning the receiver to WWV plus or minus some frequency in the receiver passband. Inaccuracies can be introduced by the receiver, PSK31 program/computer sound card or WWV propagation. WWV transmits tones of 500 and 600 Hz that can be used to check the accuracy of the sound card and program. Both USB and LSB can be used to further diagnose problems in which oscillators are off frequency in the transceiver. Modern transceivers have resolutions of 1 or 10 Hz and unbelievable stability. The PSK31 program has a counter that covers the receiver passband and can be accurately read to ±1 Hz.

PSK31 programs use a 31-Hz wide phase-shift signal to generate characters. This is about the lowest S/N mode I know. Computer errors are not usually a problem, but can be caused by the sound card and can easily be corrected by the PSK31 program. Actually, the programs check the sound card and have provisions to correct the sound-card error ±10,000 ppm. This corrects the slope of the line from 0-3000 Hz, or wherever your screen is set. PSK31 experts say that if the sound card is off, it will be by less than 2000 ppm and usually less than 1000 ppm, which is insignificant. (This is 5-Hz at 5-kHz, which is acceptable for PSK.) The PSK31 program permits a correction of ±10,000 ppm. The slope of the sound-card frequency response can be readily seen by centering WWV in the receiver passband and viewing the 600-Hz tones. The sidebands should be precisely 1200 Hz apart. Looking at the three points, WWV and the two sidebands, the slope should be zero. If not, the PSK31 program can be used to correct the error. Having determined that the sound-card slope is zero, we can look at the receiver dial and compare it with WWV to establish the receiver error.

Here is a step-by-step procedure for checking a transceiver using a PSK31 program and WWV signal. This method eliminates the need for a frequency standard, counter and the old zero-beat method. (Besides, I can't hear any frequency lower than about 50 Hz.) The WWV 10-MHz signal usually provides a good strong signal, although the 30-Hz bandwidth lets you dig it out of the noise.

1. Set the receiver to 9.999000 MHz (or to what the lowest increment your receiver provides) and to USB. You could set WWV in the center of the receiver passband for better results, but the above setting makes it easy to do the check by simple addition of round numbers.
2. Using a PSK31 program, the signal will appear at 1 kHz plus or minus the receiver error, and it can be read on the PSK31 digital frequency readout.
3. Set the receiver to 10.00100 MHz and LSB. Again, the receiver will read 1 kHz plus or minus the receiver error. This time the scale is inverted because of up-converting or down-converting to change sidebands.
4. The three frequencies generated by WWV and its sidebands then can be analyzed to provide information about the accuracy of the receiver oscillators.
   A. If the readings of WWV and the two sidebands are displaced exactly 600 Hz, the sound card is accurate and the receiver error equals the offset.
   B. If the numbers repeat, going from USB to LSB with a sign change, the master oscillator is off by the difference.
   C. If the numbers do not repeat going from USB to LSB, the up-converting or down-converting oscillator frequency is off and can be determined by the error in the difference in each and the sign.

Notice that the error can be a combination of the receiver carrier-oscillator and the upper- or lower-sideband oscillator. A little understanding of how the transceiver works and some careful analysis make a great difference in how well you can determine the actual tuned frequency. Of course the stability and resolution are important and can be analyzed.

The bottom line is that the PSK31 program permits you to read WWV's frequency to within a hertz or two by simply reading a program counter. The manufacturers do not provide this accuracy to new rigs being sold today.

PSK31 and WSJT are exciting developments in ham radio and are at the cutting edge of technology. I am proud to be a part of ham radio. G3PLX, K1JT and others have made huge contributions to communications.

Ham Radio "CC&R Bill" Reintroduced in Congress

Another Congressional attempt is under way to provide relief to amateurs prevented by private deed covenants, conditions and restrictions (CC&Rs) from installing outdoor antennas. Rep Steve Israel (D-NY) has again introduced the "Amateur Radio Emergency Communications Consistency Act" into the current session of Congress. The measure, designated HR 1478, would require private land-use regulators such as homeowners' associations to "reasonably accommodate" Amateur Radio antennas consistent with the PRB-1 limited federal preemption. PRB-1 now applies only to states and municipalities.

In remarks introducing HR 1478, Israel said passage of his bill not only would assist Amateur Radio operators but society as a whole. "Organized Amateur Radio operators—or 'hams'—regularly provide emergency communication when regular communications channels are disrupted by disaster," Israel pointed out. The growth of developed communities has put a growing number of hams under an "array of inconsistent regulations," he said, that make it harder and harder—or altogether impossible—to erect the necessary antennas.

"Not allowing hams the equipment they need could restrict communication to the local community in [disaster] situations in the future," Israel said, adding that his bill "seeks to ensure the continued viability of Amateur Radio through consistent application of federal regulations."

The one-sentence measure is identical to the text of the CC&R bill that was introduced in the last Congress: "For purposes of the Federal Communications Commission's regulation relating to station antenna structures in the Amateur Radio Service (47 CFR 97.15), any private land use rules applicable to such structures shall be treated as a state or local regulation and shall be subject to the same requirements and limitations as a state or local regulation."

DIANE ORTIZ, K2DO

HR 1478 sponsor Rep Steve Israel at the Great South Bay Amateur Radio Club's W2GSB club station, located in the Babylon, New York, emergency operations center.

HR 1478 has bipartisan support. Leading the list of 13 initial cosponsors for the measure are Reps Greg Walden, WB7OCE (R-OR) and Mike Ross, WD5DVR (D-AR)—believed to be the only Amateur Radio licensees in Congress. Joining them are representatives Tammy Baldwin (D-WI), Roscoe Bartlett (R-MD), Marion Berry (D-AR), Rick Boucher (D-VA), Jo Ann Davis (R-VA), Ralph Hall (D-TX), Carolyn McCarthy (D-NY), Michael McNulty (D-NY), Dennis Moore (D-KS), Charles Taylor (R-NC) and Patrick Tiberi (R-OH). In addition, Reps John Olver (D-MA), Ken Calvert (R-CA), John J. Duncan Jr (R-TN), Joseph Hoeffel (D-PA), Rob Simmons (R-CT) and Michael Michaud (R-ME) have signed on as cosponsors.

ARRL President Jim Haynie, W5JBP, said he was happy to see the bill back before Congress. "Of course I am very pleased that Representative Israel has reintroduced the bill," Haynie said. "The League can do the mechanics, but it is now up to our members to write their elected representative and urge support and ask that they cosponsor and support the bill." Haynie noted that the League has recently ramped up its efforts to educate members of Congress about Amateur Radio, but he said lawmakers respond best to individual members.

HR 1478 has been assigned to the House Energy and Commerce Committee. Information about the bill and a sample letter to use when contacting your representative are available on the ARRL Web site, **www.arrl.org/govrelations/hr1478/**.

Communications Subcommittee Chair Cosponsors Spectrum Protection Act

The chairman of the Senate Communications Subcommittee, Montana Sen Conrad Burns, has signed on as a cosponsor of the Amateur Radio Spectrum Protection Act, Senate Bill 537. The commitment by Burns, the expected architect of the Senate's spectrum management legislation, indicates that the measure—an ARRL initiative on its third attempt in Congress—now has his attention. Burns' cosponsorship also could convince others to follow suit.

The Amateur Radio Spectrum Protection Act of 2003 has been introduced in both chambers of Congress. Florida Rep Michael Bilirakis filed the House version of the bill, HR 713, on February 12, while Idaho Sen Michael Crapo introduced the Senate version, S 537, on March 6.

The legislation would amend the Communications Act to require the FCC to provide "equivalent replacement spectrum" to Amateur Radio and the Amateur-Satellite Service in the event of a reallocation of primary amateur allocations, any reduction in secondary amateur allocations, or additional allocations within such bands that would substantially reduce their utility to amateurs. Bilirakis and Crapo, both Republicans, have twice before sponsored similar legislation at the League's recommendation.

Montana Sen Conrad Burns.

The bills point out Amateur Radio's volunteer role in providing emergency communication "before, during, and after

Rick Lindquist, N1RL ♦ Senior News Editor ♦ n1rl@arrl.org

FCC PROPOSES VANITY FEE HIKE

The FCC has proposed increasing the regulatory fee to apply for, renew or reinstate an Amateur Radio vanity call sign from $14.50 to $16.30 this fall. The Commission included the new fee in a *Notice of Proposed Rulemaking* (*NPRM*) "Assessment and Collection of Regulatory Fees for Fiscal Year 2003" (MD 03-83), released March 26.

"We estimate that 9800 applicants will apply for vanity call signs in FY2003," the FCC said in its *NPRM*. That's up by 800 from FY2002. The agency expects to collect revenues of nearly $160,000, an increase of almost $30,000 from FY2002.

If all goes as it has in the past, the FCC will adopt a *Report and Order* on the FY2003 fee schedule this summer, and the new fee will become effective sometime in early September. Applicants for amateur vanity call signs will continue to pay the $14.50 regulatory fee per call sign (per 10-year license term) until the FY2003 fee schedule goes into effect.

The FCC *NPRM* also seeks comments on its efforts to review, streamline and modernize its fee assessment and collection processes and procedures.

FCC ADOPTS CHANGES TO REPETITIOUS APPLICATIONS RULE

The FCC has amended its rule that prohibits the filing of repetitious license applications in the wireless radio services—including the Amateur Radio Service—within a year after it has denied or dismissed "a substantially similar application" with prejudice. The FCC also has streamlined the rule, §1.937, by combining its first two subsections into a single paragraph. The FCC proposed and invited comments on the changes more than a year ago in ET Docket 02-57.

"Our amendment of §1.937 will simplify and clarify our prohibition against repetitious applications," the FCC said in a *Report and Order* (*R&O*) released April 16. "We believe that this action will promote the most efficient use of the Commission's resources by preventing the filing of such applications and barring applicants from initiating reexamination of such matters within a short time after our final decision thereon."

While the change applies to the Amateur Service, it would prohibit only a handful of applications filed by new and renewing hams. Most dismissed amateur applications—such as vanity dismissals—are turned down *without* prejudice because of procedural deficiencies. The FCC now allows such rejected applicants to correct their mistakes and file again, and it will continue to do so.

FCC rules already prohibited repetitious applications for new stations, modifications of services or facilities, or for licenses that have been revoked. The amended rule covers the filing of other repetitious applications not specified within the old rule's language, including renewal applications and applies the ban equally to "all dispositive actions, including dismissals with prejudice, denials and revocations," the FCC said. The revised rule also "sufficiently distinguishes applications dismissed without prejudice from those either dismissed with prejudice or denied," the Commission said.

When it issued the *Notice of Proposed Rule Making* (*NPRM*) in the proceeding in March 2002, the FCC cited the then-pending application of Herbert Schoenbohm, KV4FZ, of the US Virgin Islands, as an example of a repetitious application for the same service less than 12 months after the final denial of a previous application. Schoenbohm had applied for a new Amateur Radio license only weeks after his authority to operate had ended following the Supreme Court's refusal to hear an appeal of the FCC's denial of his license renewal application.

The FCC's *R&O* indirectly alludes to the Schoenbohm case, citing "at least one instance" where a licensee had filed a repetitious application for the same service less than 12 months after the denial of his renewal application. "Such cases can consume significant resources to re-litigate identical issues involving the same applicants very close in time," the FCC said. The Commission subsequently designated Schoenbohm's application for hearing and, following the hearing, granted it.

The rule change becomes effective 30 days after it is published in the *Federal Register*.

Amateur Enforcement

♦ **FCC official requests weekly reports from Maine ham:** The FCC's Boston office has requested a Maine amateur to submit weekly reports detailing some of his on-the-air activities. FCC Boston District Director Vincent F. Kajunski wrote Glenn Baxter, K1MAN, on March 4. Kajunski said the FCC needed the information to determine if Baxter was operating in compliance with Part 97 and with rules regarding recording and broadcasting of telephone calls.

"Your Amateur Radio station is apparently being used for broadcasting various 'programs,' 'talk shows,' children's shows and programs having nothing to do with Amateur Radio," Kajunski's letter asserted.

Kajunski also alleged that transmissions from Baxter's station "start and end erratically, are sometimes repetitive and abruptly end with no identification as required by Commission rules." Such operation, he said, indicates the transmissions "are not under the control of a licensed operator."

Kajunski told Baxter the weekly reports should—among other specifics—provide the name, address, telephone number and exact location of the control operator and the method of station control used when K1MAN transmits. He also requested dates, times and frequencies of broadcasts of telephone conversations; transmissions referencing the offer of a degree in electronics or an IARN (International Amateur Radio Network) credit card; transmissions referencing the IARN Web site; and transmissions soliciting donations of radio equipment or other items, including donations to "the Radio Peace Corps Foundation."

Kajunski further asked that Baxter provide information on the alleged transmission of an "apparently continuous 'CQ' loop that the FCC says aired at approximately 10-second intervals for more than two hours on February 3, 2003, on 20-meter SSB."

The FCC also seeks from K1MAN a list of dates, length of time and frequencies "during which your amateur station has operated since February 15, 2002, without you at the transmitter location." If any, Kajunski asked for the name and address of the control operator, the location of the control operator and control point and the method of control used.

♦ **"Enhanced SSB" bandwidths "extremely inconsiderate," FCC says:** The FCC has sent advisory notices to four enthusiasts of what's become known as "enhanced SSB"—the practice of engineering transmitted single-sideband au-

dio to approach broadcast quality. Letters went out April 3 to amateurs in Illinois, Florida and New Jersey who are aficionados of enhanced SSB, also known as "extended bandwidth SSB."

"The Commission has received numerous complaints regarding the operation of your station," FCC Special Counsel Riley Hollingsworth wrote the four licensees on April 3. Hollingsworth said complaints to the FCC alleged that the bandwidths of the stations' enhanced SSB emissions were "wider than necessary and contrary to good engineering practice."

"Wideband overly-processed audio, especially when coupled with the high intermodulation levels of certain amplifiers, results in the use of bandwidths extremely inconsiderate of other operators," Hollingsworth said. Such transmissions may violate FCC rules and may be at odds with what Hollingsworth described as "the expectation that the Amateur Service be largely self regulated."

Occupying more bandwidth than necessary in a heavily used amateur band, Hollingsworth wrote, is contrary to the requirement that amateurs cooperate in using the frequencies allocated to them and make the most effective use of the spectrum. Such "shortsightedness" on the part of those transmitting enhanced SSB signals not only could lead to ill will among operators but to petitions asking the FCC to establish bandwidth limits for amateur emissions. The FCC imposes no specific bandwidth limits on various amateur modes, however.

Hollingsworth cited §97.307(a) of the Amateur Service rules that requires the signal of an amateur station to not occupy "more bandwidth than necessary for the information rate and emission type being transmitted, in accordance with good amateur practice." Some amateurs have complained that enhanced SSB signals can take up 8 kHz or more of spectrum, cause splatter and unnecessarily interfere with other stations.

Hollingsworth acknowledged that the FCC encourages amateurs to contribute to the advancement of the radio art, but he recommended that the enhanced SSBers do so in a way "that does not have a negative impact on other amateur stations or their operations." He requested the four amateurs to "fully review the rules" and make sure their stations conform to them.

floods, hurricanes, tornadoes, forest fires, earthquakes, blizzards, train accidents, chemical spills, and other disasters." They also note that FCC actions "have resulted in the loss of at least 107 MHz of spectrum to radio amateurs."

A Billings, Montana, amateur with a professional and personal relationship with Burns—ARRL member Terry Whiteside, W7WWW—was instrumental in calling the senator's attention to the measure. A transportation attorney, Whiteside called the Amateur Radio Spectrum Protection Act "a natural" for inclusion in spectrum management and reform legislation expected to come out of this session of Congress.

ARRL President Jim Haynie, W5JBP, has encouraged League members to urge their senators and representatives and to cosponsor the bills, explaining that cosponsorhip lends support to legislation while it's in committee. The House bill has been referred to the Subcommittee on Telecommunications and the Internet; the Senate bill will be considered by the Commerce, Science, and Transportation Committee. "Letters and e-mails are the key to getting legislation passed," Haynie said.

In addition to Burns, S 537 cosponsors are senators Larry Craig (R-ID) and Daniel Akaka (D-HI). Cosponsors of HR 713 include John Boozman (R-AR), Patrick Tiberi (R-OH), Michael McNulty (D-NY), James Leach (R-IA), Charles Taylor (R-NC), Dave Weldon (R-FL), Ted Strickland (D-OH), Barbara Cubin (R-WY), Zoe Lofgren (D-CA), Dennis Moore (D-KS) and Scott Garrett (R-NJ).

A sample letter is available on the ARRL Web site, **www.arrl.org/govrelations/arspa.html**. Those writing their lawmakers are asked to copy their correspondence to the League via e-mail **specbill03@arrl.org**. The text of HR 713 and S 537 is available via the Thomas Web site, **thomas.loc.gov/**.

UTAH GOVERNOR SIGNS AMATEUR RADIO ANTENNA BILL

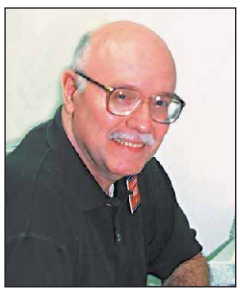
Utah Gov Michael Leavitt has signed that state's Amateur Radio antenna bill, HB 79. The bill unanimously passed a third reading in the Utah Senate February 14 on a 23-0 vote, less than a month after it was introduced. It had earlier passed the Utah House on a 65-8 vote. Leavitt signed the bill March 15. It becomes effective May 5.

"Thanks to the hams who originated the bill and defended it in its committee hearings," said a comment on the Utah Amateur Radio Club's "News About UARC and Ham Radio in Utah" Web site, **www.xmission.com/~uarc/anounce1.html#prb1bill**. "Thanks also to those who contacted their state senators and representatives and helped assure passage."

Sponsored by Rep Neal B. Hendrickson, HB 79, "Regulation of Amateur Radio Antennas," prohibits municipalities and counties in Utah from enacting ordinances that fail to comply with the limited federal preemption

ARRL Staff Member Al Alvareztorres, AA1DO, SK

ARRL Technical Information Service (TIS) Manager Al Alvareztorres, AA1DO, died unexpectedly March 26 after suffering a heart attack. He was 60.



Al Alvareztorres, AA1DO.

Hired in 1994 as the weekend W1AW operator, Alvareztorres, an accomplished Webmaster—moved to the Lab in 1999 to oversee the TIS. "Al will be missed in the ARRL Lab," said Lab Supervisor Ed Hare, W1RFI. Hare said Alvareztorres literally rebuilt the TIS Web pages from the ground up. He also was the driving force behind the "The Doctor is On-line" Web feature, co-editor of the ARRL *Ham Radio FAQ* book and author of a number of *QST* articles on mobile and stealth operating.

ARRL CEO David Sumner, K1ZZ, recalled Alvareztorres as "a quiet, friendly person who genuinely enjoyed being of service to our members and to his fellow staff members." Lab colleague Mike Gruber, W1MG, said Alvareztorres had a great sense of humor that helped make the Lab a fun place to work. "Al was universally well liked," Gruber said.

Born in New York, Alvareztorres grew up in River Edge, New Jersey, where he was first licensed in 1959 as WV2FGD. As an Air Force recruit, he traveled the world operating under various call signs. He subsequently worked in sales, electronics and production control. Survivors include his mother and a brother.

known as PRB-1. The measure requires local ordinances involving placement, screening or height of an Amateur Radio antenna that are based on health, safety or aesthetics to "reasonably accommodate amateur radio communications" and to "represent the minimal practicable regulation to accomplish the municipality's purpose."

ARRL Utah Section Manager Mel Parkes, AC7CP, has credited Mike Davis, KD7FQD, and John Hanson, KI7AR, for developing the bill and getting Hendrickson to sponsor it. A copy of the legislation is available on the Utah State Legislature Web site, **www.le.state.ut.us/**.

Utah becomes the 17th state to enact an Amateur Radio antenna bill. At press time, PRB-1 bills remained under consideration in several other states, including New York, New Jersey and California.

In Brief

• **FCC makes housekeeping changes in Amateur Service rules:** The FCC has made some minor changes in the Part 97 Amateur Service rules as a result of decisions at past World Radiocommunication Conferences. In a wide-ranging *Report and Order* released March 3 that affects several radio services, the FCC has removed §97.401(b) and international footnote 5.120 from the Amateur Service rules. The sections reference International Telecommunication Union (ITU) Resolution 640, which invited administrations to provide for the needs of international disaster communications and for the needs of emergency communications within their national regulations using certain amateur bands. Resolution 640 was deleted at WRC-97, and footnote 5.120 at WRC-2000. "We do not think this will have an impact on the Amateur Service emergency communications because Sections 97.111(a)(1) and 97.101(c) of our rules allow amateur stations to communicate with foreign stations in disaster areas, making the provisions based on the former ITU Resolution No. 640 unnecessary," the FCC said in the *R&O* in ET Docket 02-16. Those sections permit "transmissions necessary to exchange messages with other stations in the Amateur Service" unless an administration objects and require control operators "at all times and on all frequencies" to give priority to stations providing emergency communications. Footnote 5.120 had listed 80, 40, 30, 20, 17, 15, 12 and 2 meters as bands to be used in the event of natural disaster.

• **FCC cites RV owners in RFI complaint:** The FCC has told an Oregon couple to stop using its Winegard amplified television antenna (Model Sensar/Roadstar) on their recreational vehicle "until the condition causing harmful interference has been corrected." The FCC contacted Jimmy and Jan Bowen of Gresham, Oregon, following a February 3 RFI complaint from an Amateur Radio operator to the FCC Portland office. The interference was reported on 447.375 MHz. An FCC agent investigating the allegation tracked the interfering signal to the Bowens' RV in Portland. The FCC cited Part 15 rules and noted that certain Winegard antenna amplifiers "have been the source of radio frequency interference in a number of cases." Due to the complaints, Winegard, **www.winegard.com**, has agreed to replace defective units at no charge. The FCC advised the couple to contact Winegard to make necessary arrangements.

• **Digital Communications Conference issues first call for papers:** TAPR and ARRL have issued the first call for papers for presentation at the 2003 Digital Communications Conference. The 22nd annual conference will be September 19-21 at the Marriott Hartford Windsor Hotel near Hartford, Connecticut. Paper topics could include software defined radio, digital voice, digital satellite communications, GPS, APRS, DSP, HF digital modes, Internet interoperability, spread spectrum and 802.11 technologies, using *Linux* in Amateur Radio, updates on AX.25 and other wireless-networking protocols. Presentation at the conference is not required for publication. The deadline to submit papers for consideration is August 5. Submissions may be sent either by e-mail or postal mail to Maty Weinberg, KB1EIB, ARRL, 225 Main St, Newington, CT 06111. The DCC is designed for all levels of technical experience and is meant to be a weekend of fun and learning for all who have more than a casual interest in any aspect of amateur digital communications. For more information on the DCC, see "Digital Dimension," elsewhere in this issue, or visit the TAPR Web site, **www.tapr.org/dcc/index.html**.

Media Hits

■ Veteran ABC Radio Networks commentator Paul Harvey offered some kind words for Amateur Radio during his March 19 *Paul Harvey Noon News and Comment* program. "America's quiet warriors are the legion of ham radio operators, 700,000 of them, who are always at ready for backup duty in emergencies—amateur, unpaid, uncelebrated, civilian radio operators, during and after floods and fires and tornadoes," Harvey said. "After the 9/11 attacks, hams were indispensable in reuniting friends and families. Most recently it was they who expedited the search for debris after the disaster to the space shuttle *Columbia*, and right now, at this moment, they are involved in homeland security to a greater degree than you would want me to make public."

■ The *Chico Enterprise-Record* in California featured an article on the Military Affiliate Radio System (MARS), highlighting the history of the program and noting several Chico-area ham radio operators who have been MARS members. Golden Empire Amateur Radio Society President Steve Kaps, N6NPN, said activity increased as the US military buildup progressed in the Middle East in March. Al Biegler, WA6WJZ, is the net control operator for a weekly MARS net in Northern California. Other MARS volunteers mentioned included Bill Pope, W6TKE, Jerry Fuller, W6JRY, and Allen Sherwood, K6USN.

■ Retired Army Lt Col Earl Nichols, W4PII, told *The Kentucky Post* that being involved with the MARS program has allowed him to continue to "serve our country." Knowing that messages from home can boost the morale of military personnel is one reason Nichols has been a MARS operator for the past 43 years. It took two weeks for Nichols to get a telegram about the birth of his son during World War II, and he enjoys the fact that MARS can deliver messages much faster. The article also tied MARS and Amateur Radio in with current Homeland Security initiatives.

■ Amateur Radio emergency communications was the subject of a story on *News 8 Austin*, a 24-hour cable news station in Austin, Texas. Jeff Schmidt, N5MNW, explained how ham radio operators assist local officials during emergencies, and one Office of Emergency Management official called hams "critical, no matter what the emergency." Lee Cooper, W5LHC, explained that hams can operate from anywhere, under any circumstances, during emergencies. QST

Public Service Honor Roll in Action

Each month, the Public Service Honor Roll recognizes the efforts of Amateur Radio operators who are active in many aspects of public service. This includes net operations, traffic handling, emergency operations and public service communication support. There are chances that you're already involved with some aspect of Amateur Radio that would apply to the Public Service Honor Roll (PSHR).

Take a look at these categories and descriptions to see where your Amateur Radio activities fit in. At the end of each calendar month, just add up your qualifying points. If it reaches the 70-point level (or more), you've qualified for the Public Service Honor Roll! Report the good news with your call sign and monthly PSHR point total to your ARRL Section Manager and/or Section Traffic Manager. The ARRL section leaders, in turn, forward the report onto ARRL Headquarters so that Headquarters staff may prepare it for listing in the Field Organization Reports segment of *QST*'s Public Service column. Section Managers are listed on page 16 of *QST,* and on the Web page at **www.arrl.org/sections/**.

PSHR Categories

1) Participation in a public service net—1 point, maximum 40.

One example of a public service net is one that is regularly scheduled and handles Amateur Radio formal messages. There are many such public-service nets: local and section nets that are affiliated with the National Traffic System (NTS); NTS region, NTS area, and independent nets that handle messages. ARES, RACES, SKYWARN nets that meet on a regular basis would also qualify.

Public service or emergency nets that are activated to support an actual emergency or potential emergency or public-service event would be part of this first category. How about the net that has been established for training radio amateurs in public service and emergency communications? Why sure! Are you looking for a net to check into? Try the on-line *ARRL Net Directory*: **www.arrl.org/FandES/field/nets/**.

2) Handling formal messages (radiograms) via any mode—1 point for each message handled; maximum 40.

The ARRL's *Public Service Communications Manual* explains how to count your individual messages. Check the reference from Section 2, NTS Chapter 10.2. (The entire manual is at **www.arrl.org/FandES/field/pscm/**.)

3) Serving in an ARRL-sponsored volunteer position: ARRL Field Organization appointee or Section Manager, NTS Net Manager, TCC Director, TCC member, NTS official or appointee above the Section level.—10 points for each position; maximum 30.

ARRL Field Organization appointees (in alphabetical order) include the following: Assistant Section Managers, District Emergency Coordinators, Emergency Coordinators, Local Government Liaisons, Net Managers, Official Bulletin Stations, Official Emergency Stations, Official Observers, Official Observer Coordinators, Official Relay Stations, Public Information Coordinators, Public Information Officers, Section Emergency Coordinators, Section Traffic Managers, State Government Liaisons, Technical Coordinators and Technical Specialists.

The Section Manager is the ARRL-member elected League official in the section. An NTS official or appointee above the Section level would include Region and Area Net Managers, and TCC (Transcontinental Corps) Directors who are in charge of organizing TCC membership rosters of operators that comprise the corps. TCC members are those operators that are assigned to relay traffic from one NTS area to another, conducting liaison with NTS nets to do so. NTS Members at Large, NTS Area Staff Chairs, NTS Area Digital Coordinators and Digital Stations would also be included in this category.

To read more about the ARRL Field Organization and these appointments, read the article, "The ARRL Field Organization: Something for Everyone," by Dave Hassler, K7CCC, in March 2003, *QST*, pp 50-54.

4) Participation in scheduled, short-term public service events such as walk-a-thons, bike-a-thons, parades, simulated emergency tests and related practice events. This includes off-the-air meetings and coordination efforts with related emergency groups and served agencies.

—5 points per hour (or any portion thereof) of time spent in either coordinating and/or operating in the public service event; no limit.

This category recognizes the value of public safety communication events that Amateur Radio is often called to participate in. Simulated emergency tests, exercises, and drills are covered by this category. Points are gained by the amount of time that an Amateur Radio operator spends directly involved in operating the event. This also recognizes the value of off-the-air time it takes to meet with the organization or public service agency to plan and coordinate Amateur Radio involvement.

5) Participation in an unplanned emergency response when the Amateur Radio operator is on the scene. This also includes unplanned incident requests by public or served agencies for Amateur Radio participation.

—5 points per hour (or any portion thereof) of time spent directly involved in the emergency operation; no limit.

This category recognizes an Amateur Radio operator who is directly involved in an actual emergency operation. This includes the operator who is on the scene or out in the field, in the shelter, at the emergency operations center, at the hospital, or other served agency's headquarters or their temporary command center.

If you are an active participant in an unplanned incident—or in other words, an emergency operation—you may take credit for this participation even though you may not be physically at the emergency scene.

Category 5 covers all the Amateur Radio operator participants such as net controllers, net liaison stations and other radio amateurs that support communications in unplanned incidents. Even if you are not actually on the emergency scene or at the shelter, etc, but are spending time and efforts for supporting the same emergency communication effort, then this time would count for points in Category 5.

As an example, if the National Weather Service activates SKYWARN, Amateur Radio operators serve as weather spotters from their home (or car, or work, or other locations) during the weather event. Then, a tornado strikes and the Red Cross calls out the ARES members to serve in shelters and to provide support for damage assessment commu-

Steve Ewald, WV1X ♦ Public Service Specialist ♦ sewald@arrl.org

nications. These operators would be able to qualify for Category 5 points.

There would likely be several net control operators, net liaison operators, traffic handlers, etc, who are away from the disaster scene, but are spending time to support the Amateur Radio emergency communication effort on behalf of the served agencies (Red Cross and National Weather Service, in this example). They, too, would qualify for points under Category 5.

6) Providing and maintaining a) an automated digital system that handles ARRL radiogram-formatted messages; b) a Web page e-mail list server oriented toward Amateur Radio public service—10 points per item.

Category 6a recognizes the efforts it takes to provide and maintain an automated digital system (like a packet bulletin board or a PACTOR system) that handles ARRL radiogram-formatted messages.

Category 6b recognizes the Web pages and e-mail list servers have become popular and effective ways to communicate news and information to the community of radio amateurs that are involved in emergency and public service communication operations and preparedness.

If you are involved in any of these activities, keep track of your efforts and report your results accordingly. If you qualify for PSHR 12 consecutive months, or 18 out of a 24-month period, you are eligible for a one-time certificate from ARRL Headquarters. Please write (and include a list of qualifying months) to the Public Service Branch of Field and Educational Services at ARRL HQ.

South Carolina SSB Net Celebrates 45th Year

Congratulations to the South Carolina SSB Net for 45 years of service. The net, which meets nightly on 3915 kHz at 7 PM (Eastern Time) marked its 45th anniversary during a special net session on April 7, 2003. Over 140 check-ins were recorded, and that set a single-session check-in record for the net.

On this occasion, South Carolina Section Manager Jim Boehner, N2ZZ, said, "I applaud the net for the service it has provided to South Carolina and the fellowship provided to all of its members. It has brought many of the hams in South Carolina together, and I am very appreciative of all the friends I have met through that fellowship. Finally, to the SC SSB net and all participants—THANK YOU for your service to Amateur Radio!"

The SC SSB Net publishes an annual net membership roster that is a well-regarded resource for net operating and traffic-handling information. This year's officers of the South Carolina SSB Net include Net Manager Johnnie King, WA4UGD; Assistant Net Manager Joe Ferguson, W4JF; Secretary/Treasurer and editor of the net roster, Emmie Patience, KA4LRM; net historian Tom Shealy, WA4VYS. The 2001 SC Single Sidebander of the Year, Bob Good, K4BG, was the net control station for the special anniversary net session on April 7.

Field Organization Reports

Compiled by Linda Mullally, KB1HSV

Public Service Honor Roll
March 2003

This listing is to recognize radio amateurs whose public service performance during the month indicted qualifies for 70 or more total points in the following 6 categories (as reported to their Section Managers). Please note the maximum points for each category:
1) Participating in a public service net, using any mode. —1 point per net session; maximum 40.
2) Handling formal messages (radiograms) via any mode. —1 point for each message handled; maximum 40.
3) Serving in an ARRL-sponsored volunteer position: ARRL Field Organization appointee or Section Manager, NTS Net Manager, TCC Director, TCC member, NTS official or appointee above the Section level. — 10 points for each position; maximum 30.
4) Participation in scheduled, short-term public service events such as walk-a-thons, bike-a-thons, parades, simulated emergency tests and related practice events. This includes off-the-air meetings and coordination efforts with related emergency groups and served agencies.—5 points per hour (or any portion thereof) of time spent in either coordinating and/or operating in the public service event; no limit.
5) Participation in an unplanned emergency response when the Amateur Radio operator is on the scene. This also includes unplanned incident requests by public or served agencies for Amateur Radio participation.—5 points per hour (or any portion thereof) of time spent directly involved in the emergency operation; no limit.
6) Providing and maintaining a) an automated digital system that handles ARRL radiogram-formatted messages; b) a Web page or e-mail list server oriented toward Amateur Radio public service — 10 points per item.
Amateur Radio stations that qualify for PSHR 12 consecutive months, or 18 out of a 24 month period, will be awarded a certificate from Headquarters upon written notification of qualifying months to the Public Service Branch of Field and Educational Services at ARRL HQ.

595
N2CCN
550
N9TVT
540
W2MTA
490
K6SOJ
425
N2LTC
N9VE
420
W7TVA
413
KC2DAA
373
N2YJZ
350
KA2ZNZ
275
N5NAV
256
NN2H
230
KB2SNP
N2HQL
227
KB2ETO
222
N2IKR
215
KB2RTZ
214
KK3F
210
KA2GJV
KB2CCD
W2LC
205
AB2IZ
W5ZX
200
WI2G
194
AD4BL
190
KB2KOJ
189
N9NKO
185
AG9G
180
WA9JWL
168
K6YR
161
N1IST
160
W2MTO
KB2VRO
159
WNØY
155
W7ARC
150
KD1LE
KG4CHW
146
N2JBA
N2OPJ
KAØDBK
145
W9RCW
140
WB5ZED
KG9B
139
W4CAC
130
N7DRP
NØBN
W5IM
N8IO
K9FHI
127
N4TAB
125
K4RLD
KB3GFC
N2GJ
AD5KE
K9LGU
123
WB2LEZ
121
K4DND
120
WB1CHU
AB4XK
W4EAT
K4IWW
AF2FK
W1GMF
KW1U
N3RB
WX4H
WX4J
K9KNJ
WBØTAQ
AC5XK
W3BBQ
WA4DOX
KA4FZI
KD4GR
WA9ZTY
W6IVV
W4ZJY
W8YS
W6QZ
115
K4BEH
KA2YKN
KØIBS
K4YVX
KF6OIF
110
K5MC
WA1JVV
KE4JHJ
KG4FXG
AF4NS
K8GA
N8FPN
KL5T
KC7SGM
N7YSS
N1LKJ
K2UL
AG4DL
NR2F
W5GKH
N5OUJ
KG4OTL
K5UPN
KC5OZT
WA2YL
KC4ZHF
N3SW
W6DOB
N8NMA
KF5A
NJ5M
WA5OUV
N5IKN
W7QM
W7ZIW
KEØXQ
W7GB
108
N3WAV
107
KB4KA
NB4K
106
W4CC
WA1QAA
W4NTI
W6JPH
105
KG4OQA
K2ABX
N2AKZ
KB9KEG
KO4OL
103
N2JRS
102
WB2KNS
101
KBØDTI
N8JAT
K4FQU
NN7H
100
W1QU
K5IQZ
W1ALE
K4SCL
ABØWR
WØWWR
AA8SN
KC2EOT
WB2QIX
N7CM
WB2GTG
KB2KLH
N1IQI
KC3Y
WJ2F
N9MN
N1VXP
K9PUI
KA5KLU
WA8SSI
KV4AN
K3SS
KB5TCH
KD5SWI
WA4EIC
WA9VND
W9CBE
K2BCL
KD4CQJ
WW8D
KK5GY
AF4QZ
KA4UIV
W7LG
K4DZM
K7GXZ
W7GHT
99
W7TC
98
AC5VN
97
W4DLZ
WD4LSS
96
KD1SM
WB6UZX
95
W2GUT
N3WK
W2CC
NQ4U
KJ7SI
K8VFZ
94
N7TOD
W4AUN
93
K5DPG
AL7N
WA2YBM
KC2IYC
92
WD9F
91
KD4EFM
AA4BN
90
W4WXA
WB4GGS
K4WKT
WB4BIK
KG2D
WB2IJH
KE2SX
NG1A
AA3GV
AA2SV
WA2CUW
K1JPG
K8KV
KF4WIJ
KA1GWE
K9GBR
N3KB
N8DD
N8OD
K3CN
K2VX
W5OMG
WB4PAM
W4CKS
K6IUI
89
K1FP
WA8RCR
88
NØSU
WA2GUP
WA2YOW
WB5NIC
87
WA5LQZ
WB4UHC
86
N2RTF
W7VSE
N7LV
85
W8IM
KC6NBI
84
W5PY
W7EP
KK7TN
83
W3CB
AB2LF
WD9FLJ
82
KD5ITA
K1TSV
81
N3OR
80
AA4YW
K8KHZ
WA8DHB
KA2BCE
K4WWV
N1YVV
WB9OFG
KB5PGY
KG4MLD
KE4UOF
N8FXH
79
KG4MLC
W4DGH
78
KG4QIP
77
AK6DV
WØHXB
76
N1TPU
N2VQA
KJ5YY
AC5Z
KC6SKK
75
NF5B
W4PIM
WD8DHC
W5RXU
74
W1JTH
K5ER
N5KWB
WA2WMJ
WA4JPK
KB8NDS
KV4O
72
WAØLYK
K8SH
W7DPW
71
W4FAL
W5ARS
70
KF4OCU
N3WKE
K1VDH
W5XX
N4VVX

The following stations qualified for PSHR points in January, 2003, but were not recognized in this column: W8YS 120, WW8D 110, N8NMA 106, KA8WNO 90, WD8DHC 90, N8FXH 77, KB8NDS 74.

Section Traffic Manager Reports
March 2003

The following ARRL Section Traffic Managers reported: AK, AL, AR, AZ, CT, EB, ENY, EPA, EWA, GA, ID, IL, KS, KY, LA, MDC, ME, MI, NC, NFL, NH, NLI, NM, NNJ, NTX, NV, OH, OK, OR, ORG, SB, SC, SD, SDG, SFL, SNJ, SJV, STX, TN, VA, VT, WCF, WI, WNY, WPA, WV, WWA, WY.

Section Emergency Coordinator Reports
March 2003

The following ARRL Section Emergency Coordinators reported: AK, AR, AZ, EWA, IL, KS, KY, LA, MDC, MN, MO, NC, NE, NFL, NLI, NV, SFL, SC, SNJ, SV, TN, WMA, WNY, WPA.

Brass Pounders League
March 2003

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*
W1GMF	0	1792	2838	31	4661
W4ZJY	0	1031	1083	0	2114
KK3F	40	933	869	64	1906
KW1U	0	759	653	11	1423
N2LTC	0	592	573	55	1220
N1IQI	0	334	1046	0	1380
WB5ZED	69	461	372	19	921
K7BDU	21	384	477	3	885
K9JPS	0	403	32	400	835
W4EAT	0	418	404	2	824
K2BCL	16	295	280	42	633
NG1A	0	309	309	0	618
WB1CHU	23	262	69	244	598
W6DOB	0	181	349	39	569
W9RCW	0	272	21	265	558
K5UPN	23	289	209	7	528
W7TVA	59	203	192	70	524
KF5A	0	240	284	0	524
WB2GTG	0	212	255	46	513
N1LKJ	2	248	175	78	503

BPL for 100 or more originations plus deliveries: K9GU 233, N9VE 181, W9IHW 175, NJ5M 147, W7TVA 129.

Back to Basics

One of the recurring themes I get via messages and in my travels is interest in learning how to get started on "weak signal"—SSB/CW—VHF work. As we approach the summer, generally the best time for VHF, I want to address this issue. Many call these "weak signal" modes because we can copy CW and SSB signals that are barely above the noise, while FM requires a reasonably high signal level for communication. FM signals go from noisy to strong or "full quieting" in the range of a few decibels. Yet, SSB/CW signals are often far from weak. I will use VHF specifically to mean SSB/CW VHF.

What follows is a very basic look at assembling a VHF+ station: what to think about, what to buy and how to put it together. Not that I want you to avoid any building—it's a lot of fun—but I will emphasize plug and play wherever possible.

First a few caveats. What you will read here is basic—there aren't many frills. What I say is colored to some extent by my own experiences and my own biases. This isn't the *only* way you can get on the bands above 50 MHz from a permanent or portable location. It is *one* way. The information should help you decide if you want to try these modes and then help you get on the air.

Before You Begin

Assess Your Location

VHF communication is affected more by location than is HF operation. You will need a horizontally polarized antenna, usually a Yagi, and that ultimately means a rotatable outside antenna and sufficient space to erect it. Throwing a wire over a tree is not very effective. If you are prohibited from erecting outside antennas by covenants or zoning restrictions and you have no alternative (like an attic that is not covered with metal siding) VHF operations may not be feasible at your location. You also need to look at the physical characteristics of your location. Most VHF propagation uses line-of-sight paths, rather than skip (reflecting signals off layers in the ionosphere) like HF. Relatively nearby physical obstacles like tall mountains are not conducive to VHF operations.

Reread the January 2003 World Above 50 MHz Column

No matter how much you read articles like this one, there is no substitute for an Elmer. Look for someone to answer your questions in real time and guide you on the road to VHF operation. Seek out a local VHF operator or VHF-oriented club, if such exists in your general area. These are great sources of knowledge and help and they will welcome a newcomer interested in joining them on the VHF bands.

Choice of Bands

Your choices are simple for your first trip to the VHF bands: either 6 or 2 meters. Which you choose depends, to some extent, on where you are located and whether you want your activity in chunks or more evenly spread out during the year. Let's briefly discuss what they offer.

6 Meters

The heady days of the fall of 2001 and winter of 2002 are gone, and sunspot Cycle 23 is now clearly headed rapidly for a minimum. Yet, sporadic-E (E_s) short skip enlivens the band in the spring and summer. Those who live in the more Southern latitudes and/or who do not live near a major urban area should seriously consider starting on 6 meters.

2 Meters

Contacts out to 500 km and often even to 700 km are regularly possible on 2 meters with a station running a small amplifier such as we will describe later in this column. Particularly near big cities, day-to-day activity on 2 meters is often greater than on 6 meters. If you live within 300 km of a large city, consider beginning on 2 meters.

Radios

There are generally three different approaches to getting on VHF: HF/VHF+

This Month

May 31-June 2	Six Club Worldwide Contest—Friday 2300Z until Monday 0200Z
June 8	Good EME conditions*
June 14-16	June ARRL VHF Party Saturday 1800Z until Monday 0300Z
June 21-22	2003 SMIRK QSO Party—Saturday 0001Z until Sunday 2400Z
June 28-29	ARRL Field Day Saturday—1800Z until Sunday 2100Z

*Moon Data from W5LUU

Table 1

Current VHF+ Transceivers and Transverters

Only 50, 144, 432 MHz and satellite capability are noted. Downeast Microwave and SSB have a complete line of transverters for all VHF+ frequencies. Complete details on each radio can be found at the manufacturers' or dealers' Web sites.

Company	*HF/VHF+*	*VHF only*	*Transverters*
Alinco	DX-70T (A)		
Downeast Microwave			50-28 (A) 144-28 (B)
ICOM	IC-706MkIIG (ABD) IC-756PROII (A)* IC-746PRO (AB) IC-703 (A)*	IC-910H (BDS)	
Kenwood	TS-2000 (ABDS) TS-570S (A)		
MFJ		MFJ-9406X (A) MFJ-9402X (B)	
Ranger		RCI-5054DX (A)	
SSB Electronic			LT6S (A) LT2S (B)
Ten-Tec			1208A (A) 1210A (B)
Yaesu	FT-100D (ABD) FT-857 (ABD)** FT-847 (ABDS) FT-920 (A) FT-817 (ABD)* FT-897 (ABD)*		FT-1000MPMkV + FTV-1000

A=50 MHz; B=144 MHz; D=432 MHz; S=full-duplex satellite mode.
*Portable/backpack operation with batteries.
**Replacement for the FT-100D.

Gene Zimmerman, W3ZZ ♦ 33 Brighton Dr, Gaithersburg, MD 20877 (tel 301-948-2594) ♦ w3zz@arrl.org

transceivers, VHF+ transceivers and HF transceivers with transverters. I will discuss currently available new radios although comparable used radios are a less expensive route to go. The HF/VHF transceivers probably represent the easiest approach, with several avenues to VHF operation. Small fixed/portables like the ICOM IC-706 series and the Yaesu FT-100/800 series cover three V/UHF bands. Radios like the ICOM IC-756PRO cover HF and 6 meters. All-in-one radios like the Kenwood TS-2000 cover HF and up to 4 VHF+ bands with built-in packet and full duplex OSCAR satellite operation. These and several other radios are featured in Table 1.

Alternatively, there are a few VHF-only choices available. With the exception of the ICOM IC-910H, most of these are very basic radios. There was a time when these statistics were reversed, but the advent of broad-frequency power modules has revolutionized the design of VHF+ radios. Technology has made adding VHF to HF much easier than it once was.

Serious VHFers often use transverters ahead of good HF transceivers that function as IF strips. This route is somewhat more complicated than buying an HF/V/UHF transceiver. Many transverters are only available direct from the factory or from the importer. If you are interested in a certain band and can acquire a transverter for that band at reasonable cost, integrate it with your HF transceiver and try it.

A word about amplifiers is in order here. Radios running 50-100 W do not require an amplifier. While a 10 to 25 W radio is a good starting point, you may need a little more power to reach some of the more-distant stations you'll hear. If the band is open with short skip on 6 meters, 10 W is often enough because there is very little attenuation, but eventually you may want more power at your disposal. Amplifiers—often called "bricks" because of their compact rectangular shape—are readily available for reasonable prices either new or used. The standard 30-A, 13.6-V power supply will readily run both a 10/25-W exciter and a 100-150 W brick.

Antennas and Transmission Lines

All SSB/CW VHF+ operation uses horizontal polarization. Because the wavelengths are small, almost everyone uses a beam. At VHF, even a small beam is likely to work well. Look for antennas from companies that specialize in VHF antennas and/or antennas designed by well-known antenna experts like K1FO. Those who would like to build a simple alternative that costs next to nothing should review WA5VJB's Cheap Yagis mentioned in the March 2003 column.

Whatever you do, mount the antenna in the clear and above the ground clutter—that usually means at 8 meters high or higher. Extreme heights are unnecessary. In fact, an antenna at 12-14 meters may be better for 6-meter E_s than one two or three times higher. Relatively small beams work quite well. Even a three- element beam on 6 meters will work adequately. On 2 meters, there are a number of Yagis available with boom lengths between 2 and 2.5 λ (about 4-6 meters) all of which work quite well. I worked over 30 states from Maryland on 2 meters with 150 W and a 4-meter-boom Yagi that was much less effective than the modern computer-designed Yagis.

Once you have decided to put up VHF antennas, don't skimp on the transmission line. Losses at VHF are substantially greater than at HF. Use nothing less than high quality coax the diameter of RG-213. You should look for low-loss, flexible versions of coax like Belden 9913F7 or Times Wire LMR400UF. Ask if the coax has an air/microcellular-foam dielectric and an outer jacket resistant to UV. If your coax dealer doesn't know what you are talking about, find another dealer.

Accessories

A few additional components can make your life a little easier. One is necessary—a high quality 12-V power supply of sufficient current capacity to run the rig you are using. If your radio does not have a built in SWR bridge—and most do not—a VHF SWR bridge is useful. Remember, however, that your HF SWR meter is nearly always quite accurate on 6 meters. Finally, get a dummy load that will handle at least 100 W up to 2 meters and preferably higher—you might as well plan. Used in concert with the VHF SWR bridge, this will tell you how your radios are working into a perfect load.

Whether you buy your equipment new or used—or scrounge up some from your friends, give the world of SSB/CW VHF a try. You'll be glad you did.

ON THE BANDS

Six-meter and VHF through SHF conditions picked up some this March, but remained very variable.

Tropospheric Ducting

Gulf Coast tropo and North/South tropo in the Midwest continued into March. On March 7, Greg, W4OZK (EM64), reports a 2-meter contact with K5DYY (EL07). Meanwhile Tom, K5VH (EM00), worked W4HP (EM75) on 23 cm. On March 8, Tom found excellent high-microwave conditions, logging contacts with W5ZN (EM45) on 10 GHz and W4ZRZ (EM63) on 23 and 13 cm. Ron, K5LLL (EM10), logged new grids on 13 and 9 cm with W5ZN. By March 10, Bob, K4WRI, notes that the tropo had moved east with W1RLB (EL98) working ZF1DC (EK99hg). John, NEØP, reports a nice opening to the north with among other stations NØLIE (EM27), WRØF (EM29) and NØDQS (EN22) on 2 meters and with NØLIE and WRØF on 70 cm.

Aurora

The magnetic field was very unsettled in March with a number of minor storms where the K index reached five and the A indices exceeded 20, but buzz propagation reports were scarce. Greg, N8CJK (EN84), reports 6-meter AU (aurora) on 12 separate days in March with 125 contacts ranging from New England to the Dakotas and southward. On the 29th, he was the only W to work Al, KL7NO, via AU E_s.

6-Meter F2/E_s

The big 6-meter news was numerous contacts with the VP6DIA (Ducie Island) DXpedition with operator Philippe, FO3BM. The honor of the first contact on March 9 belongs to Dianna, KB6NAN, at 2302Z, followed closely by Bob, K6QXY (2304Z). Over the next few days, the reports I received indicate widespread success ranging from Florida (K4RX, AC4TO, K4MZ all EM70) to western Texas (W5OZI), Oklahoma (W5NZS), South Carolina (K4MQG) and Tennessee (K8WW) the farthest north, among others.

Most of the reports featured north-south F2, TE and TE/E_s propagation. Contacts to South America and the Caribbean were bunched around the middle of the month (especially March 11 and 17) and toward the month end. March 31 featured a lot of backscatter and contacts from W6ORS/KH6 and KH6IAA (BK29) to LU/CX. The 17th also featured a widespread E_s opening. Among the successful participants were N3DB, K4KLK, K5AM, K5IX, W5OZI, K6LMN, K7JA, KØHA and NØJK. The month went out on a strong note with high geomagnetic activity leading to good north/south F2 propagation from many places in the US. Finally, from Okinawa (PL36) comes word from Hatsuo, JA1VOK, of contacts with 9J2KC on March 12, YA4F on March 23 and several contacts with S21YY and VQ9DT in spite of the low flux.

Microwaves

Dave, K2DH, sends an interesting report on the Rochester (New York) VHF Group Microwave Marathon on March 15. There, the participants tried to achieve VUCC on the 24-GHz band in one day. Seven stations were active (K2LDU/VE3, WO2P, K2EHF, KB8VAO and K2DH) operating fixed and portable from seven different grids. K2DH and K2EHF both worked VUCC. Signals were quite strong all day, especially the over-water paths. K2EHF has the best DX at 208 km FN02wv to FN23av.

HERE AND THERE

New Scattering Mode on 10 GHz

Ernie, W7LHL, sends an interesting note providing details of an unusual upper-troposphere scattering mode on 10 GHz from nonmountaintop locations over heavily occluded paths up to 210 km. The scattering medium appears to be ice crystals within high-altitude cirrus or cirrocumulus clouds similar to those that form halos around the moon. A temperature between the two stations colder than –40ºC appears to be necessary for communications. Signals varying from weak to strong are narrow in bandwidth with some spreading using CW, JT44 and PUA43 modes. Contacts can be made using the digital modes using signals that cannot be detected by ear.

144-MHz Standings

Published 144-MHz standings include call-area leaders as of April 1. For a complete listing, check the Standings Boxes on the World Above 50 MHz Web pages at **www.arrl.org/qst/worldabove/**. To insure that the Standings Boxes reflect current activity, submit reports at least every two years by e-mail to **standings@arrl.org**. Printed forms are available by sending a request with an SASE to Standings, ARRL, 225 Main St, Newington, CT 06111.

Call Sign	State or Province	States Worked	DXCC	Grids	DX† (km)
K1CA*	NH	50	112	—	—
K1MS*	MA	50	32	—	2166
W1JR*	NH	50	23	203	2304
W1AIM*	VT	50	18	199	2276
K1SIX*	NH	43	14	201	2501
WZ1V	CT	38	10	279	2700
W1REZ	ME	36	6	182	2587
K1TEO	CT	36	5	219	2420
W3EP/1	CT	36	3	173	2450
W1ZC	NH	35	2	174	2466
K1LPS	VT	31	2	96	2273
W1LP	MA	30	5	110	—
K1AE	MA	29	3	—	2049
WA1ECF	MA	28	4	102	2340
K2AXX	NY	40	4	212	2350
WB2CUT	NJ	37	2	149	—
W2MPK*	NY	36	8	—	—
K2OVS	NY	36	5	131	2812
K1JT	NJ	36	3	120	2123
W2FCA	NY	26	2	84	2047
W3HHN	NY	25	2	71	2024
WA2ZFH	NY	24	3	52	2208
W3CMP*	PA	50	64	408	—
WA2FGK*	PA	45	36	238	—
W3ZZ	MD	38	7	247	2527
AE3T	PA	37	3	—	2510
K3KEL	PA	35	2	125	2120
K3ZO	MD	34	1	120	—
WA3DMF	MD	32	4	55	2050
WA4MVI*	SC	50	59	—	2498
W8WN*	KY	50	50	327	2273
W4MW*	NC	50	36	—	—
NB2T	FL	46	2	85	2270
W4WTA	GA	40	4	175	2413
W4DEX	NC	40	—	—	—
WB5APD	GA	38	6	239	2011
K4QI	NC	37	5	211	—
AA4H	TN	37	3	167	2007
KU4WW	AL	37	2	140	2968
KG4BMH	TN	37	2	135	2019
K4ZOO	VA	36	4	190	2162
K4RWP	TN	36	1	161	—
N4MM	VA	35	5	149	—
K4MSG	VA	21	2	64	1607
W5RCI*	MS	50	38	278	2150
W5ZN*	AR	50	36	305	2400
WD5AGO*	OK	50	33	255	2050
W5UWB*	TX	50	29	104	2197
K5CM*	OK	50	—	—	—
W5LUA*	TX	50	—	—	—
K5UR	AR	48	5	465	—
K5SW	OK	47	5	291	2269
K5MQ	LA	45	4	232	2545
KM5ES	OK	43	4	175	2369
NE0P	OK	39	1	108	2171
N5KDA	MS	38	4	184	2257
W5HNK	TX	37	3	—	2442
NL7CO	OK	36	2	147	2151
AA5C	TX	34	2	184	2202
K5LLL	TX	34	2	135	2442
WA5IYX	TX	32	2	110	2243
K5TN	OK	32	1	128	2025
AA5AM	TX	31	3	124	2271
N5HYV	LA	28	1	105	—
W5OZI	TX	24	2	138	2268.2
K6AAW*	CA	50	56	362	3831
WA6PEV*	CA	50	52	—	—
K6PF*	CA	41	31	—	—
K6QXY*	CA	24	8	—	3794
N6ZE*	CA	22	16	115	2600
W6TOD	CA	21	3	—	—
W7GJ*	MT	50	110	—	—
AA7A*	AZ	50	54	419	2983
W7RV*	AZ	50	29	257	2937
W7MEM*	ID	47	39	267	16034
K7XC*	NV	31	16	167	4056
WA7GSK	ID	29	2	197	3635
K8BHZ*	MI	50	45	362	2278
W8PAT*	OH	50	35	178	2207
W8WVM*	WV	50	29	135	1560
WA8EOJ	OH	39	3	199	2198
K2YAZ	MI	38	2	162	2167
N8KOL	OH	38	2	160	2035
W8QXO	OH	36	1	—	2092
WB8XX	OH	32	2	117	1759
KF8DX	MI	27	1	79	2450
N0AKC*	WI	50	30	228	2295
W9EME*	WI	44	18	—	2500
W9JN*	WI	43	12	242	2261
KA9UVY	IL	41	4	156	2373
N9NJY	IL	39	4	166	1655
WA9PWP	WI	32	2	138	1940
KA9UZW	WI	30	2	122	1884
W0HP*	MN	50	86	—	—
K0PW*	MN	50	39	356	2362
K0FF*	MO	50	34	267	2185
W0VD*	MO	50	26	307	—
W0RT*	KS	50	3	206	2298
KM0T	IA	48	2	185	2308
KM0A*	MO	47	11	387	2780
N0LL	KS	47	3	377	2378
K0SQ	MN	46	3	240	2804
N0HJZ	MN	46	2	222	2500
N0PB	MO	45	5	227	2058
KW0A	MO	45	2	244	2501
W0OHU	MN	45	2	181	2040
N0UK*	MN	44	2	201	2053
K0CJ	MN	44	2	—	2330
WA0KBZ*	MO	43	4	170	—
W0JRP	MO	43	3	219	2340
K0AWU	MN	42	2	147	2095
K0VSV	IA	41	2	169	2080
N0VSB	CO	36	4	164	2353
KA0PQW	MN	34	2	—	2122
WY0V	IA	33	2	119	—
WA2HFI/0	MN	31	2	126	2057
K0RZ*	CO	26	2	108	2390
KR0I	MO	26	2	88	1595
Canada					
VE3FKX*	ON	41	8	—	—
VE3DSS*	ON	38	3	—	2190
VE3TMG	ON	30	2	156	1918
VE4KQ	MB	23	2	80	1753
DX					
KL7X*	AK	49	36	177	—
XE2AT		2	2	2	1635

*Includes EME contacts
†Terrestrial
—Not given

The stations are using from 1 W to a few watts feeding small dishes and employ small amounts of upward tilt to point at the common scattering volume at 8 km up. Experiments have been conducted between the home stations of W7LHL, KD7TS, W7PUA and W7SZ. In-depth details will appear in an article scheduled for the Jul/Aug 2003 *QEX*.

DXpeditions to Bermuda

Don't you have a card from VP9 yet? You're in luck. Not one but two operations are planned for the month of June. Jon, NØJK, operating as VP9/NØJK will be active just before and during the ARRL VHF contest commencing on June 13 and ending on June 16. He favors 50.102 MHz and will have 2 meters available on 144.200. Chris, W3CMP, operating as VP9/W3CMP will be active from June 27 through July 5 on both 6 meters (50.105 MHz) and 2 meters (144.200 MHz). Chris says to watch for him on 2 meters around dawn and slightly later using scatter paths.

Microwave "Ham Social"

From Al Katz, K2UYH, comes news of a "Ham Social" at this year's IEEE/MTT International Microwave Symposium in Philadelphia. The reception is scheduled for Sunday June 8 from 7:30 to 9:30 PM in the Conference Center, Room 307 AB. The corporate sponsors for the social are Linearizer Technology, Sonnet Software, Synergy Microwave, Paradise Datacom, Thales, Analog Devices and High Frequency Electronics Publishing.

Results of the Fall Sprints

Jim, W4KXY, reports that the 222-MHz Sprint had the greatest activity. The results can be found on the Southeastern VHF Society Web site at **www.svhfs.org/.** The winners include:

- 50 MHz—W4MW, W3SO, W4WA (N7EPD/R top rover);
- 144 MHz—AK3E, K6TSK, K5YM (WB2SIH/R, AC6TA/R top rovers);
- 222 MHz—W4DEX, KE8FD, K8TQK;
- 432 MHz—WZ1V, AK3E, WA3DRC;
- Microwave—W3IY, K1DS, K8TQK (W3HMS/R top rover).

Congratulations to all!

Six Club WW Contest

Sponsored by the Six Club, this contest begins May 30 at 2300Z and runs through June 2 at 0200Z. Bonus points for working Six Club members. Details can be found at **6mt.com/contest.htm**.

2003 SMIRK QSO Party

The 2003 Six-Meter International Radio Klub (SMIRK) QSO party will be held 0001Z June 21 to 2400Z June 22. Rules can be found at **www.smirk.org/**.

June ARRL VHF Contest

The most interesting of the major ARRL VHF contests runs from 1800Z June 14 to 0300Z June 16. This contest usually features lots of 6-meter E skip. See details in May *QST*, p 101, or at **www.arrl.org/contests/rules/2003/june-vhf.html**. QST

VHF/UHF CENTURY CLUB AWARDS

Compiled by Eileen Sapko Awards Manager

The ARRL VUCC numbered certificate is awarded to amateurs who submit written confirmation for contacts with the minimum number of Maidenhead grid locators (indicated in italics) for each band listing. The numbers preceding call signs are the assigned award numbers, issued in order of date received. The numbers following the call signs indicate claimed endorsement levels. The totals shown are for credits given from February 8 to April 9, 2003. The VUCC application form, field sheets and complete list of VHF Awards Managers can be found on the VUCC Web site at **www.arrl.org/awards/vucc**. An SASE to ARRL is required if you cannot download these forms. If you have questions relating to VUCC, send an e-mail to **vucc@arrl.org**.

50 MHz
100

1281 W7YM
1282 WB6CGZ
1283 KB8U
1284 KD5OMJ
1285 W3STU
1286 KA0MWA
1287 K3TRM
1288 W5JLC
1289 KG8WB
1290 K5YPV

G1EFL 200
OK1MP 425
VE3TMG 425
K0AZ 500
W0RT 150
K1TOL 1150
K1NU 150
N2WK 600
AK3E 525
K4JAF 375
N4UFP 300
W5CIA 200
W6OMF 350
W7JW 550
KI8G 550

144 MHz
100

613 KB8U
614 AK3E
615 NE0P/5
616 K5YPV
W0RT 200
K0AZ 150
W7JW 350

222 MHz
50

113 KB8U

432 MHz
50

302 KB8U
W0RT 100

2.3 GHz
10

68 K0VXM
69 KB8U

10 GHz
5

132 KB8VAO
133 VE3SMA
AA5C 45

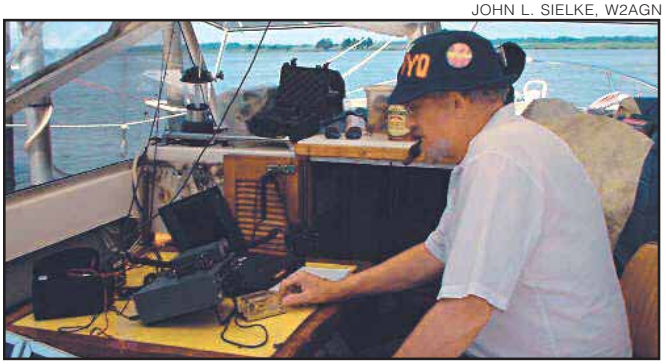
Satellite
100

125 K8KFJ
K9HF 350

QST

QRP Field Day

JOHN L. SIELKE, W2AGN



During FD2002, club trustee John Sielke, W2AGN, operated this battery/solar powered station aboard the 26 foot boat *New Joycie*. He made 360 QSOs, all QRP CW for W2DWC, the E. L. Sielke Memorial Radio Club.

CQ Field Day, CQ Field Day, this is WB3WVC calling CQ Field Day and by!

And so it begins. The largest emergency communications exercise in the world. Every year, during the last full weekend in June, thousands of Amateur Radio operators leave the comfort of their shacks and head into the bush to participate in the annual ARRL Field Day. This year Field Day occurs on June 28 and 29. Kickoff is 1800Z (UTC) Saturday and ends at 2100Z Sunday evening. Field Day is open to all amateurs in the area covered by the ARRL/RAC field organizations *and* stations in other countries within IARU Region 2. While DX stations outside Region 2 can be contacted for points, they are not eligible to submit entries to the ARRL.

While many people believe that Field Day is a contest, in reality it is *not* a contest but a method to test the readiness of amateurs to operate under adverse conditions at non-improved sites simulating emergency operating conditions. Field Day, in essence, is a training ground for emergency communications (EMCOMM) operators to hone their communications skills and develop their problem-solving abilities while working under stressful, less-than-optimum conditions. Additionally, Field Day serves as a way to acquaint the general public with Amateur Radio. Special bonus points are given to individuals and groups who set up their Field Day stations in public areas and provide the local news media with information about Amateur Radio.

While points are assessed for each contact, and Field Day might feel like a contest, the real intent is much more intense. We radio amateurs are expected to provide emergency communications support in times of natural or man-made disasters. This is part of our licensing charter with the FCC. As Field Day is a training exercise for emergency communicators, and while it is fun to participate in a "contest," participants must not lose sight of the overall objective: to improve their emergency communications skills and their ability to deal with adversity.

A "Holy Day of Obligation"

Field Day is one time when QRP operators can really show their side of the hobby off to the rest of the ham radio fraternity. My active participation in Field Day goes back over 30 years. In all this time, I have never had more fun and learned more about ham radio than on my various Field Day outings. From my first humble solo effort with my trusty Heathkit HW-7 and a vertical antenna on the sunny shores of Lake Thunderbird in Oklahoma to my recent efforts with an Elecraft K2 and some really big antennas on the Wilkes University campus, I have assimilated a lot of good "how-to" information regarding radio communications. Ask any of the folks who turn out for Field Day and you will find this one event is a tremendous learning tool and training ground. Old timers pass along their experience and tips to the new guys (and gals) and "thinking outside the box" becomes the norm.

One thing I and every other QRPer have found is that our 5 W signals propagate just fine and we can be heard by virtually anyone we call. It is amazing what an equalizer Field Day really is when it comes to the difference between 5 and 100 W. Check out some of the QRP entries in the December 2002 issue of *QST*, and you'll find that many of the small QRP groups and clubs turn in some amazing scores for only using 5 W or less. In fact, many of these QRP scores rival their higher power counterparts. Amazing? Not really. It's called operator competence. By far, the majority of QRPers are superb operators by virtue of the fact that they must hone their communications skills to make up for the lack of raw RF power. This fact, coupled with QRPers' desire to utilize some really efficient portable antennas, makes for some outstanding Field Day scores. I know of several QRP Field Day groups that design, model, build and test high efficiency wire antennas for six to eight months of the year, with the intent of using them on Field Day. Now *that* is dedication to the cause! With that kind of preparation is it any wonder their scores soar?

Edsel Murphy University

Without a doubt, Field Day tests not only operating skills but the participant's abilities to cope with problems that arise prior to and during the event. Nothing taxes the capabilities of the QRPer like Field Day. This weekend truly belongs to Edsel Murphy. You remember Murphy's Law: "If anything that can go wrong it will go wrong, at the most inopportune time and at the greatest possible cost."

Allow me to elaborate by revealing some things that I have actually encountered regarding Field Day and Edsel Murphy. First there was the large club (which will remain nameless) that had a disproportionate number of degreed engineers among its membership. Several of these rocket scientists got together and designed a killer loop antenna for 80 meters. They erected the antenna, and checked the SWR and found it needed some tweaking. They proceeded to optimize the SWR during the first part of Field Day. As evening descended they had great SWR but were having problems making contacts. Receive signal levels were down but these stalwarts kept plugging away into the night.

Morning arrived and it was my turn to hook my QRP gear up to one of their other antennas to make the low power/natural power source contacts for the

Rich Arland, K7SZ ♦ 25 Amherst Ave, Wilkes Barre, PA 18702 ♦ k7sz@arrl.org

club. As I commenced preparing my gear, I couldn't help notice that there was a piece of unterminated coax on the floor of the camper. I traced this out and found it connected to the tuning unit for the killer 80 meter loop antenna. I reentered the camper and traced out the coax on the back of the high power radio and found it terminated into the dummy load! All night long these guys had been calling CQ FIELD DAY and loading up the dummy load. The weird part is that they actually made some contacts! The score: Edsel 1, Rocket Scientists 0!

Another example occurred in the mid 1990s to another well recognized club (which will also remain nameless). Their *huge* 4 element, 40 meter wire beam was erected pointing in the wrong direction. Somehow the wire beam elements had been reversed during assembly! Undaunted, this group took Murphy by the horns. Club members dropped all but the driven element, which performed like a 40 meter dipole for close-in contacts. Then they pulled out a Radio Works Carolina Windom 160 and used this gigantic 234 foot off-center-fed dipole for the majority of their long-haul 40 meter contacts. As it turned out, the big Radio Works Windom fared quite well and their 40 meter score was on a par with previous years. Score tied…Edsel 1, Club 1.

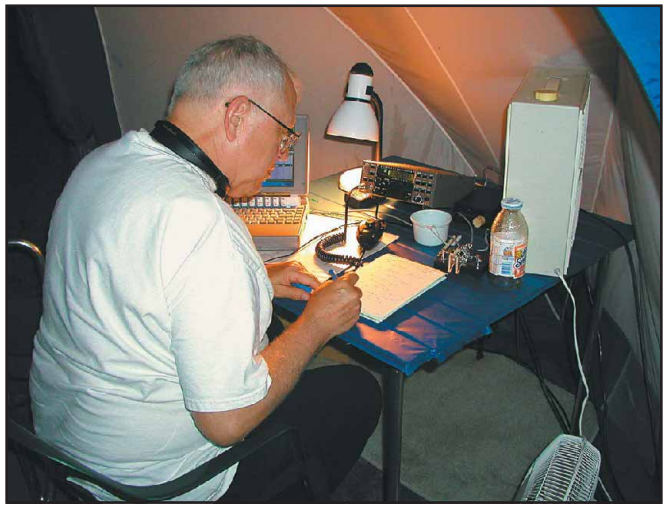
Who says old missile sites aren't great places to hold Field Day? Under the heading of "it sounded like a good idea at the time," another anonymous club decided to activate an old Nike missile site for their Field Day operations center. People started arriving on Saturday morning to erect antennas and set up gear. By the kickoff time there were five stations running full tilt. *Until dusk,* at which time the largest swarm of flying, biting insects I have ever seen descended upon these poor soft-skinned, carbon-based, life forms. No one had remembered the bug repellent! There was a mass exodus to the vehicles and several operators hightailed it out to the local 7-11 to get some Deep Woods OFF! Score: Edsel 1, soft-skinned Club members 0. Insects: well fed!

Finally, the Zuni Loop QRP Mountain Expeditionary Force (no name withholding with this one) was actually forced to curtail their Field Day activities in 1997 due to a forest fire that threatened their operating location on Table Mountain, outside Los Angeles. Score: Edsel 1, Zunis 0. Nobody ever said that life was fair!

It's the "Little Things"…

As you can imagine, Field Day extracts its toll on the participants and equipment. Good communications skills are only part of the equation. Ingenuity, tenacity, and adaptability are the key ingredients to a successful Field Day operation. Planning is essential with thought to packing redundant equipment and antennas to cover those instances where something goes really wrong.

DICK STEWART, K3ITH



Also during last year's Field Day, Carter Craigie, N3AO, operated his Elecraft K2 at less than 5 W on 15 meter CW. He made 104 QSOs on battery power as part of the Mid-Atlantic Amateur Radio Club, W3NWA, Field Day effort.

Of course, you can go a bit overboard, as witnessed by my 1996 visit to the Zuni Loop FD site. Fred Turpin, K6MDJ, and I drove up to Table Mountain in Fred's ancient Dodge Power Wagon. We were dressed for the occasion, with straw cowboy hats, blue jeans, t-shirts and boots. The Power Wagon was so overloaded with FD gear, antenna masts that stuck out the back of the bed and camping gear that we both feared we'd be stopped by the police. Fred's motto: "Take everything, including the kitchen sink" (or, in this case the BBQ grill)! Hey, if you've never had pizza done on a BBQ grill, you ain't lived. (And yes, I have the recipe.)

After a couple of hours in the open at the Zuni Loop site, I noticed my arms were glowing bright red. I was amazed since I had used SPF 25 sunscreen. John Moriarty, K6QQ, handed me some SPF 50 and told me to use it every hour. It seems that there isn't much ozone at 7600 feet to absorb the sun's UV rays. Oxygen is in short supply, too. Doug Hendricks, KI6DS, and I were walking up the trail and both of us were having difficulty breathing. I mentioned this fact and Doug said that while we both might be out of shape (there is no "might be" in my case!) the fact that we were over 7600 feet up might have something to do with our breathing difficulties.

Preparing for the "Real Thing"

In Field Day planning, the old adage, "You can't predict but you can prepare," are words to live by. Make lists of everything you *think* you'll need, then think worst case scenarios and plan for those contingencies. You will be surprised at the number of "extras" you will end up with in your final lists. I find it convenient to split the lists up in categories: radio gear, support gear (batteries, chargers, power cords, and so on), antennas (coax, connectors, tuners, and so on) and personal gear. Laminating the lists and keeping them with the various containers used to house your FD gear, allows a quick pre- and post- FD inventory to ensure that you don't forget anything.

This list-making exercise can be carried over into your EMCOMM planning. When you assemble your "jump kit," having an accurate inventory of your comm gear increases your ability to respond quickly with everything you'll need to be an effective emergency communicator.

The training you receive and the lessons you learn each Field Day will increase your EMCOMM skills and assist you in the event you are called upon to provide communications during a real-world emergency. Total QRP Field Day efforts are not only fun but a great source of camaraderie. Should you not have a group of QRPers in your area, however, offering your services to a local club by performing the low power (QRP) and natural power contacts for their bonus points will ingrain you to their cause. The usual spin-off of these outings with local clubs is that you will win some converts to QRP and, within a year or two, have a core group of QRPers with which to try your own total QRP Field Day effort.

With the events of 9-11-01, our place in the grand scheme of the defense of our nation should be very apparent. Anything we can do to become more adept at our jobs relating to EMCOMM will strengthen our nation. 73 and C U on FD! QST

Ham and Curry—A Short Visit to South India

By Henryk Kotowski, SMØJHF

Ham, bacon—any meats as a matter of fact—are not popular in India. This is probably no news to anyone. What surprised me was the popularity of ham radio there. The Indian prefix VU is not a total rarity on the Amateur Radio bands but you don't hear them every day. In places like North America, India is considered to be a difficult country to have a radio contact with. According to the latest figures, there are over 16,000 VU licensees—more than in Sweden or Poland. Surprised?

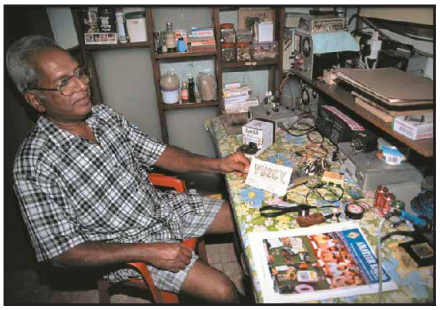
I went for a two week holiday in Goa, India in December 2002. Goa is one of the 28 states of the Republic of India—a very small one and very different. Goa had been Portuguese for centuries until 1961 when it was released to India. My interest in Goa was stirred by Luis Catulo, CT1CTZ, of Lisbon, Portugal. I met Luis in January 2002 when I made a stopover in Lisbon on my way home from a small equatorial island in Africa called Sao Tomé. I was on the air from Sao Tomé as S92JHF but Luis had lived in this island for 14 years and was quite active as CR5LC and S92LC. However, he was born in Goa and became interested in Amateur Radio there. At the end of the '50s and in the early '60s, Luis was CR8LC.

The present-day number of hams in Goa is not impressive. I managed to meet three active Goans: Cyril, VU2CY; Alex, VU2FCX, and Didier, VU2DM.

My interest in India began when I met Luis, CT1CLZ, in Portugal. Before he left Goa in early '60s he had worked at the international airport of Dabolim. Today, Alex, VU2FCX, works at this airport. He was on duty the morning I was leaving Goa and he found me in the crowd checking in. It was a pleasant accent to be seen off by one more Indian ham, proof of their great hospitality and the unique international friendship between hams.

Didier has the most advanced antennas in Goa and he does quite a bit of DXing. His proudly displayed DXCC award, one of several awards he has earned, was quite an effort. "Getting the cards is almost impossible from here," he told me. "The QSL bureau does not really exist in India and sending direct requests is very expensive." Average income, according to my inquiries, is 20 US dollars a month. Didier lives in the capital city, Panaji, and is capable of building and repairing radio equipment.

The crowd that showed up at a Mangalore restaurant to welcome me. From left: Srikanth, VU2SBJ; Prabhu, VU3BGS; Prakash, VU2JIX; Chandra, VU2RCT; Nayak, VU2NYK; Mur VU2MTT; Hedge, VU2HEG; Laxminidhi Tonse; Sukanya, VU2RDJ; Chetan, VU3DMP; Sukumar, VU3FEN; Rohit, VU2RDQ (OM of VU2RDJ), and Somashekhara, VU2NJN.



Cyril, VU2CY, at his operating table and workbench, QTH Cansa, Goa State. His regular ICOM transceiver was in Mumbai for service when I dropped in, so Cyril plays with a miniature homebrew transmitter for 7 MHz.

Cyril, VU2CY, who helped me to find Didier, is also interested in assembling small projects. He was just busy adjusting his QRP transmitter when I popped in at his house. I had found his address on **www.qrz.com** before going to Goa. One day I went to a town called Mapusa. After inhaling the smells of spices and recording the colors of the market on photographic film, I walked to the bus station. The first bus I saw had a "Cansa" sign. I recalled that Cansa was where VU2CY lived, so I jumped into the bus, showed his address to the fare collector and he nodded "yes, yes." In less than half an hour a woman told me to leave the bus and follow her. I approached a newly built house but was startled by the lack of any visible antennas. I rang the bell and soon I was talking to Cyril. His quad antenna was dismantled because the section of the house where it had been mounted was being remodeled. His ICOM HF transceiver was in Mumbai because of a dead back-up battery. Low power and low wires were the only items on his ham radio menu. Cyril spent most of his life working in Mumbai (the big city that until recently was called Bombay) but for retirement he moved back to Goa. He told me about Alex, VU2FCX, who lives in South Goa and is very keen on building and learning.

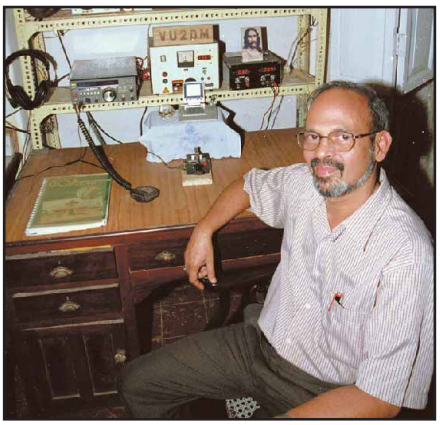
After a week in Calangute Beach in North Goa, I moved to Colva Beach in the south. These are "classical" places in Goa. From Colva Beach it was very close to Alex's place. A taxi brought me there, but Alex was not at home. Luckily his wife showed me around and even told me that their little son likes to play with daddy's radio. Alex has a selection of dipoles and inverted Vs.

From Colva Beach it was very close to the main railway station in Goa, the commercial hub of the state, called Margao or Madgaon. Railway is the common mode of transportation in India for greater distances. I went to Karnataka state one Friday, to the holy city of Udupi, about 250 miles south of Goa. The train was delayed but I was met by a small group of local hams who were waiting there patiently. There was Srikanth, VU2SBJ, whom I had been in touch with before leaving home, and his friends Somashekhara, VU2NJN, and Laxminidhi, license pending. They live in Manipal, a town a few miles east of Udupi, but they collaborate with the much larger ham community in a larger town to the south, Mangalore.

The reception organized by Srikanth was beyond all my expectations. Friday evening I was taken to one of the Hindu temples that Udupi is famous for. Filled with people and incense, with priests of sacrifice and sounds of gongs, the temple left an impression that I would not probably dare experience on my own.

The next morning we drove to the harbor of Malpe and took a boat to a small uninhabited island called St Mary's. This island was the site of a DXpedition in May 2001, as it counts for the Islands On The Air award (AS-096). Access to the island is easy but getting a permit to operate

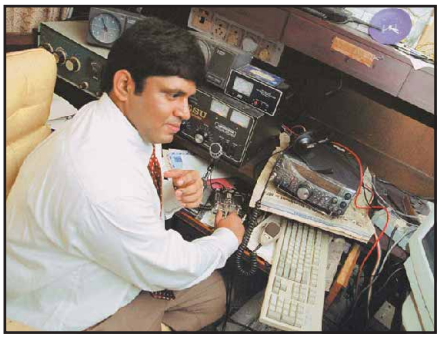
Bernie McClenny, W3UR ♦ 3025 Hobbs Rd, Glenwood, MD 21738-9728 ♦ w3ur@arrl.org



Didier, VU2DM, in his radio corner of the large house downtown in the capital city of the State of Goa, Panaji. The radio is a Yaesu transceiver but the power supply and some other accessories are home-made. Among his diplomas on the wall above the operating position are the WAC from IARU and the DXCC from the ARRL.

Somashekhara, VU2NJN, at his home in Manipal, where he teaches at the local college. His radio is an ICOM and he is mostly active on 40 and 20 meter bands.

Srikanth, VU2SBJ, in his radio nook in the attic that serves both as operating position and a workbench. Most of the equipment seen here is for free-of-charge repair.



Pai, VU2PAI, has the largest antennas in Mangalore, and a very well-equipped radio shack. Pai is very active on the air, especially during contests. He was actually attending a wedding party but left it for the sake of meeting me and showing his cozy operating position.

from here is not easy. The expedition group consisted of almost a dozen operators and supporters, most of them from Mangalore. They used 12 V car batteries, charged with solar cells, to power the four HF stations. Detailed information on this and the second IOTA DXpedition by the same group is posted on **www.vuiota.com**. The second DXpedition left for the Sacrifice Rock in Kerala State (AS-161) in January 2002 and was much more dramatic. Access to the rock is very difficult. What's next? Laccadive Islands, I presume. They are in the same direction, slightly farther to the west.

I was very curious to meet the people who have so much enthusiasm for Amateur Radio and expeditioning, so later in the evening we drove to Mangalore, some 50 miles south of Udupi. A group of several hams of different ages (and genders) were waiting for us. I was treated to a typical Karnataka meal and we talked for hours about activities and achievements, hindrances and difficulties, plans and wishes for the future.

Later, we dropped in at the home of Pai, VU2PAI, who was unable to come to the meeting. He was attending a wedding that evening but managed to sneak out for a few minutes and show me his shack. He has what is probably the most advanced antenna system in this area and he is probably the most active ham here. Pai has a very promising assistant in the person of Mur, VU2MTT. Both are quite young, very proficient, enthusiastic and ambitious. I am sure we'll hear a lot from them on the air.

Next day, Srikanth brought one more local ham with him to my hotel early in the morning. It was 80-year-old Bhat, VU2CT, and all five of us drove to visit the family of Somashekhara, VU2NJN, in the countryside. Eating off a banana leaf, sitting on the floor with crossed legs and no fork in sight was difficult in the beginning, which indicates how stiff one gets living in the so-called "Western comfort"!

Somashekhra, VU2NJN, has lived in Manipal for several years and is a teacher at the Institute of Technology. He has a new ICOM transceiver and a set of dipoles for the 40 and 20 meter bands. We tried his rig and checked into a local net on 40 meters.

Srikanth, VU2SBJ, lives not far away from VU2NJN. But his roof is full of radiators both for HF and VHF and his radio room is filled with radios and accessories. Antennas are mostly homemade and the radios are here to be repaired. Srikanth helps his local radio friends free of charge when their equipment fails. For a living, he manages a medium-sized software company in Manipal. An active ham radio operator for almost 10 years, Srikanth has other licensed hams in his family. Today he is one of the most dynamic Amateur Radio promoters in this area. He is engaged in organizing DXpeditions and hamfests, meetings and classes, emergency communications and keeping ham radios fit. And his hospitality is immense! I don't know how to repay him for all his time and kindness, showing me around, being my guide and helping me to meet so many local hams in just a couple of days.

Amateur Radio in VU

I learned quite a lot about Amateur Radio in India during this visit. For example, the late Prime Minister Rajiv Gandhi was VU2RG and was instrumental in legislative changes that promoted our hobby in the 1980s. In 20 years the number of VU licenses increased tenfold. There are several organizations and large clubs. Amateur Radio Society of India in Delhi represents the Republic of India in the IARU. The country is very large and the population of over one billion speak so many languages that it is necessary to have more local associations. The licensing authority, located in Delhi, is very slow—it can take years to get a license application processed. This is in striking contrast to India's well developed telecommunications and IT (information technology). Interest in Amateur Radio is growing fast in India. The cost of being a ham is still high, and there is no supply of locally made equipment. Servicing the existing gear is difficult.

While Amateur Radio may be losing popularity in Western Europe, because of different factors, I predict steady growth of our hobby in countries like India. We may be fewer in Europe in the future but we'll have more DX to work.

There was "curry" in the title. The spice called "curry" is unknown in India. The British created this blend of spices and gave it a name similar to the word for "soup" or "stew." And this is what you get when you order a curry in India. But every part of India has tens, maybe hundreds, of recipes for curry. There might be as many different curries as there are hams in India. Hence, the title of this article. QST

Radio Books

When I started to collect radios, I found that the only place to really learn about radios was from old books and magazines. These were published as our radio hobby evolved. What you read in them now, was as it was happening back then. Their photos and diagrams really help you understand and appreciate what our predecessors went through to get on the air. Many of them built their own parts as well as building their radios. They all owned books like these.

This month I have compiled a list of affordable books that you can still find. These books will provide a great foundation for your library. I have all of these books and recommend them. A few of them are "Pricey" and are so noted, but for the most part you should be able to find most of them for $20 to $30 or less. And they can be a lot less if you look hard for them at hamfests and at used bookstores.

In a future column, I will recommend some of the older magazines for your collection.

I often wished that I had a list like this when I got started.

Recommended Books

Antenna Engineering Handbook, Jasik, Henry. First Edition, 1961. Edited by Jasik, this book has no less than 39 renowned contributors, all specialists in the field of antennas, from long wire to complicated arrays. Containing over 1000 illustrations and line drawings, it is one of the most complete treatises on antenna theory and application. 987 pp. Scarce. Pricey.

Below Ten Meters, The Manual of Ultra-Short-Wave Radio, Millen, James and Kruse, Robert S. First Edition, 1932. One of the first manuals on ultra-short-wave radio, it is profusely illustrated with many photos of early experiments, as well as details on the history and commercial applications of this part of the frequency spectrum. A chapter on the cathode-ray television at 5 meters, complete with photos proves very interesting. A scarce volume! 68 pp. 55 photos. 67 illustrations. Softcover.

Notes on Amateur Radio Transmitter Design, Millen, James. First Edition, 1937. A fascinating collection of ideas and handy data for the amateur planning to upgrade or change his station equipment. Construction details for many circuits are shown, as well as many photos of vintage National equipment, their specs and schematics. A nice 20 p catalog of National Equipment is included. 118 pp. Scarce. Softcover.

Hammarlund Short-Wave Manual 1939, Hammarlund Manufacturing Company. The theory of design, construction and operation of short-wave radio. Includes a listing of S/W and land stations throughout the world working below 100 meters. Construction details for a one, two and three tube short wave receiver are included, as well as a 6L6 transmitter and 5-meter apparatus. 32 pp. 65 illustrations. Scarce. Softcover.

Two Hundred Meters and Down. The Story of Amateur Radio, De Soto, Clinton, West Hartford, CT: The American Radio Relay League, Inc. 1936. Paper wraps. First Edition. The fascinating story of the early days of Amateur Radio and the establishment of the ARRL. 184 pp.

Radio for All, Gernsback, Hugo. Philadelphia and London: J. B. Lippincott Company, 1922. Cloth. First Edition. "In writing the present volume the author has continually had in mind a book for the public at large, as yet not acquainted with the radio art." Contents include History; Transmitting; Receiving; Receiving Instruments; Tuning; Radio Telephony. 292 pp, 13 halftones, 133 line illustrations.

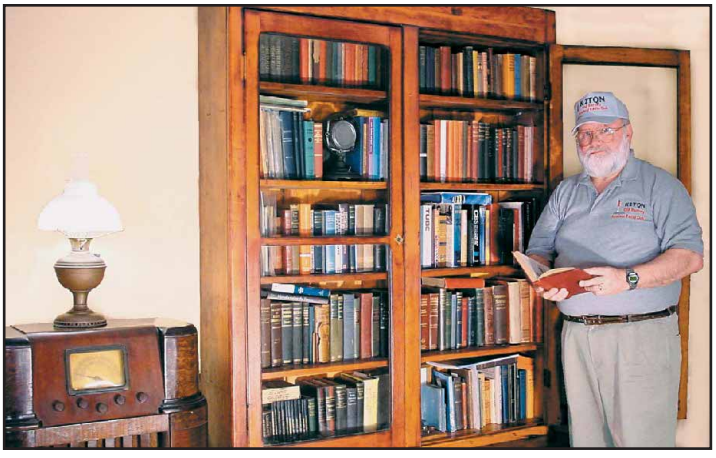
Radio up to the Minute, Irwin, John R. & Nilson, Arthur. New York: Edward J. Clode, Inc, 1927. Cloth. "A practical manual with questions and answers." 382 pp, 92 illustrations and photos of apparatus, circuits, etc.

Principles of Radio Telegraphy, Jansky, Cyril M. New York, NY: McGraw-Hill Book Company, Inc, New York. First Edition, 1919. Covers the theory and practice of radio transmission and reception. 242 pp with 179 illustrations, several of which are of radio apparatus.

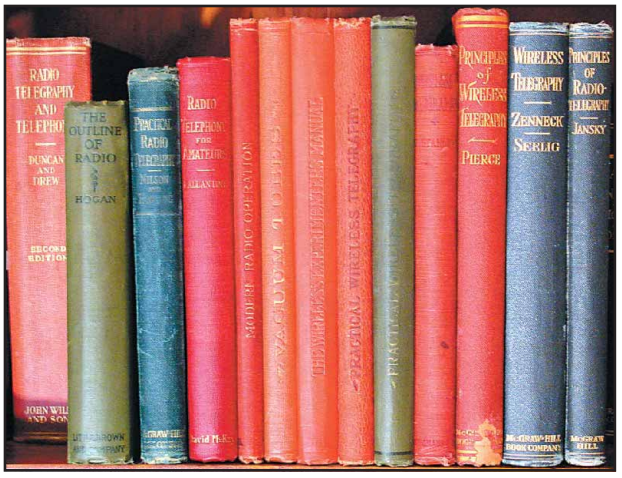
Radio Simplified, What It Is—How to Build and Operate the Apparatus, Kendall, Lewis F. and Koehler, Robert Philip. Philadelphia, PA: The John C. Winston Company, 1922. Decorative cloth. First Edition. 271 pp, 95 illustrations. Illustration shows a family listening to a radio with an external horn speaker.

Radio Theory and Operating, Loomis, Mary Texana. Washington, DC: Loomis Publishing Company, 1928. Cloth. Fourth Edition. 992 pp, 795 illustrations, plus charts, tables, etc. Supplementary circuit diagram of GE Master-Oscillator Transmitter with radiotelephone.

Wireless Telegraphy and Telephony,



K2TQN found that an antique bookcase helped get wife approval for storing the books in the living room.



Old radio books really look nice in your shack.

John Dilks, K2TQN ♦ 125 Warf Road, Egg Harbor Township, NJ 08234-8501 ♦ k2tqn@arrl.org

Morgan, Alfred P. New York: Norman W. Henley, 1916. Cloth. Third Edition. "A practical treatise on wireless telegraphy and telephony, giving complete and detailed explanations of the theory and practice of modern radio apparatus and its present-day applications, together with a chapter on the possibilities of its future development." 154 pp plus 32 p catalog; 156 illustrations and photographs.

Wireless Telegraph Construction for Amateurs, Morgan, Alfred Powell. New York, NY: D. Van Nostrand Company, 1914. Cloth. Third Edition. 222 pp plus 16 p book list; 167 illustrations, including 6 black & white plates. "In this book, the author has endeavored to present a book embracing practical information for those who may wish to build for private or experimental use a set of wireless instruments which are more than toys but yet not so expensive as commercial apparatus." Chapter titles include The Apparatus; Aerials and Earth Connections; Induction Coils; Interrupters; Keys; Oscillation Detectors; Telephone Receivers and Headbands," etc. Scarce. Pricey.

Radio's First Voice. The Story of Reginald Fessenden, Raby, Ormond (Bio). Toronto, ON: Macmillan of Canada, 1970. Trade paperback. First Edition. The biography of the first man to transmit the sound of the human voice without wires. 161 pp.

Radio Engineering, Terman, Frederick Emmons. New York: McGraw-Hill Book Co, 1937 or later, hard covers. Any edition is great. 813 pp with many illustrations, drawings, charts, diagrams and tables. Later editions reflect changes and advances made in the radio industry. This is a "must have" book. Other titles by Terman are equally useful.

The Principles Underlying Radio Communication, US Army Signal Corps. Washington, DC: US Army Signal Corps, 1919. Cloth. 355 pp, 268 illustrations and black & white plates.

The Complete Radio Book, Yates, Raymond Francis, & Pacent, Louis Gerard. New York, NY: P. & F. Collier, 1922. Cloth. First Edition. An early book for the lay reader, one of the "Popular Science Library" series. Covers the history, basic theory and application of radio. 330 pp, 77 illustrations, 1 foldout map showing worldwide submarine cables.

Short Waves, Leutz, Charles R. and Gable, Robert B. Altoona, PA: C. R. Leutz, Inc, 1930. Cloth, gilt titles. First Edition. First book devoted exclusively to high frequency currents as related to radio communications and associated fields—radio, television, ship-to-shore, directional antennae, aircraft radio equipment, short-wave receivers, UVF [medical] and amateur short-wave. 384 pp, photo illustrated, diagrams.

Modern Radio Reception, Leutz, Charles R. New York: Leutz, Inc, 1928. Revised First Edition. Covers radio receivers and accessories, radio reception, laboratory apparatus, tube data and radio standards and definitions. 384 pp.

Modern Radio Servicing, Ghirardi, Alfred A. New York: Radio & Technical Publishing, 1935. Hard cover. First Edition. A practical text on the theory, construction and use of modern radio servicing equipment; the rapid, systematic methods and technique of radio servicing in all its branches, and tested methods of selling radio service work to the public. With 760 black & white illustrations. Navy blue cloth boards with gilt spine lettering. 1302 pp, including index. [This book is a "must have"—you will learn so much from it.—*Ed.*]

Radio for Everybody, Lescarboura, Austin C. New York: Scientific American, 1923. Hard cover. Revised and Enlarged Edition. Brown cloth, gold spine/cover lettering, x-354 pp, black & white photos and technical drawings. "Being a popular guide to practical radio-phone reception and transmission and to the dot-and-dash reception and transmission of the radio telegraph."

Radio Telephony, Goldsmith, Alfred N. New York: The Wireless Press, 1918. First Edition. Hardcover cloth, 247 pp, well illustrated. [One of the best early books. —*Ed.*]

History of Radio to 1926, Archer, Gleason. New York: American Historical Society, Inc, 1938. Cloth. First Edition. One of the best histories of radio, this book covers the development of the electric telegraph, wireless telegraphy/telephony and broadcasting. 421 pp, with 20 illustrations. Pricey.

Big Business and Radio, Archer, Gleason L. New York: The American Historical Company, Inc, 1939. Cloth. First Edition. "Do not think that the present volume is a mere continuation of *History of Radio to 1926*. On the contrary, much of the struggle from which this volume takes its name was fought and won prior to July 1926. The bulk of this volume consists of a story based upon records opened for the first time to any historian." 503 pp, with illustrations. A scarce title. Pricey.

The Radio Manual, Sterling, George. New York, NY: D. Van Nostrand Company, 1930. Cloth. Second Edition. "For radio engineers, inspectors, students, operators and radio fans." 20 chapters, covering broadcast transmitters, marine R/T equipment, aircraft and ground equipment, auto alarms, police transmitters/receivers, etc. 797 pp, with 248 figures, many of which are photographs of radio equipment. [Another "must have."—*Ed.*]

Practical Wireless Telegraphy, Bucher, Elmer E. "A Complete Text Book for Students of Radio Communication," NY: Wireless Press, 1917. Green cloth with black lettering. Numerous photo and drawing illustrations. The functioning of present-day commercial wireless telegraph apparatus. Black & white illustrations. 336 pp. Second Revised Edition. Hardcover.

The Wireless Experimenter's Manual, Bucher, Elmer E. Incorporating *How to Conduct a Radio Club*. New York: Wireless Press, Inc, 1920. First Edition, completely revised and rewritten. 350 pp plus 7 pp related advertisements. Over 300 drawings, diagrams, tables, equations, pictures, etc. "Describes parliamentary procedure in the formation of a radio club, the design of wireless transmitting and receiving apparatus, long distance receiving sets, vacuum tube amplifiers, radio telegraph and telephone sets, the tuning and calibration of transmitters and receivers, general radio measurements and many other features." Index, Useful Table for Determining the Wave Length, Frequency and Oscillation Constant of Radio Frequency Circuits.

Vacuum Tubes in Wireless Communication, Bucher, Elmer E. 1919. 202 pp plus 7 pp advertisements. 148 illustrations in the text, including some halftones. "A Practical Text Book for Operators and Experimenters." 202 pp, First Edition. Cloth.

The Outline of Radio, Hogan, John V. L. Little Brown, 1923. 256 pp. Black & white photos, illustrations and diagrams. First Edition. Hardcover. [One of my favorite books. I have the first chapter online. You can read it by visiting my Web page at **www.eht.com/oldradio/arrl/index.html**.—*Ed.*]

Good luck finding your books. I know you will enjoy reading them, and don't be surprised if you catch yourself reading them over and over. QST

Where to Find Them

I have purchased books from the following old book dealers. They specialize in radio books, and will help you find that special book.

Old Authors Bookshop, PO Box 1176, Ogdensburg, NY 13669; tel 613-543-3337; **authors@mor-net.on.ca**; **www.oldauthors.com**.

New Wireless Pioneers, 1541 Bronson Rd, Grand Island, NY 14072; tel 716-773-4999; **wireless@pce.net**. Write for catalog.

Play Things of Past, 9511 Sunrise Blvd, #J-23, Cleveland, OH 44133; tel 216-251-3714; **gbsptop@aol.com**; **www.oldradioparts.com**.

Finding Conventional Wisdom

I met a fellow the other day, who has been in Amateur Radio longer than I, that is, one-third of a century. He is a big DXer and contester, a DXCC honor roller, who is always at or near the top of the contest results for his section.

I asked him, "Are you going to Dayton this year?"

"You mean the Hamvention?" he replied.

"Yes, the Hamvention in Dayton," I clarified.

"No. I don't think so," he hesitated, and then continued, "I don't go to ham conventions."

I was flabbergasted. Here was a "big gun," who has never been to Dayton, much less the Podunk County Ham Fair…a rare bird indeed. Maybe, maybe not.

The Perennial Conventioneer

I don't know about you, but I am always going to the Dayton Hamvention. That goes for the ARRL-TAPR Digital Communications Conference (DCC) and my ARRL Division convention, too. Some years I don't make it to Dayton and the DCC, but I always want to go.

Soon after I got my license, I went to my first ham radio convention: the Rochester (New York) Hamfest. My reason for going was to learn more about my interests in the hobby. You can learn a lot by reading or getting on the air, but you can also learn by attending seminars at ham conventions and hobnobbing with the experts, novices and wannabes like yourself—no matter what you wannabe.

As a young pup, I loved 2-meter DX, so I made sure I went to convention talks given by folks like K1ZND (now K1ZZ). Dave was not much longer in the tooth than I, but he had been chasing E_s, and pings and other VHF things forever. He had a wealth of knowledge to share that I would not have been able to experience if I stayed at home and read *The Radio Amateur's VHF Manual* or tuned around 144.1 MHz.

Later, when I got into RTTY, computers, packet and APRS, I continued to seek out the experts at conventions. I carried my new knowledge back home and put it to good use when I got on the air.

In addition to the knowledge I obtained attending conventions, I also discovered meaningful ham radio camaraderie by way of the "eyeball QSO." It is one thing to communicate regularly with someone on the air, but it makes a big difference when you meet them in person. Putting a living being together with that voice, code or text you copy over the air fleshes out the personality of that individual and makes for lifelong friendships.

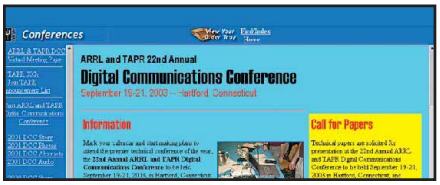


Figure 1—After you learn all about the 2003 Digital Communications Conference, register for the digital event of the year at www.tapr.org/tapr/html/conff.html.

So you can be sure that I am planning to go to this year's Hamvention and DCC. I'll probably be finalizing my Dayton shopping list by the time you read this, as the Hamvention is only a few days away (hope to see you there). At this late date, it is too late to convince you to attend Dayton because you won't find a room, so, let's talk about the DCC.

Digital Convention

I am a longtime member of the foremost digital ham radio communications organization in the world, TAPR. I attend TAPR's biannual Board of Director meetings whenever I am able (one is held at Dayton and the other at the DCC).

Two years ago, at the Board meeting in Dayton, the Board was trying to find a location for the 2003 DCC. The location of the DCC is on a rotation basis: East Coast, Midwest, West Coast. An East Coast location was on tap for the 2003 DCC.

I piped up: "Why not have the DCC in Connecticut near Newington and ARRL headquarters?" The DCC had never been held in New England and only twice was it ever northeast of the Mason-Dixon line (New Jersey in 1984 and 1992), so I suggested that a New England venue was long overdue.

Since I opened my big mouth and I was the only person in the room from New England, the Board asked if I would volunteer to help organize the 2003 DCC to be held somewhere around the environs of W1AW. I agreed, and before you know it, we are going to be having the real big digital show just up the road on I-91.

I really did not do that much! I asked the DCC experts for help (Maty Weinberg, KB1EIB, Steve and Sheila Bible, N7HPR and Mrs N7HPR, and Steve Ford, WB8IMY). Maty found a hotel, Sheila negotiated the contract with the hotel, and both Steves organized the program to be held in the hotel, and it's a great program they have in store for you.

There will be presentations of technical papers about all things digital on Friday and Saturday. In addition, there will be Saturday seminars for beginners on *WSJT* (K1JT's weak signal communications software) by Del Schier, K1UHF; *Echolink* and voice over IP by Jon Taylor, W1RFD; PSK by Steve Ford, WB8IMY; and APRS by yours truly. I will also be conducting the first ever (to my knowledge) mini-seminar on the topic of APRS Networking, where I hope we can hash out some of the problems affecting the APRS network here, there and everywhere. Friday night, there is a social get-together.

The DCC banquet occurs Saturday night with Alex Mendelsohn, AI2Q, as the after-banquet speaker. A TAPR membership meeting follows the banquet. On Sunday, Matt Ettus, N2MJI, will present a seminar about software-defined radios (SDRs).

By the way, if you want to write (and optionally present) a paper at the conference, read all about it at **www.tapr.org/tapr/html/dcccallforpapers.html**. Mail or e-mail your paper, by August 15, to Maty Weinberg (ARRL, 225 Main St, Newington, CT 06111 or **maty@arrl.org**). You can read the paper submission guidelines at **www.tapr.org/tapr/html/dccsubmissionguidelines.html**.

September 19-21 are the dates for the 2003 DCC and the location is the Marriott Hartford Windsor Airport Hotel in Windsor, Connecticut, which is south of Bradley International Airport and north of W1AW and ARRL headquarters.

For more information about the DCC and registration for this major event, go to **www.tapr.org/tapr/html/conff.html**. Also, go to **www.tapr.org/~wa1lou/dcc** to learn about Connecticut ham radio activities and other interesting activities you can participate in during the DCC.

The DCC is an opportunity for digitally oriented hams to expand their knowledge and make lifelong friends. I hope to see you there, my future friend! QST

Stan Horzepa, WA1LOU ♦ One Glen Ave, Wolcott CT 06716-1442 ♦ wa1lou@arrl.net, www.tapr.org/~wa1lou

Satellites and Field Day

With the loss of the RS-12/13 satellite, our options for satellite fun on Field Day have been trimmed back a bit. Still, there are several birds worth considering, depending on your resources.

UO-14 and AO-27 are the perennial Field Day favorites. These FM repeater satellites are accessible to any station with a dual-band 2-meter/70-cm transceiver. On a normal day, you can work either satellite with a dual-band handheld and a small dual-band beam antenna, but Field Day is not a normal day. You can expect both birds to sport wall-to-wall signals during each 15-minute pass. Unless you are lucky, a couple of watts on the uplink isn't going to cut it. Plan to use 30 W or more with the Yagis of your choice. Frequencies are shown in Table 1.

Table 1
Satellite Frequencies for Field Day

Satellite	*Uplink (MHz)*	*Downlink (MHz)*	*Mode*
OSCAR 27	145.850	436.795	FM
OSCAR 14	145.975	435.070	FM
OSCAR 20	145.900-146.00	435.800-435.900	CW/SSB
OSCAR 29	145.900-146.00	435.800-435.900	CW/SSB
OSCAR 40	435.550-435.800	2401.225-2401.475	CW/SSB

Fuji-OSCARs 20 and 29 may see more use this year. Unlike UO-14 and AO-27, these satellites can support several conversations at the same time. You'll need the ability to transmit CW or SSB on their 2-meter uplinks and receive the same on the 70-cm downlinks. That means you will need a dual-band all-mode transceiver with *full duplex* capability, or a 2-meter all-mode rig for the uplink and a 70-cm all-mode rig, or a receive converter attached to a separate 10 or 2-meter all-mode receiver or transceiver, for the downlink. Note that you must be able to receive and transmit *simultaneously*. The idea is to listen to yourself on the downlink so that you can compensate for the Doppler shift.

KØBLT and KCØGDG set up the Field Day satellite antennas at West Nebraska Amateur Radio Club station WØAFG.

Those stations that can get on AMSAT-OSCAR 40 will be in for a fascinating Field Day satellite experience. This DX bird will be available for *hours* during the event. Your easiest configuration for AO-40 is mode U/S: 435 MHz up and 2.4 GHz down. You'll need about 100 W to an 11-element Yagi on 435 MHz for the uplink. You can receive with a 3-foot parabolic dish antenna and a 2.4 GHz downconverter feeding a 2-meter all-mode transceiver.

Satellite pass-prediction software (and a lot of helpful satellite information in general) is available from AMSAT at **www.amsat.org**. You can also obtain pass predictions 24 hours in advance on the Web at **www.heavens-above.com** (you may need to register, but it is free).

OSCAR 40 ON MODE S/K

Speaking of AO-40, Mike Seguin, N1JEZ; Charlie Suckling, G3WDG; Domenico Marini, I8CVS; Jean Gabouriaud, F6GBQ and Stacey Mills, W4SM, conducted successful tests using mode S/K last February. That's 2.4 GHz up and 24 GHz down. Picking up OSCAR 40's 24-GHz downlink is challenge enough, but generating a signal sufficient to be heard on a 2.4 GHz uplink adds a new challenge.

According to N1JEZ, Charlie was using 5-W into a 6-foot dish for the 2.4-GHz uplink and Domenico was running 8 W of uplink power into a 3-foot dish. That doesn't sound like much RF, but the effective radiated power was considerable. The results were outstanding.

Mike, N1JEZ, braves a snowstorm to listen in on the OSCAR 40 mode S/K tests.

G3WDG captured some audio during the test. You can download the file *03sat06.zip* at **www.arrl.org/files/qst-binaries/** and hear how it sounded. QST

STRAYS

***QST* congratulates...**

◊ ARRL Life Member Alex Vrenios, KX9I, of Phoenix, Arizona, on his graduation from Arizona State University, where he earned a PhD in Computer Science.

◊ Bill Sinton, KI7LS, of Flagstaff, Arizona, who has written a book, *I Choose to Live—A Journey Through Life With ALS*. In it, Bill tells of his interest in Amateur Radio since he was first licensed as W3JBQ in 1940. The book has been published by Banbury Publishing (**www.banburypublishing.com/ichoosetolive.html**). QST

Steve Ford, WB8IMY ♦ *QST* Editor ♦ sford@arrl.org

The Silent Key Forest Memorial

In a letter from the Israel Amateur Radio Club (IARC) and from ARRL New York City/Long Island Section Manager George Tranos, N2GA, we learned of the Silent Key Forest. *The IARC President, Joe Obstfeld, 4X6KJ, had sent Silent Key Forest commemorative certificates for the families of each Amateur Radio operator killed in the World Trade Center on September 11, 2001. This touching and thoughtful commemoration is described below by the IARC.*

It all began in the mind of the late Ozzie (Tzvi) Osrin, 4X4CW, who wanted to establish a memorial forest of trees for all the radio amateurs of the world. He had been a radio man, a captain in the South African air force and later served with the Israel Defence Forces. He was also the first officially licensed radio amateur in Israel.

As the years went by, the late Shimshon "Sammy" Lotan, 4X4GF, joined him in developing and implementing this idea, accompanied by Shlomo Menuhin, 4X1AS, Ahron Kirschner, 4X1AT, and Tuvia Greengross, 4X4GT.

In 1983, 4X4CW, 4X4GF, 4X1AS, 4X1AT, 4X4GT and 4Z4ZB (SK) met in Shoresh with the IARC Executive Committee, with each one of the aforementioned pledging 100 trees. The project began to take shape.

4X4GF, a real steam roller who was known for his monthly motor tours of the country for hams, got things into the next stage. A site was found on the hills between Modi'in and the Tel Hadid ridge in The Ben Shemen Forest, verdant with more than several million trees, located halfway between Jerusalem and Tel Aviv. The more than 8500 acres include pine, cypress and eucalyptus trees. A ham will always look for a great QTH from which signals will "get out" in the best possible manner, and here it was. On the 22nd of October 1985, with the presence of dignitaries from the government, the first inscribed boulder was erected for the first thousand trees. The second two boulders were established later in memory of 4X4CW and 4X4GF, respectively.

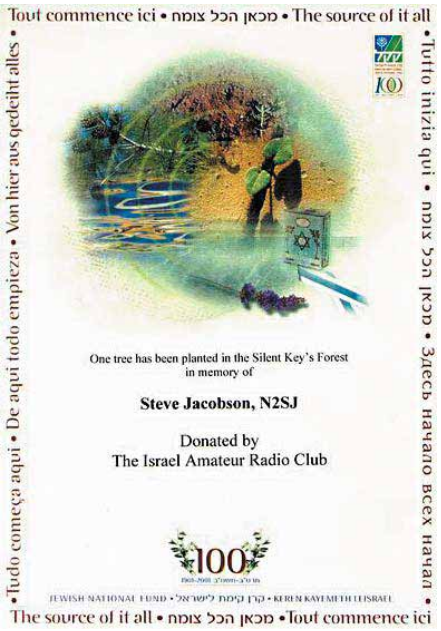
The purpose of the forest is to be a place to plant trees in memory of radio amateurs who have passed away, Silent Keys, as well as in honour of living amateurs. It is a place for festive events, for get-togethers of hams and field days.

We are hopeful that each amateur in Israel and the world will have at least one tree there. Please help us plant additional trees. It is relatively easy to get to the site—which is blessed with a beautiful view. For every thousand trees we plant, a boulder is erected with a plaque on it or alternately, a picnic table with a barbecue.

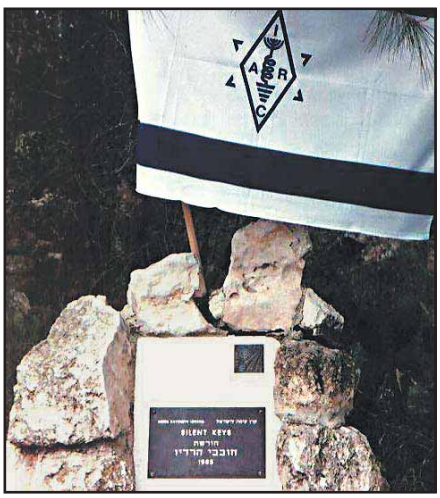
Field days and operations are planned from the "Silent Key Forest" with operations using the special call "4X4SKF." Please don't forget that in addition to the special "4X4SKF" QSL card, a certificate is awarded for every donation of trees in the name of the person honoured.

Donations from individuals for planting trees will establish a living link with those who have filled the airwaves for so many years.

For more information on the Silent Key Forest, see **www.iarc.org/hagal/skf.htm**.



The certificate memorializing Steve Jacobson, N2SJ.



A flag and boulder mark trees planted in the Silent Key Forest.

NAME CHANGE FOR YUGOSLAV SOCIETY

Reflecting a name change in the name of the country that it represents in the IARU, Savez Radio-Amatera Jugoslavije (SRJ) has changed its name to Savez Radio-Amatera Srbije i Crne Gore (SRSCG). The English translation is Amateur Radio Union of Serbia and Montenegro.

THREE NEW MEMBERS ADMITTED TO IARU

By vote of the present member-societies of the International Amateur Radio Union (IARU), three new members—National Association Radioamateurs of Georgia (NARG), Federation of Radiosport of the Republic of Armenia (FRRA) and Vietnam Amateur Radio Club (VARC)—have been admitted to the IARU effective April 4, 2003.

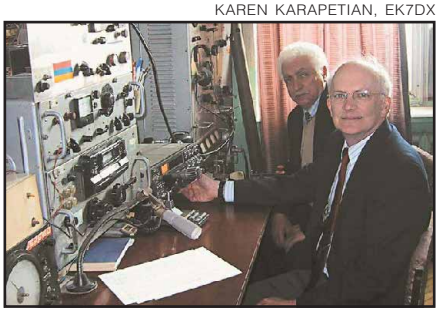
NARG was founded on September 21, 2000. It has 156 licensed radio amateurs as members out of a total of 485 in the country. The President of NARG is Mamuka Kordzakhia, 4L2M.

FRRA was founded on January 14, 1999 and has 84 of Armenia's 128 licensed radio amateurs as members. The President is George Badalian, EK6GB.

VARC was founded as a national organization in July 2002 under the Vietnam Radio-Electronics Association. From February 1996 to July 2002 the VARC was chartered in the Ho Chi Minh City area. Five of its members participated as observers in the 1997 Region 3 Conference in Beijing. The President of VARC is Eng. Nguyen Bac Ai, XV2A/3W6AR.

The IARU, founded in 1925, is a worldwide federation of national amateur radio societies with members in 156 countries and separate territories. In addition to joining the worldwide IARU, NARG and FRRA become members of IARU Region 1 and VARC becomes a member of IARU Region 3.

KAREN KARAPETIAN, EK7DX



George Badalian, EK6GB, hosted David Sumner, K1ZZ, during a February visit to club station EK8ZZ in Yerevan. George is President of the Federation of Radiosport of the Republic of Armenia, one of the newest IARU member-societies. QST

SILENT KEYS

It is with deep regret that we record the passing of these amateurs:

N1CML, Charles R. Ball, Norwalk, CT
WA1EAT, Joseph F. Daley, Quincy, MA
K1FGM, Frank A. Jomini, Hamden, CT
N1GXX, Stanley M. Pridham, Rochester, NH
K1LII, Chester P. Tammany, Rumford, RI
KB1RJF, Rene J. Fortier, Manville, RI
K1SRF, Nelson W. Treadway Jr, Gales Ferry, CT
ex-K1TKC, Robert Dunlap, Mount Desert, ME
K2AX, William H. Rawson, Dover, NJ
W2BNA, Kenneth W. Cooper, Melbourne, FL
W2DN, Patrick J. Hoke Sr, Rochester, NY
KB2KJV, Marian E. Gessin, Honeoye, NY
WA2OWJ, George M. Hickman, Somerville, NJ
WB2SJM, Edgar H. Devereaux, Highlands, NJ
W2ZQK, John H. Smith, Belvidere, NJ
N3AKO, Wm C. Mullauer, Baltimore, MD
W3ELJ, P. H. Brandt, Mount Laurel, NJ
W3MXE, Day K. Grimes Jr, Carlisle, PA
WA3NTR, Mary K. Homick, North Huntingdon, PA
KE4BVI, Don E. Harvey, Seneca, SC
W4CCS, Clifford J. Moore Jr, Purcellville, VA
K4DNV, James H. Abercrombie Sr, Woodruff, SC
W4DRF, Leland E. Patience, Belton, SC
KF4DZX, Wendell R. Weeks, Moultrie, GA
K4GKF, Thomas L. Drake, Sweetwater, TN
K4IB, Arie D. Cook, Port Charlotte, FL
K4IUR, Herman E. Ernst, Chattanooga, TN
K4JNH, Merle M. Gissiner, Mebane, NC
WB4KUP, Walter B. Robinson, Martinez, GA
ex-WD4KXK, Paul J. Losi, Johnston, NY
KD4LGL, Kathleen C. White, Memphis, TN
K4LNL, Charles C. Josey, Macon, GA
K4LYW, William E. Clugston, Atlantic Beach, NC
W4MOM, Donald F. Wilfert, Saint Petersburg, FL
W4OZF, Robert B. Wright, Macon, GA
W4QDT, George W. Bartlett, Huntsville, AL
*N4QU, Edward C. Brostek, Micanopy, FL
WA4RWK, James H. Allen, Humboldt, TN
*N4SS, Nicholas D. Zorn, Pace, FL
KC4YDQ, Kenneth L. Bowie, Morristown, TN
W4YXJ, Walter E. Graham, Montgomery, AL
W5AAC, William K. Milam, Sulphur Springs, TX
KC5FVW, Charles E. Buxton, Hatfield, AR
W5HQM, Charles E. Maupin, Moore, OK
*K5IZD, Earl J. Barrilleaux, Jefferson, LA
WA5KUI, Donald L. Scott, Alamogordo, NM
KZ5O, Rondie F. De Shazo, Amarillo, TX
W5OYY, Ernest D. Harper, Alamo, TX
WB5UNE, John W. Maples, Fayetteville, AR
*W5VCW, Mark T. Jordan Jr, Rogers, AR
N5WAJ, Erwin J. Hadash Jr, Houston, TX
K5YEP, Neal E. Rice, Carlisle, AR
K6AXS, Charles K. Hicks, Pottstown, PA
W6BBB, Percy H. Dunkle, Port Ludlow, WA
K6EB, Donald C. Bowman, Santa Rosa, CA
KH6HAO, Joseph K. Ha'o, Hilo, HI
W6ITR, Robert H. Andrews, Phoenix, AZ
N6JJX, John P. Anderson, Gardnerville, NV
‡ex-N6JSV, James Talcott, Santa Ana, CA
N6LKC, Patricia S. White, Crescent City, FL
KG6MB, Jim D. Howard, Oak Park, IL
NS6M, George Austin, Santa Barbara, CA
KE6RQQ, David W. Hivner, Oxnard, CA
KK6TR, Jules Katz, Hamilton Square, NJ
KB6VBR, Charlotte Perdue, Hanford, CA
W6WKR, John J. Copas, Monrovia, CA
KD6XY, Larry Bloom, San Bruno, CA
WA6ZLH, John A. Wester, Fairfield, CA
KA7BRT, Alve J. Charap, Tacoma, WA
W7BX, Sandy Lynch, Portland, OR
KL7DCU, Willard K. Russell, Denver, CO
W7DOQ, Willis G. McCormick, Redmond, WA
*K7ELM, Darrell E. Peterson, Albany, OR
W7FEN, Robert W. Gervenack, Woodinville, WA
W7MIU, George H. Martens, Oviedo, FL
KR7P, George A. Rhoads, Jr, Boring, OR
W7ULK, Rosella L. Hansen, Colville, WA
W7WWS, Oliver Johnson, Hamilton, MT
W7WYG, David C. Wiley, Great Falls, MT
KA7ZYQ, Gregory A. Mason, Spokane, WA
K8BEO, Ludwig Zalar, Doylestown, OH
WA8BUI, H. Rex Osborne, Ravenswood, WV
N8FVV, William F. Elder, Louisville, KY
W8IWY, Richard E. Porter, Dublin, OH
W8KPV, William H. Rhoads, Beavercreek, OH
K8LPR, Russell J. Snyder, Charlevoix, MI
WB8MMZ, Melvin F. Kirsch, Redford, MI
W8ORI, Robert E. Mumma, Lebanon, OH
WA8PRO, Charles W. Woeber, Reading, OH
W8RHG, Alfred I. Johnson, Dayton, OH
N8SNZ, Steven A. Lambert, Bluefield, WV
WB8ZUH, William J. Van Splintern, Wyoming, MI
KC9BWS, Charles H. Humboldt, Lodi, WI
K9FIM, Marvin G. Freeman, Union Mills, IN
ex-W9MYO, George V. Sherman, Columbus, IN
*W9NXM, Frank C. Bliesener Jr, Sault Sainte Marie, MI
W9SB, Wayne E. Otey, Urbana, IL
KCØBET, Lyle D. Aho, Stanley, ND
KØBRE, Verlin B. Rowley, Des Moines, IA
KGØEZ, Stanford V. Swinton, Denver, CO
WØGB, Orville F. Cook, Moorhead, MN
WØGFU, Myron E. Hornbaker, Meade, KS
NØHFF, William G. Pierpont, Wichita, KS
KØKQJ, Lloyd E. Carmer, Marshalltown, IA
KBØKUB, William P. Hyde, Cedar Rapids, IA
‡ex-WØLN, Martin R. Peterson, Winona, MN
NØMWR, Treva J. Whalen, Topeka, KS
WØOTU, Gordon E. Mycue, Maple Lake, MN
WØSDL, Charlie L. Grafft, Waite Park, MN
WAØUUC, Robert L. Hannah, Kansas City, MO
VK2SW, Sid Ward, Wagga Wagga, NSW, Australia

*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.

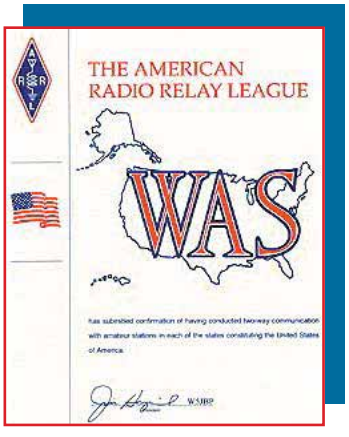
Many hams remember a Silent Key with a memorial contribution to the ARRL Foundation or to ARRL. If you wish to make a contribution in a friend's or relative's memory, you can designate it for an ARRL Foundation youth scholarship fund, the Jesse A. Bieberman Meritorious Membership Fund or the Victor C. Clark Youth Incentive Program Fund. See the Foundation listing at **www.arrl.org/arrlf/#funds**. Gifts to ARRL can be directed to the ARRL Fund or to any of six other special funds supporting specific missions of ARRL. More information about ARRL funds and on-line memorial donations is available at **www.arrl.org/development/memorial.html**. Contributions to the ARRL Foundation and to ARRL are tax deductible to the extent permitted under current tax law. You also may contact us by phone at 860-594-0200, or by mail at 225 Main St, Newington, CT 06111. QST

Kathy Capodicasa, N1GZO ♦ Silent Key Administrator ♦ n1gzo@arrl.org

STRAYS

HAVE YOU WORKED ALL STATES?

◊ The Worked All States award is given for submitting confirmations from all 50 states. Aside from the basic certificate for any combination of bands/modes, specialty certificates are issued for a variety of different bands and modes such as Satellite, 160 meters, SSTV, Digital and each VHF band. Available endorsements include SSB, CW, Novice, QRP, Packet, EME and any single band. The Digital award is available for the various modes, and is dated but not numbered. Cards are checked by a volunteer ARRL HF Awards Manager affiliated with an ARRL Special Service Club (although QSL cards can be checked at HQ, absent an awards manager). To encourage increased activity and station improvement throughout the bands, the 5-Band WAS



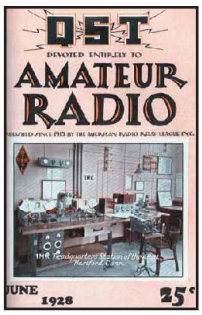
certificate (and plaque) is available for working all states on 5 amateur bands (except 10/18/24 MHz). More detailed information, including current fees and HF Awards Manager listings, is available at **www.arrl.org/awards**.

W1AW ENDOWMENT

◊ The Hiram Percy Maxim Memorial Station is a monument to ARRL founder Hiram Percy Maxim and to the history of Amateur Radio. Built on its current site in Newington, Connecticut in 1938, W1AW attracts hams from across the country and across the globe that come to visit and operate. Each year ARRL wrestles with the challenge of keeping W1AW in peak condition, including its aging antennas. Your donation to the **W1AW Endowment** will provide the vital resources to ensure that code practice and other bulletins continue, and that this richest of ARRL traditions remains on a solid financial foundation for you and for future generations. Your support with a donation today or with a planned gift is vital. For more information call 860-594-0397 or go to the Web at **www.arrl.org/endoww1aw.html**. QST

75, 50 AND 25 YEARS AGO

June 1928



♦ The cover photo shows "1MK, Headquarters Station of the A.R.R.L., Hartford, Conn." The editorial discusses the not uncommon problem of experimental commercial stations using our amateur bands.

J. J. Jakosky discusses "Electrical Prospecting," used in mining exploration. Chauncey Coston, 7ABN, tells about "A Short and Medium Wave Receiver." J. T. McCormick, 9BHR, describes "Keying for Break-In." I. Vee Iversen, 7AW, presents information about "Building a Wattmeter." E. Gherzi, of the Observatory at Zi-ka-wei (near Shanghai, China), reports on "Fading on Short Waves at Long Distances." C. E. Paulson discusses "Lunar Effects on Electro-Magnetic Waves." The year-old home-built station "8CPC," active on three wave-bands, is described and presented in photographs. M. H. Pancost, 8KN, discusses "Some Overlooked Possibilities for the Radio Club."

June 1953

♦ "Gil" Gildersleeve, W1CJD, provides a cartoon cover that shows the members of the Podunk Radio Club happily setting up their Field Day station atop Grizzly Peak (elevation 9274 feet) on a balmy summer's day. The editorial discusses Field Day, the upcoming ARRL National Convention, and the 25 years of service provided by ARRL General Counsel Paul Segal, W9EEA.

Al Pichitino, WØEDX (and chief engineer of the E. F. Johnson Company), discusses "Automatic Multiband Mobile Antennas and Mobile Antenna Characteristics." In an effort to minimize the size of ham equipment, Yardley Beers, W2AWH, describes "Methods for Compact Construction." Bob Tschannen, W9LUO, combines the mobile converter and transmitter into "A Single-Package Mobile Unit for 28 Mc." In "Build Your Own Steel Tower," W. J. Sheehan, W1IXI, tells how to build a 60-foot "windmill" style tower. E. M. Shook, W5IT, discusses "Handling TVI Complaints Due to Poor TV Sets," a common problem that hams face. "He Makes What We Hams Use" tells about Art Collins, WØCXX, and some of the interesting aspects of his amateur history. In "The World Above 50 Mc.," Ed Tilton, W1HDQ, lists the statistics for 6 and 2 meters: nine hams have now earned WAS on 6 meters, and W2NLY and W9FVJ share top honors on 2 meters, each with 22 states confirmed.

June 1978

♦ The cover photo shows a ham at his operating position, asking "How safe is your shack? Are you being zapped by rf radiation?" The editorial bemoans the problems caused by poor delivery service of *QST* by the USPS.

Nick Leggett, N3NL, presents Part 1 of "How Safe is Your Shack?", looking at the aspects of nonionizing (RF) radiation. Paul Wade, WA2ZZF, and Allen Katz, K2UYH, tell how to build "Low-Noise GaAs FET UHF Preamplifiers." Marian Anderson, WB1FSB, tells how to "Build This Novice Four-Band Vertical," a simple but effective antenna. Tony Dorbuck, K1FM, presents "Basic Antenna Concepts." Billy Walker, W5GFE, discusses "Predicting Radio Horizons at VHF." Al Meleg, N1JW, describes a high-performance solid-state filter in "The ABC Active Filter." Jerry Arnold, WA6MBP, tells how to build "A Low-Cost Burglar Alarm for Home or Car." The FCC's mobile monitoring vans are described in "On the Road with Uncle Charlie," by Charles Harris, WB2CHO. David Sumner, K1ZZ, makes one "Last Call for Comments on FCC WARC Proposals." Lindsay Winkler, W7AVE, tells about "Producing Weather Satellite Pictures at Low Cost" using a Telefax machine. In "Technical Correspondence," Al Slater, G3FXB, tells an intriguing tale: After moving into his new home, he was plagued with extreme TVI problems. He tried all sorts of fixes, none of which worked. Finally, he discovered that high-resistance electrical joints in the (unused) heating system of the greenhouse on his property were acting as nonlinear devices, detecting his HF signal and re-radiating RF over a broad spectrum that included the TV band. Removing the heating system cleared up the TVI! 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, 7½, 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 2001 *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. See "Contest Corral" in this issue. 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. The fee structure is $10 for a certificate, and $7.50 for endorsements.

♦ **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 and the following day. QST

In Search of Amateur Innovation—*Part 2*

By Greg Lapin, N9GL

The good news is that Amateur Radio innovation is alive and well. Several months ago I published a request for information from Amateur Radio operators who use our hobby to innovate with radio communications. (Op-Ed, Nov 2003 *QST*, page 101). My motivation for this came from my perceptions at the FCC Technological Advisory Council that many managers in the electronics industry believe no such innovation is taking place.

The face of innovation has changed and many people no longer recognize it. There is not as much circuit building, with experimental radios built on wooden boards and held together with glue and spit. Much of today's experimentation is with new antenna configurations, new forms of modulation and different applications of existing hardware. Innovation in software is also common. Hams have discovered how much can be accomplished with the ubiquitous and underutilized PC computer sound card DSP.

Hams are adept at demonstrating the utility of existing communications techniques, illustrating both their strengths and weaknesses. Having thousands of technologically adept people testing communications techniques is the only way to fully understand them. One group is using modified 802.11b commercial hardware to develop new networking techniques.

Solving problems with new applications of existing technology is also innovation. Digital communication is being used on the HF bands in areas that do not have basic communications. A South African ham has been using this mode to forward e-mail to missionaries in desolate regions of the African continent. He is also embarking on a project to outfit small airplanes in that area with APRS to report their positions via HF in case of emergency.

Amateur Radio also innovates in ways that do not involve active experimentation. Over 680,000 technologically capable people hold ham licenses in the United States and provide a pool of talent to help answer some of the technical questions that industry wonders about. The Amateur Radio Interference Assessment (ARIA) project is one example. The FCC is very interested in finding out how the proliferation of low power devices will affect the spectral noise floor. Amateur Radio is poised to help, something that no other group can do. The ARIA project will mobilize hams to make measurements of noise levels in ham bands that are shared with Part 15 devices. As the project ramps up we are hoping to get hundreds of volunteers to help understand the practical ramifications of placing millions of very low power devices on the air.

Some of ham radio's innovation is passive. The National Cancer Institute is currently conducting an epidemiological study of radio amateurs to help us understand if there are any disease-causing interactions between radio waves and human biology. Hams make up the largest group that has been exposed to RF energy over a long period of time. If radio waves make people ill, hams will reveal it.

Innovation on the ham bands is one of the reasons for the existence of the Amateur Radio Service, as listed in the FCC Rules, Part 97.1. The rules list five things that are expected from our hobby. Part 97.1(a) states the purpose of providing noncommercial public service communications, particularly in emergencies; Part 97.1(d) states the goal of expanding the reservoir of trained communications experts; Part 97.1(e) is directed at the DXers in our hobby, charging them with enhancing international goodwill. There are many hams among us who are fulfilling these charges.

Parts 97.1(b) and (c) are directed at innovation. The specific wording is:

(b)Continuation and extension of the amateur's proven ability to contribute to the advancement of the radio art.

(c)Encouragement and improvement of the amateur service through rules which provide for advancing skills in both the communication and technical phases of the art.

The rules for the Amateur Radio Service are tailored to make attainment of these goals possible. We are the only service that is permitted to build and modify our own equipment without prior permission from the FCC. We have been assigned mostly small frequency bands across the entire regulated spectrum to permit us to experience different types of radio wave propagation and to select the characteristics that best illustrate different properties of communications.

The argument can be made that we do not need all of our allocated frequencies. One of the hotly contested bands is 2.4 GHz. This is primarily an ISM band, a place where industrial, scientific, and medical equipment can legally generate noise. We have been granted use of 2390-2450 MHz. This is one of our largest contiguous frequency allocations and is more space than we have been allocated in all of the HF and VHF bands put together. This is also frequency space that is heavily used by Part 15 devices, including wireless networking with Bluetooth, WiFi, HomeRF and wireless USB, as well as cordless telephones, baby monitors and wireless cameras. There is considerable pressure from the manufacturers of these devices to increase the priority of unlicensed equipment so they don't have to worry about interfering with licensed services, such as Amateur Radio.

What is our argument for keeping such a large amount of spectrum? Without 2400-2450 MHz the Amateur Radio Service would still be able to provide emergency communications, the training of communicators and technicians would not be affected, and there would be no limitation for DXers. The most convincing justification for maintaining this frequency space is that its availability gives hams the ability to innovate in ways not possible in the other bands. For instance, experimentation with wideband spread spectrum requires large contiguous frequency spaces. Constant use of the spectrum is not required, but it still must be available when hams need it for experiments.

Some innovators are unaware of their own prowess ("I'm no rocket scientist"). One respondent didn't want his developments publicized at all ("I'm comfortable keeping my accomplishments private"). Many ham innovators are afraid that they will be perceived as braggarts. *Why not brag?* If we don't talk about the things we're doing, how will the world find out about them? Our hobby needs your innovations and it also needs you to publicize them. Keep on innovating!

ARRL member Greg Lapin, PhD, PE, N9GL, of Deerfield, Illinois, is chairman, ARRL RF Safety Committee (**www.arrl.org/rfsafety**) *and a member of the FCC Technological Advisory Council* (**www.fcc.gov/oet/tac**). *You can contact the author at* **n9gl@arrl.net**. *His Web site is at* **home.attbi.com/~glapin1**.

New Technician Class Question Pool to Take Effect July 1; QPC Invites Input for General Question Pool Revision

Effective July 1, 2003, a new Element 2 Technician class question pool takes effect for examinations. VECs and VEs will have new test designs available for use in exam rooms effective that date. All question pools can be found at **www.arrl.org/arrlvec/pools.html**.

The new Technician pool released by the Question Pool Committee (QPC) on December 4, 2002, contains 511 questions, up from 385 in the existing Technician class pool. The revised pool includes additional emphasis on most subjects, including added rules, operating and safety questions.

General Pool Review Up Next

Next up for review is the Element 3 General class question pool. The working syllabus for this pool was recently released by the QPC of the National Conference of VECs (essentially unchanged from the prior release—lack of public comment seemed to suggest the syllabus was fine as is).

Public input is invited and requested now on our future General exam questions. Consistent with the syllabus (found at **www.arrl.org/arrlvec/pools.html**), interested parties can submit input on questions, answers or distractors to the entire QPC via e-mail to **qpc@arrl.org**, or to QPC Chairman Scotty Neustadter, W4WW (**w4ww@arrl.net**).

When you submit new question material or suggest changes to existing questions, please limit question length to 210 characters, and answer or distractor lengths to 140 characters. (For new or existing questions being modified, please indicate the subelement reference number and topic—and existing question number, if any—with your submission; for example, "**G2B**, Operating courtesy".)

Question Pools

The current question pools and their four-year validation periods are as in the table.

To locate a VE Team or VEC in your area, see **www.arrl.org/arrlvec/examsearch.phtml** or **wireless.fcc.gov/services/amateur/licensing/vecs.html**.

***Current General class Element 3:**
Expires at midnight June 30, 2004
New General class Element 3:
Effective July 1, 2004 through
June 30, 2008

***Current Extra class Element 4:**
Expires at midnight June 30, 2006

***Current Technician class Element 2:**
Expires midnight June 30, 2003
New Technician class Element 2:
Effective July 1, 2003 through
June 30, 2007

*No update release is scheduled for July 2005

ARRL PROVIDING FCC LICENSE RENEWAL, ADDRESS CHANGES, MODS TO NONMEMBERS

Effective January 1, 2003, the ARRL is now providing FCC Amateur Radio license renewals, address changes and other license modification services to nonmembers (we have provided this service to ARRL members for the past several years).

For a $12 fee, the League will renew a nonmember's Amateur Radio ticket (the license must be within 90 days of expiration), file an application to change address or name, request a duplicate license or request the issuance of a new sequential call sign (ARRL is not able to process Vanity call sign applications).

The ARRL Volunteer Examiner Coordinator Department is processing these applications at ARRL HQ. The $12 is in line with our calendar year 2003 ARRL VEC exam application fee.

For several years, the ARRL has been handling renewals, address and name changes, and modifications free of charge for members and has directed nonmembers to the FCC's free Internet or hardcopy application options or to other providers of such services. Nonmembers who now choose to employ the League's application handling service might instead consider adding $27 (based on the current under-65 full term member rate of $39) for a full ARRL membership that includes free application handling and other services—not to mention *QST*. Members or nonmembers taking advantage of this service should submit NCVEC Form 605 (**www.arrl.org/fcc/forms.html**) to ARRL VEC, 225 Main St, Newington, CT 06111 for processing. Nonmembers should make the $12 fee payable to ARRL. For more information, contact ARRL VEC, **vec@arrl.org**.

Current Morse Code Exam Standards

Effective July 1, 2001, the following Morse code testing standards have been in use in Amateur Radio license test sessions. The standards include (as default) a Farnsworth character speed in the 13 to 15 WPM range for 5 WPM Morse code messages (special other speeds at or in excess of 5 WPM can be employed to accommodate special needs). In addition, the Morse exam audio frequency range will be between 700 and 1000 Hz for routine exams, consistent with the revised standards.

The ARRL VEC uses 15-WPM characters as its Farnsworth setting and 750 Hz as its audio-frequency standard.

Code practice transmissions from Maxim Memorial Station W1AW reflect the Farnsworth standard. W1AW code transmissions at speeds at or below 15 WPM use a 15 WPM character speed—and at speeds above 18 WPM, the 20 WPM code transmissions will be at 20 WPM characters, 25 WPM at 25, etc. W1AW Web code practice files (**www.arrl. org/w1aw/morse.html**) mirror the W1AW transmission protocol.

ARRL's *Your Introduction to Morse Code* cassette tapes and audio CDs also use the new standards.

These July 2001 Morse examination standards also affect test administration. Morse examinees have to supply fill-in-the-blank answers for the 10-question Element 1 quiz. Multiple-choice type examinations are no longer acceptable. Morse code examinees must either correctly answer 7 of the 10 fill-in-the-blank questions or correctly copy 25 consecutive characters.

ARRL Fall National Exam Days are Saturday and Sunday, September 27-28, 2003. QST

Bart Jahnke, W9JJ ♦ ARRL /VEC Manager

HAMFEST CALENDAR

(Abbreviations: *Spr* = Sponsor, *TI* = Talk-in frequency, *Adm* = Admission.)

†Alabama (Fort Payne)—Jun 14, 8 AM to 1 PM. *Spr:* DeKalb County ARC. VFW Fairgrounds, 18th St N; from I-59 take Exit 222, go E 2 miles to 18th St, take left onto 18th St, Fairgrounds are 100 yds on left. VE sessions, plenty of parking. *TI:* 147.27 (100 Hz). *Adm:* $1. Tables: $5. Greg Sarratt, W4OZK, 912 Pine Grove Rd, Harvest, AL 35749; 256-337-3636; **w4ozk@arrl.net**; **www.dekalbamateurradio.com**.

Alberta (Burbank)—Jun 13-15. Bob King, VE6BLD, 403-782-3438.

California (Ferndale)—Jun 20-22, San Francisco Section Convention. See "Coming Conventions."

†California (Santa Maria)—Jun 15; set up 7:30 AM; public 9 AM to 4 PM. *Spr:* Satellite ARC. Newlove Picnic Grounds; just S of Orcutt and W of Hwy 101, 1.7 miles S of Clark Ave, 4.5 miles N of Palmer Rd. Swapfest, tailgating, contests, T-hunt, demonstrations, Santa Maria-style Beef BBQ, free parking. *TI:* 145.14 (103.5 Hz). *Adm:* $2, under 12 free with adult. Tables: $10-$30. Eric Lemmon, WB6FLY, 4416 Titan Ave, Lompoc, CA 93436-1027; 805-733-4416; **wb6fly@arrl.net**; **www.satellitearc.com**.

†Colorado (Monument)—Jun 14, 9 AM to 1 PM. *Spr:* Pikes Peak RAA. Lewis-Palmer High School, 1300 Higby Rd; from Denver exit I-25 at southbound Exit 161 (just S of weigh station), take Hwy 105 S, go E to stoplight at Struthers Rd, go S to Higby Rd, then E to High School. Swapfest, forums (ARRL, XYL), VE sessions. *TI:* 146.97 (100 Hz), 146.52. *Adm:* $5. Tables: advance $10, door $15. Kate Muniz, KCØEGJ, 13360 Cottontail Dr, Peyton, CO 80831; 719-683-7702; **kc0egj@aol.com**; **www.qsl.net/ppraa**.

†Idaho (Rathdrum)—Jun 14, 7:30 AM. *Spr:* Kootenai ARS. Rathdrum Lions Club, Hwy 53 and Meyers Rd; at junction of Hwys 95 and 53 turn W, go 4 miles; or at junction of Hwys 41 and 53 turn E, go 1½ miles. VE sessions (all classes). *TI:* 146.98, 147.08. *Adm:* Free. Tables: Free. Jim Monroe, N7ESU, 804 North 4th, Coeur d'Alene, ID 83814; 208-687-2251; **jmonroe@dmi.net**.

†Illinois (Peotone)—Jul 6; set up Saturday 6-8 PM, Sunday 6 AM; public 8 AM to 3 PM. *Spr:* Kankakee Area Radio Society. Will County Fairgrounds; I-57 to Exit 327 E. Air-conditioned building, vendors, electronics, computers, handicapped accessible, overnight parking ($10 with electricity), 35 acres of free parking, refreshments. *TI:* 146.94. *Adm:* advance $5 (double stub), door $6 (single stub), under 12 free. Tables: $10 (reserve). Send SASE and check made payable to KARS to Chip Moore, K9IOC, 289 S Euclid Ave, Bradley, IL 60915; 815-933-1323; **karsfest@yahoo.com**; **www.w9az.com**.

†Indiana (Crown Point)—Jun 15; set up 6 AM; public 8 AM. *Spr:* Lake County ARC. Lake County Fairgrounds, Industrial Arts Building, 889 S Court St; take US Rte 231 Exit off I-65, go W into Crown Point, turn left onto S Court St, go S to Fairgrounds. Hamfest/Computer Show, commercial vendors, indoor flea market, VE sessions (walk-ins), refreshments. *TI:* 147.0, 146.52. *Adm:* $5. Tables: Free. Rich Gilles, KA9SVS, 156 S Ridge St, Crown Point, IN 46307; 219-662-0594; **paris156@yahoo.com**; **www.qsl.net/w9lj/**.

Iowa (Sioux City)—Jun 13-14, Iowa State Convention. See "Coming Conventions."

†Maryland (Frederick)—Jun 15, 8 AM to 3 PM. *Spr:* Frederick ARC. Frederick County Fairgrounds, 797 E Patrick St; I-70 (E or W) to Exit 56 (Patrick St), go W on Patrick St to Fairgrounds. Giant outdoor flea market, indoor commercial area, vendors, electronics, computers, Silent Auction, tailgating ($5 per space, plus admission), VE sessions (promptly at 9 AM; preregistration strongly recommended), easy access and parking, refreshments. *TI:* 147.06 (123.0 Hz), 146.64. *Adm:* $5. Tables: 6-ft $10 (prepaid by Jun 9); $15 (after Jun 9). Carolyn Moroney, N3VOK, 13597 Old Annapolis Ct, Mt Airy, MD 21771; 301-831-5060; **k3erm@qsl.net**; **www.qsl.net/k3erm**.

Massachusetts (Cambridge)—Jun 15. Nick Altenbernd, KA1MQX, 617-253-3776.

†Massachusetts (Falmouth)—Jun 7; set up 7 AM; public 9 AM to 2 PM. *Spr:* Falmouth ARA. Barnstable County Fairgrounds, Rte 151; from the N take Rte 495 S to Rte 28 S to the Rte 151 Exit, go E on Rte 151 for approximately 5 miles to Fairgrounds; from the E take Rte 28 W to Mashpee Rotary Circle, take Rte 151 for approximately 6 miles to Fairgrounds. Amateur Radio and ARRL promotion display, talk-in station, VE sessions. *TI:* 146.655. *Adm:* advance $7, door $8 (vendors); $3 (public). Tables: 8-ft space advance $7, door $8. Ralph Swenson, N1YHS, 99 Fox Run Ln, E Falmouth, MA 02536; 508-375-6027; **depsher911@aol.com**; **www.falara.org**.

†Michigan (Grand Rapids)—Jun 7; set up Friday 7 PM, Saturday 6 AM; public 8 AM. *Spr:* Independent Repeater Assn. Hudsonville Fairgrounds, 2 miles N of I-196 at Exit 62. Hamfest/Computer Fair, famous "Roadkill-Chili" potluck supper (Friday, 7 PM), dealers, displays (vintage ham and military radio equipment), alternative energy exhibits, trunk sales (10-ft space $6), Michigan/Florida Hams Meet (9 AM), VE sessions (10:30 AM, walk-ins), camping ($10), handicapped accessible, free parking, refreshments. *TI:* 147.16 (94.8 Hz). *Adm:* $5, under 12 free with accompanying adult. Tables: 8-ft $8. Kathy Werkema, KB8KZH, 562 92nd St SE, Byron Center, MI 49315; 616-698-6627; **kwerkema@juno.com**; **www.w8hvg.org**.

Michigan (Hastings)—Jun 28. Jack Hill, K8YPW, **k8ypw@arrl.net**.

†Michigan (Midland)—Jun 14; set up 6:30 AM; public 8 AM to 1 PM. *Spr:* Midland ARC. Gerstacker Fair Center on Midland County Fairgrounds, 6905 Eastman Ave; US-10 to Eastman Rd Exit, W on Airport Rd (immediately N of freeway) to Fairgrounds entrance. New and used amateur radio, electronics, and computer equipment; trunk sales on paved parking area ($5 per space, plus admission); VE sessions; Friday night camping nearby; free parking; refreshments. *TI:* 147.0. *Adm:* $4. Tables: 8-ft advance $6, door $8 (plus admission). Send SASE to MARC Hamfest, Box 1049, Midland, MI 48641-1049; William French, AB8JF, 940 W Stewart Rd, Midland, MI 48640-9167; 989-835-5562; fax 989-835-3205; **ab8jf@arrl.net**; or Lee Hodges, KC8ITI, 989-652-6213; **www.qsl.net/w8kea/**.

†Michigan (Monroe)—Jun 15; set up 6:30 AM; public 7:30 AM to 1 PM. *Spr:* Monroe County Radio Communications Assn. Monroe County Fairgrounds, 3775 S Custer Rd; 2 miles W of Monroe on M-50, at Raisinville Rd. Hamfest/Computer Show, indoor/outdoor flea market, trunk sales ($6, 8-ft space; plus admission), vendors, computers and equipment, distributors, overnight camping ($15, electricity included), free parking, handicapped parking, refreshments. *TI:* 146.72. *Adm:* advance $6 (with 2 stubs), door $6 (with 1 stub). Tables: $12 (8-ft, plus admission; electricity available in buildings, bring cords). Fred VanDaele, KA8EBI, 4 Carl Dr, Monroe, MI 48162; 734-242-9487; **ka8ebi@arrl.net**; **www.mcrca.org/hamfest.htm**.

†New Jersey (Piscataway)—Jun 21, 7 AM to 2 PM. *Spr:* Raritan Valley Radio Club. Piscataway High School, Hoes Ln and Behmer Rd. Ham and computer equipment dealers, new and used electronics and test equipment, ample parking, refreshments. *TI:* 146.625, 442.25 (141.3 Hz), 146.52. *Adm:* buyers $5, sellers $10; nonham spouses and under 14 free. Fred Werner, KB2HZO, 20 Woodcrest Ln, Greenbrook, NJ 08812; 732-968-7789; **wb2njh@aol.com**; **www.w2qw.org**.

†New Jersey (Washington Township)—May 31; set up 6 AM; public 8 AM to 2 PM. *Spr:* Bergen ARA. Westwood Regional High School, 701 Ridgewood Rd; from Rte 17 N or S to Linwood Ave, go E to Pascack Rd, N on Pascack, go ¼ mile to Ridgewood Rd, E on Ridgewood to high school. Vendors ($15 per space, includes 1 admission, no reservations required; reservations required for limited number of indoor spaces with electrical power), tailgating, VE sessions (8-10 AM, Novice through Extra, $12 fee), DXCC card checking, lots of parking, refreshments. *TI:* 146.79, 146.52. *Adm:* $5, wives and children free. Jim Joyce, K2ZO, 286 Ridgewood Blvd N, Washington Township, NJ 07676; 201-664-6725; **k2zo@arrl.net** or **hamfest@bara.org**; **www.bara.org**.

†New York (Cortland)—Jun 14, 7 AM to 1 PM. *Spr:* Skyline ARC. Cortland County Fairgrounds; I-81 to Exit 12, Rte 281 S; Rte 281 S to Fisher Ave, turn left onto Fisher Ave, right onto Fairgrounds Dr. Flea market, VE sessions. *TI:* 147.18. *Adm:* advance $4, door $5; under 12 free. Tables: $10 (per 8-ft space, includes 1 table and electricity). Andrew Slaugh, KB2LUV, 1134 Old Stage Rd, Cortland, NY 13045; 607-753-0597 (6-9 PM); **kb2luv@arrl.net**; **www.dreamscape.com/sarc**.

†New York (Massapequa)—May 25, 8 AM to 2 PM. *Spr:* Great South Bay ARC. Sunrise Mall, Sunrise Hwy; from Brooklyn, Queens, and Nassau take the LIE, Northern or Southern State Parkway to Rte 135 (Seaford-Oyster Bay Expressway), go S to Rte 27 (Sunrise Hwy), go E for 3 miles, entrances to Mall on left. Open-Air Hamfest (bring your own tables). *TI:* 146.685 (110.9 Hz). *Adm:* $6. Walter Wenzel, KA2RGI, Box 1356, W Babylon, NY 11704-0356; 631-957-0218; **info@gsbarc.org**; **www.gsbarc.org**.

New York (Rochester/Henrietta)—May 30-Jun 1, Atlantic Division Convention. See "Coming Conventions."

†Ohio (Milford)—Jun 21, 8 AM to 2 PM. *Spr:* Milford ARC. Live Oaks Vocational School, Buckwheat Rd; I-275 to Rte 28, right on Buckwheat Rd. Commercial vendors, tailgating, forums, foxhunt, VE sessions, refreshments. *TI:* 147.345. *Adm:* $5. Tables: $5. Chris Reinfelder, KB8SNH, 3782 Grovedale Pl, Cincinnati, OH 45209; 513-351-2776; **kb8snh@cs.com**.

Oregon (Seaside)—Jun 13-15, Northwestern Division Convention. See "Coming Conventions."

Pennsylvania (Bloomsburg)—Jun 14, Eastern Pennsylvania Section Convention. See "Coming Conventions."

†Pennsylvania (Bressler/Harrisburg)—Jul 4; set up Thursday 6-9 PM, Friday 6-8 AM; public 8 AM. *Spr:* Harrisburg RAC. Emerick Cibort Park; PA Turnpike Exit 19, N on I-283 for 3 miles, exit on Eisenhower Blvd, follow signs. Flea market, commercial dealers, tailgating ($5 per space), VE sessions (Oberlin Fire Hall at 9 AM; free), overnight camping, refreshments. *TI:* 146.76. *Adm:* $5 (nonham spouses and children free); or bring a carload of people for $10. Tables: $12 each (before Jun 1), $15 each (on or after Jun 1). Pete deVolpi, K3PD, 408 Hillside Ave, New Cumberland, PA 17070; 717-938-8249; **w3uu@aol.com**; **hrac.tripod.com/July4.htm**.

Tennessee (Knoxville)—Jun 13-14, Tennessee State Convention. See "Coming Conventions."

Tennessee (Silverpoint)—Jun 21. Bobby Raymer, N2BR, 931-537-9222.

†Tennessee (Smyrna)—Jun 14; set up Friday noon to 11 PM, Saturday 5-7 AM; public 8 AM to 5 PM. *Spr:* Nashville ARC. Tennessee Expo and Banquet Center, 1412 Hazelwood Dr; I-24 S from Nashville to Exit 66B, go N on Sam Ridley Blvd, turn right at 2nd traffic light on Old Nashville Pike, go 2.4 miles to traffic light, turn right into Expo parking. Dealers, vendors, contests (high speed CW, left foot CW), on-site moving 2-meter trans-

†ARRL Hamfest

Gail Iannone ♦ Convention Program Manager ♦ giannone@arrl.org

mitter hunt, VE sessions (register at 8 AM; testing promptly at 9 AM), self-contained RV parking, free paved parking, refreshments. *TI:* 145.47. *Adm:* $6, under 12 free. Tables: $15 (includes free electricity and 2 chairs). Murray Jones, K4ANH, 1044 Forest Harbor Dr, Hendersonville, TN 37075; 615-824-7216; **mj80917@aol.com**; **www.kf4oal.com**.

Texas (Arlington)—Jun 20-22, ARRL National Convention. See "Coming Conventions."

†Virginia (Franklin)—Jun 14, 9:30 AM to 3 PM. *Spr:* Franklin AR Repeater Assn. Bronco Club, Rte 258 to Rte 687 (Delaware Rd), approximately 3 miles, look for Bronco Club sign. Hamfest/Picnic/Tailgate, VE sessions, NC-style barbecue. *TI:* 147.3 (131.8 Hz). *Adm:* $5. G. Stewart Tyler, WA4JUO, 801 Normandy Dr, Suffolk, VA 23434-2907; 757-934-2115; **Stu.Tyler@Juno.Com**.

Attention All Hamfest Committees!

Get official ARRL sanction for your event and receive special benefits such as donated ARRL publications, 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**.

Promoting your event is guaranteed to increase attendance. As an approved event sponsor, you are entitled to advertise your event in *QST* at special rates. Make your hamfest a success by taking advantage of this great opportunity. Call the ARRL Advertising Desk at 860-594-0207, or e-mail **ads@arrl.org**.

COMING CONVENTIONS

ATLANTIC DIVISION CONVENTION

May 30-June 1, Rochester (Henrietta), NY

The Atlantic Division Convention (69th annual Rochester Hamfest and Computer Show), sponsored by the Rochester ARA, will be held at the Monroe County Fairgrounds, 2695 E Henrietta Rd; Rte 15A and Calkins Rd. Outdoor flea market runs continuously for the entire weekend beginning Friday at 6 AM; indoor exhibits open Friday noon to 5:30 PM, Saturday 8:30 AM to 5:30 PM, Sunday 8:30 AM to 1:30 PM. Features include outdoor flea market with 1200 vendors, 150 indoor commercial exhibitors with up-to-date radio and communications equipment, complete computer systems (components, software, shareware), awards banquet (Friday, 6:30 PM at the Holiday Inn, Rochester South; $29, includes registration), full day and a half of programs (Friday and Saturday at the Dome Center), DX card certification, VE sessions (on site Friday and Saturday, walk-ins accepted), limited number of camper-RV hookups are available on the grounds. Talk-in on 146.88 (110.9 Hz). Admission is $9, under 12 free. Outdoor flea market tailgate 10-ft ×20-ft spaces are $10 each. Contact Harold Smith, K2HC, 300 White Spruce Blvd, Rochester, NY 14623; 585-424-7184; fax 585-424-7130; **info@rochesterhamfest.org**; **www.rochesterhamfest.org**.

IOWA STATE CONVENTION

June 13-14, Sioux City

The Iowa State Convention (Hamboree 2003—27th Annual Hamboree), co-sponsored by the 3900 Club and the Calabash Group, will be held at the Sioux City Convention Center in the heart of downtown Sioux City at the W end of historic Fourth St; take I-29 N and S to US Hwy 20 E and W. Doors are open Friday 2-8 PM, Saturday 8 AM to 4 PM. Features include huge flea market; new equipment dealers; exhibitors; VE sessions; full slate of seminars; 2nd Annual Bicycle Mobile Hams of America Rally (Mike Nickolaus, NFØN, **nf0n@arrl.net**); QCWA/3900 Club luncheon meeting (Saturday); DXCC card checking (Saturday, 10 AM to 4 PM); left foot keying contest; buffet dinner (Friday eve); banquet (Saturday eve); featured guest from ARRL Hq Brennan Price, N4QX; refreshments. Talk-in on 146.91. Admission is $6 in advance, $7 at the door (good both days). Tables are $10 to $20. Make checks payable to "Hamboree 2003" and send with No 10 SASE to Tom Brosamle, WBØYNX, 501 S Lewis Blvd, Sioux City, IA 51106; 712-252-4107 (10 AM to 5:30 PM, Monday through Saturday); **tands@pionet.net**; **www.3900club.com**.

TENNESSEE STATE CONVENTION

June 13-14, Knoxville

The Tennessee State Convention (37th annual event; 2003 theme "United in Service and Fun for Amateur Radio"), sponsored by the RAC of Knoxville, will be held at the Cokesbury Center, 9915 Kingston Pike; I-40/75, Exit 376B toward Maryville I-140, take Exit 1A (Kingston Pike E), Center is 1/8 mile on left. Doors are open for electronics exposition and special Amateur Radio forum on Friday 6-9 PM, and for the main hamfest on Saturday 9 AM to 4 PM. Features include Hamfest and Electronics Exposition, Amateur Radio and computer equipment, flea market, fantastic inside dealers, large outside tailgate area, forums, clinics, exhibits, displays, demonstrations, CW contests, free manufacturer product literature area, VE sessions, Special Event Station, handicapped accessible, free parking, refreshments. Talk-in on 147.3, 224.5, 444.575, 53.77. Admission is $10 for both days, $6 for Saturday, Jun 14 only. Tables are $15 (8-ft). Contact David Bower, K4PZT, c/o RAC of Knoxville, Box 50514, Knoxville, TN 37950-0514; 865-670-1503; **d.bower@ieee.org**; **www.W4BBB.org**.

May 30-Jun 1
Rocky Mountain Division, Estes Park, CO*

May 31
EMCOMMWEST, Reno, NV*

June 7
Georgia State, Marietta*

July 11-13
Utah State, Bryce

July 12-13
Southeastern Division, Gainesville, GA

July 18-19
Oklahoma State, Oklahoma City

July 18-20
Montana State, East Glacier

July 25-27
Arizona State, Flagstaff

August 1-2
West Gulf Division, Austin, TX

August 3
Western New York Section, Williamsville

August 9-10
Kentucky State, Lexington

***See May *QST* for details.**

EASTERN PENNSYLVANIA SECTION CONVENTION

June 14, Bloomsburg

The Eastern Pennsylvania Section Convention (13th annual event), sponsored by the Columbia-Montour ARC, will be held at the Bloomsburg Fairgrounds; I-80 (E or W) to Exit 232 (old Exit 34), take Rte 42S to Rte 11N to Fairgrounds on the right; from N or S use I-81 or NE extension to Rte 80W to Exit 32 (old Exit 34), then Rte 42S to Rte 11N to Fairgrounds. Doors are open 8 AM to 3 PM. Features include vendors, tailgating, forums, QRP demo, VE sessions. Talk-in on 147.225, 146.52. Admission is $5. Tables are $20 (electricity $5 extra). Contact George Law, N3KYZ, 10 Whitenight Ln, Bloomsburg, PA 17815; 570-784-2299; **n3kyz@jlink.net**; **www.qsl.net/cm-arc**.

NORTHWESTERN DIVISION CONVENTION

June 13-15, Seaside, OR

The Northwestern Division Convention (SeaPac—"The Northwest's Largest Ham Convention"), sponsored by the Oregon Tualatin Valley ARC, will be held at the Seaside Convention Center, 415 1st Ave; take Hwy 101 to 1st Ave, go W on 1st Ave, Convention Center is on your left, just across the river. Doors are open for exhibitor and flea market setup on Friday, June 13 and a workshop. Features include flea market; commercial exhibits; new equipment dealers; seminars; forums; "bored spouses" program; VE sessions; luncheons; banquet (Saturday eve); special guest ARRL Vice President Kay Craigie, N3KN; refreshments. Talk-in on 146.66. Admission is $7 in advance, $9 at the door. Tables are $15 for 1 day, $25 for 2 days. Contact Will Sheffield, N7THL, c/o SeaPac Ham Convention, Box 219142, Portland, OR 97225-9142; 503-642-7314; **n7thl@juno.com**; **www.seapac.org**.

SAN FRANCISCO SECTION CONVENTION

June 20-22, Ferndale, CA

The San Francisco Section Convention (Redwood Coast Amateur Radio Convention), co-sponsored by the Humboldt ARC, Redwood ARC, Farwest Repeater Assn, and Southern Humboldt ARC, will be held at the Humboldt County Fairgrounds, 1250 Fifth Ave; from US 101 take the Fernbridge/Ferndale Exit, Eureka is 20 miles N of Fernbridge; from Fernbridge cross the historic bridge over the Eel River, drive 5 miles to Ferndale. Doors are open Friday 5:30 PM (Wine and Cheese Welcome Ice Breaker), Saturday 9 AM to 5 PM, Sunday 9 AM to 1 PM. Features include swapmeet; commercial dealers; exhibitors; vendors; VE sessions; many educational opportunities; special guest from ARRL Hq Field and Educational Services Manager Rosalie White, K1STO; banquet (Saturday, 6 PM). Talk-in on 146.85, 147.09 (103.5 Hz). Admission is $3 in advance, $4 at the door. Tables are $15. Contact Marci Campbell, KE6IAU, 1633 Mike Ln, Eureka, CA 95501; 707-442-3866; **conven@humboldt-arc.org; www.humboldt-arc.org**.

ARRL NATIONAL CONVENTION

June 20-22, Arlington, TX

The ARRL National Convention, sponsored by HamCom 2003, will be held at the Arlington Convention Center, 1200 Ballpark Way, midway between Dallas and Ft Worth, just off I-30. Doors are open Friday noon to 7 PM, Saturday 7 AM to 5 PM, Sunday 7 AM to 1 PM. Features include indoor and outdoor flea markets, commercial exhibitors, major AR manufacturers, dealers, vendors, forums (ARRL, AMSAT, APRS, QRP, DX), educational programs (including SKYWARN School, Sunday 2-5 PM), other programs from Boat Anchors to Spread Spectrum, Lone Star DX Luncheon ($35), VE sessions (all classes, all three days, preregister by Jun 6; Ted Richard, AB5QU, 817-293-6745; **ab5qu@arrl.net**), refreshments. Talk-in on 147.14. Admission is $9 in advance (by Jun 6), $10 (after Jun 6). Tables are $35 each. Contact Maury Guzick, W5BGP, c/o Ham-Com, Box 12774, Dallas, TX 75225-0774; 214-361-7574 (phone/fax); **chairman@hamcom.org**; **www.hamcom.org**.

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.

CONTEST CORRAL

Feedback

In the 2002 IARU HF World Championships, the category for **WW4LL** in Georgia should be Multioperator.

In the 2002 IARU HF World Championship results, **W1AW** was inadvertently scored from Zone 8 instead of Zone 7. The QSO and Multiplier totals are correct but their final score changes to 8,926,404, which places them in 13th place overall.

W1AW Qualifying Runs are 10 PM EDT Thursday, Jun 5, and 7 PM EDT Thursday, June 19. The K6YR West Coast Qualifying Run will be at 9 PM PDT Wednesday, June 11 (10-40 WPM). Check the W1AW Schedule elsewhere in this issue for details.

Abbreviations

SO—Single-Op; M2—Multiop—2 Transmitters; MO—Multi-Op; MS—Multi-Op, Single Transmitter; MM—Multi-Op, Multiple Transmitters; AB—All Band; SB—Single Band; S/P/C—State/Province/DXCC Entity; HP- High Power; LP—Low Power; Entity—DXCC Entity

No contest activity on 30, 17 or 12 meters. Refer to the contest Web sites for information about awards. Unless stated otherwise, regional contests only count QSOs with stations in the region. Publication deadline for Contest Corral listings is the first of the second month prior to publication.

June 7-8

QRP TAC Contest—CW—sponsored by EPA QRP Club from 1800 to 2359Z Jun 7. Frequencies: 80-10 meters. Categories: QRP (<5 W), QRPp (<1 W), Tactical (portable with temporary antennas), Homebrew, Classic (pre-1985 radios). Exchange: RST, name and telephone area code (TAC), DX send area code or prefix. PA stations send × after the area code. For more information—**www.n3epa.org/**. Logs due Jul 12 to **tac@n3epa.org** or EPA QRP Club c/o Ron Polityka, 1155 Robeson St, 2nd Fl, Reading, PA 19604-2151.

WW South America CW Contest—sponsored by the Confederacao Brasileira de Radioamadorismo (LABRE) from 0000Z Jun 7-1600Z Jun 8. Frequencies: 80-10 meters. Categories: SOAB, SOSB, MOAB. Exchange: RST and continent. QSO Points: South America entrants: own country—1 pt, different country—3 pts, diff. continent—10 pts; non-SA entrants: own country—1 pt, diff. country—3 pts, diff. cont.—5 pts, SA—10 pts. Score is QSO points × prefixes (WPX rules). For more information—**www.labre.org**. Logs due Jul 31 to **labre@labre.org** or LABRE—WWSA Contest Committee, PO Box 0000470359-970, 70359-970 Brasilia DF, Brazil.

June 14-16

ARRL June VHF QSO Party—1800Z Jun 14-0300Z Jun 16 (see May *QST*, p 101 or **www.arrl.org/contests/rules/2003/june-vhf.html**).

West Virginia QSO Party—CW/SSB—sponsored by the West Virginia State Amateur Radio Council from 1600Z Jun 14-0200Z Jun 15. Frequencies: 80-10 meters, CW—35 kHz from band edge, Phone—35 kHz from the edges of the General Class band and Novice/Tech 10-meter segment. Categories: SO, MS, MM and Mobile, all categories may be HP, LP (<100 W), QRP (<5 W), Phone, CW, or mixed mode. Work stations once per band/mode and WV stations from each county (WV mobiles keep separate log for each county). Exchange: RS(T) and WV county or SPC. QSO Points: Fixed stations: CW—2 pts, SSB—1 pt; Mobiles: CW—5 pts, SSB—3 pts; Bonus—100 pts for QSOs with W8WVA once per band/mode, WV mobiles add 100 points per county activated with minimum of 15 QSOs. Score: QSO points ×WV counties (+ SPC for WV stations), add bonus to final score, multipliers count only once. For more information—**www.qsl.net/wvarrl**. Logs due Jul 15 to **WA8WV@aol.com** or Dave Ellis, WA8WV, 610 Hillsdale Dr, Charleston, WV 25302.

Asia-Pacific Sprint—SSB—1100Z-1300Z Jun 14 (see Feb *QST*, p 103 or **jsfc.org/apsprint/aprule.txt**).

ANARTS WW RTTY/Digital Contest—sponsored by Australian National Amateur Radio Teleprinter Society (ANARTS) from 0000Z Jun 14-2400Z Jun 15. Frequencies: 80-10 meters. Categories: SO, MS, and SWL, SO and SWL only operate 30 hours. Exchange RST, CQ zone and Time (UTC). QSO Points are determined by an exchange table available from ANARTS. Score is QSO points × DXCC entities + VK, JA, VE, and W call districts + continents (counted only once). For more information—**www.users.bigpond.com/ctdavies**. Logs due Sep 1 to **ctdavies@bigpond.com** or Contest Manager, VK2BQS, Jim Swan, PO Box 93, Toongabbie, NSW 2146, Australia.

Portugal Day Contest—SSB—sponsored by Rede dos Emissores Portugueses (REP) from 0000Z-2400Z Jun 14. Frequencies: 80-10 meters. Categories: SOAB only. Exchange: RS + serial number or CT district abbreviation. QSO Points: different country—3 pts, CT stations—6 pts. Score: QSO points × CT districts counted once per band. For more information—**www.rep.pt**. Logs due Aug 31 to REP-Rede dos Emissores Portugueses, Award/Contest Manager, PO Box 2483, 1112 Lisboa Codex, Portugal.

June 21-22

Kid's Day Operating Event—1800-2400Z Jun 21 (see article elsewhere in this issue or **www.arrl.org/FandES/ead/kd-rules.html**).

All-Asian DX Contest—CW—sponsored by the Japan Amateur Radio League from 0000Z Jun 21 to 2400Z Jun 22. (SSB—Sep 6-7). Frequencies: 160-10 meters, incl 10-minute band change rule. Categories: SOAB, SOSB, MO, Low Power (Asian stations only), Junior (JA stations <20 years), Senior (JA stations >70 years). Exchange: RS(T) and a two digit number denoting the operator's age. YL stations may send 00. QSO Points for non-Asian stations: 40-15 meters—1 pt, 80 and 10 meters— 2 pts, 160 meters—3 pts. Score: QSO pts × Asian prefixes (WPX rules). For more information and Asian station QSO points—**www.jarl.or.jp/English/4_Library/A-4-3_Contests/2003AA_ Rule.htm**. Logs due Jul 31 (Oct 30 for phone) to **aacw@jarl.or.jp** (SSB logs to **aaph@jarl.or.jp**) or JARL, All Asian DX Contest, 170-8073, Japan.

His Majesty King of Spain Contest—SSB—1800Z Jun 21-1800Z Jun 22. See May *QST*, p 95.

SMIRK QSO Party—sponsored by the Six Meter International Radio Klub, 0000Z Jun 21-2400Z Jun 22. Frequencies: phone QSOs within the lower 48 states and Canada above 50.150 MHz; only DX QSOs between 50.100 and 50.150 MHz. SO category only. No repeater QSOs. Exchange: SMIRK number and grid square. QSO Points: SMIRK member—2 pts, non-member—1 pt. Score: QSO points × grid squares. For more information—**www.smirk.org**. Logs due Aug 1 to **contest@smirk.org** or Dale Richardson, AA5XE, 219 US 377 South, Junction, TX 76849-5234.

June 28-29

ARRL Field Day—1800Z Jun 28 to 2100Z Jun 29 (see May *QST*, p 101, or **www.arrl.org/contests/rules/2003/rules-fd-2003.html**).

QRP ARCI Milliwatt Field Day—1800Z Jun 28-2100Z Jun 29. Follows ARRL Field Day rules, see **personal.palouse.net/rfoltz/arci/mwfd.htm** for more information.

Marconi Memorial HF Contest—CW—sponsored by ARI from 1400Z Jun 28-1400Z Jun 29. Frequencies: 160-10 meters, according to IARU band plan. Categories: SO -LP (<100 W) and -QRP (<5 W), and MO. Exchange: RST + serial number. QSO Points: 1 pt/QSO. Score: QSO points × DXCC entities counted once per band. For more information—**www.qsl.net/ik6ptj/marconi.htm**. Logs due 30 days after the contest to **ik6ptj@qsl.net** or ARI sez. di Fano, PO Box 35, I-61032 FANO (PS), Italy. QST

H. Ward Silver, NØAX ♦ 22916 107th Ave SW, Vashon, WA 98070 ♦ n0ax@arrl.org

SPECIAL EVENTS

Layfayette, LA: Acadiana Amateur Radio Association, W5DDL. 1300Z **Jun 5**-2400Z **Jun 6**. 50 Years of affiliation with ARRL. 28.430 21.375 14.270 7.235. QSL and Certificate. Acadiana ARA, PO Box 51174, Lafayette, LA 70505-1174. **www.w5ddl.org/clubsite/**.

Lander, WY: Fremont County Amateur Radio Society, KD7PPP. 1600Z **Jun 6**-0500Z **Jun 7**. Second annual Spring Comes Late in the Wind River Mountains. 28.360 21.330 14.330 7.240. Certificate. Ray H. Snyder, 300 Wood St, Lander, WY 82520.

Ponca City, OK: Kay County Amateur Radio Club, W5HZZ. 1700Z **Jun 6**-2100Z **Jun 7**. Ponca City Oklahoma's Jammin In June Celebration. 28.365 21.365 14.265 7.265. QSL. Joe Widner, KB5DBR, 3644 Ashbury Rd, Ponca City, OK 74604.

Baltimore, MD: Historical Electronics Museum Amateur Radio Club, W3GR. 1400Z **Jun 6**-2100Z **Jun 8**. The role of electronics in the 1944 D-Day invasion of Europe. 28.450 21.110 14.250 7.110. Certificate. HEMARC W3GR, PO Box 746 MS4015, Baltimore, MD 21203.

Tupelo, MS: Tupelo Amateur Radio Club, KK5K. 2200Z **Jun 6**-2200Z **Jun 8**. 5th Annual Elvis Presley Festival Special Event—All Bands. 14.265 21.365 28.465 7.265. QSL. Tupelo Amateur Radio Club, 429 Goodlett St, Tupelo, MS 38804.

Asheboro, NC: Randolph ARC, NC4ZO. 1300Z-2000Z **Jun 7**. Warbird Air Show D-Day Commemoration. 28.400 21.320 14.240 7.240. Certificate. Randolph ARC, 6747 King Mtn Rd, Asheboro, NC 27205.

Clovis, NM: Eastern New Mexico Amateur Radio

Maty Weinberg, KB1EIB ♦ Special Events ♦ events@arrl.org

Club, KA5B. 1500Z-2300Z **Jun 7**. Buddy Holly and others Recording at the Norman Petty Studio. 21.270 14.250 7.270. Certificate. W5ROY, 208 Merrill Dr, Clovis, NM 88101.

Tylertown, MS: Southwest Mississippi ARC, KD5QNC. 1500Z-2200Z **Jun 7**. Walthall County Dairy Festival. 14.270 7.270. QSL. KD5QNC, Southwest Mississippi ARC, 1545 Friendship La NW, Brookhaven, MS 39601.

Union, IL: Illinois Railroad Museum, W9T. 1500Z-2300Z **Jun 7**. 50th Anniversary of Illinois Railroad Museum. 28.400 21.350 14.250 7.250. Certificate. Larry Zacharias, N9LZ, 1031 Pershing Dr, Wauconda, IL 60084.

Olathe, KS: Johnson County ARES, W9BSP. 1800-2200Z **Jun 7**-1800-2200Z **Jun 8**. Commemorate Marshall and Loretta Ensor CW teachers. 28.400 21.350 14.250 10.125. Certificate. Dan Reed, 29545 W 152nd Ter, Gardner, KS 66030.

Streetsville, ON Canada: Mississauga Amateur Radio Club, VE3MIS. 1400Z **Jun 7**-2000Z **Jun 8**. Streetsville Founders Bread & Honey Festival. 28.480 21.315 14.240 7.227. Certificate. MARC, C/O Michael Brickell, VE3TKI, 2801 Bucklepost Crescent, Mississauga, ON Canada L5N 1X6. US postage is not usable in Canada.

Atkinson, NH: Atkinson Amateur Radio Club, K1D. 0400Z **Jun 7**-0400Z **Jun 22**. Celebrating Kid's Day and Amateur Radio Awareness. 28.390 21.390 14.270 7.230. Certificate. Peter Schipelliti, 7 Dearborn Ridge Rd, Atkinson, NH 03811.

Columbus, OH: Scioto Valley Wireless Association, W8C. 1400Z-2100Z **Jun 14**. Radio ops from replica of Christopher Columbus's flagship. 14.250 14.040 7.225 7.040. QSL. Jim Strong, 884 T R 3006, Perrysville, OH 44864.

Peterboro, NY: Madison Oneida Amateur Radio Club, W2MO. 1400Z-2000Z **Jun 14**. 11th Annual Civil War Reenactment Weekend. 21.315 14.275 14.055 7.055. Certificate. MOARC, PO Box 241, Verona, NY 13478.

Toms River, NJ: Jersey Shore Amateur Radio Society, W2DOR. 1400Z-2000Z **Jun 14**. Dover Township (Toms River), NJ Founders Day. 28.360 21.360 14.260 7.260. QSL. JSARS, PO Box 295, Toms River, NJ 08754-0295.

Portsmouth, OH: Portsmouth Radio Club, KC8FKP. 0000Z **Jun 14**-2400Z **Jun 15**. Bicentennial Celebration and Radio Club 64 years of Service. 28.410 21.310 14.310 7.238. Certificate. Portsmouth Radio Club, PO Box 266, Portsmouth, OH 45662.

Whiteman AFB, MO: Warrensburg Area ARC, Inc, W0W. 1600Z **Jun 14**-2100Z **Jun 15**. Wings Over Whiteman Air Show—100 Years of Air Domination. 28.325 21.325 14.325. Certificate. H. Keith Haye, WEØG, 1826 NW 530, Kingsville, MO 64061. **www.whiteman.af.mil/airshow/index.shtml**.

Salt Lake City, UT: Great Salt Lake Council, BSA, K2BSA/7. 1800Z **Jun 18**-1800Z **Jun 21**. Varsity Scout Big Event at East Fork of the Bear Scout Camp. 28.325 14.250 14.035 7.130. QSL. Curt Wilbur, K7CU, 907 East 250 South, Bountiful, UT 84010.

Arlington, TX: Dallas County REACT ARC (W5DCR), W1AW/5. 1800Z **Jun 20**-1800Z **Jun 22**. W1AW/5 Special event station of the ARRL National Convention. CW 14.035 7.035; SSB 14.243 21.243. Certificate. W1AW/5 Special Event, c/o Dallas County REACT, PO Box 600215, Dallas, TX 75360-0215.

Arlington, TX: New Old Stock QCWA, Chapter 207, W1AW/5. 1800Z **Jun 20**-1800Z **Jun 22**. W1AW/5 Special event (AM station) ARRL National Convention. 14.290 AM 7.290 AM 3.880 AM. Certificate. W1AW/5 Special Event, c/o Dallas County REACT, PO Box 600215, Dallas, TX 75360-0215.

West Union, OH: DeForest ARC, K8GE. 1400Z-1900Z **Jun 21**. Ohio Covered Bridge Special Event. 14.273 7.233. Certificate. DeForest ARC, PO Box 73, West Union, OH 45693. **www.qsl.net/k8ge**.

Fremont, OH: Sandusky Valley ARC, W8M. 1200Z **Jun 21**-2400Z **Jun 22**. Ohio Covered Bridges On The Air. 14.250 14.040 7.250 7.040. QSL. Chuck Foster Sr, KB8KIK, 211 High St, Fremont, OH 43420.

Hamilton, OH: Butler County VHF Association, W8P. 1200Z **Jun 21**-2100Z **Jun 22**. Ohio Covered Bridge Event from the Bridge in Governor Bebb Park. 14.250. QSL. Tom Isgro, 67 Dayspring Dr, Hamilton, OH 45015.

Highland County, OH: Highland Amateur Radio Association, W8N. 1600-2100Z **Jun 21**-1600-2100Z **Jun 22**. Ohio Covered Bridge Weekend-Lynchburg Covered Bridge. 50.2 28.420 21.325 14.255 7.255. QSL. Highland ARA, Attn: John Levo, WA8KIW, PO Box 203, Hillsboro, OH 45133.

Huntington, WV: Tri-State ARA, W8VA. 1400Z **Jun 21**-1400Z **Jun 22**. From the Museum of Radio and Technology, commemorating West Virginia Day. 21.325 14.250 7.250. Certificate. Tri-State ARA—W8VA, PO Box 4120, Huntington, WV 25729.

Newton Falls, OH: Western Reserve Amateur Radio Association, W8T. 1200Z **Jun 21**-2000Z **Jun 22**. Ohio Covered Bridges On The Air. 10 20 40 80 m. QSL. Gail Wells, 708 Delaware Ave SW, Warren, OH 44485.

Haddonfield, NJ: Burlington County Radio Club, K2H. 1400Z-2400Z **Jun 22**. 225th anniversary of British and Hessian occupation of Haddonfield. 28.377 21.377 14.277 146.82. Certificate. K2TD, PO Box 65, Fort Dix, NJ 08640. **www.roadtomonmouth.com/hamradio.html**.

Evesham, NJ: Burlington County Radio Club, K2E. 1400Z-2400Z **Jun 23**. Celebrating the 225th Anniversary of the skirmish at Earyestown. 28.377 21.377 14.277 147.15. Certificate. K2TD, PO Box 65, Fort Dix, NJ 08640. **www.roadtomonmouth.com/hamradio.html**.

Mt Holly, NJ: Burlington County Radio Club, K2M. 1400Z-2400Z **Jun 24**. Celebrating the 225th Anniversary of British occupation and Court Martial of Pvt Fisher. 28.377 21.377 14.277 147.15. Certificate. K2TD, PO Box 65, Fort Dix, NJ 08640. **www.roadtomonmouth.com/hamradio.html**.

Rocky Hill/Kingston, NJ: Rockingham ARC, W2R. 1400Z **Jun 24**-2400Z **Jun 25**. Celebrating the 225th Anniversary of George Washington's first visit to Rockingham. 28.387 21.387 14.287 146.46. Certificate. N2GJ, PO Box 147, Kingston, NJ 08528. **www.roadtomonmouth.com/hamradio.html**.

South Brunswick, NJ: South Brunswick ARC, W2S. 1400Z-2400Z **Jun 25**. Celebrating the 225th Anniversary of George Washington's encampment in Monmouth Junction. 28.387 21.387 14.287 146.46. Certificate. NJ2SB, 618 Magnolia Rd, N Brunswick, NJ 08902-2622. **www.roadtomonmouth.com/hamradio.html**.

Cranbury, NJ: David Sarnoff Radio Club, W2C. 1400Z **Jun 26**-0400Z **Jun 27**. 225th Anniversary of Washington's encampment in Cranbury. 28.387 21.387 14.287 146.46. Certificate. R. Borchardt, 5 Cranbury Neck Rd, Cranbury, NJ 08512. **www.roadtomonmouth.com/hamradio.html**.

Merrickville, ON Canada: DX-Hounds of Ontario, VB3MCC. 2000Z **Jun 27**-2000Z **Jul 4**. Celebrating 100 years of Canadian Military Communications. 14.255 7.260 14.045 7.045. Certificate. Robert J. Calver, 419 Bates Rd RR#3, Jasper, ON, Canada K0G 1G0. **www.storm.ca/~scalver**.

Los Alamos, NM: Los Alamos Amateur Radio Club, W5PDO. 1800Z-2200Z **Jun 28**. Earthwatch Institute's Student Challenge Awards Program from Fenton Hill Observatory. 14.250 21.350 28.450. Certificate. Don Casperson, AA5PA, 984 Nambe Loop, Los Alamos, NM 87544.

Mentor, OH: Lake County Amateur Radio Association, N8BC. 1800Z **Jun 28**-2100Z **Jun 29**. State of Ohio Bicentennial Celebration. 28.410 21.310 14.310 7.235. QSL. LCARA, PO Box 868, Painesville, OH 44077-0868.

Simi Valley, CA: Ventura County Amateur Radio Society, N6R. 1800Z **Jun 28**-2100Z **Jun 29**. Lives of President and Mrs Ronald Reagan. 28.310 21.310 14.210 7.210. Certificate. Peter S. Heins, PIO, VCARS, 1559 Norwich Ave, Thousand Oaks, CA 91360-3533.

Peach Bottom, PA: Chester County Council, Boy Scouts of America, K2BSA/3. 1800Z **Jun 29**-1800Z **Jul 5**. Science Camp. 14.290 7.270 3.940. QSL. Cullen Langford, PO Box 173, Kemblesville, PA 19347.

Certificates and QSL cards: To obtain a certificate from any of the special-event stations offering them, send your QSO information along with a 9×12 inch self-addressed, stamped envelope to the address listed in the announcement. To receive a special event QSL card (when offered), be sure to include a self-addressed, stamped business envelope along with your QSL card and QSO information.

STRAYS

CLUB DONATES EASTER BASKETS FOR FAMILIES AT FORT SAM HOUSTON

◊ Just a few days after the beginning of the full force of Operation Iraqi Freedom, the Northwest Amateur Radio Society (NARS) in Houston, Texas held its March meeting. When the Ham and "Sheez," the club's ladies auxiliary, announced plans to support the troops serving overseas, we had no idea of the tremendous support we would receive.

The chaplain at Fort Sam Houston in San Antonio suggested we distribute Easter baskets for the families of those serving in the Gulf, since this Easter holiday was the first that many Fort families were to be separated from loved ones. Several members of the club worked long and hard to prepare the baskets, and local merchants donated items without any request for recognition.

When we delivered the baskets, we lost count of the times we were thanked for our efforts and our genuine gesture of caring. Amateur Radio and our club's activities were also topics of many of the conversations. Watching the children smile with excitement when they saw the Easter baskets made every minute of the effort truly worthwhile.—*Laurie Meier, N1YXU*

JOHN ELLIS, W5PDW

This is the group of NARS Ham and "Sheez" members and friends who gathered to put together Easter baskets for families of those serving in the Persian Gulf.

By Kelly Taylor, VE4XT

Results, 2002 ARRL November Phone Sweepstakes

Records were falling all over the place in the 2002 November Phone Sweepstakes—particularly in low power. A total of 1692 entries were received, of which 901 were from Single Operator Low Power Entries, the most popular category. Plus, the 1692 competitive logs are the most received for Phone Sweepstakes in the past nine years.

It is this group—Precedence "A"—that really is the "bread and butter" of the contest. They are like most of us. They have a simple station, some wire swaying in the breeze. Perhaps they have a tribander to help on the higher bands. But by the end of the contest they had participated in 235,587 QSOs during the 30-hour Sweepstakes period. The big guns would run out of guys to work real fast if it weren't for the "average" participants getting on the air to have some fun.

Records Abound

VA7RR seemingly came from nowhere to set a BC record and knock off perennial favorite Rob, VE4GV 277,440 to 266,240. Sam, VE5SF, also set the Saskatchewan record (241,280), W7ZR (228,960) set an Arizona record, NØKK (@NØAT) (219,040) set a Minnesota record, WØMW (210,400), a new record in Kansas, W8MJ's 208,640 was a Michigan record. Also in Top 10 but not setting records were K4XU (202,556), N7GYD (201,608) and K5WA (201,120).

In high power the story once again was, who else? WP3R, whose score came within a hair of breaking the overall high-power record, which is held by, you guessed it, WP3R.

Expanded Results, Line Score Printouts Available

For complete contest results on-line, please visit **www.arrl.org/contests/results**. ARRL members without Internet access may obtain a printout of the complete line scores by sending a self-addressed stamped envelope to ARRL Contest Results, 225 Main St, Newington, CT 06111. Please be sure to include the contest name and year.

QRP was won by K9TM, unlimited by K6LL, multioperator by W7GG and school club by K5UTD.

But SS isn't just about the big numbers. Certainly, tying the high-power overall record is the big story. But we'll also meet Sherman, W4ATL, who set an LP record in Georgia…Dan, K6IF, who placed 13th in high power and set a San Francisco section record despite an almost 20-year absence from contesting…and Bill, K4XS, who didn't win but prides himself on being the top-scoring mainland US station east of the Mississippi.

Low-power champ Gary, VA7RR, admits his own call isn't that well-known yet, but you've heard his voice before, first as WA6VEF and later as a guest op at VE7SZ. "It was nice to come out on top, and extremely gratifying to be successful from the home station," he says. "This was the first time I've ever entered the low power category in this contest. I had no idea what to expect; the goal was to have fun and make as many Qs as possible."

He owes his success to 10, 15 and 20, and primarily to 10. He's not expecting to

The WØEEE station being ably run by Ben, KIØPX, and Ken, KC9UMR. They cruised to a third place finish in the School Club category.

Top Ten

Phone

Single Operator, QRP

		QSO	Mults	Hrs
K9TM	133,120	832	80	22
K7MM	119,448	756	79	24
KO9A	114,550	725	79	24
VE4MM	100,480	628	80	17
WA8ZBT	93,440	584	80	22
K1AM	90,240	564	80	24
KX9X	85,280	533	80	20
NØUR	74,328	489	76	18
N8IE	67,680	423	80	22
N9NE	65,412	414	79	18

Single Operator, Low Power

		QSO	Mults	Hrs
VA7RR	277,440	1734	80	24
VE4GV	266,240	1664	80	24
VE5SF	241,280	1508	80	24
W7ZR	228,960	1431	80	24
NØKK (@NØAT)	219,040	1369	80	24
WØMW	210,400	1315	80	22
W8MJ	208,640	1304	80	24
K4XU	202,556	1282	79	20
N7GYD	201,608	1276	79	24
K5WA	201,120	1257	80	19

Single Operator, High Power

		QSO	Mults	Hrs
WP3R	425,280	2658	80	24
KH7X (KH6ND, op)	363,040	2269	80	24
K5TR	334,720	2092	80	24
WBØO	326,720	2042	80	24
K4XS	326,080	2038	80	24
W7WA	320,160	2001	80	24
K6NA (N6ED, op)	313,760	1961	80	24
WØSD (WDØT, op)	306,720	1917	80	24
VE6JY (VE5MX, op)	300,800	1880	80	24
K7RI	294,400	1840	80	24

Single Operator, Unlimited

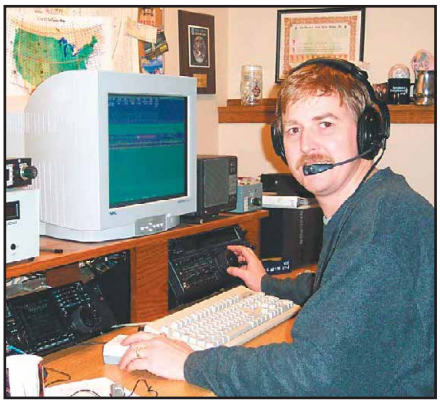
		QSO	Mults	Hrs
K6LL	298,880	1868	80	24
WB1GQR (W1SJ)	279,200	1745	80	24
N6TV	275,520	1722	80	23
K7OX	261,440	1634	80	24
W7UT	254,880	1593	80	21
KD4D	246,400	1540	80	24
N2WW	240,640	1504	80	24
W4MYA	233,440	1459	80	24
W4NF	231,680	1448	80	24
WE9V	228,160	1426	80	20

Multioperator

		QSO	Mults	Hrs
W7GG	333,120	2082	80	24
K9NS	310,080	1938	80	24
W6YX	300,160	1876	80	24
WP2Z	287,040	1794	80	20
KTØR	281,600	1760	80	24
N5DO	259,520	1622	80	24
N8HR	252,000	1575	80	24
WØNO	241,920	1512	80	24
N8KR	240,960	1506	80	24
K8CC	240,160	1501	80	24

School Club

		QSO	Mults	Hrs
K5UTD	200,480	1253	80	24
W2CXM	120,000	750	80	19
WØEEE	106,240	664	80	22
W4AQL	104,800	655	80	24
W9YT (KB9ITE, op)	86,110	545	79	18
WF4DD (KG4CZU, op)	64,622	409	79	12
KC7KFF	46,976	367	64	7
W9UIH (WØTPO, op)	43,428	282	77	19
WA5BU (K5LH,op)	41,652	267	78	12
W7ISU (W7RSR, op)	37,752	242	78	14



Kirk, NØKK, who brought home a fifth place overall finish in the Single Operator Low Power category, used the NØAT station.

stay on top as the sunspot cycle wanes, and he's forced to spend time on 20 and 40, where he's not as competitive. He says the key to success is to never give up and especially not to get sucked in by someone else's higher numbers. "I was running, I think, behind VE4GV until Sunday afternoon, when I caught up and pulled ahead."

Frequency selection is also key, particularly in low power. You'll often hear VE4GV at 14.151 on 20 or higher on 15 and 10. Gary says it's important to stay in the clear. VE4GV holds the overall low-power record, which was safe and, obviously, the Manitoba record.

There's a new low-power champ in Georgia. Sherman, W4ATL, though not in Top 10 (no. 14, by the way, one spot behind the author), beat the Georgia record set in 2000 by W4WA. Sherman's final score was 1163 by 80 for 186,080, well ahead of W4WA's mark of 178,880.

Sherman says SS is still his favorite contest, though NAQP is challenging for that title. "My goal was to break 1,000 QSOs, and I exceeded my expectations," he says. He got off to a rough start on 15 and 10 and then finally started making

Plaque Winners

Division	*Plaque Category*	*Plaque Sponsor*	*Winner*
Overall	Single Operator High Power Phone	Carl Cook, AI6V	WP3R (KE3Q, op)
Overall	Single Operator Low Power Phone	Ken Adams, K5KA	VA7RR
Overall	Single Operator QRP Phone	QRP Amateur Radio Club International	K9TM
Overall	School Club College Division Phone	Mark Smith, KD4JLC, Memorial	K5UTD
Overall	Multioperator Phone	Central Texas DX & Contest Club	W7GG
Atlantic	Single Operator High Power Phone	North Coast Contesters	K3MM
Atlantic	Single Operator Low Power Phone	Potomac Valley Radio Club	W2KA
Atlantic	Multioperator Phone	Mark Sickmeyer, KB3GJ Memorial	WR3L
Central	Single Operator High Power Phone	Society of Midwest Contesters	WB9Z
Central	Single Operator Low Power Phone	Society of Midwest Contesters	K9ZO
Central	Single Operator QRP Phone	Don Haney, W9WW	KO9A
Central	Single Operator Unlimited Phone	Society of Midwest Contesters	WE9V
Central	Multioperator Phone	Don Haney, W9WW	K9NS
Dakota	Single Operator High Power Phone	Minnesota Wireless Association	WBØO
Dakota	Single Operator Low Power Phone	Minnesota Wireless Association	NØKK (@NØAT)
Dakota	Single Operator QRP Phone	Tod Olson, KØTO	NØUR
Dakota	Single Operator Unlimited Phone	Minnesota Wireless Association	K4IU
Dakota	Multioperator Phone	In Memory of Jim Dokmo, KØFVF Minnesota Wireless Association	KTØR
Great Lakes	Single Operator High Power Phone	North Coast Contesters	K8AO
Great Lakes	Single Operator Low Power Phone	Mad River Radio Club	W8MJ
Midwest	Single Operator Low Power Phone	Society of Midwest Contesters	WØMW
New England	Single Operator QRP Phone	QRP Club of New England	K1AM
Pacific	Single Operator Low Power Phone	Jim Hollenback, NK6L	N6NF
Roanoke	Single Operator High Power Phone	Potomac Valley Radio Club	W4MR (AA4NC, op)
Roanoke	Single Operator Low Power Phone	Raleigh Amateur Radio Society—W4DW	N8II
Roanoke	Single Operator QRP Phone	Northern Virginia QRP	N5FPW
Rocky Mountain	Single Operator Low Power Phone	Grand Mesa Contesters of Colorado	KØUK
Southwestern	Single Operator QRP Phone	Ray and Donna Day, N6HE and N6HTH	W6AFA
West Gulf	Single Operator High Power Phone	Ken Adams, K5KA	K5TR
West Gulf	Single Operator Low Power Phone	Ralph "Gator" Bowen, N5RZ	K5WA
West Gulf	Multioperator Phone	Oklahoma DX Association	N5DO
Canada	Single Operator QRP Phone	Frank Merceret, NA4CW	VE4MM

Top Five By Region

Tables list call sign, score and class (Q = QRP, A = Low Power, B = High Power, U = Unlimited, M = Multioperator)

Northeast Region (New England, Hudson and Atlantic Divisions; Maritime and Quebec Sections)

K3MM	262,280	B
K3ZO	236,800	B
K1KD	228,320	B
KK1L	226,880	B
W1AO	221,920	B
K2Z (KD2RD, op)	147,040	A
K1EP	137,440	A
KZ1M	127,360	A
W2KA	118,720	A
W1JQ	118,400	A
K1AM	90,240	Q
AA2VK	42,920	Q
N3UR	42,642	Q
W1EM	39,000	Q
K3SWZ	36,778	Q
WB1GQR (W1SJ, op)	279,200	U
KD4D	246,400	U
K2PLF	225,920	U
N2MM	224,800	U
VE1OP	220,960	U
NA2NA	210,080	M
WR3L	195,040	M
K2NNY	189,920	M
W1YK	177,600	M
W2MU	161,280	M

Southeast Region (Delta, Roanoke and Southeastern Divisions)

WP3R	425,280	B
K4XS	326,080	B
W4MR (AA4NC, op)	277,120	B
W5WMU	269,600	B
KY5R	238,080	B
W4ATL	186,080	A
N8II	182,016	A
K4WX	173,760	A
NA4K	171,040	A
NY4T	152,320	A
N5FPW	47,580	Q
WB6BWZ	34,456	Q
KC5R	24,820	Q
KQ4YY	18,910	Q
K4WY	18,492	Q
W4MYA	233,440	U
W4NF	231,680	U
K4MA	224,960	U
K4WI	188,480	U
NE4S	138,684	U
WP2Z	287,040	M
NP2B	222,560	M
KM4M	197,600	M
K5DB	197,600	M
W5LAR	185,440	M

Central Region (Central and Great Lakes Divisions; Ontario Section)

WB9Z	256,640	B
N9RV (AJ9C,op)	244,640	B
KE9I	231,360	B
K9BGL	217,600	B
W9BS	209,440	B
W8MJ	208,640	A
W8DD	175,200	A
K9ZO	172,000	A
K8BL	159,840	A
ND8DX	158,400	A
K9TM	133,120	Q
KO9A	114,550	Q
KX9X	85,280	Q
N8IE	67,680	Q
N9NE	65,412	Q
WE9V	228,160	U
N2BJ	216,960	U
NA9D	215,360	U
KI9A	175,840	U
KG9X	173,600	U
K9NS	310,080	M
N8HR	252,000	M
N8KR	240,960	M
K8CC	240,160	M
K8MAD	213,600	M

Midwest Region (Dakota, Midwest, Rocky Mountain and West Gulf Divisions; Manitoba and Saskatchewan Sections)

K5TR	334,720	B
WBØO	326,720	B
WØSD (WDØT, op)	306,720	B
W5KFT (WM5R, op)	252,160	B
K5ZO	229,732	B
VE4GV	266,240	A
VE5SF	241,280	A
NØKK (@ NØAT)	219,040	A
WØMW	210,400	A
K5WA	201,120	A
VE4MM	100,480	Q
WA8ZBT	93,440	Q
NØUR	74,328	Q
WA7LNW	59,792	Q
WØETT	57,288	Q
W7UT	254,880	U
N2WW	240,640	U
NA5S	212,000	U
AA5NT	162,880	U
K1NT	136,960	U
KTØR	281,600	M
N5DO	259,520	M
WØNO	241,920	M
K7TD	225,624	M
KØGQ	210,720	M

West Coast Region (Pacific, Northwestern and Southwestern Divisions; Alberta, British Columbia and NWT/Yukon Sections)

KH7X (KH6ND, op @ KH7R)	363,040	B
W7WA	320,160	B
K6NA (N6ED, op)	313,760	B
VE6JY (VE5MX, op)	300,800	B
K7RI	294,400	B
VA7RR	277,440	A
W7ZR	228,960	A
K4XU	202,556	A
N7GYD	201,608	A
N6NF	188,320	A
K7MM	119,448	Q
W6AFA	58,624	Q
W7KQZ	57,000	Q
KH7YD	51,480	Q
W6LPW	47,880	Q
K6LL	298,880	U
N6TV	275,520	U
K7OX	261,440	U
K6XX	223,360	U
KS6H	202,240	U
W7GG	333,120	M
W6YX	300,160	M
VE6AO	215,840	M
N7PP	209,982	M
W6ISO	180,160	M

headway on 40 meters. "But after midnight it was as if someone flipped a switch," he recalls. "I had incredible runs on 40 and 80. I was planning on getting some sleep around 1 or 2 AM when the rates eased, but people kept calling me. So I kept working 'em. Stopped for breakfast when the rates finally died down around 6 AM."

That Nevada was his last section, late on Sunday, offers some insight into why Georgia isn't the best section to be fighting SS from. That his 15 and 10 meter QSOs were, combined, 1000 QSOs behind the leader, VA7RR, on those bands is also telling. Also setting section records were N8II (West Virginia) and AA7YA (Montana).

The Key to WP3R's success?

When it comes to Sweepstakes, Puerto Rico is the place to be. No need to tell Rich, KE3Q, that. Since parking himself in the high-power chair at WP3R five contests ago, Rich has won every one. He set an all-time record in 2000 and he tied it last year.

One of the beautiful things about SS is that you don't need to be a superstation to win. Indeed, WP3R is blessed with location and a tall mountain, but it's hardly a W3LPL. Talk to most superstation owners and they'll say that being that big is a disadvantage in a contest like SS, which doesn't lend itself well to multiop and doesn't permit multi-multi. Many stations fix most of their antennas on the DX headings, and often rotate only the top antennas. Plus, re-jigging a five-bands-at-once station to permit operation on all five bands from only one desk is no small feat.

Rich takes a lot of pride in tying his 2000 record of 2658 QSOs and, of course, 80 sections for 425,280 points. He wasn't counting on it, given lower raw QSO

Division Leaders

Single Operator High Power

Atlantic	K3MM	262,280
Central	WB9Z	256,640
Dakota	WBØO	326,720
Delta	W5WMU	269,600
Great Lakes	K8AO	184,000
Hudson	W2PS	191,200
Midwest	NØAC	220,410
New England	K1KD	228,320
Northwestern	W7WA	320,160
Pacific	KH7X (KH6ND, op)	363,040
Roanoke	W4MR (AA4NC, op)	277,120
Rocky Mountain	W1XE	203,040
Southeastern	WP3R	425,280
Southwestern	K6NA (N6ED, op)	313,760
West Gulf	K5TR	334,720
Canada	VE6JY (VE5MX, op)	300,800

Single Operator Low Power

Atlantic	W2KA	118,720
Central	K9ZO	172,000
Dakota	NØKK (@NØAT)	219,040
Delta	K4WX	173,760
Great Lakes	W8MJ	208,640
Hudson	K2Z (KD2RD, op)	147,040
Midwest	WØMW	210,400
New England	K1EP	137,440
Northwestern	K4XU	202,556
Pacific	N6NF	188,320
Roanoke	N8II	182,016
Rocky Mountain	KØUK	164,794
Southeastern	W4ATL	186,080
Southwestern	W7ZR	228,960
West Gulf	K5WA	201,120
Canada	VA7RR	277,440

Single Operator QRP

Atlantic	N3UR	42,642
Central	KO9A	114,550
Dakota	NØUR	74,328
Great Lakes	K9TM	133,120
Hudson	AA2VK	42,920
Midwest	WØUVC	18,788
New England	K1AM	90,240
Northwestern	K7MM	119,448
Pacific	W6LPW	47,880
Roanoke	N5FPW	47,580
Rocky Mountain	WA7LNW	59,792
Southeastern	WB6BWZ	34,456
Southwestern	W6AFA	58,624
West Gulf	WA8ZBT	93,440
Canada	VE4MM	100,480

Single Operator Unlimited

Atlantic	KD4D	246,400
Central	WE9V	228,160
Dakota	K4IU	64,116
Delta	KE5K	61,440
Great Lakes	N8BJQ	105,600
Hudson	WE2F	155,840
Midwest	WAØSXV	80,800
New England	WB1GQR (W1SJ, op)	279,200
Northwestern	K7OX	261,440
Pacific	N6TV	275,520
Roanoke	W4MYA	233,440
Rocky Mountain	W7UT	254,880
Southeastern	K4WI	188,480
Southwestern	K6LL	298,880
West Gulf	AA5NT	162,880
Canada	VE1OP	220,960

Multioperator

Atlantic	WR3L	195,040
Central	K9NS	310,080
Dakota	KTØR	281,600
Delta	K5DB	197,600
Great Lakes	N8HR	252,000
Hudson	NA2NA	210,080
Midwest	WØNO	241,920
New England	W1YK	177,600
Northwestern	W7GG	333,120
Pacific	W6YX	300,160
Roanoke	KM4M	197,600
Rocky Mountain	K7TD	225,624
Southeastern	WP2Z	287,040
Southwestern	WX7P	129,120
West Gulf	N5DO	259,520
Canada	VE6AO	215,840

School Clubs

Atlantic	W2CXM	120,000
Central	W9YT (KB9ITE, op)	86,110
Dakota	WØHSC	8,692
Delta	W5YD	11,342
Midwest	WØEEE	106,240
Northwestern	W7ISU (W7RSR, op)	37,752
Roanoke	WF4DD (KG4CZU, op)	64,622
Southeastern	W4AQL	104,800
Southwestern	KC7KFF	46,976
West Gulf	K5UTD	200,480

Affiliated Club Competition

	Score	Entries
Unlimited Category		
Society of Midwest Contesters	22,371,958	387
Northern California Contest Club	14,780,990	156
Potomac Valley Radio Club	14,747,766	180
Minnesota Wireless Association	7,084,314	91
Yankee Clipper Contest Club	5,755,512	95
Mad River Radio Club	5,385,788	52
Medium Category		
Southern California Contest Club	4,861,714	43
Florida Contest Group	3,467,230	48
Tennessee Contest Group	3,327,554	45
Frankford Radio Club	3,305,378	43
Western Washington DX Club	2,532,996	23
North Texas Contest Club	2,195,198	22
Hudson Valley Contesters and DXers	2,057,256	21
South East Contest Club	1,986,472	22
Willamette Valley DX Club	1,627,620	12
Grand Mesa Contesters of Colorado	1,334,976	18
Texas DX Society	1,294,092	12
Contest Club Ontario	1,292,790	18
Kentucky Contest Group	1,283,926	20
Central Texas DX and Contest Club	1,134,972	12
Motor City Radio Club	1,130,796	31
Oklahoma DX Association	965,718	7
Radio Amateurs of Northern Vermont	797,772	5
North Coast Contesters	733,766	11
AK-SAR-BEN	627,676	9
Cajun Contest Club	564,048	3
Rochester (NY) DX Association	559,232	9
Kansas City DX Club	523,684	8
South Jersey Radio Association	477,996	11
Lincoln ARC	437,288	5
Central Arizona DX Association	412,322	5
Rip Van Winkle ARS	411,656	9
Eastern Iowa DX Association	404,464	5
Ozark Contest Club	364,824	5
Loudoun ARG	358,456	12
West Park Radiops	309,996	10
Salt City DX Association	279,128	3
Western New York DX Association	270,604	6
Order of Boiled Owls of New York	269,544	4
Schenectady ARA	266,046	3
Mile High DX Association	253,970	4
Bay Area Wireless Association	252,474	3
Woodbridge Wireless	251,558	5
Bergen ARA	222,974	9
Southwest Ohio DX Association	205,658	3
Hazel Park ARC	158,414	8
Radio Club of Tacoma	147,524	4
Franklin County ARC	143,402	3
Sturdy Memorial Hospital ARC	130,034	13
Ozaukee Radio Club	114,810	3
Central Michigan ARC	86,522	5
Carolina DX Association	70,348	3
Murgas ARC	31,890	3
Lawton Fort Sill ARC	25,504	3
Local Category		
Spokane DX Association	985,614	8
Western Wireless Contest Club	782,642	5
Raytown ARC	750,080	4
CT RI Contest Group	616,188	10
Eastern Connecticut ARA	270,700	4
Northern New York Contest Club	228,722	8
Medina 2 Meter Group	151,528	3
St Clair Amateur Radio Club	138,772	3
Williamsburg Area ARC	132,970	5
Northern Rockies DX Association	127,542	3
Sterling Park ARC	115,978	9
Meriden ARC	113,590	6
10-70 Repeater Association	105,868	4
Rappahannock Valley Radio Club	97,008	3
Old Barney ARC	41,896	3
Hamfesters Radio Club	38,412	3
Alexandria Radio Club	33,036	3

numbers, but credits experience and improving accuracy for the tie.

He's not taking anything for granted. With a reliance on high-band operation, don't be surprised to see WP3R's scores wane with the sunspots, though it remains to be seen if his dominance will take a hit.

Rich was more than 60,000 points ahead of no. 2 Mike, KH6ND, signing KH7X, with 363,040 points. K5TR with 334,720, WBØO (326,720), K4XS (326,080), W7WA (320,160), K6NA (313,760), WØSD (306,720), VE6JY (300,800) and K7RI (294,400) round out the Top 10.

Mike, KH6ND, thinks the waning sunspots will hamper his efforts from Hawaii in the coming years and give more prominence to Midwest stations like Bill's, WBØO, though Bill is unconvinced. "KH6 will always be DX. North Dakota is rare but I worked seven or eight. I only heard one Hawaiian."

Even Rich, KE3Q, concedes that lower MUFs could shorten his 10-meter openings: "Lower MUFs could mean I don't get the good opening or don't get it as long. And, it means that even if I have a good opening, if the bulk of the activity is on a lower band it can be a mistake for me to be on the higher band. I just don't know.

"Whether declining sunspots will affect my competitiveness, I just don't know. If we all suffer equally, maybe I'll be okay. If I suffer the effects more, or less, it could make the difference," he said. He's hopeful the sunspots will hold out till this fall to let him take another run at his record, but he's fairly certain that after 2003, his record is safe, even from himself. But he's not taking the sunspot decline lying down, either. "I expect I'll be improving the Beverage(s) at WP3R in coming years so that if I'm forced to go to 80 I'll be able to hear better. Parallel 220-footers might be the thing."

George, K5TR, isn't about to count WP3R out just yet. "KP4 has a propagation and rareness advantage that is very hard to overcome. The propagation advantage is the real key—being at a distance from the US that provides conditions where you are one of the few signals on the band is a huge thing to have going for you."

Rich is adamant that location is not the only factor in winning. It's important, no question, but the top characteristic in his books is desire. The choice to find a Caribbean (or Gulf Coast) location, to build a superstation and then to make it all come together all starts with one thing: desire.

And as dominant a player as WP3R has been, it's not a superstation by any means. Well-equipped, yes. Good antennas, yes. But there is only one tower.

Winner of the Single Operator Low Power category was Gary, VA7RR.

There are no multiple stacks beaming multiple directions at once. Hardware for the lower bands is of the wire variety. And as we pointed out last year, he has to sleep under the operating bench.

Mike, KH6ND, had a great year at KH7X. But he'll be happy this year to just hold on to the Pacific Division title. "With 10 meters going away in a hurry, this year will be really tough from out here," he said. "Should be interesting."

He expects Top 5 to be dominated again by stations like George, K5TR, and Bill, WBØO. "These guys will move up in the standings once we lose 10 meters out here, and deservedly so. Most of the Top 5 scores will begin to move to the Midwest and Southwest again as the sunspots continue to decline." He's confident he could go to Windwood (WP2Z) and mount a credible challenge to Rich's SS supremacy but it's "just too expensive to rent the place for a 24-hour contest." No. 4 Bill, WBØO, credits his success to two things: no. 1—"Fifteen just wouldn't stop," and no. 2—"Fifteen just wouldn't stop."

Bill's station is located in north central North Dakota high on a hill. Though he has two towers, they're only 50-footers. He doesn't need anything taller on top of a 400-foot mound. One sports a TH7DXX locked on the southwest and the other has a rotatable TH7DXX that's usually fixed on the eastern seaboard. A TS-930 and Alpha drive a Stackmatch that splits the 1500 W to both antennas, unless there's a frequency fight under way.

The arrangement gives him a dominant signal into the most populous ham radio areas in the US. He just wishes he could be a few more miles north, where a VE4 prefix would give him a big edge over a relatively anonymous 2×3. (I can attest to the fact that VE4 is worth a few dB of gain at least.) For the low bands, he has a pair of four-squares, one for 80 and one for 40.

Another Bill, K4XS, placed fifth. "Aside from the usual WP3 operation, I'm the only Top 10 east of the Mississippi," he said. What that means, he said, is the majority of his work is on 20, a distinct disadvantage given the crowded conditions over the more open areas of 10 and 15. He thinks WBØO passed him in the standings (WBØO had 25 fewer raw QSOs) partly due to a higher UBN brought on by the crowded conditions on 20. In the final results, WBØO beat K4XS by only four QSOs.

"This year I only did 1050 QSOs on 20. In the past I have had as many as 1500 QSOs on that band. The other two workhorse bands are 15 and 40. Fifteen was especially productive this year with 775 QSOs. Usually I do more on 40 but that will pick up next year with the spots going down."

Multioperator

Leading the multiop class is a station that really doesn't expect to be competitive. "We usually do it for fun and not as a competitive venture," said Bob, W7GG. "We did well in the 2002 SS mainly due to very good propagation especially on 10 m. When 10 is open we do typically well from the NW in domestic tests!" Did well, indeed. Bob's crew of Ken, K7ZUM, Hank, KR7X and 15-year-old Jordan, KC7TWZ racked up 2082 Qs and a sweep for 333,120 points, some 144 Qs ahead of no. 2 K9NS.

Bob said he opens his station to multiop efforts as a way to attract newbies and develop some talent. So far, it's working in at least one case. "Jordan is Ken's son and is developing into a good contest operator!" K9NS (310,080), W6YX (300,160), WP2Z (287,040), KTØR (281,600), N5DO (259,520), N8HR (252,000), WØNO (241,920), N8KR (240,060), and K8CC (240,160) round out the Top 10.

The winner from 2001, WP2Z, operating at the famed Windwood hamcation rental property on St. Croix, had another, more catastrophic visit from Murphy in 2002. While in 2001, the problem was a minor networking issue that didn't keep them off the air, this year it was the backup generator. Not thinking that was a problem, since power usually only goes out during hurricanes, Stan, K8MJZ and Eric, KT8O, proceeded. Then on Sunday morning, the AC went out from 9 AM to 1:30 PM. With a 300-Q gap between them and no.1 W7GG, the resulting downtime is probably the difference between first and fourth.

The QRP category was touched by tragedy this year. Last year's winner and all-time record-setter, KL7Y (WA2GO op) was silent this year after Dan, KL7Y, died in an accident in October, shortly after a stint at KH7X in WW.

K9TM won the class with 832 QSOs and a sweep for 133,120 points. K7MM (119,448), KO9A (114,550), VE4MM

(100,480), WA8ZBT (93,440), K1AM (90,240) KX9X (85,280), NØUR (74,328), N8IE (67,680) and N9NE (65,412) were the Top 10.

Tim, K9TM, holds no illusions about why he won. "I think the key was that people in other areas were not doing serious QRP efforts. The only thing that I did was keep going back for more," he says. He's not convinced his return this year will be in QRP. "I was not ready for how much different Q would be from A. It is very disheartening to work people who have numbers much larger than yours and to have to continue to turn the dial rather than be able to run."

To win QRP, he says, "you must love to S&P. Generally speaking, I don't. I like to run and I like rate. There is a big difference between the first hour 175+ I did from WØGU (N2IC) a couple years back and doing Q power from OH. It took 4 hours of Q power S&P to get those 175 Qs."

In unlimited, Dave, K6LL, nudged out WB1GQR. Dave admits that unlimited is a refuge for stations in areas or equipped such that competing with the B-class stations is difficult if not impossible. "That was the main reason, in my case," he says. "Not only location, but hardware. I saw that K6LA won SSCW U last year, and I didn't even make the top ten in B, but our scores were very close. That's what gave me the idea in the first place."

Dave's hardware once again shows SS is not always about aluminum. His tribander is at 48 feet, his shorty-forty is at 55 and he has a half-sloper at 45.

"Arizona used to be great, geographically, until all the Technicians on 10 meters graduated to General class, and moved to other bands. Now Arizona is ho-hum."

And in a competitive spirit, he adds: "Also, I like the sound of 'unlimited.' Who wants to be limited?" Packet was not a distraction, he says, since he only used it briefly, on an untested Telnet connection through a dial-up modem that kept getting RFed. Getting that working is one thing he'll do differently this year, but even so, with a limited number of multipliers, many of which seek out the CQers anyway, how big an impact packet has is unclear.

Dan, K6IF, first started contesting back in the 1970s. Then college kicked in, and "despite valiant efforts by W2VJN," almost 20 years lapsed before he got back in. At his parents' home in the 1980s, he ran a four-element TET (remember those?) tribander, racking up 1450 QSOs and a sweep in 1981 as N6BZA. In those days, George, WB5VZL (now K5TR) and Gary, WA6VEF (now VA7RR—funny how this comes full circle) were mentors of a sort.

A year after his 1981 stint, college. Then work. Then a family. It wasn't until he bought his parents' house in 1997: "What did I find but my old inverted V and TET." That was enough to get him back on the air, but 2002 would be his first serious effort after 964 raw QSOs and a sweep the year before in only 13 hours. "I knew then that I would make a serious effort in 2002."

The operators at overall fifth place finisher KTØR: Dave, KTØR, Alan, KØAD, Greg, KØOB, and Jeff, KØMX.

From his parents' house, he began building a station in Boonville, California, and now sports a C31XR at 72 feet, a C-3E at 45 feet, 2 element 40 meter Yagi at 82 feet, 80 meter rotatable dipole at 87 feet, all on one tower and fed by a pair of TS-850s, an Alpha 76PA and an Ameritron AL-1200.

"Typical West Coast strategy—stay on the highest band that is open, point your antennas at 70 degrees and call CQ." It worked: Dan's final count was 1800 by 80, good for 13th place. Not bad for a rusty hand.

If the 2002 running of the Phone SS proves anything, it's that anybody, except perhaps in high-power, can win. W7GG certainly didn't expect his multiop effort to come out on top; K9TM credits the lack of more geographically advantaged stations for his QRP win and VA7RR not only gave VE4GV a run for his money, he beat him. You don't need a superstation to compete. You just need heart, desire and accuracy. Staying in the chair doesn't hurt either.

Affiliated Club Competition

The unlimited club competition reads a little like the high-power class: last year, Society of Midwest Contesters, followed by a bunch of others. This year, it was Society of Midwest Contesters followed by...you get the idea.

In the tighter races, Potomac Valley Radio Club couldn't eke past last year's no. 2 Northern California Contest Club, which stayed ahead of Minnesota Wireless Association. Yankee Clipper Contest Club finished fourth again this year, but thanks to Mad River Radio Club, is no longer in last place. That SMC has such a large lead (22.4 million points to 15.6 million) is in no small way related to the lead it has in contesters (387 vs 183). But on an average basis Mad River comes out on top, with 103.5 k points per team club member vs 57.8 k for SMC, 85.3 k for PVRC and 94.7 k for NCCC. But just like party leadership conventions, it's the club with the most points, SMC, that wins, irrespective of membership. Must be those cold W9 winters....

In the medium category, Southern California Contest Club, with five fewer members, beat Florida Contest Group by almost 1.5 million points, 4,861,714 to 3,467,230. Tennessee Contest Group was third with 3,327,554 points, Frankford Radio Club fourth with 3.3 million points followed closely by Western Washington DX Club with 2.5 million points.

In the local category, Spokane DX Association proves bigger isn't always better, winning with 985,614 points despite having eight members to fourth-place Connecticut Rhode Island Contest Group's 10. Second place Western Wireless Contest Club, with half the members of CT RI, proves the point even more clearly. Raytown ARC's four members, with 750,080 points and third place, also shows size doesn't matter. Eastern Connecticut ARA's 270,700 points round out Top 5.

Low Power... High Power... QRP... Single Operator... Multioperator... School Club.... It takes all kinds of stations in order to have a successful November Sweepstakes. Sweepstakes is a challenge, because of the exchange. It is a true test of operating ability because it's more than just a readable signal—it is getting a detailed message through the static, QRM, QRN and QSB. Whether you work all the sections for a sweep, work 100 stations for the pin, or just get on to hand out a few points to your friends, the ARRL November Sweepstakes is the hottest domestic contest going. See you on the bands November 15-17, 2003. QST

By **Dan Henderson, N1ND**
Contest Branch Manager

Results, the 2002 ARRL 160-Meter Contest

Ready to throw conventional wisdom out the door?

"Top band? From my small city lot?"
"I don't have acres to set up Beverages and a four-square."
"You can't work anyone from the 'black hole.'"
"I can't compete against the East Coast."

Near the top of the sunspot cycle, conventional wisdom says don't waste too much time on the low bands. Noise-levels are higher. Activity is down. Propagation isn't as good. You won't be able to work through the East coast curtain for the DX (well, that is the claim pretty much for all contesters from west of the Mississippi).

So what happened during the 2002 ARRL 160-Meter Contest?

In a year when you would expect participation to be average, since we are just past the sunspot cycle peak and not nearly at the bottom, a record number of entries were received for the contest. The old record of 777 (1996) was not just broken, it was shattered, as a record 930 entries were received at the ARRL—a 20% increase!

A new overall record was set in the Single Operator High Power category—although this one is easily explainable since it was by the superstation of VY2ZM (aka Jeff, K1ZM, arguably the most dominant contester on Top Band these days). But besides the obvious, at least one new division category record was set in five ARRL Divisions (Central, Great Lakes, New England, Roanoke and Rocky Mountain). Finally, one of the other Canadian category records was rewritten.

So, do we throw out conventional wisdom for a "new era" on Top Band?

Before we get carried away…

While total number of QSOs reported for 2002 was an all-time record (263,091) the mean and median number of QSOs were well below previous record levels for the contest. So we have more logs, but fewer QSOs per log.

During the contest, Jeff, VY2ZM, worked a total of 1592 valid QSOs surpassing the previous top QSO total made by any class station of 1563, done in 1996 by the W4WA multioperator winner. Since you can only work a station once during this contest, perhaps another good measure of activity (at least for this contest) is the fact that there were at least 1593 stations on the air that made at least one contact.

Participation by Single Operator stations was at an all-time high in each of the three power categories—QRP (82), Low (422), and High (311). It was good to see QRP activity growing. Several participants mentioned using the popular K2. John, K4WTF, participating in his first-ever contest—talked about the thrill of working both KH6ND and ZF2NT.

Top Ten

Single Operator, QRP

WA4PGM	70,497
N8VW	69,370
W3TS	56,224
W8VK	49,471
N7IR	36,934
N2CU	35,412
W4FMS	31,819
KD7AEE	31,552
K4WTF	30,919
WB8RTJ	30,294

Single Operator, Low Power

K1PX	174,600
K7CA	172,557
KO9A	143,701
W2LC	138,523
WX9U	130,284
K2BA	129,150
K4CNW	128,002
K4OAQ	124,336
WØUO	122,924
WB9CIF	120,238

Single Operator, High Power

VY2ZM (K1ZM, op)	639,744
AA1K	347,415
K9DX	314,172
W4MYA	303,054
VE3EJ	278,850
N1EU	278,320
N2NT	260,172
W5MX	233,700
K5NA	227,856
N4AF	216,546

Multioperator

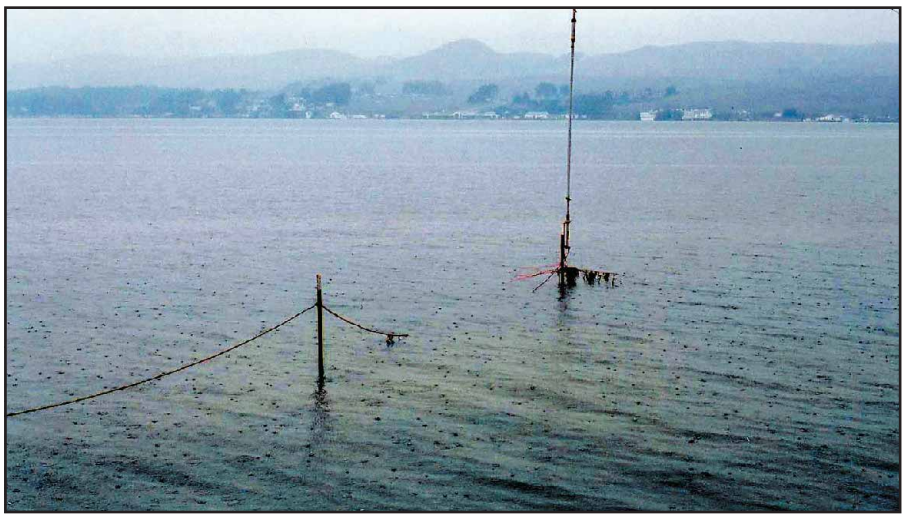
KC1XX	405,728
W2GD	343,196
WB9Z	299,985
K8XXX	267,200
NO2R	251,899
K9IZ	238,832
NØNI	226,530
WØAIH	210,672
KVØQ	210,056
K3WW	202,368

Top Ten Finishers

In the Single Operator QRP category, a close finish was seen between Kyle, WA4PGM, who set a new Roanoke Division record and Pat, N8VW, who staked

Expanded Reports Available

For expanded results, participant soapbox and the complete scores in a user-searchable database, please visit **www.arrl.org/contests/results**. ARRL Members without Internet access may obtain a printout of the complete line scores by sending a self-addressed, stamped envelope to ARRL Contest Results, 225 Main St, Newington CT 06111. Please be sure to include the contest name and year.



The K6OM QTH was at Bodega Bay, California, made famous by the Hitchcock movie, "The Birds." The tides and weather played havoc with their antenna system.

Top Five By Region

Tables list call sign, score, QSOs, multipliers, power (A = QRP, B = Low Power, C = High Power, D = Multioperator)

Northeast Region (New England, Hudson and Atlantic Divisions; Maritime and Quebec Sections)

W3TS	56,224	499	56	A
N2CU	35,412	339	52	A
K3TW	22,618	260	43	A
W1AMF	15,129	188	41	A
W1EM	10,760	135	40	A
K1PX	174,600	938	90	B
W2LC	138,523	888	77	B
WA1Z	93,528	631	72	B
K1NK	88,515	703	63	B
K1DC	79,940	562	70	B
VY2ZM (K1ZM, op)	639,744	1592	136	C
AA1K	347,415	1353	115	C
N1EU	278,320	1110	112	C
N2NT	260,172	1084	108	C
K1RX	203,991	918	97	C
KC1XX	405,728	1306	124	D
W2GD	343,196	1222	119	D
NO2R	251,899	997	109	D
K3WW	202,368	1010	96	D
K2UG	201,818	1031	94	D

Southeast Region (Delta, Roanoke and Southeastern Divisions)

WA4PGM	70,497	558	63	A
W4TMR	29,044	268	53	A
KW4JS	12,710	164	41	A
W4DEC	11,440	142	40	A
K8OWL	10,032	132	38	A
K4CNW	128,002	761	82	B
K4OAQ	124,336	812	76	B
K4WI	84,375	557	75	B
NA4K	72,280	552	65	B
K3JT	70,560	499	70	B
W4MYA	303,054	1330	106	C
N4AF	216,546	1000	102	C
N4PN	199,108	1064	91	C
K4EA	169,442	819	98	C
K8AC	154,425	848	87	C
W4CBX	112,133	664	83	D
N4CW	108,216	647	81	D
K3KO	101,360	619	80	D
W4NF	100,548	647	76	D
N4VV	51,940	360	70	D

Central Region (Central and Great Lakes Divisions; Ontario Section)

N8VW	69,370	490	70	A
W8VK	49,471	409	61	A
W4FMS	31,819	344	47	A
K4WTF	30,919	334	49	A
WB8RTJ	30,294	304	51	A
KO9A (@WE9V)	143,701	901	79	B
WX9U	130,284	837	77	B
WB9CIF	120,238	756	79	B
K9BG	110,732	721	76	B
K8FH	107,870	769	70	B
K9DX	314,172	1387	108	C
VE3EJ	278,850	1181	110	C
W5MX	233,700	1193	95	C
K9NW	208,620	1131	90	C
N9RV	197,997	1031	93	C
WB9Z	299,985	1374	105	D
K8XXX	267,200	1288	100	D
K9IZ	238,832	1277	92	D
W0AIH	210,672	1190	88	D
N8EA	126,034	756	82	D

Midwest Region (Dakota, Midwest, Rocky Mountain and West Gulf Divisions; Manitoba and Saskatchewan Sections)

KD7AEE	31,552	249	64	A
W0RSP	23,161	214	53	A
W0SEI	23,100	238	50	A
WA8ZBT	22,842	243	47	A
W0CH	20,748	198	52	A
K7CA	172,557	942	83	B
K2BA	129,150	860	75	B
W0UO	122,924	769	79	B
N0FP	104,720	678	77	B
N0IM	103,896	660	78	B
K5NA	227,856	1152	94	C
N5RG	175,120	949	88	C
K5RX	173,070	914	90	C
AE9B	170,796	982	86	C
N0TT	157,120	980	80	C
N0NI	226,530	1248	90	D
KV0Q	210,056	1113	88	D
NX5M	198,540	1056	90	D
N5TW	192,774	1061	89	D
N1LN	165,528	900	88	D

West Coast Region (Pacific, Northwestern and Southwestern Divisions; Alberta, British Columbia and NWT/Yukon Sections)

N7IR	36,934	310	59	A
WX7G	13,940	170	41	A
N6WG	12,204	168	36	A
K6EI	12,096	191	32	A
N6CMF	11,268	155	36	A
N6MU(@N6NB)	63,145	425	73	B
N6RK	54,390	382	70	B
N6NF	52,302	350	69	B
AC7A	39,130	298	65	B
K7ON	38,610	292	66	B
K6SE	134,055	777	81	C
KH6ND (@KH7R)	123,760	645	80	C
KG7H	122,391	701	81	C
WA7LT	111,274	654	82	C
W6TRW (K0DI,op)	109,980	657	78	C
N7GP	173,968	962	83	D
N7KE	97,014	591	74	D
K7TJR	60,705	389	71	D
W7TCP	47,168	349	67	D
W6AW	38,864	349	56	D

his claim with a new Great Lakes Division record. Once the dust had settled, it was Kyle taking top honors back to his Virginia shack by a score of 70,497 to 69,370. After N8VW (OH) we find Dana, W3TS (EPA), Rick, W8VK (OH), Gary, N7IR (AZ), Tom, N2CU (WNY), Frank, W4FMS (MI), Dave, KD7AEE (UT), John, K4WTF (OH), and Jim WB8RTJ (OH) rounded out the category Top Ten.

Single Operator Low Power also saw a real tussle for top honors, this time between Jim, K1PX (CT), and Al, K7CA (UT). Though Al set a new Rocky Mountain Division record, he finished second by a mere 2043 points behind Jim, who entered the winner's circle from New England. Jim, KO9A, using the WE9V station in WI finished third while also setting a new Central Division record. Scott, W2LC (WNY), Phil, WX9U (IL), Bert, K2BA (OK), Jack, K4CNW (SC), Fritz, K4OAQ (TN), Jim, W0UO (NTX) and Mark, WB9CIF (IN), all managed to find their way into the Top Ten box for 2002.

Besides VY2ZM's category record in the Single Operator High power category, we find new records set by John, K9DX (IL), in the Central and Bob, W4MYA (VA) in the Roanoke Divisions. Finishing second in the overall category was Jon, AA1K (DE) who finished ahead of K9DX and W4MYA. Rounding out the Category Top Ten you will find top Canadian in the category John, VE3EF (ON), followed by Barry, N1EU (ENY), Andy, N2NT (NNJ), Bryan, W5MX (KY), Richard, K5NA (STX) and Howie, N4AF (NC).

Eight of the Top Ten multioperator stations were traditional multiop stations, while two used spotting assistance. Congratulations to the operators at KC1XX (NH) who took top category honors with a score of 405,728. The score does establish a new standard for the New England Division. Finishing second were the capable handlers at the W2GD (SNJ). Third place was claimed by the WB9Z (IL) entry while K8XXX (MI) finished in fourth position. Other multioperator stations breaking the Top Ten included NO2R (NNJ), K9IZ (IN), N0NI (IA), W0AIH (WI), KV0Q (CO) and K3WW (EPA). While not making the Top Ten box, a special recognition goes to the VE2OJ entry, which set a new Canadian category record.

Affiliated Club Competition

Just as in Sweepstakes, the battle for the Unlimited Category was another chapter in the continuing feud between the Society of Midwest Contesters and the Potomac Valley Radio Club. SMC was able to hold off the PVRC challenge, due to 13 more logs and with about 5 k more points per log. The Medium Club gavel was claimed by the Yankee Clipper Contest Club, which edged out the Frankford Radio Club by about 500 k points. The CT RI Contest Group took top honors in the Local Club category.

Conclusion

Gene, N9TF, speaks for quite a lot of 160-meter search-and-pounce enthusiasts. "If there is one contest I make sure I don't miss each year, it's this one.

"I challenge myself to work all states and mults. However even though I missed WAS again this year (by 6) I did work my second to last state needed (ID) for 160-Meter WAS. Now if I could just find that AK station, I will be done."

Affiliated Club Competition

Unlimited Category	*Score*	*Entries*
Society of Midwest Contesters	4,043,590	67
Potomac Valley Radio Club	2,963,348	54
Medium Category		
Yankee Clipper Contest Club	3,100,162	39
Frankford Radio Club	2,585,090	35
Minnesota Wireless Assn	2,180,385	47
Mad River Radio Club	1,603,962	21
Contest Club Ontario	1,123,761	14
Kansas City DX Club	796,290	16
Central Texas DX and Contest	649,590	6
Hudson Valley Contesters and DXers	627,998	7
North Texas Contest Club	624,186	7
South East Contest Club	570,163	10
Tennessee Contest Group	537,723	16
Grand Mesa Contesters of	537,176	7
Kentucky Contest Group	432,421	7
Florida Contest Group	411,390	13
Northern California Contest Club	379,352	18
Rochester (NY) DX Assn	341,183	8
Willamette Valley DX Club	291,230	6
North Coast Contesters	288,894	7
Southwest Ohio DX Assn	257,494	3
Southern California Contest	171,304	9
Texas DX Society	139,803	3
Central Arizona DX Assn	134,445	4
Green River Valley ARS	124,684	4
Order of Boiled Owls of New York	69,750	3
Western Washington DX Club	64,562	9
West Park Radiops	40,838	4
Bergen ARA	25,286	3
Local Category		
CT RI Contest Group	183,215	6
Medina 2 Meter Group	145,961	3
River City Contesters	130,469	5

The 2003 ARRL 160-Meter contest will be held December 5-7. Anyone want to bet Gene finds the AK to finish off the WAS? A G5RV and tuner may not be the most efficient setup for 160, but it will get you on the air. Can we throw conventional wisdom out the window? Who knows… Can we guarantee some fun to be experienced on Top Band? You bet! QST

ANAHEIM, CA
(Near Disneyland)
933 N. Euclid St., 92801
(714) 533-7373
(800) 854-6046
Janet, KL7MF, Mgr.
anaheim@hamradio.com

BURBANK, CA
2416 W. Victory Bl., 91506
(818) 842-1786
(800) 854-6046
Eric, KA6IHT, Mgr.
Victory Blvd. at Buena Vista
1 mi. west I-5
burbank@hamradio.com

OAKLAND, CA
2210 Livingston St., 94606
(510) 534-5757
(800) 854-6046
Mach, K6KAP, Mgr.
I-880 at 23rd Ave. ramp
oakland@hamradio.com

SAN DIEGO, CA
5375 Kearny Villa Rd., 92123
(858) 560-4900
(800) 854-6046
Tom, KM6K, Mgr.
Hwy. 163 & Claremont Mesa
sandiego@hamradio.com

SUNNYVALE, CA
510 Lawrence Exp. #102
94085
(408) 736-9496
(800) 854-6046
Mark, WI7YN, Mgr.
So. from Hwy. 101
sunnyvale@hamradio.com

NEW CASTLE, DE
(Near Philadelphia)
1509 N. Dupont Hwy., 19720
(302) 322-7092
(800) 644-4476
Rick, K3TL, Mgr.
RT.13 1/4 mi., So. I-295
newcastle@hamradio.com

PORTLAND, OR
11705 S.W. Pacific Hwy.
97223
(503) 598-0555
(800) 854-6046
Leon, N7IXX, Mgr.
Tigard-99W exit
from Hwy. 5 & 217
portland@hamradio.com

DENVER, CO
8400 E. Iliff Ave. #9, 80231
(303) 745-7373
(800) 444-9476
Joe, KDØGA, Mgr.
John, N5EHP, Mgr.
denver@hamradio.com

PHOENIX, AZ
1939 W. Dunlap Ave., 85021
(602) 242-3515
(800) 444-9476
Gary, N7GJ, Mgr.
1 mi. east of I-17
phoenix@hamradio.com

ATLANTA, GA
6071 Buford Hwy., 30340
(770) 263-0700
(800) 444-7927
Mark, KJ4VO, Mgr.
Doraville, 1 mi. no. of I-285
atlanta@hamradio.com

WOODBRIDGE, VA
(Near Washington D.C.)
14803 Build America Dr. 22191
(703) 643-1063
(800) 444-4799
Steve, N4SR, Mgr.
Exit 161, I-95, So. to US 1
woodbridge@hamradio.com

SALEM, NH
(Near Boston)
224 N. Broadway, 03079
(603) 898-3750
(800) 444-0047
Chuck, N1UC, Mgr.
sales@hamradio.com
Exit 1, I-93;
28 mi. No. of Boston
salem@hamradio.com

See us at Dayton Hamvention – Booths 20, 21, 22 & 23

HAM RADIO OUTLET®

WORLDWIDE DISTRIBUTION

CALL FOR OUR SUPER SPRING SPECIALS!

YAESU

$70. expires 6/30/03

FT-897 VHF/UHF/HF Transceiver

- HF/6M/2M/70CM • DSP Built-in
- HF 100W (20W battery)
- Optional P.S. + Tuner

Call Now For Our Low Pricing! NEW!

$300. expires 6/30/03

FT-1000MP MKV HF Transceiver

- Enhanced Digital Signal Processing
- Dual RX
- Collins SSB filter built-in
- 200W, External power supply

Call For Low Price!

FT1000MP MKV field unit 100w w/built-in power supply in stock

$250. expires 6/30/03

FT-100D HF/6M/2M/70CM Transceiver

- Compact Transceiver w/detachable front panel
- Rx 100kHz to 970mHz (cell blocked)
- Tx 100W 160-6M, 50w 2M, 20W 70CM
- Built-in DSP, Vox, CW keyer
- 300 Memories

Call Now For Low Pricing!

$100. expires 6/30/03

FT-817 HF/VHF/UHF TCVR

- 5W @13.8V ext DC • USB, LSB, CW, AM, FM
- Packet (1200/9600 Baud FM) • 200 mems
- built in CTCSS/DCS • TX 160-10M, 6M, 2M, 440
- Compact 5.3" x 1.5" x 6.5", 2.6 lbs
- 9.6v Nicad or 8 AA battery capable

Call Now For Low Pricing!

NEW!

FT-2800M 2M Mobile

- 65w • Ruggedly Built
- Alpha Numeric Memory System
- Direct Keypad Frequency Entry
- Bullet-proof Front End

Call Now For Low Intro Pricing!

VX-7R/VX-7R Black

$50. expires 6/30/03

50/2M/220/440 HT

- Wideband RX - 900 Memories
- 5W TX (300mw 220Mhz)
- Li-Ion Battery
- Fully Submersible to 3 ft.
- Built-in CTCSS/DCS
- Internet WIRES compatible

NEW!

Now available in Black!
Great Price, Call Today!

VX-5R/VX-5RS

50/2M/440HT

- Wideband RX • 6M-2M-440TX
- 5W output • Li-Ion Battery
- 220 mems, opt. barometer unit
- Alpha Numeric Display
- CTCSS/DCS built-in

Call For Low Price!

$50. expires 6/30/03

FT-50RD

2M/440mHz Compact HT

- DVR, Decode, Paging Built-in
- Alpha numeric display
- Wide Band receive
- Battery Saver • 112 Mems
- Mil-Spec • HiSpeed scanning

Call For Your Low Price!

$50. expires 6/30/03

NEW!

FT-857

Ultra compact HF, VHF, UHF

- 100w HF/6M, 50w 2M, 20w UHF
- DSP • 32 color display
- 200 mems • Detachable front panel (YSK-857 required)

Call for Low Intro Price!

FT-90R

2M/440 Mini Dualbander Transceiver

- 50w 2m, 40w 440mHz
- Wide Rx • Detachable Front Panel
- Packet Ready 1200/9600 Baud
- Built-in CTCSS/DCS Encoder/Decoder
- Less than 4" wide!

Call for Your Low Price!

FT-920 HF+6M Transceiver

$200. expires 6/30/03

- 100w 160-6M, 12VDC
- Built-in DVR, CW Memory Keyer
- DSP, Auto-Notch • 99 Memories
- Computer controllable, CAT System

Call For Low Pricing!

NEW!

FT-8900R Quadband Transceiver

$50. expires 6/30/03

- 10M/6M/2M/70CM • Wires capable
- 800+ memories • Built-in CTCSS/DCS
- Remotable w/optional YSK-8900

Call Now For Special Pricing

AZ, CA, CO, GA, VA residents add sales tax. Prices, specifications, descriptions, subject to change without notice.

Look for the HRO Home Page on the World Wide Web
http://www.hamradio.com

COAST TO COAST FREE SHIPPING
UPS - Most Items Over $100
Rapid Deliveries From The Store Nearest To You!

See us at Dayton Hamvention - Booths 20, 21, 22, & 23

HAM RADIO OUTLET®

WORLDWIDE DISTRIBUTION

DISCOVER THE POWER OF DSP WITH ICOM!

FREE SEPARATION KIT RMK-706

LOWEST PRICE EVER!

IC-706MKIIG

- Proven Performance
- 160-10M/6M/2M/70CM
- All mode w/DSP
- HF/6M @ 100W, 2M @ 50W 440 MHz @ 20W
- CTCSS encode/decode w/tone scan
- Auto repeater • 107 alphnumeric memories

FREE DSP UT-106

IC-718 HF Transceiver

- 160-10M @ 100W
- 12V Operation
- Simple to Use
- CW Keyer Built-in
- One Touch Band Switching
- Direct frequency input
- VOX Built-in
- 101 alphnumeric memories

IC-W32A Dual Band Transceiver

- 2M, & 70CM @ 5W
- V/V, U/U, V/U
- Independent controls for each band
- 200 alphnumeric memories
- Auto repeater
- CTCSS encode/decode w/tone scan
- IRLP compatible

LOW PRICE!

IC-V8000 2M Mobile Transceiver

- 75 watts
- ICOM DMS scanning
- CTCSS/DCS encode/decode w/tone scan
- Weather alert
- Weather channel scan
- 200 alphanumeric memories
- Backlit remote control mic

$200 ICOM COUPON!

FREE POWER SUPPLY PS-125

IC-756PROII All Mode Transceiver

- 160-6M @ 100W
- 32 bit IF DSP
- Enhanced 5 inch color TFT w/spectrum scope
- Selectable IF filter shapes for SSB & CW
- Enhanced Rx performance
- SSB/CW Syncronous tuning
- Multiple DSP controlled AGC loops
- Advanced CW functions
- 101 alphnumeric memories

$200 ICOM COUPON!

FREE POWER SUPPLY PS-125

IC-746PRO All Mode 160M-2M

- 10-2M @ 100W
- 32 bit IF-DSP+ 24 bit AD/DA converter
- Selectable IF filter shapes for SSB & CW
- 102 alphnumeric memories
- Enhanced Rx performance

LOW PRICE

IC-T7H 6W, Dual Band Transceiver

- 2M/70CM
- 70 alphnumeric memories
- 6W output
- CTCSS encode/decode w/tone scan
- Auto repeater
- Easy operation!
- Mil spec 810, C/D/E*1

IC-V8 2M Transceiver

LOW PRICE

- 5.5W output
- 107 alphnumeric memories
- Customizable keys
- Auto repeater
- PC Programmable
- CTCSS encode/decode w/tone scan
- Drop-in trickle charger included

NEW!

IC-T90A Triple Band Transceiver

- 6M/2M/70CM @ 5W
- Wide band receiver 495kHz - 999.999MHz*1
- 500 alphnumeric memories
- Dynamic memory scan
- Backlit keypad & display
- CTCSS/DTCS encode/decode w/tone scan
- Weather Alert

LOW PRICE

IC-2100H 25N 2M Mobile Transceiver

- Cool dual display
- 50 watts
- CTCSS encode/decode w/tone scan
- Backlit remote control mic
- Mil spec 810, C/D/E*1
- Auto repeater
- 113 alphnumeric memories

NOW AVAILABLE!

IC-2720H Dual Band Mobile

- 2M/70CM
- VV/UU/VU
- Wide band RX inc. air & weather bands
- Dynamic Memory Scan (DMS)
- CTCSS/DTCS encode/decode w/tone scan
- Independent controls for each band
- DTMF Encode
- 212 memory channels
- Remote Mounting Kit Included

COMING SOON!

IC-208H* Dual Band Mobile

- 55 watts VHF (2M), 50 watts UHF (70CM)
- Wide Band RX**
- CTCSS/DTCS encode/decode w/tone scan
- Detachable remote head
- 500 alphanumeric memories

ICOM®

*This device has not been approved by the FCC. It cannot be sold or leased, or offered for sale or lease until approval of the FCC has been obtained. **Cellular blocked, unblocked OK to FCC approved users. ✦Limited time only. Check with HRO for details or restrictions on any offers or promotions. †For shock & vibration. © 2003 Icom America Inc. 6131 June 03. The Icom logo is a registered trademark of Icom Inc.

CALL TOLL FREE

Phone Hours: 9:30 AM – 5:30 PM
Store Hours: 10:00 AM – 5:30 PM Closed Sun.

Toll free, incl. Hawaii, Alaska, Canada; call routed to nearest store; all HRO 800-lines can assist you. If the first line you call is busy, you may call another.

West.....800-854-6046
Mountain.....800-444-9476
Southeast.....800-444-7927
Mid-Atlantic...800-444-4799
Northeast.....800-644-4476
New England..800-444-0047

Look for the HRO Home Page on the World Wide Web
http://www.hamradio.com

AZ, CA, CO, GA, VA residents add sales tax. Prices, specifications, descriptions, subject to change without notice.

ANAHEIM, CA
(Near Disneyland)
933 N. Euclid St., 92801
(714) 533-7373
(800) 854-6046
Janet, KL7MF, Mgr.
anaheim@hamradio.com

BURBANK, CA
2416 W. Victory Bl., 91506
(818) 842-1786
(800) 854-6046
Eric, KA6IHT, Mgr.
Victory Blvd. at Buena Vista
1 mi. west I-5
burbank@hamradio.com

OAKLAND, CA
2210 Livingston St., 94606
(510) 534-5757
(800) 854-6046
Mach, K6KAP, Mgr.
I-880 at 23rd Ave. ramp
oakland@hamradio.com

SAN DIEGO, CA
5375 Kearny Villa Rd., 92123
(858) 560-4900
(800) 854-6046
Tom, KM6K, Mgr.
Hwy. 163 & Claremont Mesa
sandiego@hamradio.com

SUNNYVALE, CA
510 Lawrence Exp. #102
94085
(408) 736-9496
(800) 854-6046
Mark, WI7YN, Mgr.
So. from Hwy. 101
sunnyvale@hamradio.com

NEW CASTLE, DE
(Near Philadelphia)
1509 N. Dupont Hwy., 19720
(302) 322-7092
(800) 644-4476
Rick, K3TL, Mgr.
RT.13 1/4 mi., So. I-295
delaware@hamradio.com

PORTLAND, OR
11705 S.W. Pacific Hwy.
97223
(503) 598-0555
(800) 854-6046
Leon, N7IXX, Mgr.
Tigard-99W exit
from Hwy. 5 & 217
portland@hamradio.com

DENVER, CO
8400 E. Iliff Ave. #9, 80231
(303) 745-7373
(800) 444-9476
Joe, KDØGA, Mgr.
John N5EHP, Mgr.
denver@hamradio.com

PHOENIX, AZ
1939 W. Dunlap Ave., 85021
(602) 242-3515
(800) 444-9476
Gary, N7GJ, Mgr.
1 mi. east of I-17
phoenix@hamradio.com

ATLANTA, GA
6071 Buford Hwy., 30340
(770) 263-0700
(800) 444-7927
Mark, KJ4VO, Mgr.
Doraville, 1 mi. no. of I-285
atlanta@hamradio.com

WOODBRIDGE, VA
(Near Washington D.C.)
14803 Build America Dr.
22191
(703) 643-1063
(800) 444-4799
Steve, N4SR, Mgr.
Exit 161, I-95, So. to US 1
virginia@hamradio.com

SALEM, NH
(Near Boston)
224 N. Broadway, 03079
(603) 898-3750
(800) 444-0047
Chuck, N1UC, Mgr.
Exit 1, I-93;
28 mi. No. of Boston
salem@hamradio.com

ANAHEIM, CA
(Near Disneyland)
933 N. Euclid St., 92801
(714) 533-7373
(800) 854-6046
Janet, KL7MF, Mgr.
anaheim@hamradio.com

BURBANK, CA
2416 W. Victory Bl., 91506
(818) 842-1786
(800) 854-6046
Eric, KA6IHT, Mgr.
Victory Blvd. at Buena Vista
1 mi. west I-5
burbank@hamradio.com

OAKLAND, CA
2210 Livingston St., 94606
(510) 534-5757
(800) 854-6046
Mach, K6KAP, Mgr.
I-880 at 23rd Ave. ramp
oakland@hamradio.com

SAN DIEGO, CA
5375 Kearny Villa Rd., 92123
(858) 560-4900
(800) 854-6046
Tom, KM6K, Mgr.
Hwy. 163 & Claremont Mesa
sandiego@hamradio.com

SUNNYVALE, CA
510 Lawrence Exp. #102
94085
(408) 736-9496
(800) 854-6046
Mark, WI7YN, Mgr.
So. from Hwy. 101
sunnyvale@hamradio.com

NEW CASTLE, DE
(Near Philadelphia)
1509 N. Dupont Hwy., 19720
(302) 322-7092
(800) 644-4476
Rick, K3TL, Mgr.
RT.13 1/4 mi., So. I-295
newcastle@hamradio.com

PORTLAND, OR
11705 S.W. Pacific Hwy.
97223
(503) 598-0555
(800) 854-6046
Leon, N7IXX, Mgr.
Tigard-99W exit
from Hwy. 5 & 217
portland@hamradio.com

DENVER, CO
8400 E. Iliff Ave. #9, 80231
(303) 745-7373
(800) 444-9476
Joe, KDØGA, Mgr.
John, N5EHP, Mgr.
denver@hamradio.com

PHOENIX, AZ
1939 W. Dunlap Ave., 85021
(602) 242-3515
(800) 444-9476
Gary, N7GJ, Mgr.
1 mi. east of I-17
phoenix@hamradio.com

ATLANTA, GA
6071 Buford Hwy., 30340
(770) 263-0700
(800) 444-7927
Mark, KJ4VO, Mgr.
Doraville, 1 mi. no. of I-285
atlanta@hamradio.com

WOODBRIDGE, VA
(Near Washington D.C.)
14803 Build America Dr. 22191
(703) 643-1063
(800) 444-4799
Steve, N4SR, Mgr.
Exit 161, I-95, So. to US 1
woodbridge@hamradio.com

SALEM, NH
(Near Boston)
224 N. Broadway, 03079
(603) 898-3750
(800) 444-0047
Chuck, N1UC, Mgr.
sales@hamradio.com
Exit 1, I-93;
28 mi. No. of Boston
salem@hamradio.com

See us at Dayton Hamvention – Booths 20, 21, 22 & 23

HAM RADIO OUTLET®

WORLDWIDE DISTRIBUTION

CALL FOR KENWOOD SPRING SPECIALS

KENWOOD

APRS, TNC Features Built In!

TH-D7A(G) 2M/440

- 2M/440 Dual Band
- Built-in 1200/9600 Baud TNC
- APRS Compatible
- DX Packet Cluster Monitor
- 200 Mems., CTCSS
- VC-H1 Messaging Control

Call Now For Low Pricing!

NEW!

TH-F6A

2M/220/440
Dual Chanel Receive •
.1 - 1300 mHz Rx, FM, AM, SSB •
5w 2M/220/440 TX, FM •
435 Memories •
Li-Ion Battery •

Call For Low Price!

TH-G71A 2m/440

- 2m/440 Dual Band HT
- 200 Mems
- PC Programmable
- 6w 2m, 5.5w UHF @13.8 VDC
- Alphanumeric Display
- CTCSS Built It
- Backlit Keypad

Call For Low Price!

TM-V7A 2M/440Mhz

- 50W/35W • 280 Mems • Visual Scan
- Alpha Numeric • Enc/Dec & Duplexer Built-in
- Computer Programmable • 9600 Baud Ready
- Cool-blue Reversible LCD • Backlit Mic

Call Now For Low Price!

FREE Heil Mic Package with TS-2000 Series (mic pkg from Kenwood)

HURRY! expires 5/31/03

TS-2000 HF/VHF/UHF TCVR

- 100W HF, 6M, 2M • 50W 70CM
- 10W 1.2 GHz w/optional UT-20 module
- IF Stage DSP • Built-in TNC, DX packet cluster
- Backlit Front Key Panel

Call Now For Special Price!

NEW!

Great Low Price

TM-261A 2M Mobile

- 50W + Mid and Low • Mil-Spec
- 61 Mem. Chanels • Alpha Numeric Function
- Dual Menu, DTMF Memory
- Backlit mic & built-in encode

Call Now For Special Low Price!

$200.

HURRY! expires 5/31/02

TS-570DG/TS-570SG DSP Enhanced

- 100w HF, (100w on 6M TS-570SG only)
- QSK, CW Auto Tune • Autotuner incl 6M
- DSP • Large LCD Display • Elect. Keyer
- RCP2 Radio Control Program Compatible

Call Now For Your Low Price!

TM-D700A 2M//440 Dualband

- 50w VHF 35w UHF • Opt. Voice Synthesizer
- Receives 118-1300 mHz (cell blocked)
- Remote Head Inst. only (kit included)
- 200 Memories • Built In 1200/9600 baud TNC
- Advanced APRS Features
- Dx Packet Cluster
- Tone Scan • GPS/VC-H1/PC Ports

TS-50S HF Transceiver

- TS-50S - World's smallest HF trans.
- SSB, CW, AM, FM, • 12V Gen. Cov. RX,
- 6.4 lbs., 7.16 x 2.4 x 9.32" • 100W out
- 105 db dynamic range, 100 Mems.
- Opt. ext. ant. tuners available

Call For Special Low Price!

TM742AD 2M/440Mhz

- Optional 3rd band available • Back-lit mic
- Up to 303 memories • 101 per band
- PL Encode Built in • Detachable front panel

Call Now For Your Low Price!

AZ, CA, CO, GA, VA residents add sales tax. Prices, specifications, descriptions, subject to change without notice.

Look for the HRO Home Page on the World Wide Web
http://www.hamradio.com

COAST TO COAST FREE SHIPPING
UPS - Most Items Over $100
Rapid Deliveries From The Store Nearest To You!

See us at Dayton Hamvention – Booths 20, 21, 22 & 23

HAM RADIO OUTLET

®

WORLDWIDE DISTRIBUTION

KANTRONICS | ICOM | US TOWER

KAM '98

- Single port VHF or HF
- RTTY, CW, Packet, GTOR, AMTOR, WEFAX
- GPS, NMEA-0183 compatible
- 6-16 VDC, DB-9 connector port

Call Now For Your Low Price!

KAM XL

- DSP modem offers great performance on Packet 300/1200,G-tor,Pactor, Amtor,PSK-31
- RTTY, Navtex, ASCII, Wefax, CW, GPS NMEA-0183 and more!

Call Now For Special Pricing!

KPC-3 Plus/KPC-9612 Plus

High-performance, low power TNC. Great for packet, and APRS compatible.

Call For Special Low Price!

* 110v versions only

Detailed illuminated map shows time, time zone, sun position and day of the week at a glance for any place in the world.Continuously moving – areas of day and night change as you watch.

- Mounts easily on wall. Size: 34 1/2" x 22 1/2".

Reg $1295. SALE $999.95

IC-R8500 Wide Band Receiver

- 100 kHz - 2.0 GHz*
- Commercial Grade • All Mode
- IF Shift • Noise Blanker
- Audio Peak Filter (APF)
- Selectable AGC Time Constant
- Digital Direct Synthesis (DDS)
- 1000 Alphanumeric Memories
- PC Controllable w/Optional Equipment

Call For ICOM Receiver Specials

FREE IC-UT106 DSP thru 4/30

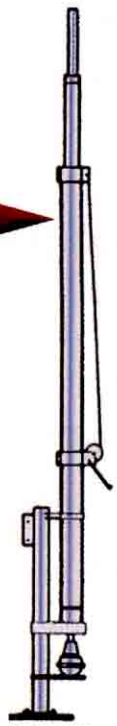
IC-R75 Wide Band Receiver

- 100 kHz - 60 MHz*
- Commercial Grade • All Mode
- Synchronous AM Detection (S-AM)
- Optional DSP w/Auto Notch Filter
- Triple Conversion
- Twin Passband Tuning (PBT)
- 1000 Alphanumeric Memories
- Up to Two Optional Filters
- PC Controllable w/Opt. Equipment

IC-R3 Wide Band Receiver

- 500 kHz - 2.45 GHz*
- 450 Alphanumeric Memories
- CTCSS w/Tone Scan
- 4 Level Attenuator
- Telescoping Antenna w/BNC Connector
- Lithium Ion Battery
- 2" Color TFT Display
- Audio/Video Output
- Four Way Action Joystick
- PC Programmable w/Optional Cable & Software

*816-901.995 MHz blocked; unblocked versions available to FCC approved users. FM video range for the IC-R3 is 900-1300 MHz & 2250-2450 MHz



Shown with Optional Rotor Base

MA-40

40' Tubular Tower

REG. $1007
SALE $849.00

MA-550

55' Tubular Tower

Handles 10 sq.ft. at 50mph
Pleases neighbors with tubular streamlined look

Reg.$1704
SALE $1399.00

TX-455

55' Freestanding Crank-Up
Handles 18 sq. ft. @ 50 mph
No guying required
Extra-strength const.
Can add raising and motor drive acces.

Towers Rated to EIA Specifications
Other Models at Great Prices!

Reg.$1915
SALE $1579.00

Buy From HRO, World's Largest U.S. Tower Dealer

All US Towers shipped by truck; freight charges additional

CALL TOLL FREE

Phone Hours: 9:30 AM – 5:30 PM
Store Hours: 10:00 AM – 5:30 PM Closed Sun.

Toll free, incl. Hawaii, Alaska, Canada; call routed to nearest store; all HRO 800 lines can assist you, if the first line you call is busy, you may call another.

West	800-854-6046
Mountain	800-444-9476
Southeast	800-444-7927
Mid-Atlantic	800-444-4799
Northeast	800-644-4476
New England	800-444-0047

Look for the HRO Home Page on the World Wide Web
http://www.hamradio.com

AZ, CA, CO, GA, VA residents add sales tax. Prices, specifications, descriptions, subject to change without notice.

ANAHEIM, CA
(Near Disneyland)
933 N. Euclid St., 92801
(714) 533-7373
(800) 854-6046
Janet, KL7MF, Mgr.
anaheim@hamradio.com

BURBANK, CA
2416 W. Victory Bl., 91506
(818) 842-1786
(800) 854-6046
Eric, KA6IHT, Mgr.
Victory Blvd. at Buena Vista
1 mi. west I-5
burbank@hamradio.com

OAKLAND, CA
2210 Livingston St., 94606
(510) 534-5757
(800) 854-6046
Mach, K6KAP, Mgr.
I-880 at 23rd Ave. ramp
oakland@hamradio.com

SAN DIEGO, CA
5375 Kearny Villa Rd., 92123
(858) 560-4900
(800) 854-6046
Tom, KM6K, Mgr.
Hwy. 163 & Claremont Mesa
sandiego@hamradio.com

SUNNYVALE, CA
510 Lawrence Exp. #102
94085
(408) 736-9496
(800) 854-6046
Mark, WI7YN, Mgr.
So. from Hwy. 101
sunnyvale@hamradio.com

NEW CASTLE, DE
(Near Philadelphia)
1509 N. Dupont Hwy., 19720
(302) 322-7092
(800) 644-4476
Rick, K3TL, Mgr.
RT.13 1/4 mi., So. I-295
newcastle@hamradio.com

PORTLAND, OR
11705 S.W. Pacific Hwy.
97223
(503) 598-0555
(800) 854-6046
Leon, N7IXX, Mgr.
Tigard-99W exit
from Hwy. 5 & 217
portland@hamradio.com

DENVER, CO
8400 E. Iliff Ave. #9, 80231
(303) 745-7373
(800) 444-9476
Joe, KDØGA, Mgr.
John, N5EHP, Mgr.
denver@hamradio.com

PHOENIX, AZ
1939 W. Dunlap Ave., 85021
(602) 242-3515
(800) 444-9476
Gary, N7GJ, Mgr.
1 mi. east of I-17
phoenix@hamradio.com

ATLANTA, GA
6071 Buford Hwy., 30340
(770) 263-0700
(800) 444-7927
Mark, KJ4VO, Mgr.
Doraville, 1 mi. no. of I-285
atlanta@hamradio.com

WOODBRIDGE, VA
(Near Washington D.C.)
14803 Build America Dr. 22191
(703) 643-1063
(800) 444-4799
Steve, N4SR, Mgr.
Exit 161, I-95, So. to US 1
woodbridge@hamradio.com

SALEM, NH
(Near Boston)
224 N. Broadway, 03079
(603) 898-3750
(800) 444-0047
Chuck, N1UC, Mgr.
sales@hamradio.com
Exit 1, I-93;
28 mi. No. of Boston
salem@hamradio.com

ANAHEIM, CA
(Near Disneyland)
933 N. Euclid St., 92801
(714) 533-7373
(800) 854-6046
Janet, KL7MF, Mgr.
anaheim@hamradio.com

BURBANK, CA
2416 W. Victory Bl., 91506
(818) 842-1786
(800) 854-6046
Eric, KA6IHT, Mgr.
Victory Blvd. at Buena Vista
1 mi. west I-5
burbank@hamradio.com

OAKLAND, CA
2210 Livingston St., 94606
(510) 534-5757
(800) 854-6046
Mach, K6KAP, Mgr.
I-880 at 23rd Ave. ramp
oakland@hamradio.com

SAN DIEGO, CA
5375 Kearny Villa Rd., 92123
(858) 560-4900
(800) 854-6046
Tom, KM6K, Mgr.
Hwy. 163 & Claremont Mesa
sandiego@hamradio.com

SUNNYVALE, CA
510 Lawrence Exp. #102
94085
(408) 736-9496
(800) 854-6046
Mark, WI7YN, Mgr.
So. from Hwy. 101
sunnyvale@hamradio.com

NEW CASTLE, DE
(Near Philadelphia)
1509 N. Dupont Hwy., 19720
(302) 322-7092
(800) 644-4476
Rick, K3TL, Mgr.
RT.13 1/4 mi., So. I-295
newcastle@hamradio.com

PORTLAND, OR
11705 S.W. Pacific Hwy.
97223
(503) 598-0555
(800) 854-6046
Leon, N7IXX, Mgr.
Tigard-99W exit
from Hwy. 5 & 217
portland@hamradio.com

DENVER, CO
8400 E. Iliff Ave. #9, 80231
(303) 745-7373
(800) 444-9476
Joe, KDØGA, Mgr.
John, N5EHP, Mgr.
denver@hamradio.com

PHOENIX, AZ
1939 W. Dunlap Ave., 85021
(602) 242-3515
(800) 444-9476
Gary, N7GJ, Mgr.
1 mi. east of I-17
phoenix@hamradio.com

ATLANTA, GA
6071 Buford Hwy., 30340
(770) 263-0700
(800) 444-7927
Mark, KJ4VO, Mgr.
Doraville, 1 mi. no. of I-285
atlanta@hamradio.com

WOODBRIDGE, VA
(Near Washington D.C.)
14803 Build America Dr. 22191
(703) 643-1063
(800) 444-4799
Steve, N4SR, Mgr.
Exit 161, I-95, So. to US 1
woodbridge@hamradio.com

SALEM, NH
(Near Boston)
224 N. Broadway, 03079
(603) 898-3750
(800) 444-0047
Chuck, N1UC, Mgr.
sales@hamradio.com
Exit 1, I-93;
28 mi. No. of Boston
salem@hamradio.com

See us at Dayton Hamvention – Booths 20, 21, 22 & 23

HAM RADIO OUTLET®

WORLDWIDE DISTRIBUTION

COMET

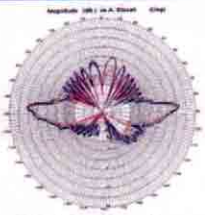
COMET LAN/802.11b/Wi-Fi Antennas

Designed for maximum range and signal strength providing long range point to multi-point wireless connections on the 2.4GHz ISM band.

GP-24

2.4GHz high gain omni-directional antenna for both the 802.11b and 802.11g standards

Gain: Twenty 1/2 waves in phase produce a high gain omni-directional pattern
Length: 5ft 10inches
Conn: Integral N-Female

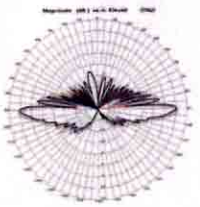


GP-24 elevation pattern

GP-24-3

2.4GHz high gain omni-directional antenna with 3 degree electrical downtilt for both the 802.11b and 802.11g standards. Specially designed pattern with downtilt concentrates the signal for maximum signal strength below the elevation of the antenna.

Gain: Twenty 1/2 waves in phase produce a high gain omni-directional pattern
Length: 5ft 10inches
Conn: Integral N-Female



GP-24-3 elevation pattern

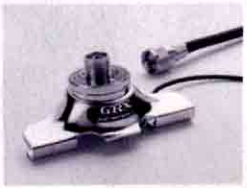
SF-245

2.4GHz medium-gain mobile antenna.

Provides maximum gain in a mobile antenna for "war drivers" and "net stumblers".

Gain: Five 1/2 waves in phase produce a medium gain omni-directional pattern
Length: 18inches
Conn: N-male

Several "no holes" N-type mobile mounts are available including the GR-5N mobile trunk-lip mount



NEW SWR/ Impedance analyzer

From Kuranishi Instruments, Japan

BR-200

A professional grade, laboratory quality test instrument. High quality no drift oscillator. Read SWR and impedance measurements with confidence

Frequency range: 1.8-170MHz
Imp measurement: 12.5-300 ohm
Built-in frequency counter
6 segment LED readout
50 ohm dummy load included
Battery or 12VDC operation

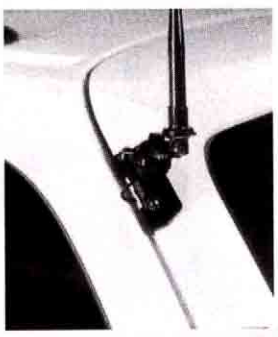
UHV-4

Quad-band 10/6/2M/70cm mobile antenna with fold-over hinge.

Designed primarily for use with the Yaesu FT-8900.

Wavelengths:
10/6M 1/4 wave
2M: 1/2 wave
70cm: Two 5/8 waves in phase
Length: 54 inches
Connector: PL-259

The UHV-4 is easily mounted with the **CP-5M heavy duty universal lip mount** pictured on a rear van lift door. It has 16'6" of deluxe coax cable including 18"of mini RG-188A/U coax for easy entry through the weather seal without causing wind noise, water leaks and/or coax damage.



Challenger Series

Super slim, super flexible dualband mobile antennas.

Dark chrome finish, fold-over hinge included.

C757 and C757NMO

Gain:
2M: 1/2 wave
70cm: Two 5/8 waves in phase
Length: 38inches
Conn: PL-259 or NMO type

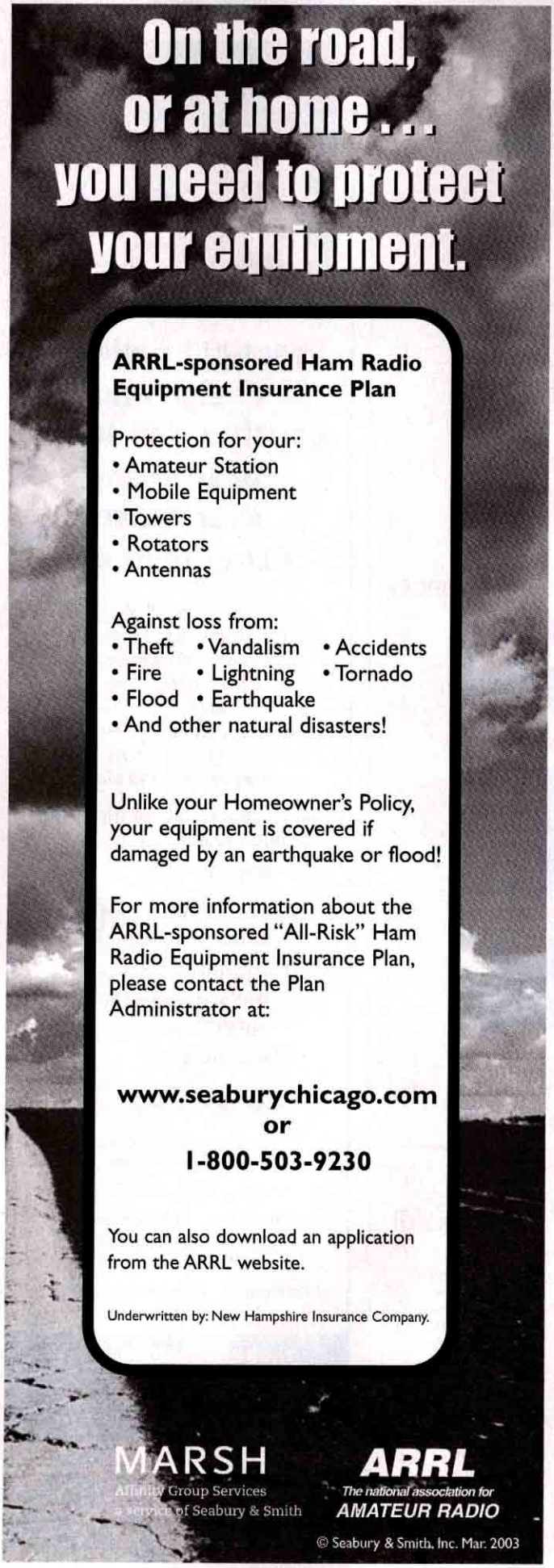
C767 and C767NMO

Gain:
2M: 1/2 wave, center phase
70cm: Two 5/8 waves, center phase
Length: 40inches
Conn: PI-259 or NMO type

AZ, CA, CO, GA, VA residents add sales tax. Prices, specifications, descriptions, subject to change without notice.

Look for the HRO Home Page on the World Wide Web
http://www.hamradio.com

COAST TO COAST FREE SHIPPING
UPS - Most Items Over $100
Rapid Deliveries From The Store Nearest To You!



Don't Let a Lightning Strike Keep You Off The Air!

ARRL offers its Members Ham Radio Equipment Insurance.

How much time and money have you spent on your ham radio equipment? What if a natural disaster strikes, forcing you off the air? You'd want to be up and running again as soon as possible with the least amount of financial worry.

With the ARRL-sponsored "All-Risk" Ham Radio Equipment Insurance Plan, you can enjoy peace of mind knowing that your valuable equipment will be covered if it's damaged or stolen. Plus, your equipment and accessories are covered while in your car, as well as at home.

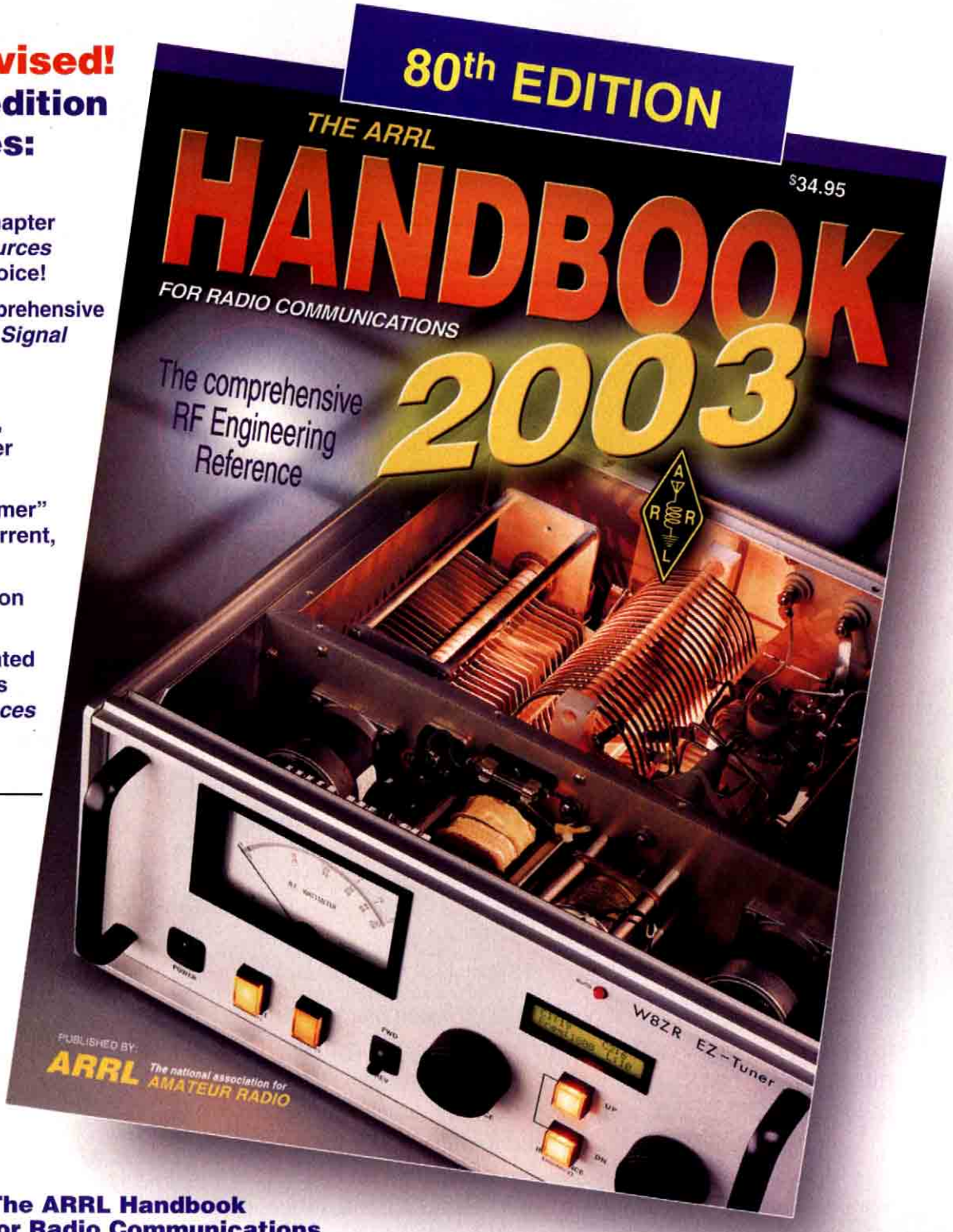
With this program, you pay the low annual rate of just $1.50 per $100 of replacement cost value! You'll find this to be significantly lower than comparable plans. If you rely solely on your homeowner's coverage, be prepared to pay a high deductible. With the ARRL-sponsored plan, you pay the low deductible of just $50 per claim. How much longer can you afford to go without coverage?

Marsh Affinity Group Services administers the ARRL-sponsored Ham Radio Equipment Insurance Plan. They have been providing insurance programs for professional organizations for over 50 years, and their strength and expertise make them a leader in the industry.

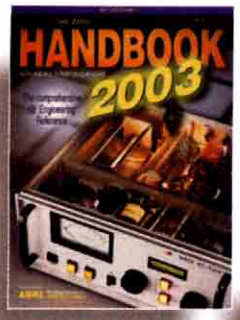
Don't wait for lightning to strike and leave you with damaged equipment and high replacement costs. Get protection now so you can avoid the financial burden of rebuilding your station. For more information, contact Marsh Affinity Group Services toll-free at 1-800-503-9230. Or, visit them on the web at www.seaburychicago.com.

Always revised!
The 2003 edition includes:

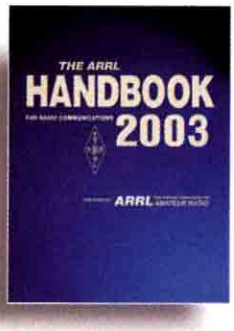
- An updated and comprehensive chapter on *Modulation Sources* including digital voice!
- A revised and comprehensive chapter on *Digital Signal Processing* (DSP) technology.
- A new high-power, automatic EZ-Tuner project by W8ZR.
- An "Ugly Transformer" project for high current, 120-V ac stations.
- A revised chapter on *Safety Practices*.
- A completely updated *Handbook* Address List in the *References* chapter.



THE STANDARD!



The ARRL Handbook for Radio Communications



Softcover—
ARRL Order No. 1921 ..... **$34.95***
*plus shipping $7 US (UPS) /$9 International

Hardcover—
ARRL Order No. 1948 ..... **$49.95***
*plus shipping $8 US (UPS) /$10 International

Available from ARRL publication dealers, everywhere!

Sales tax is required for orders shipped to CA, CT, VA, and Canada.
Prices subject to change without notice.

The ARRL Handbook CD for Radio Communications

Version 7.0—for *Windows* and Macintosh**
View, Search and Print from the entire 2003 edition book! CD-ROM.
ARRL Order No. 1956 .... **$39.95***

*plus shipping $5 US (UPS)/$7 International
**Some supplementary software utilities included—for *Windows* and DOS only.

ARRL *The national association for AMATEUR RADIO*

225 Main Street, Newington, CT 06111-1494 tel: 860-594-0355 fax: 860-594-0303

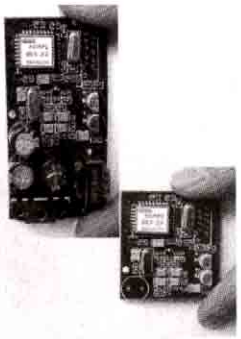
In the US call our toll-free number **1-888-277-5289** 8 AM-8 PM Eastern time Mon.-Fri. **www.arrl.org/shop**

QST 6/2003

GOT NOISE?

ADSP² - Your Noise Solution

It's hard to hear the stations you want to work, and if you can't hear them, you can't work them.



Lo Power Cat# 70-11
Hi Power Cat# 70-12

Solution: ADSP² - the affordable noise solution from SGC. ADSP² delivers top-of-the-line noise reduction for any transceiver. It works in your shack, in your car, or even in a portable station. Supply 12 VDC, connect your audio, and you've got the most advanced noise reduction available.

ADSP² Speaker
Cat# 70-14

SG-2020 ADSP²
Cat# 05-04

3 Ways to a Cleaner Signal

* SG-2020 Transceiver
* ADSP² Speaker
* ADSP² PCB Boards

Noise reduction is essential on today's crowded bands. With up to 26 dB of noise reduction and three proprietary band pass filters, ADSP² boards can be fitted to nearly any transceiver. Or use the ADSP² Speaker with noise reduction levels selected from a single switch. Of course the legendary SG-2020 transceiver has ADSP² built in. Simple to use - just press the button to select your desired noise reduction. Adaptive Digital Signal Processing from SGC is the solution to your noise problem.

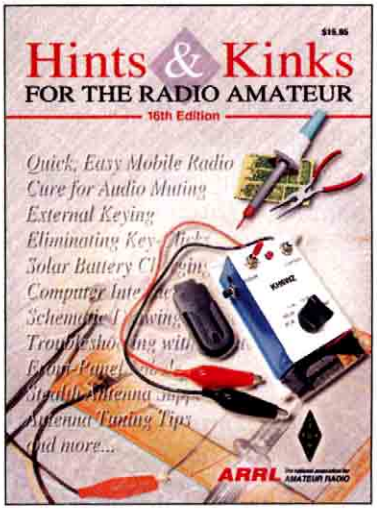
Got Noise? Get ADSP²!

SGC

No Compromise Communications

SGC Inc. 13737 SE 26th St. Bellevue, WA 98005 USA
Tel: 425-746-6310 Fax: 425-746-6384
sgc@sgcworld.com www.sgcworld.com

Hot Tips from the pages of QST



NEW EDITION!

Hints & Kinks for the Radio Amateur is the first place hams turn for information about new modes, new projects, and the latest tips. You'll find something on every page to solve problems, improve your operating, and simply have more fun on the air:

- Equipment Tips and Mods
- Batteries and Other Power Sources
- Digital Modes
- Troubleshooting
- Restoration
- Construction/Maintenance
- Test Gear
- Antenna Systems
- Operating
- Station Accessories
- Interference (RFI/EMI)

PLUS more emphasis on **computers and software**

PLUS a newly updated **list of suppliers**

AND feature articles from the popular ***QST*** column **The Doctor is IN**

Hints & Kinks for the Radio Amateur
16th Edition
ARRL Order No. 8926— **ONLY $15.95***
*shipping: $5 US (UPS) / $7 International

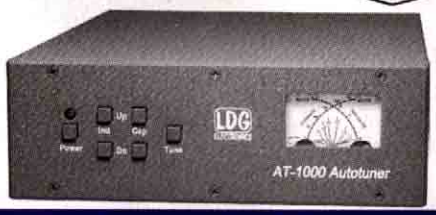
ARRL The national association for AMATEUR RADIO
SHOP DIRECT *or call for a dealer near you.*
ONLINE WWW.ARRL.ORG/SHOP
ORDER TOLL-FREE 888/277-5289 (US) QST 5/2003

R&L Electronics

1315 Maple Ave HAMilton, Oh 45011
Local/Tech 513-868-6399
(800)221-7735
http://randl.com email sales@randl.com
Fax 513-868-6574

ALINCO INCORPORATED · COMET · DIAMOND ANTENNA · GARMIN · HEIL SOUND · ICOM · KENWOOD · MFJ

LDG ELECTRONICS



Automatic Tuner
1000 Watts SSB
750 Watts CW

$499.95

LDG Automatic Antenna Tuner

Special price good through 6/15/03 or until stock is depleted, Limit 2

AT1000 An Autotuner for use with your amplifier! No more knob spinning or inductor rolling. Tunes your antenna in 1 to 8 seconds for when you QSY either in the same band or to a different band! Easy installation and use make this the choice for any Amateur Radio Operator with an amplifier. Operation is simple: Place amplifier in standby, Transmit a steady carrier, Tune and verify SWR is less than 2:1, Return your amplifier to operate and have fun with QRO! The AT-1000 covers 1.8 to 54 MHz continuous coverage. The microprocessor that controls all the tuning actions has safety software built in so that if you accidentally try to tune or fine tune the AT-1000 with more than 125 watts (1:1 load), it will lock itself to protect the relays. Just about any antenna can be tuned with the AT-1000. The antenna must be between 6 to 800 ohms (approximately 10:1 SWR) in-order to bring the SWR down to 1.5:1. If you use ladder line or long wires (random length or otherwise), add an appropriately rated Balun and you're ready to go! This Desktop Autotuner is a beautiful addition to your shack and a companion your amplifier

Popular LDG Tuners

AT11MP	*150w tuner*	**209.95**
RT11	*Remote tuner*	**199.95**
Z11	*QRP tuner*	**169.95**

YAESU

Choice of the World's top DX'ers℠

VR5000 *Receiver* ..... **CALL**
DSP1 *DSP Unit* **99.95**
DVS4 *Digital Voice Recorder* **42.00**
FVS1A *Voice Synthesizer* **38.95**

VXA700
Air Band Operation, VOR Navigation and Amateur Radio Communications, All In One!
Yes, this radio will transmit AM in the air band and FM in the 2m band! 5 watts of TX power, FM radio broadcast band receive (88-108Mhz), 190 memory channels, Submersible, Back-lit keypad and display w/dimmer, One touch emergency frequency (121.5 Mhz band), RX battery saver, CTCSS and DCS operation (amateur band only), NOAA weather channel receive, NOAA weather alert

VR120D *Receiver* **CALL**
EDC15 *DC Adapter* **19.95**
FNB79 *Nicad Battery* **16.95**

VR500 *Receiver* ..... **CALL**
ADMS3 *Programming Software* **35.95**
CSC72 *Soft Case* **17.95**
EDC5B *DC Adapter* **23.95**
FNB59 *Nicad Battery* **29.95**

Yaesu Closeout Items

CSC62 *Soft Case for 11/41 w/FNB31* **4.95**
CT30 *Mic "Y" Connector for 10/40/50* **7.95**
FBA17 *AA Holder 23/411/470* **17.95**
FNB31 *4.8v 600mah battery for 11/41/51* .. **27.95**
FNB38 *9.6v 600mah battery for 11/41/51* .. **29.95**
MH36A6J *Replacement Mic FT3000M* **39.95**
RH1 *Rubber Protector for 10/50* **4.95**
XF117CN *300hz CW filter for FT100* **69.95**

Prices are subject to change without notice.
Not responsible for typographical errors.

COMMUNICATION HEADQUARTERS, INC.

IC-756PROII
HF + 6M Deluxe FREE PS-125

IC-746PRO
HF + 6M +2M 100W FREE PS-125

IC-706MKIIG
HF + 6M +2M +440MHz FREE SEPARATION KIT

NEW! IC-703
HF

NEW! IC-208H*
2M + 440MHz

IC-T90A
6M + 2M + 440MHz

IC-2720H
2M + 440MHz

Why buy your Amateur Radio Equipment from CHQ?

There are plenty of reasons ....starting with over 16 years that Communication HeadQuarters has been in business! It takes a great deal of hard work, dedication and know-how to establish an Amateur Radio dealership in this fast-paced, technologically-driven market. But we've done it thanks to continued partnerships with leading manufacturers, a dedicated staff, a strong commitment to customer satisfaction and of course customers like YOU. It is important for us to provide you with quality products and service every time. Our GOAL is to KEEP you, the customer, HAPPY and to provide a dealership you can depend on. We want you to buy from us again. If you like doing business with us, tell all your friends. If you feel you have a problem with equipment purchased from us or our service, PLEASE let us know.

Other reasons that keep our customers coming back:

- Friendly Sales Staff.
- Knowledgeable Sales Staff.
- All employees have Ham licenses.
- Customer support for items purchased from CHQ.
- We strive to treat each customer as we would want to be treated ourselves.

All this and much more waiting for YOU! Call or check online for Special Prices!

3832 Oleander Dr., Wilmington, NC 28403 USA
technical (910) 791-8885 • fax orders (910) 452-3891 • e-mail sales@chq-inc.com

Order Toll Free 1-800-688-0073

www.chq-inc.com/icom

*This device has not been approved by the FCC. It may not be sold or leased, or offered for sale or lease, until approval of the FCC has been obtained. All specifications are subject to change without notice or obligation. 6129

Batteries / Chargers

BUY DIRECT FROM THE U.S. MANUFACTURER

– SPECIAL –
FOR THE MONTH OF JUNE
10% OFF
RADIO SHACK HTX 420 Li-ion REPLACEMENT BATTERIES
Monthly Discounts Applicable to End-Users Only
Look for July's Special of the Month

NEW Universal Clips and Adapters

Attach appropriate adapter to your radio. Connect your Universal Clip to your belt and place your radio onto the Universal Clip. Radio will not come loose from Universal Clip unless it is rotated 180° and removed.

W&W has the LARGEST selection of Quality High Capacity NiMH & Li-ion Batteries

95% of All W&W Battery Packs Are Made With SANYO/Panasonic Cells

NYS residents add 8.5 % sales tax. Add $5.00 for shipping.

W&W MANUFACTURING CO.

800 South Broadway, Hicksville, NY 11801-5017

Made in U.S.A.
Send for free catalog & price list

IN U.S. & IN CANADA CALL TOLL FREE 800-221-0732 • IN N.Y.S. 516-942-0011 • FAX: 516-942-1944
E-Mail: email@ww-manufacturing.com Web Site: www.ww-manufacturing.com

MADE IN U.S.A.

Prices & specifications subject to change without notice.

BUDGET SMARTUNER™ SG-239

Always wanted a Smartuner, but didn't think you could afford one?

Solution: The SG-239 Smartuner is now available for $179.95. Smartuners are automatic, high performance, and fast. No antenna coupler on the market can match it.

Cat# 54-22

Smart Choice! Smartuner!

No Compromise Communications
Tel: 425-746-6310 Fax: 425-746-6384
sgc@sgcworld.com www.sgcworld.com

AMATEUR TELEVISION

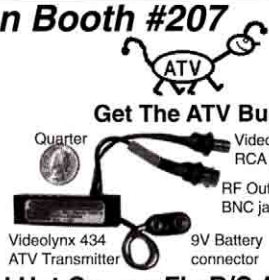
Web site: http://www.hamtv.com

Get Your ATV Gear at Dayton Booth #207

TC70-20S ATV Transceiver
Plug in and play ATV with this 4 channel Tx, 420-450 MHz band/ch3 Rx 20 Watt ATV Transceiver...$549
Join the ATV fun! Plug in your camcorder or video camera, TV set, 70cm antenna, mic and 13.8Vdc @5A. Send and receive live action color video just like broadcast TV with other hams.

Check out the ATV action with this 420-450 MHz to Ch 3 Downconverter and your TV set.

TVC-4G ATV downconverter...$99



Build a Hard Hat Cam or Fly R/C ATV
Videolynx Z70A w/sound & 4 ch Tx.....$149
Videolynx 434 MHz Video Transmitter...$99
50-100 mW, .6x.8x2.3", 1.5 oz., 9V@40ma
TXA5-RC 1.5 Watt ATV Xmtr board.....$129

Video ID Overlay boards from Intuitive Circuits Insert into the video line. Plug in GPS data line. **OSD-GPS...$119**

R/C Aircraft ATV with GPS & Call ID overlay

Hams, call or email for our 10 page ATV catalogue or down load from our web site. We have it all for the 420 MHz to 10.4 gHz ham bands: ATV transmitters - AM and FM, downconverters starting at $59, receivers, modules, antennas, etc., for base, repeaters, portable, R/C, rockets, balloons and more.

CALL (626) 447-4565 M-Th 8AM - 5:30 PM PST.
P. C. ELECTRONICS Since 1965
2522-WR Paxson Lane Arcadia CA 91007
Email: tom@hamtv.com
Web: www.hamtv.com
24hr FAX: (626) 447-0489
Tom (W6ORG) & Mary Ann (WB6YSS)

KJI Electronics

SERVING AMATEUR RADIO SINCE 1978

Phone 973-364-1930 or fax 973-239-4389 your order today! We gladly accept Visa/Mastercard/AmEx/Discover.

HF Made Easy!

$749 delivered to your door*

HF Made Easy package includes:

IC-718 transceiver with HM-36
MFJ-971 Tuner
SEC-1223 power supply (or equivalent)
CC-1 RG-8X coax cable (66 ft)
CC-2 jumper (3 ft)
G5RV 80/10m antenna
Optional UT-106 DSP **free until 5-31-03**
Free UPS ground delivery*

Advanced Performance, Simple Operation

160-10m at 100 watts
12v operation
CW Keyer built-in
One touch band switching
Direct frequency input
VOX built-in
101 memory channels
500kHz-30.0MHz Rx
IF shift
Optional DSP
PC programmable with optional software

King of the Hill!

HF package includes:

IC-765PROII transceiver
SM-20 station microphone
BY-1 Bencher iambic paddle
MFJ-890 atomic DX beacon monitor
PS-125 power supply
SP-20 station speaker

IC-PW1 power amplifier
Antenna of your choice:
- Force 12 SIGMA 5
- GAP TITAN
- HYGAIN AV-640

or $350 credit

100 ft RG-213U coax cable
Free UPS ground delivery*

$7,849 delivered to your door*

*Free UPS ground delivery offer good in continental USA only.
Limited to stock on hand. Items available on a "first come, first served" basis. While we do our best to check for errors, mistakes may occur: please call to verify pricing. 6130

Test drive the full line of ICOM products. Come on over to our store to see the in-store working display.

For more great deals on ICOM products, visit us on the web:
www.kjielectronics.com

KJI Electronics
394 Bloomfield Ave Caldwell, NJ 07006
Open daily Monday-Sunday 1-5pm, evenings Monday-Friday 7-9pm
(closed Wednesdays)

Call us during business hours: **973-364-1930**
Fax anytime: **973-239-4389**

AUTHORIZED • ICOM • DEALER

YOUR ICOM AMATEUR RADIO HEADQUARTERS IN NEW JERSEY SINCE 1978

KENWOOD

TH-G71A Sharp Distinction: The brighter side of handy communications. (right) This FM dualbander (144/440MHz) boasts an illuminated keypad and LCD, high-performance antenna, and a stylish yet ergonomic design. The 5W G71A also offers convenience with its memory name function, menu mode, PC compatibility and 200 memories. 2.31"w x 4.44"h x 1.44"d, 11.6 oz **$229.95**

TH-F6A Unique features the competition is still scratching their heads over. The FM 144/220/440MHz F6A offers dual-channel RX capability, 16-key pad, multi-scroll key, 5W, and no fewer than 435 memories. Other attractive features include built-in ferrite bar antenna for AM, backlit LCD, lithium-ion battery, and a MIL-STD design. 2.3"w x 3.44"h x 1.18"d, 8.8 oz **$329.95**

TH-D7A(G) Explore APRS opportunities with an HT built for the future. (middle) This 5W FM dualband (2M, 440MHz) is equipped with a TNC and provides the radio enthusiast with a range of data communications options. Along with simple packet, use the D7A(G) along with APRS and a GPS unit to send positioning data. Transmit coordinates to a friend, who can pinpoint the location. 4.75"h x 2.25"w x 1.5"d, 12 oz **$359.95**

TM-261A Fully equiped, supremely user-friendly 2M mobile. The 261A puts out an impressive 50 Watts with mid- and low-power settings. For quick access, essential data can be stored in 62 "memory name function" memory channels. Other features include DTSS selective calling, multi-scan capability, and a case built to MIL-STD. 5.5"w x 6.56"h x 1.56"d, 2.2 lbs **$149.99**

TM-G707A The essence of ease. From the extra-large panel to Kenwood's Easy Operation mode, the G707A is extraordinarily user-friendly. In addition to its regular profile, it can store four others for instant recall. This 50W/35W, FM dualband (144/440MHz) offers 180 multi-function memories with name function to identify each. 5.5"w x 1.56"h x 7.44"d, 2.65 lbs **$269.95**

TM-V7A Cool Blue: The look of mobile communication. The V7A 144/440MHz FM transceiver marks a departure in ergonomic design with its easy-to-operate control panel and reversible LCD. The "5-in-1" programmable memory, 50/35W, DTSS and pager functions, and dual receive on one band make it a pace-setter. 5.5"w x 1.56"h x 7.44"d, 2.65 lbs **$399.95**

TM-D700A Harnessing APRS®, GPS and SSTV. This FM 144/440MHz mobile features a built-in TNC offering options including simple packet. However, the brightest spot of the 50/35W D700A is its ability to enable APRS® without a computer. It also has 200 memories, dual receive, built-in CTCSS/DCS, and DX cluster monitoring. 5.5"w x 1.58"h x 7.68"d, 3 lbs **$519.95**

TS-50S Compact milestone. One of the most compact HF (160-10M) transceivers, the 50S can be mounted in a vehicle, taken on DXpedition, or installed as a base station. Despite its compact dimensions it packs a hefty 100W punch. Features include DDS with "fuzzy" control, AIP, and dual VFOs. 7.06"w x 2.38"h x 9.19"d, 6.4 lbs **$649.95**

TS-570D(G) Affordable DSP without compromise. High-end technology doesn't mean a high-end budget. With 16-bit DSP, untouchable digital filtering, heavy-duty transmitter design, and central frequency control system, the 570D(G) provides 160-10M operation. 10.63"w x 3.75"h x 11"d, 15 lbs ..... After *Rebate! **$889.95**

TS-570S(G) The 570D(G) with 6M.... After *Rebate! **$1059.95**

TS-2000 Distinctive by design, packed for performance. The all-mode, HF, 2M, 6M, 70cm 2000 is serious about DSP. Its advanced digital technology converts analog waveforms into digital data, enabling such digital processing as IF filtering, slope tune, auto notch and AGC. 10.63"w x 3.75"h x 12.5"d. FREE Heil Mic thru 5/31/03, USA only **$1699.95**

AES

AMATEUR ELECTRONIC SUPPLY

5710 W. Good Hope Rd.
Milwaukee, WI 53223
414-358-0333
1-800-558-0411
Fax 414-358-3337
Service 414-358-4087
milwaukee@aesham.com

621 Commonwealth Ave.
Orlando, FL 32803
407-894-3238
1-800-327-1917
Fax 407-894-7553
orlando@aesham.com

28940 Euclid Ave.
Cleveland, OH 44092
440-585-7388
1-800-321-3594
Fax 440-585-1024
cleveland@aesham.com

4640 South Polaris Ave.
Las Vegas, NV 89103
702-647-3114
1-800-634-6227
Fax 702-647-3412
lasvegas@aesham.com

Store Hours
Mon–Fri • 9am to 5:30pm
Saturday • 9am to 3pm

1-800-558-0411
www.aesham.com

*Rebate good thru 5/31/03, USA only
Prices subject to change without notice.

ICOM

AES
AMATEUR ELECTRONIC SUPPLY

IC-V8 Quality, simplicity, anywhere. (right) This 144MHz FM transceiver's front panel and chassis are constructed of tough polycarbonate and die-cast aluminum for durability. The 5.5W V8 offers a 16-button keypad and 100 alphanumeric memories. CTCSS, DTCS and DTMF encoder are standard. 2.13"w x 5.19"h x 1.38"d, 12.3 oz ..... © **CALL**

IC-T7H Powerful output and ample receive audio. (left) A 6W amp circuit provides superior transmit on both VHF and UHF when 13.5 V DC is supplied. In addition, a full 500mW of AF is output from the speaker – easy to copy in noisy environments. Separate CTCSS tone encoder and encoder/decoder are standard. Single push action makes it simple. This 2M/440MHz meets MIL SPEC. 2.25"w x 4.34"h x 1.06"d, 10 oz ..... © **CALL**

IC-T2H SPORT More than enough power. The 6W Sport meets MIL SPEC for shock and vibration and is more than enough for long distance communications. The 2M handheld boasts tone squelch, customizable keys, DTMF encode, 40 memories, 10 weather channels and cloning. 2.3"w x 5.5"h x 1.3"d, 14.8 oz ..... © **CALL**

IC-2100H-25N Durable 2M rig with superior RX IMD, performance. The 2100H25N offers 50W on transmit, extending its range. It also features CTCSS tone enc/decode, tone scan and 100 alphanumeric memories. It can be remote controlled using the new backlit mic. 5.5"w x 1.56"h x 7.09"d, 2 lbs, 10 oz ..... © **CALL**

IC-2720H Twice the versatility, twice the fun! The 2M/440MHz, 50/35W 2720H offers simultaneous receive capability, independent controls for each band, and DMS with 212 memories. It also features CTCSS/DTCS, weather alert, auto repeater, remote control mic and compact remote head. Mount controller to unit with optional MB-85. 5.5"w x 1.56"h x 7.38"d, 3 lbs (main)..... © **CALL**

IC-V8000 75W of "base station" power. The 75W V8000 also offers selection of 25, 10 and 5W. With an operator-facing speaker, audio is clear. The 144-148MHz V8000 also features CTCSS/DTCS, standard DTMF encoder, 207 memories, FM narrow mode, and remote control mic. 5.9"w x 1.97"h x 5.9"d, 2.22 lbs..... © **CALL**

IC-718 Origin of the HF transceiver. With performance found in the HF all-band 718, such as wide dynamic range, high S/N ratio, and full duty operation, making distant contacts is easy. Experi-ence its combo of the latest RF and digital technology. 9.44"w x 3.75"h x 9.41"d, 8 lbs, 6 oz ..... NOW! FREE UT106 included © **CALL**

IC-703 For the QRP enthusiasts. The 160-10M 703 is capable of 5/10W and focuses on QRP performance. A portable HF unit, it features a relay-type antenna tuner, low current consumption, DSP, memory keyer and 105 memories. Ideal long distance communications when normal set up is absent. 6.56"w x 2.28"h x 4.88"d, 4.4 lbs..... © **CALL**

IC-703PLUS The 703, plus 6M..... © **CALL**

IC-746PRO 32-bit DSP takes you even higher. All-mode operation, 100W, 102 alphanumeric memories, and a multi-function LCD are impressive in the HF/50/144MHz 746PRO. Its floating point DSP and 24-bit AD/DA converter make it a must-have. Also has memory keyer, built-in antenna tuner and digital noise reduction. 11.3"w x 4.7"h x 12.5"d, 19 lbs, 13 oz ..... NOW! FREE PS-125 included © **CALL**

IC-756PROII A leap forward for the digital revolution. An all-mode, HF, 50MHz transceiver designed to include customer-suggestions. The PROII not only offers a 32-bit Floating DSP, but also has built-in 24-bit AD/DA converter, enhanced backlighting, selectable IF shape, adjustable noise blanker, and improved audio fidelity. 13.38"w x 4.38"h x 11.19"d, 21 lbs, 1 oz ..... NOW! FREE PS-125 included © **CALL**

5710 W. Good Hope Rd.
Milwaukee, WI 53223
414-358-0333
1-800-558-0411
Fax 414-358-3337
Service 414-358-4087
milwaukee@aesham.com

621 Commonwealth Ave.
Orlando, FL 32803
407-894-3238
1-800-327-1917
Fax 407-894-7553
orlando@aesham.com

28940 Euclid Ave.
Cleveland, OH 44092
440-585-7388
1-800-321-3594
Fax 440-585-1024
cleveland@aesham.com

4640 South Polaris Ave.
Las Vegas, NV 89103
702-647-3114
1-800-634-6227
Fax 702-647-3412
lasvegas@aesham.com

Store Hours
Mon–Fri • 9am to 5:30pm
Saturday • 9am to 3pm

1-800-558-0411
www.aesham.com

Prices subject to change without notice.
© w/Instant Coupon, coupons expire 5/31/03

NEW

DX4WIN V6

Featuring Integrated PSK31, and Dual Radio Support

DX4WIN now combines the quality features, flexibilty and customer support it's famous for, with a high quality *INTEGRATED* PSK31 interface. No longer do you have to work PSK and then log in separate applications. It can *ALL* be done within DX4WIN, using all standard DX4WIN features.

DX4WIN version 6.0 only $89.95
Shipping $6.95 US/$11 DX.
Upgrades available for previous versions

To order, or for more information, contact:

Rapidan Data Systems
PO Box 418, Locust Grove, VA 22508
(540) 785-2669; Fax: (540) 786-0658
Email: support@dx4win.com
Free version 6.0 demo and secure online ordering at **www.dx4win.com**

Rig Wrapper

YAESU MP series Owners

Protect your valuable investment and maintain its pristine condition by keeping it dust and scratch free with a *Rig Wrapper*.

Personalize with your call letters and/or the ARRL decal.
Cover $59.99, Call Letters $10.00, ARRL decal $3.00
121 E. Wooster Street, Bowling Green, OH 43402
sales@distaview.com, 800.795.9970

CSI wants YOU!

CSI is the leading in-building wireless system infrastructure supplier in the US. To sustain our growth we need more great people.
We are currently looking for an **RF ENGINEER** BSEE with 4+ years of experience in microwave amplifier and circuit design (100 MHz-18 GHz). Preference for those with PCS/Cellular frequency range experience.
Email your resume to **personnel@cellularspecialties.com**, or mail it to
Cellular Specialties Inc.
Personnel Department
670 N Commercial Street, Manchester, NH 03101

HONDA®
GENERATORS

What are YOU plugging into?

- **Super quiet running ~ 53 - 59dB!** (Quieter than normal speech!)
- **Extra long run time.** (Runs up to 15 hours on one gallon!)
- **Lightweight & portable.** (Easy to carry - weighs less than 47 lbs!)
- **Honda invertor technology.** (Run sensitive electronics worry free!)
- **Eco-throttle** (Varies engine speed to increase fuel efficiency while reducing sound level!)

EU2000i
$859
FREE SHIPPING!
In continental US

EU1000iA2 also available $629

www.Mayberrys.com/generators

or call us toll free:
800-696-1745
Authorized Dealer
MAYBERRY
SALES & SERVICE, INC.
232 Main Street~PO Box 113, Port Murray, NJ 07865

Please read your owner's manual before operating your Honda Power Equipment. Connection of a generator to house power requires a transfer device to avoid possible injury to power company personnel. Consult a qualified electrician

---

Design— Experimentation— Measurement

Experimental Methods in RF Design brings professional RF design experience to the radio amateur. It's written for anyone with a driving curiosity about state-of-the-art equipment.

Contents:

- Basic Investigations in Electronics
- Chapters on Amplifiers, Filters, Oscillators, and Mixers
- Superheterodyne Transmitters and Receivers
- Measurement Equipment
- Direct Conversion Receivers
- Phasing Receivers and Transmitters
- DSP Components
- DSP Applications in Communications
- Field Operation, Portable Gear, and Integrated Stations

CD-ROM included with design software, listings for DSP firmware, and supplementary articles.

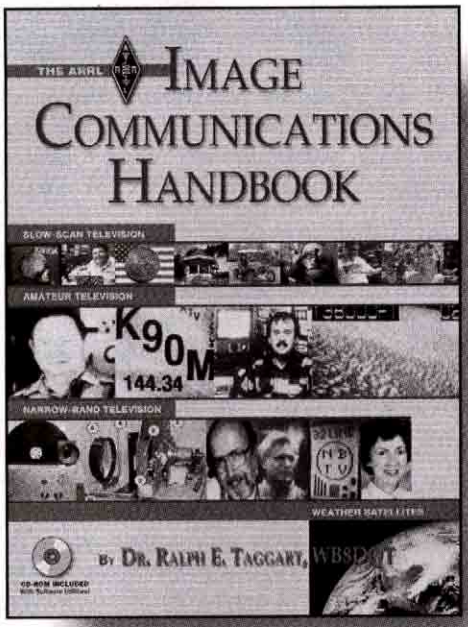
Experimental Methods in RF Design
512 pages. ARRL Order No. 8799 — **$49.95***
*shipping: $8 US (UPS)/$10 International

ARRL *The national association for AMATEUR RADIO*
SHOP DIRECT *or call for a dealer near you.*
ONLINE WWW.ARRL.ORG/SHOP
ORDER TOLL-FREE 888/277-5289 (US) QST 3/2003

Now Shipping!

The ARRL IMAGE COMMUNICATIONS HANDBOOK

Explore the possibilities of using Amateur Radio to **see and talk with other hams!** With home computers, widely available software, and gear many hams already own, it's easier than ever to enjoy the imaging modes: Narrow-Band Television (NBTV), Amateur Television (ATV), Slow-Scan Television (SSTV), and Weather Satellite Imaging (WEFAX).



The ARRL Image Communications Handbook

by Dr. Ralph E. Taggart, WB8DQT

Book includes CD-ROM with software utilities.

ARRL Order No. 8616—$25.95*

*shipping: $6 US (UPS)
$8.00 International (surface)

Sales tax is required for orders shipped to CA, CT, VA, and Canada.

Available from ARRL Dealers EVERYWHERE.

YOU'RE....
ON THE AIR

ARRL *The national association for AMATEUR RADIO*
www.arrl.org/shop

225 Main Street, Newington, CT 06111-1494 **tel: 860-594-0355 fax: 860-594-0303**
In the US call our toll-free number **1-888-277-5289** 8 AM-8 PM Eastern time Mon-Fri.

QST 11/2002

YAESU

VX-1R Power out of the pocket. (right) This 500mW dualband (144/430MHz) handheld gives the user wide receiver coverage in a small package. The 1R offers 291 memories, ARTS™, internal speaker, SmartSearch™, and dual watch. It also provides one-touch emergency access and built-in CTCSS/DCS enc/decoder while operating for more than 11 hours on a single charge. 1.9"w x 3.2"h x 1"d, 4 oz ..... © **$124.99**

VX-5R/VX-5RS Toughest HTs setting water resistance standards. (middle) Boasting 5W, the 5R/5RS cover 50/144/430MHz while offering shortwave to microwave reception. Perfect for outdoor activities, they feature an optional barometric pressure unit. The black or silver units are built with alphanumeric memories and CTCSS/DCS. 2.3"w x 3.4"h x 1.1"d, 8.9 oz ..... © **$269.95**

VX-7R/VX-7RB The first submersible amateur handhelds. (left) Protected against water by gaskets and weatherproofing techniques, the 50/144/430MHz, 5W 7R/7RB are rated for a 3-foot, 30-minutes submersion. Tough magnesium bodies make them ideal for the outdoors. They include dual/wide-band receive, status strobe, and "internet" key for access to the new WIRES™ system. 7RB sports a black case. 2.4"w x 3.5"h x 1.1"d, 9.2 oz ..... © **$299.95**

FT-2800M Cool and quiet 65W operation. The most rugged 2M transceiver ever provides 65/25/10/5W with an extensive 221 memories, alphanumerics and CTCSS/DCS. The 2800M also features NOAA with weather alert, WIRES™ access, SmartSearch™, and excellent receive. With a bullet-proof front end and direct keypad entry, it's a dream come true. 6.3"w x 2"h x 7.3"d, 4 lbs **$159.95**

FT-90R Big power, big performance, micro-mini size! This 144/430MHz FM mobile is high power with high reliability... pocket-sized. The 90R features 50/35W, user-programmable function keys, 186 memories, versatile scanning, CTCSS/DCS, and direct frequency entry. 3.9"w x 1.2"h x 5.4"d, 1.4 lbs..... **$349.95**

FT-8900R Leading the way in FM mobile design. The 29/50/144/440MHz 8900R has no peer among mobiles offering leading edge features like VHF/UHF full duplex, independent operation on two bands, and six "Hyper Memory" keys. The 8900R also provides 50W (35 on 440MHz), access to internet linking, over 800 memories, CTCSS/DCS and duplexer. 5.5"w x 1.6"h x 6.6"d, 2.2 lbs© **$389.95**

FT-817 Self-contained, battery-powered, multi-mode portable. The 5W 817 is designed for operation on HF, plus 6M, 2M, and 70cm. Whether you perfer SSB, CW, AM, FM, Packet, or SSB-based digital modes, it is ready to join you on your next hiking, camping, or search-and-rescue adventure. 5.3"w x 1.5"h x 6.5"d, 2.6 lbs..... © **$629.95**

FT-100D The smallest full-featured HF/VHF/UHF transceiver. With coverage from HF to UHF, built-in DSP, and 100W HF/50MHz output (50W on 2M, 20W on 430), the 100D keeps you in touch with the world, at home or away. It also features a 500Hz crystal filter, high-stability oscillator, CTCSS decoder, and high-quality speaker. 6.3"w x 2.1"h x 8"d, 6.6 lbs.© **$789.95**

FT-897 All-in-one portable base. The all-mode, multi-band 897 features high output 100W (HF/6M), 50W (2M), 20W (70cm), rugged construction, 200 memories, and optional internal power supply and external antenna tuner. 7.87"w x 3.15"h x 10.3"d, 8.6 lbs ..... © **$919.95**

FT-920 Dedicated to the enhancement of Signal-To-Noise ratio. The 160-6M 920 is optimized for noise reduction, wide dynamic range and audio tailored to the operator's voice. This 100W rig also has dual watch, keyboard freq. entry and 127 alphanumeric memories. 15.2"w x 5.3"h x 12.5"d, 24 lbs..... NOW! FREE FM board with purchase © **$1139.95**

AES
AMATEUR ELECTRONIC SUPPLY

5710 W. Good Hope Rd.
Milwaukee, WI 53223
414-358-0333
1-800-558-0411
Fax 414-358-3337
Service 414-358-4087
milwaukee@aesham.com

621 Commonwealth Ave.
Orlando, FL 32803
407-894-3238
1-800-327-1917
Fax 407-894-7553
orlando@aesham.com

28940 Euclid Ave.
Cleveland, OH 44092
440-585-7388
1-800-321-3594
Fax 440-585-1024
cleveland@aesham.com

4640 South Polaris Ave.
Las Vegas, NV 89103
702-647-3114
1-800-634-6227
Fax 702-647-3412
lasvegas@aesham.com

Store Hours
Mon–Fri • 9am to 5:30pm
Saturday • 9am to 3pm

1-800-558-0411
www.aesham.com

Prices subject to change without notice.
© w/Instant Coupon, coupons expire 6/30/03

Visit Your Local HAM PROs!

NEW
BR-200 Kuranishi Instruments Japan
Laboratory Quality
Antenna Analyzer
Test SWR and Impedance
with CONFIDENCE!
Range: 1.8 - 170 MHz

Over 245 years of combined professional service to the Amateur Radio community.

ICOM®

ICOM Coupons Expire 5/31/03.
Call for Latest Info.

FREE PS-125
$200 Mfr Coupon

IC-746PRO
HF, 6M, 2M
100W All Bands, All Modes
32 Bit DSP

$20 Mfr Coupon

IC-703
HF or HF/6M
0.1 – 10W
Built-in Tuner

$20 Mfr Coupon

IC-V8000
2M FM Mobile
75W Max
WX Alert

YAESU

Choice of the World's top DX'ers℠

Yaesu Coupons Expire 6/30/03.
Call for Latest Info.

$70 Mfr Coupon

FT-897
HF, 6M, 2M, 440
100W HF and 6M
50W on 2M, 20W
on 440

FT-857
HF, 6M,
2M, 440
Compact Mobile

FT-2800
2M FM Mobile
65W Max
Large Display
preset NOAA WX

KENWOOD

$200 Rebate from Kenwood

TS-570DG/SG
HF or HF/6M
Built-in DSP
Internal Tuner

Free Heil Mic from Kenwood

TS-2000S
HF, 6M, 2M, 440
Optional 1.2GHz & Built-in
TNC Tuner

TM-D700A
2M/440 FM Mobile
VV, UV, UU
Built-in TNC

Kenwood Rebates and Free Items
Offers Expire on 5/31/03.
Call for Latest Info.

Prices, products and policies may vary between dealer locations. Not all dealers have all product lines.
All prices and products subject to change. Not responsible for typographical errors.

DISCOVER MasterCard VISA

Lentini Communications, Inc.

1•800•666•0908

Local (860) 666-6227
FAX (860) 667-3561
21 Garfield Street
Newington, CT 06111
www.lentinicomm.com

Austin Amateur Radio Supply

1•800•423•2604

Local (512) 454-2994
FAX (512) 454-3069
5325 North I-35
Austin, Texas 78723
www.aaradio.com

Associated Radio

1•800•497•1457

Local (913) 381-5900
FAX (913) 648-3020
8012 Conser
Overland Park, KS 66204
www.associatedradio.com

ComDaC Radio

1•800•382•2562

Local (269) 982-0404
FAX (269) 982-0433
1051 Main Street
St. Joseph, MI 49085
www.comdac.com

Universal Radio, Inc.

1•800•431•3939

Local (614) 866-4267
FAX (614) 866-2339
6830 Americana Pkwy.,
Reynoldsburg, Ohio 43068
www.universal-radio.com

Radio City, Inc.

1•800•426•2891

Local (763) 786-4475
FAX (763) 786-6513
2663 Country Road I
Mounds View, MN 55112
www.radioinc.com

July 4, 2003 is a significant date for all radio amateurs!

Go to the ARRL website
to make your contribution at
www.arrl.org/defense
or send your contribution to:

WRC-03 Special Campaign
2003 Spectrum Defense Fund
225 Main Street
Newington CT 06111-1494

The 2003 World Radiocommunication Conference (WRC-03) is just around the corner —just a few weeks away!

And three years of hard work and preparation will come to a head. When the conference closes on July 4 we should have answers to vital questions that affect all of us….

…will the frustrating overlap between amateurs and broadcasters on 40 meters finally be eliminated – without reducing our essential 300 kHz bandwidth?

…what will be the outcome of broadcasters' request for more HF spectrum?

…will additional allocations be given to "little LEO" satellites?

…and more.

The team representing you at WRC-03 is prepared – but we face an uphill battle against commercial interests with deep pockets and a climate where domestic security concerns influence spectrum decisions.

Please lend your voice and your financial support by May 30. Thank You!

Assistant Technical Editor

The ARRL Publications Group is seeking a full-time Assistant Technical Editor. The position is located at ARRL Headquarters in Newington, Connecticut.

The Assistant Technical Editor will have a wide range of responsibilities involving several ARRL publications.

- *Product Review editor*: Planning the column for each issue of *QST*, including selecting appropriate gear to review, arranging for purchase of the equipment, writing the review or finding a reviewer, working with the ARRL Lab to schedule testing, preparing the column for publication and ensuring that the manufacturer has a chance to review the column before publication.
- *NCJ handling editor*: Working cooperatively and efficiently with the *NCJ* editor to ensure that each issue of *NCJ* meets its editorial goals and its deadline. Working cooperatively and productively with Production staff to ensure that each issue is attractive and completed on schedule. Preparing manuscripts for publication, checking carefully for spelling, grammar and usage.
- *Editor, The ARRL Repeater Directory:* Working effectively and cooperatively with frequency coordinators and others who provide material for publication in each annual edition. Preparing the material for publication and working closely with Production staff to ensure that the book meets its editorial goals and its deadline.
- Compiling and editing New Products announcements for each issue of *QST*.
- Taking digital photographs for publication in ARRL periodicals.

Qualifications

- Broad knowledge of and experience with Amateur Radio and electronics
- Some knowledge of and experience with the design and construction of Amateur Radio equipment, antennas and accessories
- A college degree, preferably in a related field
- A minimum of one year of writing or editing experience
- Demonstrated ability to work effectively and productively with a variety of people
- Demonstrated ability to meet deadlines
- Proficiency with Microsoft Office, especially Word
- An Amateur Radio license
- Several years of on-the-air experience with a variety of Amateur Radio equipment preferred
- Some experience with digital photography preferred

The starting date for this position is on or around August 1, 2003. Starting salary $34,000-$38,000, depending on experience. Please send your resume and a cover letter to Robert Boucher, ARRL, 225 Main St, Newington, CT 06111, fax 860-594-0298; e-mail **rboucher@arrl.org**. No telephone calls, please. ARRL is an Equal Opportunity Employer.

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 . . .

The MIRAGE B-2518-G gives you 160 Watts of brute power for 25 Watts input on all modes -- FM, SSB, or CW!

B-2518-G **$329** Suggested Retail

Ideal for 10 to 35 Watt 2 Meter mobile or base. Hear weak signals -- low noise GaAsFET preamp gives you excellent 0.6 dB noise figure. Select 15 or 20 dB preamp gain.

B-2518-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, warning LED.

Smooth adjustable Transmit/Receive switch with remote external keying.

Draws 17-22 Amps at 13.8 VDC. Measures a compact 12x3x5½ inches.

MIRAGE RUGGED!

RC-2, $45. Remote Controls most Mirage amps. On/Off, preamp On/Off, selects SSB/FM. With 18 foot cable (longer available with special order).

More 160 Watt, 2 Meter Amplifiers . . .

B-5018-G, $329. Same as B-2518-G but for 20 to 60 Watt mobile or base. 160 Watts out for 50 Watts in. Gives you 160 Watts out for 50 W in.

B-1018-G, $409. MIRAGE's most popular *dual purpose* HT or mobile/base amplifier. 160 Watts out for 10 Watts in. For 0.2-15 Watt rigs.

***Power Curve** -- typical output power in Watts*

B-1018-G	40	60	140	150	160	160	--	--	--	--	--
B-2518-G	--	0.5	30	56	91	111	135	153	160	160+	--
B-5018-G	--	--	--	52	99	119	125	130	135	145	160
Watts In	0.25	0.5	3	5	8	10	15	20	25	35	50

100 Watts for 2 Meter HTs

B-310-G **$199** Suggested Retail

MIRAGE RUGGED!

***Power Curve** -- typical B-5016-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 4¾x1¾x7¾ 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-5016-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 B-5016-G 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, $389 -- 100 W out/30 in. For 5 to 45 Watt *mobile/base*. **D-1010-N, $419**, 100 W out/10 in. *Dual purpose* -- for handhelds or mobile/base. **D-26-N, $289**, 60 W out/2 in, for *handhelds*.

Amateur TV Amps

Industry standard ATV amps -- **D-1010-ATVN, $439**, 82 Watts PEP out / 10 in. **D-100-ATVN, $439**, 82 Watts PEP out/2 in. (without sync compression).

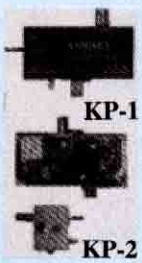
Remote Control Head for Amps

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



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, $169 to $739.

Commercial Amps ($159 to $429)

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

Call your dealer for your best price!
Nearest Dealer/Free Catalog: 800-647-1800

http://www.mirageamp.com

Technical: 662-323-8287 **Fax:** 662-323-6551

MIRAGE

COMMUNICATIONS EQUIPMENT
300 Industrial Park Road
Starkville, MS 39759, USA

Prices and specifications subject to change ©*2000 Mirage Communications*

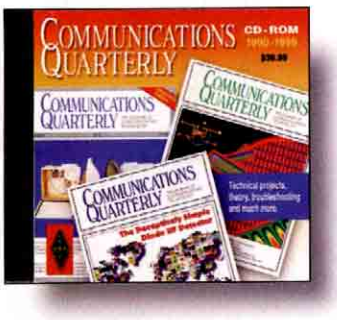
MIRAGE . . . the world's most rugged VHF/UHF amplifiers!

ARRL CD-ROM Collections

ARRL Periodicals on CD-ROM are fully-searchable collections of popular ARRL journals. Every word and photo published throughout the year is included!

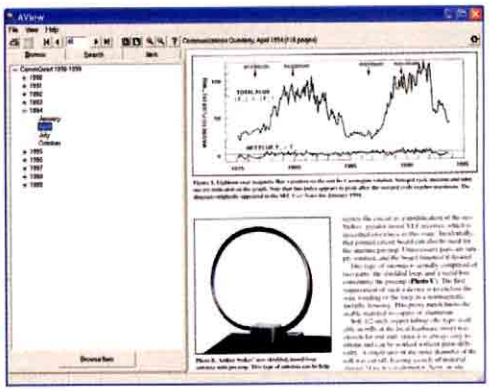
SEARCH the full text of every article by entering titles, call signs, names—almost any word. **SEE** every word, photo (including color images), drawing and table in technical and general-interest features, columns and product reviews, plus all advertisements. **PRINT** what you see, or copy it into other applications. **WEB LINKS** appearing in any article can be used to launch your existing Web browser to view additional information (feature available for versions beginning with 1996).

System Requirements: Microsoft *Windows*™, 1999, 2000, 2001, and 2002 editions support *Windows* and Macintosh systems, using the industry standard Adobe *Acrobat Reader*® (included).



Communications Quarterly CD-ROM

This CD-ROM collection covers volumes of *Communications Quarterly* published from 1990-1999. Gain access to advanced technical topics in articles which cover transmitter, receiver and transceiver projects, theory, antennas, troubleshooting and much more. High quality black-and-white page scans can be read on your computer screen or printed. Quickly **search** for articles by title and author, **select** specific year and issue, and **browse** individual articles and columns. Requires Microsoft *Windows*™.



ARRL CD-ROM Collections

ARRL Periodicals CD-ROM
(includes *QST*, *QEX*, *NCJ*)
NEW! #8802 Year 2002 **$19.95**
#8632 Year 2001 **$19.95**
#8209 Year 2000 **$19.95**
#7881 Year 1999 **$19.95**
#7377 Year 1998 **$19.95**
#6729 Year 1997 **$19.95**
#6109 Year 1996 **$19.95**
#5579 Year 1995 **$19.95**

QST View CD-ROM
#7008 Years 1915-29 **$39.95**
#6710 Years 1930-39 **$39.95**

QST View CD-ROM (cont.)
#6648 Years 1940-49 **$39.95**
#6435 Years 1950-59 **$39.95**
#6443 Years 1960-64 **$39.95**
#6451 Years 1965-69 **$39.95**
#5781 Years 1970-74 **$39.95**
#5773 Years 1975-79 **$39.95**
#5765 Years 1980-84 **$39.95**
#5757 Years 1985-89 **$39.95**
#5749 Years 1990-94 **$39.95**
#8497 Years 1995-99 **$39.95**
#QSTV (all 12 sets) **$399**

#8780 **Communications Quarterly CD-ROM** (1990-1999) **$39.95**

Ham Radio Magazine CD-ROM*
#8381 Years 1968-76 **$59.95**
#8403 Years 1977-83 **$59.95**
#8411 Years 1984-90 **$59.95**
#HRCD (all three sets) **$149.85**

#7660 **QEX Collection CD-ROM** (1981-1998) **$39.95**

#7733 **NCJ Collection CD-ROM** (1973-1998) **$39.95**

www.arrl.org/shop
1-888-277-5289 (US)

*Ham Radio CD-ROM, © 2001, American Radio Relay League, Inc.
Ham Radio Magazine © 1968-1990, CQ Communications, Inc.

Shipping & Handling charges apply: US orders add $5 for one CD, plus $1 for each additional CD ($10 max.). International orders add $2.00 to US rate ($12.00 max.) Or, contact ARRL to locate a dealer. **Sales Tax** is required for orders shipped to CA, CT, VA, and Canada.

10 Bands -- 1 MFJ Antenna!

Full size performance . . . No ground or radials

Operate 10 bands: 75/80, 40, 30, 20, 17, 15, 12, 10, 6 and 2 Meters with one antenna Separate full size radiators . . . End loading . . . Elevated top feed . . . Low Radiation Angle . . . Very wide bandwidth . . . Highest performance no ground vertical ever . . .

Operate 10 bands -- 75/80, 40, 30, 20, 17, 15, 12, 10, 6 and 2 Meters with this MFJ-1798 vertical antenna and get *full size performance* with no ground or radials!

Full size performance gives high efficiency for more power radiated. Results? Stronger signals and more Q-5 QSOs.

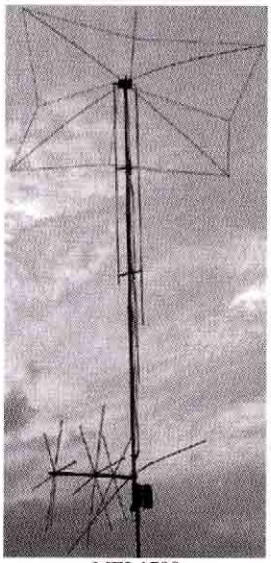
Full size performance also gives you exceptionally wide bandwidths so you can use more of your hard earned frequencies.

Full size performance is achieved using separate full size radiators for 2-20 Meters and highly efficient end loading for 30, 40, 75/80 Meters.

Get very low radiation angle for exciting DX, automatic bandswitching, omni-directional coverage, low SWR. Handles 1500 Watts PEP SSB.

MFJ's unique *Elevated Top Feed*™ elevates the feedpoint *all the way to the top* of the antenna. It puts the maximum radiation point high up in the clear where it does the most good -- your signal gets out even if you're ground mounted.

It's easy to tune because adjusting one band has minimum effect on the resonant frequencies of other bands.



MFJ-1798
$289.95
Ship Code F

Self-supporting and just 20 feet tall, the MFJ-1798 mounts easily from ground level to tower top -- small lots, backyards, apartments, condos, roofs, tower mounts.

Separate Full Size Radiators

Separate *full size* quarter wave radiators are used on 20, 17, 15, 12, 10 and 2 Meters. On 6 Meters, the 17 Meter radiator becomes a 3/4 wave radiator.

The active radiator works as a stub to decouple everything beyond it. *In phase* antenna current flows in all parallel radiators.

This forms a very large equivalent radiator and gives you incredible bandwidths.

Radiator stubs provide automatic bandswitching -- absolutely *no loss* due to loading coils or traps.

End Loading

On 30, 40, 75/80 Meters, end loading -- the most efficient form of loading -- gives you highly efficient performance, excellent bandwidth, low angle radiation and automatic bandswitching.

MFJ's unique *Frequency Adaptive L-Network*™ provides automatic impedance matching for lowest SWR on these low bands.

Tuning to your favorite part of these bands is simple and is done at the *bottom* of the antenna.

No Ground or Radials Needed

You don't need a ground or radials because an effective counterpoise that's 12 feet across gives you *excellent* ground isolation.

You can mount it from ground level to roof top and get awesome performance.

No Feedline Radiation to Waste Power

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.

Built to Last

Incredibly strong solid fiberglass rod and large diameter 6061 T-6 aircraft strength aluminum tubing is in the main structure.

Efficient high-Q coils are wound on tough *low loss* fiberglass forms using highly weather resistant *Teflon*® covered wire.

MFJ's Super High-Q Loop™ Antennas

MFJ-1786
$379.95
Ship Code F

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.

Heavy duty thick ABS plastic housing has ultraviolet inhibitor protection.

NEW! **MFJ-1788, $429.95.** Same as MFJ-1786 but covers 40 Meters-15 Meters continuous. Includes super remote control.

MFJ-1782, $339.95. Like MFJ-1786 but control has only fast/slow tune buttons.

MFJ-1780, $249.95. *Box Fan* Portable Loop is about the same size (2x2 foot) as a box fan, complete with handle. Covers 14-30 MHz. Control has fast/slow tunes.

MFJ Portable Antenna

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.

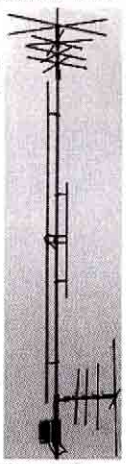
MFJ's G5RV Antenna

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



MFJ-1796
$209.95
Ship Code F

Only 12 feet high and has a tiny 24 inch footprint! Mount anywhere -- ground level to tower top -- apartments,small lots, trailers. Perfect for vacations, field day, DXpedition, camping.

Efficient end-loading, no lossy traps. Entire length is always radiating. Full size halfwave on 2/6 Meters. High power *air-wound* choke balun eliminates feedline radiation. Adjusting 1 band has minimum effect on others.

MFJ-1792, $169.95. Full size 1/4 wave radiator for 40 Meters. 33 feet, handles 1500 Watts PEP. Requires guying and radials.

MFJ-1793, $189.95. Like MFJ-1792 but has full size 20 Meter 1/4 wave also.

Free MFJ Catalog
and Nearest Dealer . . . 800-647-1800

http://www.mfjenterprises.com

1 Year *No Matter What*™ warranty 30 day money back guarantee (less s/h) on orders from MFJ

MFJ ENTERPRISES, INC.
Box 494, Miss. State, MS 39762
(662) 323-5869; 8-4:30 CST, Mon.-Fri.
FAX: (662) 323-6551; **Add s/h**
Tech Help: (662) 323-0549

MFJ . . . the world leader in ham radio accessories!

hand-held

THE ARRL REPEATER DIRECTORY®

2003-2004

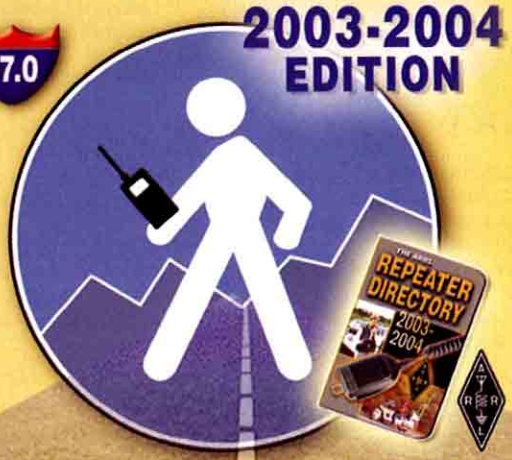
IRLP

Now including IRLP (Internet linked) nodes.

TravelPlus For Repeaters™

2003-2004 EDITION

ver 7.0



Includes the entire ARRL Repeater DataBase

The ARRL Repeater Directory®

2003/2004 Edition. 624 pages.
ARRL Order No. 8918—$9.95*
***shipping: $4 US (UPS), $6.00 International**

The ARRL Repeater Directory on your COMPUTER!

...Planning a vacation or weekend trip? ...Traveling on business to different cities? ...Preparing for a backpacking or mountaintop adventure? ...Taking along your GPS and laptop computer?

***TravelPlus for Repeaters* is Feature-Packed!**

- Map your travel route and tune in. Supports GPS.
- **MORE DATA!** Includes *The ARRL Repeater DataBase*, IRLP nodes, AM/FM radio, broadcast television, and NOAA weather stations.
- Print maps and repeater lists.
- Export data. Transfer to Palm™ or Pocket PC, radio programming software, and more.

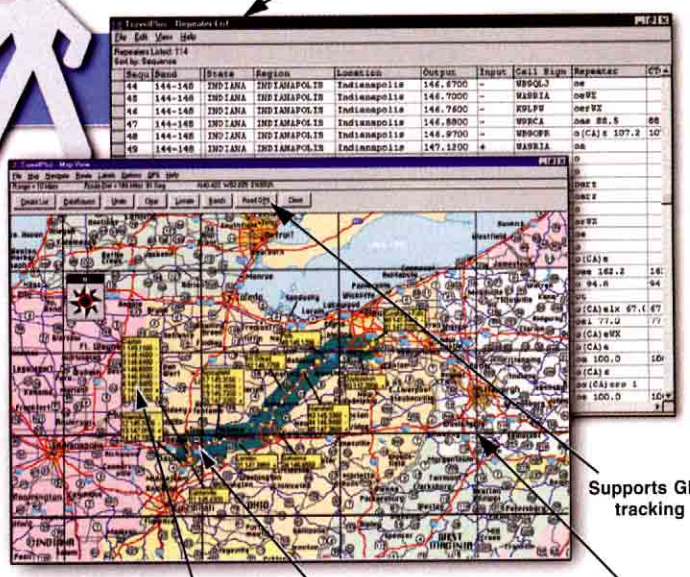
Learn More! www.arrl.org/TravelPlus

***TravelPlus for Repeaters™* CD-ROM**
2003-2004 Edition, Version 7.0.
ARRL Order No. 8985—**$39.95***
*shipping: $5 US (UPS), $7.00 International

Upgrade at Dayton

Bring your previous version *TravelPlus* proof-of-purchase!

Requires Microsoft *Windows* 98SE-XP, and a Pentium or comparable processor. Upgrade available for previous customers. Contact ARRL for details.



ARRL *The national association for AMATEUR RADIO*

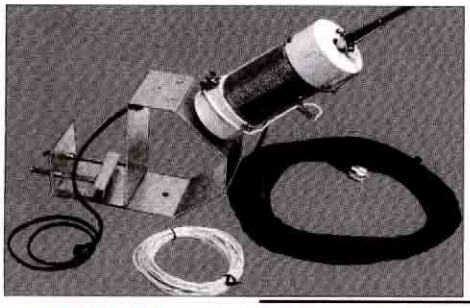
SHOP DIRECT *or call for a dealer near you.*
ONLINE **WWW.ARRL.ORG/SHOP**
ORDER TOLL-FREE **888/277-5289 (US)**

Sales tax is required for orders shipped to CA, CT, VA, and Canada. Call for details.

QST 6/2003

MFJ *Apartment* Antenna

Covers 40 thru 2 Meters . . . Mounts outdoor to windows, balconies, railings . . . works great indoors mounted to desks, tables, bookshelves



MFJ-1622 **$99.95** *New!*

New MFJ-1622 Apartment Antenna lets you operate 40 thru 10 Meters on HF and 6 and 2 Meters on VHF with a single antenna!

Its universal mount/clamp lets you easily attach it to window frames, balconies and railings. It also works great indoors mounted to a bookshelf, desk, or table. It's not a 5 element yagi, but you'll work your share of exciting DX!

Highly efficient air wound "bug catcher" loading coil and telescoping 5½ foot radiator lets you really get out! Radiator collapses to 2½ feet for easy storage and carrying.

It includes coax RF choke balun, coax feed line, counterpoise wire and safety rope. Handles 200 Watts PEP.

Operating frequency is adjusted by moving the "wander lead" on coil and adjusting counterpoise for best SWR.

MFJ Ground-Coupled Portable Antenna Base

Provides effective RF ground and stable mount for vertical antennas . . . Antennas radiate well with low SWR

MFJ-1904 **$99.95** *New!*

MFJ *Ground-Coupled Portable Antenna Base*™ provides an *effective* RF ground 160 through 2 Meters and a stable mount for vertical antennas.

Capacitive coupling to ground is a *time-proven* principle. It needs no tuning and antenna radiates well and gives good SWR on all bands. Performance is similar to mobile stations when using a mobile antenna but is far better with longer antennas.

The base can support a lightweight multi-band vertical antenna -- like the all band Hy-Gain 18AVS and the bandswitching MFJ-1795 -- and provide a semi or permanent installation.

You can easily set up and take down vertical antennas for stealth operation and hide the base by covering it with dirt.

The MFJ-1904 is a 2x2 foot *stainless steel* square with reinforcing bends that greatly strengthens it. Folded and tapered six-inch *stainless steel* legs firmly anchor the MFJ-1904 into the ground.

Built-in antenna mount with SO-239 coax connector and two U-bolts lets you mount most standard and homebrew vertical antennas.

Standard 3/8-inch x 24 mobile mount is built-in for MFJ Mobile Whips, bug catchers, *Hustlers* and screwdriver antennas.

Two handles make carrying and removing the base fast and easy. You can also attach radials for improved performance.

33 Feet Telescoping fiberglass Mast . . .

Collapses to 3.8 feet, weighs 3.3 lbs.

Super strong fiberglass mast has huge 1¾ inch bottom section. Flexes to resist breaking. Resists UV. Put up *full size* inverted Vee dipole/vertical antenna in minutes and get *full size performance!*

MFJ-1910 **$79.95**

MFJ Vertical

for Antenna Restricted Areas

40, 20, 15, 10 Meters, Automatic Band Switching

Perfect for permanent or portable operation in antenna restricted areas. Hide behind trees, fences, buildings, *in* bushes -- only 7 to 10 feet tall (adjustable).

MFJ-1795 **$149.95** *New!*

Low angle of radiation for DXing, omni-directional, handles 1500 watts PEP, low SWR.

Highly efficient end-loading. Entire length radiates.

Ground mounts with suitable ground such as MFJ-1904 *Ground-Coupled Antenna Base*, radials or ground rods. Or roof mount with radials.

HF mini-Bugcatcher

Highly efficient 40 - 6 Meter base-loaded 5½ foot Bugcatcher mobile antenna . . . Use light duty mounts

Become an *"HF Mobileer"* almost instantly with this *new* MFJ high-efficiency *mini-bugcatcher* mobile antenna! Have tons of fun rag-chewing and DXing on the HF bands. Turn boring drives into fun-filled ham adventures.

MFJ-1624 **$79.95** *New!*

Attach a simple mount to your vehicle (*mounts*: trunk lip, MFJ-347, $39.95; mirror or luggage, MFJ-342, $9.95; tri-magnet, MFJ-338T, $19.95) . . . **Screw** in your MFJ *mini-bugcatcher* . . . **Throw** your rig into your car, plug into cigarette lighter and turn power down to 20 Watts (to avoid overloading your cigarette lighter; MFJ-1624 handles 300 Watts PEP). **Operate!**

Bugcatcher design uses large highly-efficient *air-wound* inductor -- far out performs other compact HF antennas. *Exclusive* built-in inductive matching network keeps SWR low. 5½ foot whip collapses to 2½ feet for easy storage and low garages. Base loaded for minimum wind load and light duty mounts. Change band by moving *wander lead*. 3/8x24 in. mount.

MFJ Portable Antenna

MFJ-1621 **$89.95**

Operate from apartments, homes, hotels, campsites, beaches or any antenna restricted area. Work all bands 40, 30, 20, 17, 15, 12 and 10 Meters.

DXCC, WAZ, WAC, WAS have been won with the MFJ-1621! Compact 6x3x6 inch cabinet has 4½ foot telescoping whip, built-in antenna tuner, field strength meter and 50 feet coax. Handles 200 Watts.

MFJ Super High-Q Loop

MFJ's *tiny* 36 inch diameter *high-efficiency* loop antenna performs like a *full-size* dipole! Operate 10 thru 30 MHz *continuously* -- including WARC bands!

MFJ-1786 **$379.95**

Ideal for limited space -- apartments, small lots, motor homes, attics or mobile homes.

Mounts vertically or horizontally. Low angle radiation gives you excellent DX.

Super easy-to-use! Remote control auto-tunes to desired band, then beeps. No control cable needed. Handles 150 watts.

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 -- *gives you highest possible efficiency*. Heavy duty thick ABS plastic housing has ultraviolet inhibitor protection.

Free MFJ Catalog

Visit: http://www.mfjenterprises.com or call toll-free 800-647-1800

1 Year *No Matter What*™ warranty • 30 day money back guarantee (less s/h) on orders direct from MFJ

MFJ ENTERPRISES, INC.
300 Industrial Pk Rd, Starkville, MS 39759 **PH:** (662) 323-5869
Tech Help: (662) 323-0549
FAX:(662)323-6551 8-4:30 CST, Mon.-Fri. ***Add shipping.***

http://www.mfjenterprises.com for instruction manuals, catalog, info

Ham Ads

1) Advertising must pertain to products and services which are related to Amateur Radio.

2) The Ham-Ad rate for commercial firms offering products or services for sale is $1.25 per word. Individuals selling or buying personal equipment: ARRL member 65¢ per word. Non-ARRL member $1 per word. **Bolding** is available for $1.75 a word. You may pay by check payable to the ARRL and sent to: Ham Ads, ARRL, 225 Main St., Newington, CT 06111. Or, you may pay by credit card sending the information by fax to 860-594-4285 or via e-mail to hamads@arrl.org. The credit card information we need is: the type of credit card, the exact name that appears on the credit card, the credit card number, the expiration date, and the credit card billing address.

3) Remittance in full must accompany copy since Ham-Ads are not carried on our books. Each word, abbreviation, model number, and group of numbers counts as one word. Entire telephone numbers count as one word. No charge for postal Zip code. No cash or contract discounts or agency commission will be allowed. Tear sheets or proofs of Ham Ads cannot be supplied. Ads submitted in writing should be typed or printed clearly on an 8 1/2" X 11" sheet of paper.

4) Closing date for Ham-Ads is the 15th of the second month preceding publication date. No cancellations or changes will be accepted after this closing date. Example: Ads received April 16th through May 15th will appear in July *QST*. If the 15th falls on a weekend or holiday, the Ham-Ad deadline is the previous working day. Please contact the Advertising Department at 860-594-0231 or hamads@arrl.org for further information or to submit your ad.

5) No Ham-Ad may use more than 100 words. No advertiser may use more than two ads in one issue. A last name or call must appear in each ad. Mention of lotteries, prize drawings, games of chance, etc. is not permitted in *QST* advertising.

6) New firms or individuals offering products or services for sale must check with us to determine if a production sample (which will be returned) should be submitted for examination. Dealers are exempted, unless the product is unknown to us. Check with us if you are in doubt. You must stand by and support all claims and specifications mentioned in your advertising.

The publisher of *QST* will vouch for the integrity of advertisers who are obviously commercial in character, and for the grade or character of their products and services. Individual advertisers are not subject to scrutiny.

The American Radio Relay League does not discriminate in its advertising on the basis of race, color, religion, age, sex, sexual orientation, marital status, or national origin.

The League reserves the right to decline or discontinue advertising for any other reason.

QST HAM ADS ON THE WEB
— UPDATED MONTHLY

http://www.arrl.org/ads/ham-ads.html

SELL YOUR RADIO TODAY! Check out *RADIOS ON-LINE* on the ARRL web site: http://www.arrl.org/ads/RadiosOnline/

CLUBS/HAMFESTS/NETS

BUY AND SELL AT:
www.HamRadioAuction.com

COUNTY HUNTERS: Worked All Texas Award. Beautiful Certificate. Temple Amateur Radio Club, P.O. Box 616, Temple, TX 76503 www.tarc.org

FRIEND OF BILL W.?? - Join HAAM net Saturdays at 12:30 Eastern on 14.290; Sundays at 09:30 Pacific on 14.340/2. K6LX

FT. TUTHILL — Flagstaff, AZ. Arizona's largest hamfest, JULY 25, 26, 27. I-17 exit 337, 3 miles south of I-40. ARRL, Manufacturers, Dealers, Exhibits, Nationally Renowned Speakers, Seminars, HUGE SWAP, Camping. SPONSOR: AMATEUR RADIO COUNCIL OF ARIZONA - 16845 N 29th Ave #312, Phoenix, AZ 85053-3041. VM (602) 881-2722, www.arca-az.org/arca

Join the **LAMBDA AMATEUR RADIO CLUB** (LARC) since 1975 the only open and visible public service oriented ham club for gay and lesbian hams. Newsletter, skeds, hamfest meetings, listserv, and full service web site http://www.lambdaarc.com Write LARC, POB 21669, Cleveland, OH 44121-0669 or email larc@lambdaarc.com

MARCO The Medical Amateur Radio Council Ltd. is a charitable non-profit group of health care professionals who meet weekly at 10:00am Eastern on Sunday for "Grand Rounds" 14.308 MHz. All are welcome. Membership inquiries to WE1MD@arrl.net or CBA. SASE for newsletter to: MARCO, 144 Head of the Tide Road, Belfast, ME 04915. http://www.marco-ltd.org

RAINBOW AMATEUR RADIO ASSOCIATION Serving the gay/lesbian community. ARRL affiliated. Privacy respected. Active weekly HF nets, monthly newsletter, e-mail server, chat room, VE teams, Dxpeditions. Web site: www.rara.org. Information: PO Box 18541, Rochester, NY 14618-0541.

SUSSEX NJ HAMFEST - OUR 25TH ANNUAL New Jersey, (Augusta) Sunday, July 13, 2003. Sponsor: Sussex County ARC. Time: 8 am, Sussex County Fairgrounds, Plains Rd. off Rt 206. Free parking. Refreshments. Admission $5 (YLs and Harmonics free), Tailgate Space $15, Indoor $15 per table. Limited supply of tables available. Contact Dan Carter, N2ERH, 8 Carter Lane, Branchville, NJ 07826; Phone: 973-948-6999; Email: hamfest@scarcnj.org

THE ARRL LETTER — The League's news digest for active amateurs, professionally produced and edited and available in a weekly electronic edition via the World Wide Web at http://www.arrl.org/arrlletter

THE VETERAN WIRELESS OPERATORS ASSOCIATION, a 74-year old, non-profit organization of communications professionals invites your inquiries and application for membership. Write VWOA, Edward Pleuler, Jr., Secretary, 46 Murdock Street, Fords, NJ 08863. Visit our web site for activities, history, membership: http://www.vwoa.org

WORK GEORGIA'S 159 COUNTIES: New award, with progress certificates for 50 and 100 counties. Atlanta Radio Club, http://www.w4doc.org

PROPERTY/ VACATION/RENTALS

A BERMUDA HAM QTH awaits you. Email edkelly@ibl.bm or phone VP9GE 1-441-293-2525.

A home for sale with OPTIMAL HAM reception in DENVER FOOTHILLS. Established Antenna. $405,000. Call Anne Cucchi 303-202-2282.

A Texas Tower with House for sale or rent near Plano. al7aw@arrl.net

AFRICAN DX SAFARIS Led by ZS6WPX. Check out www.k5lbu.com

MFJ 1.8-170 MHz SWR Analyzer™

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!

The world's most popular SWR analyzer just got incredibly better and gives you more value than ever!

MFJ-259B gives you a complete picture of your antenna's performance. You can read antenna SWR and Complex Impedance from 1.8 to 170 MHz.

You can read Complex Impedance as series resistance and reactance (R+jX) or as magnitude (Z) and phase (degrees).

You can determine velocity factor, coax cable loss in dB, length of coax and distance to a short or open in feet.

You can read SWR, return loss and reflection coefficient at any frequency simultaneously at a single glance.

You can also read inductance in uH and capacitance in pF at RF frequencies.

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-1312D, $14.95. Its rugged all metal cabinet is a compact 4x2x6¾ inches.

How good is the MFJ-259B?

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.

More MFJ SWR Analyzers™

MFJ-249B, $229.95. Like MFJ-259B, but reads SWR, true impedance magnitude and frequency only on LCD. No meters.

MFJ-209, $139.95. Like MFJ-249B but reads SWR only on meter and has no LCD or frequency counter.

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-1312D, $14.95. *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*™.

Genuine MFJ Carrying Case

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!*

MFJ-99, $54.85. Accessory Package for MFJ-259/B/249/B/209. Includes *genuine* MFJ-29C carrying case, MFJ-66 dip meter adapter, MFJ-1312D 110Vac adapter. ***Save $5!***

New! Tunable Measurement Filter™

MFJ-731, $89.95. *Exclusive* MFJ tunable RF filter allows accurate SWR and impedance measurements 1.8 to 30 MHz in presence of strong RF fields. Has virtually no effect on measurements. Works with all SWR Analyzers.

MFJ *No Matter What*™ warranty

MFJ will repair or replace (at our option) your MFJ *SWR Analyzer*™ for one full year.

Free MFJ Catalog
Nearest Dealer . . . 800-647-1800

http://www.mfjenterprises.com

• 1 Year *No Matter What*™ warranty • 30 day money back guarantee (less s/h) on orders from MFJ

MFJ ENTERPRISES, INC.
Box 494, Miss. State, MS 39762
(662) 323-5869; 8-4:30 CST, Mon.-Fri.
FAX: (662) 323-6551; **Add s/h**
Tech Help: (662) 323-0549

MFJ-224 **$159.95**

MFJ 2 Meter *FM SignalAnalyzer*™

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.

More hams use MFJ SWR Analyzers™ than any others in the world!

ANTIQUE/VINTAGE/CLASSIC

MFJ TUNERS

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.

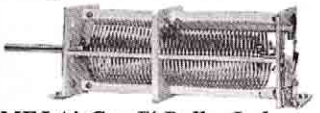
The rugged world famous MFJ-989C handles 3 KW PEP SSB amplifier input power (1500 Watts PEP SSB output power). Covers 1.8 to 30 MHz, including MARS and WARC bands.

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, custom inductor switch, 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 **$119.95**

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 **$109.95**

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.

Free MFJ Catalog
and Nearest Dealer . . . 800-647-1800

http://www.mfjenterprises.com

1 Year *No Matter What*™ warranty 30 day money back guarantee (less s/h) on orders from MFJ

MFJ ENTERPRISES, INC.
Box 494, Miss. State, MS 39762
(662) 323-5869; 8-4:30 CST, Mon.-Fri.
FAX: (662) 323-6551; **Add s/h**
Tech Help: (662) 323-0549

MFJ *Sound Card-to-Rig* Interface

Use sound card and rig for all digital modes!

Plug and Play -- includes software, all cables, AC power supply . . . RFI-proof . . . Isolation transformers -- no hum, noise, distortion . . . Operate PSK-31, packet, APRS, AMTOR, RTTY, SSTV, CW, Meteor Scatter, others . . . Use as Voice Keyer, CW Contest Memory Keyer . . . Monitor On/Off Switch . . .

MFJ1275/M/T
$99.95

New!
Includes AC power supply, RS-232 cable!

Plug this new MFJ-1275/M/T sound card interface between your transceiver and computer and enjoy operating all digital modes.

Everything you need is included -- software, audio cables, RS-232 serial cable and AC power supply.

Provides fully automatic operation with audio and push-to-talk control. It matches sound card audio, eliminates ground loops and provides microphone override.

Models available for all transceivers with 8-pin round, 8-pin modular (RJ-45) or 4-pin round microphone plugs.

Operate PSK-31, packet, APRS, AMTOR, RTTY, SSTV, CW, high speed CW Meteor Scatter and many others. Also use as Contest Voice Keyer and CW Contest Memory Keyer.

Digital Modes or Normal Operation

Select the ON digital mode -- all connections are made between your rig and computer for instant digital operation.

Select BYPASS normal mode -- your transceiver and computer connections are restored for their normal operation.

Audio Isolation Transformers

Audio isolation transformers and relay eliminate ground loops, audio hum, noise and distortion.

RFI-Proof

Extensive RF suppression and line isolation eliminates RF feedback problems.

Automatic Microphone Override

Transmit mic audio at any time by pressing PTT to override digital modes -- great for SSTV and Contest Voice Keyer.

More Impressive Features

Serial port -- lets computer control radio to override/interrupt digital transmissions.

VOX Control -- lets you use VOX control when not using computer serial port control.

Level Controls -- for transmitter drive and for receiver-to-sound card drive level. No need to adjust microphone gain or sound card level when you change modes.

Stereo or Mono Audio Input -- A front panel switch selects left, right, or both sound card audio output channels to accommodate various programs.

Off-the-air recording -- for replaying or for use with spectrum analyzer programs.

Monitor on/off switch lets you have a normal QSO and receive SSTV pictures at the same time in the *"monitor on"* position. This is great for modes like SSTV and Voice Keyer operation that may require listening to receive audio during operation.

Rugged Construction -- All aluminum cabinet and surface-mount construction gives you years of trouble-free service.

Use any Transceiver

Internal jumpers program microphone wiring for any brand or model radio -- no soldering required. Order **MFJ-1275** for 8-pin *round* mic plug. Order **MFJ-1275M** for 8-pin *modular* mic (RJ45) plug.

NEW! Order MFJ-1275T, for *4-pin round* mic plug, for Ten-Tec and others.

Plug and Play!

Everything you need is included --audio and RS-232 cables, AC power supply and a CD with a collection of the most popular amateur radio software to operate PSK-31, RTTY, SSTV, PACKET, AMTOR, CW, HSCW Meteor Scatter, Contest Voice Keying and other modes. Use 12 VDC or 110 VAC.

No Matter What™ Warranty

Protected by MFJ's famous *No Matter What™* one year limited warranty. MFJ will repair or replace (at our option) your MFJ-1275/M/T *no matter what* for one full year.

Try it for 30 Days

Order from MFJ and try it -- no obligation. If not delighted, return it within 30 days for refund less shipping.

New! *Super* Sound Card Interface

MFJ-1279/M/T
$129.95

This *super* sound card interface has all of the features of the MFJ-1275 ***plus . . .***

- **Auxiliary Input Jack:** Lets you switch your sound card from MFJ-1279 so you can use your sound card for something else. No more plugging/unplugging!
- **Direct CW/FSK Keying Jack:** Allows direct CW or FSK keying operation.
- **Headphone Jack:** Use your stereo headphones so you won't disturb your XYL (also turns off external speaker).
- **Footswitch:** Use footswitch or other for PTT (push-to-talk) when not using VOX.

Plug and Play! Includes software CD, RS-232 and audio cables, AC power supply.

Order MFJ-1279 for 8-pin round mic, MFJ-1279M for 8-pin modular (RJ-45) mic, MFJ-1279T for 4-pin round mic.

Add "X" suffix for 220VAC.

New! *Basic* Digital Interface

MFJ-1273B
$59.95

Plug and Play! Has sound card, radio, speaker, RS-232 jacks. Includes: software CD and RS-232, audio, mic cables. No external power needed. Has no mic jack or mic switch. **Order** MFJ-1273B for 8 pin round mic, MFJ-1273BM for 8-pin modular (RJ-45) mic, MFJ-1273BT for 4-pin round mic.

DSP Sound Card Programs

MFJ-1296, $129.95. *RadioCom4* integrates PSK31, SSTV, FAX/Sat FAX, RTTY, SITOR, DSP audio filters and radio control.

MFJ-1298, $199.95. *RadioCom5* -- all features of *RadioCom4* plus DSP Audio Filter analyzer, Spectrum Analyzer, Dual Scope Display, Sound Recorder, Time and Frequency Management, Frequency Analyzer, 3D Scanner, Satellite tracking, Rig Control for over 80 radios, more! **Free demo at:** *www.mfjenterprises.com/freedemo.php*

Free MFJ Catalog

and Nearest Dealer . . . 800-647-1800

http://www.mfjenterprises.com

• 1 Year *No Matter What™* warranty • 30 day money back guarantee (less s/h) on orders direct from MFJ

MFJ ENTERPRISES, INC.
300 Industrial Pk Rd, Starkville, MS 39759 **PH:** (662) 323-5869
Tech Help: (662) 323-0549
FAX:(662)323-6551 8-4:30 CST, Mon.-Fri. ***Add shipping.***

MFJ . . . the world leader in ham radio accessories!

GENERAL

MFJ *Switching* Power Supplies

Power your HF transceiver, 2 meter/440 MHz mobile/base and accessories with these new 25 or 45 Amp MFJ MightyLite™ Switching Power Supplies!

No RF hash . . . Super lightweight . . . Super small . . . Volt/Amp Meters . . .

MFJ's new adjustable voltage switching power supplies do it all! Power your HF or 2M/440 MHz radio and accessories.

MFJ's *MightyLites*™ are so light and small you can carry them in the palm of your hand! Take them with you anywhere.

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 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-4125
25 Amp
$109.95
plus s&h

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.

Free MFJ Catalog
Nearest Dealer . . . 800-647-1800

http://www.mfjenterprises.com

• 1 Year *No Matter What*™ warranty • 30 day money back guarantee (less s/h) on orders direct from MFJ

MFJ ENTERPRISES, INC.
Box 494, Miss. State, MS 39762
(662) 323-5869; 8-4:30 CST, Mon.-Fri.
FAX: (662) 323-6551; **Add s/h**
Tech Help: (662) 323-0549

All are protected by MFJ's famous No Matter What™ one year limited warranty.

ATTENTION **YAESU FT-102** master repairs. Over 10,000 hours servicing only the FT-102. Every part available. NC4L, Mal 954-961-2034

BEAM HEADINGS $6.00 **PROPAGATION SOFTWARE** $20.00 Engineering Systems Inc., P.O. Box 1934, Middleburg, Virginia 20118-1934 w4het@aol.com

BIGGEST on-line ham classifieds: http://swap.QTH.com

BUY AND SELL AT: **www.RecRadioSwap.com**

CASH FOR COLLINS & HALLICRAFTERS SX-88; 62S-1; 55G-1; 399C-1; KWM-1; 51S-1 "buy any Collins equipment" Leo KJ6HI ph/fax (310) 670-6969, radioleo@earthlink.net

CELLULAR TOWER LEASES Tower lease pay $2,000 monthly. Want or have one? Go to www.walkertowers.com

COLLINS 30S1, $2900.00, Southern California. W3KIG/6 at 805-649-3937

COLLINS 312B-2 + 270G-2 LOUDSPEAKERS. Newly manufactured Collins accessories + spares. Please visit our website at, http://www.advanced-optics.com/collins.htm For all US and Canadian sales please contact David Knepper, W3ST, Post Office Box 34, Sidman, PA 15955. Phone (814) 487-4403 Eves or email him at cra@floodcity.net

COMPETENT SERVICE for Drake TR4. Call K6OB, 661-871-5066

DIGITAL FIELD strength meters: IC Engineering, http://www.digifield.com

DXPEDITIONS on DVD! Contest and DXpedition Videos by 9V1YC. 7 different titles now available on both DVD and VHS! VKØIR Heard, ZL9CI Campbell, FOØAAA Clipperton, A52A Bhutan, VP8THU South Sandwich, VP8GEO South Georgia, and WRTC 2002 Finland. $25 each, shipping included. VISA/MC, paypal, or check. Contact: Charlie Hansen, NØTT, 8655 Hwy D, Napoleon, MO 64074 Tel: 816-690-7535 E-mail: n0tt@juno.com

ELECTRONIC COMPONENTS, kits, test equipment, antenna supplies, books, and tools. Many hard to find items like variable capacitors, vernier dials and drives, coil forms, magnet wire, toroids, more. Visit Ocean State Electronics at **www.oselectronics.com**

ELECTRONIC KITS & ASSEMBLIES. Surplus Parts www.a-aengineering.com

Electronic Kits, infrared thermometers, components, hobbyist cad software. NTE/ECG authorized distributor. School discounts. Call J-Tron, 888-595-8766, www.j-tron.com

"EVERYTHING FOR THE MORSE ENTHUSIAST." **Morse Express.** Keys, keyers, kits, books. 303-752-3382. http://www.MorseX.com

FOLDING/BACKPACK SOLAR PANELS: Folding panels are epoxy construction (rugged, ripstop nylon case) and are ideal for portable/QRP as well as field day operations. 10, 20 and 30 watt models. Full line of folding solar panels, charge controllers, desulfators and other solar energy components (including kits). Full sized solar panels and all popular brands of panels, controllers and inverters. ConnecticutSolar, on the web at: http://www.ctsolar.com

MFJ DX Beacon Monitor

Get *up-to-the-minute* worldwide DX band conditions in *minutes* on 14, 18, 21, 24, 28 MHz bands using the International Beacon Network of 18 worldwide beacons!

MFJ DX Beacon Monitor lets you instantly see on world map which beacon you're hearing on your transceiver . . . No need to copy 22 wpm CW . . . Positively identify beacons even if CW is weak, fluttery or distorted . . . Tells you where to point your antenna . . . Fascinates visitors . . .

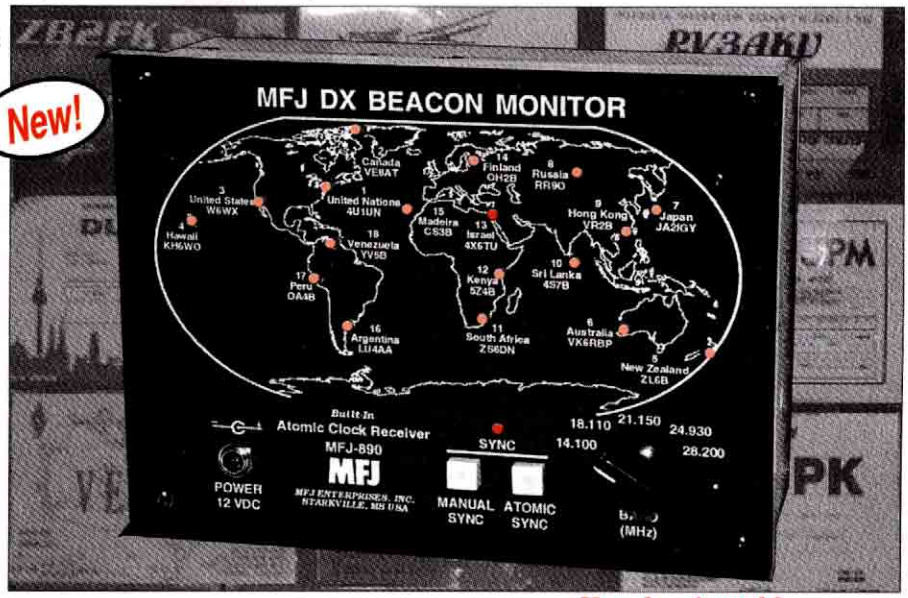
MFJ-890
$99.95

Get up-to-the-minute worldwide DX band conditions in minutes on 14, 18, 21, 24, 28 MHz bands using the International Beacon Network of 18 beacons throughout the world!

MFJ's new* DX Beacon Monitor *lets you instantly see which beacon you're hearing on your transceiver -- an LED lights up on its world map to show you the beacon location and where to point your antenna.

It's fascinating to hear and watch each beacon location light up as they become active across the world.

It's great for DXers, contesters, ragchewers and SWLers.



The International Beacon Network

The *International Beacon Network* provides a reliable source of signals for determining HF propagation 24 hours a day.

It consists of 18 beacons evenly located throughout the world.

Each beacon transmits on 14.1, 18.11, 21.150, 24.93 and 28.2 MHz.

The transmit sequence moves westward from New York across North America, Asia, Pacific to Africa, Europe and South America.

On each frequency, each beacon transmits for ten-seconds -- its call sign at 22 wpm CW and a one-second dash at 100 Watts and three one-second dashes at 10, 1, 0.1 Watts.

When each beacon completes a transmission it goes silent on that band and switches to the next higher band.

For more information see Oct/Nov, 1994, Sept, 1997 *QST* and Jan 1999, Sept/Dec 2001, Jan 2002 *Practical Wireless* of U.K.

How are band conditions?

Tune to a beacon frequency. If band conditions are good, you'll hear each beacon identifying in Morse and four dashes each at a lower power level.

The more beacons you hear, the more open the band is to different parts of the world.

The more dashes you hear per beacon, the better the quality of propagation and the more robust the band is. If you hear the 100 milliwatt dashes from many beacons you know *the band is wide open!*

In just three minutes you'll know how band conditions are worldwide.

It's interesting to see how propagation vary from day to day -- what beacons you can hear and at what power level.

You may find that the band is wide open but nobody is on.

Which band is best to reach a particular part of the world?

By storing the beacon frequencies in your transceiver's memory, you can quickly check all five bands to see which band has the best propagation to a particular part of the world.

MFJ DX Beacon Monitor lets you instantly see on world map which beacon you're hearing

You don't have to copy CW at 22 wpm to identify a beacon.

When you *hear* a beacon, an LED instantly lights up on a world map to show you its location. **You** can positively identify each beacon -- even if the signal is weak, and the CW is fluttery or distorted.

The world map display also tells you where to point your antenna.

How does it work?

The transmit sequence of the beacons are precision timed using GPS (Global Positioning Satellites).

The *MFJ DX Beacon Monitor* duplicates this precision timing sequence and lights an LED to show which beacon is transmitting. A microprocessor and a *built-in WWVB atomic clock receiver* provides ultra precise synchronization. Has manual sync for use *anywhere* in the world. MFJ-890 is not a beacon receiver that receives beacons directly.

The MFJ-890 is a self-contained stand-alone unit. It requires no antenna and no connection to your transceiver or receiver. 6¾Wx5¼Hx3D inches. Uses 12 VDC or 110 VAC with optional MFJ-1315, $14.95.

Free MFJ-890 Instruction Manual

Visit *http://www.mfjenterprises.com*

No Matter What™ Warranty

Protected by MFJ's famous *No Matter What*™ one year limited warranty. MFJ will repair or replace (at our option) your MFJ-890 *no matter what* for one full year.

Try it for 30 Days

Order from MFJ and try it -- no obligation. If not delighted, return it within 30 days for refund less shipping.

MFJ-464 CW Reader with built-in Keyer

MFJ-464
$179.95
(Keyboard, paddle not included.)

Plug this new MFJ CW Reader with built-in Keyer into your transceiver's speaker/phone jack and key jack.

Now you're ready to compete with the world's best hi-speed CW operators -- and *they won't even know you just passed the code test!*

Sends and Reads 5-99 WPM. Automatic speed tracking. Large 2-line LCD shows send/receive messages. Use single or iambic paddle or computer keyboard. Easy menu operation. Front panel speed, volume controls. 4 message memories, type ahead buffer, read again buffer, adjustable weight/sidetone, speaker. RFI proof.

Free MFJ Catalog
Visit: http://www.mfjenterprises.com or call toll-free 800-647-1800

• 1 Year *No Matter What*™ warranty • 30 day money back guarantee (less s/h) on orders direct from MFJ

MFJ ENTERPRISES, INC.
300 Industrial Pk Rd, Starkville, MS 39759 **PH:** (662) 323-5869
Tech Help: (662) 323-0549
FAX:(662)323-6551 8-4:30 CST, Mon.-Fri. ***Add shipping.***

http://www.mfjenterprises.com for instruction manuals, catalog, info

FOR SALE: 60 Foot Dish with full Azimuth and Elevation drives. Situated on 2 acres in Southeastern Colorado. Price $375,000.00. First mortgage available with 85K down payment. Call owner: W2PLL. Tel. 631-287-6133. Institutions and corporations having IRS: 501-C3 standing may contact us for consideration. Please: Serious inquiries only.

FOR SALE - DRAKE TR-7 / TR-7A / R-7 / R-7A Service kit. Includes 13 Extender Boards and Digital Jumper Card. $63.85 includes postage. See http: // www.atnet.net/~rsrolfne Bob W7AVK, 2327 Malaga Road NE, Moses Lake, WA 98837, w7avk@arrl.net, 509-765-4721.

FREE DX HEADING MAPS, lists at http://forums.delphiforums.com/haminfo. W2HOJ

FREE!!! Ham Radio and other CD-Roms & Software disk catalog. **MOM 'N' POP'S SOFTWARE**, P. O. Box 15003-HA, Springhill, FL 34604-0111. 1-352-688-9108. momnpop@momnpopsware.com

FREE: Ham Radio Gospel Tracts, SASE. KW3A, 265 West Ave., Springfield, PA 19064.

GALVANIZED GUY BRACKETS AND TORQUE ARMS. Rohn 25/45 $65/120 a set + shipping (includes zinc plated hardware). Stainless steel hardware is available for an additional charge. We also do custom fabrication. Norm's Fabrication, W8TTH, 2201 Porter Hwy, Adrian, MI 49221. 517-263-7363. w8tth@tc3net.com

GET MORE OUT OF HAM RADIO! Books on electronics engineering and amateur radio up to 15% off. Quality Technical Books, http://qtb.com/hamradio

HALLICRAFTERS Service Manuals. Amateur and SWL. Write for prices. Specify model numbers desired. Ardco Electronics, P.O. Box 95, Dept. Q, Berwyn, IL 60402.

HAM SHACK ACCESSORIES: from parts, tubes, keys up to mugs and blankets! Anthony Welsh Ltd. www.anthonywelsh.com

HEATHKIT AMATEUR RADIO REPAIR by RTO Electronics, 7280 Territorial Road, Benton Harbor, MI 49022. 616-468-7780. E-mail: hamtech@rtoham.com. www.rtoham.com

HEATHKIT, KENWOOD, YAESU repair. Ed, WA1LJY, 269-429-4295.

HEATHKITS WANTED: Unassembled kits, catalogs, manuals and older gear. Bill, WA8CDU, 616-375-7978. billrobb@net-link.net

HENRY 2K WANTED: Plate current meter or non-working Henry 2K for parts. Mike Ludkiewicz, 143 Richmond Road, Ludlow, MA 01056

HY POWER ANTENNA COMPANY http://www.angelfire.com/electronic/hypower/

ICOM repair most ICOM radios by ex-ICOM tech. COMTEK, http://www.w7jv.com w7jv@aol.com 360-779-9730, Kuni.

K8CX Ham Gallery **http://hamgallery.com**

KENWOOD Factory Authorized Service. Also repair **ICOM**, **YAESU** and others. GROTON ELECTRONICS (978) 630-9996. http://www.grotonelectronics.com/

LEARN CODE by Hypnosis, www.success-is-easy.com 800-425-2552.

Are You radioACTIVE?

Jerry Kloss, NØVOE, sure is!

"I was hooked the moment I first saw ham radio. Since I am visually impaired and have great difficulty reading, passing the FCC exam seemed like an insurmountable obstacle. A friend suggested the **Courage HANDI-HAM System.** In a matter of a few days I was listening to the voice of Tony Tretter, WØKVO, as he read ARRL's "Now You're Talking." I attended Radio Camp, learned code, and worked on upgrades using taped study materials."

Jerry and guide dog, Kerwin.

The **HANDI-HAM System** is a non-profit international organization dedicated to Amateur Radio education for persons with physical disabilities. We can help you gain your license. We welcome volunteers, too! Your tax-deductible gifts will help us do this work.

Courage HANDI-HAM System
3915 Golden Valley Road • Minneapolis, MN 55422

Toll Free Membership/Donations: 1 866 426 3442
1 866 HANDIHAM
on the web: www.handiham.org
e-mail: handiham@courage.org

Have a rig you no longer use? We will find a home for it!

courage

WHERE ABILITIES AND DISABILITIES BECOME POSSIBILITIES

MACINTOSH ham logging program on CD-ROM. http://www.peachtree-solutions.com

MORSE 0-20 WPM 90 days guaranteed! Codemaster V for IBM compatible PC $29.95. Morse Express, 800-238-8205. **http://www.MorseX.com**

NEW **ROHN TOWERS** - Cheap. Check us out www.alabamatower.com

ONE-MAN TOWERS™. Free-standing; no guy lines. Self-erecting. Beefy welded steel. Raise/lower antennas without climbing. 33-82 feet. 120 mph, 19 square feet. (888) 558-4300; www.onemantowers.com.

QFile™ QSL FILING SYSTEM: Pre-printed mylar-reinforced 5x8 index dividers for all current **DXCC** entities. Organize your QSLs! P.O. Box 77001, Charlotte, NC 28271-7000 www.radio-warehouse.com

QST '95 to '01 Offer KE7GM at KE7GMx@aol.com or 360-466-3823

QST MAGS. 1990 thru 1995. Like new. $30 plus UPS. Joe, W5UGI, 865-977-9024.

RADIO REPAIR, Done right! Specializing in Kenwood, Yaesu, Icom. INTERNATIONAL RADIO, 1118 Raymond Ave., Fort Pierce, FL 34950. intlradio@juno.com 1-772-489-6302 http://www.qth.com/irsd

Remote Control by DTMFs over the telephone http://www.hamkit.com

REPEATERS - VHF & UHF "Hi Pro", Two Year Warranty. Free Catalog. Maggiore Electronic Lab., 600 Westtown Rd., W. Chester, PA 19382. 610-436-6051. www.hiprorepeaters.com

RF TRANSISTORS & TUBES 2SC2879, 2SC2290, 2SC2312, 2SC1969, SD1446, MRF317, 3-500ZG, 3CX3000A7, 4CX250B, 4CX1000A, 4CX1500B, 4CX5000A, 572B. SEE OUR WEB SITE FOR OTHER PRODUCTS. www.westgateparts.com WESTGATE 800-213-4563

SATELLITE EQUIPMENT - C/Ku Band Big Dish Equipment, http://www.daveswebshop.com

SELL: MINT KENWOOD TS-520-S, SP-520, AT-230, MC-50, HS4 phones. Call Frank, W2UNH 609-298-2393

SELLING MY JUNK AND STUFF before old age gets me. Some tubes, meters, microphones, CW paddles, parts, books and equipment. Write or call for list. Bill, WØPR, 1347 South 400 East, Springville, UT 84663. 801-491-8982

SMC ELECTRONICS - Surplus and refurbished electronic equipment including repair/replacement/experimenter parts and accessories. Over 4100 items in stock. KA1BIN **www.smcelectronics.com**

SURPLUS MICROWAVE PARTS AND TEST EQUIPMENT. Visa, MasterCard and Discover. **DudleyLab.com** Toms River, NJ, USA. 732-240-6895

TELEGRAPH KEYS wanted by collector. Bugs and unusual or unique straight keys or sounders, and tube electronic keyers. Also pre-1950 callbooks. Vince Thompson, K5VT, 3410 N. 4th Ave., Phoenix, AZ 85013. 602-840-2653.

TELESCOPIC FIBERGLASS POLES - 3 heavy duty models, 19 to 22 ft., stackable to 39 ft. www.TMastCo.com, or The Mast Co., P.O. Box 1932, Raleigh, NC 27602

The SPYDERCONE ANTENNA. **Any Band** limited space antenna. Call Now Free 877-890-CONE (2663) www.coneantenna.com

Collins Radio Manual Repository

Hundreds of Manuals & CDs in Stock

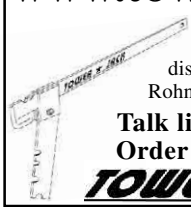
Need info to repair or restore just about anything that Collins made? We probably have it! We also have rare equipment manuals and internal documents that are impossible to find elsewhere! All Collins ham equipment manuals are also available on our Collins Radio CD-ROM set.

Radio Era is the largest publisher of old radio information in digital format in the world. Call, Email or Write for our catalog of CDs and tell us your needs!

SCHEMATIC & MANUAL SERVICE BUREAU
500,000 schematics - 40,000+ Manuals & Growing

RADIO ERA ARCHIVES
2043 Empire Central - Dallas, Texas 75235
214-358-5195 - Fax 214-357-4693
Major credit cards - Sales@Radioera.com
www.radioera.com

www.towerjack.com

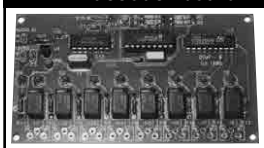


TOWER * JACK, the best tool you'll ever have for disassembling and assembling Rohn towers.

Talk line 1-615-758-9233
Order line 1-800-242-0130

TOWER ★ JACK®

DTMF decoder board with eight relays



Remote control eight devices via radio audio. Password protection against unauthorized entry. Unique board ID. Comes assembled **with relays.** 4.5" x 2.5".

Intuitive Circuits, LLC
Voice: (248) 524-1918
http://www.icircuits.com

DTMF-8 $119.00
Visa • MC • Prepayment

JOBS

National Personal Emergency Response Company (www.link-to-life.com) looking for part time installers in California (Orange & Sonoma counties), Washington, DC, New York (Erie & Sullivan county) Washington (Grays Harbor) & Virginia. Installs take approximately 1 hour. Reimbursed monthly at $50.00 / install, $25.00 / service call and $10.00 / disconnect. Please email jh@link-to-life.com.

TECH TALK

IC-910H and Satellites

Whether you are seriously into satellites or just want to experiment with a different aspect of the hobby, the IC-910H will provide you an Out of this World experience.

Basics. Transmit power of 100 watts on 144MHz band, 75 watts on 430MHz band and 10 watts on the 1200MHz band, (with optional UX-910, 1200MHz band unit). Effective cooling ensures stable output for continuous operation. A high performance receiver with 0.11 microvolt of high sensitivity (at 10db S/N on SSB, CW mode). When it is used with optional mast mount pre-amps you will experience top class receiving characteristics, indispensable for obtaining weak signals in satellite communications. 1200 bps and 9600 bps packet operation are available on separate data sockets. (Go to www.icomamerica.com for a more detailed description.)

IC-910H

Having Fun. Enjoy talking to hundreds of your fellow hams on AO-27 or UO-14–FM Repeaters in the Sky. Here's how. Connect your IC-910H to a dual band vertical antenna then tune the main band on the IC-910H to FM 145.850 (transmit, no need for high power); tune the sub band to FM 436.805 (receive) plus or minus to compensate for doppler shift. (No need to compensate for transmit doppler.) Make sure the radio is set to tune the "sub" band. When the footprint of the satellite known as AO-27 can be "seen" by your antenna, listen and then make a short transmission. In no time you will be making new friends on these FM Birds. Remember, don't be an alligator (a big mouth with no ears), listen then talk. Remember to change your receive frequency down as the satellite passes by, tune down from 436.805 to 436.785 (approximately). WOW! you've done it. More fun...tune into the hams onboard the International Space Station.

Getting Serious. For those that want to do serious satellite work, saddle up your IC-910H to Icom mast mounted preamps connected to circular polarized yagi antennas, rotated by a good azimuth/elevation rotator. Hitch up your computer and satellite tracking software. When interfaced to the rotator the program will move the antennas to track the satellite as it moves across the sky. Connect your computer via a serial port to the optional CT-17 computer interface and your tracking program will change the IC-910H frequencies, compensating automatically for doppler shift. Spend hours talking on SSB on AO-10 or minutes of "shear terror" talking on some of the LEO (low earth orbit) birds. Normal or reverse frequency track tuning is a standard feature. Connect the optional Icom AG-2400 mast mounted down converter to a 2.4GHz dish antenna and the other side to the IC-910H 144MHz band and enjoy hours of fun receiving AO-40 telemetry using computer sound card interface programs, (readily available on the internet), or converse with fellow hams using the 430MHz or 1200MHz band uplink on SSB.

Really Serious. Controlling a multi-million dollar satellite requires rock solid stability and reliability (CR-293, high stability crystal oscillator). Adding an optional Icom UT-106 DSP unit (one per band) allows copy of weak telemetry signals, otherwise missed. With the IC-910H's ten satellite memories, baud rate selection on main/sub bands, ease of interface to command and control hardware and software, the IC-910H is the transceiver of choice for control of amateur radio satellites....Just ask the control operators of AO-27 (N3UC and N1UC), both of whom use the IC-910H.

To enjoy an extraterrestrial experience, check out the IC-910H at your Icom dealer today or call for a free brochure, 24 hours a day: 425-450-6088

Index of Advertisers

ADVERTISING DEPARTMENT STAFF

Joe Bottiglieri, AA1GW, Accounts Manager
Carol Patton, KB1GAT, Advertising Traffic Coordinator

1-800-243-7768

Direct Line: 860-594-0207 ***Fax:*** 860-594-4285
e-mail: ads@arrl.org ***Web:*** http://www.arrl.org/ads

SAVE BIG ON ANTENNAS, TOWERS & CABLE

TELESCOPING ALUMINUM TUBING

DRAWN 6063-T832

.375 ..... $.70/ft	1.250" .. $1.55/ft
.500" ..... $.80/ft	1.375" .. $1.75/ft
.625" ..... $.90/ft	1.500" .. $1.95/ft
.750" $1.00/ft	1.625" .. $2.25/ft
.875" $1.10/ft	1.750" .. $2.50/ft
1.000" ... $1.20/ft	1.875" .. $2.75/ft
1.125" ... $1.35/ft	2.000" .. $3.00/ft
	2.125" .. $3.50/ft

In 6' or 12' lengths, 6' lengths ship UPS. Call for 3/16"& 1/4" rod, bar stock, and extruded tubing.

CUSHCRAFT ANTENNAS

13B2/A148-10S	$149/85
A270-6S/A270-10S	$79/99
A3S/A4S	$449/539
A50-3S/5S/6S	$95/169/259
A627013S	$189
AR2/ARX2B	$49/69
AR270/AR270B	$85/99
R6000/R8	$319/449
X7/X740	$679/289
XM240	$719

Please call for more Cushcraft items

FORCE 12–MULTIBAND

C3	10/12/15/17/20m, 7 el	$599
C3E	10/12/15/17/20m, 8 el	$649
C3S	10/12/15/17/20m, 6 el	$539
C3SS	10/12/15/17/20m, 6 el	$559
C4	10/12/15/17/20/40m, 8 el	$759
C4S	10/12/15/17/20/40m, 7 el	$679
C4SXL	10/12/15/17/20/40m, 8 el	$979
C4XL	10/12/15/17/20/40m, 9 el	$1119
C19XR	10/15/20m, 11 el	$959
C31XR	10/15/20m, 14 el	$1299

Please call for more Force 12 items

TRYLON "TITAN" TOWERS

SELF-SUPPORTING STEEL TOWERS

T200-64	64', 15 square feet	$1099
T200-72	72', 15 square feet	$1299
T200-80	80', 15 square feet	$1499
T200-88	88', 15 square feet	$1769
T200-96	96', 15 square feet	$2049
T300-88	88', 22 square feet	$1989
T400-80	80', 34 square feet	$1899
T500-72	72', 45 square feet	$1799
T600-64	64', 60 square feet	$1699

Many more Trylon towers in stock!

BENCHER / BUTTERNUT

Skyhawk, Triband Beam	$1129
HF2V, 2 Band Vertical	$239
HF5B, 5 Band Minibeam	$349
HF6VX, 6 Band Vertical	$329
HF9VX, 9 Band Vertical	$349
A1712, 12/17m Kit	$54
CPK, Counterpoise Kit	$129
RMKII, Roof Mount Kit	$159
STRII, Roof Radial Kit	$125
TBR160S, 160m Kit	$119

More Bencher/Butternut–call

M2 VHF/UHF ANTENNAS

144–148 MHz

2M4/2M7/2M9	$95/115/125
2M12/2M5WL	$159/209
2M5-440XP, 2m/70cm	$169

420–450 MHz

440-70-5W/420-50-11	$135/93
432-9WL/432-13WL	$175/229
440-18/440-21ATV	$125/145

Satellite Antennas

2MCP14/2MCP22	$175/229
436CP30/436CP42UG	$229/269

ROHN TOWER

25G/45G/55G	$89/189/239
25AG2/3/4	$109/109/139
45AG2/4	$209/225
AS25G/AS455G	$39/89
BPC25G/45G/55G	$75/99/110
BPL25G/45G/55G	$85/109/125
GA25GD/45/55	$68/89/115
GAR30/GAS604	$35/24
SB25G/45/55	$39/89/109
TB3/TB4	$85/99

Please call for more Rohn prices

US TOWER

MA40/MA550	$849/1399
MA770/MA850	$2359/3649
TMM433SS/HD	$1139/1379
TMM541SS	$1499
TX438/TX455	$979/1579
TX472/TX489	$2459/4579
HDX538/HDX555	$1269/2269
HDX572MDPL	$5899

Please call for help selecting a US Tower for your needs. Shipped factory direct to save you money!

COMET ANTENNAS

GP15, 6m/2m/70cm Vertical	$149
GP6, 2m/70cm Vertical	$139
GP9, 2m/70cm Vertical	$179
B10NMO, 2m/70cm Mobile	$36
SBB224NMO, 2m/220/70cm	$69
SBB2NMO, 2m/70cm Mobile	$39
SBB5NMO, 2m/70cm Mobile	$55
SBB7NMO, 2m/70cm Mobile	$75
Z750, 2m/70cm Mobile	$55
Z780, 2m/70cm Mobile	$69

Much more Comet in stock–call

M2 ANTENNAS

50–54 MHz

6M5X/6M7	$209/299
6M7JHV/6M9KHW	$259/469

HO LOOPS

6M/2M/222/432	$95/45/45/45

HF ANTENNAS

10/15M4DX, 4 Element	$389/439
20M4DX, 4 Element 20m	529
KT36XA, Triband Beam	$1249

More M2 models in stock–please call

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	$239
RT936, 9 Foot, 18 sq ft	$389
RT1832, 17 Foot, 12 sq ft	$519
RT2632, 26 Foot, 9 sq ft	$869

UNIVERSAL ALUMINUM TOWERS

4-40'/50'/60'	$539/769/1089
7-50'/60'/70'	$979/1429/1869
9-40'/50'/60'	$759/1089/1529
12-30'/40'	$579/899
15-40'/50'	$1019/1449
23-30'/40'	$899/1339
35-30'/40'	$1019/1569

Bold in part number indicates windload capacity. Please call for other Universal models. Shipped factory direct to save you money!

DIAMOND ANTENNAS

D130J/DPGH62	$79/139
F22A/F23A	$89/119
NR72BNMO/NR73BNMO	$39/54
NR770HBNMO/NR770RA	$55/49
X200A/X3200A	$129/210
X500HNA/X700HNA	$229/369
X510MA/X510NA	$189/189
X50A/V2000A	$99/149
CR627B/SG2000HD	$99/79
SG7500NMO/SG7900A	$75/112

More Diamond antennas in stock

MFJ

259B, Antenna Analyzer	$219
269, Antenna Analyzer	$299
941E, 300W Antenna Tuner	$109
945E, 300W Antenna Tuner	$99
949E, 300W Antenna Tuner	$139
969, 300W Antenna Tuner	$169
986, 3KW Antenna Tuner	$289
989C, 3KW Antenna Tuner	$309
1798, 80–2m Vertical	$249
1796, 40/20/15/10/6/2m Vert.	$189

Big MFJ inventory–please call

COAX CABLE

RG-213/U, (#8267 Equiv.)	$.36/ft
8X-MINI, Mini RG-8 Foam	$.19/ft
RG-213/U Jumpers	Please Call
RG-8X Jumpers	Please Call

Please call for more coax/connectors

TOWER HARDWARE

3/8"EE / EJ Turnbuckle	$11/12
1/2"x9"EE / EJ Turnbuckle	$16/17
1/2"x12"EE / EJ Turnbuckle	$18/19
3/16" / 1/4" Preformed Grips	$5/6

Please call for more hardware items

TIMES MICROWAVE LMR® COAX

LMR-400	$.59/ft
LMR-400 Ultraflex	$.89/ft
LMR-600	$1.19/ft
LMR600 Ultraflex	$1.95/ft

HIGH CARBON STEEL MASTS

5 FT x .12" / 5 FT x .18"	$35/59
10 FT x .18" / 11 FT x .12"	$129/80
16 FT x .12" / 16 FT x .18"	$119/179
20 FT x .25	$315
22 FT x .12" / 21 FT x .18"	$149/235

GAP ANTENNAS

Challenger DX	$289
Challenger Counterpoise	$29
Challenger Guy Kit	$19
Eagle DX	$299
Eagle Guy Kit	$29
Titan DX	$329
Titan Guy Kit	$29
Voyager DX	$409
Voyager Counterpoise	$49
Voyager Guy Kit	$45
Quick Tilt Ground Mount	$75

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	$129/169/199
G6-270R, 2m/70cm Vertical	$169
G6-144B/G7-144	$109/179

Hustler Resonators in stock–call

ANTENNA ROTATORS

M2 OR-2800PDC	$1249
Yaesu G-450A	$249
Yaesu G-800SA/DXA	$329/409
Yaesu G-1000DXA	$499
Yaesu G-2800SDX	$1089
Yaesu G-550/G-5500	$299/599

ROTATOR CABLE

R62 (6, #18)	$.32/ft.
R81/82	$.25/.39
R84	$.85/ft

PHILYSTRAN GUY CABLE

HPTG1200I	$.45/ft
HPTG2100I	$.59/ft
PLP2738 Big Grip (2100)	$6.00
HPTG4000I	$.89/ft
PLP2739 Big Grip (4000)	$8.50
HPTG6700I	$1.29/ft
PLP2755 Big Grip (6700)	$12.00
HPTG11200	$1.89/ft
PLP2758 Big Grip (11200)	$18.00

Please call for more info or help selecting the Phillystran size you need.

WEEKDAY HOURS:
9 AM–5 PM CST

SATURDAY HOURS:
9 AM–12 NOON CST

CREDIT CARDS:
M/C, VISA, DISCOVER

TEXAS TOWERS

A Division of Texas RF Distributors, Inc. • 1108 Summit Avenue, Suite #4 • Plano, TX 75074

(800) 272-3467

LOCAL CALLS:
(972) 422-7306

EMAIL ADDRESS:
sales@texastowers.com

INTERNET ADDRESS:
www.texastowers.com

HUGE ICOM DEALS ★ HUGE YAESU DEALS

IC-756PRO2 ..... In Stock!

The Icom IC-756 PRO2 is an all mode HF and 6m transceiver featuring 32-bit digital signal processing, automatic antenna tuner, 100 watts RF output, digital twin PBT, 5" multifunction color TFT LCD display with band scope function, built-in CW and SSB memory keyers, and more. Supplied with a hand mic and DC 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-746PRO ..... In Stock!

The Icom IC-746PRO is an all mode HF/6m/2m trasceiver with 32-bit IF level DSP. The radio features a built-in auto tuner, built-in RTTY demodulator and decoder (reads out on the radio's LCD display), auto notch, digital twin PBT, and more. Supplied with up/down hand mic and DC power cord.

IC-910H ..... In Stock!

All-mode 2m/70cm dual band transceiver, featuring dual data inputs, CTCSS encode/decode, CW keyer, satellite mode, scan, sweep display function, optional 23cm module, optional DSP, and more. Supplied with up/down hand mic and DC power cord.

FT-1000MP-V .... Yaesu Special!

Competition class HF DSP transceiver with auto tuner, 200 Watts RF output, and more!

FT-1000MP-V Field ..... New!

Low power (100W) version of the FT-1000MP-V, with built-in power supply.

FT-920 ..... Yaesu Special!

All mode HF/6m XCVR featuring DSP, automatic tuner, and more. With up/down hand microphone and DC power cord.

Quadra System ... Lower Price!

Solid state 1 kW autotuning amplifier.

FT-897 ..... Now In Stock!

"Backpack" all-mode HF/6m/2m/70cm XCVR offering 100 watts of output power! The radio can be run from optional internal batteries with reduced output of 20 watts, or an optional internal power supply can be installed instead. An optional bolt-on external auto tuner is also available. The FT-897 is a truly self-contained portable!

FT-847 ..... Yaesu Special!

Great all-mode XCVR covering HF/6m/2m/70cm! The radio is perfect for satellite operation, and features DSP, CTCSS tone encode/decode, and more. Supplied with up/down microphone 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 Lower Price!

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-2720H ..... New!

Dual band 2m/70cm FM XCVR. Features removeable control panel, CTCSS tone encode/decode/scan, cross band repeat, 1200/9600 bps data jack, dual RX, extended RX, 212 memory channels, and more. Supplied with DTMF hand microphone, mounting brackets, and power cord.

IC-V8000 ..... New, In Stock!

Great 75W 2m mobile XCVR. Features CTCSS tone encode/decode/scan, 207 memories, front panel mounted speaker, and more. Supplied with a DTMF hand mic, mounting bracket, and DC cord.

FT-8900R ..... New, In Stock!

Quad band mobile XCVR covers 10m/6m/2m/70cm, with cross-band repeat, tone encode/decode, and removable control panel for remote mounting.

FT-90R ..... Great Low Price!

Ultra-compact 2m/70cm mobile XCVR. With removeable control head.

FT-2800M ..... New!

Rugged 2m mobile XCVR, built to MIL-STD 810, with 65 watts RF output.

FT-100D ..... Yaesu Special!

Ultra-compact all mode XCVR for HF/6m/2m/70cm. Features DSP, CW memory keyer, tone encode/decode, 200 memories, VOX, and more. Supplied with a DTMF hand mic, DC power cord and mounting bracket.

FT-817 ..... Now In Stock!

A truly tiny self-contained all mode HF/6m/2m/70cm QRP XCVR featuring tone encode/decode, 200 memories, VOX, and more! With hand mic, DC cord and bracket.

IC-T7H ..... Icom Special!

Small 6W 2m/70cm, with full CTCSS tone.

IC-T2H Sport ..... Great Price!
IC-T90A ..... New, In Stock!
IC-V8 ..... New, In Stock!
IC-W32A ..... In Stock!

IC-207H ..... Great Low Price!

A great 2m/70cm dual band mobile XCVR, featuring CTCSS tone encode/decode, 182 memories, removable control panel, and more. With a back-lit DTMF hand mic, mounting bracket, and a DC power cord.

IC-2100H ..... Great Low Price!

Rugged 2m mobile XCVR with CTCSS tone encode/decode/scan, DTMF paging/squelch, 113 memory channels, and more.

IC-PCR1000 ..... Icom Special!
IC-R8500/R75 ..... In Stock!
IC-R2/R3/R10 ..... In Stock!

G-2800DXA $1089

Heavy duty antenna rotator handles 34 sq. ft. of antenna load, and features 450° rotation, preset and variable speed.

G-1000DXA $499
G-800SA/DXA $329/409
G-450A $249
G-5500 ..... $599
G-550 ..... $299

FT-50RD ..... New Lower Price!
VR-120D ..... Yaesu Special!
VR-500 ..... Yaesu Special!
VX-1R ..... New Lower Price!
VX-5R ..... Yaesu Special!
VX-150 ..... Yaesu Special!
VX-7R ..... Now In Stock!

WEEKDAY HOURS:
9AM–5PM CST

SATURDAY HOURS:
9AM–NOON CST

CREDIT CARDS:
M/C, VISA, DISCOVER

TEXAS TOWERS

A Division of Texas RF Distributors, Inc. • 1108 Summit Avenue, Suite #4 • Plano, TX 75074

(800) 272-3467

LOCAL CALLS:
(972) 422-7306

EMAIL ADDRESS:
sales@texastowers.com

INTERNET ADDRESS:
www.texastowers.com

WORLD'S SMALLEST DUAL-BAND HT WITH WIDE-BAND RX

The world's smallest Dual-Band HT with up to 1.5 Watts* of output power is your high-tech gateway to the world, via VHF, UHF, Shortwave Broadcast, Marine and Aircraft bands, or WIRES™ Internet linking!

*1.5 W/144 MHz, 1 W/430 MHz

Actual Size

SMALLEST HT WITH HIGH OUTPUT POWER

Measuring just 1.9" x 3.2" x 0.9" and weighing less than 3/10ths of a pound, the VX-2R is supplied with a 1 Amp-hour (3.7 V) FNB-82LI Lithium-Ion Battery Pack, providing up to 1.5 Watts of output power on the 144 MHz band, and 1 Watt on 430 MHz. If you supply 6 Volts of DC power from the optional E-DC-21 DC Adapter, the VX-2R puts out 3 Watts on VHF, and 2 Watts on UHF!

WIDE BAND RECEIVE

The wide frequency coverage of the VX-2R includes the AM Broadcast band, continuous HF shortwave coverage, VHF/UHF coverage up to 729 MHz, plus 800-960 MHz (cellular blocked). So you won't miss any of the action, whether you're on the Ham bands or monitoring overseas news, FM broadcasts, TV audio, Marine or Air Band users, or Public Safety communications. Special memory banks allow quick recall of Marine, Shortwave, and NOAA Weather broadcasts (with "severe weather" alert).

HIGH PERFORMANCE

- WIRES™ Internet Linking Key and 9-Memory DTMF Autodialer
- Over a Thousand Memory Channels (20 Memory Groups available)
- CTCSS/DCS Encode/Decode
- Automatic Repeater Shift
- Host of Convenient Scanning Features

New style High Capacity Compact Lithium-Ion Battery FNB-82LI (3.7 VDC 1 Ah)

Rugged Diecast Chassis

Supplied accessories:
FNB-82LI, Charger NC-85, Antenna, Belt Clip

*Simulated LCD.

VX-2R

Ultra-Compact 144/430 MHz Dual-Band FM Transceiver

YAESU
Choice of the World's top DX'ers™

Vertex Standard
US Headquarters
10900 Walker Street
Cypress, CA 90630 (714)827-7600

For the latest Yaesu news, visit us on the Internet:
http://www.vxstdusa.com

The DXer's Advantage... Packet Cluster Tune

Brochure & Operators Manual Available at our Website

The All New TS-2000 Multi Band/Multi Mode Transceiver

The all new Kenwood **TS-2000** series transceiver offers today's demanding Amateur operator high performance operation without the compromising limitations found in other similar multi-band, multi-mode transceivers. The **TS-2000** offers 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-B2000** 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 add the optional UT-20 1.2 GHz module at 10 watts, you will have assembled the most advanced dual receiver multi-mode transceiver ever produced. 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 Tune 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 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 highest performance Amateur Radio ever produced. **Available now.**

KENWOOD
COMMUNICATIONS

AMATEUR RADIO PRODUCTS
3975 Johns Creek Court, Suwanee, GA 30024
P.O. Box 22745, Long Beach, CA 90801-5745, U.S.A.
Customer Support: (310) 639-4200 Fax: (310) 537-8235
03ARD-2246 #042303

ISO 9001
JQA-1205
Communications Equipment Division
Kenwood Corporation
ISO 9001 certification

INTERNET
Kenwood Website
http://www.kenwood.net
Kenwood Information
ftp://ftp.kenwood.net