Official Journal of
ARRL
The national association
for AMATEUR RADIO

QST

devoted entirely to
AMATEUR RADIO

September 2003

QST reviews

Yaesu VXA-700 Spirit
2 meter handheld transceiver

Yaesu VR-500
All mode wideband receiver

ICOM IC-R10
All mode wideband receiver

Keep your amplifier in top condition

40 meter victory at WRC-03

An easy to build VHF/UHF collinear

How to test for capacitor ESR

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Tune in the world with Icom!

New IC-R5

Winning performance! Compact, and packed with features!

150 kHz – 1.3 GHz* • AM, FM, WFM • 1250 Alphanumeric Memories • CTCSS/DTCS Decode • Weather Alert • Dynamic Memory Scan (DMS) • Preprogrammed TV & Shortwave • Weather Resistant • 2 AA Ni-Cds • PC Programmable

IC-R3

See & Hear all the action!

• 500 kHz – 2.45 GHz* • AM, FM, WFM, AM-TV, FM-TV • 450 Alphanumeric Memories • CTCSS with Tone Scan • 4 Level Attenuator • Telescoping Antenna with BNC Connector • 2" Color TFT Display with Video/Audio Output • Lithium Ion Power • PC Programmable

IC-R10

Advanced performance!

500 kHz – 1.3 GHz* • AM, FM, WFM, USB, LSB, CW • 1000 Alphanumeric Memories • Attenuator • Backlit Display & Key Pad • VSC (Voice Scan Control) • 7 Different Scan Modes • Beginner Mode • Band Scope • Includes AA Ni-Cds & Charger • PC Programmable

New Software IC-PCR1000 BON

Turn your PC into a wide band receiver! Compatible with most PC's and laptops, the 'PCR1000 connects externally- in minutes! Now with Bonito™ software! Updated ICOM software compatible with later versions of Windows™ OS is also now available!

• 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 w/optional UT-106

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The experts choice!

• 100 kHz - 2.0 GHz* • AM, FM, WFM, USB, LSB, CW • 1000 Aphanumeric Memories • Commercial Grade • IF Shift • Noise Blanker • Audio Peak Filter (APF) • Selectable AGC Time Constant • Digital Direct Synthesis (DDS) • RS-232C Port for PC Remote Control with ICOM Software for Windows® (RSR8500)

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ICOM®

*Cellular frequencies blocked.

Buy a New PRO Series Rig - Save $200 & Get a Free PS-125!*

Meet the PROs!

IC-756PROII ADDITIONAL FEATURES

5" TFT Color Display • Separate RX Only Antenna Jack • Transverter I/O Port • Live Band Scope • Digital & Analog Meter • Dual Receive • Digital Voice Recorder

Let the power of 32 Bit DSP show you how to pull signals out of the dirt that old analog rigs can't. Icom's PRO series makes the difference between a successful QSO and a lost opportunity. See your authorized Icom dealer today to rediscover the fun & excitement of amateur radio.

• 32 Bit Floating Point IF DSP & 24 Bit AD/DA Converter • Selectable Digital IF Filter Shapes For SSB & CW • Improved 3rd Order Intercept Point • All Mode • CW Memory Keyer • VOX • Auto Antenna Tuner • AGC Loop Management • Auto & Manual Notch • Digital Twin Passband Tuning • Built-in RTTY Demodulator & Decoder • And More

IC-746PRO ADDITIONAL FEATURES

LCD Display • 9600 Baud Packet Capable • Digital Meter • RX Audio Equalizer • SWR Analyzer • Sweeping Scope

ACCESSORIES

IC-PW1 1kW Linear Amplifier

- *Remote Control Head*
- *100% Duty Cycle*
- *Auto Antenna Tuner*

Can be used with *ANY* HF, 6M, or HF/6M transceiver.

PS-125 DC Power Supply

- 25 Amps Continuous
- 13.8 V DC
- Quieter RF Operation

Smaller footprint - takes up less space, matches newer ICOM rigs.

SP-20 External Speaker

Equipped with four selectable audio filters. Can be connected to two transceivers.

SM-20 Desktop Mic

Provides high quality audio to the transceiver. Equipped with low frequency cut capability.

*LIMITED TIME OFFER. SEE PARTICIPATING AUTHORIZED DEALER FOR DETAILS.

Why not? You deserve it!

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ICOM

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Summer Deals!

Deal 1.

POWEREX
Empowering Your Digital Life.

MH-C204F Kit
Smart Charger

Advantages:

- Microprocessor driven intelligent rapid charger.
- Charge most batteries in about three hours.
- Charge two or four AA/AAA NiMH or NiCD rechargeable batteries.
- Condition and rejuvenate batteries.

Includes:

- One Smart Charger.
- EIGHT PowerEx AA 2200mAh NiMH rechargeable batteries.
- One AC adapter.
- One Car charger.
- Two battery carrying cases.

P/N: MH-C204F8AA22

$49.95

Deal 2.

POWEREX
Empowering Your Digital Life.

MH-C401FS Kit
100 Minute Cool Charger

Advantages:

- Charge AA / AAA NiMH or NiCD batteries in 100 Minutes Accurately and Cooly.
- Manually switch between 100 minute fast charge and 5 hour gentle charge.
- Charge 1, 2, 3 or 4 batteries.
- Unique FLEX negative pulse charging algorithm allows the battery to accept a more complete charge.

Includes:

- One 100 minute cool charger.
- Four PowerEx AA 2200mAh NiMH rechargeable batteries.
- One AC adapter.
- One Car charger.
- One battery carrying case.

P/N: MH-C401FS4AA22

$49.95

Available at: Ham Radio Outlet — www.hamradio.com; AES Amateur Electronic Supply — www.AESham.com

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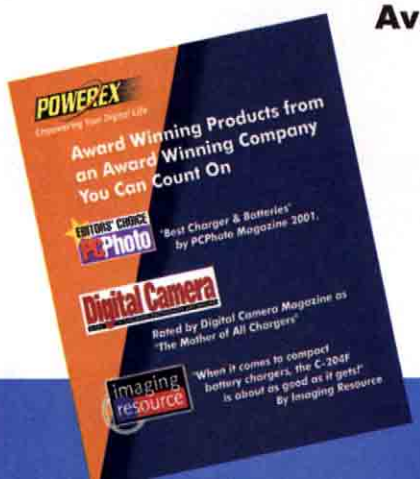

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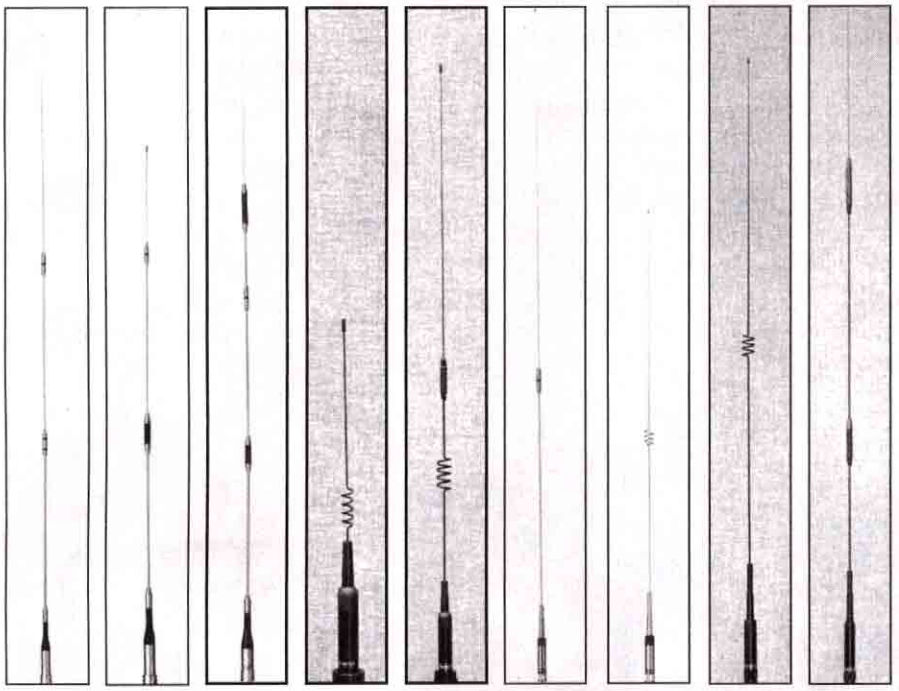
VHF/UHF And HF/VHF Mobile Antennas– Maximum Performance Without Compromise

You've seen the rest...now own the BEST!



SG2000HD | SG7500A SG7500NMO | SG7900A | NR72BNMO | NR73BNMO | NR2C | NR770HA NR770HB | NR770HNMO NR770HBNMO | CR627B CR627BNMO

HV7A Mobile Antenna System

For New HF/VHF transceivers (Such as: IC706 series and FT100) NEW!

Optional Loading Coils

HVC7	40m
HVC14	20m
HVC18	17m
HVC21	15m

Recommended Antenna Mounts: K400C or K600M

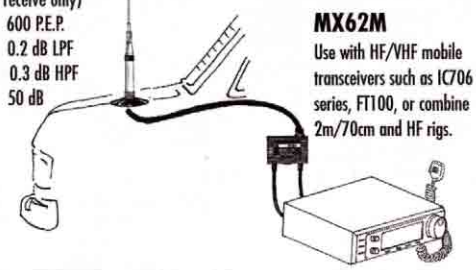
MX62M Duplexer

Specifications:
HF/6m & 2m/70cm bands
1.6-56 MHz LPF
76–470 MHz HPF
(76–120 receive only)

Watts:	600 P.E.P.
Loss:	0.2 dB LPF
	0.3 dB HPF
Isol.:	50 dB

The NEW HV7A has 5 band capability: 70cm, 2m, 6m, and 2 HF bands through use of loading coils. Foldover feature allows for easy access into low overhead buildings. Ideal for users of IC706 series and FT100 radios.

Bands Supplied:	10m/6m/2m/70cm
Opt. Loading Coils:	40m/20m/17m/15m
Power, P.E.P.:	HF 120w/VHF 200w
Mount Connection:	UHF
Length:	54"
SWR:	1.5:1 nominal



MX62M

Use with HF/VHF mobile transceivers such as IC706 series, FT100, or combine 2m/70cm and HF rigs.

SPECIAL FEATURES:

- Factory pre-tuned/no adjustment
- Highest Performance antennas
- NMO and UHF (PO) base styles
- 24 Kt gold plated connector pin
- No grounding required unless noted
- Fold-over feature on most models

FOLD-OVER

Patented One-Touch Fold-over Feature
(Not available on NR72BNMO, NR73BNMO, & NR770SA.)

MODEL	BAND (MHz)	WATTS	CONN.	HT. IN.	ELEMENT PHASING
NR72BNMO*[6]	2m/70cm	100	NMO	13.8	1/4λ, 1/2λ
NR73BNMO	2m/70cm	100	NMO	33.5	1/2λ, 1-5/8λ
NR770HA[7]	2m/70cm	200	UHF	40.2	1/2λ, 2-5/8λ
NR770HNMO[8]	2m/70cm	200	NMO	38.2	1/2λ, 2-5/8λ
NR770RA	2m/70cm	200	UHF	38.6	1/2λ, 2-5/8λ
SG7000A*[6]	2m/70cm	100	UHF	18.5	1/4λ, 6/8λ
SG7500A	2m/70cm	150	UHF	40.6	1/2λ, 2-5/8λ
SG7500NMO	2m/70cm	150	NMO	41.0	1/2λ, 2-5/8λ
SG7900A*	2m/70cm	150	UHF	62.2	7/8λ, 3-5/8λ

* Not recommended for Magnet Mount
6 Grounding required.
7 NR770HB same specifications but in black finish.
8 NR770HBNMO same specifications but in black finish.
9 52-54MHz only

MODEL	BAND (MHz)	WATTS	CONN.	HT. IN.	ELEMENT PHASING
NR2C	2m	150	UHF	55.5	1/2λ+1/4λ
SG2000HD*	2m	250	UHF	62.6	1/2λ+3/8λ
SG6000NMO*[6,9]	6m	150	NMO	39	1/4λ
CR224A*[6]	2m/1-1/4m	150	UHF	68.5	7/8λ, 2-5/8λ
CR320A*[6]	2m/1-1/4m 70cm	200 100/200	UHF	37.4	1/4λ, 1/2λ 2-5/8λ
CR627B*[6,9]	6m/2m/	120	UHF	60	1/4λ, 1/2+1/4λ/
CR627BNMO*[6,9]	70cm	120	NMO	60	2-5/8λ

1/4λ rated in dBi.

www.rfparts.com/diamond

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QST

September 2003 ♦ Volume 87 Number 9

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Technical

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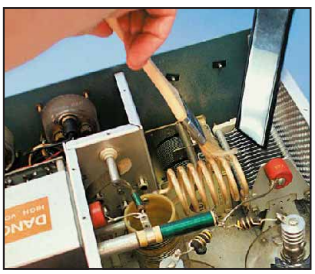

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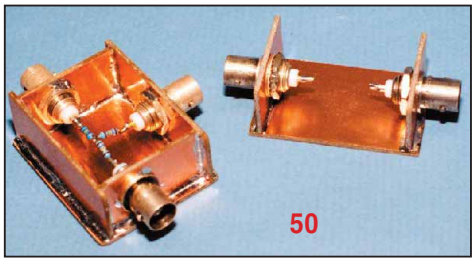
News and Features

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

QST Workbench



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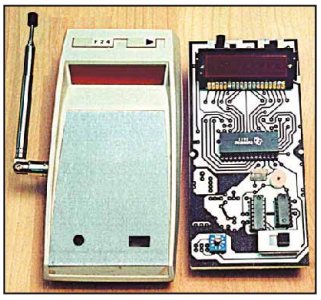

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Operating

Departments

Our Cover
Whether solid-state or tube, VHF or HF, newer or older, amplifiers need periodic TLC. Prolific author H. Ward Silver, NØAX, shares his techniques for keeping amplifiers in top condition. The article begins on page 33. Photo by Bob Schetgen, KU7G.

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.

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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

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Prices and specifications subject to change without notice or obligation.

- **Way Cool Optional Backpack.**

A must have accessory! With room for batteries, and other gear. Has a belt clip for the control head so you can operate on the go. (So cool, even '706 owners want one!)

The Ultimate Portable QRP Rig!

Reasons why you will 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.** Icom's engineers focused on the bands that really mean the most to QRP operators.
- **Internal Antenna Tuner.** 160-10M or 160-6M*. Internal, automatic and designed with latching relays so no current draw when the match is achieved.
- **DSP.** That's 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 for outdoors!
- **No Assembly Required.** The '703 is ready to go when you are!

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Why not? You deserve it!

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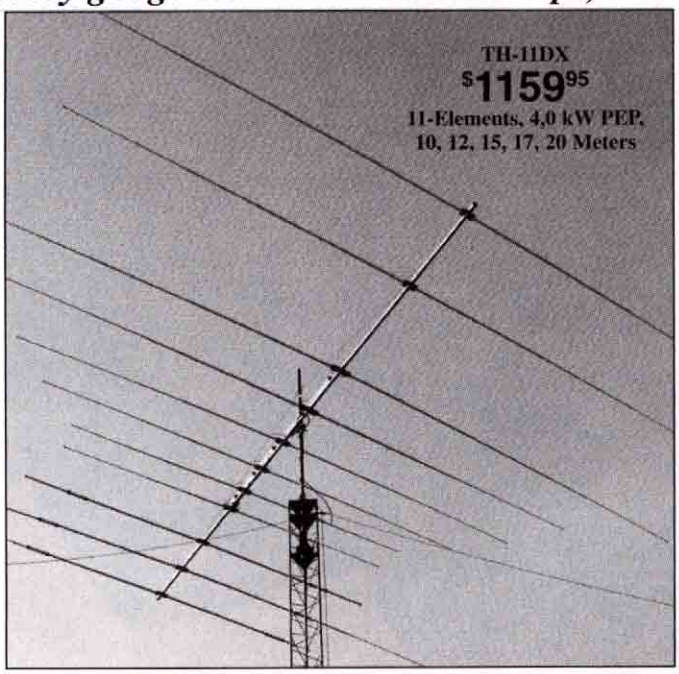
*Depending on version.

hy-gain HF BEAMS...

. . . are stronger, lighter, have less wind surface and last years longer. Why? Hy-Gain uses durable tooled components -- massive boom-to-mast bracket, heavy gauge element-to-boom clamps, thick-wall swaged tubing -- virtually no failures!



TH-11DX, $1159.95. 11-element, 4.0 kW PEP, 10,12,15,17,20M

The choice of top DXers. **With** 11-elements, excellent gain and 5-bands, the super rugged TH-11DX is *the "Big Daddy" of all HF beams!*

Handles 2000 Watts continuous, 4000 Watts PEP.

Every part is selected for durability and ruggedness for years of trouble-free service.

Features a low loss log-periodic driven array on all bands with monoband reflectors, BN-4000 high power balun, corrosion resistant wire boom support, hot dipped galvanized and stainless steel parts.

Stainless steel hardware and clamps are used on all electrical connections.

TH-7DX, $869.95. 7-element, 1.5 kW PEP, 10,15,20 Meters

7-Elements gives you the *highest average gain* of any Hy-Gain tri-bander!

Dual driven for broadband operation without compromising gain. SWR less than 2:1 on *all* bands.

Uniquely combining monoband and trapped parasitic elements give you an excellent F/B ratio.

Includes *Hy-Gain's* diecast aluminum, rugged boom-to-mast clamp, heavy gauge element-to-boom brackets, BN-86 balun. For high power, upgrade to BN-4000.

TH-5MK2, $759.95. 5-element, 1.5 kW PEP, 10,15,20 Meters

The broadband *five element* TH5-MK2 gives you outstanding gain.

Separate air dielectric *Hy-Q* traps let you adjust for maximum F/B ratio on each band.

Also standard is *Hy-Gain's* exclusive *BetaMATCH*™, stainless steel hardware and compression clamps and BN-86 balun.

TH-3MK4, $469.95. 3-element, 1.5 kW PEP, 10,15,20 Meters

The super popular TH-3MK4 gives you the *most gain for your money* in a full-power, full-size durable Hy-Gain tri-bander!

You get an impressive average gain and a whopping average front-to-back ratio. Handles a full 1500 Watts PEP. 95 MPH wind survival.

Fits on average size lot with room to spare -- turning radius is just 15.3 feet. Four piece boom is ideal for DXpeditions. Rotates with CD-45II or HAM-IV rotator.

Features *Hy-Gain BetaMatch*™ for DC ground, full power *Hy-Q*™ traps, rugged boom-to-mast bracket and mounts on standard 2"O.D. mast. Stainless steel hardware. BN-86 balun recommended.

TH-2MK3, $369.95. 2-element, 1.5 kW PEP, 10,15,20 Meters

The 2-element TH-2MK3 is Hy-Gain's *most economical* full power (1.5kW PEP) full size tri-bander.

For just $339.95 you can greatly increase your effective radiated power and hear far better!

Ruggedly constructed, top-performing, compact 6 foot boom, tight 14.3 foot turning radius. Installs almost anywhere. Rotate with CD-45II or HAM-IV. BN-86 balun recommened.

EXP-14, $599.95. 4-element, 1.5 kW PEP, 10,15,20 Meters

Revolutionary 4-element compact tri-bander *lets you add 40 or 30 Meters!* Has 14 foot boom and tight 17.25 feet turning radius. Fits on roof tri-pod, mast or medium duty tower.

Hy-Gain's *patented* broadbanding *Para Sleeve* gives you less than 2:1 VSWR. 1.5kW PEP.

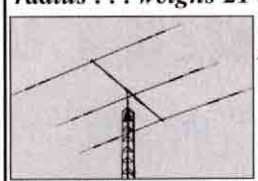
BetaMATCH™ provides DC ground to eliminate static. Includes BN-86 balun. Easily assembled.

Truly *competitive against giant tri-banders at half the cost!*

QK-710, $179.95. 30/40 Meter option kit for EXP-14.

Compact 3-element 10, 15, 20 Meter Tri-Bander

For limited space . . . Installs anywhere . . . 14.75 ft turning radius . . . weighs 21 lbs . . . Rotate with CD-45II, HAM-IV



Fits on light tower, suitable guyed TV pole, roof tri-pod

TH-3JRS, $359.95. Hy-Gain's *most popular* 3-element 10, 15, 20 Meter tri-bander fits on most lots! Same top performance as the full power TH3MK4 in a compact 600 watt PEP design.

Excellent gain and F/B ratio let *you* compete with the "big guns".

Tooled manufacturing gives you *Hy-Gain* durability with 80 MPH wind survival.

Model No.	No. of elements	avg Gain dBd	avg F/B dB	MaxPwr watts PEP	Bands Covered	Wind sq.ft. area	Wind (mph) Survival	Boom (feet)	Longest Elem. (ft)	Turning radius(ft)	Weight (lbs.)	Mast dia O.D.(in.)	Recom. Rotator	Retail Price
TH-11DX	11	*For Gain and F/B ratio--See...*		4000	10,12,15,17,20	12.5	100	24	37	22	88	1.9-2.5	T2X	$1159.95
TH-7DX	**7**			**1500**	**10, 15, 20**	**9.4**	**100**	**24**	**31**	**20**	**75**	**1.5-2.5**	**HAM-IV**	**$869.95**
TH-5MK2	5	• www.hy-gain.com		1500	10, 15, 20	7.4	100	19	31.5	18.42	57	1.5-2.5	HAM-IV	$759.95
TH-3MK4	**3**	• Hy-Gain catalog		**1500**	**10, 15, 20**	**4.6**	**95**	**14**	**27.42**	**15.33**	**35**	**1.9-2.5**	**CD-45II**	**$469.95**
TH-3JRS	3	• Call toll-free		600	10, 15, 20	3.35	80	12	27.25	14.75	21	1.25-2.0	CD-45II	$359.95
TH-2MK3	**2**	800-973-6572		**1500**	**10, 15, 20**	**3.25**	**80**	**6**	**27.3**	**14.25**	**20**	**1.9-2.5**	**CD-45II**	**$369.95**
EXP-14	4			1500	10,15,20 (opt. 30/40)	7.5	100	14	31.5	17.25	45	1.9-2.5	HAM IV	$599.95

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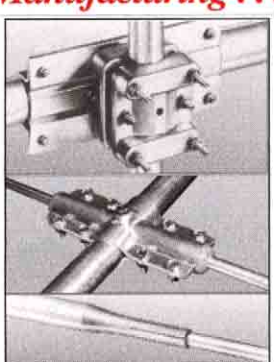
2. *Tooled* *Boom-to-Element Clamp*

3. Thick-wall *swaged* aluminum tubing



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"IT SEEMS TO US..."

A WRC Makes History

Every World Radiocommunication Conference (WRC) makes history. The international Radio Regulations define the obligations of telecommunications administrations to manage the use of the radio spectrum in their jurisdictions so as not to cause harmful interference to radio services in other countries. Every WRC amends the Radio Regulations to accommodate new uses of radio or to provide greater protection or flexibility for existing uses. Sometimes, what seems like a minor change has great implications for the commercial exploitation of the spectrum. On other occasions, massive revisions are pushed through—at considerable expense—in order to accommodate new services that are massively hyped but (in the case of satellite services, quite literally) never get off the ground.

Even against this background, there was something special about WRC-03. As reported in this issue beginning on page 40, the conference decided that—for the first time in history—an HF broadcasting allocation would be moved in order to accommodate the needs of another service. HF broadcasters follow a coordinated seasonal schedule that changes on the last Sunday of March and October. When the Summer 2009 schedule takes effect on March 29 of that year, 7100-7200 kHz will no longer be available to broadcasters. Instead, for the first time in decades, radio amateurs in Regions 1 and 3 will be able to use this frequency range and those of us in Region 2 should be free of the interference from high-powered broadcasting stations that has plagued us for as long as most of us can remember. The conference was not able to resolve the problem completely—the *status quo* prevails at 7200-7300 kHz—but it is undeniable that when WRC-03 ended, the amateur service was a lot better off at 7 MHz than when it began.

Amateurs in Regions 1 and 3, and especially in Europe, are the biggest beneficiaries; their 40-meter band will double in size. Here in Region 2, anyone who has ever listened to 40 meters at night can readily appreciate how nice it will be to say goodbye to the broadcasters in that 100 kHz.

Nighttime 40-meter phone operation has never been for the faint of heart. For those of us in the 48 contiguous states to be heard, we must find a slot in between AM transmitters running hundreds of kilowatts into huge antennas. Listening from Europe or Asia for 40-meter phone signals from the U.S. requires good equipment and a high threshold of pain. Where it's permitted, operating phone below 7100 kHz is no picnic, either; the band is much too narrow for anything resembling a clear frequency to be available. Nowhere else in the congested amateur HF bands are the problems of interference between amateurs as great as they are here. At last, some relief is on the horizon.

So we have the first half of the loaf. What about the second?

As you will read when you come to page 40, getting broadcasting cleared from the first 100 kHz was difficult. Many broadcasters came to the conference confident that they would not have to move; after all, they never had. A number of fixed and mobile service representatives—mostly military—lobbied strongly for no reduction in the utility of their allocations around 7 MHz. Persuading both groups to take the second step at WRC-07 will not be easy. If broadcasting is shifted up there is an impact on the fixed and mobile services, who will also be under pressure to relinquish spectrum for broadcasting expansion elsewhere between 4 and 10 MHz. We will have to justify our requirements all over again, using the post-2009 scenario as the new baseline. We will have to counter the argument, "Let's see how much improvement results from what WRC-03 has already done for amateurs before we do any more."

Before leaving WRC-03 to the judgment of history I must say a word about the people who made it possible for Amateur Radio to gain ground at WRC-03 in the face of such strong competition for spectrum. Three of us who were in Geneva on your behalf—Paul Rinaldo, W4RI, Jonathan Siverling, WB3ERA, and I—are professional employees of the ARRL. Walt Ireland, WB7CSL, another member of the ARRL staff whose past experience as an HF broadcaster has been invaluable to us, also worked tirelessly during conference preparations. Many other ARRL staff members contributed in a variety of ways. But we were just doing our jobs. The real heroes are the many volunteers who have contributed countless hours of their personal time to the same endeavor, through either the International Amateur Radio Union or their national member-societies (of which the ARRL is but one). Some of their contributions are mentioned in this month's article, but many are not. In particular, there are many past volunteers whose work laid the foundation for our current success.

These volunteers are radio amateurs who have chosen to spend time that they might otherwise have devoted to their families, their careers, or simply to their on-the-air operating so that your own operating time could be a bit more fulfilling. Even after working with them for more than 30 years I cannot explain their motivations. All I can do is marvel, express gratitude on behalf of the entire Amateur Radio community, and pray that we never take such dedication for granted.—*David Sumner, K1ZZ*

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Easily handles 1500 Watts continuous carrier even on 160 Meters . . . High-current edge-wound silver plated Roller Inductor . . . Two 500 pf high capacitance tuning capacitors with 6:1 vernier reduction drives . . . 3 core choke balun . . . Six position antenna switch . . . True peak reading Cross-Needle SWR/Wattmeter . . .

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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.

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ARRL in ACTION

***YOUR* membership at work**

By Dave Hassler, K7CCC, dhassler@arrl.org

League Sides with Cingular on RFI, Zoning Issue

What at first glance may seem non-ham flotsam on the sea of FCC dockets can sometimes turn out to be of serious interest to Amateur Radio. That's why ARRL representatives in Washington, DC, are always on the lookout for FCC petitions and legislative bills that could impact Amateur Radio, pro or con.

ARRL weighed in on a Cingular Wireless petition last year that reaffirmed federal preemption over local attempts to regulate cellular telephone radio frequency interference (RFI). ARRL HQ Regulatory Information Specialist John Hennessee, N1KB, underscored the significance of such a strong statement from the FCC on federal preemption regarding the operation of radio equipment: "This decision states FCC policy—that they are the only body that has jurisdiction on RFI—very clearly, and that's important," he said.

The League supported the position of Cingular Wireless that Anne Arundel County, Maryland, could not include RFI concerns in a zoning ordinance regarding antenna towers. The FCC granted Cingular its *Petition for Declaratory Ruling* and affirmed that the Communications Act gives the FCC authority over RFI problems and that the Supremacy Clause of the US Constitution (Article VI) gives the federal government the power to supersede a state or local law.

"This decision, running 17 pages, is as thorough a statement of FCC RFI preemption as has come from the Commission in many years," said ARRL General Counsel Chris Imlay, W3KD, who filed the League's comments with the FCC. "While the case law has been consistently favorable, the FCC has been sparse in saying much since a case called *960 Radio* in 1985. This is a very good defense tool in RFI cases, especially in problem states."

Success at WRC-03, ARRL July Board Meeting

As part of the IARU observer team, ARRL CEO David Sumner, K1ZZ, attended the World Radiocommunication Conference 2003 in Geneva, Switzerland in June and July. When the dust settled, Amateur Radio had received a worldwide 200 kHz allocation at 40 meters, effective in 2009, doubling the worldwide ham allocation while maintaining the 300 kHz Region 2 band. A number of other decisions were made that also affect Amateur Radio. Sumner's full report of the proceedings starts on page 40.

July always finds the League's officers converging on Connecticut for the semi-annual ARRL Board of Director's meeting. The complete recap of the meeting begins on page 58.

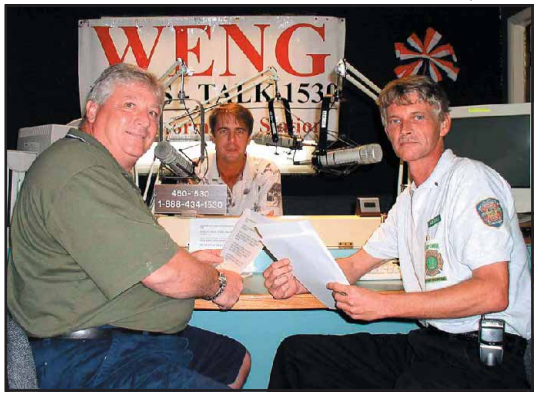
Ham Radio Gets "On the Radio" in Florida

Down in West Central Florida, ARRL Public Information Officer Mike Swiader, KA9WIE, never misses a chance to promote the League and ham radio, so it's a double bonus when once a month he talks about Amateur Radio on WENG-AM's ham radio call-in show in Englewood.

"I've been in business and advertising all my adult life, and I know that when you want to get the word out about a product or service, you go to the media," Swiader said. While promoting Amateur Radio at a county fair, he ran across Ken Kuenzie, KAØPGO, co-owner of WENG, and pitched the idea of a call-in show on 1530 AM, which covers Sarasota and Charlotte counties. "He said it was a great idea and that he'd clear some time," Swiader said. West Central Florida PIC Jack Doyle, WX1JAD, added that he thought the ability to communicate with a large segment of the community all at once was a gem of an idea. "The radio call-in show has helped us make the community aware of what emergency communications services Amateur Radio provides to our communities," he said.

So far, the topics have covered Amateur Radio's role in a local disaster operating drill, hurricane tracking, ARES/RACES and a number of public safety topics. Swiader also hosted a show about how the League fits into the world of Amateur Radio. "It's been working great," Swiader reported. "A lot of our callers don't even know that Amateur Radio is still around, but once they understand that we're here and what it is we can do for the community, they think it's great. This is a good way to get Amateur Radio back in the forefront of things. The whole goal here is encourage the public to develop an interest in Amateur Radio."

JACK DOYLE, WX1JAD



Once a month, Mike Swiader, KA9WIE (left), and Jack Doyle, WX1JAD (right), come into the studios of WENG-AM to cohost a call-in show about Amateur Radio. Topics have ranged from public safety to severe weather response to ARRL's field organization, and the shows have left a very favorable impression in the community. Scott Holcomb of WENG Radio is at the center of the photo.

Swiader, the president of the Peace River Radio Association and also an Assistant Emergency Coordinator, added that he makes sure to include the contact information for area clubs, so that interested persons can take the next step. A side benefit is WENG's willingness to provide some space on a broadcast tower for ham antennas!

Section Managers Get Around on Field Day

MYRA KITCHEN, K3PHG

At left, Assistant Section Manager Jeff Beals, WA4AW, stands inside the big canopy at the Field Day location of the Fort Pierce (Florida) ARC. Taking a quick break from operating is Pete Amar (center), KD4SPW, while an unidentified ham at right makes another contact.

While Field Day is far and away the most popular ARRL operating event, many section-level volunteers use the weekend to make field trips of a different sort. Personal contact with clubs leaves an impression that won't soon be forgotten. A couple of examples follow:

In South Carolina, Section Manager Jim Boehner, N2ZZ, and Section Emergency Coordinator Charlie Miller, AE4UX, took an 11-hour, 500-mile tour of the lower part of the state, while Roanoke Division Vice Director Les Shattuck, K4NK, visited Field Day sites in three northern counties.

Boehner and Miller had breakfast with the Aiken Contest Group and then went over to The Ridge Amateur Radio Club in Batesburg-Leesville, where the Ridge gang had homebrewed a lawnmower engine/modified alternator emergency power supply. Next up, a visit to the Columbia and Palmetto Amateur Radio Clubs at a joint site, and then it was off to the Florence ARC at Lake Darpo, where a barbeque lunch was on the slate. About three hours later, Miller and Boehner were in Myrtle Beach to see the Grand Strand ARC's use of a public park's large flagpole to create an emergency vertical antenna for 40 meters. With a set of radials unrolled around it, the pole exhibited a near-flat SWR along the entire band! Finally, battling a pounding downpour, the duo arrived at the USS *Yorktown*, where the Charleston Amateur Radio Club was set up.

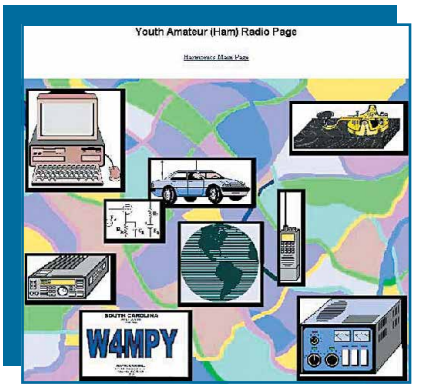
In Southern Florida, Assistant Section Manager Jeff Beals, WA4AW, went on a two-day excursion, visiting nine Field Day sites in seven counties. Beals' first stop was at the Fort Myers Amateur Radio Club. He then went to the Amateur Radio Association of Southwest Florida's site, the North Naples Red Cross. After some time spent with the Big Lake ARC in Clewiston, Beals ended his first circuit with a visit to the West Palm Beach ARC. The next day saw Beals at the Okeechobee ARC, Fort Pierce ARC, Martin County ARA/ARES and Tequesta Repeater Group sites.

RAMON KOLB, KX1T

From left, Boston ARC's Bill Ricker, N1VUX, goes over assignments as Eastern Massachusetts Section Manager Phil Temples, K9HI; club member Paul Olivieri, N1ZKR, and EMA PIO Bill McInnch, KA1MOM, look on at the Boston Amateur Radio Club's Field Day site.

"Harmonics" Web Page Debuts

Imagine it: an 8-year-old kid's first crystal set, built with the help of his grandfather. Wow! People talking on the radio "without electricity"! That was this author's introduction to the magic of radio in the early 1970s. But in this century, there are many avenues through which to experience the magic. One way the thrill of radio can be transmitted to youth is via the Internet and to that end, ARRL Educational Program Coordinator Jean Wolfgang, WB3IOS, has created a kids' Web page called *Harmonics*.



The new "Harmonics" Web page features a number of fun ham-related activities that will both entertain and inform youngsters in the ways of Amateur Radio. On this page, kids can click on a picture and explore various types of ham activity. For example, clicking on the key will start a Morse code sound file and selecting the base transceiver will play a phone QSO.

"The mission of the new kids' page is to expose children to the possibilities of Amateur Radio, not clobber them over the head with a pile of technical information," Wolfgang said. The Web pages, located at **www.arrl.org/FandES/ead/youth/**—and as the first item on the ARRL home page "Educational" drop-down menu—feature the first of a number of age-appropriate activities for kids. Web visitors can play games, print out activity coloring pages, read news about other kids involved with ham radio, work puzzles, click on live links, listen to audio samples of Morse code and space station contacts, and much more. Throughout the site, kids are greeted by colorful cartoon ham-sters, who explore the world of Amateur Radio along with the children visiting the site.

The pages target kids aged 5-15, inviting them to get acquainted with the basic ideas of Amateur Radio through immediate personal interaction and discovering how other kids are using ham radio to further science exploration and personal communication. "This is just the start, the first incarnation of the pages," Wolfgang said. "In the near future, we're planning more games, a QSL card template with drag-and-drop interactive design, and more ham-ster cartoon adventures."

Guide to ARRL Member Services

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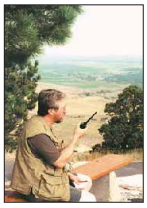



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The ARRL News service is the most credible source of news for the amateur community. Breaking stories are available on the ARRLWeb. You can also listen to ARRL Audio News on the Web, or by telephone at 860-594-0384. Have a news tip? E-mail **n1rl@arrl.org**.

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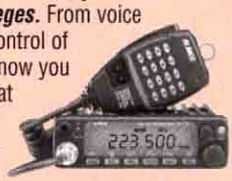

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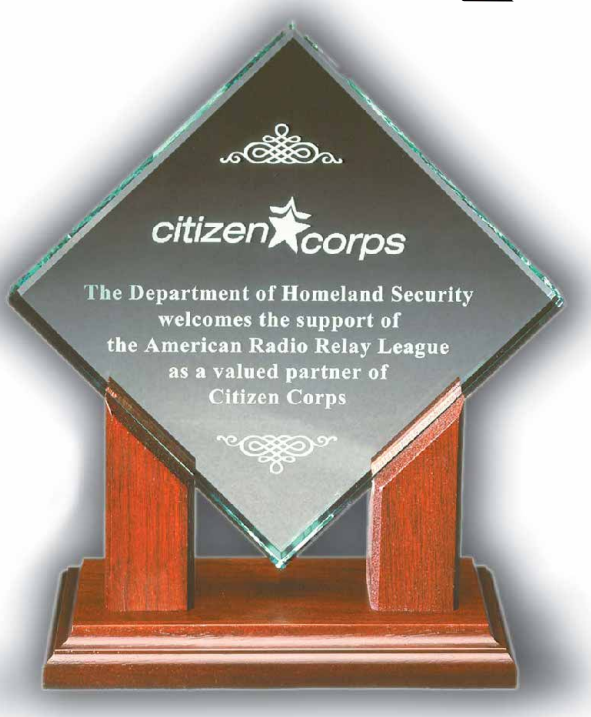
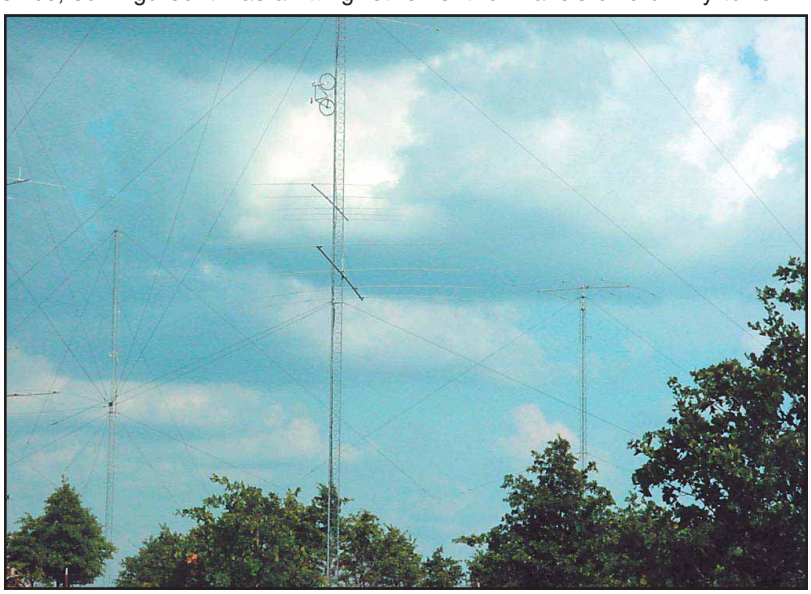


New affiliation: **In June, this impressive award was presented to ARRL President Jim Haynie, W5JBP, by Ron Castleman of the US Department of Homeland Security. It recognizes the new and vitally important relationship between ARRL and DHS—ARRL is now an official affiliate program of Citizen Corps, an initiative within DHS. For more information, see "Happenings," elsewhere in this issue.**

We'll let Mark Beckwith, N5OT, of Bartlesville, Oklahoma, explain this one: "I am an old bike racer. Oklahoma has an annual event called the 'Freewheel' where hundreds of cyclists ride about 700 miles from border to border across the state. I was going to have done it this year, but my plans changed. The route was scheduled to go right by N5OT. Naturally, I felt inclined to show all my friends I was thinking of them, even though I wasn't out riding with them. I bolted the bike on at about 7 AM, and the riders started coming by at about 7:45. I was tickled to see more than one stop to take a photo.

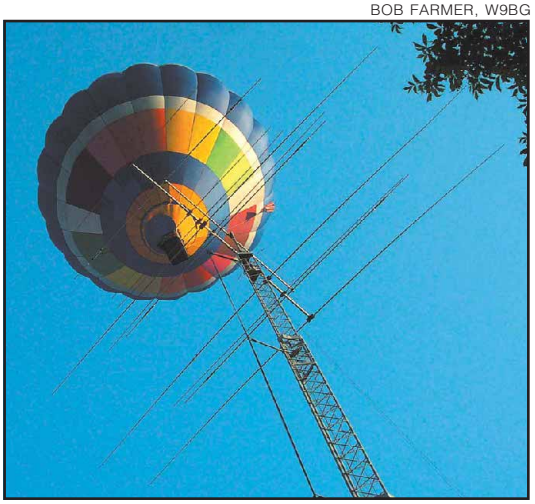
"The bike is the first nice bike I ever had—it was given to me in about 1984 by my lifetime pal David, N6AN (AA6RX). I have gotten other bikes since, so I figured it was a fitting retirement for Dave's bike on my tower."



KATHY STANFILL, KS6CW

Ridin' high: **A California ham came across this unusual sight while visiting northeastern Oklahoma. Look carefully near the top of the tower.**

BOB FARMER, W9BG



Why use a crane? **Bob Farmer, W9BG, of North Barrington, Illinois, seems to have found a new way to hoist his antennas.**

JON CAERY, KC5LVW

While on vacation in Branson, Missouri, Jon Caery, KC5LVW, found these cookies far superior to the "Simplex" brand.

ARTHUR Z. ROWE, N1ORC

A ham is a ham...: **Makes sense for a promotional ad for the town calling itself "The Ham Capital of the World" to feature some familiar phrases. Arthur Rowe, N1ORC, of Lawrence, Massachusetts, notes: "The community is very thankful to the Amateur Radio groups that assisted their area in the recent floods, when cell phones could not handle the emergency traffic."**

BUDDY CLIFTON, N7HD

Wind damage brings repair solution: **After ferocious winds bent an element of Buddy Clifton's M² antenna at 25 feet, he came up with a clever way of making future repairs. "After considerable thought," he writes, "I found a 12 foot handicap ramp on an auction site and purchased the pallet rack material to construct the extended work platform. I will now be able to repair any part of the antenna without dropping it to the ground."**

BERNIE PARKER, K5BP

WB6ACU at W1AW/5: **Eagles guitarist Joe Walsh, WB6ACU, was among the guest ops at the station set up in conjunction with June's Ham-Com/ARRL National Convention in Arlington, Texas. There was a vintage AM station inside the commercial exhibits area (courtesy of QCWA Chapter 27 and AM International) and a CW/SSB/satellite station in the outside flea market. Among the other visitors was the DeGolyer Elementary Amateur Radio Club, K5DES, a "Big Project" school. Dallas County REACT provided the CW and SSB stations, and Keith Pugh, W5IU, of AMSAT, set up the satellite station.**

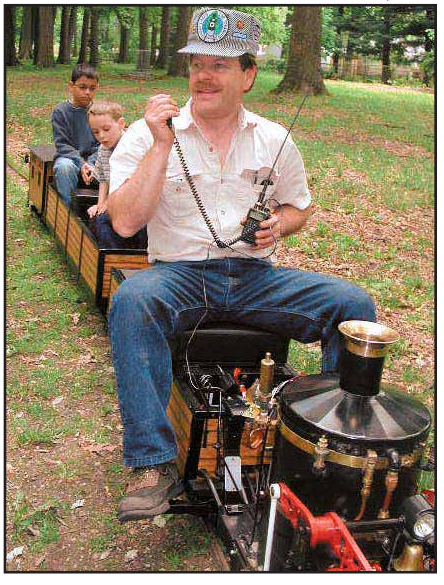
JACK CANTRELL, ABØOX

Pirate and Smoky consider their options.

MARK HARLACHER, MD, KF6YMT

The Harris family of Ventura, California, is into ham radio in a big way. Clockwise from top left: Theory instructor Robert Lavin, K6BOB, of Uncle Bob's Radio School; dad David Harris, KD6LET; Jonathan Fleischer, AC6GS, part of the VE team; Wesley Harris, KG6QHT, age 7; mom Desireé Domingo Foraste, KD6LEW; and Ryan Harris, KG6QHU, Wesley's twin brother.

TONY GALLUCCI, N8VR



One weekend a month, the Great Lakes Live Steamers give rides to young rail fans at Starr Park in Royal Oak, Michigan. Bob Winkel, KG8DD, is one of the several hams in the ranks of the group. He's riding a 1/8 scale 1830s locomotive.

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- Two receivers, with an amateur-bands-only main receiver and general coverage subreceiver. Each receiver has fully programmable AGC characteristics and 590 IF-DSP filters standard. Receivers can be used separately or in tandem for diversity reception on any frequency with no compromise in RX performance. Use both receivers on a single antenna, or both on separate antennas.
- ORION is equipped with dual antenna outputs, two linear amplifier keying outputs, two band data connections. This allows two sets of amplifiers and antennas to be connected to the radio simultaneously to take full advantage of both receivers' capabilities.
- Continuous real-time spectrum display with 5 selectable widths.
- Adaptive DSP noise reduction filtering available in 9 stages. Dual noise blankers, both DSP and 'analog' are provided.
- Optional heavy-duty internal automatic antenna tuner matches up to 10:1 SWR (8 to 600 ohms load impedance).
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- SSB audio receive and transmit controls. 18 transmit bandwidths to a maximum of 3.9 kHz are provided along with equalization on both transmit and receive. Bass and treble response can each have their own EQ setting.
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ORION uses both crystal roofing filters and IF-DSP bandwidth filtering as part of the main receiver. The usual pitfall for top-notch performance in a modern HF receiver is the use of a 15- to 20-kHz wide roofing filter at the 1st I-F stage. This wide filter will allow unwanted signals outside of your receiver's passband to compromise receiver performance. By using crystal filters as selectable roofing filters at the 1st I-F, undesirable signals are kept out of the receiver chain and do not compromise close-in receiver performance.

Any signal that appears inside the roofing filter – even if you do not hear it in your receiver passband – will have a negative impact on receiver performance. Loud signals inside a roofing filter lead to a loss of dynamic range and receiver sensitivity. Consult any ARRL product review from the past two years and look at the difference in receiver performance numbers for 20-kHz spacing and 5-kHz spacing two-tone dynamic range and third-order intercept. The 5-kHz spacing numbers are always significantly worse than the 20-kHz numbers for our competitors transceivers – this is because of the presence of the loud test signals under their wide roofing filters. Imagine how much worse it is if you have several loud signals within 15 kHz rather than just two used for testing! The optimum receiver set up is to use high-rejection, very narrow crystal filtering up front, and brick-wall DSP filtering at the end of the chain at the 3rd I-F. No receiver system can top this! There are six crystal roofing filter positions in ORION. Three roofing filters at 6 kHz, 2.4 kHz, and 1 kHz are standard; three at 1.8 kHz, 500 Hz, and 250 Hz are optional. ORION's roofing filters are not to be confused with traditional crystal bandwidth filters – for bandwidth filtering, ORION has 590 built in DSP filters from a minimum of 100 Hz to a maximum of 6 kHz. What is the result? Receiver performance specifications that are significantly better than any other transceiver on the market to date.

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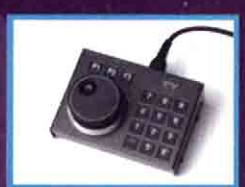

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A GREAT HOBBY

♦ Prior to the fall of 2001, I had never heard the term "ham radio." One day in early September, I noticed my husband on the ARRL Web site taking a practice exam for his Technician license. When I asked him what he was doing, he briefly explained Amateur Radio to me, and expressed his long desire to become a ham. It sounded interesting enough, so it wasn't long before I went out and bought *Now You're Talking!* and started studying for my license. I received my first ticket in October 2001, and was on the radio the day I received my call sign, KG6IDV. With much coaxing from my Elmer (Dave Mangels, AC6WO), I studied hard for my upgrade and four months later, I went from Technician to Extra, all at one session. Again, with the persuasion of Elmer Dave, I became a VE representing the ARRL in Stanislaus County, California.

In February 2003, at a Stanislaus ARA interactive workshop, with the help of Chuck Marble, KE6OAG, I had my first satellite contact, UO-14, and was able to talk with a fellow ham in British Columbia. That was an exciting accomplishment.

Amateur Radio has been an interesting experience and I'm proud to be involved in such a great hobby. I'd like to thank my husband Jim for introducing me to Amateur Radio, and Dave Mangels, AC6WO, for encouraging me to go all the way to the top.—*Laurie J. Warren, AE6CL, Modesto, California*

REDUCE THE POWER OF BPL

♦ I just read through the article on the Broadband over Power Line proposal ("ARRL in Action," July 2003, p 12) and I have to say I'm amazed and dismayed at such a proposal—amazed that companies would even consider such a method given the sorry state of so many power lines in the US, and dismayed at the possible interference it could cause.

Ed Hare's statement about "...Many hams have a power line within 30 feet of their house" is close to the mark, but unfortunately for most of us here in older portions of overcrowded Southern California its more like *20* feet. That's right—here in Downey the required minimum setback from the back of a home to the property line is only 20 feet. Same for most of the older surrounding cities built before underground utilities came into vogue (and then it's even less in a lot of cities). Yes, some homeowners are lucky in that they live on yet older, deeper or larger lots (like the house where I grew up), but they are in the minority.

The condition of the power lines themselves leads to noise and degradation of signals of any kind. For example, when one of the 120 V feeds at the transformer down the street fried due to overloading, did Edison's crew replace the high voltage to transformer feed line? No! I actually saw the lineman pull hard on the wire to make it reach the transformer. He then sanded the burned end to clean it, and clamped it back on the transformer. Voilà—the power was back on. But for how long? What about noise due to arcing? Who knows; who cares? It sure appears that Edison doesn't.

Add to that the numerous old baked transformers, strange collections of feed wires, "singing" high voltage lines and just the age of the lines themselves (most have been in place in our city since about 1950), and you've got a sure-fire recipe for noise of all kinds.

Sorry, but BPL is just a bad idea. I hope we and the ARRL can convince the FCC of this.—*John Powell, KF6EOJ, Downey, California*

[Editor's Note: There's more about the BPL issue in this month's "Happenings" column.]

WILL CODE DIE?

♦ With the demise of the mandatory Morse code requirement, it is very possible that our most reliable mode, very possibly useful even in the event of a nuclear attack, will lose popularity to modes that do not require a learning process, such as voice and digital modes, to operators like me, who will want to get right on the HF bands we've heard so much about.

Now, don't get me wrong. I'm all for the removal of the Morse requirement, and I'm not prophesying the Doom of CW. I do not look forward to a day when Amateur Radio is not able to provide assistance in an emergency. I do not want the Morse requirement completely eliminated, either. I believe that the Morse requirement should hold for the highest license class, such as Extra in the US. It should still be viewed as an important skill, if not an essential one.

Morse code is still the best way to pass data reliably, despite recent advances in digital modes. I will learn Morse code eventually, and so should anyone truly serious about this hobby. —*Joseph Harrison, WN5FIZ, Renton, Washington*

HALF A LOAF

♦ I have been only half a ham.

Over 25 years ago I got my first license—Novice-WDØAEW. But I never made a CW contact.

After a while I struggled through 13 WPM CW so I could upgrade to General. I very quickly upgraded to Advanced—KBØSP. Yet I never made a satisfying CW contact.

After few years I organized and taught a number of ham classes. I specialized in taking the new student all the way to General class. I had great success in teaching CW to beginners and was named as Western Pennsylvania Educator of the year by the ARRL. But I still had never made a satisfying CW contact.

Restructuring came along and the Extra class license I had longed for became mine at 1 minute past midnight on April 15, 2000. But I *still* had made no satisfying CW contacts. I still believed I would thoroughly enjoy CW if I could get my competency and speed up to something in excess of 20 WPM, but it had not happened.

Oh, how I wish I had learned CW the way I had learned to teach it (at high speed, no "lookup table", software that avoided the memorized code tape and a variety of drills that kept the learning interesting). But I relegated myself to using the microphone and being half a ham.

Well, that is changing. The QRP bug bit me. I read about the Rock-Mite in *QST* and decided that I had to build one. It is too cute to relegate to a conversation piece. So now I have *got* to get competent so I can use it on the air. Besides,

people always want to know how far I have "talked" with it!

I am on course to learn CW the right way. And I have found some new tools: the *Morse Code Teaching Machine* (free software at **www.c2.com/~ward/**), the Koch method (free software at **www.sdc.org/~finley/finley.morse. html**), and Morse Pilot 3.1 (free software for your PALM at **www.spectrum.uni-bielefeld.de/~gibbon/**), which is helping me learn to copy behind and hold the characters in my head—something that has always been a problem for me.

The other night I did make a couple of CW contacts. Oh, my CW was not perfect. I don't have a clue how fast (slow) it really was. I miscopied a few characters and one whole thought was too garbled to make out. My fist was a bit shaky—my most frequently sent character was a series of eeeeees. But it was fun and I know I will persevere to become a whole ham. —*Leonard Budd, W8LWB, Cincinnati, Ohio*

YOU'RE WELCOME!

♦ I have meant to compose this letter for some time. I have been a member of ARRL for a few years now, and have always considered *QST* as one of the premier benefits of membership. It is a clean magazine; I can leave my copy anywhere in the house and not worry about my 6 year old son or pre-teen daughter picking it up. Now, I know that the vast majority of hams are not spring chickens, but neither are they dead, and they are still predominantly male. If you look at other publications aimed at male hobbyists, the ads are full of bikinis (or less), the articles with crude humor. Not so with *QST*. I am certain this is increasingly the result of vigilance and enforcing of standards, and I want to encourage this with all my heart. Thank you for your efforts in the past, and keep up the good work!—*Howard Parks, AB9FH, West Allis, Wisconsin*

LET'S USE 222

♦ Since 9-11 the government has urged all American families to take certain preparedness steps, including having a family communications plan—a means of getting in touch with family members who may be separated during their normal daily activities.

We all know that any emergency communications plan which doesn't include Amateur Radio will come up short because conventional "consumer grade" communications methods always jam up and busy out. And with hams taking a more active role than ever in Civil Defense, the 2 meter and 70 cm repeaters are sure to be heavily occupied with emergency nets.

This would leave little opportunity for family members to pass important messages such as "I'm okay. Grab your gopacks, get Joey and I'll meet you at..." There simply aren't enough wide-coverage repeaters to accommodate this kind of not-quite-emergency traffic. But there is a solution to this potential problem.

Designate 222 MHz as the "family logistics band"—a place where family members will meet if there is an emergency. This one move alone would generate more usage of a band that has been underutilized for decades. Clubs would be encouraged to maintain 222 repeaters, and the sales of 222 MHz radios would go through the roof.

Some non-hams would even be attracted to the hobby when they see how reliable ham radio is during an emergency. And there would be plenty of room for them, and the rest of us too, up on 220—away from the RACES and ARES nets. —*James Alderman, KF5WT, Dallas, Texas*

WE'RE PROS

♦ I've read with interest NE2Q's perspective on what we call ourselves as well as the comments ("Op-Ed," Feb 2003, p 95). As far as ARES and RACES volunteering is concerned, I'm for removing the "amateur" descriptor for what it conveys to the uneducated public. In our little corner of the world (Santa Cruz County, California), in direct support of public safety agencies during very large events we state several times a year that we are professionals (albeit unpaid) in every sense of the word. I'm sure, like every other ARES and RACES group in the country, we bring the seriousness, dedication and practice to radio communications that paid professionals do.

Emblazon "Volunteer Radio Communication" across the backs of our ARES and RACES vests, please.—*Jim Piper, N6MED, Aptos, California*

LET'S GIVE OURSELVES CREDIT

♦ I fully agree with the article entitled "Are We Really Amateurs?" We really need to change our name from a 1900 misnomer to a 2003 name. Radio Operators of America sounds a lot more professional and may finally attract a few more people below the age of 50. Have you noticed how few new young operators there are?

Let's give ourselves the credit we deserve and stop calling ourselves amateurs.—*Dr Marc G. Lewey, KA2YFI, Tarrytown, New York*

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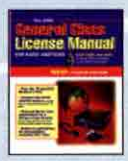

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By Dan Friedrichs, KØIPG

An Easy to Build, Dual-Band Collinear Antenna

Get some gain on 2 meters and 70 centimeters, without a beam. Collinear verticals have been used for years in commercial and government services; KØIPG shows how to build one for the amateur bands.

Why collinear? The simple answer is gain. Most 1/4 wave antennas radiate some of your signal energy up into the clouds. They have gain, but unless you're trying to talk to the space shuttle, that gain is going in the wrong direction. [Quarter-wave antennas don't work very well without a counterpoise—whether that's a car body, radials or the ground. While a vertical antenna does have some high-angle radiation components, its low-angle component is greater than a horizontal dipole of equivalent length, provided both are operated suitably above ground.—*Ed.*] A collinear antenna provides a lower angle of radiation, meaning more of your signal energy will go "out" instead of "up."

What Do I Need to Build It?

This antenna was designed to be simple and inexpensive to build. All you need are the following components:

- A 10 foot length of 3/4 inch PVC pipe
- A 3/4 inch PVC end cap for the top of the PVC pipe (to keep the rain out)
- A 1/2 inch wood dowel, about 1 1/2 inches long
- 4 feet of 20 gauge solid, insulated copper wire
- 7 feet of 12 gauge solid, insulated copper wire
- 20 inches of 300 Ω twin-lead (avoid the foam type)
- A small piece of copper-clad printed circuit board material

I was able to obtain all of the supplies in one trip to my local hardware store, at a cost of about $5. Of course, the proverbial well-stocked junk box can lower that cost.

Building the Matching Section

First, we'll assemble the matching section shown in Figure 1. This will require the 20 inches of twin-lead and whatever coaxial line you are going to feed the antenna with. Start by removing 1/2 inch of insulation from each of the twin-lead conductors, at the bottom. Twist these exposed wires together and solder. From your solder joint, measure up 1 1/2 inches and mark that spot. Measure up an additional 1/8 inch from the mark and make another wire mark. Remove all the insulation between those two marks, making sure not to damage the conductors in the process.

Once you have that completed, it's time to attach your feed line (the coax cable). I used a long piece of cable, with a PL-259 type connector attached that could connect directly to my transceiver. You may choose, instead, to use a shorter piece with an SO-239 type coaxial socket that you can mount at the antenna's base. In any case, you'll need to separate the center conductor from the shield braid of the coax, leaving about 1 inch of each side exposed. You'll now connect the coax cable ends to the 1/8 inch wire areas that you previously removed insulation

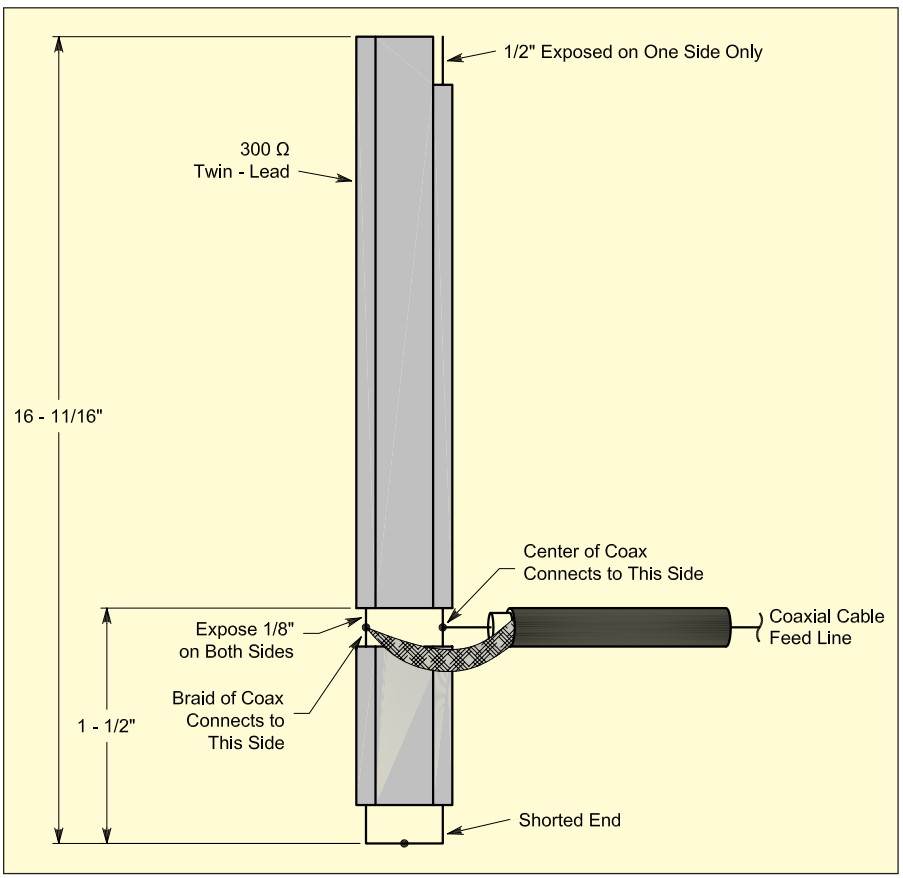

Figure 1—The matching section for the dual-band collinear is constructed of 300 Ω twin-lead. The coaxial feed line connects directly to it.

DAN FRIEDRICHS, KØIPG

Figure 2—A look at the coaxial feed line, which is soldered to the bottom end of the matching section. The details are shown in Figure 1.

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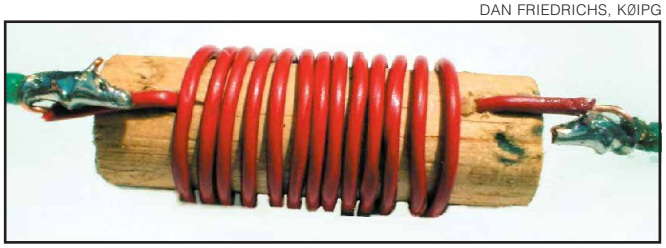
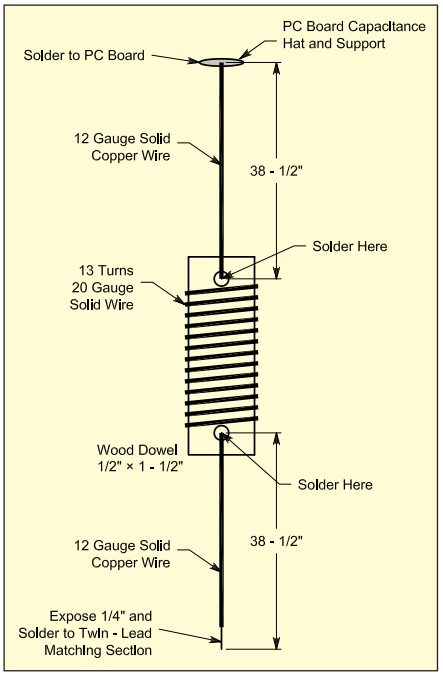


Figure 4—The decoupling coil is wound on a wooden dowel form. The radiating elements are then soldered to the coil.

Figure 3—The collinear radiating element and its decoupling choke are both built from solid copper wire. The coil is wound on a wood dowel form for support.



from. Solder the braid to one side of the exposed twin lead and the center to the other side (which side connects to which isn't important at this time). Now, measure up $16^{11}/_{16}$ inches from the bottom of the twin-lead and cut off any excess from the top. Finally, at the top of the twin lead, remove $^1/_2$ inch of insulation from the side of the twin lead that you connected the center of the coax to. The matching section is now completed. A view of the bottom of the matching section can be seen in Figure 2.

The Radiating Element

Although the matching section was somewhat difficult to assemble, you'll find that the radiating element is much easier to construct. Its construction is shown in Figure 3. Start by cutting 2 pieces of the 12 gauge wire to $38^1/_2$ inches long. These will form the top and bottom of the radiating element.

For the coil, you'll need the $^1/_2 \times 1^1/_2$ inch wood dowel and the 20 gauge wire. Start by drilling two holes in the dowel, each $^1/_8$ inch in diameter and $1^1/_8$ inch apart. Insert the end of the wire through one of the holes, leaving about 1 inch sticking out the hole. Hold this end and using the remaining wire, wind 13 turns tightly onto the dowel. Then, holding the coil so it doesn't unwind, insert the remaining wire through the other hole and pull it tight. Bend the wire 90° as both sides of the wire exit the dowel to keep the coil from unwinding. Once again, leave about 1 inch of wire free at this end. Strip the insulation off the wire ends, close to the coil. Now strip about $^1/_4$ inch off the end of each of the 12 gauge wire radiators (top and bottom). Wrap and solder each end of the coil leads to the top and bottom of the 12 gauge radiators. You may want to pass the 12 gauge wire through the coil holes as a convenient anchor point before soldering. You've now completed the radiating element. A close-up of the coil is shown in Figure 4.

Connecting It All Together

Remember the $^1/_2$ inch of insulation we removed from one side of the twin-lead earlier? You'll need to remove $^1/_4$ inch of insulation from the end of the bottom $38^1/_2$ inch radiator section and solder it to the exposed twin-lead of the matching section.

The printed circuit board will be used to support the antenna in the PVC pipe. Make sure you use real copper-clad PC board material, not perf board. The board will be used to support the antenna and it will also serve as a capacitance hat. Cut a circle in the board that's marginally larger than the inside diameter of the PVC, but smaller than the outside diameter; drill a small hole in the center of the board and solder the end of the top of the radiating element to the copper. Now you'll be able to insert the whole assembly into the PVC pipe (twin-lead end first) supported by the PC board holder. You can now put the PVC end cap on the top (over the board). The end cap can be glued to the PVC pipe, if desired, but make sure the antenna works first!

Some tuning of the antenna may be necessary. If you have problems getting the antenna to work on your desired frequency, try adjusting the lengths of the $38^1/_2$ inch sections (they should be $^1/_2$ wavelength long at your frequency). Be sure to adjust them both equally. You might also try connecting the coax slightly higher or lower on the twin-lead matching section.

If you feel really ambitious, you can increase the gain even further by adding additional coils and $^1/_2$ wave radiating sections. The antenna begins to get quite long, however, and you'll reach a point of diminishing returns. The physical support of a long piece of PVC pipe can be difficult. [Two additional radiators should give the antenna another 3 dB of gain, but that will make this antenna about 16 feet long. Antenna gain does come at the expense of length and/or size! This antenna operates on its third harmonic on the 70 centimeter band; hence it has a higher high-angle radiation component there. The relative increase in gain due to the compression of the vertical (high angle) component will be more apparent on 2 meters than on 70 centimeters.—*Ed.*]

Finally, you'll probably want to fill the bottom end with silicone sealant or another waterproof material to protect it from the elements. And there you have it…. This antenna will provide you with both 2 meter and 70 centimeter capabilities as well as significantly increased gain at the lower radiation angles.

Dan Friedrichs, KØIPG, is a 17 year old high school student who's been a ham for about 3 years. Dan has an Extra class ticket and enjoys contesting, DXing, operating VHF and UHF, and homebrew building. He plans a future study of engineering. He can be reached at 1616 7th Av SE, Le Mars, IA 51031 or at **danf@frontiernet.net**.

By Jim McClanahan, W4JBM

Understanding and Testing Capacitor ESR

High ESR is a common cause of failure with electrolytic capacitors. Enhance your troubleshooting skills, learn about ESR and build a simple adapter that will let you test for it.

Eventually everyone who repairs electronic gear will encounter a "tough dog"—some piece of equipment with an intermittent problem that can't seem to be fixed. Sometimes these end up being set aside and never repaired. At other times, a scattered approach to component replacement fixes the problem, but the real cause is never isolated or understood.

Over time, most technicians find that replacing electrolytic capacitors in a suspect section or in the unit's power supply often fixes these problems. But testing the replaced capacitors typically fails to show any specific problem. In the end, it's not very satisfying to finish a repair and not be able to pick up one component and say, "This was bad…"

Are these capacitors really the cause of the problem? If so, what is wrong with them? And more importantly, is there a way they can be tested?

Traditional Capacitor Testing

Testing electrolytic capacitors can be a challenge. While a visual inspection may find a leaky capacitor, most other testing requires that the capacitor be removed from the circuit. Sometimes it is even difficult to do a through visual inspection without removing the capacitor—capacitors with radial leads can rupture through the bottom (circuit board side) in a way that is difficult to see with the capacitor installed.

Once a capacitor is isolated from the circuit, an ohmmeter can often be used to check for shorts or for excessive leakage resistance. There is the old trick of using an analog volt-ohmmeter to watch the capacitor charge on the resistance scale. And, you can use an RCL bridge or one of the new digital meters to actually measure the capacitance. You may find, however, that the capacitor can pass all of these tests and still be defective.

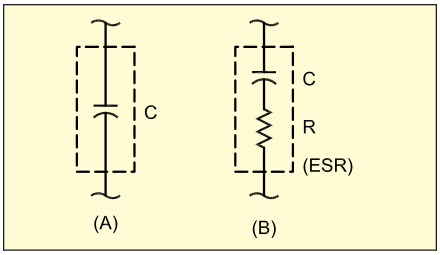


Figure 1—An ideal capacitor is shown at A. ESR can be modeled as an ideal resistor in series with an ideal capacitor, as shown in B. More complex models are sometimes used when considerations like leakage resistance and series inductance are important.

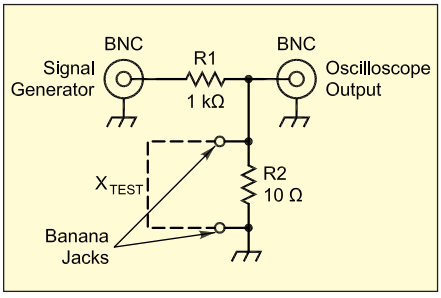


Figure 2—The simple ESR test adapter circuit.

The Problem Identified

So just what does go wrong with the electrolytic capacitors that are at the heart of these problems? First, it is important to realize that real-world components differ from the ideal components that we study. Sometimes those differences are subtle. At other times they are significant.

Figure 1A shows an ideal capacitor. Real capacitors have a characteristic called *equivalent series resistance* (ESR). Figure 1B shows an easy way to model this—the ESR is shown as an ideal resistor in series with an ideal capacitor. A number of things contribute to ESR losses, including the connections internal to the capacitor, plate losses, leakage and other factors. The typical ESR of an electrolytic capacitor will be so low (a few tenths of an ohm) that it is usually ignored.

ESR increases as a capacitor ages and begins to dry out or corrode. [Electrolytic capacitors usually have a wet-paste electrolyte.—*Ed.*] Once the problem begins, it tends to accelerate—higher ESR leads to capacitor heating, and this heating further dries the electrolyte, which increases the ESR. This is especially a problem in demanding applications such as switching power supplies.

It's not unusual to find a capacitor that has an ESR in the tens of ohms yet tests good in all other respects. While this may not seem significant, this increased resistance can lead to a wide array of problems—many of which are often difficult to isolate and track down.

How Common Is It?

Look in an electronics parts catalog at Panasonic M-Series electrolytic capacitors, for example, and you will find that the rated life for a capacitor operating at +85°C is 2000 hours. That may sound like a long time, but think about a typical home appliance, the VCR. Its LED clock is always on, which means its power supply is operating continuously… 24/7. There are 8760 hours in a year—so in these "always-on" applications, a capacitor that runs hot (because of bad thermal design or an adverse operating environment) will last only a few months.

Reducing the operating temperature below the rated maximum helps tremen-

dously and capacitor manufacturers have certainly made progress in extending the life of capacitors. The life of electrolytic capacitors in demanding applications, however, is still typically years, not decades.

Think about the extreme environment that mobile radio transceivers endure. The miniaturization of equipment implies lower air circulation, which certainly leads to greater thermal stress. The switching power supplies so common today are rough on capacitors and are very sensitive to increases in ESR.[1] With our gear, like most other electronic devices, electrolytic capacitor failure is one of the leading causes of equipment problems.

The Basics of ESR Testing

As we go through the next few paragraphs, keep in mind an engineering "rule of thumb" about capacitors: *At low frequencies, capacitors look like open circuits. At high frequencies, they look like short circuits.*

A normal ohmmeter uses dc from a battery to measure resistance. Since a capacitor looks like an open circuit at dc (that's as low a frequency as you can get!), we should read infinite resistance on the ohmmeter. (What we'll actually see is any leakage resistance and the reading of our ohmmeter may vary as the capacitor charges, but let's ignore those effects for now.)

But what if our ohmmeter used ac instead of dc? If the frequency is high enough and the capacitance is large enough, the capacitor begins to look like a short circuit. So, using an ac ohmmeter we would measure just the ESR of the capacitor.

We have made two assumptions here—one about the frequency and one about the capacitance. We want as high a frequency as practical, but not so high that we have to worry about stray capacitance or lead length. For the moment, let's consider a frequency of 50 kHz.

The other assumption was that the capacitance was high enough. ESR problems typically manifest themselves in electrolytic capacitors; these can run anywhere from several thousand microfarads down to values lower than a microfarad. So, for argument's sake, let's consider a 5 µF capacitor.

How does a 5 µF capacitor look at 50 kHz? For an ideal capacitor, the impedance will be determined by the equation:

$X_c = 1/[2\pi fC]$

where

X_c = capacitor impedance in ohms
f = frequency in Hz
C = capacitance in farads.

Solving for X_c shows us that our 5 µF capacitor will have an impedance of around 0.6 Ω when measured at a frequency of 50 kHz. As mentioned earlier, ESR values can be less than 1 Ω, so the capacitor's impedance of 0.6 Ω shouldn't overwhelm our ESR measurement.

What if we had used a different frequency? Say, for example, we wanted to use 60 Hz since it's the readily available ac power line frequency. In this case, the impedance of an ideal 5 µF capacitor would be over 500 Ω. Measuring an ESR of less than an ohm in series with this would prove to be a challenge. This same challenge exists when we try to measure the ESR of capacitors smaller than a few microfarads.

ESR testing can typically be performed without removing the capacitor from the circuit. If we use very low voltage ac signals for our testing (say less than 0.1 V_{peak}), we won't have to worry about active components (transistors and diodes) turning on. Most passive components in parallel with the capacitor under test will have high impedances when compared with the expected ESR of the capacitor.

An ESR Test Adapter

So what have we learned? To measure ESR we need, in simplified terms, an ohmmeter that uses an ac voltage to make its measurements. That ac voltage needs to have a frequency that is high enough to reduce the impedance of an ideal capacitor to a few ohms (at most) to measure the ESR of capacitors in the microfarad range and higher.

Several commercial products fit the bill, but what if you don't want to invest in an ESR-meter? If your bench is equipped with an oscilloscope and a function generator (or an audio signal generator) you can use the adapter shown schematically in Figure 2 to check capaci-

Figure 3—The ESR test adapter built by the author.

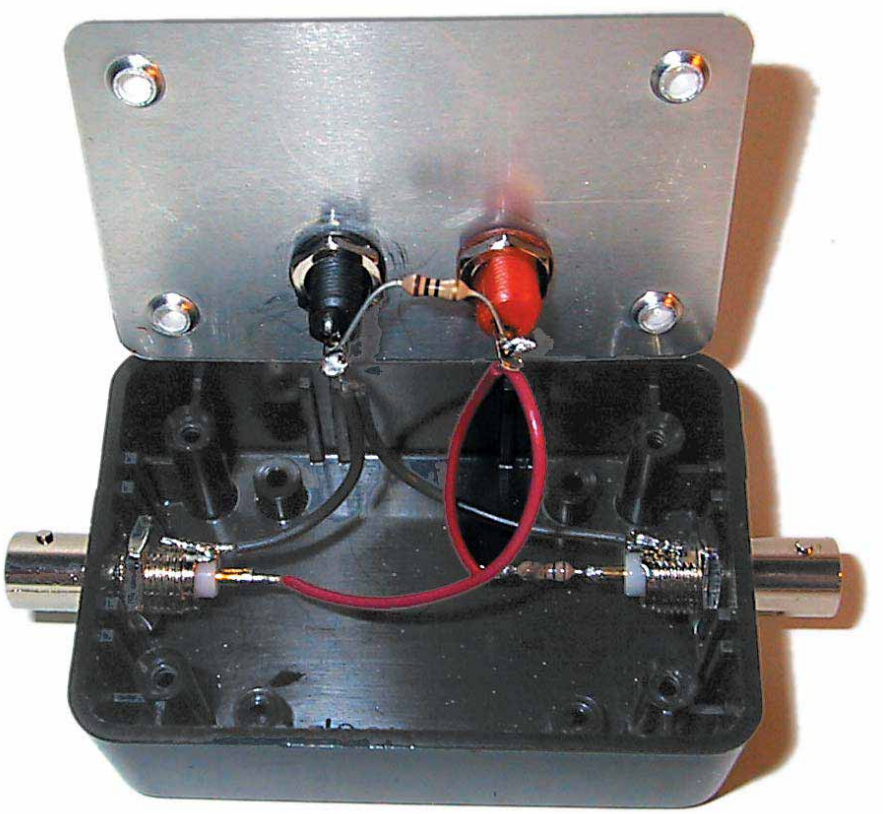
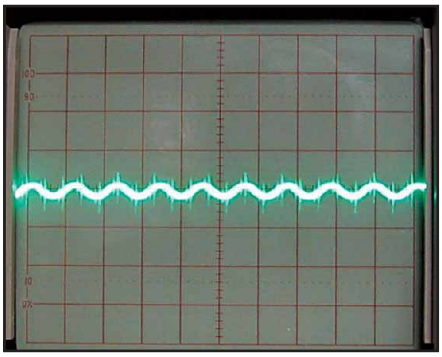
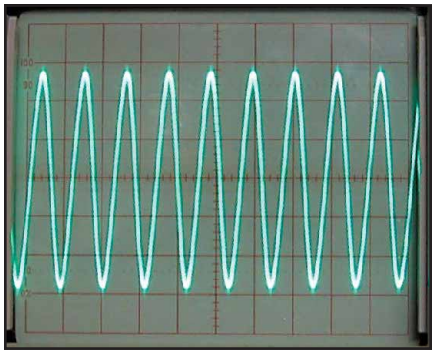


Figure 4—A view inside the ESR test adapter.

[1]The high ripple frequencies seen in switching power supplies (often 500 kHz or more because of the switching frequencies) result in a capacitive reactance that is very much influenced by the capacitor's ESR. The capacitor's ESR can often be higher than its intrinsic reactance at these frequencies and low ESR capacitors are usually used for these demanding applications.—*Ed.*



(A)



(B)

Figure 5—Test results of a new 10 µF capacitor are shown in A. Notice the relatively large drop in voltage indicating low ESR. A bad 330 µF capacitor having high ESR is shown in B.

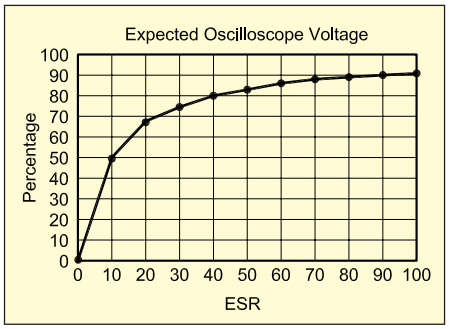


Figure 6—The change of voltage seen by the oscilloscope gives an indication of the ESR value. This graph shows the percentage (of the initially calibrated full screen voltage) expected for various values of ESR. The greatest change occurs with good capacitors—those having low ESR.

tor ESR. Basically, a signal generator is terminated into a 1010 Ω load that is made up of R1 and R2 in series. The device under test is placed in parallel with R2 while we note the change in voltage drop on an oscilloscope.

Figures 3 and 4 show the test adapter built by the author. The adapter is housed in a small project box. BNC jacks are used for the connections to the signal generator and the oscilloscope. Banana jacks are on the top of the adapter, although 5-way binding posts could also be used. Test leads can be used to troubleshoot in-circuit components, but they should be kept short. The test leads I use show about 1 Ω of series resistance at 100 kHz—a significant (but not overwhelming) amount when measuring ESR.

In operation, the signal generator is set between 50 kHz and 100 kHz with an output voltage of about 1.0 V_{peak}. The oscilloscope is then adjusted so that the signal trace fills the display.

Remember our observation that a capacitor looks like a short at high enough frequencies? When X_{test} is a good capacitor, this short-circuit will reduce the voltage seen by the oscilloscope. Figure 5A shows the results of testing a good 10 µF capacitor. Actually, the oscilloscope is showing the effect of the 1 Ω test-lead impedance mentioned earlier. When measured with a calibrated ESR meter, the ESR of this capacitor was about 0.1 Ω.

In a capacitor with high ESR we will see a smaller change. Figure 5B shows the results of testing a bad 330 µF capacitor I found in my junk box. The ESR of this capacitor was measured to be around 25 Ω and was clearly defective.

While most of the commercial testers have "expected readings" tables or "pass-fail" indicators, it's important to realize that there is no definitive line between good and bad readings. So, while our test adapter is more "qualitative" than "quantitative," this doesn't turn out to be a serious shortcoming. The best approach is to compare the results you see from a capacitor under test to the results you see with a known good capacitor of similar value and type. Also keep in mind that ESR is a dynamic quantity and can vary with frequency, temperature and other factors.

Typically, we are only interested in measuring ESR in electrolytic capacitors down to about 1 µF. But the test adapter can still provide useful information below this limit. For example, I recently used my ESR test adapter to identify a failed-open 0.1 µF ceramic disc capacitor used in the construction of an audio oscillator circuit. I was also able to quickly check other capacitors from the same batch that had already been installed and satisfy myself they were good.

How sensitive is our tester? Figure 6 shows what you can expect in terms of changes in voltage the oscilloscope sees for various values of ESR. With an ESR of around 90 Ω, you'll see the voltage measured by the oscilloscope drop by about 10 percent. Since most ESRs are less than 1 Ω, you will usually be looking at significant changes on the oscilloscope.

You can also change the sensitivity by using different values of R2. For larger capacitors (like 1000 µF) you might want to use a lower value of R2 (say 5 Ω or perhaps less) so you can measure very low ESRs. Conversely, if you want to do a qualitative check of ceramic disc capacitors, you might want to increase the value of R2.

As discussed earlier, most capacitors can be tested while still installed in the circuit, but make sure the *power has been disconnected* and the capacitor is *fully discharged*. Failure to do so could lead to damage to the test equipment or even injury to the person doing the testing. Remember that high-value electrolytic capacitors can store lots of energy!

And...In Conclusion

Spend a bit of time testing old capacitors from your junk box or check out the filter capacitors in some of the old power supplies you have lying around. After you get some hands-on experience with ESR testing, you'll develop a "feel" for what's "good" and what's not.

Your ESR tester isn't the answer to all possible problems, however. For example, capacitors that fail shorted can still exhibit a low ESR. Fortunately, failures of this type typically exhibit symptoms very different than ESR problems and tend to be easier to diagnose.

There are other uses for your ESR tester. You can easily test transistors for shorts since the low voltage won't cause P-N junctions to turn on. Small inductors can be tested, too. Don't be afraid to experiment with it and see what other applications you can find. But even without other applications, the ESR test adapter can save hours of frustration when tracking down one of the leading causes of problems with electronic equipment—bad electrolytic capacitors. Pull those "tough-dogs" off the shelf and get to work!

Jim McClanahan, W4JBM, was first licensed in 2001, but his interest in radio dates back more than 30 years ago when he built his first crystal set. Jim operates CW although he says that he feels more comfortable with a soldering iron in his hand than a key. He has an Amateur Extra class ticket and enjoys homebrewing QRP gear. Jim is a telecommunications consultant and has a BSEE from the University of Tulsa and an MBA from Oklahoma State University. He can be reached at 300 Relais Trace, Alpharetta, GA 30004 or at **w4jbm@arrl.net**.

By H. Ward Silver, NØAX

Amplifier Care and Maintenance

With few moving parts, your amplifier can be easy to overlook. Here are some ideas for taking care of amplifiers.

Amplifiers come in all shapes and sizes, large and small, light or heavy, tube or solid-state, VHF or HF. Regardless, they all need a little TLC from time to time. They can cost as much as top-of-the-line radios, so it's important that they get a little maintenance on a regular basis.

While this article focuses on amplifiers that use vacuum tubes, many of the ideas presented here can and should be applied to any amateur amplifier—HF or VHF/UHF. Solid-state amplifiers operate at lower voltages and generally have fewer points of failure, but they still need occasional maintenance.

Safety First

It is important to review good safety practices.[1] Tube amplifiers use power supply voltages well in excess of 1 kV and the RF output at full throttle can be hundreds of volts, as well. Almost every voltage in an amplifier can be lethal! Take care of yourself and use caution!

- *Power Control*—Know and control the state of both ac line voltage and dc power supplies. Physically disconnect line cords and other power cables when you are not working on live equipment. Use a lockout on circuit breakers. Double-check visually and with a meter to be absolutely sure power has been removed.
- *Interlocks*—Unless specifically instructed by the manufacturer's procedures to do so, never bypass or "rig" an interlock. This is rarely required except in troubleshooting and should only be done when absolutely necessary. Interlocks are there to protect you.
- *The One-Hand Rule*—Keep one hand in your pocket while making any measurements on live equipment. The hand in your pocket won't give current a chance to flow through you. It's also a good idea to wear shoes with insulating soles and work on dry surfaces. Current can be lethal even at milliampere levels—don't tempt the laws of physics.
- *Patience*—Repairing an amplifier isn't a race. Take your time. Don't work on equipment when you're tired or frustrated. Wait several minutes after turning the amplifier off to open the cabinet—capacitors can take several minutes to discharge through their bleeder resistors.
- *A Chicken Stick*—Make this simple safety accessory shown in Figure 1 and use it whenever you work on equipment in which hazardous voltages have been present. The ground wire should be heavy duty (12 gauge minimum) due to the high peak currents (hundreds of amperes) present when discharging a capacitor or tripping a circuit breaker. When equipment is opened, touch the tip of the stick to *every* exposed component and connection that you might come in contact with. Assume nothing—accidental shorts and component failures can put voltage in places it shouldn't be.
- *The Buddy System and CPR*—It's always a good idea to use the buddy system when working around any equipment that has the potential for causing serious injury. The buddy needn't be a ham, just anyone who can be nearby in case of trouble. Your buddy should know how to remove power and administer basic first aid. Since hams work around electrical equipment frequently, it would be a good idea to have your buddy or someone in the household know CPR, as well.[2]

Cleanliness

The first rule of taking good care of an amplifier is cleanliness. I realize that 90 percent of ham shacks have just failed the first rule. Amplifiers need not be kept sparkling new, but their worst enemy is heat. Excess heat accelerates component aging and stresses those expensive tubes and transformers. There are two areas to keep clean—the inside and the outside.

Outside the amplifier, you need to prevent dust and obstructions from blocking the paths by which heat is removed. This means keeping all ventilation holes free of the ever-present dust bunnies, pet hair

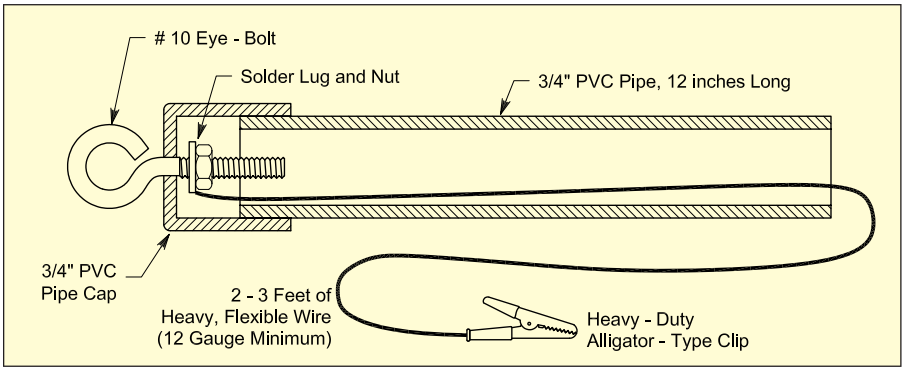


Figure 1—The "chicken stick" is a great way to ensure that everything inside the amplifier that should be discharged actually is. It can be a life saver.

[1]Notes appear on page 37.

and insects. Fan intakes are particularly susceptible to inhaling all sorts of "goop." Get out the vacuum cleaner and clean not only the amplifier, but the surrounding areas. Don't even think about letting liquids anywhere near the amplifier. One spilled cup of coffee can cause hundreds of dollars of damage.

Keep papers or magazines off the amplifier—even if the cover is solid metal. Paper acts as an insulator and keeps heat from being radiated through the cover. Amplifier heat sinks must have free air circulation to be effective. There should be at least a couple of inches of free space surrounding an amplifier on its sides and top. If the manufacturer recommends a certain clearance, mounting orientation or air flow, follow those recommendations.

Just as the outside needs to be kept clean, so does the inside. High voltage (HV) circuits attract dust like crazy. The dust slows heat dissipation and will eventually build up to the point where it arcs or carbonizes. Our friend the vacuum cleaner should make another appearance to remove any dust or dirt. If you find insects (or worse) inside the amp, try to determine how they got in and plug that hole. Window screening works fine to allow airflow while keeping out visitors. While you're cleaning the inside, this is a great time to perform a visual inspection as described in the next section.

Vacuuming works best with an attachment commonly known as a "crevice cleaner." Figure 2 shows a crevice cleaning attachment being used with a small paintbrush to dislodge and remove dust. Don't use the vacuum cleaner brush attachment; they're designed for floors, not electronics. Some vacuums also have a blower mechanism, but these rarely have enough punch to clean as thoroughly as a brush. Besides, that dust you blow all over is going to wind up in some other equipment, so it's best to take it out of circulation, so to speak. The brush will root dust out of tight places and off components without damaging them or pulling on connecting wires.

If you can't get a brush or attachment close enough, a spray can of compressed air will usually dislodge dust and dirt. If you use a rag or towel to wipe down panels or large components, be sure not to leave threads or lint behind. Never use a solvent or spray cleaner to wash down components unless the manufacturer advises doing so—you might leave behind a residue or damage the component.

Visual Inspection

Once the amplifier has been cleaned, it's time for a visual inspection. Remove any internal covers or access panels and...*stop*! Get out the chicken stick, clip its ground lead securely to the chassis and touch every exposed connection. Now, using a strong light and possibly a magnifier, look over the components and connections. Amplifiers have far fewer components than transceivers do, so it's quite feasible to look at every component and insulator. Look for cracks, signs of arcing, carbon traces (thin black lines), discoloration, loose connections, melting of plastic, and anything else that doesn't "look right." This is a great time to be sure that mounting and grounding screws are tight. While you're in there, does anything smell burnt? The nose can quickly detect the odors of toasted transformer, cooked capacitor or roasted resistor. Learn the smells of healthy and not-so-healthy components.

Make a note of what you find, repair, or replace—even if it's absolutely nothing. If you don't keep a shack notebook, start one. A simple spiral notebook with notes about maintenance, wiring, color coding, antenna behavior and so forth can be a big time-saver.

Electrical Components

An amplifier contains many heavy-duty HV and RF components. These can be expensive and hard to replace, so it's important that you take good care of them. Let's start with the power supply.

There are three basic parts to amplifier power supplies—the ac transformer and line devices, the rectifier/filter and the metering/regulation circuitry. Transformers need little maintenance except to be kept cool and be mounted securely. Line components such as switches, circuit breakers and fuses, if mechanically sound and adequately rated, are usually electrically okay, as well.

Rectifiers and the capacitors that filter the HV dc require occasional cleaning. Look for discoloration around components mounted on a printed circuit board (PCB) and make sure that all wire connections are secure. HV capacitors are generally electrolytic or oil and should show no signs of leakage, swelling or outgassing around terminals.

Located at the output of the filter, components that perform metering and regulation of voltage and current can be affected by heat or heavy dust. If there has been a failure of some other component in the amplifier—such as a tube—these circuits can be stressed severely. Resistors may survive substantial temporary overloads, but may show signs of overload, such as discoloration or swelling.

Amplifiers contain two types of relays—control and RF. Control relays switch ac and dc voltages and do not handle input or output RF energy. The usual problem encountered with control relays is oxidation or pitting of their con-

S. COHEN, N1SC; R. SCHETGEN, KU7G

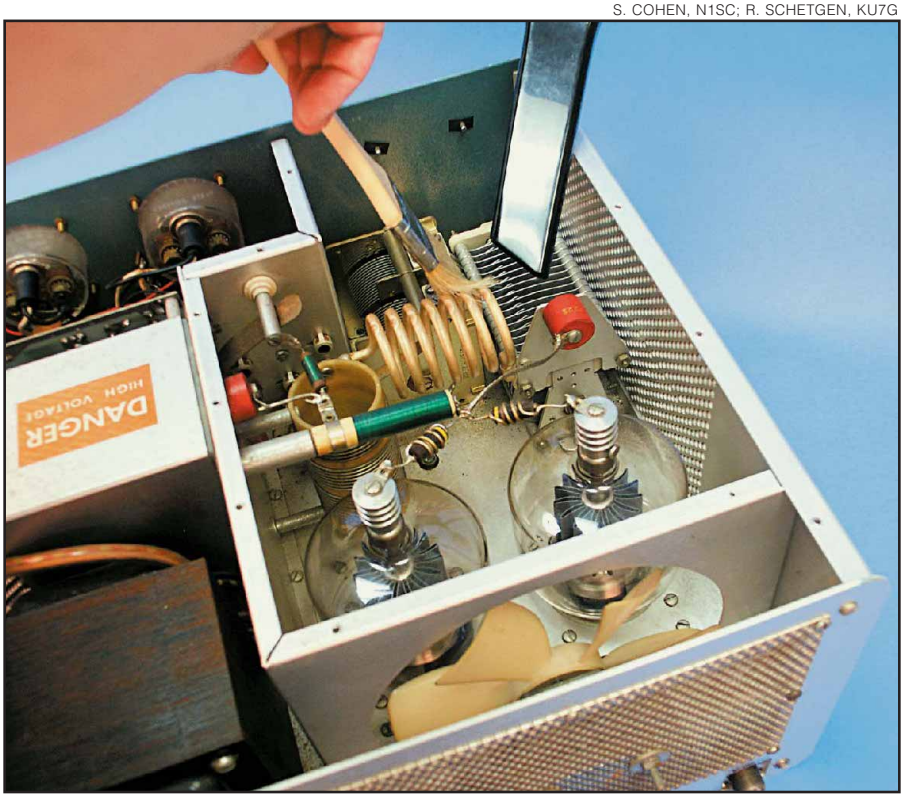


Figure 2—A small paintbrush and a vacuum cleaner crevice attachment make dust removal easy.

tacts. A burnishing tool can be used to clean relay contacts. In a pinch a strip of ordinary paper can be pulled between contacts gently held closed. [Avoid the temptation to over-clean silver-plated relay and switch contacts, as the author points out later. It is easy to remove contact plating with excessive polishing and while silver-plated relay and switch contacts may appear to be dark in color, oxidized silver (black) is still a good conductor. Once the silver's gone, it's gone; contact erosion will then be pervasive.—*Ed.*] If visual inspection shows heavy pitting or discoloration or resistance measurements show the relay to have intermittent contact quality, it is best replaced.

RF relays are used to perform transmit-receive (TR) switching and routing of RF signals through or around the amplifier circuitry. Amplifiers designed for full break-in operation will usually use a high-speed vacuum TR relay. Vacuum relays are sealed and cannot be cleaned or maintained. When you replace RF relays, use a direct replacement part or one rated for RF service with the same characteristics as the original.

Cables and connectors are subjected to heavy heat and electrical loads in amplifiers. Plastics may become brittle and connections may oxidize. Cables should remain flexible and not be crimped or pinched under clamps or tie-downs. It's a good idea to gently wiggle cables while watching the connections at each end for looseness or bending. Connectors can be unplugged and reseated once or twice to clear oxide on contact surfaces. Carefully inspect any connector that seems loose. Be especially careful with connectors and cables in amplifiers that have RF decks that are in separate enclosures from those of their power supplies. Those interconnects are susceptible to both mechanical and electrical stress and you don't want an energized HV cable loose on the operating desk. Check both the soldered electrical integrity and the mechanical stability of those cables and make sure they are tightly fastened.

As with relays, switches found in amplifiers are either control function orientated or RF routers. Adequately rated control switches, if mechanically sound, are usually okay. Bandswitches are the most common RF switch—usually a rotary phenolic or ceramic type. A close visual inspection should show no pitting or oxidation on the wiper (the part of the switch that rotates between contacts) or the individual contacts. Arcing or overheating will quickly destroy rotary switches. Figure 3 is a photo of a heavy-duty band switch that has suffered severe damage from arcing. Slight oxidation is acceptable on silver-plated switches. Phosphor-bronze contacts can sometimes be cleaned with a light scrub from a pink pencil eraser, but plating can be easily removed, so use caution with this method and be sure to remove any eraser crumbs. Rotary switch contacts cannot be replaced easily although individual wafer sections may be replaced if an exact matching part can be obtained.

Amplifiers use all types of capacitors and resistors. When replacing them, be sure to use a part rated for the use to which it will be put. Voltage and power-handling ratings are particularly important, especially of those handling high RF currents. An RF tank capacitor replacement should be checked carefully for adequate RF voltage and current ratings, not just dc. HV resistors are generally long and thin to prevent arcing across their surfaces. Even if a smaller (and cheaper) resistor has an equivalent power rating, resist the temptation to substitute it. In a pinch, a series string of resistors of the appropriate combined value can be used to replace one HV unit. Don't use carbon resistors for metering circuits, use metal or carbon film types. The carbon composition types are too unstable.

If you are repairing or maintaining an old amplifier and manufacturer-specific parts are no longer available, the ham community has many sources for RF and HV components. Fair Radio Sales and Surplus Sales of Nebraska are familiar names.[3] Hamfests and Web sites such as **www.eham.net** or **www.k1dwu.net/hamtrader** often have amplifier components for sale. You might consider buying another amplifier of the same type in non-working condition for parts use.

Tubes

The single most expensive component in an amplifier is usually the vacuum tube that performs the amplification. Good maintenance of tubes starts with proper operation of the amplifier. Follow the manufacturer's instructions for input drive levels, duty cycles, tuning and output power level. Frequently check all metered voltages and current to be sure that the tubes are being operated properly and giving you maximum lifetime. Penta Labs has an excellent Web page on maintaining power tubes.[4]

The internal mechanical structures of tubes generally do not deal well with mechanical shock and vibration, so be gentle. The manufacturer may also specify how the amplifier is to be mounted, so read the operating manual.

Tubes generate a lot of heat, so it's important that whatever cooling mechanism employed is kept at peak efficiency. Airways should be clean, including between the fins on metal tubes. All seals and chimneys should fit securely and be kept clean. Wipe the envelope of glass tubes clean after handling them—fingerprints should be removed to prevent baking them into the surface.

On metal tubes that use finger-stock contacts, be sure the contacts are clean and make good contact all the way around the tube. Partial contact or dirty finger stock can cause asymmetric current and heating inside the tube, resulting in warp-

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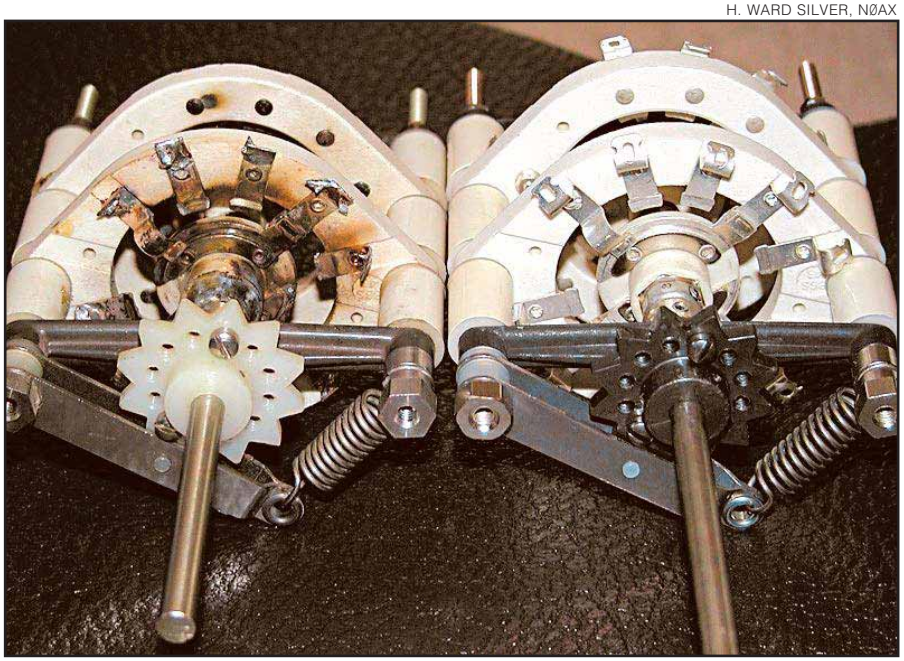

Figure 3—The band switch section on the left clearly shows the signs of destructive arcing.

ing of internal grids and possibly causing harmonics or parasitics.

Plate cap connections and VHF parasitic suppressors should be secure and show no signs of heating. Overheated parasitic suppressors may indicate that the neutralization circuit is not adjusted properly. Inspect socket contacts and the tube pins to be sure all connections are secure, particularly high-current filament connections. Removing and inserting the tubes once or twice will clean the socket contacts.

Adjustments to the neutralizing network, which suppresses VHF oscillations by negative feedback from the plate to grid circuit, are rarely required except when you are replacing a tube or after you do major rewiring or repair of the RF components. The manufacturer will provide instructions on making these adjustments. If symptoms of VHF oscillations occur without changing a tube, then perhaps the tube characteristics or associated components have changed. Parasitic oscillations in high-power amplifiers can be strong enough to cause arcing damage. Perform a visual inspection prior to re-adjusting the neutralizing circuit.

Metering circuits rarely fail, but they play a key part in maintenance. By keeping a record of "normal" voltages and currents, you will have a valuable set of clues when things go wrong. This is perfect information for the shack notebook. Record tuning settings, drive levels, and tube voltages and currents on each band and with every antenna. When things change, you can refer back to the notebook instead of relying on memory.

Mechanical

While the amplifier is primarily an electronic beast, it has a significant number of mechanical parts that affect its well-being. Thermal cycling and heat-related stresses can result in mechanical connections loosening over time or material failures.

Switch shafts, shaft couplings and panel bearings all need to be checked for tightness and proper alignment. All mounting hardware needs to be tight, particularly if it supplies a grounding path. Examine all panel-mounted components, particularly RF connectors, and be sure they're attached securely. BNC and UHF connectors that are mounted with a single nut in a round panel hole are notorious for loosening with repeated connect/disconnections.

Rubber and plastic parts are particularly stressed by heat. If there are any belts, gears or pulleys, make sure they're clean and that dust and lint are kept out of their lubricant. Loose or slipping belts should be replaced. Check O-rings, grommets and sleeves to be sure they are not brittle or cracked. If insulation sleeves or sheets are used, check to be sure they are covering what they're supposed to. Never discard them or replace them with improperly sized or rated materials.

Enclosures and internal shields should all be fastened securely with every required screw in place. Watch out for loosely overlapping metal covers. If a sheet metal screw has stripped out, either drill a new hole or replace the screw with a larger size, taking care to maintain adequate clearance around and behind the new screw. Tip the amplifier from side to side while listening for loose hardware or metal fragments, which should all be retrieved.

A great time to clean the front and back panels and get gummy finger deposits off before they cause permanent finish damage is during maintenance. If the amplifier is missing a foot on the cabinet or an internal shock mount, replace it. A clean unit with a complete cabinet will have a significantly higher resale value than a dirty, grubby one, so it's in your interest to keep the equipment looking its best.

Shipping

When you are traveling with an amplifier or shipping it, some care in packing will prevent needless damage. Improper packing can also result in difficulty in collecting on an insurance claim, should damage occur. The original shipping cartons are a good method of protecting the amplifier for storage and sale, but they were not made to hold up to frequent shipping. If you travel frequently, it is best to get a sturdy shipping case made for electronic equipment.[5]

Some amplifiers require the power transformer to be removed before shipping. Check your owner's manual or contact the manufacturer to find out. Failure to remove it before shipping can cause major structural damage to the amplifier's chassis and case.

Tubes should also be removed from their sockets for shipment. It may not be necessary to ship them separately if they can be packed in the amplifier's enclosure with adequate plastic foam packing material. If the manufacturer of the tube or amplifier recommends separate shipment, however, do it!

Cleaning and Maintenance Plan

This discussion should have given you plenty to think about. It's easy to defer maintenance, but as with a vehicle, performance and lifetime are improved if a regular program is put into place. For amateur use, there is little need for maintenance more frequently than once per year. If there is a period of the year in which you are most active, put a note on the calendar about six weeks in advance to "open the hood," giving you time to obtain and replace any components.

Consider the maintenance requirements of your amplifier and what its manufacturer recommends. Sit down with your amplifier's manuals and make up a checklist of what major steps and tools are required. When maintenance time rolls around, you'll be prepared and be able to perform the job in the most efficient manner.

Troubleshooting

A benefit of regular maintenance will be familiarity with your amplifier should you ever need to repair it. Knowing what it looks (and smells) like inside will give you a head start on effecting a quick repair.

The following discussion is intended to illustrate the general flow of a troubleshooting effort, not be a step-by-step guide. Figure 4 shows a moderately-high-level troubleshooting flow chart. Before starting on your own amplifier, review the amplifier manual's "Theory of Operation" section and familiarize yourself with the schematic. If there is a troubleshooting procedure in the manual, follow it, of course.

You might be surprised how many "amplifier is dead" problems turn out to be simply a lack of ac power. Before even opening the cabinet of an unresponsive amplifier, be sure that ac is really present at the wall socket and that the fuse or circuit breaker is really closed. Assuming that ac power is present, trace through any internal fuses, interlocks and relays all the way through to the transformer primary terminals.

Hard failures in a high voltage power supply are rarely subtle, so it's usually clear if there is a problem and what components are involved. When you repair a power supply, take the opportunity to check all related components. If all defective components are not replaced, the failures may be repeated when the circuit is re-energized.

Rectifiers may fail open or shorted—test them using a DVM diode checker. An open rectifier will result in a drop in the HV output of 50 percent or more but will probably not overheat or destroy itself. A shorted rectifier failure is usually more dramatic and may cause additional rectifiers or filter capacitors to fail. If one rectifier in a string has failed, it may be a good idea to replace the entire string as the remaining rectifiers have been subjected to a higher-than-normal voltage.

High voltage filter capacitors usually fail shorted, although they will occasionally lose capacitance and show a rise in ESR (equivalent series resistance). Check the rectifiers and any metering compo-

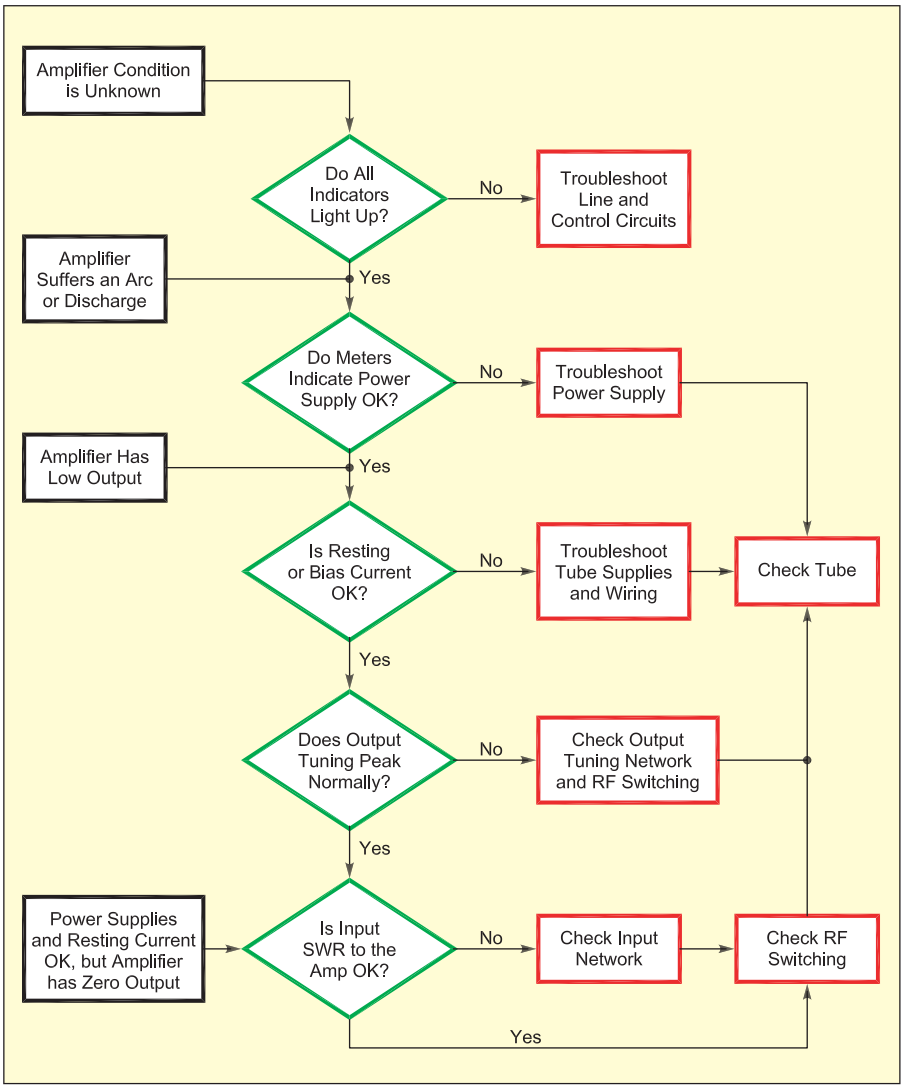

Figure 4—This moderate-level flow chart is a good way to identify amplifier problems quickly in lieu of a misplaced or nonexistent manufacturer's troubleshooting procedure.

nents—they may have been damaged by the current surge caused by a shorted filter. Power transformer failures usually manifest themselves by insulation failures with consequent arcing of the windings. Either can result in the unmistakable aroma of overheated transformer. A failed transformer is generally not repairable.

Along with the HV plate supply, tetrode screen supplies occasionally fail, too. The usual cause is the regulation circuit that drops the voltage from the plate level. Operating without a screen supply can be damaging to a tube, so be sure to check the tube carefully after repairs.

If the power supply checks out okay and the tube's filaments are lit, check the resting or bias current. If it is excessive or very low, check all bias voltages and dc current paths to the tube, such as the plate choke, screen supply (for tetrodes) and grid or cathode circuits.

Having exhausted power supply and dc problems, you will then turn to the RF components or "RF deck." There is a natural tendency to forge ahead and swap in a known-good tube or tubes. Don't! Tubes are expensive and if the problem is elsewhere, you may damage the spares. Wait to swap tubes until you are sure that the tube is likely to be defective.

Check the input SWR to the amplifier. If it has changed (you did write down the normal SWR and drive levels, didn't you?) then you likely have a problem in the input circuitry or one or more tubes have failed. Perform a visual check of the input circuitry and the band switch, followed by an ohmmeter check of all input components.

If input SWR is normal and applying drive does not result in any change in plate current, you may have a defective tube, tube socket, or connection between the input circuits and the tube. Check the TR control circuits and relay. If plate current changes, but not as much as normal, try adjusting the output tuning circuitry. If this has little or no effect, the tube may be defective or a connection between the tube and output circuitry may have opened. If retuning has an effect, but at different settings than usual, the tube may be defective or there may be a problem in the tuning circuitry. A visual inspection and an ohmmeter check are in order.

The key to finding the trouble with your amplifier is to be careful and methodical, and to avoid jumping to false conclusions or making random tests. The manufacturer's customer service department will likely be helpful if you are considerate and have taken careful notes detailing the trouble symptoms and any differences from normal operation. There may be helpful guidelines on the manufacturer's Web pages or from other Internet resources. Sometimes there is more than one problem—they work together to act like one very strange puzzle. Just remember that most problems are very simple and can be isolated by careful, step-by-step tests.

Summary

Amplifiers have been part of ham radio for many years. They are simple, reliable pieces of equipment that respond well to basic care and common sense. Take the time to know your amp—inside and out. If you take care of it, it will reward you with reliable service and maximum tube lifetime.

Notes

[1]Chapter 9 of the current *ARRL Handbook for Radio Communications* is an excellent source of safety information. Available from your local dealer or the ARRL Bookstore. Order no. 1921 (softcover), no. 1948 (hardcover). Telephone toll-free in the US 888-277-5289, or 860-594-0355, fax 860-594-0303; **www.arrl.org/shop/**; **pubsales@arrl.org**.

[2]Instructions for CPR can be found at: **about-the-web.com/spiritworks/web/Kaiser/html/adult.htm**.

[3]Two sources of HV and RF parts include Surplus Sales of Nebraska (**www.surplussales.com**) and Fair Radio Sales (**www.fairradio.com**). Others can be found at the ARRL Technical Information Service database (**www.arrl.org/tis/tisfind.html**).

[4]Penta Labs, "Tube Maintenance & Education" (**www.pentalaboratories.com/maintenance.asp**).

[5]Pelican (**www.pelican-shipping-cases.com**) and Anvil (**www.anvilsite.com**) make excellent shipping cases suitable for carrying amplifiers and radio equipment.

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By Phil Salas, AD5X

Solid-State Those Pilot Lamps

Tired of replacing pilot lamps in your radio gear? Use light-emitting diodes (LEDs) instead.

Lately, I've been really getting into restoring old boatanchor radios, my latest project being the restoration of an older Johnson Viking Ranger transmitter. Along with that older equipment, even relatively recent pieces of ham gear use the popular #44, #47 and #51 pilot lamps that operate at voltages of about 6 V ac. The Johnson Ranger uses five 6.3 V ac pilot lamps, each drawing about 250 mA, for a total draw of about 8 W of power, with much of that going into heat. Three of those lamps are enclosed in difficult-to-replace areas on the Ranger: the dial (two lamps) and the meter (one lamp). Long-term exposure to the approximately 1.5 W per lamp of heat in these enclosed places was a concern to me. [In many cases it also accounts for the dial and meter face discolorations in older equipment. Prolonged heat and plastics do not mix well.—*Ed.*]

Recently, the prices of ultra-bright white LEDs have dropped significantly.[1] These LED lamps are actually three times brighter than the incandescent pilot lamps used in the Johnson Ranger. LEDs do have a narrow viewing range, however, so they can normally only be used when the lamp is configured so that the LED faces forward. In the three enclosed pilot lamps of the Ranger, the pilot lamps do face forward, so I thought these would be perfect for LED replacements.

Making the LED Pilot Lamps

Most ultra-bright LEDs have normal operating currents of about 20 mA. To set this current properly, I put a 1 kΩ potentiometer in series with a 6.3 V ac source and measured the current on a multimeter. Remember that LEDs are diodes, so they rectify the ac voltage and LED polarity doesn't matter when they are used on an ac source. (Polarity does matter if the LED is driven from a dc voltage source; the anode of the LED should then go to the positive side of the supply voltage.) Using this methodology, I determined that the series dropping resistors necessary to provide 20 mA from a 6.3 V ac source for most ultra-bright LEDs is as shown in Table 1. [Ohm's Law works just as well here. Just remember that the voltage is ac, which is then rectified by the LED. We are interested in the *average* ac voltage and current and $E_{avg}=0.9E_{rms}$. For a current of 20 mA, $R= E_d / I$, where $E_d = 5.67 - V_{diode}$ and I = 0.02 A. So, for the white LED, which requires a forward voltage of 4 V, R = 1.67/0.02 = 83.5 Ω. Close enough!—*Ed.*]

Building a pilot lamp substitute is easy if you build the LED and dropping resistor directly into the associated pilot lamp socket. In my case, the pilot lamps all used bayonet bases. I chose to purchase some #47 bulbs[2] and sacrifice them for this purpose. If you have some used bulbs in your junk box, so much the better.

To prepare the LED lamp base, do the following:

- Put on safety glasses!
- Wrap the pilot lamp in a small plastic sandwich bag and gently crush the glass part with pliers.
- Using the pliers, gently squeeze and rotate the base. This should break up the remainder of the glass and cement in the base. When complete, ensure that the base is as round as possible.
- Shake out the glass, and then use a solder sucker or wick to remove the solder from the tip of the base.
- Using needle nose pliers, pull the remaining pieces of bulb and wiring out of the base. If necessary, use the solder sucker or wick to clear out any remaining solder.

The bulb retrofit circuit is shown in Figure 1. Let's build it! In my case, I used the 3000 mcd ultra-bright white LEDs discussed earlier with a 1/2 W, 82 Ω series resistor.[3] A 1/4 W resistor is fine, but RadioShack didn't carry 82 Ω resistors in that size. Figure 2 shows two completed LED pilot lamps, and the parts for a third lamp.

Cut one lead of the resistor, and one lead of the LED to 1/8 inch. Overlap these short leads and solder them together. The use of a desktop "helping hand" is great

Table 1
Dropping Resistors to Provide 20 mA

LED	*Voltage*	*Resistor*
White	4 V	82 Ω
Green	3 V	120 Ω
Amber	3 V	120 Ω
Blue	3 V	120 Ω
Red	2 V	160 Ω

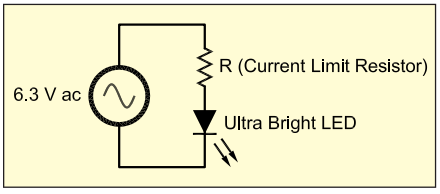


Figure 1—The LED lamp replacement circuit.

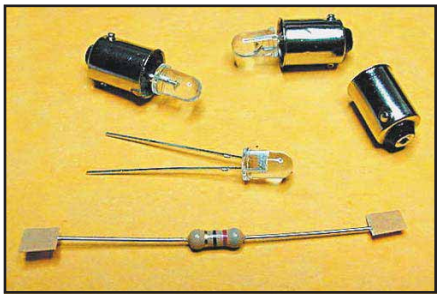


Figure 2—The LED and its associated current limit resistor. Some completed LED bulb assemblies can be seen to the rear.

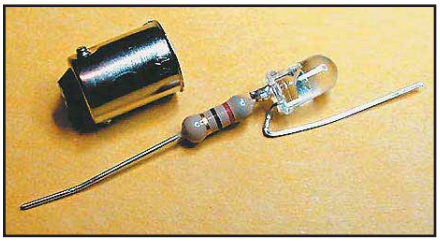


Figure 3—A completed LED and its current limiting resistor ready to be soldered into the bulb base. Note how the leads are positioned for soldering.

[1]Notes appear on page 39.

for holding these parts together while soldering. Now bend the remaining LED lead over and up as seen in Figure 3.

Insert the long resistor lead through the hole in the base until the body of the resistor bottoms out in the base. Solder the resistor lead in place. Solder the bent-up LED lead to the side of the lamp base. If you'd like, you can fill the base with epoxy or hot glue to give it some stability. I didn't find this necessary. Clip off excess lead lengths and you're done. You've now decreased the current drain by at least a factor of 10, and significantly increased the reliability of the lamp. In most cases, the intensity will also be noticeably brighter.

The remaining two lamps used in the Johnson Ranger mount vertically in their holders. The light projects from the lamp sides, through two jewel assemblies to the front panel. The jewel assemblies happen to have an inside diameter of 5 mm; therefore the 5 mm ultra-bright LEDs will fit tightly into these assemblies. I soldered a 1 kΩ series resistor from the applicable 6.3 V ac source to one lead of each LED, and a ground wire to the other lead of each LED. These two jewelled LEDs were too bright with the 82 Ω resistor and the current had to be reduced considerably.

In Conclusion...

Building LED replacement lamps for normal incandescent pilot lamps is not difficult.[4] It's also no longer expensive, due to the improved prices on ultra-bright LEDs. You will probably never have to replace a pilot lamp again after making this conversion.

Notes

[1]All Electronics (**www.allelectronics.com**) sells 5 mm 3000 mcd (ultra-bright) white LEDs for $2 each (catalog no. LED-75).

[2]All Electronics (**www.allelectronics.com**) catalog no. LP-47.

[3]RadioShack catalog no. 271-1107 (**www.radioshack.com**).

[4]Complete LED lamp assemblies are also commercially available in various bulb bases from the following sources: Ledtronics Inc, 23105 Kashiwa Ct, Torrance, CA 90505; tel 800-579-4875; **www.ledtronics.com** and Lumex Inc, 290 E Helen Rd, Palatine, IL 60067; tel 847-359-2790; **www.lumex.com**. Although more expensive, they are finished lamp assemblies and ready to use.—*Ed.*

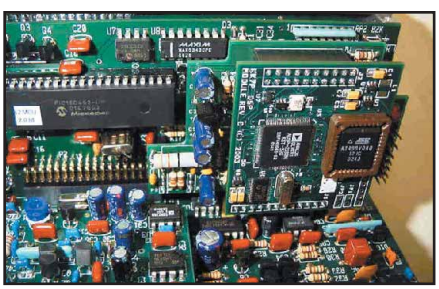
Phil Salas, AD5X, licensed since 1964, enjoys operating CW on the HF bands. He has a BSEE from Virginia Tech and an MSEE from Southern Methodist University and is currently the Vice President of Engineering for Celion Networks in Richardson, Texas. Phil lives with two very understanding family members—his wife, N5UPT, and daughter, AC5NF. He can be contacted at 1517 Creekside Dr, Richardson, TX 75081 or at **ad5x@arrl.net**.

NEW PRODUCTS

DSP OPTION AVAILABLE FOR THE ELECRAFT K2

◊ Elecraft has introduced another optional accessory for their K2 transceiver kit line. The KDSP2 brings digital signal processing (DSP) technology to the K2. Up to four programmable filter selections are available for each mode, as well as noise reduction and notch filtering. All parameters are adjustable by the operator. Also included is a clock/calendar and backup battery, which can replace a separate timepiece for field operation. The module plugs into the K2's control board; no wires are involved in the installation.

Price: $219. For more information, contact Elecraft, PO Box 69, Aptos, CA 95001; tel 831-662-8345; fax 831-662-0830; **sales@elecraft.com**; **www.elecraft.com**.



SCILUX LASER-ENGRAVED CALL SIGN PRODUCTS

◊ Scilux is offering novelty call products using subsurface laser engraving and LED illumination. A laser beam split in two penetrates a piece of glass and causes internal damage at a fine point when the laser beam recombines under computer controlled focus. This process is used to create a 3D or

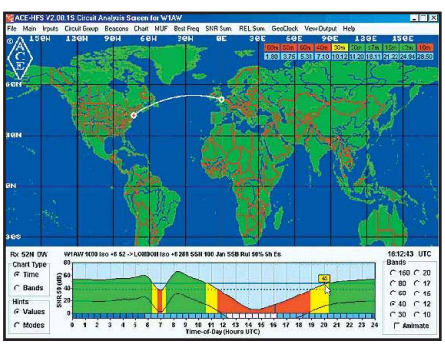
2D image inside the glass.

A QSL card image can be permanently etched inside a piece of 4×6×3/8 inch optic crystal and is displayed using super-bright LEDs in wood presentation bases. Call signs are suspended inside a 60×60×80 mm optic crystal cube or inside a crystal key chain. Lighted display bases can be left on continuously, as the LEDs are low voltage with no heat build- up and have a rated life of 100,000 hours.

For more information, contact Scilux, Inc; tel 937-252-6000; **www.scilux.com**.

ACE-HF PROPAGATION PREDICTION SOFTWARE VERSION 2

◊ ACE-HF has recently announced the release of version 2 of its propagation prediction software. The new version features many new capabilities including reverse area coverage, circuit group and NCDXF beacon predictions, and an all-new antenna selection facility that contains many antenna array models. The popular animated features of the previous version are retained.



Price: ACE-HF Version 2 PRO, $99. Discounts on upgrades from previous versions are available. For additional information contact ACE-HF, 2218 N Tuckahoe St, Arlington, VA 22205; tel 703-241-2661, fax 703-241-5809; **www.acehf.com**; **orders@acehf.com**. ACE-HF products are also available from Array Solutions, 350 Gloria Rd, Sunnyvale, TX 75182; tel 972-203-2008; fax 972-203-8811; **www.arraysolutions.com**; **wx0b@arraysolutions.com**.

FEEDBACK

◊ In the article "Put a Big Dish on AO-40—"The EZ BUD" (July 2003 *QST*), the microammeter shown in Figure 7, page 31, should have its polarity reversed. Also, with apologies to Bob Bruninga, the WB4APR Web site (Note 2, page 32) should be **web.usna.navy.mil/~bruninga/ao40ant.html**.—*Clair Cessna, K6LG*

◊ In the July 2003 article "Radio Camp" (pages 41-42), I was surprised to see that unlicensed persons were talking to a ham in Italy. Since we do not have third party agreement with Italy, this is not legal. —*Brian Harrington, WD8MXR*

◊ In the article on the new 60 meter band ("60 Meters: Frequently Asked Questions," Aug 2003), there was a typographical error in the list of authorized channels in the sidebar on page 45. The list on page 44 is correct. The channels are at 5332, 5348, 5368, 5373 and 5405 kHz.—*Tnx Michael Toia, K3MT*

By David Sumner, K1ZZ

WRC-03 from the Amateur Perspective

Amateur Radio scores gains at its most important worldtelecommunication conference since 1979!

The long-awaited 2003 World Radiocommunication Conference (WRC-03) is now history, and for the amateur service it was indeed historic. Among the four dozen agenda items were several of vital interest to radio amateurs, including realignment of the 7-MHz band, a complete revision of the international Radio Regulations that apply specifically to the amateur and amateur- satellite services, and the introduction of a new science service into the 70-cm band—with appropriate safeguards for amateurs.

WRCs are conducted by the International Telecommunication Union, a specialized agency of the United Nations. The telecommunications administrations of the ITU Member States gather every few years to amend the international Radio Regulations, which have the force and effect of a treaty. Other organizations interested in telecommunications, including the International Amateur Radio Union (IARU), are invited to participate as observers and may submit information documents, but only administrations may make proposals and vote.

The big news from WRC-03 is that in 5 1/2 years—half a sunspot cycle—the worldwide portion of the 7-MHz amateur band will double in size, to 200 kHz! This was achieved without losing anything in Region 2, where amateurs will continue to enjoy the full 300-kHz allocation. The incompatibility between amateurs in Region 2 and broadcasters in Regions 1 and 3 will be cut in half, with an opportunity to revisit the issue at WRC-07 (but with the gains we have already made "locked in" for that conference). Thus, in a few short years our 40-meter band will become much more useful at night here in the Americas and during both day and night elsewhere in the world.

This marks the first time that a high-frequency (HF) broadcasting allocation has been relocated in order to meet the needs of another service. Other matters on the WRC-03 agenda may have had more commercial significance, but none represented a greater milestone in the decades-long history of radio conferences.

The initial debates on 7-MHz realignment were held in Sub Working Group 4C1 on June 17 with an overflow crowd of more than 100 delegates present.

Three Years of Preparations

Preparations for WRC-03 began even before the final gavel fell at the previous WRC, held in Istanbul in May-June 2000[1]. A WRC doesn't just happen; technical studies and other "homework" must be done beforehand. Beginning in September-October 2000, according to a plan worked out in Istanbul, the ITU-R Working Parties charged with WRC-03 preparations each met several times to develop draft text for a Conference Preparatory Meeting (CPM) Report. The IARU is a Sector Member of ITU-R and its representatives participated fully in this process on all of the issues of concern to amateurs. In addition, the ARRL and other IARU member-societies were able to place delegates on their national delegations to these meetings. The CPM was held in Geneva in November 2002; its Report contained more than 700 pages on technical, operational, and regulatory/procedural matters to be considered at WRC-03.[2]

[1]Notes appear on page 45.

TIM TOTTEN, N4GN

(L-R) IARU team members Wojciech Nietyksza, SP5FM, Michael Owen, VK3KI, David Sumner, K1ZZ and Robert W. Jones, VE7RWJ. Jones served as a consultant to the IARU. IARU President Larry Price, W4RA, headed the IARU observer team.

Proposals Drive the WRC Process

The CPM Report is useful to the conferees, but the fuel that feeds a WRC is proposals from administrations. In recent years, regional telecommunications organizations have played an increasingly important role as administrations set out to develop proposals that will be supported by their neighbors. The European Conference of Postal and Telecommunications Administrations (CEPT) is the most sophisticated of these organizations. Through a highly structured process, CEPT developed European Common Proposals (ECPs)

on every agenda item. IARU Region 1 was allowed to participate fully in this process, which involved its volunteers attending more than a dozen meetings held all over Europe. Similarly, IARU Region 2 was able to participate in preparations by CITEL, the telecommunications entity of the Organization of American States, and IARU Region 3 had a similar opportunity within the Asia-Pacific Telecommunity (APT). A preparatory meeting by the African Telecommunications Union (ATU) held in Libreville, Gabon, also proved to be very important.

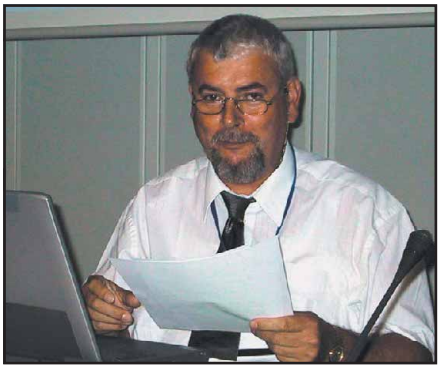
Conference decisions relating to Article 25 (the service rules for the amateur and amateur-satellite services) and to an allocation for satellite-borne Synthetic Aperture Radars (SARs) in the 70-cm band are described in sidebars written by Michael Owen, VK3KI, and J. Kenneth Pulfer, VE3PU. Michael and Ken handled these issues as volunteers for the IARU over a period of several years and were on hand in Geneva to help ensure successful outcomes. The body of this article will focus on 7-MHz realignment, a vitally important issue for amateurs worldwide that was known to be one of the most difficult and controversial issues facing WRC-03.

The Genesis of a Conundrum

The CPM Report provides a thumbnail history of how the 7-MHz allocations to the amateur and broadcasting services came to be what they are today and a brief explanation of the problems that result:

> The purpose of carrying out a realignment of the bands around 7 MHz is to remedy the long-standing difficulties experienced by the amateur service and the limitations placed on the broadcasting service as a result of the changes made to the frequency bands around 7 MHz at the Atlantic City WARC in 1947.
>
> Historically until the 1938 Cairo Conference the band 7000-7300 kHz was allocated exclusively to the amateur service. Conditions in Europe and Asia led to the reduction to 7000-7150 kHz in ITU Regions 1 and 3. A final reduction to 7000-7100 kHz took place at WARC-59. The Region 2 allocation remained unchanged at 7000-7300 kHz amateur exclusive.
>
> For the amateur service the usefulness of the allocations around 7 MHz for worldwide links is limited because only 100 kHz of spectrum between 7000 and 7100 kHz is common to Region 2 and Regions 1 and 3. The 7100-7300 kHz band is allocated exclusively to the broadcasting service in Regions 1 and 3, and exclusively to the amateur service in Region 2. Given the large disparity in signal levels between the two services, broadcasting transmissions cause interference to the sensitive receivers used in the amateur service during periods of good propagation between Regions 1 and 2. The degree of interference experienced in Region 2 varies with the time-of-day, season, solar activity and distance from broadcasting stations in other regions.

Alan Ashman of the Australian Communications Authority chaired both Working Group 4C and Ad-Hoc 2 of the Plenary. In both groups he helped delegates understand the need for compromise.



Jan Verduijn of the Radiocommunications Agency, The Netherlands, was the CEPT coordinator for the 7-MHz agenda item. His determination to find a solution satisfactory to all of his "clients" — amateurs, broadcasters, and military — was an important element in the conference's success.

The CPM Report does not recite the more recent history of attempts to resolve the amateur/broadcasting incompatibility. The 1979 World Administrative Radio Conference (WARC) tried and failed; the fixed service was unwilling to give up the spectrum that realignment would have required. Indeed, for about 24 hours of that 11-week conference the 40-meter amateur band had been cut back to 100 kHz to provide a worldwide broadcasting allocation! It took the unanimous and determined opposition of the administrations in Region 2 and support from other parts of the world to restore the 300-kHz amateur allocation.[3] The 1992 WARC also tried, but all that could be accomplished was a 50-kHz expansion of the broadcasting allocation (effective in 2007) and Recommendation 718 that a future conference should "consider the possibility of aligning the allocations to the amateur service around 7 MHz, with due regard to the requirements of other services."[4] There matters lay until WRC-00, which agreed to place the following item on the WRC-03 agenda: "to consider realignment of the allocations to the amateur, amateur-satellite and broadcasting services around 7 MHz on a worldwide basis, taking into account Recommendation 718 (WARC-92)."

At the time of WRC-00 it seemed as if the fixed service interests might finally be willing to acknowledge that their HF requirements had diminished over the years. Satellites, fiber optic cables, and other media had reduced their dependence on HF. At least, that's how it looked until September 11, 2001. Suddenly, military and other government agencies with responsibility for national security—not just in the United States but in other countries as well—began to look at HF with new appreciation. As we radio amateurs know very well, HF covers long distances without the need for infrastructure. If you're responsible for providing communications "no matter what," HF is going to be in your tool kit. So, as we prepared for WRC-03 we found that once again it was a three-way problem, with amateurs, broadcasters, and the military as the principal players.

It is important to remember that spectrum access is a zero sum game. For you to win, someone else has to lose. The only exception is if a compatible sharing scenario can be developed. It is also important to bear in mind that with few exceptions, ITU decisions are made by consensus. Everyone must be willing to live with the result, because no one can force an administration to accept a result it doesn't like. Thus there is overwhelming pressure on conferees to compromise, even when they are in the majority on an issue.

The Opening Bell

WRC-03 opened on Monday morning, June 9, with about 2,000 people present including an experienced IARU team headed by President Larry E. Price, W4RA. The core IARU team included Wojciech Nietyksza, SP5FM, Michael Owen, VK3KI, J. Kenneth Pulfer, VE3PU, David Sumner, K1ZZ, and Consultant Robert W. Jones, VE7RWJ. Bob Jones is a familiar face around the ITU, having just retired as Director of the ITU Radiocom-munication Bureau; it was enormously valuable to have him in Geneva on our behalf. Also present

New Regulations for the Amateur Services

By Michael Owen, VK3KI

On July 4, the 2003 World Radiocommunication Conference ended. On the following day the revised Article 25 of the Radio Regulations, the international regulations governing the amateur and amateur-satellite services, came into effect. Some of the provisions of these regulations date back to 1927! What follows is a summary of changes likely to be of greatest interest to amateurs. A more detailed paper is available at the IARU Web site**, www.iaru.org/rel030703att3.html**. The paragraph numbering is provisional and is subject to change when the new edition of the Radio Regulations is published.

Content

The old regulations limited international amateur radiocommunication to "plain language" and to "messages of a technical nature relating to tests and to remarks of a personal character for which, by reason of their unimportance, recourse to the public telecommunications service is not justified." This was both vague and uncertain, and certainly reflected a time, now well past, when in most countries the common carrier was a government monopoly. So, the old provision was replaced by a new one as follows:

25.2 *Transmissions between amateur stations of different countries shall be limited to communications incidental to the purposes of the amateur service, as defined in No.* ***1.56*** *and to remarks of a personal character.*

The definition of the amateur service remains unchanged.

It is assumed that the phrase in the old provision requiring transmissions to be in "plain language" meant something transmitted by either voice or Morse that anyone could hear and understand. But today amateurs use many codes, and so what is meant by the phrase "plain language" could become a question in some countries. So, the simple phrase in the old regulation was replaced by a new provision, as follows:

25.2A *Transmissions between amateur stations of different countries shall not be encoded for the purpose of obscuring their meaning, except for control signals exchanged between earth command stations and the space station in the amateur satellite service.*

"Third party Messages"

One of the most difficult areas was the old provision dealing with so-called "third party messages." The provision that dated back to 1932 read as follows:

It is absolutely forbidden for amateur stations to be used for transmitting international communications on behalf of third parties.

That prohibition of international communication on behalf of third parties is very wide. What is a communication on behalf of a third party? School children speaking to an astronaut is a communication on behalf of a third party, as is participation in the Jamboree on the Air. The provision inhibited preparation for disaster communication and international disaster relief communications unless special arrangements were in place between the two countries concerned.

The new provision reads as follows:

25.3 *Amateur stations may be used for transmitting international communications on behalf of third parties only in the case of an emergency or disaster relief. An administration may determine the applicability of this provision to amateur stations under its jurisdiction.*

The exception to the blanket prohibition for cases of emergency and disaster relief is important, and when read with the new provision (see below) intended to encourage emergency communication by amateur stations it may lead administrations to adopt new regulations to facilitate such activities.

Also significant is the fact that bilateral agreements are no longer required in order for international third party messages

were IARU Vice President David Wardlaw, VK3ADW, serving on the Australian delegation as he has done frequently since 1979; IARU Region 2 Vice President Dario Jurado, HP1DJ; and IARU Region 1 Vice Chairman Tafa Diop, 6W1KI, serving as an observer for the ATU. A number of other amateurs were present on their national delegations, either to represent the amateur services under the sponsorship of their national IARU member-society or in a professional capacity (see Table 1).

The first order of business was the election of Dr. Veena Rawat of Canada as Conference Chairman. The work was assigned to committees according to a previously agreed structure. Most of our critical agenda items went to Committee 4 chaired by Eberhard George, DL7IH. The SAR issue went to Committee 5.

The key committees held their organizational meetings on Monday afternoon and their work was further parceled out to Working Groups. Most of our items went to Working Group 4C, chaired by Alan Ashman of Australia and with about 200 participants. WG 4C in turn set up three Sub-Working Groups, two of which were of interest to us. SWG 4C1 chaired by Don Messer of the United States had about 120 regular participants and was responsible for items relating to HF broadcasting, including 7-MHz realignment. SWG 4C3 chaired by Keigo Komuro, JA1KAB, of the delegation of Japan (who happens to be Secretary of IARU Region 3) was responsible for Article 25 and had about 35 regular participants.

WG 4C itself took care of Article 19, relating to the construction of amateur call signs, and was able to dispose of this minor item without too much difficulty. The result is that administrations will have greater flexibility in assigning call signs to amateur stations, including the option of using up to four characters in the suffix (the last of which shall always be a letter)

Table 1
Radio Amateurs at WRC-03

In addition to those mentioned in the body of the article, the following are among the radio amateurs who attended WRC-03 and played a role in our success.

Representing IARU member-societies on national delegations:
Oyekunle B. Ajayi, 5NØOBA, Nigeria
Jim Dean, VE3IQ, Canada
Arie Dogterom, PAØEZ, Netherlands
Ole Garpestad, LA2RR, Norway
Fred Johnson, ZL2AMJ, New Zealand
Keith Malcolm, VK1ZKM, Australia
Jay Oka, JA1TRC, Japan
Y. S. Park, HL1IFM, Republic of Korea
Dr Rhee Joong Guen, HL1AQQ, Republic of Korea
Paul Rinaldo, W4RI, USA
Pedro Seidemann, YV5BPG, Venezuela
Jon Siverling, WB3ERA, USA
Colin Thomas, G3PSM, United Kingdom
Roman Tomas, RZ3AA, Russian Federation

National delegates in a professional capacity (partial list):
Moshe Ben-Isaac, 4X4PG, Israel
John Breen, EI7BV, Ireland (head of delegation)
Sergiy Bunin, UR5UN, Ukraine
Eberhard George, DL7IH, Germany (head of delegation, chairman of Committee 4)
Pekka Länsman, OH2NCS, Finland
Trond Olsen, LA8XM, Norway
Chris Slomczynski, SP5HS, Poland
Hans Blondeel Timmerman, PA7BT, Netherlands
Frank Williams, N4FK, United States

Special thanks to Gerald Lander, HB9AJU, for logistical support of the IARU.

to be permitted. Each administration can decide for itself what its amateur stations will be allowed to do in this regard. Of course, for such messages to be exchanged outside of emergencies or disaster relief, the administration at each end of the circuit must have decided to allow it.

Operator Qualifications

The old regulation that Morse was a requirement for the operators of amateur stations below 30 MHz was replaced with a provision giving each administration the right to decide whether Morse is a required qualification as follows:

25.5 *Administrations shall determine whether a person seeking a license to operate an amateur station shall demonstrate the ability to send and receive texts in Morse code signals.*

Morse code is no longer an internationally required qualification for an Amateur Radio license, though an administration may still require it.

Aside from the Morse code, the only statement of operator qualification in the old regulations was that "Administrations shall take such measures as they judge necessary to verify the operational and technical qualifications of any person wishing to operate the apparatus of an amateur station." After some debate, this was replaced with:

25.6 *Administrations shall verify the operational and technical qualifications of any person wishing to operate an amateur station. Guidance for standards of competence may be found in the most recent version of Recommendation ITU-R M.1544.*

The reference to the Recommendation is a non-mandatory reference. That is, an administration is not bound to follow it, but it is expected that all administrations will take the Recommendation into account when setting the qualification for an amateur licensee.

The Recommendation, which was adopted in 2001, is quite general and simply provides a list of topics about which a licensee shall demonstrate a "theoretical knowledge." That accords with the IARU position that the Radio Regulations should give some guidance as to the qualification appropriate for an amateur license, but should not attempt to set a syllabus, as the diversity of environments for which a standard must be set is very great.

Emergency Communications

A new provision reads:

25.9A *Administrations are encouraged to take the necessary steps to allow amateur stations to prepare for and meet communication needs in support of disaster relief.*

It is hoped that administrations will make regulations that facilitate amateurs preparing for emergencies and providing communications in emergencies and for disaster relief. This was an important IARU objective. While this capability is taken for granted in some countries, that is not the case everywhere.

Conclusion

The Radio Regulations are the written result of the welding together of the different views of different people with different languages and from different cultures. It is no doubt easy to say that some of the provisions could be expressed more elegantly, and that some of the provisions are not necessary.

The meaning of the new Article 25 is clear and the changes accomplish all of the objectives of the IARU, even if expressed in language different from that originally suggested. The changes and additions to Article 25 by WRC-03 should meet the needs for the future of the amateur service.

as well as the option to use even more than four characters temporarily for special occasions.

SWG 4C1 was also responsible for changes necessary to implement digital sound broadcasting (called DRM, for the French term "digital radio mondiale") in the HF bands and did not consider the 7-MHz issue until Tuesday, June 17. From the first debate that morning it was clear that coming to agreement would not be easy.

From Many Proposals, Four...Then Three...Then...?

There were at least eight different proposals for the 7-MHz agenda item. The strongest support was for the ECP, which was backed by 31 European administrations plus a couple outside of Europe. The ECP called for 7000-7200 kHz to become exclusively amateur worldwide, with 7200-7300 kHz to be shared between the amateur, fixed, and mobile services in Regions 1 and 3 and to remain exclusively amateur in Region 2. It also called for 7300-7550 kHz to become a worldwide broadcasting band. Implementation would be in two stages.

There were 15 administrations in the Americas supporting the Inter-American Proposal (IAP) from CITEL. The IAP called for 7000-7300 kHz to become exclusively amateur worldwide, by virtue of broadcasting in Regions 1 and 3 being shifted upward by 200 kHz. The IAP was thus very attractive to amateurs but had nothing for broadcasters. Israel made a proposal similar to the IAP but with 250 kHz worldwide for broadcasters.

Ten African administrations supported providing 100 kHz for amateurs now with another 100 kHz at a future WRC, and through the ATU spokesman (Oyekunle B. Ajayi, 5NØOBA) expressed a willingness to be flexible.

The APT had been unable to reach agreement on a common proposal. The various Asia-Pacific administrations offered a variety of proposals ranging from the ECP to no change. Japan and the Republic of Korea submitted a joint proposal providing 100 kHz on a shared basis for amateurs, in the year 2015.

One of the last proposals to reach Geneva, just a few days before the opening of the conference, was from the United States. After considerable internal debate and negotiation the U.S. proposed a modified version of the ECP, with just 50 kHz additional for broadcasting in Region 2 and worldwide sharing of 7200-7300 kHz by the amateur, fixed, and mobile services.

The Arab Group, Iran, Indonesia, Australia, and several others proposed "no change."

On June 18 SWG 4C1 set up a drafting group chaired by Fred Johnson, ZL2AMJ, who is Chairman of IARU Region 3, to try and amalgamate as many of the proposals as possible. Fred reported the following day that his group had managed to whittle the proposals down to four, although there was not complete agreement within the group favoring the greatest change (CEPT, CITEL, ATU, and the U.S.). Another attempt eventually resulted in SWG 4C1 being able to report to WG 4C on June 23 that the number of alternatives was down to three. A key player in achieving this step was CITEL coordinator Barry Isherwood of Industry Canada. However, time was running out. WG 4C finished without resolving the remaining differences and reported to Committee 4 that it had been unable to reach agreement.

On Thursday evening, June 26, the Conference Chairman met with regional coordinators to come to agreement on how five difficult issues including 7 MHz would be handled. There it was agreed that at this conference amateurs in Regions 1 and 3 would receive 100 kHz with an opportu-

The 70-cm SAR Story

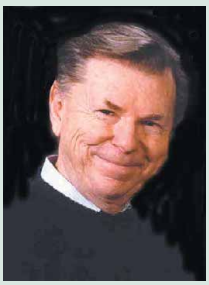
By J. K. Pulfer, VE3PU

The story of SAR begins with the United Nations Conference on Environment and Development held in Rio de Janeiro in 1992. The conference identified an urgent need for systematic observations of forest cover. The requirement for a spaceborne Synthetic Aperture Radar (SAR) transmitting in the UHF range between 420-470 MHz has been justified on the basis that it is the best method to conduct these observations.

The question of a possible SAR allocation in the amateur 70-cm band has been with us since WRC-95. It was finally resolved at WRC-03 with a secondary allocation, subject to constraints, from 432-438 MHz.

What is a SAR and Why Should it Operate at 432-438 MHz?

Synthetic Aperture Radar, SAR, uses a pulsed transmitter. The radiated signal is swept over a wide bandwidth (as much as 30 MHz) during each 50 µS pulse. The return echo is compressed, simulating a short received pulse that gives high-range resolution. Using sophisticated digital signal processing, the receiver also combines echoes from many successive pulses. This means that radar on a moving satellite behaves as if it had a long antenna along the orbit trajectory, and can therefore produce very high-resolution images.



Ken Pulfer, VE3PU

The depth of penetration of a SAR signal below the surface of the Earth changes with frequency and is on the order of one wavelength in soil. This means that a SAR can detect objects that are hidden from normal satellite photographs. A proposal for an allocation at 430 MHz for a spaceborne earth-penetrating SAR was introduced by The Netherlands at WRC-95. Such a SAR could "see" far enough into soil to detect moisture around the roots of trees in tropical forests. Before the radar could be permitted to operate, however, the question of interference to existing spectrum users needed to be evaluated. This resulted in Resolution 712 that called for "sharing studies."

Sharing with SAR

From the Amateur Radio point of view, there were two aspects to the sharing problem: one technical and one political.

The technical problems were complex, because a SAR is a sophisticated imaging radar, but we knew how to deal with them. The studies took place in ITU-R Study Group 7 and its Working Party 7C beginning in 1996.

The political aspect was more difficult. The proposed SAR allocation was justified by the perceived need to respond to the loss of tropical forests and related global warming. It was difficult to get any administration to publicly oppose it.

To complicate matters, almost all attendees involved in the Study Group worked in some aspect of remote sensing, an aspect of environmental monitoring. They were also unwilling to oppose the proposal. The IARU and the ARRL were the only "bad boys" in the discussions.

The IARU decided to oppose the allocation on purely technical grounds, demonstrating that a SAR could not share with existing services without severe restrictions on the design and operation of the radar transmitter and antenna.

For amateur CW, SSB, FM and digital receivers, it is possible to calculate and confirm the degree of interference expected from a wideband SAR signal. The initial calculations were done by VE3PU, supported by technical assistance and laboratory measurements performed at ARRL Headquarters.

It was shown that EME (moonbounce) and amateur satellite reception between 430 and 440 MHz would be subject to interference any time a SAR was above the horizon (for the SAR designs being proposed). This would amount to almost one hour in 24 for a SAR in a polar orbit, which was considered completely unacceptable.

The US Department of Defense also showed that The Netherlands SAR designs were incompatible with Space Object Tracking Network radars in the band 420-450 MHz located in North America and some other countries including Greenland and Turkey. NASA's Jet Propulsion Laboratory developed more sophisticated SAR designs that used much less transmitter power and antennas with lower sidelobe levels, and were therefore more suitable for sharing than earlier versions.

The studies resulted in a complete rewrite of Recommendation ITU-R SA.1260 by defining the constraints under which SARs must operate in order to protect incumbent services, including the amateur and amateur-satellite services. WRC-03 made the SAR allocation subject to the condition that its use shall be in accordance with revised version, Recommendation ITU-R SA.1260-1.

What Will Be the Impact of SARs on Amateurs?

The decision taken at WRC-03 allocates the band from 432-438 MHz to the Earth-exploration satellite service (active) as a *secondary* allocation to be used by satellite borne synthetic aperture radars. The secondary allocation means that a SAR may not interfere with, and must accept interference from, an amateur station in Region 1 and those countries in Region 2 where amateurs have a primary allocation. In addition, it means that SAR operators must coordinate with the amateur service in those countries where amateurs also have a secondary allocation.

In addition, the allocation approved at WRC-03 will be subject to a number of constraints, including the following:

- When taking measurements, a SAR will not be permitted to operate for more than 15 percent of the time. In addition, unless it has a nuclear power source, it will have to be off the air for extended periods to recharge its batteries.
- A SAR will not be permitted to operate within line of sight of the NASA Space Object Tracking radars, and will not be permitted to operate over China. This means that it will not operate over North and Central America, Europe, and most of Asia north of 20 degrees northern latitude.
- A SAR operating within line of sight of terrestrial stations of the amateur service in Region 1 (Europe, Africa, Russia, Northern Asia, much of the Middle East and part of Antarctica) and several countries in South America where amateurs have a primary allocation from 430-440 MHz, must not produce interference in an amateur receiver using an omni directional antenna, which exceeds a level 6 dB below receiver noise, for more than 1 percent of the time. To hear the SAR, an amateur in these regions would have to point a directional antenna towards the satellite. This threshold of interference is based on a low-noise CW or SSB receiver. The FM and digital receivers commonly used with repeaters at 70 cm are much less sensitive to interference, and are unlikely to be affected at all.
- A SAR will not be permitted to operate within line of sight of any amateur satellite capable of receiving in the 70-cm band, unless the interfering signal produced is less than a specified amount for more than 99% of the time. The interference level for a satellite is set at 10 dB higher than that for a ground station.

These constraints should result in a situation where most of the world's amateurs will rarely, if ever, experience interference from a SAR. Needless to say, without the involvement of the IARU over a period of years, there would be little, if any, protection of the amateur and amateur-satellite services.

nity to revisit the issue of another 100 kHz at the next conference. Broadcasting would shift upward by 100 kHz in Regions 1 and 3 and would receive an additional 50 kHz in Region 2. The implementation date, sharing arrangements, and other details were left to be worked out by the experts.

Friday, June 27, saw furious work being done among the concerned parties to nail down the details. CEPT coordinator Jan Verduijn of The Netherlands was the focal point. Committee 4 finished on Monday, June 30, without being able to take up the subject. That evening, Alan Ashman was tasked with chairing an Ad Hoc of the Plenary to finish the work on 7 MHz. The Ad Hoc met until 1:40 AM but there was still too much divergence; administrations were far apart on implementation dates (dates as far out as 2033 had been suggested) and a few among the "no change" group were standing fast (although several, including Australia, were willing to accept the compromise).

All day Tuesday, July 1, regional and national coordinators were busy circulating revisions to the package in an attempt to reach consensus. The issue came up in Plenary at 11:00 PM and used an hour and 10 minutes of precious meeting time. In the end, the Chairman guided a fragile, tentative agreement through a very contentious meeting; however, it was not clear that the Arab Group and Iran would accept the result. Work on footnotes to accommodate their stated needs occupied much of Wednesday, and a document setting out the result (with some "square brackets" indicating incomplete agreement) was distributed to delegates that evening. The Plenary met until 3:30 AM Thursday without reaching the 7-MHz item.

A few hours later the Plenary was back in session for its final hours. At 10:17 AM the 7-MHz item was taken up, the remaining details were nailed down, and 10 minutes later we had an agreement! Some countries, mostly in Region 3 and the Arab Group, insisted on providing additional allocations in their countries for the fixed and mobile services at 7100-7200 kHz by footnote. The footnote does not include any countries in Region 2, where the entire 300-kHz band remains exclusively amateur, or in Europe. The implementation is in one stage, on 29 March 2009, which coincides with a planned schedule change for broadcasters.

The WRC-07 Agenda

The ITU is in the midst of a budget crisis. As a result there was considerable pressure to limit the agendas of the next two WRCs, now scheduled for the first half of 2007 and (very tentatively) 2010.

There are two items on the WRC-07 agenda that are important to the amateur service:

SHOZO HARA, JA1AN

Three Australians caught in the act: Michael Owen, VK3KI, David Wardlaw, VK3ADW, and Keith Malcolm, VK1ZKM, share a moment with IARU President Larry Price, W4RA, during the IARU reception June 18. Michael handled Article 25 for the IARU team, completing an assignment that began in 1996 when he was IARU Vice President and served as Chairman of the IARU Future of the Amateur Service Committee. David is the current IARU Vice President and served with Keith, who represented the Wireless Institute of Australia, on the Australian delegation.

1.13: "taking into account [three Resolutions], to review the allocations to all services in the HF bands between 4 MHz and 10 MHz, excluding those allocations to services in the frequency range 7000-7200 kHz and [the aeronautical and maritime service bands that are subject to planning], taking account of the impact of new modulation techniques, adaptive control techniques and the spectrum requirements for HF broadcasting;"

1.15: "to consider a secondary allocation to the amateur service in the frequency band 135.7-137.8 kHz;"

The first of these provides an opportunity for additional realignment of 7200-7300 kHz without risking the loss of what we have already gained at 7100-7200 kHz (although 7200-7300 kHz in Region 2 is by no means secure). It *may* also provide an opportunity to pursue a 5-MHz allocation of some kind. However, the reference to "the spectrum requirements of HF broadcasting" is significant. Working Party 6E, made up mostly of broadcasters, will be taking the lead on the technical studies relating to this agenda item. For WRC-03 the lead Working Party on the 7-MHz agenda item was 8A, which is "home" to the amateur and amateur-satellite services. So we face some significant hurdles, not the least of which is that many broadcasters did not expect 7-MHz realignment to take place at WRC-03 and are unhappy at having to move. On the other hand, by the time of WRC-07 much more should be known about the future prospects for HF broadcasting; even the broadcasters themselves admit that there is a lot riding on whether listeners are attracted to DRM.

The second item arose from a CITEL proposal championed by Canada for WRC-03 to provide an amateur LF secondary allocation. The matter was not on the conference agenda and several administrations objected to taking action without the opportunity for technical studies, so it was placed on the WRC-07 agenda instead.

Thanks For Your Support!

Attending dozens of preparatory meetings all over the world and sending a team of experienced volunteers and ARRL staff to Geneva for a month is not something that the ARRL and our sister IARU member-societies can afford to do as a matter of routine. As an ARRL member, your dues help—but dues alone are not enough. Voluntary contributions to the ARRL Fund for the Defense of Amateur Radio Frequencies were an essential element in our success in Geneva. If you are an ARRL member, and especially if you also contributed to the Fund, thank you! You were an important member of Amateur Radio's team in Geneva.

Now for 2007!

Notes

[1]L. Price, W4RA, D. Sumner, K1ZZ, and P. Rinaldo, W4RI, "World Radiocommunication Conference 2000," *QST*, August 2000, pp 51-54.

[2]R. Lindquist, N1RL, "WRC-03 Conference Preparatory Meeting Expands 40-Meter Options," Happenings, *QST*, February 2003, pp 79-80.

[3]R. Baldwin, W1RU, and D. Sumner, K1ZZ, "The Geneva Story," *QST*, February 1980, pp 52-61.

[4]D. Sumner, K1ZZ, "WARC-92 Finds Room for New Radio Services," *QST*, May 1992, pp 25-28.

David Sumner, K1ZZ, is Chief Executive Officer, ARRL and Secretary, IARU. He can be reached at **k1zz@arrl.org**.

By Jean Wolfgang, WB3IOS

Jamboree on the Air 2003

A look at the FCC Rules governing JOTA, to be held this year October 18-19.

JOTA, Jamboree on the Air, is a 46 year old tradition. If you haven't participated in this annual October event, you're missing a great weekend. Offer a Boy Scout or Girl Scout leader (Cubs and Brownies included) the opportunity for their troop to participate in this worldwide scouting tradition. If you need a little help or more information, please visit **www.arrl.org/FandES/ead/#scout**.

In 2000, Les Mitchell, G3BHK, the founder of JOTA, said, "Little did I think when I drew up the plans and rules for the first event in 1958 that its popularity would increase and spread around the world. Even more astonishing is the fact that after all this time it still holds its popularity and now has a participation of some half a million Scouts and Guides in over 100 countries involving some 10,000 amateur radio stations. In fact it has become the largest international Scout event ever."

Each year the ARRL HQ receives questions about third party regulations, frequencies, control operators and how nonhams can make contacts. Putting kids on the radio is no different than allowing your neighbor to make a contact. All the FCC rules must still be observed.

Here, John Hennessee, N1KB, ARRL Regulatory Information Specialist, interprets a few regulatory points to keep in mind.

Which countries can a US ham contact?

A licensed amateur can make contact with any other amateur provided that the US amateur is operating on a frequency permitted by his or her license. There are no "banned countries" for US amateurs.

Which countries can a nonham contact from the US?

Any time a nonham (the "third party") is participating in a conversation with a foreign country, the US must share a third party traffic agreement with that country. If this agreement does not exist, the communication cannot take place. Readers can find the third party country list in *The ARRL FCC Rule Book*, *The ARRL Operating Manual* or on the ARRLWeb at **www.arrl.org/FandES/field/regulations/io/recip.html**. Some countries have special exceptions for events like JOTA, but the US does not.

BILL MORINE, N2COP

Bill Wetherill, N2WG, assists an unidentified Tiger Cub during JOTA 2002. The BSA Cape Fear Council held JOTA at a public park in Wilmington, North Carolina.

When and Where

JOTA 2003 begins Saturday, October 18, at 0001 local time and ends on Sunday, October 19, at 2359 local time.

Suggested Worldwide Scout Frequencies

Band (meters)	*Phone (MHz)*	*CW (MHz)*
80	3.740, 3.940	3.590
40	7.270	7.030
20	14.290	14.070*
17	18.140	18.080
15	21.360	21.140
12	24.960	24.910
10	28.390	28.190

Go to **www.arrl.org/FandES/ead/#scout** for more information.

*14.070 is generally in use for PSK31. Consider operating CW *below* this frequency.

How do stations identify when third parties are involved?

When an international third party contact is made, both the call signs, that of the US station and the foreign station, must be exchanged at the end of the contact [97.115(c)]. There are two possibilities for station identification. If the station operator holds a lower class license than the control operator the call of the control operator follows the call of the operator [97.119(e)]. If the station licensee gives permission for his or her call to be used, that single call and frequency privileges can be used exclusively, provided that a control operator is present [97.119(a)]. However, a club call sign does not have assigned frequency privileges. Unless a control operator is present, each ham may only use the frequencies allotted to his license.

The published frequencies are a starting point. During JOTA you will find Scout contacts all over the band. It is important that you listen to the frequency before you begin calling CQ or sending a signal. Remember that a single group cannot own a particular ham radio frequency. The Worldwide Scout frequencies listed are not specific to the USA. Consequently, a mode that we would expect to find on a particular frequency in the US may not be on the same frequency in another country.

Surveying the JOTA Scene

You can register your JOTA event at **www.arrl.org/FandES/ead/youthskeds/**. Some Scout troops are very small or may want to check out JOTA before setting up one of their own. Registering will help them locate the closest JOTA event.

Whether this is your first JOTA or your 10th, please complete the simple survey at **www.arrl.org/FandES/ead/jotalog/** after JOTA. Completing this form will help ARRL monitor the growth and identify the needs of this activity. Last year we received twice as many surveys as the year before, representing 44 states. We did not receive surveys from Arizona, Hawaii, Idaho, Mississippi, Utah or Wyoming, and so we have no way to verify that there was JOTA activity from those states.

For some clubs, October 18-19, 2003 means big plans, lots of Scouts, radios, antennas, modes, contacts and teaching a merit badge. For others, JOTA means simply getting a few Scouts together to talk on the radio. I don't think the number of Scouts or contacts made is an accurate measure of JOTA success. Perhaps a better gauge is the answer to a simple question: How much curiosity has been stirred up in the Scouts?

Jean Wolfgang, WB3IOS, is ARRL Educational Programs Coordinator. She can be reached at **jwolfgang@arrl.org** *or 860-594-0219.*

By Steve Ewald, WV1X

2003 Simulated Emergency Test

What role will you play this October 4-5?

In a sense, the very first Basis and Purpose for the Amateur Radio Service in the FCC Rules and Regulations—97.1 (a)—provides a mission statement:

"Recognition and enhancement of the value of the amateur service to the public as voluntary noncommercial communications service, particularly with respect to providing emergency communications."

An important annual event to assist in supporting this Basis and Purpose is coming October 4 and 5, 2003. It's the ARRL Simulated Emergency Test (SET), and it's designed to test Amateur Radio emergency-operating skills and procedures and to check the readiness of emergency equipment and antennas. If an emergency were to occur in your vicinity, how would you respond? What role would you play in a communications emergency?

Field Organization Ready to Help

The ARRL Field Organization Leaders and many volunteers who are active in public service and emergency communications are busy preparing the framework for this year's SETs. Groups, such as the Amateur Radio Emergency Service, the National Traffic System (NTS), the Radio Amateur Emergency Service (RACES), and other members of the ARRL Field Organization like Net Managers (NMs), Emergency Coordinators (ECs), District Emergency Coordinators (DECs) and Section Emergency Coordinators (SECs) all play a leadership role.

To find out what's going on in your area, contact one of these officials. More information may be obtained by logging onto your ARRL Section's Web page at **www.arrl.org/sections**. This will lead you to a listing of your Section Leaders and pertinent news and links. See page 16 of *QST* for a listing of all ARRL Section Managers.

BRIAN HOULAHAN

One tornado near Monett, Missouri, during the severe weather outbreak this past spring.

Community Involvement

The SET is a great chance to showcase the capabilities of Amateur Radio and to improve them when necessary. It's also an opportunity to work and practice with community and public service agency officials to learn what their communication needs may be before an emergency strikes.

The ARRL has national Statements and Memoranda of Understandings with several organizations such as American National Red Cross, Salvation Army, the National Weather Service, National Communications System, and Association of Public Safety Communication Officials—International. This past June, the League also signed a Statement of Affiliation with the Department of Homeland Security.

Your local SET might involve the local branch or chapter of any of these national agencies. In consideration of local schedules of these agencies and others, ARRL Field Organization Leaders may wish to conduct the local or sectionwide SET on another weekend in the Fall. Specific SET guidelines and reporting forms for these Field Leaders will be forthcoming and will also be posted on the ARRLWeb at **www.arrl.org/FandES/field/forms/**.

Additions/Corrections to 2002 SET Results

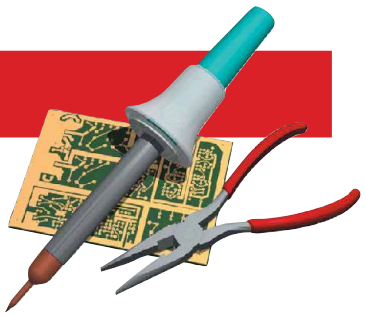
Please note the following additions and corrections to the 2002 SET Results that appeared in the July 2003 issue of *QST*.

Area	*Reporter*	*Score*
ARES Activity		
North Carolina		
Carteret Co	W9EF	269
North Texas		
Wichita Co	W5GPO	1150
Oregon		
Oregon District 3	N7ZHG	158
Sacramento Valley		
Siskiyou/Modoc Co	K6SOJ	157
Santa Clara Valley		
Monterey Co	W6FDO	262
South Texas		
NW Harris Co	KK5CA	190
Western Pennsylvania		
Blair Co	KA3EJV	221
Net Activity		
North Carolina		
Carteret Co	W9EF	129
Oregon		
UMERSO Net	N7ZHG	42
Western Pennsylvania		
Blair Co	KA3EJV	176

Revised 2002 SET Top Ten

In consideration of the additions/corrections to the 2002 SET Results, here is a revised Top Ten list of sections in the 2002 SET.

Section	*Points*
ARES Activity	
Michigan	4937
North Carolina	4266
Western New York	2696
Ohio	2180
North Texas	2106
Western Pennsylvania	1952
Oregon	1895
New Hampshire	1628
Illinois	1411
Mississippi	1400
Section/Local Nets	
North Carolina	3279
Connecticut	1770
Michigan	1577
Western New York	1230
Ohio	749
Western Pennsylvania	835
Oregon	575
Orange	522
New Hampshire	521
Eastern New York	420



The Doctor is IN

Q From Jack, W1TEC, comes this: I had always thought that the ARRL had a policy of not allowing antenna gain values to be published as part of advertisements published in *QST*. In a full page ad on page 8 of the July 2003 issue there are free-space gain values given in dBi for each band. Is this a change in policy I have missed, or, since they specify gain in dBi, is that acceptable?

A That advertiser was kind enough to provide the information needed for the ARRL Lab to employ computer antenna modeling techniques to verify the gain figures claimed in that ad. This is in accordance with the ARRL's advertisement acceptance policy. Several other antenna manufacturers have also met this requirement. For the complete text of our Advertising Acceptance Policy (AAP) and for further information on how it is applied in the case of antenna gain figures, please see AAP (**www.arrl.org/ads/#policy**) and "Antenna Ads in ARRL Publications" (**www.arrl.org/ads/antenna**). It is worthwhile to quote a portion from these: "…at least one fundamental property *must* be shown if *any* performance claims are made—the gain in free space at a specified frequency. This must always be shown referenced to a free-space isotropic antenna, meaning that gain must be shown in dBi. If the advertiser wishes to show, in addition, the gain with reference to a half-wave dipole in free space, he can do so by showing both dBi and dBd…"

Of course, the advertiser is free to, and encouraged to, provide more than this basic data to enable a member to make an intelligent decision on a purchase. Performance claims must be verifiable by accepted modeling software or by actual measurement on a certified antenna test range. That test range must meet EIA standard RS-329, Part 1. In lieu of RS-329 certified results, the advertiser may advertise performance figures derived from specific antenna modeling programs and all advertising performance claims derived from antenna modeling must indicate that they are calculated.

Q Here's a question from John, KE4QK: Most previous ham radio-computer interfaces address the incompatibility of TTL (+5 V) radio serial ports with computer serial ports (–9 V) as a problem (see *The ARRL Handbook*, 1995 edition, p 22.11). I have seen several such items use the printer parallel port (LPT1) rather than the serial port for connections between the radio transceiver and the computer. Does this circumvent the problem?

A Yes, the printer port is TTL level compatible. A lot of software for communications, however, is written around the serial port because it gives the program more control capability (if desired, although some serial port software doesn't need it). Also, it is sometimes nice to be able to use both ports at the same time. Some contest logging software makes use of the parallel printer port for CW keying while the serial port is used for transceiver control.

Q Roy Burris, N4NYJ, writes the following: My cousin wants to have a working computer; the big problem is that something is causing the lights in her house to flicker too often. About 2½ months ago, she was using her computer when the house lights started to flicker more than she had ever seen them do before. The computer and the monitor both went dead and neither has worked since. Do you have any idea how the voltage from the wall outlet to her outlet strip could be stabilized, so her computer or monitor would not be affected?

A My primary concern would be an intermittency within the house wiring. One of several failure modes can occur. Should the connection to the neutral wire be compromised at the service entrance, voltages on a 115 V ac circuit can rise to dangerous levels, as the 230 V ac service input is intermittently applied across two load branches on either side of the neutral, which now may not be connected to ground and/or to the center tap of the service transformer. In older services, a local ground may not be present and the only ground wire is the neutral connection, which is usually grounded at the service entrance. These intermittent conditions can damage appliances such as a computer, but more importantly, they can present a potentially serious shock hazard. One telltale symptom occurs when the lights flicker—they can actually get brighter (rather than dimmer) than their normal "on-state." My suggestion would be to have the house wiring checked by a licensed electrician as soon as possible. *Do not*, unless you are qualified to do so, get into the sub-panel service entrance…those voltages can be lethal and are always "hot."

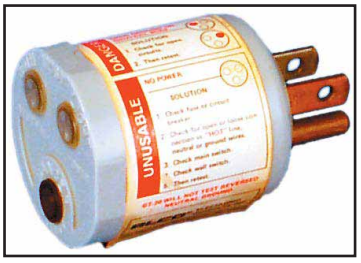


Figure 1—A simple electrical outlet tester can identify many local ac wiring problems.

A good idea would be to purchase an electrical outlet checker and polarity tester, as shown in Figure 1. These can be obtained at most electrical or building supply houses for a few dollars. They will warn you about crossed neutral-ground connections, switched hot-grounds, open neutrals and grounds and other local service wiring problems.

As far as protection for computer gear is concerned, try an ac line transient suppressor, otherwise known as a "surge suppressor." It can protect the equipment from excessive "spike" voltages on the ac line, but will do nothing for the intermittent house wiring we spoke about. Nor will it protect against low line voltages (so-called "brownouts"). The Doctor also needs to caution you about using light-duty computer "surge suppressors" with high current amateur transmitters. These devices are frequently not robust enough to handle the ac current demands of higher power amateur gear and may be built with poorly constructed ac outlets designed for relatively low current loads. Look

for one that has at least a 15 A load rating.

An excellent stabilization technique for computer equipment (and amateur equipment, for that matter, if the rating is high enough) is an Uninterruptible Power Supply or UPS. These will produce an ac output voltage of the correct (115 V_{rms} ac) level, regardless of input line level fluctuations. They are usually designed as "zero-crossing" devices, which means they switch on at the input sine wave polarity transition and there's no output voltage turn-on "glitch" (thus the term "uninterruptible"). Good ones produce a sine-wave or a near sine-wave output waveform synchronized to the ac line frequency and they generally have transient suppression built in. Figure 2 shows a high quality UPS. Try to stay away from those that generate a modified square wave output and test any prospective UPS candidate for RFI susceptibility. Some of these can be affected by RF energy from nearby transmitters and antennas. Good luck!

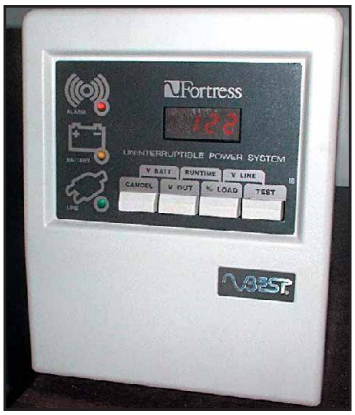


Figure 2—An Uninterruptible Power Supply (UPS) can correct for many line voltage level changes, spikes, line transients and outages. The better ones produce a sine waveform.

Q Ralph, W6DV, poses the following: I know a lot of chips aren't made any more, but it amazes me that they seem to have no history, either. I have searched the Web for the following:

SN72747, Texas Instruments, 10 pin can

SN75138, Texas Instruments, 18 pin DIP

SD12386, National, 14 pin DIP

I'm hoping you can find me a source of data on these. I have many of the 72747s and am hoping they are good for something. Can you direct me to something, hopefully on the Web, that I can read and copy?

A I'll try to answer your question as best as I can, Ralph, but information on older ICs is not easy to come by. I'd guess that the 747s are TI's equivalent of the Fairchild μA 747, a popular dual operational amplifier. If you have a lot of them, it might be worthwhile to put one in a test circuit and see if it works.

The SN75138 appears to be a quad TTL data transceiver, and you can find a data sheet at **www.scanti.ru/docs/datasheets/slls079b.pdf**. I typed SN75138 into my Web search engine and it came up with several sources.

I don't recognize the National chip. One possibility is that the number is a special proprietary house number. Semiconductor house numbers are fairly common and are not easily deciphered. They are often assigned to custom circuits made for a particular customer. *The Art of Electronics* by Horowitz and Hill, has a useful guide on deciphering part numbers. Look at Appendix J of the first edition and good luck!

Q A note from Bill Turini, KA4GAV, asks: How important is the impedance match between your radio and your headphones? I know that, with RF, impedance is very important for power transfer, but is a direct impedance match necessary for headphones? I noticed that when I use headphones of higher than 8 Ω impedance the only noticeable change is in volume. Can other changes occur, such as distortion, sensitivity and damage to the audio output circuitry?

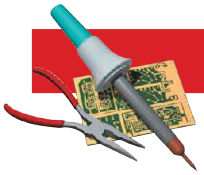
A In conventional amateur equipment headphone, impedance matching is not normally of concern. There's enough audio output power available to drive any reasonable load impedance at ample volume levels and, as long as the level doesn't approach clipping, distortion won't be a problem. Most equipment includes a current limiting resistor in series with the headphone jack to preclude damage to both the audio output circuitry of the equipment and the attached output device.

Headphone impedance is important, however, if the output device can't source very much audio output current like an RF field strength meter, a grid-dip oscillator or a crystal set. In that situation, the higher the impedance the better, as you'd want to minimize the current drawn by the headphones. So-called "high-sensitivity" headphones with impedances in the range of 2000 to 10,000 Ω are typically used with the devices mentioned. They are called high-sensitivity because they require very little current to produce a given audio sound pressure level in dB. Recall that $P=I^2R$ (W), so the higher the R or Z, the greater the output power for a given current. Headphones in the low to mid impedance range (8 to 600 Ω) are commonly available for use with modern day amateur equipment, although high impedance headphones can be used, too. Notice that I said "modern day" equipment. Amateurs of the teens and early 1920s used crystal detectors and battery power for their receivers, and their headphones (Baldwin, Brandes and Trimm were some of those early manufacturers) had to be of the "high-sensitivity" and high impedance type. A pair of high impedance, high sensitivity headphones is shown in Figure 3.

Figure 3—An older pair of high impedance headphones (Baldwin). These are also known as "high-sensitivity" types.

There is another factor to be considered when using headphones. The impedance level is generally indicative of the frequency response of the headphones. Generally, low impedance headphones have a wide, "high-fidelity" type response whereas high impedance headphones tend to have a communications type, narrow response. That may be something to consider, especially if you're using them for CW, as the narrow response would be better suited to noise cancellation. Also, remember that a low impedance output circuit, as found on most modern amateur gear, will support both low and high impedance headphones, but the converse is not true. A high impedance output circuit will not be capable of driving low impedance headphones. As you can see (or hear), there's more to headphones than meets the ear!

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



By Bob Kopski, K3NHI

An Easier Way to Build PC Board Enclosures

Can't find a chassis or cabinet for your latest project? K3NHI shows you how to build effective and attractive enclosures…easily, inexpensively and quickly.

Homebrewers often use single and double-sided printed circuit (PC) board stock as raw material from which to build custom electronic enclosures. It is readily available, not too expensive and fairly easy to work. Popular base materials include phenolic or the stronger G-10 glass epoxy material. This approach is especially popular for RF circuit enclosures where a leak-free enclosure is desired. One classic example is the step attenuator project in some earlier editions of *The ARRL Handbook* (1992 edition, p 25-38).

As easy as it is to do, there are some aspects of working PC material that can be challenging. For example, while the material can be cut with a stationary sheet metal sheer, few of us have access to one. A hacksaw or coping saw can do the job, but it's more difficult to get a quality edge cut straight. Also, uniformly cut pieces of identical size, such as desired for box sides and partitions, require considerable measuring and cutting care. I decided there had to be a way to ease these tasks, and I set about to find one.

Simple Wood Fixtures and Other Tools

After some thought and trial and error, it seemed clear that only a few very simple tools were needed to do a really good job. Figure 1 shows it all. The items needed include two simple wooden fixtures, some straight edge metal pieces and a hobby knife. Not shown is some sandpaper for final touches on the cut edges.

The first wood fixture needed is a "cutting jig." Mine is simply a piece of white pine about $4\frac{1}{2}$ inches wide and 1 foot long. The exact dimensions are not critical but the wood should be warp free. I glued an equal length of $\frac{1}{4}\times\frac{3}{4}$ inch pine trim material along one edge, forming a full length "dog." This becomes a simple resting edge during material cutting and it must be a straight piece. The fixture itself can be seen in Figure 2 and the technique for scoring the work is shown in Figure 3.

I call the second fixture the "break tool." Mine consists of two pieces of 1×2×12 inch maple stock separated but fixed to each other at the ends by $\frac{1}{16}$ inch thick double-sided foam tape. My break tool began life in the local hardware store as a 1×2×24 inch piece of quality maple, which I selected for

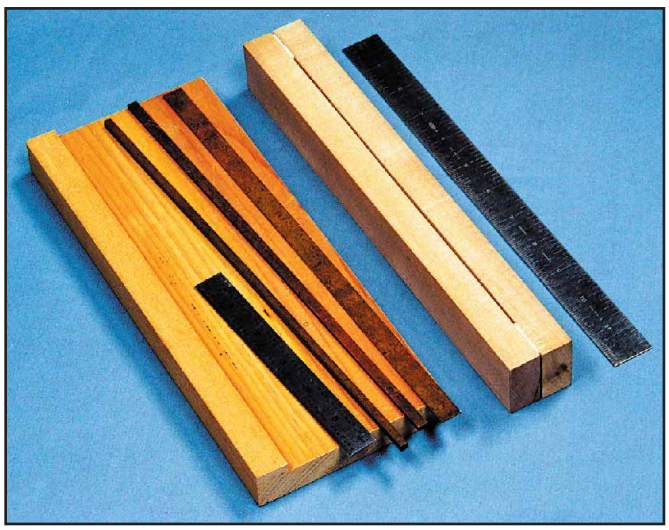


Figure 1—These are some of the simple fixture parts needed to build functional, good looking enclosures from printed-circuit material. A few dollars' worth of wood and metal are all that are needed.

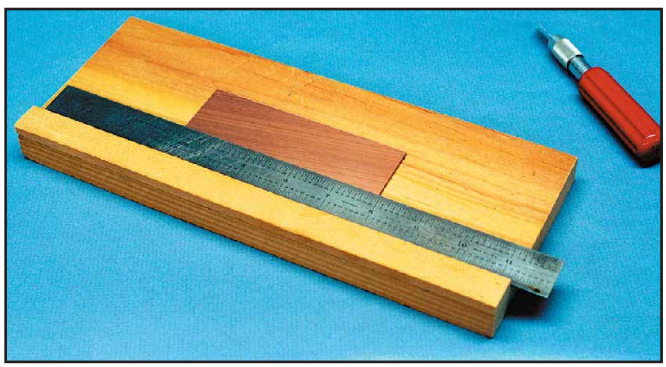


Figure 2—Ready to score a $\frac{7}{8}$ inch wide printed circuit strip. Here a metal scale gauges the width; the simple cutting jig assures accurate, uniform dimensions piece to piece.

Figure 3—Keep everything snugly in place and against fixture dog, keep fingertips in back of the gauge edge, then score the material several times on both sides with a hobby knife.

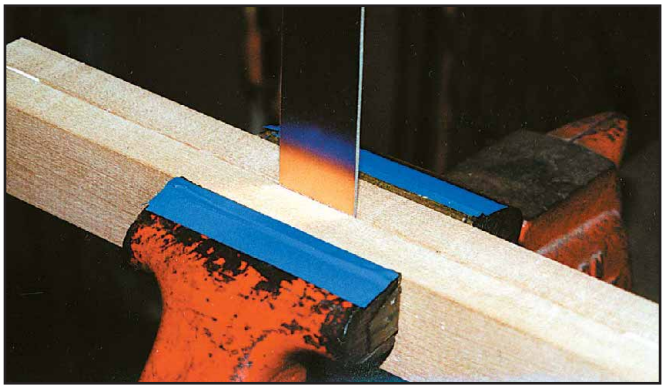


Figure 4—Scored piece of printed-circuit board material held in 1/16 inch break fixture slot. Phenolic based board snaps right off with a little push; G-10 type material requires some back and forth "push-pull" motion.

straightness and then cut in half. It cost less than $2 and can be seen in Figure 4.

It's important to use a hard wood for the break tool (not pine). While I chose maple, I think birch or oak would do the job just as well. It's also important when taping the pieces together to make sure they are exactly even along the long edges. Choose a good quality double-stick foam tape similar to the 3-M brand—easy to get in most hardware and variety stores. One-sixteenth thick tape is just the right size to work 1/16 inch PC board material.

Cutting Gauges

Begin your project by knowing what it is you want to assemble and the dimensions of the PC board pieces needed to do it. It helps to have a dimensioned sketch. It's also best to choose dimensions that equal readily available metal straight edges like those shown.

Examples of the latter include metal drafting scales, which are readily available in a variety of widths and lengths. An even larger variety of metal straight edge material can be found in hobby and craft stores. These stores usually have a "Metal Center" display stand holding many different brass sheet strips and rectangular sections. If the exact width you seek is not available, simply "parallel" narrower pieces and "build up" to the desired dimension. For example, a 1/8 inch square tube and a 1/2 inch wide flat strip "add up" to a width of 5/8 inch. These chosen strips become "cutting gauges"; this will become clearer later.

Cutting and Tools

I have used a variety of hobby knives for this task, although I tend to favor the huskier types like the one shown in Figures 2 and 3. Whatever your choice, be sure to have some spare blades on hand. "Box cutters" with snap-off blades may be a good choice too, although I've not tried these.

Now the fun part begins. Since most enclosures have all sides and may have internal partitions that require the same width material, it makes sense to cut lengths of this particular width first. Simply place the PC board material on the cutting jig snugly against the dog, lay the selected metal gauge on top of the work and against the dog, and draw the knife along the gauge edge scoring the board material several times. Flip the work over, and do the same thing on the other side.

It's important to cut completely through the copper, and to have at least some scoring of the base material on both sides of the PC board. Some extra slices are recommended for material like G-10, since this is a bit tougher to work with. Notice that using the width gauge ensures that the score marks on both sides of the work are located exactly opposite each other.

Now insert the scored board material in the break tool. It should slide in snugly between the two wood pieces. Locate the score marks exactly at the edges of the wood rails, and snug the whole works in a bench vise as shown in Figure 4.

At this point all you need do is push on the material outside the wood rails and snap—off comes the exposed piece of board. Depending on the size of the work, you may want to use a spare piece of wood as a "push piece" to get uniform pressure along the work edge. Also, that "snap" is actually the case for phenolic based PC material. Tough stuff like G-10 will break less dramatically and usually needs some "back and forth" push and pull on the exposed piece. Both materials will come apart with nice straight edges with only a little sanding needed to de-burr and smooth the final edges. I prefer to use a sanding block—sandpaper tacked to a wood block—to get the best edges. This method allows repeatable, accurate widths to be cut and requires only a little care in the overall task to achieve.

Cutting the resulting PC strips to length is done in much the same way. Place the just-cut strips in end-to-dog fashion, lay in place a gauge of width equal to the desired finished piece length and score both sides of the work as described above. Depending on the exact dimensions of all involved, it may be helpful to use a small drafting triangle to ensure squareness. Just place one edge of the triangle against the dog, nest the PC strip against both the dog and the other triangle edge, and then place the gauge. Here again, similarly cut PC pieces come out uniformly dimensioned—very nice when it comes to accurate, good looking final box assembly. The enclosure top and bottoms are handled the same way.

While obvious, I want to include this advisory anyway: Hold everything snugly while doing the scoring—no slipping allowed. *Be absolutely sure* your fingertips do not overhang the gauge edge! (Guess how I found out that this is a good idea?)

Figure 5 shows an additional trick for achieving accurate box assembly. Using the cutting jig and an additional small, squarely cut wood block, place the enclosure base plate against the dog

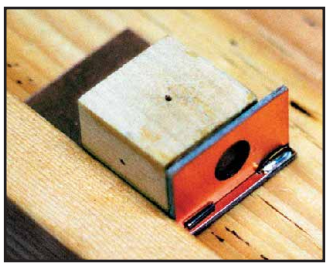


Figure 5—Use one hand to hold the printed circuit board pieces and small wood block in the cutting jig. Two 1/4 inch lengths of solder are strategically placed at the board intersection. Use the other hand to bring an iron in and tack the pieces together.

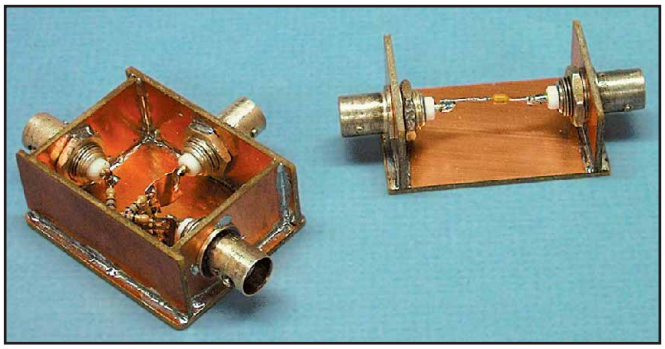


Figure 6—Two examples of simple printed circuit board structures made as described herein. The temporarily uncovered box is a 50 Ω power splitter. The "U" shaped assembly is a component test jig.

and put the small block on top also against the dog. Place a PC board sidepiece on the previously marked board material base against both the dog and the block. Adjust all for proper relative position and hold firmly. Using tweezers or similar, drop some precut 1/4 inch lengths of solder right at the interface edge of the PC board pieces. Now bring to bear a suitable iron to spot solder or "tack" the pieces. (Yes, it requires only two hands!) When this cools, the work can be separated from the wood tooling and the corner soldering completed. [It should be easy to "drag" a bead of solder (while feeding solder) along the joint with the soldering iron tip when the work temperature is proper. Allow a sufficient, but not excessive, time for heating. It's a good idea to use flux remover to clean the joint after soldering. As with anything else, "practice makes perfect" and the technique is easily learned. The editor has built many enclosures this way and can say that it works well!—*Ed.*]

While these procedures may seem intrinsically simple, intuitive and inexpensive, you'll get better results with a little practice. I suggest trying this on some PC scraps before you undertake a "real" project. Of course, all the normal advisories and precautions apply. For example, I like to drill any holes in the pieces before assembling them. Also, shiny and clean copper solders a whole lot better than any other kind. Similarly, a clean and tinned, proper temperature, adequate mass soldering tip makes the solder seams look truly professional. Two examples of finished enclosures can be seen in Figure 6. Happy box building!

All photos were taken by the author.

Bob Kopski, K3NHI, has been licensed since 1959. Having a strong interest in aeromodeling and electronics, he has homebrewed extensively in the radio control field and flies R/C aircraft routinely on 6 meters. He has also operated both fixed and mobile on that band. Bob writes at length on the R/C modeling field for a model aviation magazine and his modeling and R/C interests date back to the early 1950s with a specialty in electrically powered R/C models. He has published many articles covering model aircraft design and electronics. Bob is the author of "An Advanced VHF Wattmeter," which appeared in the May/June 2002 issue of QEX. *He's a retired senior design engineer and has BSEE and BSEP degrees from Lehigh University. You can reach him at 25 W End Dr, Lancaster, PA 19446.*

NEW PRODUCTS

I-MATE MICROPHONE INTERFACE FOR ICOM TRANSCEIVERS

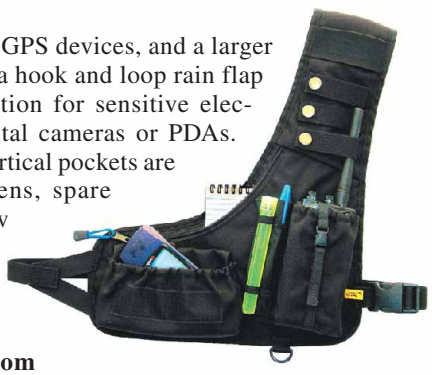
◊ Designed for operators who work contests, chase DX or frequently have the need to transmit prerecorded messages, I-MATE has been released for the IC-756PROII and IC-746PRO transceivers. The I-MATE accommodates both ICOM and Heil microphones and has a jack for inserting digital audio into the MIC input of the transceivers.

I-MATE is designed and manufactured by Gerry Smith, W6TER, and Jim Van Putten, W8QT, of The Better RF Company. I-MATE is priced at $74.95 plus $5 s/h ($10 foreign). For more information, see **www.betterRF.com** or contact **w6ter@betterRF.com**.

CUTTING EDGE ENTERPRISES GEARHARNESS

◊ Cutting Edge Enterprises has recently added the PowerPort GearHarness to its line of radio packs, pouches and travel cases. The GearHarness is constructed of medium weight, lightly padded nylon, and features a mesh backing that allows air to circulate between your body and the harness.

There are three main pockets. Two are designed to fit handheld-sized radios or GPS devices, and a larger horizontal pocket sports a hook and loop rain flap that offers added protection for sensitive electronic gear, such as digital cameras or PDAs. Two additional narrow vertical pockets are intended for holding pens, spare antennas or even glow sticks for night work.



Price: $36.95 plus shipping and handling. For further details, visit **www.powerportstore.com** or contact Cutting Edge Enterprises, 130 Anacapa Cir, San Luis Obispo, CA 93405; tel/fax 800-206-0115; **orders@powerportstore.com**.

3-DIMENSIONAL FOLDED LOOP ANTENNAS FROM NANTENNA

◊ Designed to enhance the performance of handheld 2 meter radios, the 3-DFL is a full one-wavelength loop folded in three dimensions. This ground-independent, vertically polarized antenna is omnidirectional and covers the entire 2 meter band. At 9×9×17 inches, this antenna is designed with portability in mind.

Price: $39.95. Contact Nantenna LLC, PO Box 141, 3313 W Cherry Ln, Meridian, ID 83642: tel 208-898-3410; **www.nantenna.com**.

Experiment #8—The Linear Regulator

Voltage regulators provide stable power for sensitive electronic circuits. In our final power supply experiment, we combine our experience with transistor amplifiers, op-amps and Zener diodes into a linear voltage regulator.

Terms to Learn

- *Linear*—a circuit in which the current and voltage can take on any value within a continuous range
- *Regulate*—to control a voltage or current such that it matches an established level
- *Setpoint*—the desired level at which the regulator output is to be maintained
- *Pass transistor*—the transistor in a regulator circuit through which current flows to the output circuit

The Linear Regulator

Figure 1A shows the block diagram of a *pass-type* voltage regulator. The *control element* is the decision-maker. It compares the output with its *setpoint* and varies the *control signal* to the *pass element* so that the output matches the setpoint. A simple example is squirting water from a hose with your thumb. The setpoint is where your eyes tell you the water is supposed to go. Your thumb is the pass element and your brain is the control element, constantly monitoring where your eyes say the water is actually going.

The control element in a linear regulator is a high-gain amplifier with one input connected to the setpoint and the other to the output. Any imbalance results in a strong response at the amplifier's output that causes the pass element to restore the output to the expected value. In our experiment, the control element will be an op-amp with the setpoint provided by a Zener diode. Figure 1B shows the complete circuit.

We can break this circuit down into three familiar parts—a Zener diode reference, an amplifier and an op-amp. The Zener diode that supplies the setpoint is the same one that we used in experiment #6 with an extra 0.1 µF capacitor to filter high-frequency noise. The pass transistor circuit is just an emitter-follower (EF) amplifier (Experiment #2) turned on its side! The EF's input is the control signal and its output is the load current. It is the job of the op-amp to supply enough base current (I_b) to the pass transistor so that its emitter current (I_e) can drive the load to the desired voltage, balancing the output and setpoint voltages at its inputs.

Testing the Linear Regulator

- The object is to design a fixed-voltage regulator that supplies 10 mA to a 470 Ω load at 5.1 V dc.
- Using Experiment #6's Zener (1N4733A) circuit and assuming that the load current going into the op-amp is very small, we can use the same 330 Ω resistor for R_z to supply current to D_z, which then supplies a 5.1 V dc setpoint.
- How much base current is needed for the transistor to drive the load?

$$I_e = I_b (\beta+1), \text{ so } I_b = I_e / (\beta+1) \qquad \text{[Eq 1]}$$

The 2N4401 transistor's data sheet shows that its minimum dc current gain (β or h_{FE}) is 80 for an emitter current of 10 mA. That means I_b must be 125 µA or more to drive the transistor hard enough to allow I_e to reach 10 mA. This is well within the op-amp's capability.

- Take particular care to connect the op-amp's inverting (–) and noninverting (+) terminals correctly.
- Supply 12 V dc to the regulator's input—the Zener diode and output voltages should be almost identical and close to 5.1 V dc. The output of the op-amp should be about 0.7 V greater than the load voltage. How much power is the transistor dissipating?

$$P = I_e \times (V_{in} - V_{load}) \text{ and } I_e = V_{load} / 470\ \Omega$$

- Vary the input voltage up and down by 3 V. What is the effect on load voltage? How low can the input go before the output voltage drops?

Variable Regulators

In many cases a variable output voltage is needed. Figure 2 shows two types of variable regulators that use a single

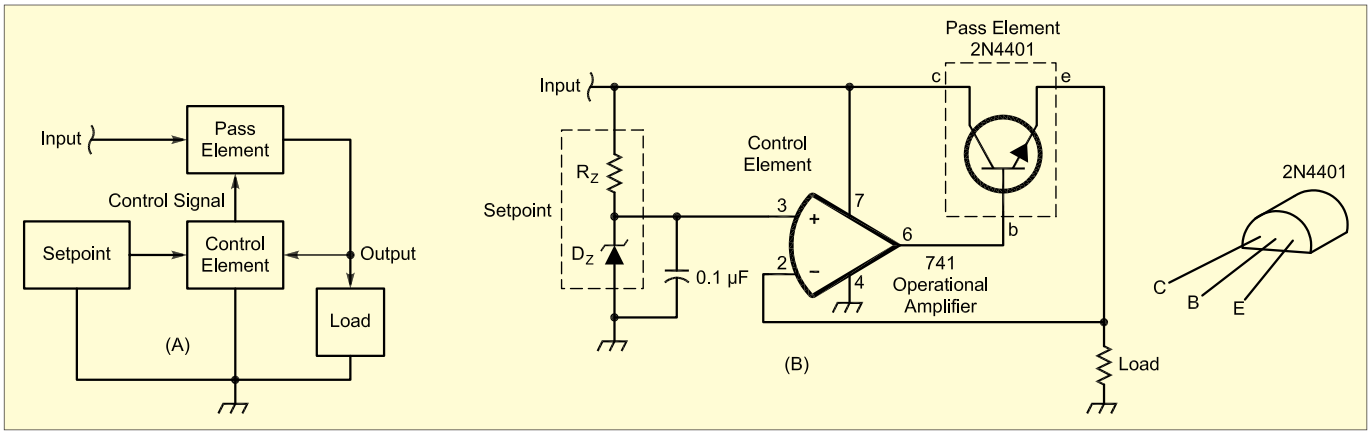


Figure 1—A: The block diagram for a pass regulator. B: The pass regulator implemented with actual components.

H. Ward Silver, NØAX ♦ 22916 107th Ave SW, Vashon, WA 98070 ♦ n0ax@arrl.org

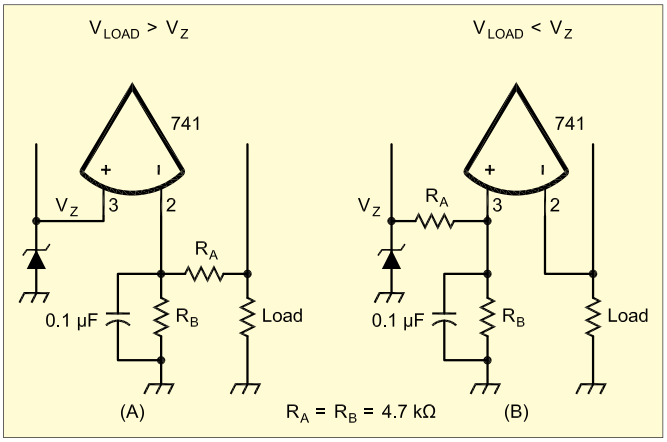


Figure 2—A: The voltage divider of R_A and R_B causes the op-amp to drive the pass transistor so that the load voltage is higher than the Zener voltage, V_Z. B: Performing the same trick for load voltages lower than V_Z.

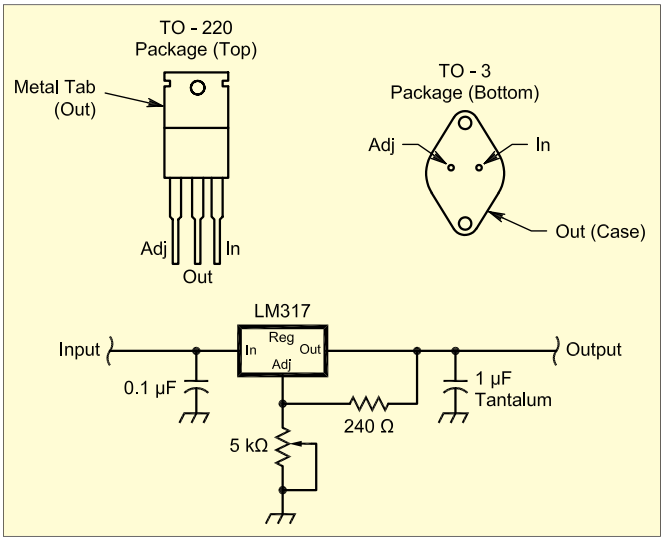


Figure 3—The LM317 adjustable three-terminal regulator is very versatile and rugged. The capacitors are required to ensure that the regulator's internal amplifiers remain stable under all conditions. The 240 Ω resistor limits the current through the 5 kΩ potentiometer. This regulator has an adjustable output from 1.2 V to a maximum that is about 3 V lower than the input voltage.

reference Zener diode. The 0.1 µF capacitors remove high-frequency noise from the control voltages.

To regulate at load voltages greater than that of the Zener diode, a resistive voltage divider reduces the load voltage so that a fraction of the actual load voltage is supplied to the op-amp's inverting (–) terminal in Figure 2A.

$$V- = V_{load} (R_B / [R_A + R_B])$$

In order to balance its input voltages, the op-amp must drive the transistor until the load voltage is greater than the setpoint by the inverse of this fraction.

$$V_{load} = V_Z ([R_A + R_B] / R_B) \quad [Eq\ 2]$$

To obtain load voltages less than the Zener's voltage, use the circuit of Figure 2B. The voltage divider to reduces the Zener voltage, causing the setpoint to be reduced.

$$V_{load} = V_Z (R_B / [R_A + R_B]) \quad [Eq\ 3]$$

Testing a Variable Regulator

- Add two 4.7 kΩ resistors for R_A and R_B as shown in Figure 2A. The output voltage should change to nearly 10.2 V dc and the op-amp's output to around 10.9 V dc.
- Move the 4.7 kΩ resistors to divide the Zener voltage as in Figure 2B. Now the output voltage should be about 2.5 V dc and the op-amp's output about 3.2 V dc.
- Create an adjustable output regulator by replacing the two 4.7 kΩ resistors with a 10 kΩ potentiometer. Keep the 0.1 µF capacitor at the midpoint of the divider.

The Three-Terminal Regulator

There are many integrated regulators available for fixed and variable positive and negative voltages. These generally have three terminals—input, output and ground—thus creating the generic term "three-terminal regulator."

The most popular IC regulator family is the 78xx, where "xx" denotes the output voltage. A type 7805 delivers 5 V dc output, a 7812 supplies 12 V dc, and so on. The 79xx regulator series regulates negative voltages. The 78Lxx and 79Lxx are low-power regulators. There are also numerous adjustable integrated regulators, such as the LM317 shown in Figure 3. One of the earliest IC regulators was the Fairchild µA723; it's still in use. It's possible to regulate up to 10 A with an IC regulator (the TO-3 type LM396).

These packages have numerous useful features. The voltage drop from input to output can be up to 40 V dc. They can sense when they're getting too hot and shut themselves down. They're protected against short circuits. They have excellent regulation. You can see why they're so popular!

Two caveats, however. The regulators use high-gain amplifiers. These amplifiers can oscillate under some conditions and input and output capacitors are sometimes required, as shown in Figure 3. If overloaded, the regulators will temporarily shut themselves off until they cool, then turn back on. If the overload is persistent, this cycle can repeat as fast as tens of times per second. On a 'scope this appears as high-frequency "noise" from oscillation or a repeating "hiccup" as the chip switches between overheating and shutdown.

Try a 7805 or LM317 and learn how to use these valuable parts. Keep the current to 500 mA or less to avoid overheating the prototype board terminals.

Suggested Reading

Chapter 11 of *The ARRL Handbook* has a substantial discussion of power supply regulation. *The Art of Electronics*, by Horowitz and Hill, really shines, with page after page of Chapter 6 devoted to regulators and an excellent discussion of the 723 regulator IC.

Shopping List

- 2N4401 NPN transistor (RadioShack 276-2058)
- 470 Ω, 2 - 4.7 kΩ, 1 kΩ, 2.2 kΩ, 1/4 W resistors
- 10 kΩ potentiometer
- 2 – 0.1 µF, 50 V ceramic capacitors and a 1 µF, 35 V tantalum capacitor
- 741 op-amp (RadioShack 276-007)
- LM317 adjustable regulator (RadioShack 276-1778)

Next Month

Let's get back to basics next month with an experiment that shows how to design driver circuits for heavy loads.

This month brings a generous contribution from Steve Alpert, W1GGN. He constructed a spreadsheet that performs all the necessary calculations for the common emitter amplifier in our first experiment. It also includes a nifty lookup table for standard resistor values. It's available on the Hands-On Radio Web site: **www.arrl.org/tis/info/html/hands-on-radio/**.

Maldol HVU-8 Base-Station Antenna

By Steve Ford, WB8IMY
QST Editor

The Maldol HVU-8 is an unusual creature. It looks like a vertical ground-plane antenna, especially with its complement of radial elements at the base. The inductively loaded "radials" and "radiators" share a common feed line. Thanks to the element design and configuration, the result is an antenna that boasts the ability to operate on 80, 40, 20, 15, 10, 6 and 2 meters, as well as 70 cm, without taking up a great deal of real estate. The HVU-8 is about 9 feet tall and its width from tip to tip of the longest radiators is approximately 5 feet. It is rated at 150 W continuous power.

The challenge with a limited-space antenna of this type is to incorporate multiband operation without grossly sacrificing efficiency. The HVU-8 attempts to wring as much efficiency as it can from its design by making the 2:1 SWR bandwidths quite narrow. On 80 through 6 meters, the specified bandwidths are:

3.5 MHz	± 11 kHz
7 MHz	± 25 kHz
14 MHz	± 26 kHz
21 MHz	± 67 kHz
28 MHz	± 130 kHz
50 MHz	± 660 kHz

On 80 and 40 meters, the HVU-8 covers only 3.5 to 3.575 and 7 to 7.10 MHz, respectively. If you plan to use the HVU-8 on these bands, plan to operate CW or digital.

Although the HVU-8 is advertised as a "base-station" antenna, you can also use it in temporary applications. For this review, I set up an HVU-8 in a portable tripod mount.

Installation and Tuning

You begin the installation by clamping a short support pipe to the mast. The main body of the HVU-8 fits into this support pipe and is held in place with several screws. Next, you screw on the various elements to either the top or bottom of the main body as instructed. I'd strongly recommend eye protection during installation. Total assembly time in my test was 15 minutes.

I approached the tuning phase with some trepidation. The HVU-8 instructions warn you to be patient, which is like a doctor telling you, "This may sting a little." I used an antenna analyzer to tune the HVU-8 and that turned out to be a wise decision. The analyzer allowed me to easily sweep through the bands and determine where the antenna was resonant. If you don't own an antenna analyzer, buy one, pester your club into buying one or chip in with some ham friends and purchase one to share. You don't need an analyzer to tune the HVU-8, but it makes the process *much* easier.

When I did my first sweep through the bands, I was surprised to find that the HVU-8 was resonant either within the bands, or just outside. With the help of analyzer, it took about 30 minutes to tweak the antenna. This involved loosening Allen-head screws that held the radial and radiator whips in place, moving the whips ever so slightly and then tightening the nuts once again. Part of the time was also consumed by having to climb a stepladder to reach the upper elements, move the ladder, take measurements, replace the ladder and so on.

The Maldol HVU-8 in a temporary test installation.

This could be a serious hassle if you install the HVU-8 on a pitched roof.

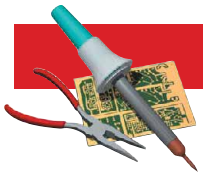
How Well Did It Work?

A number of contacts revealed that the HVU-8 performed essentially like a mobile antenna. As you'd expect, performance was mediocre on 80 and 40 meters and improved as I moved to higher bands. On 15 through 6 meters, it was comparable to a low wire dipole. Two meter and 70-cm performance seemed to be similar to a ground plane or J-pole.

The strength of the HVU-8 is that it offers multiband capability to hams with very little room to erect antennas. The weaknesses are its limited bandwidths and difficult tuning, but that's the trade-off for preserving as much efficiency as possible.

Manufacturer: Hokushin Industry Company, Chiba City, Japan. Distributed in the US by NCG Companies, 1275 North Grove St, Anaheim, CA 92806; tel 714-630-4541. Available from various Amateur Radio dealers. Suggested list price $349.95.

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



HINTS & KINKS

KENWOOD TS-850 AUTOMATIC ANTENNA TUNER MODIFICATION

◊ I am one of many proud owners of a Kenwood TS-850SAT. I really believe that, for the money, it's one of the best rigs available for either casual or contest use. I also use a multiband "non-resonant" antenna: a 550-foot horizontal loop fed by 450-Ω ladder line with a remote balun at its lower end, then a short length of low-loss coax. The antenna works nicely on all bands, but it requires an antenna tuner. The TS-850SAT has an internal antenna tuner that is fast and has memories that enable it to quickly retune itself when the operator changes bands. Unfortunately, as designed, the internal antenna tuner is completely bypassed when the rig is in receiving mode. For me, this was enough of a drawback for me to purchase an external, manually operated antenna tuner, which would be inline for both transmit and receive. Anyone who has ever used a "hunk of wire" (non-resonant) antenna on a receiver knows that receiver performance is enhanced noticeably when a tuner is inserted to match the antenna. Sensitivity is increased, and front-end selectivity is improved with a tuner.

The external tuner served me well, but I soon grew tired of retuning when moving quickly up and down the bands during contests—particularly on the lower HF bands. If only the TS-850's internal autotuner worked on receive! After all, many of the newer rigs boast this seemingly simple feature.

Calls to Kenwood and Internet research unearthed no documented modifications for the TS-850's internal tuner. But one evening, while thumbing through my *QST* collection, I came upon an entry in the July 1994 "Hints and Kinks" column written by Dave DeCoons, KE2SL, which told how to perform a similar modification on the TS-850's little brother, the TS-450. Surely, given the basic design similarities between the '450 and the '850, this modification *must* be adaptable to my TS-850. After e-mail conversations with Clif Holland, KE2SL, of AVVid and Randy Starace of KK7TV Communications, and after careful examination of the TS-850's schematic and circuit boards, I came up with a relatively simple modification that puts the internal tuner in line during both transmit *and* receive.

As designed by Kenwood, the internal automatic antenna tuner sits between the output of the Filter Unit (at the transmitter output) and the input of the antenna relay. The input to the '850 receiver is cabled directly to the antenna relay. There is no path from the antenna jack through the tuner and into the receiver.

The goal of this modification is to reposition the antenna tuner in the circuitry so that it is in-line while both transmitting *and* receiving. This feat is accomplished by placing the tuner between the antenna jack (the SO-239 on the back of the rig) and the antenna relay. Once you move the tuner from its original position, the connection from the output of the filter unit to the input of the antenna relay must be reestablished by replacing the jumper that makes this connection in the absence of the tuner.

A few cautions: First, do not perform this modification if you intend to work cross-band split with the antenna tuner inline. The antenna is tuned based on transmit frequency. Working cross-band, the antenna would not be correctly tuned on the receive frequency. Second, use a low-wattage soldering iron and exercise great care around sensitive components. Third, find or obtain the short coaxial jumper that is installed in the absence of the internal tuner. *Once you reposition the tuner, you cannot transmit without that jumper in place, even if you choose to bypass the tuner via the button on the front panel!* If you do not have this jumper, you can probably get it from Kenwood. The part number is E31-2088-05.

To perform this modification, first disconnect all power and other cables from the rig. Next, remove the top cover and locate the Filter Unit. There is a shield over the filter board. Remove the shield and set it aside with its screws.

Remove AT-1 and AT-2 cables from connectors CN2 and CN5 respectively. Do not unplug the cables from where they connect inside the tuner. Carefully label each so that they are connected properly in the steps below.

Replace the coaxial-cable jumper between CN2 and CN5. (This is the jumper that is installed in the absence of the automatic tuner, mentioned above. It jumpers the output of the Filter Unit to the input of the antenna-relay circuit.)

Unsolder jumper W3 that connects to the SO-239 on the back of the rig.

Cut off the small connectors on the ends of the AT-1 and AT-2 cables that you removed from CN2 and CN5. Prepare the ends of AT-1 and AT-2 so that you have about 1/4 inch or so of center conductor and braid available for the connections mentioned in the following steps.

Solder the center conductor of AT-2 (tuner output) to center of the antenna jack (SO-239) on the back of the rig. Be very careful not to burn any of the wiring.

Solder the center conductor of AT-1 (tuner input) to the end of the W3 jumper that you unsoldered from the SO-239 (above).

Solder the braids of AT-1 and AT-2 together and ground them to ground lug of the SO-239.

Make sure your connections are mechanically and electrically solid and that the connections you made are not touching any other existing connections on the board. Replace the cover of the filter unit, and re-assemble the radio.

The automatic tuner is now between the antenna port (SO-239) and the antenna relay. The THROUGH-AUTO switch still works K1 in the autotuner and still bypasses the tuner if desired. The replacement of the jumper between CN2 and CN5 sends the output of the filter unit to the antenna-relay circuit.

The repositioning of the tuner does not affect its ability to intelligently tune. In fact, when the radio is tuned to a frequency remembered by the tuner, you can hear the receiver sensitivity peak as the tuner automatically adjusts to the proper setting. This improvement in receiver performance is alsoheard when the TUNE button is depressed.—*Steve Scheinberg, W3SY, 4209 Madonna Rd, Jarrettsville, MD 21084;* **w3sy@arrl.net**

MOBILE AND PORTABLE LOGGING HINTS

A Custom Log

◊ I recently acquired one of those new MF/HF/VHF/UHF all-mode boxes. As a result, I have been doing a lot more portable and mobile operating lately. I have the rig, mic, key, tuner, antenna, battery and other accessories organized into a couple of packages so that everything is easy to grab when I suddenly decide that I want to get on the road or out in the field. The one shortcoming that I encountered was my station log. I was

Bob Schetgen, KU7G ♦ Senior Assistant Technical Editor ♦ h&k@arrl.org

Figure 1—The *ARRL Mini Log Book* (Order #7539, $4.95) is convenient for records of mobile/ portable contacts.

not willing to risk taking my *ARRL Log Book* with me, as it represents an irreplaceable record of station activity, QSLs sent and received, DXCC countries worked, Maidenhead grids contacted and so on. I usually ended up keeping mobile and portable log data on scraps of paper and transferring it to my permanent log later. This was a haphazard approach at best, and sometimes resulted in my forgetting to note one or more important pieces of information such as frequency or time.

In response to this problem, I decided to make up a convenient paper log form on my computer. I used Microsoft Works to do this, but any spreadsheet and/or word processing program should do the job.[1] I started by using the spreadsheet function to make up a log form that duplicates the data fields in the *ARRL Log Book*. The only difference is that the QSL Sent and Received columns are replaced by a column labeled "M/P" to indicate mobile or portable and another labeled "X," which I use to flag when the entry has been transferred to my permanent station log. I designed the form to exactly fill one standard page in landscape format, and formatted the spreadsheet cells with a solid line border. Next, I used my printer's "two-up" and two-sided printing functions to print several sheets of paper with four such log pages per sheet (two per side). The two opposite sides are printed "head to tail" instead of the usual "head to head" format. Finally, I printed one sheet with two log pages on one side and a blank page on the other side. This sheet is run through the printer one more time, with "KR8L MOBILE/PORTABLE LOG" printed in 36-point type on the bottom half of the blank page using the word processor.

When the sheets are stacked in the proper order and folded in half, the result is a $5^1/_2 \times 8^1/_2$-inch booklet. Three staples along the folded top edge keep everything together. There is a title page on the front and a blank page on the back, and all of the log pages are oriented the same way as you page through the booklet. I now have a handy, neat, and good looking log booklet that I can keep in a side pocket of the camera bag that I use to carry the rig and accessories. Because the format duplicates that of my *ARRL Log Book*, it is a simple matter to transfer data to my permanent station log when I return home. *—William A. Parmley, KR8L, 4540 S Ammon Rd, Idaho Falls, ID 83406;* **kr8l@arrl.net**

[This is a fine idea for a customized radio log. You may prefer the smaller, more finished *ARRL Mini Log Book* published for just this purpose. See Figure 1.—*Ed.*]

An Audio Log

◊ An easy method of logging those oh-so-sweet DX mobile contacts is to use one of the many digital voice recorders available at business and electronics stores. Without fumbling for paper and pencil, you can keep your eyes safely on the road.

The cost of these miniature units has dropped significantly in the past few years. I purchased the model DR-32 from RadioShack on sale for $39.95. It contains two folders of 15 minutes recording time each. This allows me to keep personal notes and QSOs in one folder and work-related memos in the other. This arrangement has proven very convenient.

The features and prices vary considerably. Key-chain models with less than a minute of recording time can be had for under $10. Professional units capable of downloading two hours of recording to a PC and taking digital photos can cost $200. Serviceable units with multiple folders and 30 minutes of recording time cost $40 to $50.

This method has allowed me to safely log many great mobile QSOs that would have been otherwise forgotten or lost. A great side benefit is retaining all items on the grocery list that the spouse just relayed on your way home from work! *—Robert G. Hunt, KY7C, 926 Copper Basin Rd, Prescott, AZ 86303;* **robthunt@hotmail.com**

[1]You can download *Works* and *Excel* worksheets from the ARRLWeb at **www.arrl.org/files/qst-binaries/**. Look for 03HK09.ZIP.

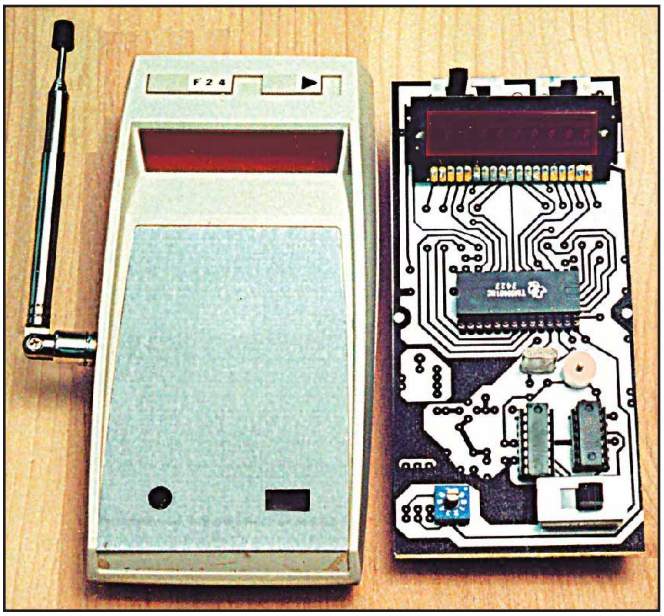


Figure 2—KØOVQ checks packaging issues with a paper and cardboard circuit.

WILL IT FIT?

◊ Before committing a PC-board design to copper, I often print a component-side view on plain paper and glue it to a sheet of thin cardboard. I then punch holes with a sharp stylus and mount the major components (using TTL ICs as stand-ins for any CMOS devices).

This helps me verify that there's adequate clearance between components and between components and the enclosure. The method is particularly helpful when reusing an old enclosure. I can make sure that switches and control shafts line up with existing holes. Figure 2 shows a mock-up of a frequency counter that I wanted to mount in a case from a defunct calculator. The mock-up demonstrated that one of the switches had to be moved to line up with a hole in the case. It also disclosed a problem I wasn't even looking for: The crystal was too tall. I wouldn't have been able to close the case! Fortunately, I discovered both problems at a point where they were very easy to fix.*—Roy A. Raney, KØOVQ, 600 Jackson St, Denver, CO 80206;* **k0ovq@arrl.net**

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, 225 Main St, Newington, CT 06111, 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. QST

By Dave Patton, NT1N, and Rick Lindquist, N1RL

ARRL Board Requests Policy Recommendations to Implement WRC-03 Results

The ARRL Board of Directors has called on ARRL Chief Executive Officer David Sumner, K1ZZ, General Counsel Chris Imlay, W3KD and the Executive Committee to develop ARRL policy recommendations for an FCC filing to implement the results of World Radiocommunication Conference 2003 (WRC-03). ARRL President Jim Haynie, W5JBP, chaired the July 18-19 Board session in Windsor, Connecticut.

"The League, as the Amateur Radio representative in the United States, will, through its democratic process, review input from its members as to the impact and implementation of these results to the Part 97 rules," the Board's resolution declared. The Board is to hear a report on the policy recommmendations at its January 2004 meeting. The Board also expressed gratitude to the IARU and ARRL WRC-03 team for its "tireless and dedicated efforts in promoting Amateur Radio" and congratulated it for achieving the IARU's goals at the month-long international conference that wrapped up in Geneva July 4.

Delegates to WRC-03 reached a compromise on a 200-kHz worldwide allocation—7000 to 7200 kHz—effective in 2009, with no change to the existing 300-kHz allocation in the US or elsewhere in Region 2. The conference also eliminated the requirement that administrations make license applicants prove Morse code proficiency to operate below 30 MHz. That action left it up to individual administrations to retain or drop Morse code as an examination element for HF access. Decisions made at WRC-03 also resulted in a wide variety of changes to other sections of Article 25 of the international *Radio Regulations* affecting international communications involving third-party traffic, international recognition of the licenses of visiting amateurs and communication with so-called "banned countries."

President Jim Haynie, W5JBP, presents Vice President Fried Heyn, WA6WZO, with a long-term membership award. Heyn has served the Board for 20 years.

Awards and Recognition

See page 61 for more on the Award Winners.

Minute	*Award*	*Action*
18	2002 Herb S. Brier Instructor of the Year Award to Ed Weiss, W1NXC	Conveyed
19	2002 Hiram Percy Maxim Award to Ben Schupack, NW7DX	Conveyed
20	2002 Excellence in Recruiting Award to Joe Giraudo, N7JEH	Conveyed
21	2002 Doug DeMaw ,W1FB, Technical Excellence Award to Gerald Youngblood, AC5OG	Conveyed
22	2002 Professional Educator of the Year Award to Bruce Watson, AA3LX	Conveyed
42	Lifetime Achievement Award to Dave Bell, W6AQ	Conveyed
46	2002 Microwave Development Award to Barry Malowanchuk, VE4MA	Conveyed
47	2002 Technical Innovation Award to Jonathan P. Taylor, K1RFD	Conveyed
48	2002 Technical Service Award to Dan Hampton, K4ITL	Conveyed
54	First Knight Distinguished Service Award to Joe Knight, W5PDY	Conveyed

The Board also implemented some of the recommendations contained in a wide-ranging *Final Report of the Volunteer Resources Committee to the ARRL Board of Directors—an Evaluation of the ARRL's Field Organization*. It left other recommendations for Sumner to study and determine by the Board's next meeting what's needed to put them into effect. ARRL Midwest Director Wade Walstrom, WØEJ, chairs the VRC. The

committee study concluded that the state of the ARRL Field Organization is "fair" but not what it should be to meet the League's "overall obligations to provide emergency communications, especially at the national level."

The "Minute 56" Report

During its two-day session, the Board also reviewed a major study, commissioned at last July's Board meeting, of the bands from 902 MHz to 24.25 GHz. ARRL Technical Relations Manager Paul Rinaldo, W4RI, General Counsel Chris Imlay, W3KD, and First Vice President Joel Harrison, W5ZN, prepared the so-called "Minute 56" report.

Last year, the Board had concluded that since Congress was reviewing spectrum management policy, it was "vitally important" for ARRL to evaluate spectrum use policies in the upper-UHF bands with an eye toward developing options to protect the allocations and to make greater amateur use of those frequencies.

At this summer's meeting, the Board voted to initiate a process to revise ARRL band plans for amateur allocations between 902 MHz and 24.25 GHz. "New band plans will be developed using as a goal the full amateur deployment of each band," the Board said. "The President is authorized to appoint a band plan committee of volunteers and staff for that purpose."

The Board further voted unanimously to authorize President Haynie—with assistance from Imlay and Rinaldo—"to explore specific terms of expanded partnering plans with the National Public Safety Telecommunications Council (NPSTC) looking toward greater integration of amateur operation in the bands 902 MHz to 24.25 GHz in public safety and homeland security communications."

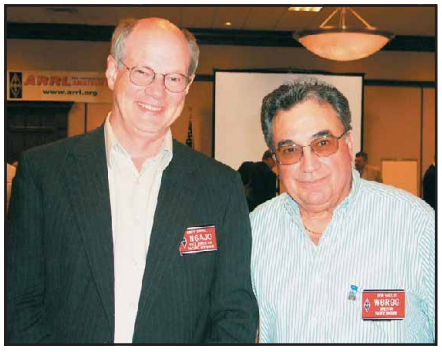
Board Mandates Nationwide ARES Communications System, Section Emergency Plans

In another response to the VRC *Final Report*, the Board called for a program to provide a comprehensive interstate, national and international system to enhance the communications capability of the Amateur Radio Emergency Service (ARES). The Board's resolution cited "future expectations of ARES for such a nationwide emergency message-handling capability" in light of the League's new

Summary of Major Board Actions

The complete Minutes of the Second Meeting of the Board, *Moved and Seconded,* are now published only on the ARRLWeb (**www.arrl.org/announce/board-0307**). If you do not have Internet access you may request a written copy of the Minutes by writing to: ARRL Secretary, 225 Main St, Newington, CT 06111.

Minute		*Action*
25	**Ad-hoc committee for ARES emergency communications** *Ad hoc committee of members to develop a comprehensive program to enhance the current ARES emergency communications capability.*	**Approved**
26	**No new Bulletin Manager or Official Bulletin Station appointments** *Existing BMs and OBSs will continue at discretion of cognizant Section Manager*	**Approved**
27	**SECs to develop Section Emergency Plans** *Section Emergency Coordinator (SEC) in all seventy one (71) American Radio Relay League Sections shall develop, implement, and maintain a comprehensive Section Emergency Plan no later than December 31, 2003.*	**Approved**
28	**Enhanced leadership training for SMs** *EVP to determine how best to improve leadership training for Section Managers*	**Approved**
29	**Implementation of VRC report recommendations** *Chief Executive Officer is directed to study and determine the necessary action to implement the recommendations contained in the "Volunteer Resources Committee Final Report to the ARRL Board of Directors, An Evaluation of the ARRL's Field Organization" not otherwise specifically addressed by separate motion to the Board of Directors. Action plan to Board by December 31, 2003.*	**To CEO**
31	**Standing Orders 3, 6, 7, 20, 116, 83-2.20, 84-2.25, 98-1.47** *Eliminates obsolete Standing Orders*	**Deleted**
32	**New committee to revise band plans for the bands between 902 MHz and 24.25 GHz** *New band plans will be developed using as a goal the full Amateur deployment of each band. The President is authorized to appoint a band plan committee of volunteers and staff for the purpose.*	**President**
33	**Explore partnering possibilities with NPSTC** *The President, with assistance from the General Counsel and Technical Relations Manager, is directed to explore specific terms of expanded partnering plans with the National Public Safety Telecommunications Council (NPSTC) looking toward greater integration of Amateur operation in the bands 902 MHz to 24.25 GHz in public safety and homeland security communications.*	**Approved**
43	**New Public Relations Committee Mission Statement** *Updates 10 year old Mission Statement*	**Approved**
52	**Article 4** *Updates Article 4 to delete reference to "two-year" terms for Directors*	**Amended**
53	**By-law 23** *Updates election schedule for Divisions*	**Amended**
54	**Knight Distinguished Service Award** *New award established to recognize exceptionally notable contributions by a Section Manager to the health and vitality of the League.*	**Conveyed**
55	**ARRL Web Privacy Policy** *Directors and Section Managers may communicate with members in their divisions and sections, respectively, on ARRL business unless the member has opted out of receiving such communication.*	**Amended**
56	**ARRL Volunteer Mentor Program** *VRC to develop two or more viable options for a program that will establish an ARRL Volunteer Mentor (Elmer) program providing for the promotion, support and growth of mentoring in Amateur Radio.*	**To VRC**
58	**ARRL President's Award** *New award for ARRL members who have shown long-term dedication to the goals and objectives of ARRL and Amateur Radio, and whose support of individual programs and/or goals has been above and beyond normal efforts.*	**Created**
59	**Review of MOU with National Frequency Coordination Council** *Executive Committee is tasked to review and recommend any changes it determines necessary*	**To EC**
60	**Filing with FCC after results of WRC-03** *Will develop recommendations on ARRL policy for an FCC filing to implement the results of WRC-03.*	**To EC**



The new Pacific Division Team: Vice Director Andy Oppel, N6AJO, and Director Bob Vallio, W6RGG.

President Jim Haynie, W5JBP, presents Rosalie White, K1STO, with a long-term membership award. White, Headquarters' Field and Educational Services Manager has been a member for 31 years.

Citizen Corps partnership with the Department of Homeland Security. There are situations, the Board said, when ARES "must have the capability to pass traffic across the nation quickly and accurately."

The Board established an *ad hoc* committee of members to develop the comprehensive ARES communications capability in coordination with ARRL Field and Educational Services and the VRC. The *ad hoc* panel will present a preliminary plan at the Board's January 2004 meeting and a final plan at its July 2004 meeting.

The VRC *Final Report* cited "several shortcomings" to the National Traffic System (NTS) overall "that diminish its effectiveness as a viable emergency backup nationwide communications system." The VRC said deficiencies included delivery delays, an "overall reluctance to embrace newer communications technologies" and a "lament" in some responses from Section Managers that ARES was not utilizing NTS capabilities. "Part of that lament could be alternately phrased that ARES is not coming to NTS to use NTS in its function," the VRC *Final Report* said. The study also noted a dwindling interest in NTS.

The VRC *Final Report* recommended that ARRL discontinue financial support to the NTS at the national level; that Section Traffic Managers obtain Amateur Radio Emergency Communications Level 1, 2 and 3 certification and Net Managers earn at least Level 1 and 2 certification as soon as possible, if NTS is to be a viable emergency communications option; that STMs "strongly encourage" NTS members to earn Level 1 certification; and that NTS operators "acquaint themselves with ARES and its leaders."

The VRC *Final Report* said the ability to pass emergency traffic within sections "seems to be reasonably well in place in most sections."

In an additional action related to the VRC *Final Report*, the Board called on the Section Emergency Coordinator (SEC) in each of the 71 ARRL sections "to develop, implement and maintain a comprehensive *Section Emergency Plan* no later than December 31, 2003." Copies of the plans would be filed by each SEC, with the Section Manager and with Field and Educational Services at ARRL Headquarters. Plans would be reviewed and updated annually.

BM, OBS Appointments to Phase Out

The Board also decided that no new Bulletin Manager or Official Bulletin Station appointments would be granted, although BM and OBS appointments may be renewed at the discretion of the Section Manager. The action also was recommended in the VRC *Final Report*. While these appointments were important in the past, the Board said, ARRL Web and e-mail news and bulletins have replaced their function, and many SMs no longer support them. The designations will be dropped from the Field Organization once there are no longer any active BM and OBS appointees.

Section Manager Training Augmented

New ARRL Section Managers already attend an SM training workshop and orientation session at League Headquarters. In a move to boost the leadership ability of the SMs, the Board—again in response to a recommendation in the VRC *Final Report*—called on Sumner to formally establish courses to convey leadership training as a part of the SM's orientation sessions.

"Such courses may take the form of resident training at ARRL Headquarters; on-line Web-based courses; or correspondence courses," the Board resolved. "Participation in leadership training courses is considered an essential element of the duties and responsibilities of all Section Managers."

Board Okays Elmering Resolution

Citing the Amateur Radio tradition of Elmering (mentoring) new and prospective amateurs, the Board okayed a resolution instructing the VRC to develop two or more viable options for an ARRL Volunteer Mentor program that would provide for "the promotion, support and growth of mentoring in Amateur Radio." The VRC is to present its options at the Board's January meeting.

"One of the most critical points in a new licensee's career is the transition from license study to on-the-air operation," the Board said. "A newcomer's interest in Amateur Radio has the best chance of flourishing under the guidance and encouragement of one or more experienced radio amateurs."

New Awards Created

The Board also created two new awards —the Knight Distinguished Service Award and The President's Award. The Distinguished Service Award's namesake—ARRL New Mexico Section Manager Joe T. Knight, W5PDY—also was selected to be its first recipient. Knight served for 27 years as SM and, the Board said, "has distinguished himself as a leader among leaders" who often has "gone above and beyond the call of duty" by volunteering to train and orient new SMs. The award will recognize "exceptionally notable contributions" to the "health and vitality" of the League by an SM. Knight, who stepped down recently for health reasons, received an *in absentia* standing ovation.

The new President's Award will go to an ARRL member or members who "have shown long-term dedication to the goals and objectives of ARRL and Amateur Radio" and who have gone out of their way to support individual League programs and goals. Nominations will come from directors with approval by the ARRL President and the Executive Committee.

By Jean Wolfgang, WB3IOS, Steve Ford, WB8IMY, and Dave Hassler, K7CCC

ARRL Award Winners for 2002

Each year at its July meeting, the ARRL Board of Directors conveys a number of awards to recognize excellence in technical innovation, public service and education. This year there is one new award: the Joe Knight, W5PDY, Distinguished Service Award. Let's meet the winners for 2002:

The Knight Distinguished Service Award

The inaugural ARRL Knight Distinguished Service Award was given to the citation's namesake, retired New Mexico Section Manager Joe Knight, W5PDY. Knight stepped down July 2 after serving as New Mexico's SM for 27 years.

Knight guided a New Mexico section that is high on public service and emergency preparedness. He helped to maintain the WA5IHL Megalink Repeater System, which allows a ham with an FM handheld radio to communicate anywhere in the vast and rugged state, and he advocated for APRS and SKYWARN ties into the system. In addition, Knight oversaw many HF nets and tirelessly promoted the ARRL field organization and the League, helping to create a cadre of knowledgeable and enthused volunteers in New Mexico.

Professional Educator of the Year Award

Bruce Watson, AA3LX, of Butler, Pennsylvania, is the 2002 ARRL Professional Educator of the Year. This award is presented to a teacher who uses Amateur Radio within a curriculum. The Lambda Amateur Radio Club of Philadelphia is the award cosponsor.

Watson is a seventh grade science teacher at Mars Area Middle School and has used Amateur Radio in his curriculum for about nine years. He also started a "lend-a-radio" program at his local club to temporarily provide new hams with a radio.

Currently, Watson is designing a presentation showing the positive effects of teaching and using Amateur Radio in the classroom.

The Lifetime Achievement Award

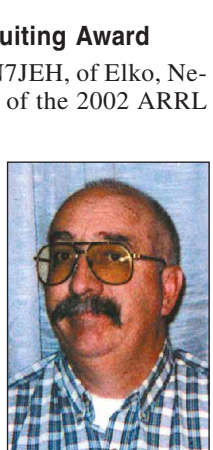
Famed DXer and filmmaker Dave Bell, W6AQ, has been honored with an ARRL Lifetime Achievement Award. The ARRL Board of Directors noted Bell's many significant contributions to the ARRL, including his recent work as director on the new *Amateur Radio Today* video CD and his production on the ARRL films *The Ham's Wide World*, *Moving up to Amateur Radio* and *The New World of Amateur Radio*, as well as *Ham Radio Olympics*. He made his first film for the League, *This is Ham Radio*, in 1970.

Bell has also produced a number of television shows, documentaries and TV movies. Bell recently produced the Danny Glover-directed film *Just a Dream* (2002).

The winner of both an Emmy and Peabody award, Bell has also served the League as Chairman of the Public Relations Committee and has written many articles in support of Amateur Radio.

Excellence in Recruiting Award

Joseph Giraudo, N7JEH, of Elko, Nevada, is the recipient of the 2002 ARRL Excellence in Recruiting Award. The award is cosponsored by the Carson Valley Radio Club of Minden, Nevada.



"Joe has done more to recruit new hams and ARRL members in Eastern Nevada than anyone else. From installing highway signs, publishing newsletters, working with the Boys Scouts, setting up public displays, arranging for PSAs and newspaper coverage, Joe does it all," said Dick Flanagan, W6OLD, ARRL Nevada Section Manager.

The Doug DeMaw, W1FB, Technical Excellence Award

Gerald Youngblood, AC5OG, received the 2002 Doug DeMaw, W1FB, Technical Excellence Award for his groundbreaking articles in the July/August and September/October 2002 issues of *QEX*: "A Software-Defined Radio for the Masses." The articles describe the development of the SDR-1000, one of the first multimode software-defined transceivers with HF capability.

Youngblood is a member of the ARRL SDR Working Group and currently enjoys software radio development, 6 meter DX and satellite operation.

Youngblood lives in Austin, Texas and is currently CEO of Sixth Market, Inc, a hedge fund that trades equities using artificial intelligence software. In April 2003, he founded FlexRadio Systems to market Software Defined Radio products to the Amateur Radio market.

The Microwave Development Award

Barry Malowanchuk, VE4MA, is the winner of the ARRL 2002 Microwave Development Award. After several years of hard work, Malowanchuk and Al Ward, W5LUA, completed the world's first 24 GHz Earth-Moon-Earth contact on Aug 18, 2001.

Notable among his technical achievements, Malowanchuk developed the VE4MA Feedhorn. He has also made contributions in the field of preamplifiers and high-power amps for 1.3, 2.3 and 3.3 GHz. Malowanchuk and Ward are currently working on completing an

EME contact at 47 GHz.

For all the technical achievements, Malowanchuk said he cherishes his work in EME because of the close and enduring friendships he's made.

The Technical Service Award

Danny Hampton, Jr, K4ITL, of Raleigh, North Carolina is the recipient of the ARRL 2002 Technical Service Award. Hampton is the architect of the Piedmont Coastal Repeater Network, established in the early 1970s, a network that today sports over 40 machines in North Carolina.

The system is heavily used for public service work. The North Carolina Office of Emergency Management and SKYWARN have recognized the network's vital role in emergency communication. Recently, Hampton helped coordinate the development of a local hospital-based Amateur Radio emergency repeater system tying 10 facilities together.

A ham since 1958, Hampton is the technical committee chairman of the SouthEastern Repeater Association as well as ARRL North Carolina Section Technical Coordinator.

The Technical Innovation Award

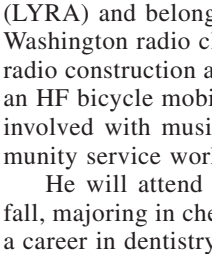
Jonathan Taylor, K1RFD, of Ridgefield, Connecticut, is the winner of the ARRL 2002 Technical Innovation Award. Taylor is the developer of the EchoLink voice-over-Internet Amateur Radio repeater linking system. Since May 2002, over 75,000 hams worldwide have registered their call signs with the free system; typically, 1500 stations are online at once in 300 simultaneous QSOs.

Taylor built nearly all of the software from the ground up, including the VoIP protocols, digital mixing, user interface and Web server.

The public service and emergency communication applications of EchoLink are valuable, allowing repeaters not within range of each other to be linked to form an ad-hoc network for a public service event or in an emergency. EchoLink also allows hams who cannot have outdoor antennas to still have worldwide contacts with other amateurs.

The Hiram Percy Maxim Award

Eighteen-year-old Ben Schupack, NW7DX, of Sammamish, Washington is the winner of the 2002 ARRL Hiram Percy Maxim Award, acknowledging an exceptional ham under 21. An avid Morse operator, Schupack won first place in the 2001 World Wide WPX Contest, in the Low Power Rookie category, copying CW at speeds near 45 wpm.

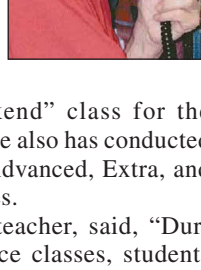


An Extra class licensee, Schupack is the Northwest Division manager for the League of Young Radio Amateurs (LYRA) and belongs to several Western Washington radio clubs. He enjoys QRP radio construction and recently designed an HF bicycle mobile station. He is also involved with music, running and community service work.

He will attend Whitman College in fall, majoring in chemistry on his way to a career in dentistry.

The Herb S. Brier Instructor of the Year Award

Edmund Weiss, W1NXC, of Ashland, Massachusetts, received the 2002 ARRL Herb S. Brier Instructor of the Year Award. The Lake County Amateur Radio Club of Crown Point, Indiana co-sponsors the award.



After years of teaching Morse code and several license classes, Weiss is now the Director of Training for the Framingham ARA in Masachusetts. In 1995, Weiss organized and held the "License-in-a-Weekend" class for the Technician license. He also has conducted several courses for Advanced, Extra, and General class licenses.

Weiss, a former teacher, said, "During my earlier Novice classes, students ranged from 9-80. The teaching style had to be adjusted to compensate for this difference in not only learning ability, but also attitude."

ARRL 2003 Technical Awards Call for Nominations

ARRL members are encouraged to send nominations to ARRL Headquarters. Please include basic contact information for both you and the nominee. Submit support information along with a nomination letter, including endorsements of ARRL affiliated clubs and League officials. Nominations should thoroughly document the nominee's record of technical service and accomplishments. The nomination form for these awards can be found at **www.arrl.org/ead/award/application.html**.

ARRL Technical Service Award is to be given annually to the licensed radio amateur whose service to the amateur community and/or society at large is of the most exemplary nature within the framework of Amateur Radio technical activities. These include, but are not limited to:

- Leadership or participation in technically oriented organizational affairs at the local or national level.
- Service as an official ARRL technical volunteer.
- Service as a technical advisor to clubs sponsoring classes to obtain or upgrade amateur licenses.

The Technical Service Award winner will receive an engraved plaque. In addition, the winner may request ARRL publications of a value up to $100.

ARRL Technical Innovation Award is granted annually to the licensed radio amateur whose accomplishments and contributions are of the most exemplary nature within the framework of technical research, development and application of new ideas and future systems. These include, but are not limited to:

- Development of higher-speed modems and improved protocols.
- Promotion of personal computers in Amateur Radio applications.
- Activities to increase efficient use of the amateur spectrum.
- Digital voice experimentation.

The Technical Innovation Award winner will receive a cash award of $500 and an engraved plaque.

ARRL Microwave Development Award is given each year to the amateur (individual or group) conducts research and application of new and refined uses and activity in the amateur microwave bands. This includes adaptation of new modes both in terrestrial formats and satellite techniques.

The Microwave Development Award winner will receive an engraved plaque. In addition, the winner may request ARRL publications of a value up to $100.

Nominate Now!

Send nominations to: ARRL Technical Awards, 225 Main St, Newington, CT 06111. Nominations must be received at Headquarters by March 31, 2004. Send any questions to Headquarters or e-mail **jwolfgang@arrl.org**.

"BPL is a Pandora's Box of Unprecedented Proportions," ARRL Tells FCC

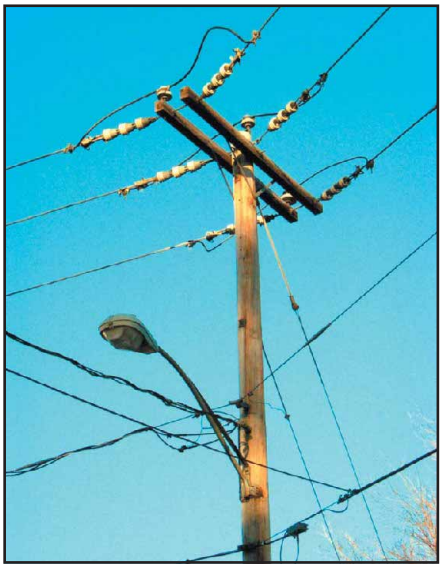
Citing the potential for interference to and from Amateur Radio, the ARRL has called on the FCC to "take no steps" to permit Broadband over Power Line (BPL)—a form of power line carrier (PLC) technology. The League's 120-page response—including studies—came July 7 in response to the FCC's BPL *Notice of Inquiry* (*NOI*) in ET Docket 03-104. The *NOI* asking how the FCC should regulate the delivery of broadband services to homes and businesses using electrical wiring to distribute high-speed digital signals attracted some 1900 comments—many from the amateur community—by the filing deadline. Comments continued to arrive after the deadline had passed.

"ARRL is unwilling to have the Amateur Service gored with the double-edged sword of an incompatible service that will at once (1) cause widespread interference, and (2) preclude any future changes in the amateur HF allocations," the ARRL said in its comments. The League concluded that, based on "diligent and exhaustive research," BPL must avoid any and all amateur MF, HF and VHF allocations without exception. "This interference potential, as a matter of both law and fact, disqualifies access BPL as a potential future competitive broadband delivery system," the ARRL said.

So-called "access BPL" would use existing overhead medium-voltage power lines to distribute Internet and broadband services to homes and businesses. The League said that while it's aware that current Part 15 rules permit BPL, its interference potential remains untested and unrealized, since access BPL systems are not yet deployed. BPL proponents would prefer that the FCC authorize even higher power levels for such systems, however.

"BPL is a Pandora's Box of unprecedented proportions," the ARRL declared. It asked the FCC to modify its Part 15 rules to prevent interference to users of the HF and low-VHF spectrum from the outset and "to prevent consumers' reliance on BPL as an interference-free broadband delivery system."

In announcing its BPL initiative earlier this year, members of the FCC could barely contain their enthusiasm for the technology. As the League's comments point out, however, the FCC acceded to the utility industry by citing potential interference to and from unlicensed power company PLC power-grid control systems in turning down ARRL's petition for a 136 kHz amateur allocation. ARRL had asked that hams be permitted to transmit on 136 kHz at less than 2 W effective isotropic radiated power (EIRP); the FCC had proposed 1 W EIRP.



BPL would use "medium-voltage" power lines like these, found in a typical residential area.

"Yet, the same industry, together with BPL manufacturers, is apparently contending now that at HF and VHF, where the power lines are better antennas than they are at LF, that BPL can co-exist with amateur stations using more than 10,000 watts EIRP," the League said. "Both arguments cannot be valid."

League studies suggested that received signal levels of BPL broadband noise at typical amateur stations would be anywhere from 34 to 65 dB higher than typical ambient noise levels in the worst-case situations. "BPL cannot be deployed using amateur allocations in the MF, HF and VHF bands without severely high interference potential," the ARRL reiterated.

Electric utility companies would operate many, if not most, BPL systems, but the ARRL noted that some power companies have demonstrated a less-than-stellar record of cooperation in resolving complaints of power line noise to hams. "It is a very substantial problem now for the Amateur Service, without the addition of BPL to the mix," the League said.

The ARRL concluded by urging the FCC to ensure that BPL "is not permitted to operate in or near any Amateur Radio allocations." In addition, the ARRL said, spurious emissions from BPL facilities must be substantially attenuated below current Part 15 requirements.

The League has initiated an important Spectrum Defense Fund campaign to support activities to educate government officials on the potential threat that BPL poses to Amateur Radio. To find out more, or to support ARRL's efforts in this area, visit the ARRL's secure BPL Web site, **www.arrl.org/forms/development/donations/bpl/**.

Amateurs Part of Early Disaster Response, DHS Official Says

ARRL now is an official affiliate program of Citizen Corps, an initiative within the Department of Homeland Security to enhance public preparedness and safety. ARRL President Jim Haynie, W5JBP, signed the formal *Statement of Affiliation* between DHS and ARRL during the ARRL 2003 National Convention June 21 in Arlington, Texas. Chief Operating Officer of the Emergency Preparedness and Response Directorate (FEMA) Ron Castleman represented Under Secretary for Emergency Preparedness and Response Michael D. Brown at the signing.

Citizen Corps Liaison to the White House Liz DiGregorio urged amateurs to explore ways to expand their role in the community beyond being a last resort when other communication systems fail.

"You are there. You are part of that very, very first response when it happens locally," especially in the initial stages of an emergency or disaster, DiGregorio told the overflow audience. "You need to show your community that you're engaged," she said.

Castleman noted that hams have a "long and distinguished history" of assisting and cooperating with FEMA and said the agency wants to continue to work with Amateur Radio operators as partners and expand hams' community safety role. "We also want to help prepare every citizen

Rick Lindquist, N1RL ♦ Senior News Editor ♦ n1rl@arrl.org

FEMA official Ron Castleman (left) and ARRL President Jim Haynie, W5JBP, sign the *Statement of Affiliation*.

Citizen Corps White House Liaison Liz DiGregorio.

across our country *before* disaster strikes," Castleman said.

The League joins the National Safety Council, Points of Light Foundation, National Voluntary Organizations Active in Disaster, National Volunteer Fire Council, National Fire Protection Association, Save A Life Foundation and The Jaycees as Citizen Corps affiliate programs.

The *SoA* calls on DHS and ARRL to raise public awareness of Amateur Radio as a safety resource. "That's what you are all about, and we need a safer America," DiGregorio said.

In addition, DHS and ARRL will cooperate in providing training and accreditation for Amateur Radio emergency communications. They also will work together to promote the formation of local Citizen Corps councils and assist them with education, training and volunteer service opportunities "that support first responders, disaster relief organizations and community safety efforts." As an affiliate, ARRL will be linked from the FEMA and Citizen Corps Web sites.

"We need you, and you need us, and we want to work together with you to make this all happen," DiGregorio concluded, "because we all share the same goal, and that goal is a better, stronger, more secure America."

The ARRL National Convention 2003 was held in conjunction with Ham-Com in Arlington, Texas. FEMA also announced the *SoA* signing on its Web site, **www.fema.gov/nwz03/nwz03_138.shtm**.

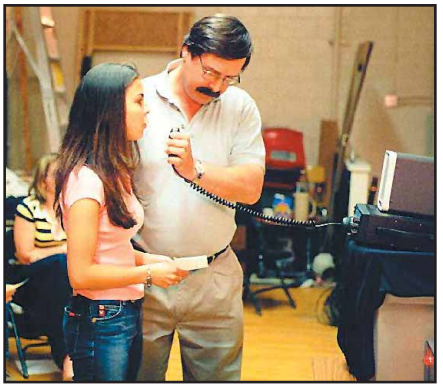
ARISS LOGS ITS 100th SCHOOL GROUP CONTACT

The Amateur Radio on the International Space Station (ARISS) program has reached a milestone with its 100th school group contact. Expedition 7 NASA Science Officer and Flight Engineer Ed Lu, KC5WKJ, took the controls of NA1SS aboard the space outpost to answer a dozen questions June 12 from grade 7-12 students gathered at Lively District Secondary School in Sudbury, Ontario, Canada.

"I would choose to go on a mission to Mars," Lu told the students, "because I think that's the place in our solar system that has the best chance of having life besides our Earth, and I would love to go there to try and find that." Lu said that while a human spaceflight mission to Mars is not yet on NASA's schedule, he hopes to one day have the opportunity to journey there. "Maybe one of you kids down there will get a chance to do it if I don't get to go," he added.

Lu says he sees a lot of things that are "incredibly interesting" from his vantage point in space, including looking down at Earth and viewing the northern and southern lights. But he said he hasn't been inspired to want to live in space indefinitely.

Asked whom he would like to have accompany him into space if he could pick one person, Lu replied, "If I could bring one person with me, it would be my fiancee, and if I said anything else, boy would I be in trouble."



Natalie Sgoifo asks her question, while Steve Gorecki, VE3CWJ, holds the microphone.

Aboard the ISS since late April, Lu—who turned 40 July 1—is part of the first two-person crew headed by Expedition 7 commander Yuri Malenchenko, RK3DUP. The Expedition 7 crew is scheduled to return to Earth in October.

On Earth, Steve Gorecki, VE3CWJ, served as control operator. He had assistance from members of the Sudbury Amateur Radio Club. ARISS is an international project with participation by ARRL, NASA and AMSAT.

CALIFORNIA GOVERNOR SIGNS AMATEUR ANTENNA BILL

Efforts by proponents of California's Amateur Radio antenna bill apparently paid off July 14 when Gov Gray Davis signed Assembly Bill 1228. The measure, which cleared both legislative houses with unanimous votes, incorporates the essence of the limited federal preemption known as PRB-1 into California law.

"Amateur Radio's message got through 'the pileup' in Sacramento," said ARRL Southwestern Division Director Art Goddard, W6XD. "Thanks to all the hams in California who wrote cards, letters and e-mails urging their representatives and their governor to pass this legislation,"

In a statement, Davis cited the "thousands of hours of volunteer service" Amateur Radio operators donate in support of state and local government. Davis said ham radio volunteers play a crucial role in times of disasters or emergencies. "By providing a reliable communication system during an emergency situation, such as a terrorist attack, Amateur Radio stations provide an invaluable service to the state of California," Davis added.

AB 1228 was sponsored by freshman Assembly member Bob Dutton (R-Rancho Cucamonga). Mike Mitchell, W6RW, spearheaded the Amateur Radio community's efforts to promote the bill. "Great news that Governor Davis signed AB 1228!" a delighted Mitchell reacted. "Congratulations to the hams of California!"

Goddard expressed similar elation. "This bill will give hams in California a fighting chance to have a reasonable antennas," he said. He also congratulated Dutton and his staff for shepherding the bill through committees and both legislative branches without a single dissenting vote. California's ham community also owes its appreciation to Mitchell for being "our sparkplug" on the bill, Goddard said. He also cited ARRL staffer Dean Straw, N6BV, and Pacific Director Bob Vallio, W6RGG, for speaking on behalf of the bill in hearings.

The bill went to Davis for his signa-

FCC News

FCC PUTS BANDWIDTH PETITION ON PUBLIC NOTICE

The FCC accepted comments during July on a *Petition for* Rule *Making* from two amateurs calling on the FCC to establish SSB and AM bandwidth standards. The petition, designated RM-10740 by the FCC, was filed May 27 by Michael Lonneke, WØYR, and Melvin Ladisky, W6FDR. The deadline to file comments was July 26. The FCC may address the petition in a future *Notice of Proposed Rule Making* that includes other Amateur Radio-related regulatory issues.

Referencing four Enforcement Bureau letters (one of which was included in the petition as an exhibit) sent to amateurs and alleging overly wide SSB signals, the petition asks the FCC to "remove the ambiguity" in the Part 97 rules and establish SSB and AM transmission bandwidth standards.

On HF frequencies below 28.8 MHz, it recommended a maximum 2.8 kHz bandwidth for SSB (J3E) emissions and a maximum 5.6 kHz bandwidth for AM (A3E) emissions.

FCC ATTEMPTING TO RECTIFY CALL SIGN GOOF

The FCC issued a *Memorandum Opinion and Order* (*MO&O*) July 3 in an effort to rescind a vanity call sign it had issued erroneously to a Virginia amateur. Last August, the FCC's Licensing and Technical Analysis Branch of the Public Safety and Private Wireless Division (within the Wireless Telecommunications Bureau) erroneously granted the request of Richard L. Smith of Chesapeake, Virginia, to have the call sign KC4USH. The Branch is responsible for issuing all amateur license and call sign grants.

The Commission says that since the KC4USA through KC4USZ call sign block has been reserved for US Navy amateur stations in Antarctica, the KC4USH call sign should not have been issued to Smith, a General-class licensee who used to be KG4UKV. The FCC wants Smith to take back his former call sign.

The FCC said it would not issue a modification order until Smith had received notice of the proposed action and had a chance to protest.

Amateur Enforcement

♦ **FCC again warns former amateur about unlicensed operation:** The FCC again has Richard Allen Burton, ex-WB6JAC, in its sights. FCC Special Counsel Riley Hollingsworth sent a *Warning Notice* to the former amateur licensee July 3 citing monitoring information alleging that Burton had operated on 2 meters "on numerous occasions" in the Los Angeles area since January. Burton, who lost his General ticket in 1981 and has a lengthy history of alleged unlicensed operation—most or all of it on amateur frequencies—already has served time behind bars for his offenses, most recently in 2001.

"You are advised that additional instances of unlicensed operation on any frequency for which a license is required will lead to the same result," Hollingsworth wrote.

Hollingsworth noted that FCC records indicate Burton has an application under review for a General Mobile Radio Service license. "Issues surrounding the 2003 unlicensed radio operation will be made a part of that proceeding," Hollingsworth told Burton. The FCC wrote a Los Angeles-area repeater owner late last year to warn him about allowing Burton to use his repeater.

As part of a plea agreement, Burton spent three months in a federal prison in Texas in 2001 following his arrest and indictment the previous year for Communications Act violations.

♦ **FCC sets aside California ham's ticket while it investigates false distress calls:** The amateur application of a California man is pending while the FCC looks into allegations that the individual may have made false marine distress calls. The FCC's Wireless Telecommunications Bureau (WTB) had granted Michael V. Swift of San Ramon a Technician ticket, KG6QOB, on May 1 but set it aside on May 29.

The FCC's Riley Hollingsworth wrote Swift June 3 about the matter, warning him that he no longer had authority to operate Amateur Radio transmitting equipment. The FCC's San Francisco Field Office followed up June 20 with a more detailed letter to Swift that cites complaints from the US Coast Guard about false distress calls last May. Using direction-finding techniques, Commission agents tracked the signals to Swift's residence. During the inspection, FCC agents determined that transmissions on 157.100 MHz (Marine Channel 22A) had come from a Yaesu FT-2500M amateur transceiver operated by Swift.

"Unlicensed operation of this radio station must be discontinued immediately," FCC San Francisco District Director Thomas Van Stavern told Swift.

The FCC official directed Swift to "have the transceiver returned to the original manufacturer's specifications."

Van Stavern further asked Swift to explain under what authority he operated on marine channels, who modified the FT-2500M to enable operation outside the amateur bands and where he obtained the transceiver.

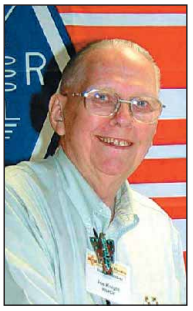
ture on July 3, and Goddard and Vallio promptly mounted a campaign to have amateurs contact Davis and urge him to sign it. Davis had vetoed a similar bill in 2000, in part citing the cost for studies the legislature had required. The 2003 bill contained no such provisions.

The new law requires any ordinance regulating Amateur Radio antenna structures not to preclude but to "reasonably accommodate" Amateur Radio communications, to allow amateur station antenna structures "at heights and dimensions sufficient to accommodate Amateur Radio Service communications" and to constitute "the minimum practicable regulation to accomplish the legitimate purpose of the city or county."

The most ham-populated state in the US, California becomes the 20th state to adopt PRB-1 legislation. The state is home to some 100,000 amateur licensees—almost 15 percent of the US total.

DEAN OF SECTION MANAGERS STEPS DOWN, SM APPOINTMENTS MADE

The dean of ARRL Section Managers—New Mexico's Joe Knight, W5PDY—stepped down July 2 after serving for nearly 27 years—longer than any other sitting SM. Knight cited poor health in his decision to retire from the volunteer position. ARRL Field and Educational Services Manager Rosalie White, K1STO, named New Mexico Assistant SM Bill Weatherford, KM5FT, of Albuquerque, to fill out Knight's term, which ends December 31.



Retiring New Mexico SM Joe Knight, W5PDY.

"It hurts me deeply to step down, but after almost 27 years in this position, all good things must come to an end," said Knight, who urged support for his replacement. A Life Member and an Assistant SM,

Weatherford is the trustee of Albuquerque Amateur Radio Club's N5VA. Weatherford already has indicated plans to run for the SM job in his own right.

Among those praising Knight was Bernalillo County Emergency Management Coordinator Don Scott, N5UJT, who cited Knight's many years of "tireless effort" in coordinating and promoting Amateur Radio in New Mexico. "As an emergency manager, the services of Joe and Amateur Radio as a whole cannot go unnoticed," Scott said.

Knight was the focus of an article in the January 2003 issue of *QST*, "The Luckiest Man Alive," which outlined the vast emergency communication resources that Knight and hundreds of other dedicated volunteers have built up over the years in New Mexico.

ARRL Field and Public Service Team Supervisor Steve Ewald, WV1X, said Knight provided a fount of valuable experience that he was happy to share with others during the ARRL Section Manager's Workshops. The ARRL Board of Directors established the Knight Distinguished Service Award at its July meeting, as reported elsewhere in this issue.

White also announced leadership changes in four other ARRL sections:

- Former Michigan SM Dale Williams, WA8EFK, has picked up the reins from Debbie Kirkbride, KA8YKK, who stepped down June 17 for health reasons but who hopes to remain active in the section. Kirkbride became SM last July after former SM Dick Mondro, W8FQT, became the Great Lakes Vice Director. Williams served as Michigan SM from 1992 until 1996 and is heavily involved in emergency communications.
- Ed Bruette, N7NVP, has replaced veteran ARRL Western Washington Section Manager Harry Lewis, W7JWJ, who stepped down July 1. Bruette—an Assistant Section Manager and the only candidate who had filed to succeed Lewis this fall—will fill the remaining three months of Lewis's term. White praised Lewis's work as SM since January 1991. Lewis will continue as Technical Coordinator. Lewis's wife, former Northwestern Division Director Mary Lewis, W7QGP, also has resigned as a Western Washington Assistant Section Manager. Bruette was Section Emergency Coordinator from 1998 through 2002 and is Washington's State RACES officer.
- In the East Bay Section Ti-Michelle Connelly, NJ6T, has replaced Dennis Franklin, K6DF, who stepped down effective June 23 citing health reasons. Connelly will serve out the remainder of Franklin's term, which ends December 31. She has served as an Assistant SM and Affiliated Club Coordinator for about three years and as Net Manager for two years.
- Former Oregon Section Manager Randy Stimson, KZ7T, replaces Marshall D. Johnson, KK7CW. Johnson was removed from office in a June recall election, only the third time that's happened in League history. The audited vote to oust the freshman SM was 939 to 280. Stimson served as Oregon SM from 1987 until 1998, and he's active in public service activities. He'll complete the rest of Johnson's term, which ends next June 30.

Notable Silent Keys

Top 40 meter DXer Al Hix, W8AH, SK: Albert H. "Al" Hix, W8AH, of Charleston, West Virginia, died June 25, after a brief illness. He was 85. A DXCC Honor Roll member with 388 entities confirmed, Hix also was at the top of the worldwide 40 meter DXCC pile with 362 entities. ARRL West Virginia Section Manager Hal Turley, KC8FS, said Hix could be tenacious in a DX pileup but was "a true gentleman" who readily shared his affection for ham radio. Licensed in the 1930s, Hix was an electrical engineering graduate of West Virginia University and World War II US Army Signal Corps veteran. A past president of the West Virginia State Radio Council and of the West Virginia Quarter Century Wireless Association, Hix was voted West Virginia Outstanding Amateur Radio Operator of the Year in 1986. He was a member of ARRL and of the Kanawha Amateur Radio Club. The family invites donations to the ARRL Foundation's pending Albert H. Hix Memorial Scholarship Fund, 225 Main St, Newington, CT 06111-1484.

Well-known contester, DXer dies in fall from tower: Well-known contester and DXer Steve Miller, N8SM, of Prosper, Texas, died June 15 as a result of a fall while working on his Amateur Radio tower. He was 38. An ARRL member, Miller had extensive experience in tower work and antenna installation and—with help from several other hams—had erected a 136-foot tower on his property. According to unofficial accounts, Miller was working alone on his tower when he fell. His wife, Radhicar, found him on the ground, but rescue personnel were unable to revive him. ARRL antenna specialist Dean Straw, N6BV, was among those expressing shock and sadness at his death. "Steve always had the most intelligent comments and questions concerning whatever technical topic we were discussing," said Straw. "I will miss his innate, contagious enthusiasm." First licensed as WD8IXE in 1977 at age 12, Miller—an Ohio native—was routinely active during the CW weekends of the CQ World Wide, ARRL International DX and ARRL November Sweepstakes events. He also had operated on several DXpeditions and was an ARRL DXCC Honor Roll member with 332 entities confirmed (mixed). Survivors include his wife and daughter. A Memorial service was held June 19.

Media Hits

- An Associated Press story from Miami called ham radio operators a "critical component" of hurricane forecasting, despite today's sophisticated technology used to predict storms and provide critical information. Amateur Radio coordinator at the National Hurricane Center in Miami John McHugh, KU4GY, was interviewed about ham radio's role during hurricanes. Also interviewed was ARRL Virgin Islands Section Manager John Ellis, NP2B. The AP story was picked up by *USA Today* among other news outlets.
- Ten-year-old Ashley Kopacki, NJ2YL, was featured in a June story in New Jersey's *Mount Olive Chronicle*. Kopacki "caught the bug" from her father and quickly was on her way to getting her Extra class ticket. The article covered Kopacki's varied interests in ham radio, including contesting. Chris Linne, N2OPO, submitted the story to the paper, along with a photo of Kopacki operating, and it ran just in time to plug ARRL Field Day.
- ZDNet, an on-line technology news service, ran an editorial on ham radio by ZDNet's Anchor Desk Executive Editor David Coursey, N5FDL. An ARRL Life Member, Coursey credits ham radio for his career in the technology field. In his editorial, Coursey plugged ARRL Field Day and told his readers that he hoped to pique their interest in becoming ham radio operators themselves. He included his own e-mail address for further information on license classes in the San Francisco area and asked for reader feedback. QST

Yaesu VXA-700 Spirit 2 Meter Handheld Transceiver

Reviewed by Rosalie White, K1STO
ARRL Field & Educational Services Manager

You've probably caught yourself occasionally saying, "Somebody ought to make [insert contraption here]." Hams with an interest in aviation have probably said, "Somebody ought to make a radio that works on both ham and aviation bands." Well, Vertex Standard, which manufactures and markets amateur equipment under the Yaesu banner, now sells that one-of-a-kind radio—the VXA-700 Spirit. It's a diminutive dynamo that receives and transmits on both the Amateur Radio 2 meter band and the aviation bands, and also receives NOAA weather channels. Before you ask, the packaging loudly announces that you must have an Amateur Radio license to transmit on the ham bands. Normally I refuse to be a test pilot, but I was a natural, being the one current pilot on ARRL's staff, to test-fly this unit.

As I pulled the VXA-700 out of its box, it felt really good in my hand. Rounded edges with rubberized corners allow a nice grip and fit. My fingers easily grab hold of the knobs "on the fly" even during bumpy flights. For size, don't even think "bulk." The handheld weighs just over 9½ ounces, not adding much to your jump kit or your plane's weight and balance. At 2.36×3.78×1.12 inches (excluding the antenna), you can stash it handily under the seat. The radio also comes with a belt clip.

The handheld operates off a rechargeable lithium-ion battery supplied with the radio. The manual suggests you charge the battery for 12 hours, and it is rated at 300 charge cycles. As with other radios, when the battery icon blinks on the LCD display, you must recharge the battery before further use. You don't want to recharge it before that icon indicates it's time because it could degrade the charge capacity—deep cycling helps maintain longer battery life.

Typical of newer handhelds, you'll find the PWR button at the top left corner near the Spirit's front keypad. Depress it for three seconds to turn it on; it has a bright orange marking. Pressing the BAND key repetitively switches between the air bands, 2 meter ham band and FM broadcast band. The easiest way to tune in frequencies is to enter the numbers directly on the keypad.

You may also choose a frequency by turning the top panel's DIAL knob. When you enter a frequency in the usual repeater range, the transmit offset is entered automatically. This Automatic Repeater Shift feature may be turned off or overridden for machines with nonstandard repeater frequencies or shifts.

As with the VX-7R, squelch is controlled via a menu option. Press and hold in the SQ key for three seconds, and this instantly recalls "Menu Item SQL" on the AM or narrow FM mode, or "WSQL" on the wide FM mode. Next press the SEL key, and you'll be able to adjust the squelch. Rotate the DIAL to set the squelch threshold and press the SEL key to save that setting. Press PTT repetitively until the radio exits to normal operation.

Both hams and pilots sometimes will hear very weak signals from a ground station or aircraft. You can disable the squelch temporarily by pressing and holding for two seconds the MONITOR key on the left side of the radio, just below the PTT button. Press MONITOR to return to normal operation. Some cars and airplanes will have impulse noise caused by the engine's ignition system. The VXA-700 has an Automatic Noise Limiter feature that should help reduce ignition noise.

Bottom Line

If you're ready to move up to a good 2 meter hand-held with one-of-a-kind extras such as AM and aviation capabilities, the VXA-700 Spirit is worth a close look.

Is One VXA-700 in the Hand Worth Three in the Bush Pilot's Plane?

The DIAL serves as the large tuning knob. A secondary dial is located around the base of this main knob, and controls the radio's volume. The Spirit has several "Easy Tuning" special functions. One of these is the variable frequency oscillator (VFO) tuning system, which allows you to tune through the air band, 2 meter band and FM band using the DIAL selector, the keypad or the scanner. Just press the BAND key momentarily.

Several keys have triple functions. The primary functions are labeled on the key top, and are activated by pressing the key momentarily. The secondary functions are labeled in yellow above the top edge of the key, and are activated by pressing the F key first, then the indicated key. The third functions are labeled in black above the top edge of the key, and are activated by pressing and holding the indicated key for two seconds. Once you become familiar with the radio, you're fine, but you'll need the user's manual for a while. Of interest to hams, but especially to pilots: The radio can be used for scanning while en route, allowing you to listen for traffic at nearby airports that operate on various frequencies.

All in One

Another special function is *Memory Recall*. It allows you to store and recall as many as 102 channels in the main memory bank. You can label these channels with an alphanumeric name of up to 8 characters for quick identification.

Brennan Price, N4QX ♦ Assistant Technical Editor ♦ n4qx@arrl.org

Table 1
Yaesu VXA-700 Spirit, serial number 3C030250

Manufacturer's Claimed Specifications	Measured in the ARRL Lab
Frequency Coverage: Receive, 88-108 MHz (WFM), 108-137 MHz (AM), 144-148 MHz, 162-165 MHz; transmit, 118-137 (AM), 144-148 MHz.	Receive and transmit, as specified.
Power requirements: 4.5-15 V dc[1]; receive, 0.18 A; transmit, 1.7 A (max, high power).	Receive (max volume, no signal), 0.19 A battery, 0.48 A external dc[2]; transmit, 1.4 A (battery and dc).
Size (height, width, depth): 3.8x2.4x1.1; weight, 9.9 ounces.	
Receiver	**Receiver Dynamic Testing**
Sensitivity: WFM, 12 dB SINAD, 88-108, 2 μV; AM, 6 dB S/N, 108-137 MHz, 1 μV; FM, 12 dB SINAD, 144-148 MHz, 0.32 μV; 162.4-162.55 MHz, 0.4 μV.	AM, 10 dB S+N/N, 120 MHz, 0.56 μV; WFM, 12 dB SINAD, 100 MHz, 1.0 μV; NFM, 12 dB SINAD, 144 MHz, 0.17 μV; 162 MHz, 0.17 μV.
Blocking dynamic range: Not specified.	120 MHz, 25 kHz spacing, 58 dB.
AM two-tone, third-order IMD dynamic range: Not specified.	25 kHz offset from 120 MHz, 58 dB.
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz offset from 146 MHz, 55 dB, 10 MHz offset from 146 MHz, 75 dB.
Adjacent-channel rejection: AM, NFM, 25 kHz offset, 60 dB.	20 kHz offset from 146 MHz, 64 dB.
Spurious response: Not specified.	IF rejection, 110 dB; image rejection, 76 dB.
Squelch sensitivity: Not specified.	At threshold, VHF, 0.13 μV.
Audio output: 400 mW at 10% THD into 8 Ω (dc).	605 mW at 12% THD[3] into 8 Ω.
Transmitter	**Transmitter Dynamic Testing**
Power output: 118 MHz, 1.5 W carrier (AM only); 144 MHz, FM, 5.0 W high; AM, 1.3 W carrier; medium and low power not specified.	120 MHz, 1.4 W (carrier); 146 MHz, 5.0 / 2.5 / 1.1 / 0.38 W;
Spurious signal and harmonic suppression: 60 dB.	120 MHz, 62 dB; 144 MHz, 68 dB. Meets FCC requirements.
Transmit-receive turnaround time (PTT release to 50% of full audio output): Not specified.	Squelch on, S9 signal, 167 ms.
Receive-transmit turnaround time ("tx delay"): Not specified.	94 ms.

[1]External dc. Battery is 7.2 V.
[2]Tested at 13.8 V.
[3]Volume is adjusted in steps; the next lower step produced 2.7% THD (450 mW output).

A third special function is *Book Memories*, which are preprogrammed by the factory or dealer, and include the air band frequencies used in your area. These can be changed by the user.

The fourth special function, *Weather Channel Memories*, can only be found in the US version of the radio. For this function, 10 weather channels are preprogrammed at the factory. The VXA-700 automatically scans this bank when "WX" is selected.

Two-Meter AM!

Shortly after getting the VXA-700, I made 2 meter simplex and repeater QSOs, and I listened to the NOAA weather frequencies. I also tried 2 meter AM QSOs—yes, 2 meter AM! While I sat in my office during noon hour using the radio's 4 W output, Brennan, N4QX, walked around the whole building, just as in the TV ads, saying "Do you hear me now?" We heard each other at every spot. Brennan said my audio sounded fine, and the Spirit's reception was pleasing to hear, the same as when I made the 2 meter FM QSOs. However, the AM signal did appear to be more susceptible to causing problems to an unshielded computer speaker on the desk of another ARRL staff member.

Hams who are interested in AM operation on 2 meters should check with their local frequency coordination body to determine where AM operation is recommended. The band plan suggested by ARRL calls for miscellaneous modes, including AM, between 145.50 and 145.80 MHz. Brennan and I operated in this frequency range, but your local convention may be different.

The manual describes repeater operation, including automatic repeater shifts, manual repeater shift activation, changing the default repeater shifts, CTCSS operation and the automatic range transponder system.

A nice option is the USER key, a user-programmable key that may be set up for a pair of functions that you use frequently. There is a stopwatch timer and countdown timer—very handy to instrument-rated pilots who might like a backup to the timers they use so often.

Red Light, Green Light

You can customize the Spirit's display, such as the contrast and the display dimmer. Bright red and green lights grace the radio, and as with the VX-7R, you may customize the colors via the Menu mode. The colors tell you such things as whether the battery is charged or not. Out of the box, green means a signal is being received, while red shows the radio is transmitting. But more important to a pilot is the blue-violet light.

If a pilot is in dire need of assistance in a tough flying situation, he or she can punch in 121.5 MHz, which is monitored by the Federal Aviation Administration

to help pilots who ask for it. If such a situation occurs, the last thing a pilot needs is to have to fumble with a radio. On the VXA-700, a pilot can push the clearly marked 121.5 key to transmit instantaneously on this frequency, even when the keypad lock function is on.

The pilot's emergency rule is aviate, navigate, communicate—in that order. Vertex Standard makes it easy to deal with the latter after handling the former. Let's say a pilot smells something hot. In my case it was the circuit breaker for the retractable gear just before making a landing. The Spirit lets you hit the 121.5 key, you see the friendly blue-violet light and hear a reassuring tone sing out. You then ask to be vectored to the nearest airport, right now!

The Spirit's aviation Com band covers 118.0000 to 136.9750. Its Nav band covers 108.0000 to 117.9750 MHz. Pilots can transmit a call to a Flight Service Station using the Com band frequencies while receiving a VOR station in the Nav band.

The VOR mode displays a course indicator showing the VFO frequency, the heading and the "to" or "from" flags. Or you can display the CDI mode, which reads out your heading, a course deviation needle, and the "to" or "from" flags.

The Spirit's manual explains how to use the radio to fly to a VOR station and know if you are right or left of course, and by how many degrees. Or the radio can be configured to indicate the deviation from a desired course. I found that while flying, the VXA-700 captured the VOR signals, but reception sometimes faded, not providing a reading of my course position. An external antenna is probably the answer to this problem.

Accessories

Accessories supplied with the VXA-700 include the lithium-ion battery pack (7.2 V, 700 mAh), battery charger, helical antenna and headset cable. The headset cable allows you to plug your favorite aviation headset into the VXA-700. An optional cable can be purchased to provide push-to-talk capabilities with your aviation headset. An optional SMA-to-BNC adapter is available so that you can use a different antenna. Also optional are a dc cable with noise filter, dc cable that is a plug and wire only, speaker microphone and desktop rapid charger.

If you're a ham looking for more than FM in a 2 meter handheld, the VXA-700 will offer you AM. If you're a pilot, you can never have enough backup equipment, and the VXA-700 can be your security blanket.

Manufacturer: Vertex Standard, 10900 Walker St, Cypress, CA 90630; tel 714-827-7600; fax 714-827-9100; **www.vxstdusa.com**. Price: $419.95.

QST Reviews Two All-Mode Handheld Receivers

Reviewed by Brennan Price, N4QX
Assistant Technical Editor

Continuing our evaluation of handheld receivers from last month's *QST*, we turn to two recently released all-mode models, the ICOM IC-R10 and the Yaesu VR-500. An all-mode, handheld, MF/HF/VHF/UHF receiver may be useful to hams operating from a temporary location. For instance, an emergency communicator using a VHF transceiver may want to monitor his area's HF emergency net. An all-mode handheld receiver allows such a ham to do so without carrying a significant amount of heavy additional equipment in his jump kit.

Two things about these types of handhelds should be established up front. First, the antennas included with the radios are universally too short for ideal reception below VHF frequencies. You will hear strong MF and HF signals on the attached rubber ducks, but attaching a more substantial antenna to the BNC or SMA connector will aid reception considerably. Second, with a small size and a small price tag, receiver performance will not match that found in higher cost, tabletop models. The user must adopt realistic expectations on sensitivity and dynamic range. With these across-the-board limitations in mind, let's take a look at how these two rigs look, feel and perform.

ICOM IC-R10

ICOM's newest entry into this class of receiver is its IC-R10, which is significantly more substantial than the IC-R5 model reviewed last month. Its size is reminiscent of handheld transceivers of a few years ago—not as big as the first handhelds that came on the market, but bigger than most current models (such as ICOM's IC-T90A). It fits nicely in the palm of an adult hand, but the hand doesn't embrace it completely.

Operation of the nicely sized 20-key control panel is straightforward, and direct frequency entry is easy. All frequencies are entered in MHz, so users will want to be sure to use the decimal when entering MF or HF frequencies. Changing from mode to mode is easily accomplished by clicking the MODE key on the top row of the keypad. Clearly labeled supplemental functions for each key may be accessed through the FUNC key, located at the upper left side of the radio, where the push-to-talk button might be located on a transceiver. An experienced user of Amateur Radio equipment should be able to figure the basic tuning and mode selection steps on his or her own, without cracking the 78-page instruction manual. (Our manual had a second 78 pages printed in Spanish. Multilingual instruction manuals have long been used in many other areas

Table 2
ICOM IC-R10, serial number 0501461

Manufacturer's Claimed Specifications	Measured in the ARRL Lab
Frequency coverage: Receive, 0.5-824; 849-869; 894-1300 MHz.	Receive, as specified.
Modes of operation: FM, WFM, AM, SSB, CW.	As specified.
Power requirements: 0.18 A (rated output), 4.8-16 V dc.	0.14 A (max volume, no signal), tested at 13.8 V dc.
Size (HWD): 5.1x2.3x1.2 inches; weight, 10.9 ounces.	
CW/SSB sensitivity (10 dB S/N): 0.5-5, 200-340, 800-1300 MHz, 0.4 μV; 5-200 MHz, 0.25 μV; 340-700 MHz, 0.32 μV; 700-800 MHz, 0.63 μV.	Noise floor (MDS): 1.0 MHz, –129 dBm; 3.5 MHz, –132 dBm; 14 MHz, –131 dBm; 50 MHz, –132 dBm; 144 MHz, –133 dBm; 222 MHz, –128 dBm; 432 MHz, –128 dBm; 902 MHz, –131 dBm; 1240 MHz, –126 dBm.
AM sensitivity (10 dB S/N): 0.5-5, 200-340, 800-1300 MHz, 1.6 μV; 5-200 MHz, 1.0 μV; 340-700 MHz, 1.4 μV; 700-800 MHz, 2.0 μV.	AM, test signal modulated 30% with a 1-kHz tone, 10 dB (S+N)/N: 1.0 MHz, 0.89 μV; 3.8 MHz, 0.6 μV; 53 MHz, 0.58 μV; 120 MHz, 0.59 μV; 146 MHz, 0.62 μV; 440 MHz, 0.93 μV.
FM narrow sensitivity (12 dB SINAD): 0.5-5, 800-1300 MHz, 0.5 μV; 5-200 MHz, 0.32 μV; 200-340 MHz, 0.45 μV; 340-700 MHz, 0.35 μV; 700-800 MHz, 0.79 μV.	FM narrow, 12 dB SINAD: 29 MHz, 0.23 μV; 52 MHz, 0.23 μV; 146 MHz, 0.2 μV; 222 MHz, 0.34 μV; 440 MHz, 0.35 μV; 906 MHz, 0.28 μV; 1296 MHz, 0.39 μV.
FM wide sensitivity (12 dB SINAD): 75-200 MHz, 1.0 μV; 200-340 MHz, 2.2 μV; 340-700 MHz, 1.3 μV; 700-800 MHz, 2.0 μV; 800-900 MHz, 1.6 μV.	100 MHz, 1.1 μV.
Blocking dynamic range: Not specified.	CW mode: 3.8 MHz, 54 dB; 14 MHz, 60 dB; 50 MHz, 70 dB; 144 MHz, 73 dB*; 222 MHz, 65 dB; 432 MHz, 66 dB; 902 MHz, 66 dB; 1240 MHz, 78 dB.
Two-tone, third-order IMD dynamic range: Not specified.	CW mode dynamic range and third-order intercept point: *Frequency (MHz)* / *Dynamic Range (dB)* / *Intercept point† (dBm)* 3.8 / 47 / –62 14 / 50 / –56 50 / 56 / –48 144 / 58 / –47 432 / 54 / –47 902 / 56 / –47 1240 / 64 / –30
Second-order intercept point: Not specified.	–19 dBm.
FM adjacent channel rejection: Not specified.	20 kHz channel spacing: 29 MHz, 48 dB; 52 MHz, 47 dB; 146 MHz, 44 dB; 440 MHz, 49 dB; 906 MHz, 51 dB; 1246 MHz, 55 dB.
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz channel spacing: 29 MHz, 45 dB; 52 MHz, 47 dB*; 146 MHz, 45 dB*; 440 MHz, 46 dB; 906 MHz, 46 dB; 1246 MHz, 55 dB*; 10 MHz channel spacing: 52 MHz, 62 dB; 146 MHz, 66 dB; 440 MHz, 66 dB.
Squelch sensitivity: AM, 0.5-5, 200-340, 800-1300 MHz, 1.6 μV; 5-200 MHz, 1.0 μV; 340-700 MHz, 1.4 μV; 700-800 MHz, 2.0 μV; FM, 0.5-5, 800-1300 MHz, 0.5 μV; 5-200 MHz, 0.32 μV; 200-340 MHz, 0.45 μV; 340-700 MHz, 0.35 μV; 700-800 MHz, 0.79 μV; WFM, 75-200 MHz, 1.0 μV; 200-340 MHz, 2.2 μV; 340-700 MHz, 1.3 μV; 700-800 MHz, 2.0 μV; 800-900 MHz, 1.6 μV.	At threshold: FM, 29 MHz, 0.14 μV; 52 MHz, 0.14 μV; 146 MHz, 0.11 μV; 440 MHz, 0.18 μV; 906 MHz, 0.16 μV; 1246 MHz, 0.21 μV.
Audio output: 0.12 W at 10% THD into 8 Ω load.	0.11 W at 10% THD into 8 Ω.
IF/audio response: Not specified.	Range at –6 dB points (bandwidth): CW: 443-3352 Hz (2909 Hz); USB: 450-3353 Hz (2903 Hz); LSB: 444-3343 Hz (2899 Hz); AM: 322-3815 Hz (3493 Hz).
Spurious and Image rejection: Not specified.	IF: 14 MHz, 98 dB; 52 MHz, 88 dB; 144 MHz, 62 dB; 440 MHz, 23 dB; 906 MHz, 97 dB; 1270 MHz, 69 dB; Image: 14 MHz, 71 dB; 52 MHz, 64 dB; 146 MHz, 76 dB; 440 MHz, 37 dB; 906 MHz, 61 dB; 1270 MHz, 54 dB.

Except as noted, all dynamic range measurements were taken using the ARRL Lab standard spacing of 20 kHz.
†Third-order intercept points were determined using noise floor reference.
*Measurement was noise-limited at value indicated.

of the electronics industry, but this is the first time this writer can remember an Amateur Radio manufacturer adopting this useful practice.)

As can be expected, reference to the manual is critical for more advanced uses, such as programming the 1000 memory channels distributed through 18 memory banks. Each memory may contain a name, mode, attenuator condition, and scanning condition in addition to the frequency. The programming steps are described in detail in the manual, and users familiar with programming similar types of radios will have no difficulty whatsoever.

As usual, both spectrum ranges and memory banks can be scanned. An auto memory write scanning function allows the user to scan a spectrum segment and store each active frequency in a special 100-channel memory bank. This is useful for checking for active frequencies in an unfamiliar location. Another 100-channel memory bank serves as a repository for "program skip" frequencies, which can be automatically skipped over while scanning for different frequencies.

Even though ICOM's manual is good, figuring out all of the scanning nuances can be frustrating. This is true of any such radio, and ICOM attempts to address this by establishing what they call an easy mode. When the user presses the EASY key on the front panel, 10 pre-programmed spectrum segments may be selected from the numeric keypad (which then becomes disabled for direct frequency entry). However, in order to get the most use out of this mode, the programmed frequency ranges may need to be tweaked. For instance, the 88-108 MHz FM broadcast band scans in 200 kHz steps. While this is the correct step, calling up the band out of the box will set the receiver to 88.0 MHz, and scanning steps will call up even numbers in the tenths digit. Of course, United States FM broadcast stations are centered on odd frequencies. Changing the band edges to 87.9-107.9 MHz would be useful for quick scanning of the FM broadcast segment.

Editing previously programmed memories and scanning parameters is fairly easy as well. The clearly labeled EDIT key edits the parameters of whatever is being displayed on the screen at the time, whether it's a memory channel or an easy mode band segment.

A variety of miscellaneous functions rounds out the 'R10's operating features. Users can set display lighting and contrast to their liking. If users wish to control the receiver via computer, the radio is compatible with ICOM's optional CT-17 CI-V interface, which was not tested in this review.

For a rig this size, the IC-R10 actually sounded pretty good, surprisingly so on the FM broadcast band. When some friends bemoaned the lack of a radio in the office where we were working, I whipped the 'R10 out of my briefcase and quickly tuned to the music station of their choice. I didn't expect high fidelity reception on the very modest speaker, and I didn't get it. But the audio was considerably more pleasant on both FM and AM than it usually is on an all-mode receiver of this size. The CW sidetone was a little too low in frequency for my liking, but minor deviations from the actual frequency can adjust the sidetone heard by the user. ARRL Lab test results are in Table 2.

Four 700-mAh NiCd batteries are included, as is a wall adapter, with which the batteries can be charged. My biggest complaint with ICOM's R10 offering is the small capacity of these batteries, particularly when a plethora of higher capacity AA cells are on the market. Nevertheless, the user may substitute his or her own batteries, and the overall performance is commendable.

Manufacturer: ICOM America, 2380 116th Ave NE, Bellevue, WA 98004; tel 425-454-8155; fax 425-454-1509; **www.icomamerica.com**. Price: $299.95.

Yaesu VR-500

Yaesu's VR-500 is much closer to the size of its modern handheld transceivers, such as the Vertex Standard VXA-700 reviewed in the preceding pages. It's just a little bit bigger than Yaesu's VX-5R. Batteries are not included; the user provides his or her own.

The basic functions are all easily accessible, and a user wishing to skip the manual and play can easily select a frequency by direct entry. The 15-key front panel has rather small buttons, due largely to the small size of the radio. Changing the mode requires use of the FUNC key, located once again where the push-to-talk key would be on a handheld transceiver. Holding down the FUNC key and pressing 0 toggles back and forth between narrow and broadcast FM, AM, lower and upper sideband, and CW.

The VR-500 also offers 1000 main programmable memories, storable in 10 memory banks. Each memory bank contains the memory channels that begin with its number; for instance, memory bank 1 contains memories 100 through 199. The user need not designate the channel in which a frequency is to be stored; the simple storage feature allows automatic entry into the next available empty register. For those who aren't picky about the organization of their frequently used settings (I am not, but your mileage may justifiably vary), this can be a time saver. Each memory can store an alphanumeric label in addition to frequency and operating mode. The alphanumeric label can be used to recall the memory channel through the appropriately named alphanumeric memory recall feature. If your Amateur Radio club, the Rotten Amateur Radio Society, for example, has three repeaters, you might choose to program them as ROTTEN1, ROTTEN2 and ROTTEN3. Doing a search for ROTTEN will recall these channels.

The VR-500's manual distinguishes between searching and scanning. Searching is something you can do in the VFO mode while hunting for active frequencies. Scanning is something only done in memory mode, when active memory channels are sought. The VR-500 makes extensive use of the FUNC key in accessing several functions, and searching and scanning are no exception. FUNC 3 will get you started. The nuances are better described in the manual than I could describe them here. Individual memory banks can be designated during scanning, and other banks can be ignored.

Yaesu also has an easy mode in the VR-500, but it's called the preset mode instead. Holding the FUNC and CLR(P.SET) keys down momentarily will turn this on and off. Ten amateur, broadcast and weather bands are defined.

A nifty feature carried over from other Yaesu products is the band scope, which graphically displays active frequencies near the currently tuned frequency. A "channel marker" can be adjusted underneath this display in order to zero in on and snare a new frequency once the band scope is turned off. Also carried over is their Smart Search feature, which allows automatic storage of active frequencies found during a search. A separate, 31-channel memory bank exists for this purpose, and is a boon for operators looking for a few quick frequencies on a particular band in an unfamiliar place.

An extensive 32-item menu system allows the user to specify a plethora of preferences, including back lighting, automatic mode selection, display language, on/off timer, scan delay time, and the useful flexible frequency step, where the user can specify a different step for different modes. Cloning from one VR-500 to another is possible, but the manual does not reveal any provision for computer control.

The tiny speaker is adequate, with the reproduction of broadcast signals slightly better than expected. Amateur signals were reproduced in a decipherable manner, but the CW reproduction was somewhat anemic; W1AW sounded a bit like a sick duck when I tuned it in. Once again, the CW sidetone was somewhat low, but fiddling with the tuning fixes that.

Receiver performance is summarized

Table 3
Yaesu VR-500, serial number 3E380060

Manufacturer's Claimed Specifications	Measured in the ARRL Lab
Frequency coverage: Receive, 0.1-824; 849-869; 894-1300 MHz.	Receive, as specified.
Modes of operation: FM, WFM, AM, SSB, CW.	As specified.
Power requirements: 0.115 A, 9.0-16 V dc.	0.07 A (max volume, no signal), tested at 13.8 V dc.
Size (HWD): 3.7x2.3x0.9 inches; weight, 7.8 ounces.	
CW/SSB sensitivity (10 dB S/N): 0.1-5 MHz, 0.6 μV; 5-520 MHz, 0.5 μV; 520-1300 MHz, 0.8 μV.	Noise floor (MDS): 1.0 MHz, –129 dBm; 3.5 MHz, –128 dBm; 14 MHz, –128 dBm; 50 MHz, –132 dBm; 144 MHz, –131 dBm; 222 MHz, –133 dBm; 432 MHz, –132 dBm; 902 MHz, –129 dBm; 1240 MHz, –123 dBm.
AM sensitivity (10 dB S/N): 0.5-5 MHz, 1.5 μV; 5-370 MHz, 1.0 μV.	AM, test signal modulated 30% with a 1-kHz tone, 10 dB (S+N)/N: 1.0 MHz, 0.63 μV; 3.8 MHz, 0.72 μV; 53 MHz, 0.46 μV; 120 MHz, 0.46 μV; 146 MHz, 0.54 μV; 440 MHz, 0.67 μV;
FM narrow sensitivity (12 dB SINAD): 5-520 MHz, 0.5 μV; 520-1300 MHz, 1.2 μV.	FM narrow, 12 dB SINAD: 29 MHz, 0.29 μV; 52 MHz, 0.22 μV; 146 MHz, 0.27 μV; 222 MHz, 0.2 μV; 440 MHz, 0.27 μV; 906 MHz, 0.08 μV; 1296 MHz, 0.17 μV.
FM wide sensitivity (12 dB SINAD): 5-370 MHz, 1.5 μV; 370-520 MHz, 1.8 μV; 520-1300 MHz, 3.0 μV.	100 MHz, 0.86 μV.
Blocking dynamic range: Not specified.	CW mode: 3.8 MHz, 66 dB; 14 MHz, 68 dB; 50 MHz, 66 dB; 144 MHz, 75 dB; 222 MHz, 66 dB*; 432 MHz, 69 dB*; 902 MHz, 74 dB; 1240 MHz, 61 dB*.
Two-tone, third-order IMD dynamic range: Not specified.	CW mode dynamic range and third-order intercept point: *Frequency (MHz)* / *Dynamic Range (dB)* / *Intercept point† (dBm)* 3.8 / 54 / –47 14 / 53 / –48 50 / 53 / –53 144 / 57* / –46 432 / 60 / –42 902 / 58 / –42 1240 / 59* / –34
Second-order intercept point: Not specified.	–21 dBm.
FM adjacent channel rejection: Not specified.	20 kHz channel spacing: 29 MHz, 44 dB; 52 MHz, 44 dB; 146 MHz, 42 dB; 440 MHz, 47 dB; 906 MHz, 59 dB; 1246 MHz, 55 dB.
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz channel spacing: 29 MHz, 45 dB*; 52 MHz, 44 dB*; 146 MHz, 43 dB*; 440 MHz, 47 dB*; 906 MHz, 59 dB*; 1246 MHz, 56 dB*; 10 MHz channel spacing: 52 MHz, 53 dB; 146 MHz, 57 dB; 440 MHz, 63 dB.
Squelch sensitivity: Not specified.	At threshold: SSB, 14 MHz, 0.18 μV; FM, 29 MHz, 0.15 μV; 52 MHz, 0.09 μV; 146 MHz, 0.19 μV; 440 MHz, 0.24 μV; 906 MHz, 0.15 μV; 1246 MHz, 0.38 μV.
Audio output: 0.125 W, distortion and load unspecified.	0.11 W at 10% THD into 8 Ω.
IF/audio response: Not specified.	Range at –6 dB points, (bandwidth): CW: 430-2604 Hz (2174 Hz); USB: 394-2475 Hz (2081 Hz); LSB: 430-2606 Hz (2176 Hz); AM: 309-2464 Hz (2155 Hz).
Spurious and Image rejection: Not specified.	IF: 14 MHz, 67 dB; 52 MHz, 75 dB; 144 MHz, 57 dB; 440 MHz, 53 dB; 906 MHz, 78 dB; 1270 MHz, 32 dB; Image: 14 MHz, 54 dB; 52 MHz, 52 dB; 146 MHz, 44 dB; 440 MHz, 55 dB; 906 MHz, 40 dB; 1270 MHz, 35 dB.

Except as noted, all dynamic range measurements were taken using the ARRL Lab standard spacing of 20 kHz.
†Third-order intercept points were determined using noise floor reference.
*Measurement was noise-limited at value indicated.

in Table 3. It's a very good receiver for a handheld of this price class, but the results come with a caveat. The dynamic range and FM adjacent channel rejection measurements were taken with the receiver running on 3 V dc internal battery power. When power was applied from the ARRL Lab's external power supply through the EXT DC jack, these measurements were almost universally noise-limited at significantly degraded values. Under external power, the *best-case* values for two-tone, third-order IMD and third-order intercept point were 35 dB and –70 dB, respectively, at 1240 MHz. For optimum performance in crowded band conditions, users may wish to stick with internal batteries.

All in all, Yaesu nicely incorporates some of its more popular handheld transceiver functions into this radio, and fans of those functions will like it. It's a nice little rig designed for an uncrowded band.

Manufacturer: Vertex Standard, 10900 Walker St, Cypress, CA 90630; tel 714-827-7600; fax 714-827-9100; **www.vxstdusa.com**. Price: $299.95.

TECHNICAL CORRESPONDENCE

RE "THE ST LOUIS SWITCHER"

By Steven D. Katz, WB2WIK, 20510 Malden St, Winnetka, CA 91306;
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◊ I read "The St Louis Switcher," by Matt Kastigar, NØXEU (May 2002 *QST,* pp 35-38) with interest and offer some follow-up information that may save readers some trouble.

First, the resulting item from the article is labeled a "13.6-V 20-A Power Supply," when, in fact, it isn't. By the author's admission, and apparently confirmed in the ARRL Lab, the power supply blew a line fuse at 17.5 A dc output from the +12 V bus, and the regulation was poor enough that with a 20 A load the output voltage dropped 6%, down to 12.77 V dc.

Being intimately familiar with PC power supplies over a period of many years, I suspect the "output ac ripple" quoted on page 38 of the article isn't quite as low as stated (15 mV) if measured at full load. Is that 15 mV RMS? 15 mV peak? 15 mV P-P? At 20 A? At what frequency? Was the entire spectrum from dc to the 10× harmonic of the switch scanned? The number sounds far too low for a power supply that is obviously dropping out of regulation.

These issues are all relatively minor in the big picture. The power supplies discussed in the article are PS/2 types, having the features indicated. PS/2 power supplies are technically obsolete and at their "End of Life" for the PC industry, which adopted the ATX standard more than four years ago. ATX power supplies, which are available from 100 W to 600 W+, are quite different animals and they are commonly found in most all PCs disposed of or recycled today. PS/2 power supplies most commonly yielded 230 W maximum, arranged as follows: +5 V@23 A, +12 V@ 9 A, –5 V@0.5 A, –12 V@0.5 A.

This totals 231.5 W and represents about the "best of breed" PS/2 power supplies used in PCs. Larger power supplies were used in servers having multiple CPUs. Other PC supplies get more interesting.

For one thing, the Intel ATX standard came along with Pentium-class CPUs, which operate on a bus voltage of 3.3 V. The ATX standard also requires that the power supply never fully shuts down: that it always provides a source of +5 V dc, called "standby" voltage, so that grounding a single pin on the 20-pin ATX connector "soft starts" the power supply and allows it to provide power to the other rails. That pin is 14, which must be tied to a common connection to make the power supply function for bench use, such as powering amateur gear. This important piece of data appears to be missing from the subject article.

I pulled three ATX 2.04 compatible power supplies and derived vastly different results. All are "new" power supplies that meet their published specifications. None of them can provide 20 A dc at +12 V with transient response times that would permit CW operation. In all cases, I loaded the +5 V bus as stipulated for "minimum load" by the manufacturer (typically, 2 A dc, which required a 2.5 Ω, 20-W resistor).

The 3P Pacific Power Products KPP400J-4B, a very good (one of "best of breed") ATX power supply, is rated 14.0 A at +12 V (although it can provide 42.0 A at +5 V and 20.0 A at +3.3 V, as well as other outputs). I was able to crank the voltage up to 12.6 V, not quite 13.8, but better than 12.0 and seemingly sufficient to power my test transceiver, a Kenwood TS-850S/AT. As long, that is, as I used the TS-850S/AT at about 50 W of output power in a steady-carrier mode such as FM or RTTY. When switched to CW and sending dits at 30 WPM, the TS-850's transmitted signal exhibited some very undesirable traits, including chirp. Increasing the power to 100 W output and sending more dits caused the 6 A ac-line fuse to blow.

The other two power supplies failed the "CW" test almost immediately and did not fare as well as the 3P model.

A "best of breed" PS/2 power supply taken from a last-generation AT chassis is Seventeam model ST-300WHT, which is rated 15 A at +12 V (as well as 23 A at +5 V, and small currents at –12 and –5 V). It's called a "300 W" power supply, and thus has about 70 W more capacity than the typical 230 W PS/2 unit. Loading the +5 V bus with the resistor as stated earlier, I ran the "CW" test with the TS-850S/AT and not only did the rig chirp and sputter, but the power supply failed altogether.

A more common PS/2 power supply, a 230 W model, is Powertech's CK-4250DE, found in many PCs. It is only rated for 9 A at +12 V and could not muster enough output to run the TS-850 at anything more than about 40 W of RF output power.

While PS/2 power supplies remain abundant, especially in recycling centers (and literally in dumps!), they are not well suited to conversion to bench supplies or for powering Amateur Radio equipment at the 20 A level. I notice the N2APB model shown in the photograph is sitting alongside an FT-817 (5 W rig which requires no more than 2 A dc). This seems like a more appropriate load for the power supply.

I recommend that readers carefully select a suitable candidate supply for conversion and stress several points not mentioned in the article:

1. Since the ATX standard is more than four years old, most PC power supplies on dealer's shelves today will be "ATX" not PS/2. Many in recycling centers are already ATX as well, I have found. These are a better choice than PS/2 power supplies, because they tend to have more +12 V power available.

2. Remember, if you do use an ATX power supply, you must jumper pins 13 and 14 of the 20-pin motherboard connector to turn the power supply on. Simply plugging in the supply is not enough, and most ATX power supplies don't even have a power switch.

3. If you can, use a power supply that has Active Power Factor Correction, usually indicated as PFC. Reason: To meet the requirements of the European Union regulations concerning Information Technology Equipment that can carry the CE Mark, active PFC is a given. Power supplies not using PFC won't meet a requirement called European Norm (EN) 61000-3-2 for line power harmonic reduction. Here in the States, this is not a requirement (yet), but the benefit of a good PFC circuit is that it tends to additionally filter and smooth noise that might normally be conducted back from the power supply into the ac line. This reduces conducted RFI a great deal, making almost any PFC power supply a better choice for use around radio equipment.

4. If you want to power QRP gear at less than 5 A dc load current or FM gear (constant-carrier) at less than 10 A dc load current, a PC power supply can make an ideal, very inexpensive source. But for modes that tax the power supply's ability to hold up during rapidly switching loads, such as CW, and to a lesser extent SSB, especially if the load current exceeds 10 A dc, I have yet to find a suitable PC power supply for the application. The larger Enterprise (server) class power supplies, frequently in the 500-600 W range, might do it; but the smaller 230-

300 W units found in surplus PCs may not be worth converting.

CURRENT FLOW

By Professor Dean S. Edmonds, Jr, K1QCI
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◊ Once more the old physics professor is inspired to write you by one of your answers. This time it's the question about which way electrons flow that appeared in a recent [Sept 2001, p 56—*Ed.*] issue of *QST*. Of course you're quite correct in stating that the conduction electrons in a complete circuit move from the negative battery terminal around the circuit to the positive terminal, just as you would expect from the ideas that electrons are negative and like charges repel while unlike charges attract. And indeed, this direction of flow is opposite to the so-called *conventional* direction, usually assumed in circuit analysis that does not consider the mechanism of conduction. But I'd go easy on this *hole-flow* bit.

In the first place, in the normal conduction of electricity by metallic conductors, which is what the questioner is talking about, the flow of charge is known to be by electrons. Conducting metals are characterized by a crystal lattice in which the outer, or valence, electrons are free to move through the crystal structure. In the language of solid-state quantum mechanics, metals have a continuum of allowed energy states called the conduction band lying above the Fermi sea (the inner electron states) but with no energy gap separating the two. The objection that the electrons do not move fast enough "to create the behavior we observe" is really not valid, although the fact that a circuit comes alive the instant the switch is turned on has bothered students of electricity for generations. For the actual speed with which electrons move down a current-carrying wire—the so-called *drift velocity*—is indeed very slow. An example given in a well-known physics text[1] shows that the electrons in a length of #14 (AWG) copper wire carrying a current of 10 A is only 0.036 cm/s. That means it takes 28 seconds for any given electron in this wire to move 1 cm along the wire! How, then, can a whole circuit, that could involve miles of wire, start up all at once?

I've always answered this question by considering a long garden hose attached to a bib tap. If the hose is full of water, water shoots out the open end as soon as the tap is turned on. It's not the same water as is coming through the tap at that instant, but who cares? If you've seen one bit of water, you've seen them all. Of course the hose had to be full initially, but a metal wire is always full of free electrons, and we have it on the authority of Wolfgang Pauli himself that all electrons are identical. In a circuit, when the switch is turned on, the electrons passing through the switch contacts are not the same as those further around the circuit, but you can't tell the difference. Again, if you've seen one electron, you've seen them all!

So why is the direction of conventional current flow opposite to that of electron motion? Never mind hole flow, it's because Benjamin Franklin made a mistake: As early as 1733, the French physicist C. F. duFay had postulated that there were two kinds of electricity (what we would call electric charge). One was obtained by rubbing a plastic (amber or sealing wax or what we would call hard rubber) with wool and was therefore called resinous electricity. The other was obtained by rubbing glass with silk and was called vitreous electricity. DuFay also established that like charges repel and unlike charges attract. Franklin then observed that since in algebra, if you multiply two positive or two negative quantities together you get a positive quantity (which he thought of as indicating repulsion), whereas if you multiply a positive by a negative or a negative by a positive you get a negative quantity (signifying attraction), better names for the two kinds of electricity would be plus and minus. It was then up to him to determine which was which, and because he was working from a somewhat different basis than duFay (and of course knew nothing about the existence of electrons), he got it wrong in the light of subsequent developments.

It's just a shame that the electron, the principal charge carrier in ordinary conduction, turned out to carry the type of charge that Franklin had called negative. He could perfectly well have made the opposite choice, in which case none of the confusion about the direction of current flow would have arisen. Thus an important bit of modern nomenclature stems from a mere quirk of history—the arbitrary choice by a pioneer in the field.

[1]Halliday, D., and R. Resnick, *Fundamentals of Physics* (New York: John Wiley & Sons, 1970), pp 509-510.

NEW OLD DATA ON BEACONET^31

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◊ Our article, "Collecting Propagation Data on 10 Meters using BEACONet^31" (June 2002 *QST*, pp 37-39) attracted the attention of Robert Gonsett, W6VR. Bob brought to our attention an abstract from the publication "Radio Wave Propagation, Consolidated Summary Technical Report of the Committee on Propagation of the National Defense Research Committee," Charles R. Burrows, Chairman, which was published by Academic Press, Inc, in 1949.

During the early years of World War 2, government researchers had set up a station in San Diego (not all that far from the author) and in San Pedro (not all that far from KF6XA whose BEACONet transmissions provided the data we submitted in the *QST* paper). Those stations gathered both HF and VHF propagation data. We repeat here some of the findings reported in the Summary Technical Report:

> The meteorological conditions at San Diego during most of the year are characterized by the presence of a high-pressure area and high-level subsidence. In more concrete terms, there is a surface stratum of comparatively cool and moist air on top of which there is a layer of very dry, warm air. The transitions between the two strata are as sharp as can be found anywhere, and the transitional layer is often no more than a few hundred feet thick. The height of the transition layer above the ground is usually between 1000 and 3000 ft and sometimes as much as 4000 ft.
>
> Summarizing the results of this experiment, it may be said that the phenomenon of reflection from an elevated layer has been well established qualitatively and, in some respects, quantitatively. The meteorological conditions at San Diego are rather singular, and so far such reflection occurring in a systematic fashion has not been described elsewhere though indications of similar effects have occasionally been reported.

Bottom line, it looks as if the propagation effects we reported in our June 2002 *QST* article had been noticed and explained some 60 years ago. Once again, the pioneering work that was done in "radio" and "radar" during World War 2 turns out to have enduring value.

We now have thousands of KF6XA BEACONet data points at W3NRG, with equipment kept constant. The peaks and valleys in Figure 3 of our article become very muted during the summer months. The sharp layer transition suggested by the WW2 data apparently remains distinct and at a height for strong propagation of KF6XA's signal to W3NRG nearly around the clock. The high capture rate experienced at night in the winter months occurs in daylight as well during summer months.

APRS and Search and Rescue

By Jeff Lehman, KD6DHB
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JEFF LEHMAN, KD6DHB

The APRS team: Tad Gallistel, KG6ANQ, Jeff Lehman, KD6DHB, Mark Kinsey, KG6JZX and Mark Kern, KE6QXF. All are members of the San Bernardino County Sheriff's Cave Rescue Team.

1. APRS Introduction

A year or so ago I was on a search as part of a composite team that was sent to assist in the evacuation of some overdue hikers. The hikers were found the previous evening, and had spent a cold night with rescuers. From the outset there was difficulty in locating the proper canyon for our descent. The weather was cloudy so aviation was not flying at the beginning of the mission, and the location reports from those with the rescue subjects were conflicting. Since we were carrying vertical gear (ropes, carabiners, harnesses, etc) I opted not to bring my GPS or personal radio so as to reduce my load in the steep terrain (I learned many lessons on this rescue, two of the most important being never leave your radio and never leave your GPS).

From the outset, I realized that our team was having GPS "issues." When I heard the team member with the GPS report our position, it didn't correspond to where I thought we were on the map. After a couple of position reports, I started to get a bit frustrated with my navigation abilities, when I asked, "What map datum is your GPS set to?" I knew something was amiss when I got a blank stare. It turned out that the GPS's datum was set to "User Datum." While we did accomplish our mission that day, it began the search for a better way to monitor a SAR team's location.

Later, when relating this story to my teammates, most of them hams, we decided that it would be nice to reduce the likelihood of user error in the use of these technologies. After all, unless you use radios and GPS units regularly, their effective use can be daunting. A few of us had been talking about the use of the Automatic Position Reporting System in SAR, but we hadn't pursued it aggressively.

APRS was developed by Amateur Radio operator, Bob Bruninga, WB4APR, more than 10 years ago, and hams have been using APRS to track things such as floats in the Tournament of Roses Parade, runners on the Olympic Torch Relay, high altitude balloons and their personal vehicles. APRS encoders take the position output of a GPS receiver and use a radio to transmit a "packet" of this information that can be decoded by another station and plotted on a map. Depending on the rate at which one reports his position, the receiving station gets real-time locations for each station.

The reception of a packet can be improved with the use of digipeaters. Like radio repeaters that are used with voice communications, digipeaters can sit on mountaintops and repeat position packets. The difference with digipeater use is that it is transparent to the end user. Since there are no input and output frequency offsets, or PLs to set there is nothing that the user in the field must do. They just go about their primary job—searching and rescuing. In addition, portable digipeaters can be set up very easily that can help fill in areas of poor coverage. No large duplexing "cans," controllers, or other equipment associated with voice communication repeaters are required. A digipeater consists of a terminal node controller (TNC) and a radio.

The Mountain Rescue Association (MRA) offers a grant to further research in search and rescue operations each year. We wrote a proposal to the MRA (**www.mra.org**) to study the use of APRS in search and rescue (SAR) environments. We proposed to study the optimum enclosure for the trackers, the optimum reporting interval, the use of digipeaters, and the use of high-quality topographic map software to display position reports. In addition, we sought to use equipment (radios and GPSs) that our team already owned. To our delight our proposal was funded and we began, in earnest, the construction and purchase of the necessary hardware and software to build six tracking encoders and a base station to receive the reports and display them on a map.

2. Hardware and Software

Encoders

When designing the device that is to accompany rescuers in the field, there are a number of requirements for effective SAR use. The device must be weatherproof to some degree, it must be relatively lightweight and not bulky; the device should not encumber the rescuer to such a degree that their ability to perform their primary function is compromised. Finally, the device should be "rescuer proof." That is, there should be minimal maintenance required once deployed. The greater the number of buttons, and user intervention that is required, the greater the likelihood that the device will fail due to user error.

After investigating numerous options for encoders which included the TinyTrakII encoder (**www.byonics.com**), Paccomm PicoPacket (**www.paccomm.com**), and the Tigertronics TigerTrak TM-1 (**www.gpstracker.com**), we decided upon the TigerTrak TM-1. We initially purchased and built two TinyTrak's, but we were not able to get past an RF interference issue that would lock the encoder into transmit. Our packaging requirements necessitated close proximity of encoder and radio, and we were not

able to provide adequate shielding. The TigerTrak did not seem to have the same problems, so we decided to use this device.

The TigerTrak is a small, robust tracking encoder that will interface to just about any GPS or radio. Jason Yilek manager of CJ Products, the distributors of the TigerTrak, worked hard with us to make sure that this device would fit our design requirements. For example, when he found out that we were going to use the popular Garmin eTrex GPS with the device, they made a modification to the board to make sure that the voltage levels provided by the eTrex would indeed work with the TigerTrak. It turns out that some eTrex GPS units don't provide enough voltage at the serial port to successfully pass the data with the TigerTrak. A modification to the board, and a diode in the cable (they even gave us the diode so that we could include it in our cable) took care of any potential problems with the GPS interface.

Radios

Being hams, our team has a cache of the popular Yaesu VX-150 handheld VHF radio. This radio is well-suited for rugged treatment, and they have performed admirably in the field for a number of years. The trick to interfacing this radio to the encoder was finding a source for the 4-conductor microphone plug now popular on Yaesu radios. One suggestion from a local amateur radio store was to buy the cloning cable and cut it in half, but this was an expensive option, and it did not allow for a 90 degree bend in the connector. A call to the Yaesu parts department and their technical folks yielded no leads. Finally, we happened upon a terrific source. Bux Comm Co. (**www.buxcommco.com**) has the 4-conductor right-angle plug molded onto a spiral microphone cord. What a find! This enabled us to make a robust connection to the encoder for only a few dollars.

Base Station

For the command post station we purchased a Kantronics KPC-3+ TNC and connected it to a Yaesu FT-50R handheld transceiver that we had in the team cache. The TNC was connected to a team member's personal laptop computer, and the radio fed a "James Pole" copper J-pole purchased from James Pole Antennas (**www.jamespole.net**).

Software

The mapping software is a crucial part to APRS. After all, the whole point is to show where things are. The trouble with APRS software and SAR is that most of the mapping packages for use with APRS are street-level maps, and not topographic maps for wilderness use. To compound the difficulties, the USGS topographic maps used for wilderness travel use the North American Datum of 1927 (NAD27) and the maps with packages such as DeLorme StreetAtlas, Microsoft Mappoint, or WinAPRS use WGS84 or NAD83 as their datum. Also, most wilderness SAR uses the Universal Transverse Mercator (UTM) coordinate system. UTM coordinates are much easier to decipher when trying to plot a position on a map. With the UTM system, finding your position on the map is much like playing the game of *Battleship*. Your position is a series of numbers that correspond to so many units over and so many units up in a particular grid shown on the map. The position reports available via APRS use the NMEA sentence which is given in latitude and longitude. The ability to translate between coordinate systems and datums is an important feature.

We tried three software packages: *WinAPRS*, *APRSPoint*, and *APRS+SA*. Another package, *XASTIR*, which has topographic map support, was not actually used in the field due to the fact that it only runs under *LINUX* (The source code for a *Windows* version is available at the time of this writing), and we did not have a laptop configured to run *LINUX* at the time. While *Mappoint* was the most user-friendly in terms of the integration of maps with APRS software, the ability of APRS+SA to translate position reports between coordinate systems and datums made it the favorite.

Why is this an important feature? First, since APRS positions are reported in latitude and longitude, it is helpful to convert these positions to UTM so that they can periodically be plotted by hand on the master command post map somewhere in the command post. Also, remember that the positions are being reported relative to the WGS84 or NAD83 map datum so they correctly appear on the real-time APRS map. That master map in the command post, however, uses the NAD27 datum so in order to correctly plot a position on this map, the position reports need to be translated to the correct datum. To be honest, for most work the difference between NAD27 and NAD83/WGS84 is negligible, but in the example given at the beginning of this article, the difference between these was significant. Finally, this conversion is handy because the GPS's in the aircraft in our county are set to read NAD83/WGS84 and latitude and longitude. Often positions of teams on the ground (who are using NAD27 and UTM) are routed through the command post so that the appropriate conversion can be made in the case where a helicopter needs to meet a team on the ground.

As an additional note, there are a number of topographical map packages available that would make an excellent platform for APRS. The author contacted National Geographic Topo Maps (formerly TOPO!) and MapTech, and both companies said they had no plans to offer APRS support. This is unfortunate, because either of these would be an excellent SAR tool.

Roving Digipeater

Since most SAR missions occur in sparsely populated areas we were not certain how well the existing APRS network would be accessible to digipeat our field stations. We did consider using full-fledged TNC's (encoders and decoders) for each of the field stations so that each could serve as a digipeater, and forward position reports along, but this option was beyond our budget, and form factor requirements. We decided that one or more roving digipeaters may be the best way to ensure that the position reports of those teams in the field would be heard by the command post.

Small, portable digipeaters have been constructed by a number of folks to support APRS activities. Deployment of man-portable digipeaters would be very helpful in remote locations, but they could not be fielded as quickly as a vehicle-based digipeater. For most operations, however, a digipeater with a relatively high-power radio (>10 W) in a vehicle is the most useful. This digipeater can move as teams move, or quickly be placed in a location where it can hear the stations in the field and be heard by the command post. So far, we have used one roving digipeater and it has been sufficient in a number of different kinds of terrain.

The use of existing digipeater infrastructure greatly simplifies the problem of getting the position reports back to the command post. If the command post can hear one or more existing hill-top (WIDE) digipeaters then chances are the roving digipeater can as well. In this manner, the hilltop digipeater can forward packets even if the roving digipeater is out of range for direct contact with the command post. More on this later.

3. The Field Tests

After a few months of building and research we were able to field our six tracking devices, base station, and a roving digipeater on three different occasions.

A. Mountain Terrain with Rolling Hills

The first operation was part of a San Bernardino County Sheriff's West Valley SAR Team search scenario in the local San Bernardino Mountains.

The plan was the "overdue hiker scenario" where the team rolls on site, interviews the reporting person, sketches any shoe prints, makes team assignments, and searches for the lost person. Mark Kinsey, KG6JZX, a fellow Cave Team member, and I were to attach our tracking devices to one member of each of the six search teams, set up a base station for map display, and deploy our roving digipeater if necessary. The search scenario occurred in Holcomb Valley which is well suited for a first-time test. For the most part, radio coverage is not greatly complicated by the terrain, but as with any search, communication can always be problematic.

Mark Kinsey and I were prepared to operate out of the front seat of a vehicle, but Bill Maclay, KD6HFY, member of both the San Bernardino County Sheriff's Search Dog Team and Communications Team, showed up with his nifty trailer with well-appointed radio/computer workspace. This freed our team vehicle for use as the roving digipeater. We maintained a position lock on every team throughout the duration of the eight hour scenario. When we began to not get position reports from teams at each two-minute interval, the roving digipeater was deployed to fill the gaps. This digipeater was the Cave Rescue Team truck with a TNC attached to its VHF radio (Kenwood TM-733A). I drove the roads in the area finding a high spot, and coordinated with Mark back at the command post to confirm that he was getting position reports. When the teams moved to an area no longer covered by the digipeater, I moved along as well. A few times we "lost" teams for 10 or 15 minutes, but this could have been due to poor GPS coverage, as the encoder will not send a packet unless the GPS has a position lock. In one case it was due to a team member's pack covering the GPS during a lunch break.

Since this was new technology, the APRS information was not relied upon heavily early in the search. One of the issues was the location of the mapping display with respect to the master search map. It would be more effective if they were right next to each other. Also, one of the current difficulties with SAR use is that the maps provided with the APRS software are street-level maps, and not topographic maps. We could see relative locations and locations with respect to roads, but not directly on a topographic map.

At one point three teams were waiting for instructions at a road intersection when one of the teams "caught sign" and began tracking. Right away their departure from the area was noticed on the APRS plot and the command post called to ask why they were leaving, and why the command post wasn't notified. As it turned out, one of the other teams at the intersection had suggested to the tracking team that they should notify the command post of their departure, and the tracking team was about to do that when the command post called. This same day we were able to notify two teams that they were actually following each other, and to spread out to make a more effective search.

[Editor's Note: This article will continue next month.]

Field Organization Reports

Public Service Honor Roll
June 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.

700
W7TVA
555
K4SDI
520
AD5KE
510
N2CCN
445
W2MTA
440
N9TVT
420
N2LTC
385
W5IM
347
KY4NU
340
N5NAV
337
KA0JLF
330
KA2ZNZ
300
KC2DAA
295
W5OMG
W2LC
284
N1IST
283
AD5CA
276
N0ZIZ
271
AB2IZ
265
NC2F
250
W3YVQ
K5DPG
245
N2IK
240
N5OUJ
KB2KOJ
230
KB2SNP
225
W5ARS
220
KD1SM
WB1CHU
WA2WMJ
KC4YGB
215
W9RCW
213
KA0DBK
211
KA2IWK
210
N8IO
205
K9JPS
202
KB5PGY
201
KA2GJV
200
KV4AN
KG4OTL
W7ARC
N7EIE
W8QOI
198
AB0UY
195
WI2G
190
N2JBA
KB2CCD
189
K8CQF
184
KK3F
180
KD1LE
KI4ANQ
K2ABX
AG9G
WA9ZTY
174
W5RIP
171
N2YJZ
170
K4IWW
169
N7TOD
163
AC5VN
158
KA0YEB
154
K5ER
KB2ETO
152
N4TAB
151
KD5CZM
N3WAV
150
NJ5M
KA5KLU
WB2UVB
149
KB0DTI
147
N2GJ
146
NN2H
145
W4WNY
WB0TAQ
AF4QZ
143
NN7H
141
W5RXU
140
KD4GR
137
K4DND
135
N7LV
130
WA1QAA
WA2YBM
WB5ZED
KK5GY
AC5XK
KW1U
KI4ANP
AG4DL
125
K4FQU
124
N8ZJU
123
KC2ANN
122
KA0O
121
W5PY
120
KC5OZT
W6QZ
N1LKJ
W1GMF
W3BBQ
WA4DOX
W6IVV
W2GUT
K4RLD
W4EAT
WX4J
KG4CHW
KA4FZI
W8YS
AA8SN
118
N2JRS
116
W3ZQN
115
WX4H
WB8RCR
114
W6JPH
111
KB5ILY
110
K5UPN
N7YSS
K5MC
AF4NS
N3SW
WA5OUV
W5GKH
K3JL
K2UL
WN0Y
WA2GUP
N2AKZ
KE4JHJ
K9LGU
W9BHL
N8OD
NR2F
WA2YL
KC4ZHF
N8NMA
W7QM
N7YSS
W7ZIW
K8GA
K8KV
W7GB
109
WA1JVV
108
KB2RTZ
W4CC
107
K4BEH
106
W2MTO
KA2BCE
105
KG4OQA
104
W4ZJY
WV7W
103
KG4CSQ
102
WD4LSS
K8KHZ
101
N2OPJ
K4YVX
100
KB5TCH
W1QU
N7CM
K5IQZ
N5KWB
K2BCL
WJ2F
AF2K
KC2EOT
WB2QIX
KB2KLH
AB0WR
W9CBE
WA8SSI
N9MN
WA4EIC
KG4MLC
KE4UOF
WA9VND
KA4UIV
K8AE
K8VFZ
W7GHT
K7GXZ
N1VXP
K4WWV
99
W3CB
W7TC
98
KB4KA
97
W4IJH
K3SS
N8FXH
96
NB4K
95
W4DLZ
K3CN
KO4ZE
W0HXB
KA7TTY
94
KA9IKK
KG4FXG
KJ7SI
93
KA9HRO
W5XX
KO4OL
KD6YJB
KA9HRO
92
W1ALE
91
KC0IDI
90
W4CKS
W4NTI
W4PIM
KB3GFC
N3WK
AA3GV
NF5B
W4WXA
K4FUM
WB4GGS
N5IKN
AA2SV
KC2IYC
KG2D
WB2IJH
WB2GTG
KG9B
N8DD
W8IM
K1JPG
K4KAM
KF4WIJ
WB4PAM
WD8DHC
K4DZM
W7LG
WB7VYH
N3KB
89
K4BG
W2CC
KB8NDS
KA4LRM
87
KC3Y
W7VSE
WB4BIK
KD5SWI
W4CAC
85
WW8D
W7DPW
83
AD4BL
82
WB5NIC
81
KD5ITA
KA9RZL
80
N3RB
KL7OR
KB7US
W5NK
N4FNT
KD4FUN
N2ULY
AA4YW
WA0LYK
KG4MLD
WA8DHB
78
KC0HOX
KE2SX
AA4BN
77
KJ5YY
K5SFM
W2QOB
76
W4QAT
N3OR
K1TSV
N2VQA
WA2CUW
75
W4DGH
N8IBR
74
KE0XQ
73
K2VX
72
KC6SKK
W4FAL
71
KK7TN
K4QKY
70
N1IQI

The following stations qualified for PSHR points in previous months, but were not recognized in this column: (May) W4WNY 164, W4ZJY 107, NF5B 159, KD1SM 139, WB1CHU 130, AA8SN 128, AC5VN 123, K6YR 120, K5MC 110, N1VXP 110, KG4CSQ 108, WA1URS 105, N5KWB 103, K5DPG 101, W1QU 100, K5ER 93, W5PY 92, KA1GWE 90, WB8RCR 90, W4CKS 90, W4DLZ 87, KD5ITA 86, W4PIM 80, W4NTI 78, KF6OIF 76, KC6NBI 70. (Apr) AB2IZ 400, KG4CSQ 163, K4DZM 100, KO4OL 100, NB4K 75.

Section Traffic Manager Reports
June 2003

AK, AR, CO, DE, EB, EMA, EPA, EWA, GA, ID, IL, IN, KS, KY, LA, MDC, ME, MI, MS, NC, NFL, NH, NLI, NM, NNJ, NNY, NTX, OH, OK, OR, ORG, SC, SD, SNJ, STX, SJV, TN, VA, WCF, WI, WMA, WNY, WPA, WWA, WY. The following STM reports for May were received but not reported in the last month's column: IL, ME, NNY, SB, WMA.

Section Emergency Coordinator Reports
June 2003

AK, AR, AZ, EWA, IL, IN, KS, KY, LA, MDC, MI, MO, MN, NE, NLI, SFL, SNJ, SC, STX, SV, TN, WMA, WNY, WPA, WV. The following SEC reports for May were received but not reported in last month's column: AZ, KS, LA, NE, WPA,

Brass Pounders League
June 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.

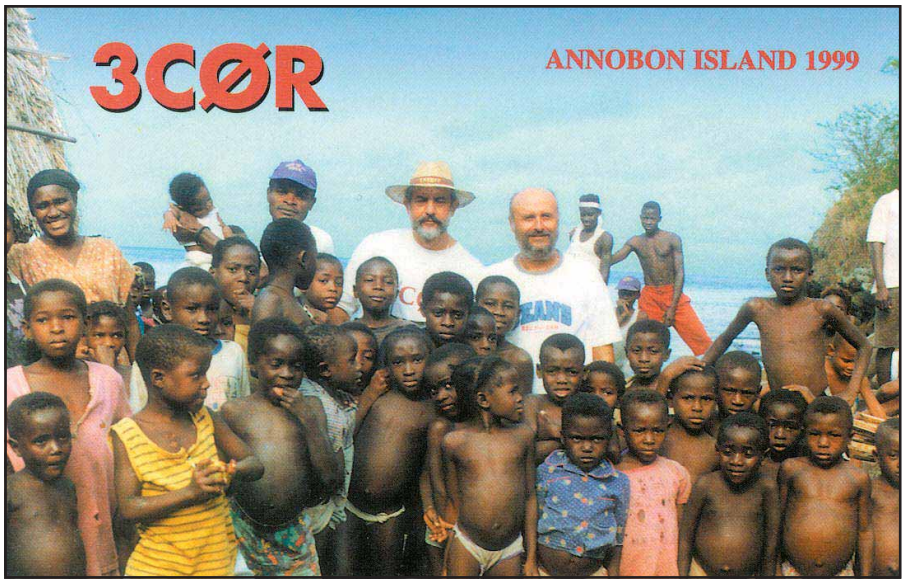
Call	*Orig*	*Rcvd*	*Sent*	*Dlvd*	*Total*
W4ZJY	0	1187	1029	0	2216
KK3F	23	962	918	0	1903
W1GMF	0	256	1201	7	1464
KA5KLU	0	599	705	31	1335
W4EAT	0	563	539	0	1102
N2LTC	0	537	503	48	1088
K9JPS	0	455	30	440	925
WX4H	0	512	400	2	914
W7TVA	36	419	63	392	910
KW1U	0	422	385	23	830
K7BDU	0	391	392	0	783
WB5ZED	-	-	-	-	706
N9VE	0	283	37	264	584
W7QM	60	233	267	4	564
W6DOB	11	186	312	37	546
K5UPN	16	257	231	4	508

BPL for 100 or more originations plus deliveries: W9IHW 206, K9GU 147, W9RCW 121, AK6DV 120, NJ5M 110.

Annobon Island

Annobon Island (3CØ) measures 3 km wide by 6 km long and is located approximately 193 km southwest of Sao Tome (S9). The small mountainous island is located about 470 km from Equatorial Guinea. Annobon was discovered by the Portuguese in the 15th century and later purchased by the Spanish in 1778. However, it wasn't until 1885 that the island was inhabited.

Equatorial Guinea, which is the parent country of Annobon Island, gained its independence from Spain on October 12, 1968. This happened shortly after Francisco Macias Nguema was elected as the first president of Equatorial Guinea. Macias Nguema gave himself the title of "President for Life" and took complete control of the government of Equatorial Guinea in 1972. He was one of the worst dictators in African history, having killed or exiled close to a third of the country's people. In 1979 Lt Colonel Teodoro Obiang Nguema Mbasogo successfully led a *coup d'etat* and executed the dictator.



Elmo, EA5BYP, and Vic, EA5FO, are heading back to Annobon Island in October. They operated as 3CØR in September 1999.

Past DXpeditions from Annobon, 3CØ

Annobon, also known as Pagalu, was added to the DXCC list in 1968, as it more than met the minimum distance criteria from the "parent country" Equatorial Guinea. The first DXpedition was by Martti Laine, OH2BH, and Ville Hiilesmaa, OH2MM. This was just the first of many firsts for Martti. The two Finns flew onto the island and the exciting adventure is told in "Where do we go next?" It was almost 20 years later, October 1979, when a group of Spanish operators made it to the island and made some 8400 QSOs in just 48 hours. Carl Henson, WB4ZNH, and his wife Martha, WN4FVU, chartered a plane and were active as 3CØAC and 3CØBC in January 1982. The Hensons' operation was the first and only to include a female operator. Eric Sjolund, SMØAGD, sailed to the island in November 1989 and operated as 3CØGD for five days, making about 6200 QSOs. A Spanish group flew to the island via Libreville, Gabon in August 1991. They operated as 3CØCW making 13,266 QSOs on SSB and 12,491 on CW. The most recent operation from Annobon was in September 1999 by 3CØR. This

Annobon Island is located near Equatorial Guinea off the west coast of Africa

operation was originally to include Vic, EA5YN; Elmo, EA5BYP; Ramon, 3C1GS, and Robert, 3C1RV, but only the two Spanish operators were able to make the trip. During the 3CØR operation, the two were active for nine days, making 23,800 QSOs despite some equipment failures and operator setbacks.

October 2003 DXpedition to Annobon

On June 25, 2003 Vicente, EA5YN, announced that he would be teaming up with Franz, DJ9ZB; Elmo, EA5BYP, and Victor, EA5FO, for a DXpedition to Annobon Island in October of this year. Vic and Elmo are veterans from the September 1999 3CØR operation. Although no call sign was mentioned in the press release, they have obtained the license and will announce the call prior to the start of the operation. The group plans to be active on 160 meters and RTTY on this trip. Victor will be doing the RTTY and possibly other digital modes. Franz and Elmo will handle the SSB work while Vic will be handing out the CW QSOs. They plan to have three stations active. The operation is expected to be on the air for 15 days. Financial and any other support are solicited and welcomed. Contact Tony, EA5BY, at **ea5by@lynxdxg.com**. QSL via DJ9ZB.

W9DXCC GATHERING

The 51st annual W9DXCC Convention and Banquet will be held on September 20 at the Holiday Inn "Holidome" in Rolling Meadows, Illinois, just northwest of Chicago. This is one of your editor's favorite DX events of the year and Bill Smith, W9VA, has once again done a fantastic job of lining up a full schedule. For a complete listing of speakers, directions and details, check out the W9DXCC Convention Web site at **www.qth.com/w9dxcc/**.

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WØDXCC GATHERING IN MINNESOTA

The doors of the Bloomington, Minnesota, Holiday Inn on Highway 35W and 94th St will open for WØDXCC 2003 at 8 AM October 18. CQ Hall of Fame Inductee and "Mr. WØDXCC 2002" Glenn Johnson, WØGJ, will speak on his experiences with four-square antennas and will offer the latest news from Bhutan, and Ralph Fedor, KØIR, will present a seminar on his DXpeditions to various rare and very rare Antarctic DX entities. Radio City, Mounds View, will present a demo comparing today's top radios, and Timewave Technology will demonstrate the art of digital signal processing technology.

Other speakers already booked for the Convention include Carl Leutzelschwab, K9LA, with an intriguing talk on the challenges of WØ-land propagation and Igor Zdorov, WØIZ, with a presentation on his DXpedition exploits to rare African and Asian entities. "We are adding more great speakers and will be releasing the information shortly," Chair Lou Sica, ACØX, reports. The Convention will conclude with a 7 PM Banquet at the Holiday Inn with a Keynote Speaker. Details for the Convention can be requested by e-mailing **w0dxcc@w0dxcc.com** or by sending a self-addressed, stamped envelope to WØDXCC 2003, PO Box 390633, Minneapolis, MN 55439-0633. Information is also available on the WØDXCC 2003 home page at **www.w0dxcc.com**.

DX NEWS FROM AROUND THE GLOBE

BS7H—SCARBOROUGH REEF

We've had lots of questions about when BS7H will be active again from Scarborough Reef (Huang Yan Dao). There have been three operations from the rocks, two of which counted for DXCC. The first operation did not count as the operators were sitting on scaffolding, which was partially in the ocean. Although the April 1995 and April 1997 operations both counted for DXCC, the 1997 operation was cut short after military forces from a neighboring country escorted the team off the reef. The BS7H license has been secured and the landing permit is not a problem. The real issue seems to be political between China and its neighbor. Chinese authorities report it may be possible to attempt another operation after the Philippines hold their upcoming elections, which are scheduled to take place next summer. Until then it may be very difficult for this "Top Three Country" to be active. Watch the DX bulletins for any updates.

DXCC CHALLENGE

Eight operators have now reached the 3000-entity level in the DXCC Challenge. They are W4DR at 3079, W1NG at 3047, K5UR at 3043, SP5EWY at 3031, W9ZR at 3024, W1JR at 3015, I4EAT at 3011 and K8MFO at 3006. ARRL's complete June 1 update is available at **www.arrl.org/awards/dxcc/listings/challenge.html**.

FG—GUADELOUPE

Roberto, EA2RY, says a group of three will be operating from Guadeloupe (FG) September 23 to October 9, including the CQ WW RTTY Contest.

FO—FRENCH POLYNESIA AND AUSTRAL ISLANDS

Three Italians plan an operation from some Polynesian IOTAs in September and October. They are looking at Maria Island (OC-NEW) in the Australs and Hereheretue (OC-052) in French Polynesia. They leave Italy September 26 and return October 17. QSL to their home calls.

HP—PANAMA

Special call sign HP1ØØRCP will be on the air from Panama November 1-3 all bands and modes (CW, SSB, RTTY and PSK31) to commemorate the 100th anniversary of the Republic of Panama. A special commemorative QSL will be available for two IRCs or one US dollar. Web sites: **www.radioclubdepanama.org** and **www.qsl.net/hp1rcp**.

HKØ/S—SAN ANDRES ISLAND

Members of the Florida DXPedition Group plan to operate from San Andres Island during the period of October 20 to 28. They will run four or five stations before and after the contest. The group has requested the contest call sign 5JØX. This year the team is asking for donations to help offset the costs, which they have not done in the past. Those interested in donating can contact Bill Gallier, FDXPG, 2694 North Camel Ave, Middleburg, FL 32068. You can also check out their Web page at **www.geocities.com/hk02003** and **www.geocities.com/w4wx1/upcoming**.

INDIAN OCEAN ISLANDS

G4IRN, John, has received his S79 call sign from the Seychelles authorities. He did get S79IRN, which is what he requested. Look for activity from the Seychelles from September 13 to 16 and again from September 23 to 27. He will be active as FH/G4IRN from Mayotte from September 16 to 23. John will be on CW on 10-40 meters with 100 W. QSL via G4IRN.

SV—GREECE

Michael, SV8/DF3IS, will be on Thasos Island (EU-174) September 11-25, 40-10, CW and SSB. QSL via his home call.

T32—EAST KIRIBATI

Members of the Western Wireless Contest Club are planning a contest DXpedition to East Kiribati during the CQ World Wide CW DX Contest in late November. The team plans to be active from T32 from November 23 to December 7. They will be active on 10-160 meters, including a multi-two operation in the CQWW CW Contest. Operators will include NØKV, KØMP, N2WW, WØZA, NOØT and NØZM. Most of the gang do not have their call signs yet. T32MP (KØMP) and T32KV (NØKV) are known, however. QSL cards will go via their home calls.

Effective June 5, 2003 the new QSL manager for La, T32Z, is Pete, K3PD. Logs for 2002 and afterward are available. Any previous QSL requests sent to N7YL have been lost. Pete reports that Janice is now inactive. Those needing a QSL from T32Z will need to resubmit to K3PD. No older logs exist, so please do not submit for any contacts before 2002.

VK9C—COCOS-KEELING AND VK9X—CHRISTMAS ISLAND

Female DXpedition operators VK3DYL, VK4SJ and VE7YL have announced that they are heading to Christmas Island and Cocos-Keeling this fall. VK9XYL from Christmas Island is scheduled for October 13-27 and VK9CYL from Cocos-Keeling is set for October 27-November 10. QSL both via VK3DYL.

VK9CT and VK9CD will be the Cocos-Keeling call signs for four German operators October 11-23. Ops are Gerhard, DJ5IW; Thomas, DL2RMC; Hartmut, DM5TI, and Andree, DL8LAS. They will be on 160-6, concentrating on the lower bands and 30, 17 and 12 meters, including AO-40, with three stations. QSL via DL2RMC. The same operators will also be on Christmas Island, VK9X, as VK9XW, VK9XM, VK9XT and VK9XA, October 4-11.

VP8—SOUTH SHETLANDS

LZ2UU, Dany, says he will be the radio operator on the South Shetlands (VP8) or Bulgaria's Antarctic Base St Kliment Ohridski from mid-November this year through February next year, using the LZØA call sign. He expects to be on all the bands, CW, SSB and RTTY. In the CQWW CW he will use VP8/LZ2UU. He may be on in other operating events as well.

ZK1—SOUTH COOK ISLANDS

Dave, W6AQ, and Don, K6IPV, have made plans to head for the Pacific later this year. The two plan to operate from the South Cook Islands for the CQWW SSB DX Contest in late October. They expect to arrive on Rarotonga Island on the evening of October 20 (local) and stay through October 29. Licenses have been applied for. Victor, ZK1CG/ZK1USA, has been a tremendous help in coordinating their trip and promises to help whenever he can. They anticipate having antennas for all bands (10-160 meters) and will attempt to be mostly on SSB with some CW. The guys realize the need for this DXCC entity on RTTY, especially in Europe, so Don will do this mode, along with other digital modes, while Dave will be checking out the local dining and wine establishments. They will both have their spouses along with them for this trip so they won't "have at least one transmitter on the air 24 hours a day," but will be on as much as possible. Both calls and QSL routes will be announced in the near future.

ZL8—KERMADEC ISLANDS

ZL3CW/F2CW, Jacky Calvo, is heading back to Raoul Island in the Kermadec Islands. He will be using the call ZM8CW starting about October 11 for about 10 days of operations. QSL via ZL1AMO.

WRAP UP

That is all for this month. A special thanks to EA5BY, EA5RM, EA5YN, KE3Q and *The Daily DX* for supply information for this month's column. Don't forget to continue sending your DX news, club newsletters and photos. Until next month, see you in the pileups!—*Bernie, W3UR* QST

June 2003: A Historic Month in E_s Annals

Sporadic E on the bands above 6 meters is one of the rarest and most exciting forms of propagation in the VHF world. E_s is a biphasic phenomenon with a major peak in the Northern Hemisphere around the summer solstice in June and a minor peak at the winter solstice in December. Last month's column described the promising beginning of this year's summer season, some widespread openings in the US and some mighty large events in Europe. Nothing could have prepared us for what happened in June.

The rarest of rare VHF propagation is 222 MHz E_s. First documented with a 1987 contact between K5UGM (EM12) and W5HUQ (EM90), only a handful of contacts have ever been made by this mode, the longest being between W5UWB (EL17) and W6QIW (DM14) in 2000. Most of these contacts involved east/west paths across the southern US except for VE3AX's (FN02) contact with K5LLL (EM10) in 2001. The harbinger of things to come was a 222 MHz contact at 2354Z on June 9 between John, W5UWB, and KCØCOU (DN70). On June 14 at 0001Z, Pat, N6RMJ (DM14), worked John, KFØM (EM17), from John's rover wagon. John was running 15 W to a small Yagi at the time. Then on June 17 came the most extensive 222 MHz E_s opening of all time. Let's turn now to a slightly edited version of the events from Ned, AA7A, who was in the thick of things from beginning to end:

> June 17 was one of the most amazing evenings on the radio for me. Six meters opened up around 0200Z in a normal summer evening fashion. The MUF was building steadily until around 0230Z, when I started to hear weak signals on 144.200. I fired up the 2 meter amplifier, called a quick CQ and worked W7IEY in CN87 at 0240. The band quickly settled into a very good opening with many S9 + 40 dB signals. I managed to log 20 stations in the Washington/British Columbia area over the next half-hour as I have done in such openings for the past 25 years from Phoenix. But this year, there was something different.
>
> I had recently completed my 222 MHz station in preparation for this year's June VHF QSO party: a Yaesu FT-736R, Mirage 120-W brick and M^2 8-λ Yagi at 25 feet. On a lark, I swung the antenna up towards the Pacific Northwest (PNW) as the opening kicked into really high gear. I was alternating between working stations on 2 meters and calling CQ on 222.1 MHz CW. I would announce when I went to 222 on the 2 meter frequency and got acknowledgements from the 2 meter crowd that they would listen on 222.
>
> I must say that hearing K7XQ's call pop out of the noise on 222 gave me a shock. He faded out before he was done calling me and did not come back. I went back to 2 meters to inform him that I heard him. So we went back to 222 and after a few minutes he reappeared and we quickly completed at 0311Z. I was simply amazed. I've been around enough to know that something special was going on.
>
> I heard nothing else on 222 after continued calling, so I went back to 2 meters and worked nine more stations in the PNW. I would go back to 222 every couple of minutes and call CQ on CW. About 20 minutes after my first 222 E_s contact, signals picked up a lot on 2 meters and I went back to calling diligently on 222. I then worked two more stations on 222: K7ND and W7YOZ around 0340Z. When that peak was over, I caught them back on 2 meters; they were as ecstatic as I was about these contacts.
>
> Word apparently got out and I had quite a gang hanging around my 2 meter "run" frequency as I continued to coordinate between 2 and 222. At 0354Z, 222 caught fire and I managed to work five stations on sideband: W7BNH, KE7SX, W7FHI, K7NQ (repeat) and KB7DQH. Some of these stations were pushing S9 + 40 dB. That was all I heard on 222—for a while.
>
> I continued to work stations on 2 meters and check 222 for another hour in this fabulous opening. At 0500Z, NN7J in CN85 informed me that I was louder than ever on 2 and that we should try 222. After a few calls, he came back on 222.100 MHz and was pinning the meter. We completed quickly. At this point, I was thoroughly spent. That made nine contacts (eight unique) in CN85, 87 and 96 over a two-hour span. The sporadic E continued until around 0530Z.
>
> The 222 MHz band was probably "open" nearly as long as the 2 meter band. The EIRP of my 2 meter station is nearly 20 dB higher than my 222 MHz station. Some of the stations I worked in the PNW were running only 10 W into a single modest-length Yagi. I can only imagine

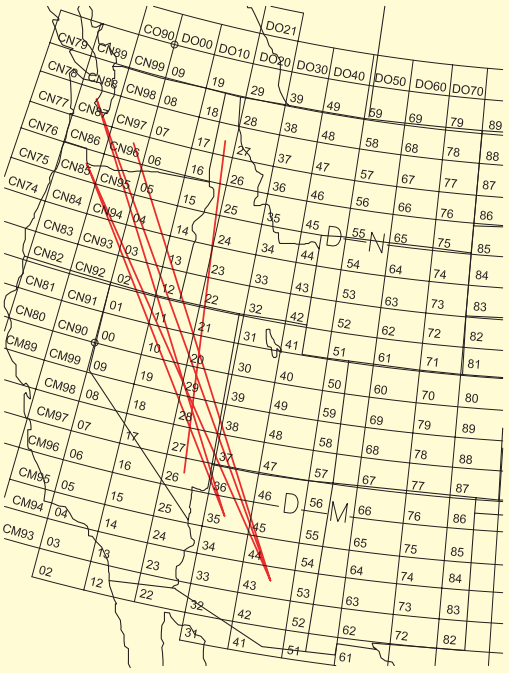


Figure 1—Paths for the 222 MHz E_s opening of June 17.

This Month

*September	No good or excellent EME conditions this month
September 13-15	ARRL September VHF QSO Party
September 25-28	2003 Microwave Update Everett, Washington

*Moon Data from W5LUU

Gene Zimmerman, W3ZZ ♦ 33 Brighton Dr, Gaithersburg, MD 20877 (tel 301-948-2594) ♦ w3zz@arrl.org

Table 1
Summary of June US 2 Meter E_s Openings

Date	*Duration (hrs)*	*Grids (west)*	*Grids (east)*
06/09/03	>1.0	DN70,30,44 DM26,42,43,62,68,79,78	EL07,08,09,17,18.19. 29 EM00,10,12,13,15,25, 30,31,36,37
06/10/03	0.25	EM09 EN10	FN02,31,32,33,42
06/10/03	0.7	DM98 EM09	FN10,20,30 FM17,19
06/13-14/03	0.8	CM98 CN85,92 DM03,05,07,13, 14,26,33 CN85,92 DM11	DM65,78,DN70 EL07,29 EM09,17,19,25,27,28, 29,35,38 EN10
06/15/03		DN07,17 CN87,90,92,96,97	DM33,35,42,43,44,54,65,72,73,98 EM09 EN04 EL07
06/17/03	>3.0	DM03,04,11,12,14,22,26,33,34,35,43	DN07,13,17,22,45,55 CN80,85,89
06/17//03	>3.0	CM87,88,89,97 CN80 DM06.07	DN70, EM17,27
06/20/03	0.1	EN37	FN43
06/22/03	0.1	EL17	EN40,53
06/23/03	0.1	EL96	FK68
06/24/03	>3.0	EL09,29 EM00,02,10,12,13,25, DM81	EL79,86,87,88,89,96,97,98 EM60,70,80,81, 83,90,92
06/26/03	1.0	CN85,87,88,96,97 DN13,17	DN70,71 DM79 EM09

what I would have done with a 222 station equipped similarly to my 2 meter EME setup. Or better yet, stations of that magnitude at both ends of the circuit.

At the same time Jim, K7ND, and Marty, K7AYP, reported short duration openings to AA7A and W7RV (DM35). The closest contact, at 1286 km, belongs to Al, K7ICW (DM26ja), and K7MAC ex-KB7IY (DN17sn). Using the G7RAU on-line MUF calculator, the MUF at that time was approaching 261 MHz. (Thanks to W5UWB, N6RMJ, AA7A, K7ICW, K7NW, N7DB, WA7TZY and W9WI.)

Two Meter E_s

Last summer there was almost nothing. This year June adds 10 different 2 meter E_s openings to the three we had in May. The openings are summarized in Table 1. Certain features are worth a special mention. Unlike many previous years, the majority of the E_s favored the western and northwestern states. As Larry, K6AAW, put it, he is lucky to see brief 2 meter E_s once every 10 years in CN80. Texas was a major epicenter although NØLL in Kansas got more than his share of activity (five openings in June to both coasts). Conditions were generally flat in the East during the ARRL VHF QSO Party, but early on June 15 there were apparently multiple E clouds linking the southwest and the Pacific Northwest. During this time, K5DYY (EL07ws) worked KA7SAG/R in CN92, a distance of more than 2600 km. Two of the openings were unusual because they lasted more than three hours apiece and many stations worked dozens of contacts in dozens of grids. Along with the 222 MHz E_s on the 17th, extensive areas of the entire West Coast, the Southwest and parts of the Midwest were involved. June 24 featured a powerful transgulf E_s opening with central and western Texans working southern Georgia and all but southern Florida. Jack, W5JLC in DM81, appeared to be at the western end of the link. [Thanks to K3TV, W3CMP, AC4TO, KE4YYD, W4VC, K5AM, K5DYY, K5SW, N5TIF, W5UWB, W3XO/5, WA5IYX, K6AAW, K6LMN, KT6KT, N6PEQ, N6RA, N6RMJ, AA7A, K7AYP, K7ICW, K7RAT, KR7O, N7DB, N7EPD, N7LT, NJ7A, W7MEM, WA7TZY, W8WN, KØAWU, KØAZ, KØGU, KØSM, KØVXM/4, KCØCOU, NØLL and VE7CMK.]

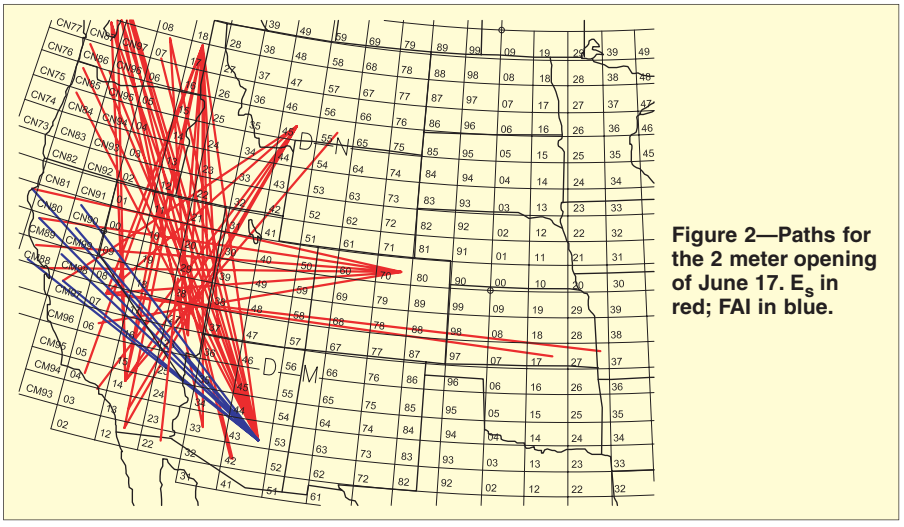


Figure 2—Paths for the 2 meter opening of June 17. E_s in red; FAI in blue.

GI/GM to VE/W on 2 Meters?

Well, almost. Seekers of the Brendan Trophy came close to being rewarded on June 26. That morning featured a powerful multihop E_s opening from all of Europe into VE1, 2 and northern New England (see below). The strength of the opening quickly diminished in other parts of the US. At 1900Z Northern Ireland SWL Paul Logan identified WHCF-FM in Bangor, Maine, on 88.5 MHz. Soon afterward, both he and David Hamilton (Scotland) identified CBTB-FM in Newfoundland on 97.1 MHz. The most distant appears to be WFRY-FM in Watertown, New York, a distance of 4905 km—double-hop E_s and maybe more. These appear to be the first ever reports of transatlantic propagation on the FM broadcast band between the British Isles and North America (see **www.dxradio.co.uk/transatlanticfm.html**). [Thanks to ZL4AAA, K3ZO and W8WN.]

Europe

Think things are really hopping over here? Wait 'til you see what's been happening across the pond. Eighteen days of E skip (some 36 hours or so in total) to go along with the eight days in May. No wonder Udo, DK5YA, says we need to rename sporadic E "Usual E." Again, I am in debt to the DK5YA VHF Page (**www.vhfdx.de**); the GØNFA VUSHF Daily Newsletter (**www.144mhz.co.uk**); and the Good DX DXrobot at (**www.gooddx.net**). It is impossible to do justice to what has been happening in Europe.

Openings have ranged over the entire continent, beginning as early as 0940Z and ending as late as 2110Z. Most of the openings appear to be midday events as opposed to US domestic openings, which

appear to favor the late afternoon and early evening. In terms of long openings, June 22 featured more than six hours of E_s between ≈0940Z and ≈1815Z. There were 28 DXCC countries involved and some prodigious contact totals like 138 from CN8LI. Three other days had more than three hours of E_s propagation; each of these on June 9, 16 and 18 were fueled by huge E clouds and MUFs at 200 MHz or higher. The highest MUF was estimated to be around 260 MHz in western Europe on June 20. Too bad there is no 222 MHz allocation in Europe! There was no action from EA8 to central Europe, but EA, F and G worked the Canary Islands on a couple of occasions. RZ6BU worked SU1SA on June 18, when large numbers of Arabic FM stations were audible. CT1EPS (IM57xc) worked D44TD (HK86no) on a very short opening on June 26. The long-distance champs for the month seem to be EA1AK/7 (IM66vp) and SV9CVY (KM25ka) at 2802 km. Multiple clouds at different times of the day and at the same time of the day were evident on half of the days.

Japan

Hatsuo, JA1VOK, reminds me that there is plenty of E_s in Japan. His initial E_s contacts were on June 7 with JG5KFN/6 and JJ1EQW both in Okinawa (JR6) and to UAØ (PN53 and QN16) on June 22 [a good day all over the world]. On June 29, Hatsuo worked DS1NNB and DS5DOB in Korea on FM, and JD1YAB (QL17) worked into JA8.

Can all of this continue? As I write this on July 7, Europe has already had E_s four days this month, the US three days and Japan at least once. Tune in next month and see.

ON THE BANDS

Just because 2 meters and 222 MHz were so very good doesn't mean that other bands and propagation modes were missing.

Six Meters

Once again there was E_s essentially every day of the month. Two openings dominated. A widespread opening to Europe from the Northeast, Southeast and some stations in the Midwest as far westward as NØLL occurred on June 6. W3EP/1 worked as far eastward as SV and was spotted by JY9NX. Riccardo, T72EB, made more than a dozen Ws from New England to South Carolina and Georgia extremely happy. The westernmost station to work him was Vic, K5XX (EM21). On June 26, a massive opening from all parts of Europe delighted stations in northern New England and nearby Canada. Joe, W1JR, worked over 100 Europeans between 1630Z and 2040Z. I received enthusiastic reports from VE2CSG (FN56), N1RWY (FN54), WA1PBR (FN55) and N3DB (FM18). Meanwhile Phil, NØKE (DM69), notes his first ever E_s contacts with Europe (PAØLSB, ON4IQ). Perhaps the most interesting contact may have been on June 25 between K4RX (EM70) and YMØKA (KM39). Contacts between Brazil and Europe on E_s in the summer are quite rare—there is little F2 and it's the wrong time of year for TE—but on that same day PY was into PA, DL and F. Auroras were minimal in June although K4XXX (EM77) and KØTVD (EN21) noted a number of contacts via the buzz mode on June 16/17. All in all, there were NA/Europe openings on more than a dozen days in June and several additional days with propagation into the Caribbean. After a slow start in May, propagation to the Caribbean, Central and South America from the US and Europe was excellent according to reports from WP4LNY and YV4DDK.

Conditions to the northwest were quite good. Several stations in the Midwest/Southwest (NØJK, K6IX, K5SW and W5UWB) reported excellent propagation to KL7NO (BP54) and NL7ZW (BP71) on June 10. A little further south, Ron, KL7XL (CO27), was into the Pacific Northwest that day and into the entire West Coast on June 17. Hatsuo, JA1VOK, reports the first E_s opening of the season to US/Canada was a contact with VE7AG (CN89) at 0500Z on June 26, while JS6CDB (PL36) worked both VE7AG and K7OFT (CN87). Joe, K7KQU, reports contacts with six JAs and two KL7s at that time.

My thanks to the 27 correspondents who sent me 6 meter reports including K1FPV, W1DYJ, K4KLK, K4PI, VE2PIJ and G4UPS not otherwise mentioned.

Tropospheric Ducting

Although it was early in the season, there was a significant tropo opening throughout the Midwest between June 21 and 27. Beginning on the 21st, Bill, KØAWU, worked south as far as W5RCI (EM44) on 2 meters, K5UR (EM35) on 222 MHz and the EN40s on 432 MHz. The same day, Darin, KB9WZJ (EM69), worked as far eastward as K2TXB (FM29). Arliss, W7XU (EM13), worked as far eastward as W4HP (EM75) on 2 meters, KG5MD (EM36) on 222 MHz, W4HP on 432 MHz and AG4V (EM55, ≈1200 km). Phil, KE8RO (EN81), reports contacts are far southward as EN44 on June 24 and EM54 on June 25. At the other end of the path, Gary, KE8FD (EM84ku), worked 15 new grids on 2 meters, five on 222, nine on 432 and one on 1296 between June 21 and 25, mostly in Indiana, Illinois, Missouri and Ohio. The best DX was WØVD (EM27ud) at 1034 km and W8MIL (EN74ic) at 1044 km. The Transpacific duct was active in June. Bob, K6QXY (CM88), reports the KH6HME beacon on nine different days with all four beacons from 2 meters through 1296 MHz audible on June 10 and 29. Bob actually worked KH6HME on June 9 on 2 meters and 222 MHz, while Tom, N6RA (CM87), worked Paul on June 29 on 2 meters.

Missing from this column are reports of several DXpeditions: VP9/NØJK, V25XX, VP9/W3CMP and C6A/W6JKV. We'll hear from them next month.

HERE AND THERE

ARRL September VHF QSO Party

The major ARRL VHF contest with the greatest chance of seeing a big tropo opening starts at 1800Z September 13 and ends at 0300Z September 15. Further details can be found in the August 2003 issue of *QST* or at **www.arrl.org/contests/rules/2003/sep-vhf.html**.

E-Skip Alert System

Compliments of Allard, PE1NWL, an E_s alerting system has been established for North America. Go to **gooddx.xs4all.nl/cgi-bin/gooddxvisitors** to subscribe. Shelby, W8WN, provides a detailed explanation of that site at **www.qsl.net/w8wn/hscw/papers/esalerts.html**. Please notice that the system is still experimental and occasional false alarms may occur. Allard emphasizes that the DXrobot is a free and strictly noncommercial service; your e-mail address will *never* be given away to anybody, and the DXrobot will *never* send you spam.

2003 MICROWAVE UPDATE

Sept 25-28 in Everett (Seattle), Washington in conjunction with the Pacific Northwest VHF Society. This is the biggest microwave event of the year. For more details visit **www.microwaveupdate.org/**. QST

STRAYS

DON MURRAY, W9VE

In April, members of the Dallas Amateur Radio Club presented Bob, W5NYM, and Caroline L. S. Swann, W5NYL, with the 2003 DARC Whit and Anne Griffith Public Service Award for their decade-long efforts to welcome newcomers to Amateur Radio.

Atlanticon 2003

Atlanticon 2003 was a fascinating weekend. As usual, the New Jersey QRP Club hosted a terrific QRP Forum that featured an outstanding array of guest speakers. Among them was one James Bennett, KD5VGS, whose presentation centered upon his very successful PAC-12 portable antenna system that won the HFPack "Antenna Shootout" at Pacificon the previous year. James' PAC-12 bested all comers including the Super Antennas MP-1, the usual assortment of single-band whips and the Miracle Antenna. This "Shootout" has become a regular feature of Pacificon. The tests are conducted on a test range using a dipole reference antenna. All antennas under test are compared to this reference and are rated in descending order as to the amount of dB below the reference.

I was so intrigued by the PAC-12 that I decided to build one for myself and field-test it on several outings over the summer. First, the majority of the components to construct this multiband vertical antenna are available at most home improvement stores. The remaining parts are procured from RadioShack, so there is really no reason that a frugal QRPer should be without a good portable antenna. Total cost of this antenna is well under $25 (lower if you have a good junk box).

I won't delve into construction details, as a full account of how to construct the PAC-12 antenna is on the New Jersey QRP Club's "Web site on CD-ROM" available from the club for $10. Check out their Web site for ordering information at **www.njqrp.org**. After the unit was built, I used the MFJ-259 antenna analyzer to adjust the antenna on 40, 30, 20 and 17 meters (these were the only bands I was really interested in for portable work). Each band coil assembly required only minor tweaking and final resonance was achieved by varying the length of the 6 foot whip at the top of the antenna.

A close-up of the prototype multiband coil showing the shorting lead connected for operation on 30 meters.

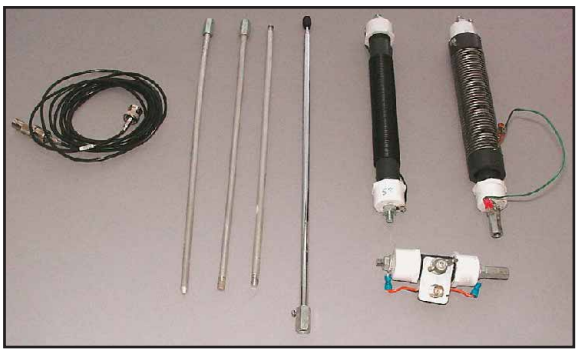
The Design

James' design involves using two 12 inch sections of 1/4 inch aluminum rod, held together end-to-end with couplings. The lower rod mates with the feed-point insulator while the upper end mates with the band coil of your choice. The RadioShack 6 foot whip sits atop the band coil, making the overall height of this antenna around 9 1/2 feet. Essentially this is a center-loaded vertical. An additional 12 inch section mates with the bottom of the feed-point insulator and is either pushed into soft ground or held in a small tripod mount to raise the antenna a foot or more above ground. Radials are attached to the ground end of the feed-point insulator. James recommends three to four radials, which can be made from virtually any small diameter flexible wire. Lay the radials out like spokes in a wheel around the antenna. The PAC-12 collapses down into a compact bundle for easy transport.

If your feed-line run is less than 25 feet, RG-174 should work well. If you are paranoid about feed-line losses, substitute RG-58U or RG-8X, which have less loss at higher frequencies.

My results with the PAC-12 were quite gratifying. Having experimented with a variety of portable commercial antennas over the last couple of years, it was nice to build an antenna for under $25 that worked as well, if not better, than some the commercial versions I'd tested.

At this price, the frugal QRPer could easily build a second PAC-12 and, with the judicious use of phasing lines, produce a very potent 2 element vertical beam. A portable phased 2 element, 40 meter array you can put in your backpack would make one heck of a Field Day antenna system.



The entire PAC-12 antenna broken down for transport. The two coils in the photo are the 40 meter and 30-10 meter prototypes.

Multiband Coil

The center loaded design of this vertical is intended to result in improved efficiency when compared to base-loaded designs. After building the original PAC-12 design, I contacted James regarding the possibility of a multiband tapped coil arrangement. Interestingly enough, he had been working on just such an item and lent me one of his prototypes to take with me on my annual pilgrimage to Tyndall AFB, Florida, in June.

The multiband coil is designed to work from 30 to 10 meters. The prototype is approximately 10 inches long and has a total of 40 turns of #22 AWG bare wire on a form about 1 1/2 inches in diameter. The PAC-12 is assembled in the usual manner with the multiband coil substituted for the single-band coil just below the 6 foot whip. The shorting pigtail of this coil is moved from the bottom of the coil toward the top to select the desired band.

Using my MFJ 259 antenna analyzer I started checking the antenna at various tap points. The third tap resonated the antenna at 10.082 MHz, very close to the 30 meter QRP operating frequency. At an SWR of 2:1, the entire 30 meter band can be covered on this one tap. Ditto on 20 meters. While I could get the PAC-12 with the multiband coil to resonate on 17 and 15 meters, 10 meters posed a problem and I had to play with the whip length in order to make the antenna play on 10.

This multiband coil, in combination with the 40 meter single band coil, will definitely provide 40-10 meter operation. This certainly beats carrying along individual single band coils for the PAC-12. The savings in bulk and weight will be a welcome relief to backpackers and hikers.

I'd like to thank James Bennett, KD5VGS, for designing such a great little antenna and allowing me the opportunity to test his prototype multiband coil on my recent trip. QST

Rich Arland, K7SZ ♦ 25 Amherst Ave, Wilkes Barre, PA 18702 ♦ k7sz@arrl.org

WD-40 and Dumpster Diving on the Way to ISS

By Bill Meara, CU2JL, N2CQR, MØHBR
n2cqr@arrl.net; **planeta.clix.pt/n2cqr**

It was as if the shot of WD-40 had brought the old machine back to life. And this was a machine that had lived a lot. This Tandy computer had been around—it had been with me for two years in Spain's Basque country, and for four years in the Dominican Republic. It had twice served in Washington, DC. I'd bought it while I was in Honduras in the late 1980s. It was my first computer.

In preparation for my upcoming transfer from the Azores (to London), as I tried to figure out what to keep and what to toss, I came to the old Tandy. This computer had obviously been living on borrowed time. When the hard disk had started giving me trouble, inquiries on the Internet had produced the suggestion that perhaps the hard disk's motor had "seized up." Maybe all that tropical dust and humidity had finally killed off my Tandy 1000 TL.

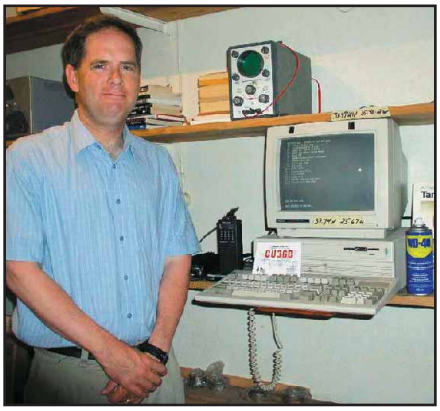
The computer was halfway to the dumpster when I thought of WD-40. Ah yes, the fountain of youth for aging machines! The elixir of life for old electronics! Just the thing for a seized up motor. I popped open the cabinet and pulled out the hard disk card. I gave it one quick squirt, and watched as the magical lubricant worked its way inside.

It's Alive!

A few minutes later I fired up the Tandy and, to my amazement, the hard disk was once again accessible. There were all the old programs and files that had been out of reach. Looking through the directory I came across *Orbits II* by Roy Welch, WØSL.

This was the program that had given birth to a satellite craze in the Dominican Republic during the mid 1990s. Armed with this software, we could predict to the minute the arrival of the Russian low-Earth orbit satellites RS-10 and RS-12. We'd also used it to track numerous shuttle missions and the *MIR* space station; with the help of *Orbits II,* we had been able to establish voice and packet contact with these spacecraft.

Also present on the hard disk was *PACTERM*, the program I'd used with my old KPC-3 packet radio terminal node controller (TNC). The TNC and my old RadioShack HTX-202 2 meter handheld transceiver were nearby, and I had a 1/4 wavelength ground plane (made from coat hangers) on the roof. The wheels started turning, and soon I was downloading the latest Keplerian elements for the International Space Station (ISS).



The author with his junk box satellite station in the Azores. Notice the QSL card from Terceira island, and the can of WD-40.

Success!

My friend Messias Moniz, CU2BJ, and I were able to capture packets from the space station on our first attempts. This was fun and interesting, but soon it got better. On Thanksgiving evening, 2002, with clear skies over Sao Miguel Island, I checked the computer and saw that shortly after dusk the ISS (with the shuttle *Endeavor* attached) would be passing almost directly overhead. At the appointed minute, I left the receiver and computer on and stepped out into the backyard with Billy, my five year-old son. Looking to the southwest, there it was, coming at us, very bright to the naked eye. We watched with fascination as the space station disappeared from view as it flew into the Earth's shadow directly above us.

That was all very intriguing, but the space station had still more geek thrills in store for us. The next night, Messias and I were tuned in on the 145.800 MHz ISS downlink frequency, capturing digital signals from the bird. To our amazement, we saw Azorean packets coming down to us.

The Azores are nine islands about 1000 miles from mainland Portugal. On a world map, they look close together, but in fact more than 100 miles of ocean separate our island (Sao Miguel) from Terceira Island. And we could tell from the call sign that Terceira was the source of the mysterious signal. "Who is that guy?" we wondered.

The call didn't ring a bell at first, but a quick check of QRZ.com showed that CU3GC was Ray Mottley, aka WL7CDK. I sent Ray an e-mail and told him we'd detected his signals. Ray was astonished. The transmissions we'd monitored were his first uplink attempts. Working completely independently, two American hams in the Azores had become active on ISS at exactly the same time. I began to think that we might have an *X-Files* script in the making.

Coordinating via e-mail, Ray and I agreed to try a QSO via the space station's digital repeater. On 29 November 2002, as the huge space station zoomed up over the Atlantic at 17,500 MPH, I started sending packets on the 145.990 MHz uplink. Suddenly one of them was repeated by the space station. Then down came a packet from Ray with a message: "Bill I see your transmission congrats." We went on to discuss how we owed each other QSL cards, and Ray suggested that we write up our adventures for *QST*. I knew Messias was monitoring, so I sent him a call via ISS, just so he could see his call sign repeated from above. (He saw it, and was very pleased.) Mark Austin, KB1GVR, provided icing for the cake by sending me an e-mail reporting that one of my packets had been picked up on the East Coast.

In his book *First Light—The Search for the Edge of the Universe*, author Richard Preston describes the work of the "Palomar Mountain gadgeteers," an intrepid group of scientists and technicians who turn electronic junk (often obtained from dumpsters) into devices that probe the farthest reaches of the universe. This little space project made me feel like one of those dumpster-diving space-age gadgeteers. It was great fun. And it's not often that you get to use WD-40 to fix a computer. QST

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

DIGITAL DIMENSION

Meteor Trails Challenge

If you have been reading my writings here over the years, you know that I often go on and on about propagating VHF and UHF signals by means of the ionized trails left in the wake of meteors burning up in the Earth's atmosphere. Meteors enter the atmosphere all the time, not just during the well-publicized meteor showers like the Perseids, Geminids and so on. In my opinion, they are an untapped natural resource for VHF and UHF communication.

Back in the August 1995 installment of my old "Packet Perspective" *QST* column, I suggested trying packet meteor scatter with plain-vanilla packet radio stations so that as many people as possible would be able to participate. That meant 2 meter FM AFSK at 1200 baud. Since it was my bright idea, I volunteered to coordinate the effort and I suggested kicking around some ideas. What frequency should we use? What information should our beacons contain? Should we use the 15 second transmit-receive procedure used by the weak-signal folks, or should we do something different? I asked to hear your thoughts on those and other topics so we could come to a consensus, formulate a plan and get on the air in time for upcoming meteor showers.

Bob Bruninga, WB4APR, the inventor of the Automatic Packet Reporting System (APRS), decided to follow up my proposal and organize something for the 1995 Perseids meteor shower. Using unconnected/unprotocol packets containing grid-square data, packet stations in the northeast, southeast, southwest and northwest quadrants of North America took turns transmitting packets during the meteor shower.

WB4APR tallied the results of the 2 meter test and reported that a total of 19 stations heard a total of 18 stations on 2 meters, all on paths of several hundred miles with most between 600 and 1000 miles. The best DX was KO4HD's reception of N3EOY's beacons 1196 miles away.

Ralph Wallio, WØRPK, reported even more success on 6 meters. In addition to a number of one-way reception reports in the 200 to 900 mile range, WØRPK completed two-way contacts with KØBI 400 miles away and N3MNT 915 miles away!

Admittedly, the test occurred during optimal meteor-trail conditions, but it did prove that the concept of meteor-trail communication via a digital mode is viable.

Figure 1—If the band is open and nobody is transmitting, does anybody hear the band opening? Learn the answer at the PropNET Web site.

Other folks, like Ev Tupis, W2EV, and his baby, PropNET, have been experimenting with packet meteor-trail and other means of propagation on their 2, 6 and 10 meter net frequencies with some success for the past five years or so. Browse on over to the PropNET Web site (**www.rochesterny.org/beaconet/propnet/**) and see what I mean.

I recently received an e-mail from another meteor-trail fan, Vern Eubanks, KØLVS (**k0lvs@yahoo.com**), who wrote:

> Nature created this most unusual, nothing-else-in-the-spectrum-like-it, method of propagation, ie, meteor burst (MB), but there is absolutely no present real use for MB because of data latency and unpredictable time of the next available ionized trail.
>
> Okay, there was (is?) the Snowtell MB network of remote sensors for snow accumulation monitoring to estimate Spring runoff in the Western US, and there were some air-traffic-control tests using MB in Alaska, as well as some other stuff, but those were force-fitted where any number of other communication channels would have worked just fine (or better).
>
> A channel is absolutely useless if you have to wait until the next meteor shower. That doesn't constitute a channel, nor do partial calls and canned reports constitute "communications." But MB communications via the day-to-day under-dense meteor trails can be achieved, and I believe it can even be achieved on 10/12/15 meters when those bands are closed to normal propagation! (Somebody prove me wrong!)
>
> Here's a challenge. There are thousands of graduate and undergraduate students out there asking for that age-old engineering student's question, "What can I do for my semester project/Masters/PhD thesis?"
>
> Model the propagation path including diurnal/annual/geographic/frequency variations. A lot of research has already been done on this subject. What has potential, particularly something that has been overlooked? What communications service has potential: data/packet connectivity/remote sensing à la Snowtell?
>
> After someone has nailed down the propagation model, what is the absolute best waveform. I don't know what it is, but it isn't CW or FM-style packet. It is probably something new that can promote two-way communications despite the relatively long propagation delay, when compared to the short time of channel availability for under-dense trails.
>
> Note that I am not anti-CW. In fact, I am a former Navy radioman, who has "pounded brass for food." CW is not likely to be the optimum MB mode because of the MB channel characteristics. What else works? What is a trade-off that works and has a workable compromise for Amateur Radio stations? What's the communication return-on-investment? What is the "application"? How can MB be used for commercial, as well as Amateur Radio operators?
>
> I had often thought MB might offer some data connectivity to extremely remote, economically-challenged populations, but modern commercial communications may have erased that as a useful application.

That's a lot of food for thought. Vern has challenged you by way of me. Let me know if you decide to pick up the gauntlet and what you plan to do about it.

By the way, see you at the ARRL/TAPR Digital Communications Conference (**www.tapr.org/tapr/html/conff.html**) later this month! QST

STRAYS

***QST* congratulates...**

◊Al Cohen, W1FXQ, of Newington, Connecticut, who was recognized recently for having been licensed 70 years by the Nutmeg chapter of the CQWA. Al is ARRL Public Information Coordinator for the Connecticut Section. Frank Darmofalski, W1FD, of Cheshire, Connecticut, was also honored for 70 years as a ham.

Stan Horzepa, WA1LOU ♦ One Glen Ave, Wolcott CT 06716-1442 ♦ wa1lou@arrl.net, www.tapr.org/~wa1lou

A Classic Weekend for Old Radios

The long weekend of September 26-29 will be exciting for "Old Radio" readers, as two of the fastest growing ham radio operating events will take place. First it's AM International's Discovery Weekend, which begins on Friday evening, September 26 and ends Sunday evening, September 28. Then second, it's the Classic Exchange contest, which will run from early Sunday morning, September 28, to early Monday morning, September 29.

The AM Discovery Weekend brings together many classic AM transmitters on the air and raises the awareness of the presence and fun of AM. Details of scoring and awards are in the August issue of *Electric Radio* magazine.

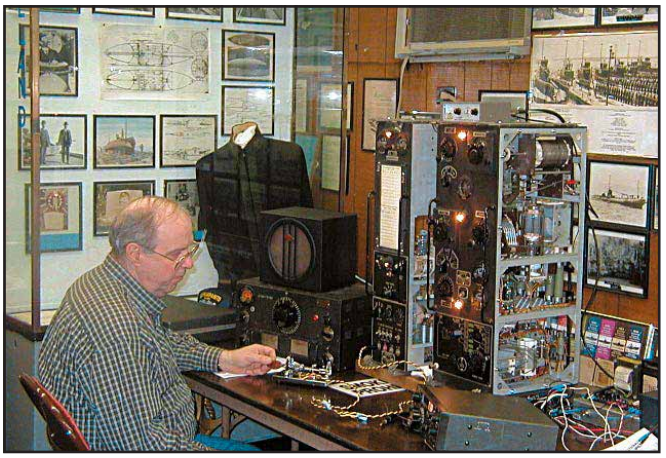
The Fall Classic Exchange (CX) will be held concurrently with the AM International AM Discovery Weekend to encourage more participation in both events as well as addressing the desire for more classic ham radio operating time.

For those of you who are too young to have listened to ham radio in the 1930s through the 1960s, this weekend is for you. You will hear hundreds of classic radios on the air at the same time.

For those of you who have an old radio (or two), now is the time to dust it off, get it hooked to an antenna and put it on the air. Experience the thrill of CW, AM and early SSB.

To help you recognize what the old transmitters sound like on CW, listen to the note. It probably won't sound pure like the modern radios do. In fact it may have a distinct click or thump sound sent with each dit or dah, accompanied with a somewhat raspy note. Some of them may sound as bad as a buzzer. Remember to set your receiver filter to wide, because they may be drifting up and down the band as their tubes warm up and cool down. Keep one hand on the tuning knob so you can follow them.

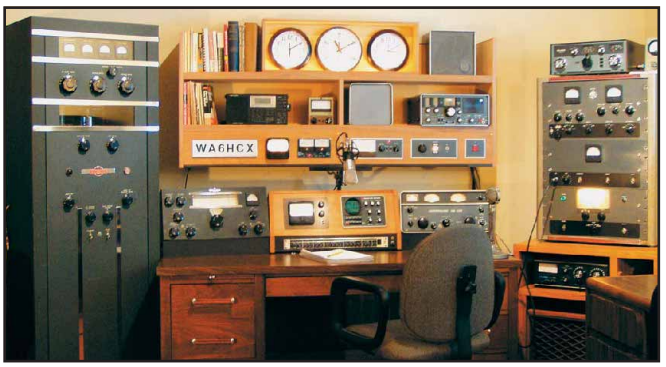
If you are new to all of this, try to work some of them and find out what they are using. Then later on, you can search the Internet with Google, or your favorite search engine, and find out about the different radios you heard. Many collectors have Web pages loaded with photos and descriptions of their radios.



Howie Holden, WB2AWQ, will be operating the TBW transmitter at the NJ Naval Museum/USS Ling, SS297, shown here in its debut for Submarines on the Air, April 2002.

Marty Reynolds, AA4RM, will be on with his very rare Stancor 69 transmitter and RME 69 receiver. (If you have a Stancor 69, please let me know—we are trying to find out how many are out there.—*K2TQN*)

This is the AM station that Al Klase, N3FRQ, restored for my Old Radio museum. It is a Collins 75A1 receiver on the left and a Collins 32V3 transmitter on the right. Look for us on AM and CW.



George Silva, WA6HCX. The transmitter on the left is a Collins 30K1, vintage 1947. It was the first big amateur transmitter built by Collins after the war. The final is a 4-125 modulated by a pair of 75TH's. Frequency bands are 80-10 with an AM output of 250 W. On the desk next to it is the 310B3 matching exciter/vfo. George built the console and cabinetry out of walnut. The receiver is a Hammarlund HQ200. The transmitter on the right is a Globe King 500B, which he uses on 160 meters. For several years now, George has operated almost exclusively on AM.

John Dilks, K2TQN ♦ 125 Warf Road, Egg Harbor Township, NJ 08234-8501 ♦ k2tqn@arrl.org

Mike Warren, KØMAZ, sitting in front of his primary AM station: Collins R-390 and a military T-368. Behind him is his Hallicrafters SX-101 and EF Johnson Viking Valiant transmitter. Look for Mike on 3885, 14,286, 29.0 and 50.4!

Niel Wiegand, WØVLZ, will be using his homebrew station.

About CX

The CX is a no-pressure contest celebrating the older commercial and homebrew equipment that was the pride and joy of ham shacks many decades ago. The object is to encourage restoration, operation and enjoyment of this older "Classic" equipment.

The traditional CX contest, including CW, SSB and AM will be on Sunday. There will be CX recognition for high scores in AM, SSB and CW as well as overall. AM QSOs exchanging the usual CX data may be made for CX score throughout the weekend.

You need not operate a classic rig to participate in the CX; you may use any rig in the contest although new gear is a distinct scoring disadvantage. You can still work the "great ones" and join in the fun with your modern equipment.

Operating in the CX Contest

The traditional CX will run from 1300 UTC September 28 to 0700 UTC September 29 (9 AM Eastern Time on Sunday to 3 AM Eastern Time Monday).

CW: Send CQ CX

Phone: Call CQ Classic Exchange

Suggested Frequencies (MHz)

CW: 1.810, 3.545, 7.045, 14.045, 21.135, 28.180 MHz.

AM: 1.890, 3.880, 7.290, 14.286, 21.420, 29.000 MHz.

SSB: 3.870-3.875, 7.280-7.285, 14.270-14.275, 21.370-21.375, 28.490-28.495 MHz.

Exchange your name, RST, QTH (state US, province for Canada, country for DX), receiver and transmitter type (homebrew send final amp tube or transistor type), AMI number if available (AM only) and other interesting conversation.

The same station may be worked with different equipment combinations on each band and in each mode. Nonparticipating stations may be worked for credit.

Scoring

Calculate your score for each mode (CW, AM, SSB) and total those scores for your overall CX score.

Individual Mode Score Formula

Multiply total number of QSOs (on all bands) by the sum of the number of different types of receivers plus the number of different transmitters you worked (transceivers count both as a transmitter and a receiver) plus the number states/provinces/countries worked on each band. Multiply that product by your CX multiplier.

Your CX multiplier is the total years old of all receivers and transmitters used. Each receiver or transmitter must be used in a minimum of three QSOs to be counted in the multiplier. If the equipment is homebrew, count it as a minimum of 25 years old, unless the actual construction date, or the date of its construction article, in case your "reproduction" is more than 25 years old.

Total QSOs all bands (times) RCVRs + XMTRs + states/provinces/countries (total each band and mode separately; add totals together) (times) (the CX multiplier):

Score = QSOs × (RX+TX+QTHs) × CX multiplier

Certificates and appropriate memorabilia are awarded every now and then for the highest score, the longest DX, exotic equipment, best excuses and other unusual achievements. Send logs, comments, anecdotes, pictures, etc, to J. D. "Mac" MacAulay, WQ8U, at **WQ8U@arrl.net**, or by mail to WQ8U, 6235 Wooden Shoe Ln, Centerville, OH 45459.

The CX Newsletter and announcement of next CX will be posted on their Web site: **qsl.asti.com/CX** and distributed via e-mail to those submitting reports via e-mail. If you submit a report via postal mail, please note if you want a paper copy of the CX newsletter.

My thanks go to Howie Holden, WB2AWQ, and to Ray Osterwald, NØDMS, for their help providing this information.

Great September Hamfests

You will be able to see my Old Radio museum at the following hamfests that will have a high percentage of classic radios:

Maryland: On September 6 and 7, I will be at the Fall-Fest, home of the 2003 ARRL Maryland-District of Columbia Section Convention at the Howard County Fairgrounds, West Friendship, Maryland. There will be a huge AM ham radio display; meet and talk to the experts. For more information, see **www.fall-fest.com**.

New Jersey: On Sunday September 14, 2003 the Delaware Valley Radio Association (NJ) and the NJ Antique Radio Club will try something new (actually old)—a combination vintage style hamfest and an Antique Radio Meet. The DVRA has returned to their old hamfest location, the National Guard Armory in Lawrenceville. It is a huge building with inside displays and a large area outside for tailgating. Plenty of parking on site is available. It is just off Rtes 95 and 206, and easy to get to. They have invited the NJARC to participate with them to make this a hamfest loaded with old radios and related displays. For more information: **www.w2zq.com/hamfest.html**.

See my Web site, **www.eht.com/oldradio/arrl/index.html** for more information and the latest links to the hamfests. Look for my hat at the hamfests and say hello.—*K2TQN*

DC to Daylight—*Part 2*

In the first installation of "DC to Daylight" in July 2003 *QST*, we reviewed the atmospheric absorption and modes of propagation for EHF. Remember that frequencies from 30 GHz to 300 GHz are called the EHF band, for extremely high frequency. Someday, we may also explore the vast range of frequencies spanning between 300 GHz and light at over 1000 times that frequency. For now, it is a big enough challenge to build equipment and operate in the EHF range. In this installment, we explore devices and circuits for these frequencies, and give some examples of successful ham radio communications in the rarified portions of our hobby.

Devices and Circuits for EHF

Figure 1 shows a very simple, and common transceiver for EHF.[1] Often, the use of multiplying mixers allows the use of a lower frequency (more easily generated) LO. For instance, to make a 145 GHz contact, one might use a 47 GHz (×3) or even a 11.8 GHz (×12) local oscillator and an appropriate mixer. The noise figure of the mixer increases (gets worse) both as the frequency goes up and as the multiple increases, so there is a penalty in using higher harmonic numbers. Typical harmonic mixer LO power levels are around +20 dBm maximum (100 mW) and transmit IF power of 0 dBm (1 mW).

If your approach will use wideband FM and thereby reduce the need for frequency stability it is possible to eliminate the IF/mixer and directly modulate a source, such as a Gunn diode oscillator. In a design where DX is being attempted, however, wide bandwidth costs too many dB.

Oscillators

Reasonably stable microwave oscillators start with a crystal or a synthesizer, and then through multiplication and phase locking of other oscillators, generate microwave energy. Oscillators that are locked this way include DRO (dielectric resonant oscillators), and cavity oscillators to produce energy in the 10 to 20 GHz range for further use. This kind of oscillator is often found at hamfests. Gunn oscillators can be made to work (and can be locked) up to about 100 GHz—but are much more difficult to find surplus, and the locking circuitry usually has to be developed by the builder.

Frequency Stability

Once locked, microwave oscillators behave very similarly to their locking sources (with error, stability and phase noise appropriately multiplied). For instance, if you use a crystal that is drifting ±10 Hz each hour, running at 100 MHz, which through various multiplication chains eventually is used to generate 145 GHz, then the multiple of 1450 will turn the 10 Hz/hour instability into 14.5 kHz/hour of drift. Ovenized crystals are likely to hold to within 1 Hz over several minutes (with absolutely perfect power supply and stable components in the oscillator). You do not want the additional burden of hunting for the frequency over one or two dozen kilohertz when trying to make a difficult EHF contact. High-stability OCXOs and rubidium standards found at hamfests need to be employed for successful narrowband DX EHF communication (where we typically use CW).

Power

Gunn diodes can be constructed to oscillate at frequencies across the entire microwave region, up to 100 GHz. They are capable of power over 200 mW, although the power capability drops somewhat as the frequency increases.

The Gunn can be frequency and phase locked by controlling bias (see Figure 2), and with some difficulty it can even be amplitude modulated. It has quite a bit of phase noise if it is not locked, and tends to drift with changes in temperature, cavity and age. A Gunn must be locked for narrowband EHF work in order to achieve acceptable stability and noise.

There are some commercially available transistors that will generate +20 dBm (100 mW) up to about 50 GHz. They are very expensive, and only available in die form. There are laboratory experimental amplifiers that have been tested to as high as 110 GHz, producing about 100 mW output, and although there is unlikely to be commercial availability for several years, 100 mW at 120 GHz is very QRO!

Finding Mixers

As mentioned above, mixers have more noise as the frequency increases and more noise as the harmonic multiple goes up. There are general-purpose multiplying mixers that are used to extend the frequency range of spectrum analyzers. A pair of these were used to make some of the first Amateur Radio EHF full duplex CW radios. Typical configurations have the subharmonic LO and IF on the same connection, so a diplexing filter is required for operation.

There are mixer circuits available from DB6NT as published in *DUBUS* and sold by Kuhne Electronic for 47, 145 and 245 GHz.[2] There are also mixers to be found in surplus and flea markets.

[1]Notes appear on page 89.

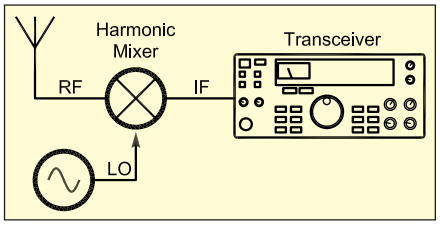


Figure 1—A narrow-band EHF radio consisting of a harmonic mixer, LO and transceiver.

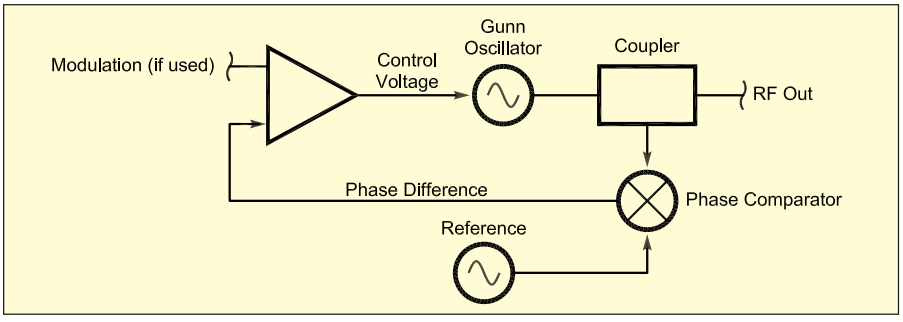


Figure 2—Voltage controlled locking can produce stability just as good as the reference.

Tom Williams, WA1MBA ♦ wa1mba@arrl.org

General Motors and others have established an automotive radar band at 76 GHz, and the FCC has moved amateur privileges in that band to accommodate the radar band. Someday there will be surplus parts in the junkyard! Although there is not a large need for low-noise in this application, development of affordable sources, receivers, transmitters and antennas is underway.

Dishes and Lenses

Antenna gains at these frequencies are pretty impressive. A properly designed and fed 18 inch dish ($^1/_2$ meter) at 245 GHz can provide nearly 60 dB of gain! This is enough to turn 1 µW into 1 W of ERP. Although multimillion dollar dishes have been built up to 13 meters in diameter that are effective to 300 GHz, most antennas for these frequencies are much smaller (less than a half meter). Unfortunately, dishes that maintain ±0.2 mm across their surface are not easy to find. It is possible that amateur telescope mirrors could be adapted. Their comparatively high f/D (they are exceedingly shallow) demands selection of appropriate feed horns.

Lenses are often used in millimeter wave applications for several reasons. They can be machined with relative ease (they are made of plastic), and can be fed with a horn from the back eliminating feed shadow, and placing the electronics right on the feed. Elimination of the large waveguide losses at these frequencies translates into higher performance.

Operating

Just a few years ago, getting on the upper bands meant building two complete stations because there was no one else on. Now it is common to make contacts on 47 GHz on the national calling frequency of 47,088.100 MHz. The higher bands, however, are still only workable with prior arrangement. As of this writing, there is no agreement in the US on a calling frequency for the 78, 120 or 241 GHz bands. A recent conversation on one of the microwave e-mail reflectors came up with no fewer than five calling frequencies in use on the 78 GHz band. Every suggested frequency made good sense. The best bet is to find out who is on in your area and agree to use their frequency. Eventually, there will be enough activity to settle into a good calling frequency.

There are plenty of records to be made and to extend. Since most QSOs on the amateur millimeter wave frequencies are done with line-of-sight paths, much future work lies ahead for exploring non-traditional modes of propagation. When the author made the world's first valid amateur contacts on 120 GHz and 145 GHz in the early 1990s, the distance race had begun. It seems that just about every season, all of the EHF records are extended. The first VUCC has been awarded in North America for both the 47 and 78 GHz bands.

One of the operators/builders who has extended and holds several records is Brian Justin, WA1ZMS. His 241 GHz radio is shown in Figure 3. This radio is based on a phase locked 40 mW, 80 GHz Gunn oscillator and an X3 GaAs Schottky diode multiplier. A very high stability 10 MHz OCXO is used as the PLL frequency reference. With dc bias changes, the multiplier also serves as a receive harmonic mixer. The multiplier produces 1 mW of transmit power and as of this writing has been used in a QSO with a similar radio at a distance of over 11 km. The antenna used with the radio is a homebrew 150 mm diameter parabolic reflector with a Cassegrain feed. A telescope slow-motion control head was used to help aim the <0.6° beamwidth antenna. A 432 MHz rig serves as the IF radio.[3] The complete radio is designed to operate on a 12 V dc battery supply and is easy to transport to high, snow covered mountaintops during the winter where the best "mm-wave weather" is found.

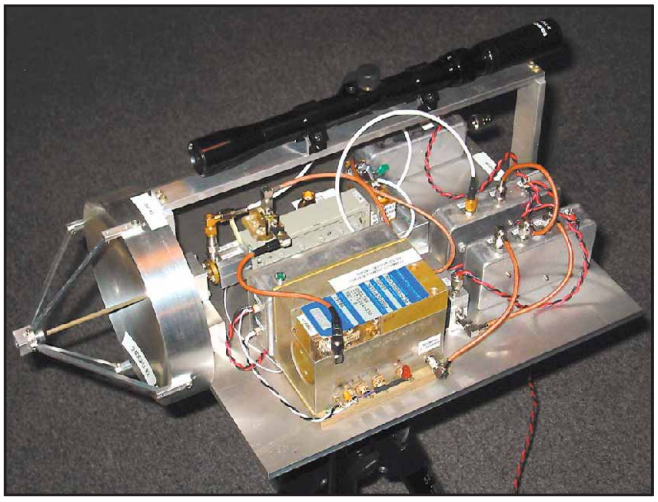


Figure 3—Here is WA1ZMS's 241 GHz radio. On top is a rifle scope for pointing.

From Brian Justin, WA1ZMS

After phase-locking the Gunns to 100 MHz homebrew 60 deg OCXOs, W4WWQ and I did 3.8, 6.1, 7.3 and finally 11.4 km.

WX at time of 11 km QSO was: 3/11/02 0225Z, Temp 5.6°C, Dew Pt –15°C, RH 21%. Calculated loss of 0.647 dB/km.

Each QSO was done on a slightly drier day than the last. I kept the OCXOs running the entire winter season by battery power when away from the QTH and with a dc supply when not out making QSOs. The goal was to age the crystals and keep the things as stable as possible.

Except for trying new sites at night only to find later in the day that a tree branch was in the path 500 ft away, we were able to make just about every QSO we've tried to do. About an 80% success rate! To me, this just proves the Leibe model. Most of the times that we didn't make a QSO, it was due to a tree that we didn't see because it was nighttime or equipment trouble like a PLL that wouldn't lock when it was really cold outside. The gear problems can be fixed by letting the equipment sit outside on a winter's night unpowered and see if it will operate after being ice cold for several hours. If it doesn't work, it's not worth taking out roving for DX records!

This same gear was used for my 1.4 km QSO on 322 GHz by tuning the RX IF to what would be the result by having the diode multipliers run in 4th harmonic mode.

Interested in EHF?

All it takes to get on is two hams who want to put in the effort and dig around for parts. EHF is one of the wide open areas for ham radio experimentation, records setting and serious technical challenges. Have fun.

I want to thank Brian Justin, WA1ZMS, for his help with this column. Next time we will return to SHF as we take a closer look at building a 24 GHz station.

Notes

[1]Williams, T. and J. Mead, "Contacts in the Upper EHF Bands," *Proceedings of Microwave Update 1993* (Newington: ARRL, 1993).

[2]Kuhne Electronic GmbH can be found at **www.kuhne-electronic.com/**.

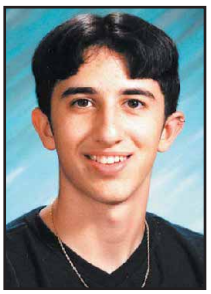
[3]Audio recording of a portion of the 11 km, 241 GHz QSO can be found at **www.mgef.org/audio/241GHz_record_11_4km.wav**. QST

2003 Scholarship Recipients Set High Standard!

Every September, it's our proud pleasure to bring *QST* readers news of ARRL Foundation scholarship winners. Campuses across the nation are welcoming new or returning students for a vibrant year of learning and preparation for future careers. Your generous donations continue to make a difference to the faces that grace this article, as we all know that higher education is a costly but important endeavor. Thanks for staying the course…so our students can stay with *their* courses!

Andrew F. Schaefer, KB2ZWZ
Binghamton, New York
Cornell University
The ARRL Scholarship to Honor Barry Goldwater—$5000

Scott J. Finman, KD7KGT
Post Falls, Idaho
Johns Hopkins University
The Mary Lou Brown Scholarship—$2500



Timothy L. Murphy, KB2YGJ
Bergenfield, New Jersey
Rensselaer Polytechnic Institute
The Perry F. Hadlock Memorial Scholarship—$2000

Ryan T. Stevens, KC8KPU
Spruce, Michigan
University of Michigan
The Earl I. Anderson Scholarship—$1250

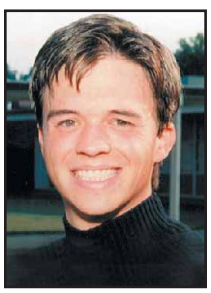
David T. Shane, KC8UKW
Kirksville, Missouri
Truman State University
The Paul and Helen L. Grauer Scholarship—$1000

Victoria M. Reid, AA3OT
Sigel, Pennsylvania
Clarion University of Pennsylvania
The You've Got A Friend Scholarship—$1000

Wesley B. Digh, KG4TWU
Morgantown, North Carolina
University of North Carolina—Asheville
The L. Phil and Alice J. Wicker Scholarship—$1000

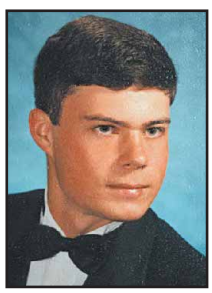
James J. Wenner, K6NSY
Westminster, California
University of California—Irvine
The Charles N. Fisher Memorial Scholarship—$1000

Victoria K. Worster, KD5LJW
Harrison, Arkansas
Arkansas Tech University
The K2TEO Martin J. Green Memorial Scholarship—$1000



John L. Walker, N4DMR
Cullman, Alabama
University of Alabama—Huntsville
The Charles Clarke Cordle Memorial Scholarship—$1000

Rebecca J. Bauer, KC5IXY
Texarkana, Texas
Texas A & M University
The Tom and Judith Comstock Scholarship—$1000



Ryan J. Nerp, KC2EDH
Lake Katrine, New York
State University of New York
The Henry Broughton, K2AE Memorial Scholarship—$1000

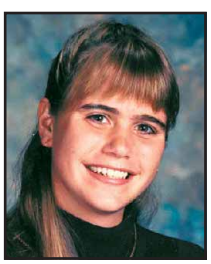
Kathleen M. Cain, KB1GDG
Southwick, Massachusetts
The Webb Institute
The Donald Riebhoff Memorial Scholarship—$1000

Ross E. Mehaffey, KCØABQ
North Bend, Nebraska
University of Nebraska—Lincoln
The General Fund Scholarship—$1000

Linda M. Bolle, KB1BKO
Reading, Massachusetts
Antioch New England Graduate School
The General Fund Scholarship—$1000

Melissa A. Johnson, K1MJ
Bemidji, Minnesota
Bemidji State University
The General Fund Scholarship—$1000

Therese Long, KC8PEZ
Imlay City, Michigan
University of Michigan—Flint
The General Fund Scholarship—$1000

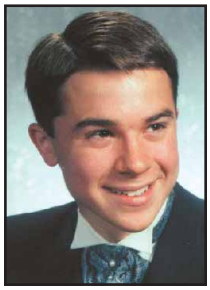


Elizabeth A. Watt, N1UNX
Stratford, Connecticut
Southern Connecticut State University
The New England FEMARA Scholarships—$600

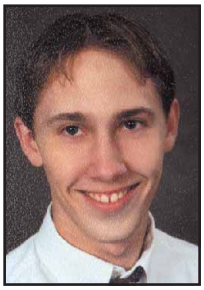
Mary E. Lau, N1VH ♦ Secretary, ARRL Foundation Inc. ♦ n1vh@arrl.org

Chad E. Bulkley, N1UDN
Westport, Connecticut
Maine Maritime Academy
The New England FEMARA Scholarships—$600

Jason M. Marshall, KB1CZE
Monticello, Maine
LeTourneau University
The New England FEMARA Scholarships—$600



Andrew J. Maroney IV, W2AJM
New Windsor, New York
Boston University
The Dr James L. Lawson Memorial Scholarship—$500



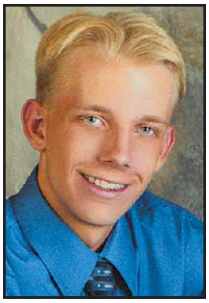
Brett W. Hallacher, N3WED
Columbia, Pennsylvania
University of Detroit Mercy
The Francis Walton Memorial Scholarship—$500

Elizabeth J. Bedoe, KB9WOV
Mokena, Illinois
Eastern Illinois University
The Six Meter Club of Chicago Scholarship—$500

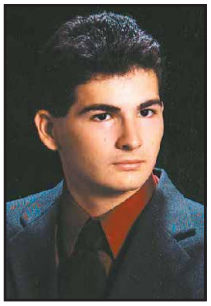
Joseph L. Aubin, KC9BWW
Bloomington, Indiana
Rose-Hulman Institute of Technology
The Chicago FM Club Scholarship—$500

Jonathan M. Allgood, KF4LVX
Oakwood, Georgia
University of Georgia—Athens
The Eugene Sallee, W4YFR Memorial Scholarship—$500

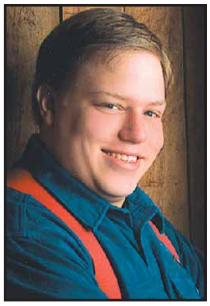
Maria A. Shahid, KF6WJX
Albuquerque, New Mexico
University of New Mexico
The Albuquerque ARC/Toby Cross Memorial Scholarship—$500



Christopher J. Dean, KD7CNJ
Tucson, Arizona
University of Arizona
The Central Arizona DX Association Scholarship—$500



John R. Skok, KC2IAW
Apalachin, New York
Cornell University
The Norman E. Strohmeier, W2VRS Memorial Scholarship (1)—$500



John R. McIntyre, KC2JSJ
Rochester, New York
Rochester Institute of Technology
The Norman E. Strohmeier, W2VRS Memorial Scholarship (2)—$500

Scholarships were also awarded to the following students not shown:

Chad A. Wassinger, NØYK, Scott City, Kansas—Garden City Community College, *The Irving W. Cook Scholarship, WAØCGS*—$1000; Olaf C. Anderson IV, KCØIVQ, Great Bend, Kansas—Fort Hays State University, *The PHD-ARA Scholarship*—$1000; Daniel R. Birt, AD5NP, Denton, Texas—California Institute of Technology, *The Fred R. McDaniel Memorial Scholarship*—$500.

Benjamin Schupack, NW7DX, the first-ever William R. Goldfarb Scholarship recipient, was profiled in July 2003 *QST*, p 87.

To apply for Year 2004 scholarships, download our application from **www.arrl.org/arrlf** after October 2003 or write to *The ARRL Foundation, Inc, 225 Main St, Newington, CT 06111*. Deadline for applications with transcripts affixed is **February 1, 2004**.

STRAYS

POWER PLANT SPECIAL EVENT

◊ Attention, nuclear power plant operator, engineers, technicians, workers, vendors, and government agents: I am planning an Amateur Radio special event for Feb 28, 2004.

I am proposing to have all nuclear stations (60+ sites) in the country be able to contact each other (and the NRC) via Amateur Radio (HF), including a recent innovation of VHF radio/computer interface (IRLP). The event would be set up on the grounds of your nuclear plant or possibly in the TSC (Technical Support Center) or EOF (Emergency Office Facility) on February 28, 2004.

All those plants or agencies interested in participating in the first-time event are encouraged to e-mail me for details.—*Larry Wheeler, KG4RGN, Williamsburg, Virginia*; **kg4rgn@yahoo.com**

KIDS EXPLORE HAM RADIO FROM BATTLESHIP

◊ In March, during spring vacation, 13 members of the Codington Elementary School ARC in Wilmington, North Carolina, visited Radio Central on the battleship *North Carolina*. We used the battle ship call NI4BK that belongs to the Azalea Coast ARC. The coax and antennas were original equipment on the ship and date back to the '40s. The kids created many pile-ups and had a great time making DX and stateside contacts.

I hold a free Technician class and summer camp for kids in grades 5 through 8 at the University of North Carolina at Wilmington each summer. Allowing kids to operate from the battleship helps keep their interest piqued until the class begins. I expect to have a full class/camp (30-plus) this summer.—*Bill Wetherill, N2WG*

QST congratulates. . .

◊ Curt Bartholomew, N3GQ, and Stephen Hood, KB4WKK, who work in the Office of National Security Coordination, at Federal Emergency Management Agency (FEMA) Headquarters, recipients of two Director's Awards from outgoing FEMA Director Joe Allbaugh. The rare and coveted award, the highest award in FEMA, cites them "for their selfless response to the attack of September 11, 2001." Their second award was for national security (classified) contributions related to the nation's response to the 9/11/01 terrorist attacks.—*Dee McDaniel, K3KAT*

SILENT KEYS

It is with deep regret that we record the passing of these amateurs:

W1BTL, Joseph P. Galvani, Pocasset, MA
NM1DR, Daniel Ruddy, Northampton, MA
KA1QVF, Robert D. Williams, Newington, CT
W1WJZ, James R. Walker, Concord, MA
K1ZBD, Samuel C. Lapidge, Monroe, CT
K2HG, Henry G. Rainville, Ventnor City, NJ
WB2JXJ, Curtis L. Faulkner, Binghamton, NY
W2LEC, John Bruscella, Toms River, NJ
WB2ODG, Ernest H. Mueller, Fuquay Varina, NC
W2RJE, Rawlins J. Eastwick Jr, Haddonfield, NJ
WB2SFX, Edwin B. Cohen, Browns Mills, NJ
N2UYW, William H. Rogers, Chestertown, MD
K3AMO, Adrian Boone, Yardley, PA
N3BPJ, Raymond G. Steever, Newtown Square, PA
W3DEL, Paul M. Scholl, Reading, PA
N3HT, W. Hugh Toole, Lima, PA
AA3IZ, Farouk N. Ahamad, New Castle, DE
K3MLX, Julian T. Robinson, Chestertown, MD
WA3OTH, Joseph P. Conway, Rockledge, PA
K3PVR, Raymond J. Stima, Cleona, PA
KA3SJJ, Francis E. Lewandowski, Reading, PA
WA3ZGI, William F. Weaver, Scottdale, PA
W4COW, Wesley C. Randles, Amherst, MA
*W4DB, Lester McGlaughn, Rainbow City, AL
W4DSK, Charles R. Furman, Chattanooga, TN
WB4DSK, Edward A. Bukley, Fort Payne, AL
KT4ED, Billy D. Prince Sr, Norcross, GA
K4EZC, Leo W. Grant, Hernando, FL
*W4FG, Francis C. Irby, Oakland Park, FL
K4FUF, Edward R. Stamps, Macon, GA
W4FWS, Franklin W. Shires, Knoxville, TN
AG4HA, James J. Tobin Jr, Davenport, FL
N4HAT, Terence J. Thomas, Plantation, FL
KE4HUY, Billy D. Sims, Montgomery, AL
WB4IKM, Jessie E. Horner, Humboldt, TN
N4JAT, Jerry A. Taber, Stanfield, NC
K4JJO, Martin L. Crisp Sr, Soddy Daisy, TN
W4JUM, Oris Phifer, Murfreesboro, TN
W4KHL, Roy M. Dobbs, Louisville, KY
KI4NT, Robert E. Baer, Delray Beach, FL
*AA4OK, Lyman D. Strietelmeier, Newnan, GA
W4RXG, Beacham Leonard, Winston Salem, NC
W4SL, David J. Caldwell, Bristol, TN
KC4TJZ, Roy L. Joyce, Camden, TN
W4TWO, Paul D. Hunt, Elizabethtown, NC
*K4UMD, James M. Bonner, Birmingham, AL
KF4WSF, Victor E. Cannon, Live Oak, FL
WU4Y, Walter R. Camper, Birmingham, AL
W4YXA, Bill Gilley, McMinnville, TN
K4ZCB, Hugh P. Earle, Madisonville, KY
KD5CIN, Brenda A. Temple, North Little Rock, AR
*W5IWE, O. R. Hennington, San Antonio, TX
K5LF, Charles D. Raynes, Kansas City, MO
WB5MOE, Dante D. Ganzerla, Vicksburg, MS
KD5PYB, Eddie D. Mccully, Tupelo, MS
N5RXF, Mayo E. Dacci, Lawton, OK
WA5SOJ, Martin A. Gehling, Pierre Part, LA
KE5TY, John E. Riley, LaPorte, TX
W5ULY, Johnney D. Cupp, Denison, TX
KK5YY, Gerald G. Schmitt, Los Alamos, NM
WB6CML, Robert D. Hailey, Birmingham, AL
W6ELR, William J. Klintworth Jr, Laughlin, NV
WD6EYP, Robert Drake, Redding, CA
WI6J, David J. Leaven, Riverside, CA
W6MRP, Harold E. Pedersen, Kingsburg, CA
N6NAY, Robert L. Clark, Camarillo, CA
ND6N, Robert L. Sherman, Murrieta, CA
W6NRO, Albert L. Helzer, Madera, CA
N6OMS, Sidney L. Radus, Yorba Linda, CA
KF6PZG, Roe S. Ramsay, Torrance, CA
WA6QDC, Frank E. Collins, Palo Alto, CA
WB6QPD, Lester M. Fujii, San Leandro, CA
W6RKZ, Dean P. Scott, Austin, TX
WA6TFR, Louis T. Barnes, Glendale, CA
N6TNW, Shirley J. Zuttermeister, Valley Springs, CA
WB6UKB, Richard L. Bennett, Fresno, CA
K6VAN, Arlis L. Van Osdel, Phoenix, AZ
*W6VTL, William C. Allport, Carmichael, CA
WT6WWT, Roger B. Espe, Sun City, CA
WA7AHW, Raymond A. Munger, Portland, OR
KL7FNH, Lawrence W. Downie, Sitka, AK
W7JVB, Roland G. Kissler, Moses Lake, WA
K7LQI, Frank L. McJannet, Seattle, WA
W7MBH, David L. Marshall, Los Lunas, NM
*W7MCU, Leonard A. Westbo Jr, Auburn, WA
KG7PG, LeRoy Welch, Poulsbo, WA
W7QHC, William N. Bramwell, Phoenix, AZ
W7RH, Gerald F. Warner, Idaho Falls, ID
KA7TDR, James C. Denton, Bellingham, WA
WB7VSZ, Donald E. Myers, Spokane, WA
AB7XJ, Donald D. Birge, Carlton, OR
W7ZZ, William Vandermay, Portland, OR
W8AH, Albert H. Hix, Charleston, WV
N8DPV, Odell Atkinson, Ironton, OH
W8EFW, Paul M. Cornell, Cleveland, OH
W8FAU, Ralph J. Paulun, Canfield, OH
*W8FBH, Herbert L. Lipson, Burbank, CA
W8GGL, Francis J. Shiller, Lake Helen, FL
N8GSF, Robert Anderson, Marlette, MI
KA8KYL, G. Paul Oberst, Fremont, OH
KB8LOI, Francis R. Harlow, West Olive, MI
W8LQA, Roland P. Steinmetz, Sun City, AZ
W8MWI, Robert St Clair, Conyers, GA
KB8OGT, James R. Spicer, Wyoming, MI
WD8OTI, Robert L. Michon, Hanover, MI
N8QFW, Jeffrey Briley, Johannesburg, MI
K8RNZ, George C. Emeigh, Port Huron, MI
*W8RQ, Russell Meese Jr, Allen Park, MI
W8SIZ, Donald R. Ingalls, Tawas City, MI
N8SM, Steve Miller, Prosper, TX
W8ZT, James H. Hampton, Arcadia, CA
K9BMC, Donald W. Brisson, West Salem, WI
N9IDN, Joanne Chute, Rushville, IL
K9QXM, Gerald J. Galvin, Saukville, WI
KB9RIB, William K. Conway, Lake Forest, IL
WA9VPD, Owen R. Ingram, Pekin, IL
W9VVE, Eric C. Falk, Lakeview, AR
*WB9WRW, Ronald T. Armstrong, Waukesha, WI
*NØBNS, Joseph W. Elliott, Kansas City, MO
*WØCW, Mayo J. McAllister, Leawood, KS
KØFFX, Eugene W. Johengen, Hackensack, MN
KØIAU, William W. Maupin, Northome, MN
WAØQEX, Charles Harrington, Western, NE
WØQMH, Lloyd Walker, Lincoln, KS
KØUZW, Harold E. Joseph, Coffeyville, KS
NØXWP, Denis A. Erickson, Cottage Grove, MN
WØZO, Anthony J. Weiner, Franklin, NC
G4MGZ, Robert E. Curtis, Wiltshire, Great Britain
JP1BJR, J. A. Masaharu Okochi, Tokyo, Japan
VA6AS, Allan Simpson, Calgary, AB, Canada
*VE3SU, W. G. Banner Edwards, Barry's Bay, ON, Canada

*Life Member, ARRL

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 or relative's memory, you can designate it for an existing youth scholarship, the Jesse A. Bieberman Meritorious Membership Fund, the Victor C. Clark Youth Incentive Program Fund, or the General Fund. Contributions to the Foundation are tax-deductible to the extent permitted under current tax law. Our address is: The ARRL Foundation Inc, 225 Main St, Newington, CT 06111. QST

Kathy Capodicasa, N1GZO ♦ Silent Key Administrator ♦ n1gzo@arrl.org

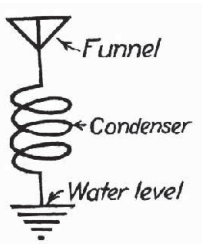
STRAYS

THE ARRL DIAMOND CLUB

◊ The **ARRL Diamond Club** is a donor recognition program of annual support that includes *QST* and all the benefits of ARRL membership plus additional benefits. Contributions begin at $75 a year ($50 a year for Life Members). Gifts to the Diamond Club are for one year of benefits and are tax deductible to the full extent of the law. ARRL members may contribute to the Diamond Club at any time during their membership yearusing their membership renewal form, by phone or on the Web. Donors wishing to contribute $500 or more may donate in monthly or quarterly credit card installments. Diamond Club information and contribution formare on the web at **www.arrl.org/diamondclub** or call 860-594-0397 for a brochure.

SIMILARITY

◊Has anyone noticed the similarity between our ARRL emblem and the American Rum Runners League?—*From Sep 1922 QST*

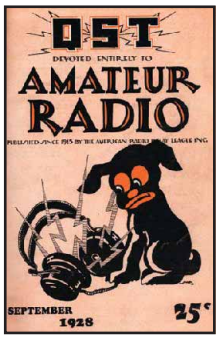


QST congratulates...

◊Pete Onnigian, W6QEU, of Sacramento, California, who has been elected a Fellow of the Society of Broadcast Engineers.

75, 50 AND 25 YEARS AGO

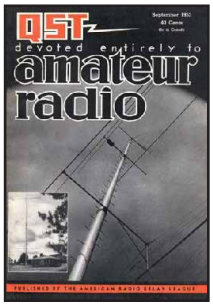
September 1928



♦ The cover art shows a perplexed little dog listening to the audio from a set of headphones. The editorial reports that the Amateur Extra First Grade Radio Operator License has been reinstated. The Radio Divison, Department of Commerce, had discontinued the license in the spring of 1927 because of perceived disinterest in the license class, but hams had clamored for it to be available once again.

Ross Hull reports on "The Oscillator-Amplifier Transmitter" and its suitability for 1929 operation under the new radio regulations. In another article, Ross tells about "Adapting Medium and High-Powered Self-Excited Transmitters for 1929 Service." Harold Westman chimes in with "Remodeling the Traffic Tuner for 1929." As usual, the ARRL helps lead the amateur community into new frontiers. "Radiovision," by Thornton Dewhirst, discusses techniques for receiving television signals. "We Ought to Talk Frequency" discusses the forthcoming 1929 amateur bands. James Lamb, 1SZ-1CEL, tells about "The Zepp," and how to get maxi-mum performance using that Hertz antenna with two-wire voltage feed.

September 1953



♦ The cover photo shows the huge antenna system of W2SAI—a 100-foot self-supporting seamless-tubing mast that holds up three stacked 20-meter dipoles and a large "bedspring" type reflector, topped by a full-size 40-meter vertical. The editorial urges amateurs to unite to support the League's efforts to defend Amateur Radio against the pressures of other radio services.

Ben Russ, W2QZ, tells about "The 'Little Firecracker' Linear Amplifier," which uses a pair of 6146s. Ira Gardner, W6LNN, describes "The Simplest Modulator," a cathode modulator that plugs directly into the cathode circuit of the transmitter's output stage. A. F. Dinsmore, W8AUN, tells about "The Hot-Rod Mobile Antenna," with simple frequency adjustment. Charles Faulkner, W6FPV, reports on how he used a surplus 3-6 Mc. command receiver and crystal-controlled converters to build "A Command Set Receiver for 6 and 10." J. S. Belrose, VE3BLW, discusses "Short Antennas for Mobile Operations." George Hart, W1NJM, tells "A Tale of Two Tornadoes" that recently hit Flint, Michigan, and Worcester, Massachusetts. Rod Newkirk, W1MVW, DX Editor of *QST*, spins a funny yarn about how a Miss America expressed interest in Amateur Radio, and what it led to.

September 1978

♦ The cover art illustrates the spiraling technology of NBVM—narrow band voice modulation. The editorial addresses the possibilities of NBVM.

Doug Blakeslee, N1RM, describes "An Inexpensive Capacitance Meter." Floyd Carter, K6BSU, makes an introduction, "Meet the Remarkable But Little-Known Vackar VFO!" Walter Schulz, K3OQF, tells about "Designing a Vertical Antenna." Earl Quay, W4MKC, tells how to build "An Auditory Dip Oscillator." Bob Elde, WØENC, discusses "A Solid-State Transverter for 70 cm." David Sumner, K1ZZ, Assistant Secretary, IARU, reports on "Direction Finding, European Style." Carl Bixby, W1TKG, tells about "JG1QFW, First Solo Explorer to Reach the North Pole." A photo in Strays shows Ben Stevenson, W2BXA, receiving the first satellite DXCC award from ARRL Communications Manager George Hart, W1NJM. 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

COMING CONVENTIONS

EASTERN VHF/UHF CONFERENCE

August 22-24, Enfield, CT

The Eastern VHF/UHF Conference, co-sponsored by the Eastern VHF/UHF Society and the North East Weak Signal Group, will be held at the Radisson Hotel, 1 Bright Meadow Blvd, off Rte 5; from Springfield take I-91 to Exit 49, left off ramp, take second right; from Hartford take I-91 to Exit 49, right off ramp, take first right. Doors are open Friday 4 PM, Saturday 8 AM to 9 PM, Sunday 8 AM to noon. Features include hospitality suite (Friday eve), sessions (technical, Band Rap, lab), lectures, homebrew equipment displays, small vendor display area, noise figure and antenna measurements, banquet (Saturday, 7 PM; $26), outdoor flea market (Sunday morning only). Admission is $25 (includes Conference Proceedings and flea market entrance); $5 for buyers, $10 for sellers (flea market entrance for those not registered for Conference; bring your own tables, electricity not available). Contact Bruce Wood, N2LIV, 3 Maple Glen Ln, Nesconset, NY 11767; 631-265-1015 (home) or 631-293-9600 (work); **bdwood@erols.com**; **newsvhf.com**.

ALASKA STATE CONVENTION

September 14, Anchorage

The Alaska State Convention, sponsored by the Anchorage ARC, will be held at the Northway Mall, corner of Glenn Highway and Airport Heights Way. Features include demos (QRP, Satellite), VE sessions, special guest from ARRL HQ (Ed Hare, W1RFI, Lab Supervisor). Talk-in on 147.27 (100 Hz). Admission is free. Contact Randy Vallee, KL7Z, 8401 Northwind Ave, Anchorage, AK 99504; 907-333-7219; **kl7z@arrl.net**; **www.KL7AA.org/**.

W9DXCC CONVENTION

September 19-20, Rolling Meadows, IL

The W9DXCC Convention (51st W9DXCC DX Convention and Banquet), sponsored by the Northern Illinois DX Assn, will be held at the Holiday Inn "Holidome," 3405 Algonquin Rd; I-90 N to Rte 53 to Algonquin Rd Exit, left at light, hotel on right. Doors are open Friday 7:30 PM for "Welcome Reception," Saturday registration at 8 AM, convention begins at 9 AM. Features include forums and presentations, ARRL News and Views, DXCC QSL card checking, CW Pileup Contest, hospitality suites (Friday and Saturday), banquet (Saturday, 7 PM). Talk-in on 147.36. Admission is $50 in advance (before Sep 12), $55 at the door (convention and banquet); $28 in advance, $30 at the door (convention only). Contact Bill Smith, W9VA, 1345 Linden Ave, Deerfield, IL 60015; 847-945-1564; **w9va@aol.com**; **www.w9dxcc.com**.

DIGITAL COMMUNICATIONS CONFERENCE

September 19-21, Hartford/Windsor, CT

The ARRL/TAPR Digital Communications Conference will be held at the Marriott Hartford Windsor Airport Hotel, 28 Day Hill Rd in Windsor. For reservations contact the Marriott at 860-688-7500 or on the Web at **www.marriott.com/dpp/PropertyPage.asp?MarshaCode=BDLAP**. Features include Friday evening social get-together, introductory and technical sessions, seminars, banquet (Saturday eve, $30; special guest speaker Alex Mendelsohn, AI2Q, ChipCenter Senior Technology Editor), Seventh Annual APRS National Symposium, and much more. Preregistration (before Sep 1) for two-day conference is $70 (includes proceedings); after Sep 1 or at the door $80; preregistration (before Sep 1) for single day conference is $40 (includes proceedings); after Sep 1 or at the door $50. Contact the TAPR office at 972-671-8277; fax 972-671-8716; **tapr@tapr.org**; **www.tapr.org/dcc/**.

August 22-23
New Mexico State, Albuquerque*

August 23
Missouri State, Columbia*

August 23-24
West Virginia State, Weston*

September 5-7
Southwestern Division, Long Beach, CA*

September 6-7
Maryland-DC Section, West Friendship*
Great Lakes Division, Findlay, OH*

September 7
Western Pennsylvania Section, Butler*

October 11
Northern New York Section, Lake Placid

October 12
Connecticut State, Wallingford

October 18
WØDXCC, Bloomington, MN

October 31-November 1
Michigan State, Holland

November 1-2
Georgia Section, Lawrenceville

November 8
South Carolina Section, Myrtle Beach

***See August *QST* for details.**

ILLINOIS STATE CONVENTION

September 19-21, Peoria, IL

The Illinois State Convention (Peoria Superfest 2003), sponsored by the Peoria Area ARC, will be held at the Exposition Gardens, 1601 W Northmoor Rd; I-74 to Exit 91 B, N on University, 3.8 miles to Northmoor Rd, left on Northmoor, go 1 block. Doors are open Friday 3 PM to dusk, Saturday and Sunday 6 AM to 4 PM (commercial buildings open at 8 AM). Features include Amateur Radio Hamfest and Computer Show, giant outdoor flea market ($5 per space, covers both days), new and used amateur radio equipment and accessories, commercial dealers, manufacturer reps, computers and software, electronic parts and components, technical forums, VE sessions (Sunday, 11:30 AM to 1 PM; Bob Davis, AA9MY, **Bob@GlassComp.com**), acres of free parking, refreshments. Talk-in on 147.075, 146.76. Admission is $5 in advance (2 stubs), $7 at the door (1 stub). Tables are $15/$20. Contact John Coker, N9FAM, c/o Peoria Superfest, Box 3508, Peoria, IL 61612-3508; 309-369-7428 or 309-692-3378 (info line); **n9fam@arrl.net**; **www.w9uvi.org**.

ARKANSAS STATE CONVENTION

September 20, North Little Rock

The Arkansas State Convention ("All-Arkansas Hamfest"), sponsored by the Central Arkansas Radio Emergency Net (CAREN), will be held at the ALLTEL Arena, One Alltel Arena Way; take Exit 141B (Broadway) off I-30, proceed to W side of I-30, corner of Broadway and Cypress. Doors are open 8 AM to 3 PM. Features include flea market, dealers, forums, APRS and Packet Radio demonstrations, VE sessions, plenty of parking, refreshments. Talk-in on 146.94. Admission is $5, under 12 free with paying adult. Tables are $20. Contact Mark Barnhard, KD5AIV, Box 2893, Little Rock, AR 72203; 501-221-3909; **kd5aiv@arrl.net**; **www.carenclub.com**.

MICROWAVE UPDATE/PACIFIC NORTHWEST VHF CONFERENCE

September 25-28, Everett, WA

The Microwave Update/Pacific Northwest VHF Conference, co-sponsored by the Microwave Update 2003 Committee and the Pacific Northwest VHF Society, will be held at the Holiday Inn Hotel and Conference Center, 101 128th St SE; from Seattle-Tacoma International Airport (SeaTac), go N on Hwy 518 to I-5, take I-5 N through Seattle to Exit 128 (128th St SE), Holiday Inn is just E of I-5 on the N side of 128th St. Features include Microwave Update 2003, PNWVHFS technical sessions, PNWVHFS annual meeting, Boeing Factory Tour, hospitality session, technical sessions, surplus dealers, Noise Figure Lab, banquet (Saturday eve), swap tables, tailgate "Junque Sale." Admission is $40 in advance, $50 at the door. Contact John Price, N7MWV, 12026 81st Ave NE, Kirkland, WA 98034; **n7mwv@mindspring.com**; **www.microwaveupdate.org/**.

EASTERN WASHINGTON SECTION CONVENTION

September 27, Spokane

The Eastern Washington Section Convention, co-sponsored by the Kamiak Butte Amateur Repeater Assn, Spokane Radio Amateurs, NW Tri-State ARO, Palouse Hills ARC, Inland Empire VHF Club, and the Spokane DX Assn, will be held at University High School, 12420 E 32nd Ave; take the Pines Rd Exit off I-90 (Exit 289), go S on Pines Rd, continue straight to 32nd Ave, school is on corner of Pines Rd and 32nd Ave. Doors are open for setup Friday 7-9 PM, Saturday 8 AM; public Saturday 9 AM to 5 PM. Features include vendors; seminars; Silent Auction; Country Store; VE sessions (2 PM); from ARRL Hq Field and Regulatory Correspondent Chuck Skolaut, KØBOG; APRS demo; ARRL forum; foxhunt; refreshments. Talk-in on 147.24, 146.52. Admission is $5, under 18 free. Tables are $7.50 before Aug 27; $10 after August 27. Contact Betsy Ashleman, N7WRQ, 3903 E 48th Ave, Spokane, WA 99223; 509-448-5821; **n7wrq@aol.com**; **www.kbara.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. QSTz

Gail Iannone ♦ Convention Program Manager ♦ giannone@arrl.org

HAMFEST CALENDAR

Attention: The deadline for receipt of items for this column is the **1st of the second month preceding publication date**. For example, your information must arrive at HQ by **September 1** to be listed in the **November** issue. Hamfest information is accurate as of our deadline; contact sponsor for possible late changes. For those who send in items for Hamfest Calendar and Coming Conventions: Postal regulations prohibit mention in *QST* of prizes or any kind of games of chance such as raffles or bingo.

(Abbreviations: *Spr* = Sponsor, *TI* = Talk-in frequency, *Adm* = Admission.)

Alaska (Anchorage)—Sep 14, Alaska State Convention. See "Coming Conventions."

†**Alaska (Fairbanks)—Sep 12-13;** set up 9 AM; public Noon to 4 PM. *Spr:* Arctic ARC. Pioneer Alaska Centennial Civic Center, Airport Rd between Peger Rd and Moore St; eastbound from the airport on Airport Rd, turn N onto Peger Rd, make immediate right turn into Pioneer Park parking lot. Swap 'n Sell, vendors, Arctic ARC Annual Meeting (Saturday, 1:15 PM), Bunny Hunt (Saturday, 2:30 PM), VE sessions and FCC commercial exams, banquet (Friday, 7:30 PM, River's Edge Resort; Attitude Adjustment Seminar at 6:30 PM), ARRL forum (Friday at noon on Tanana Chief Paddlewheel Boat moored at its dock). *TI:* 146.28/146.88 (103.5 Hz). *Adm:* Free (optional donation of a can of food for the Community Food Bank). Tables: $10 (reserve). Jim Movius, KL7JM, Box 83992, Fairbanks, AK 99708; 907-452-6347; fax 907-452-6349; **ajmovius@gci.net**; **www.mosquitonet.com/~fbrown/03hamfest.html**.

†**Arizona (Kingman)—Sep 20,** Dawn to 2 PM. *Spr:* Hualapai ARC. Mohave Community College parking lot, 1971 Jagerson Ave; I-40 to Exit 51 (Stockton Hill Rd), N to Jagerson Ave, go E on Jagerson to College. VE sessions, ARCA meeting. *TI:* 146.76 (131.8 Hz). *Adm:* Free. Tables: Free. Bill Beaman, KAØIYS, 2652 E Mary Ave, Bullhead City, AZ 86426; 928-758-6780 or 928-279-6502.

†**Arkansas (Bentonville)—Sep 12-13;** set up Friday 6 PM, Saturday 6 AM; public 8 AM to 1 PM. *Spr:* Benton County Radio Operators. Thomas Jefferson School, 810 Bella Vista Rd; from 71B go E on Tigar Blvd to Bella Vista Rd, go S to second school on left. VE sessions (10 AM), refreshments. *TI:* 145.29. *Adm:* $3 each or 2 for $5. Tables: $5. Clarence Morrow, AD5AM, 815 N 30th, Rogers, AR 72756; 479-631-9231; **ad5am@mc2k.com**.

Arkansas (North Little Rock)—Sep 20, Arkansas State Convention. See "Coming Conventions."

California (Vacaville)—Aug 30. Larry Hogue, W6OMF, 707-452-9701.

Colorado (Longmont)—Sep 28. Dan Wisotzkey, NØNLS, **N0NLS@aol.com**.

Connecticut (Enfield)—Aug 22-24, Eastern VHF/UHF Conference. See "Coming Conventions."

Connecticut (Hartford/Windsor)—Sep 19-21, Digital Communications Conference. See "Coming Conventions."

†**Connecticut (Newtown)—Sep 14;** set up 7 AM; public 8:30 AM to 12:30 PM. *Spr:* Candlewood ARA. Edmond Town Hall, Rte 6; Exit 10 off I-84, follow signs. Flea market, new equipment dealers, computers, electronics, tailgating ($8, includes 1 admission), ample parking, refreshments. *TI:* 147.3 (100 Hz). *Adm:* $5, under 12 free. Tables: $12.50 (includes 1 admission). John Ahle, W1JMA, 120 Fire Hill Rd, Ridgefield, CT 06877; 203-438-6782; **w1jma@arrl.net**; **www.danbury.org/cara/**.

†**Delaware (Felton)—Sep 14,** 7 AM to 2 PM. *Spr:* Kent County ARC. Diamond State Drive-In; 8 miles S of Dover on Rte 13. Large tailgate area. *TI:* 146.97. *Adm:* $5. Kenneth Steele, N3QJJ, 316 W Commerce St, Smyrna, DE 19977; 302-653-2144; **n3qjj@hotmail.com**; **www.kcarc.net/pages/flea%20market.html**.

†**Florida (Melbourne)—Sep 13-14;** set up Friday afternoon (outdoor), 6-8:30 PM (indoor); public Saturday 9 AM to 5 PM, Sunday 9 AM to 4 PM. *Spr:* Platinum Coast ARS. Melbourne Auditorium, 625 E Hibiscus Blvd; from I-95 take US 192 E to US 1, N to Hibiscus Blvd, turn left. Large outdoor tailgating area ($10 per spot), indoor swap, commercial booths, meetings. *TI:* 146.85. *Adm:* $5. Tables: $20 (swap), $80 (commercial). Joe Mitchell, K4AW, 3 Oliphant Cir, Indialantic, FL 32903; 321-720-9967; **k4aw@arrl.net**; **pcars.org/hamfest**.

†**Florida (Orlando)—Sep 27,** 7 AM to 2 PM. *Spr:* Bahia Shrine AR Unit. Bahia Shrine Center, 2300 Pembrook Dr; from I-4, take Maitland Blvd westbound, turn left onto Pembrook Dr. Ham fellowship, tailgating. *TI:* 147.39. *Adm:* $2. Tables: $5. Warren Hill, W4WHH, 177 Hanging Moss Dr, Oviedo, FL 32765; 407-365-6682; **w4whh@aol.com**; **www.bahiashrine.org/users/radio/**.

†**Georgia (Dallas)—Sep 13.** *Spr:* Paulding ARC. Paulding Meadows Park, Hwy 61 N; take Hwy 61, 2 miles N of Paulding County Courthouse, turn left into Paulding Meadows Park. Free tailgating, VE sessions. *TI:* 146.85. *Adm:* Free. Tables: $5. Sean Sparks, W4JFL, 123 Glenwood Ct, Douglasville, GA 30134; 770-949-5370; **w4jfl@arrl.net**; **www.pauldingarc.com**.

†**Illinois (Grayslake)—Sep 27-28;** Saturday 8 AM to 4 PM, Sunday 8 AM to 3 PM. *Spr:* Chicago FM Club. Lake County Fairgrounds, Rtes 45 and 120; I-294 N to Rte 120, W to Rte 45. Huge outdoor flea market (open both days at 6 AM), indoor commercial vendors, major manufacturers and leading distributors, computers and electronics, VE sessions (both days, walk-ins), free parking, outdoor electrical hookups available, self-contained camping ($10, water and electricity $15 each day). *TI:* 146.76 (107.2 Hz). *Adm:* advance $8, door $10 (good both days); under 12 free. Tables: 8-ft $25 (good both days). Send SASE to CFMC, c/o Jerry Spearman, W9EG, 348 W Natoma Ave, Addison, IL 60101-3422; 630-628-1501; **w9eg@chicagofmclub.org; www.chicagofmclub.org**.

†**Illinois (Joliet)—Aug 24;** set up Saturday 3-6 PM, Sunday 6 AM; public 8 AM to 1 PM. *Spr:* Bolingbrook ARS. Inwood Recreation Center, 3000 W Jefferson St; I-55 to Rte 52 (Jefferson St), go E approximately 2 miles to Center. Huge outdoor flea market on paved parking lot, AR gear, computer items, electronics, VE sessions (9 AM to noon, walk-ins welcomed; register for all tests by 11 AM), overnight parking for vendors (no hookups or services), free paved parking, refreshments. *TI:* 147.33, 224.54. *Adm:* advance $5, door $6. Tables: before Aug 15 $10 and $15, after Aug 15 $17 and $25. Tom Ballard, N9LJY, 19 W 609 Dystrup Rd, Lemont, IL 60439; 630-739-3740; **tb1301@comcast.net**; **www.k9bar.org**.

Illinois (Peoria)—Sep 19-21, Illinois State Convention. See "Coming Conventions."

Illinois (Rolling Meadows)—Sep 19-20, W9DXCC Convention. See "Coming Conventions."

†**Indiana (Bedford)—Oct 5;** set up Saturday; public Sunday 6 AM to 5 PM. *Spr:* Hoosier Hills Ham Club. Lawrence County 4-H Fairgrounds, US 50 W; from Bedford take SR 37 S to US 50 W, turn W (left) onto US 50, 2 miles to entrance on right. Vendors, VE sessions, free chili dinner (Saturday eve). *TI:* 146.73 (107.2 Hz). *Adm:* $7. Tables: $25. Tim Miller, K9US, 1021 Old State Rd 450, Bedford, IN 47421; 812-277-8583; **timk9us@msn.com**; **www.hoosierhillshamfest.org**.

†**Indiana (Goshen)—Oct 5**. *Spr:* Michiana Valley Hamfest Assn. Elkhart County Fairgrounds Building "A," 17746 CR 34; from N use US 33 S through Goshen, turn E at Goshen High School, travel 0.6 mile to Gate 1, turn right, go 600 feet and park in Lot A, use Gate B to enter Building A. *TI:* 145.43. *Adm:* advance $5, door $6. Tables: $15. Denny Denniston, KA9WNR, 21970 Kern Rd, South Bend, IN 46614-9295; 574-291-0252 (7-10 PM); **ka9wnr@att.net**.

†**Iowa (West Liberty)—Oct 5,** 7 AM. *Sprs:* Muscatine and Iowa City ARCs. Muscatine County Fairgrounds; 17 miles NW of Muscatine, 15 miles E of Iowa City; from I-80 take Exit 259 S 10 miles, follow signs. "Southeast Iowa Hamfest," free outdoor flea market, Saturday evening pre-hamfest Wiener Roast, VE sessions. *TI:* 146.85, 146.91, 146.52. *Adm:* $5. Tables: $8 ($1 per foot). Chuck Couch, WAØLCK, 263 Paddock Cir, Iowa City, IA 52240; 319-358-7605; **ccouch@soli.inav.net**; **www.qsl.net/kc0aqs**.

Kansas (Holton)—Sep 21. Jim Brown, KØYLW, 785-364-2949.

Massachusetts (Cambridge)—Sep 21. Nick Altenbernd, KA1MQX, 617-253-3776.

†**Massachusetts (Orange)—Sep 27**. *Spr:* Mohawk ARC. Athol-Orange Elks Hall, 92 New Athol Rd; Rte 2 (E or W) to Exit 16, go N on Rte 202 to junction of Rte 2A at McDonald's, go left on Rte 2A towards Orange, Hall is 1 mile on left. *TI:* 145.37 (136.5 Hz), 146.58. *Adm:* $3. Tables: advance $10, door $15. John Dould, AE1B, 22 S Athol Rd, Athol, MA 01331-2722; 978-249-5980; **ae1b@hotmail.com**.

†**Massachusetts (South Dartmouth)—Sep 14;** set up 6 AM; public 7 AM to Noon. *Spr:* Southeastern Massachusetts ARA. SEMARA Clubhouse, 54 Donald St. Flea market, vendors (free space and admission), VE sessions (10 AM, walk-ins), refreshments. *TI:* 147.0. *Adm:* $2 (nonham spouses and children free). Tables: Free. Tim Smith, N1TI, 3 Riverside Dr, Mattapoisett, MA 02739; 508-758-3680; **rt_smith@yahoo.com**; **www.semara.org**.

†**Michigan (Adrian)—Sep 14,** 8 AM. *Spr:* Adrian ARC. Lenawee County Fairgrounds, Dean and Addison Streets. 31st Annual Hamfest and Computer Show, trunk sale spots ($3 each), VE sessions, camping facilities, handicapped parking. *TI:* 145.37 (85.4 Hz). *Adm:* $5. Tables: $10 (8-ft). Eric Smith, K8JVW, 5398 Hunt Rd, Adrian, MI 49221; 517-263-5407; **k8jvw@arrl.net**; **www.w8tqe.com**.

†**Michigan (Grand Rapids)—Sep 13;** set up 6 AM; public 8 AM. *Sprs:* Grand Rapids ARA, Lowell ARC, and Michigan AR Alliance. Forest Hills Northern High School, 3801 Leonard St NE; I-96 to Exit 38; Hwy M-44, N 1 mile to Leonard St, turn right (E), 0.8 mile to school, turn left. Electronics/Computer/Ham Radio Equipment Swapmeet, flea market, trunk sales (no extra charge, admission required), VE sessions (10 AM, all walk-ins), overnight self-contained camping (Friday, no hookups). *TI:* 147.26 (94.8 Hz), 146.52. *Adm:* $5 (not required of HS or younger students with student ID). Tables: $10 (8-ft, reserved by Sep 2), $5 (5-ft round, non-reserved). Ed Novakowski, N8UXN, c/o GRARA, Box 3282, Grand Rapids, MI 49501-3282; 616-458-9029 (eves); **hamfest@w8dc.org**; **www.w8dc.org/swap.htm**.

†**Missouri (Warsaw)—Oct 4,** 9 AM to 2 PM. *Spr:* Twin Lakes ARC. Community Center, 181 W Harrison; 1 mile W of US 65 on State Rte 7, go S on Main St to Court House Sq, turn W, go 1 block to hamfest. VE sessions (1 PM, all classes; walk-ins welcomed), refreshments. *TI:* 147.3. *Adm:* $3 each or 2 for $5. Robert "Gene" Payne, KCØDRL, 942 W Jackson St, Warsaw, MO 65355; 660-438-8650; **gpo@dam.net**.

†**Nebraska (Springfield)—Sep 13.** *Spr:* Ak-Sar-Ben ARC. Sarpy County Fairgrounds, Hwy 50 and Main St; exit I-80 at Hwy 50, go S 5 miles to Springfield, look for signs leading to flea market. Free coffee, refreshments. *TI:* 146.94. *Adm:* $2. Tables: $7. Pat Joseph, KØCTU, 1821 Robertson Dr, Omaha, NE 68114; 402-492-9156; **pjoseph@email.com**; **www.aksarbenarc.org/flea2003.shtml**.

†ARRL Hamfest

†New Jersey (Lawrenceville)—Sep 14; set up 6 AM; public 8 AM. *Spr:* Delaware Valley RA. National Guard Armory, 151 Eggert Crossing Rd; from NJ Tpk take 195W to 295N to 95S to 206S (Exit 7) to Eggert Crossing Rd. Hamfest/Computerfest, flea market, Amateur Radio and computer equipment, tailgating ($10, includes 1 admission), New Jersey Antique Radio Club display (various items for sale), mobile radio museum (John Dilks, K2TQN), ECHOLINK Board demonstration (Jim Millner, WB2REM), free parking, refreshments. *TI:* 146.67 (131.8 Hz). *Adm:* $6, under 12 free. Tables: indoor $15 (includes 1 admission), $10 additional space; $25 indoor with electricity (vendors need to bring your own table not to exceed 10 feet). Glenn Costello, N2RPM, Box 7024, W Trenton, NJ 08628; 609-882-2240; **abbott0903@hotmail.com**; **www.w2zq.com**.

†New York (Horseheads)—Sep 27, 8 AM to 2 PM. *Spr:* ARA of the Southern Tier. Chemung County Fairgrounds, Grand Central Ave; in Horseheads on Rte 17, at 2nd light turn S on Grand Central Ave, proceed ½ mile to Fairgrounds. Elmira International Hamfest/Computerfest, free flea market, dealer displays, VE sessions (9 AM, walk-ins accepted; John, 607-565-4020), Bunny Hunt, camping, pancake breakfast (8 AM), free parking, refreshments. *TI:* 146.7, 147.36, 444.2. *Adm:* advance $5, door $6, under 11 free. Tables: 1-5 $12 each, 6-9 $11 each, 10 or more $10 each. Elliott Blauvelt, N2OJM, Box 44, Elmira, NY 14902-0044; 607-739-5626; **n2ojm@arast.org**; or Randy Viele, N2SYT, 607-732-2822; **www.arast.org**.

†New York (Queens)—Oct 5, 9 AM to 2 PM. *Spr:* Hall of Science ARC. NY Hall of Science Museum Parking Lot (Flushing Meadow Corona Park), 47-01 111th St. Electronics and computer equipment, tailgating, tune-up clinic, VE sessions (10 AM; Lenny Menna, W2LJM, 718-323-3464), free parking, refreshments. *TI:* 444.2 (136.5 Hz), 146.52. *Adm:* buyers $5, sellers $10 (per space). Stephen Greenbaum, WB2KDG, 85-10 34th Ave, Jackson Heights, NY 11372; 718-898-5599 (eves only); **wb2kdg@arrl.net**; **www.qsl.net/hosarc**.

†New York (Syracuse)—Sep 13, 8 AM to 2 PM. *Spr:* Radio Amateurs of Greater Syracuse. Pompey Hills Fire Department; take I-81, Exit 15 onto Rte 20 E, go 6 miles to Henneberry Rd, on left. Indoor/outdoor flea market, vendors, dealers, exhibitors, displays, computer equipment, ARRL forum, NTS, awards, VE sessions (Noon, walk-ins), refreshments. *TI:* 147.3. *Adm:* $5, under 17 free. Tables: $12 (or bring your own, 8-ft space $5). RAGS, Box 88, Liverpool, NY 13088; 315-698-4558; **ragsonline@hotmail.com**; **www.ragsinreview.com**.

†Ohio (Cincinnati)—Sep 21. *Spr:* Greater Cincinnati ARA. Scarlet Oaks Vocational Campus, 3254 E Kemper Rd; from I-275 N of Cincinnati, exit OH SR 42 S (Exit 46), go S on Rte 42 to Kemper Rd W, right on Kemper, 1 mile W to Great Oaks sign, turn right to hamfest. Hamfest/Communications Expo, commercial vendors, VE sessions, refreshments. *TI:* 145.27. *Adm:* advance $5, door $6. Tables: $35. Tom Denham, K8VOE, 9299 Minuteman Way, West Chester, OH 45069; 513-779-3951; **cincinnatiamateurradio.com**.

†Ohio (Cleveland)—Sep 28. *Spr:* Hamfest Assn of Cleveland. Cuyahoga County Fairgrounds, 164 Eastland Rd, Berea; 1½ miles W of I-71 and Bagley Exit 235, ½ mile S on Eastland Rd. Flea market ($6 per space), ARRL forum, VE sessions, card checking, refreshments. *TI:* 146.73 (110.9 Hz). *Adm:* $6. Tables: $20. Hamfest Assn of Cleveland, 800-CLE-FEST; **info@hac.org**; **www.hac.org**.

†Ohio (Medina)—Oct 5, 8 AM to 2 PM. *Spr:* Medina Two Meter Group. Medina County Career Center, 1101 W Liberty St (State Rte 18); take I-71 S from Cleveland, N from Columbus to Exit 218, go W through downtown Medina, Career Center is 2.5 miles outside of town, look for the school zone which is the Medina Career Center. Flea market, new and used ham gear, computer equipment, vendors, VE sessions, free parking, handicapped accesible, refreshments. *TI:* 147.03 (141.3 Hz). *Adm:* advance $4, door $5. Tables: $9. Mike Rubaszewski, N8TZY, 57 Boston Reserve Ln, Brunswick, OH 44212; 330-273-1519; **n8tzy@m3net.net**; **www.qsl.net/n8tzy**.

Pennsylvania (Lancaster County)—Oct 4. Dave Phillips, W3CWE, 717-872-6578.

†Pennsylvania (Schnecksville)—Sep 20; set up 6 AM; public 7 AM. *Spr:* Delaware Lehigh ARC. Schnecksville Community Fire Company No 1 Grounds, on Rte 309; 4.3 Miles N of Rte 22 (near Allentown). Flea market, vendors, tailgating (admission plus $2 per space), ham radio equipment and computers, handicapped accessible, refreshments. *TI:* 51.76, 146.7, 444.9 (all 151.4 Hz). *Adm:* $5, nonham spouses and under 12 free. Tables: admission plus $4 per table (indoor only). Susan Marie Schoch, KB3IDW, 705 S Armour St, Allentown, PA 18103-3362; 610-797-1437; **kb3idw@arrl.net**; **www.dlarc.org**.

†Pennsylvania (Washington)—Oct 5, 8 AM to 2 PM. *Spr:* Washington Amateur Communications. Washington County Fairgrounds, 2151 N Main St; I-79 to Exit 41 (Racetrack Rd); if coming from I-79 N take left off exit, if coming from I-79 S, take right onto Race Track Rd, follow to stop light, go left onto Pike St, at next light go right onto Country Club Rd, follow to stop sign, go right onto N Main St, Fairgrounds on right just across railroad tracks. VE sessions, breakfast and lunch served with free coffee. *TI:* 145.49, 146.79. *Adm:* $5. Tables: $10. Jack Dayton, KA3ZLR, 701 Ridge Ave, Canonsburg, PA 15317; 724-746-4669; **ka3zlr@arrl.net**; **wacomarc.org**.

†Pennsylvania (York)—Sep 13-14. *Spr:* York Hamfest Foundation. 4-H Club Center, 771 Stoverstown Rd; from US Rte 30, 5 miles W of York, proceed SW for 1.5 miles on State Rte 116 to Stoverstown Rd. Indoor/outdoor tailgating, vendors, antique radio displays, seminars, VE sessions. *TI:* 147.33. *Adm:* $5. Tables: $15 ($3 discount for additional tables). John Shaffer, W3SST, 2596 Church Rd, York, PA 17404; 717-764-4805; **w3sst@yorkhamfest.org**; **www.yorkhamfest.org**.

†South Carolina (Rock Hill)—Oct 4, 8 AM. *Spr:* York County ARS. York County Technical College, 452 S Anderson Rd; Exit 79 (Dave Lyle Blvd) off I-77 to Hood Center Dr, drive 0.6 mile, look for entrance to York Tech on left. VE sessions, refreshments. *TI:* 147.03. *Adm:* advance $6, door $7. Tables: $35. Bob Bacharach, WA2EMF, 1627 Bridal Tr, Rock Hill, SC 29732; 803-327-2634; **wa2emf@arrl.net**; **www.ycars.org**.

†Tennessee (Monroe County)—Sep 13, 7 AM. *Spr:* Monroe ARS. Monroe Farmers Market, New Hwy 68; from I-75 take Exit 60 in Sweetwater, go E onto New Hwy 68, go through 2 traffic lights, continue straight for 5.5 miles (1.5 miles past Lost Sea), watch for signs. Sheltered-roof vendor area. *TI:* 146.82 (141.3 Hz). *Adm:* $3. Eric Fridley, KG4FZS, 148 Woodby-Fridley Rd, Sweetwater, TN 37874; 423-351-0028; **kg4fzs@yahoo.com**; **www.qsl.net/kg4yti**.

†Tennessee (Sevierville)—Oct 3-4; Friday 5-9 PM, Saturday 9 AM to 3 PM. *Spr:* Ten-Tec. Ten-Tec Factory, 1185 Dolly Parton Pkwy, 2 miles E of downtown Sevierville on Hwy 411 N; directly across from Sevier County High School. Factory tours, forums, VE sessions. *Adm:* Free. Stan Brock, WDØBGS, 1185 Dolly Parton Pkwy, Sevierville, TN 37862; 865-453-7172; **sales@tentec.com**; **www.tentec.com**.

†Texas (Midland)—Sep 13, 8 AM to 5 PM. *Spr:* Permian Basin ARC. Lee Youth Center and Parking Lot, 3500 Neely, corner of Neely and Tarleton St; Midkiff Exit off I-20 E or W, follow Midkiff through town to get to Neely, turn left at sixth traffic light on Midkiff, follow Neely to Tarleton St, turn right. Swapmeet/Tailgate, dealers, refreshments. *TI:* 147.28 (88.5 Hz), 444.925 (146.2 Hz). *Adm:* Free (Donations accepted and appreciated). Tables: Free (limited, or bring your own). Dwayne Fox, W5ZOX, 3707 Gaston Dr, Midland, TX 79703; 915-967-2444; **w5zox@cox.net**; **www.pbarc.org**.

†Vermont (Waterbury)—Sep 20, 8 AM to 2 PM. *Spr:* Central Vermont ARC. Waterbury Armory, Armory St; I-89 to Exit 10 S, take sharp left to Union St, take first left to Armory St. Flea market, forums, VE sessions. *TI:* 146.625 (100 Hz). *Adm:* $6. Tables: $4. Tom Girardi, WA1YNU, 51 Maple Ave, Barre, VT 05641; 802-793-2959; **wa1ynu@pshift.com**.

†Washington (Chehalis)—Sep 27, 9 AM to 1 PM. *Spr:* Chehalis Valley ARS. Lewis County Fairgrounds, 255 N National Ave; from I-5 take Exit 79, go E to the "T" and turn left, stay on this road for 3 miles, turn left onto Exibitor St, go 1 block to stop sign, turn left and go 100 ft, turn right into Fairgrounds, follow signs for parking. VE sessions (by reservation). *TI:* 147.06, 146.46. *Adm:* $3. Tables: 6-ft, advance $15, after Sep 14 $20. Bill Harwell, AC7SR, 362 SW Chehalis Ave, Chehalis, WA 98532; 360-748-8086; **ac7sr@arrl.net**; **www.cvars.org/**.

Washington (Everett)—Sep 25-28, Microwave Update/Pacific Northwest VHF Conference. See "Coming Conventions."

Washington (Spokane)—Sep 27, Eastern Washington Section Convention. See "Coming Conventions."

Attention All Hamfest Committees!

Get official ARRL sanction for your event and receive special benefits such as donated ARRL publications, handouts, and other support.

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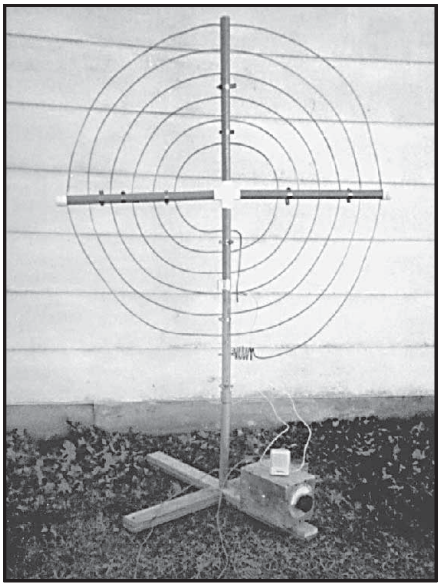
STRAYS



Charles, WAØQEX, is experimenting with this home-built antenna made of 50 feet of ¼ inch copper tubing. Depending on the configuration, it can be used for 80 meters, 40 meters and broadcast band receive with a crystal set.

By Scott Robbins, W4PA

2003 ARRL International DX CW Contest Results

Preparation and planning are the keys to every successful ARRL DX CW contest operation, whether it takes place from inside W/VE or from a DX location. Noncontesters can't appreciate the amount of effort that goes into the typical all-out contest effort, regardless of the class of entry of the participating station.

It can be as simple as keeping up maintenance on a home station or as complicated as figuring out flight schedules and coordinating with a distant host to assess equipment needs prior to a boom or bust weekend on the bands from a location far from home.

Goals vary. Many of us compete with ourselves. Others are jazzed by the mental challenge of "decoding" a contest. Others are pushed by ego or will to compete against the best of the best on equal terms. The vast majority of contest participants aren't planning on "winning" anything—only enjoying a few hours on the bands seeking out more contacts or the sheer pleasure of doing it.

Perseverance, long term, is the key to success in contesting. Rare is the contest operator who appears out of nowhere to make a category top 10 as a first time contest entrant. Many top 10 visitors are familiar call signs, and they have become familiar for no other reason than year after year they're on the air making contacts and soaking up knowledge that will be useful for future contest ventures. Accumulated knowledge leads to better results—and as years pass and entrants rotate in and out of serious contesting, the knowledgeable and committed rise to the top and new call signs appear in the top 10 boxes to start yet another cycle.

The W/VE single op all band unassisted QRP, Low Power, and High Power categories all featured decisive victories by the three winners, a new Canadian record for Low Power set by VE3EJ and a near miss by NT1N at KT1V to break the High Power single operator record. Dave will happily settle for both his victory and the #2 all-time highest score in the category.

From the DX side, the QRP single operator record was broken by FY5KE (F5MZN, op). V26G took it down to the wire for a victory and also squeezed by the log checking process to set the new DX Single Op, Assisted category score record. We saw an extremely close race in the High Power category where ultimately WP3R (K9PG, op) prevailed over two other battle-seasoned contest operators.

Generally, scores were lower in most categories than in the last three runnings of ARRL DX CW. In the three W/VE multioperator categories, a good indicator of overall activity, scores were down some 20% over 2002. With the continued decline in the sunspots, the trend will likely continue for the next several years. There are always surprises to be had during those solar minimums, however, and plenty of time to be planning for the upswing in sunspots late in the decade. Start building that 10 meter "elephant gun" monobander stack—now!

The PJ2T team for the 2003 ARRL International DX CW contest included WØNB, WA9S, WØCG (kneeling), W8TK, and W9EFL.

Expanded Results, Line Score Printouts Available

For complete contest results online, 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.

W/VE QRP

Long term perseverance paid off in the QRP category with the awarding of the Tod Olson, KØTO plaque to QRP winner George Briggs, K2DM. George finished 2nd in the QRP category in 2000, 2001 and 2002. Operating 41 hours total, George had a QRP top-10 best 0.2% error rate for a line score of 1117 QSOs/305 mults for a point total of just over 1 million.

As usual, the QRP top 10 was spread over a geographically diverse area with top 10 finishers from 7 different US call areas. The southeast was well represented with perennial QRP entrant Tom Russell, N4KG, operating his fine monobander-equipped Alabama station to a second place finish at 773,388 points.

Dale Martin, KG5U, of Houston, Texas comments, "I must have sent my call a million times in this contest," and finished third with 481,425. Fourth place went to Arizona's Gary Hembree, N7IR, with a score of 374,472.

2003 Kansas City DX Club Dayton CW pileup champion Doug Smith, W9WI, finished fifth from Tennessee with a score of 371,280.

Rounding out the top 10 were W6JTI (SF), N1TM (CT), K3AJ (MDC), WB3BEL (VA) and NU4B (TN).

W/VE Low Power

This year's W/VE low power winner is three-time WRTC competitor and Ontario resident John Sluymer, VE3EJ. John's line score of 2700/400=2,484,000 was both a victory in the low power category and a new Canadian record.

Positions 2 through 10 for the low power top 10 were a toss-up, with only some 400,000 points separating the remaining 9 slots. Very competitive, to say the least. It was Ed Sawyer, N1UR (VT) finishing second with 1810/349 for just under 1.9 million points in the self-described "little pistol" category. Ed ran

Top Ten—US CW

US CW Single Operator High Power

KT1V (NT1N, op)	6,226,974
KQ2M	5,675,454
VY2ZM (K1ZM, op)	5,490,114
K1TO	5,480,952
K5ZD (W4PA, op)	5,458,815
N2NT	4,914,630
AA1K	4,461,795
K3ZO	4,357,794
K2UA	4,212,600
VY2TT (K6LA, op)	4,043,034

US CW Single Operator Low Power

VE3EJ	2,484,000
N1UR	1,895,070
W3EF	1,844,814
K2PS	1,749,150
KK9A	1,653,900
W1WAI	1,621,224
N5AW	1,618,875
W2TZ	1,585,503
WJ9B	1,498,941
N4TZ	1,430,244

US CW Single Operator QRP

K2DM	1,022,055
N4KG	773,388
KG5U	481,425
K3TW	433,497
K2JT	376,650
N7IR	374,742
W9WI	371,280
W6JTI	358,545
N1TM	326,151
K3AJ	319,872

US CW 10

W4ZV	442,734
K5RX	310,086
K1XX	298,494
N4AO	231,264
WB4TDH	193,776
W9XT	114,144
K9OM	108,780
WR3L	91,530
K9HUY	86,526
K6EID	82,476

US CW 15

W4KZ (K4BAI, op@NQ4I)	472,548
KR2Q	416,988
K4OAQ	392,337
N6IG	273,537
KVØQ	267,138
K2BA	238,545
W7UT	227,850
N8BJQ	203,820
WX5S (@ W6YX)	182,250
KA6A	157,080

US CW 20

N2MF	505,080
N8II	386,484
K9NW	364,704
W7WA	322,296
NQ4I	312,480
VE6EX (@ VE6JY)	108,480
VE1AYY	87,129
KA7T	74,337
WA1FCN	73,485
K9CAN	71,910

US CW 40

N4PN	307,098
W5UN	244,125
N2WW	152,490
K2UOP	130,005
K4TX	117,234
W3PP	86,592
KØFX	77,787
W9SE	51,984
KT8X	43,362
W4IDX	42,411

US CW 80

W1MK	198,198
KU8E (@NQ4J)	83,808
K4DLJ	45,738
K8AQM	31,680
W8QID	28,728
VE3PN	26,847
VO1TA	20,412
K4ESE	18,921
K6OY	18,270
K8MD	15,066

US CW 160

K4TEA	8,442
K3JJG	7,257
W3GH	4,488
W2VO	3,828
W8TOP (W8UVZ, op)	3,330
K6SE	1,176
N4PSE	960
VE7SL	546
W7DRA	252
K7UIR	156

US CW Single Operator Assisted

W2UP	5,636,958
K3WW	5,513,832
KI1G	4,510,584
AA3B	3,898,500
N1EU	3,841,830
W2GD	3,250,944
K2XA	3,242,160
K4MA	3,178,140
W3FV	2,882,064
W4NF	2,803,086

US CW Multioperator Single Transmitter

K8AZ	4,511,910
K1IR	4,184,544
WT1T	3,561,345
K5TR	3,455,910
K4NNN	3,143,640
W8AV	3,121,092
NØNI	2,767,770
W2MU	2,281,554
K9ES	2,267,190
WN9O	2,065,140

US CW Multioperator Two Transmitters

K4JA	9,566,580
N3RS	9,527,637
K1KI	8,781,804
N4RV	6,399,000
K8CC	5,267,520
KØTV	5,105,232
K8LX	4,947,000
VE1JF	4,192,260
K6KM	3,269,370
W6OAT	1,999,404

US CW Multioperator Unlimited Transmitters

KC1XX	13,784,511
W3LPL	12,682,272
K1XM	12,288,051
K1TTT	9,703,470
K1RX	9,458,010
W4MYA	8,889,030
K9NS	8,879,544
N2RM	7,709,394
KB1H	6,605,016
K5GO	6,362,874

100 W to "Field Day-style" ladder mounted, rope-guyed 10 and 15 meter beams at 25 feet up, a 20 meter delta loop, 2 el, 40 m beam at 40 feet, With dipoles on 80 and 160 meters he was able to squeeze by the rest of the pack for a second place finish.

We were sorry to note that 6th place finisher David Allen, W1WAI (EMA), a well liked member of the Yankee Clipper Contest Club, became a silent key in May 2003.

The high finisher from west of the Mississippi was N5AW (STX) who finished 7th overall with a line score of 1439 QSOs and 375 multipliers for 1,618,875 points. Others making an appearance in the Top Ten were W3EF (MDC), K2PS (SNJ), KK9A (IL), W2TZ (WNY), WJ9B (NC) and N4TZ (IN).

W/VE High Power

Magic numbers abound in ham radio. "100" for DXCC and VUCC. "40" for the CQ Worked All Zones award. "3076" for the USA-CA county award. For the ARRL DX CW single op category, the magic number in recent years has been "6,000,000." The W/VE single op high power winner for 2003 is Dave Patton, NT1N, who operated from and as KT1V in New Hampshire. Dave's score of 6,226,974 is the second highest ever recorded in the category, and represents only the 4th time a score of 6,000,000 or greater has been recorded by a single op, high power entrant—and the first unassisted single op to break 500 countries on CW (507). Dave was aggressively moving multipliers from band to band and ended up finishing only one counter behind the top packet-assisted multiplier hunter for mult total. The top 5 finishers had a "low" of 3902 QSOs (VY2ZM) to a "high" of KT1V's 4094. Dave was able to outdistance the pack by virtue of his excellent QSO error percentage of 0.2% and nonstop multiplier hunting.

Second place finisher is 2001 single op high power winner Bob Shohet, KQ2M (CT) with a line score of 4086/463 for 5,675,454.

After Bob's second place finish there was a horserace for the next three spots, with only 31,000 points separating positions 3 through 5. In third place was VY2ZM (MAR) operated by Jeff Briggs, K1ZM, at 3902/469 for 5,490,114. 2003 CQ Contest Hall of Fame entrant and three time WRTC co-champion Dan Street, K1TO had the top high power score from outside the Northeast, finishing #4 from West Central Florida with a superb line score of 4042/452 for 5,480,952. At the bottom end of the top 5 was 2002 high power winner Scott Robbins, W4PA, operating from K5ZD (WMA) with a line score of 4089/445 for 5,458,815 points.

Rounding out positions 6 through 10 were N2NT (NNJ) at 4,914,630, AA1K (DE) 4,461,795, K3ZO (MDC) 4,357,794, K2UA (WNY) 4,212,600 and VY2TT (K6LA, op, PEI) at 4,034,034.

Tied for the best error accuracy rate with KT1V (NT1N) at 0.2% was 8th place finisher Fred Laun, K3ZO.

W/VE Single Op, Assisted

Eastern Pennsylvania stations took the top 2 spots for the single operator, assisted category in 2003. Coming in #1 was Barry Kutner, W2UP with a line score of 3743/502 for 5,636,958 points and his first single op, assisted category victory.

Perennial assisted contender Charles Fulp, K3WW finished a close second with 3618/508 for 5,513,832. Chas' multiplier count of 508 was tops among all single operator entrants. Since the introduction of the assisted category in 14 years ago, Chas has finished either #1 or #2 every year except 1992, with wins in 1993, 1994, 1999, and 2002.

In third place was 5-time assisted category winner Rick Davenport, KI1G (RI) with 4,510,584 points. The top 5 were rounded out by Bud Trench, AA3B (EPA) at 3,898,500 and Barry Gross, N1EU (ENY) with 3,841,830.

Name the only operator in radio contesting history to have won the single op unassisted high power category from the DX side for both modes of the ARRL DX and CQ WW contests? You'd have 6th place finisher and CQ Contest Hall of Famer John Crovelli, W2GD (alter ego P4ØW) operating assisted from the domestic side this time for a score of 3,250,944 from Northern New Jersey. The rest of the category Top Ten is inhabited by K2XA (ENY), K4MA (NC), W3FV (EPA), and W4NF (VA).

W/VE Single Band

Bill Tippett, W4ZV (NC) made it a "two-fer" with his second consecutive victory in the W/VE single band 10 meter category, working 1306 QSOs and 113 countries for total score of 442,734

On 15 meters, John Laney, K4BAI, operating as W4KZ at the contest superstation of NQ4I, took home the win with 1486/106 for 472,548. Finishing a close second was Doug Zwiebel, KR2Q (NNJ), with 1404/99 for 416,988.

Moving up a band after winning the 15 meter category in 2002 was Brian Edward, N2MF (WNY), who handily won the 20 meter single band trophy with a line score of 1464/115 for 505,080 points. Jeff Hartley, N8II (WV), was second with 386,484 and Mike Tessmer, K9NW (IN), was third at 364,704.

Forty meters featured last year's second place finisher Paul Newberry, N4PN (NFL), moving up a notch to take first prize at 1034/99 for 307,098 points. VHF moonbounce guru David Blaschke,

DX Single Operator High Power winner Paul, K9PG, who was the op at WP3R.

W5UN, went for the longer waves this time to take 2nd place from his Texas QTH with a score of 244,125.

Perennial 80 meter victor Robye Lahlum, W1MK (EMA), kept his 80 meter single band streak alive with his 10th consecutive win in the category with a score of 198,198. Second place went to Jeff Clarke, KU8E (GA), also operating from the NQ4I station and finishing with a total score of 83,808.

Competition was light in the W/VE 160 meter single band category, with winner K4TEA (GA) making 67 contacts with 42 counters for a total score of 8442. Second place 160 meter finisher was K3JJG (EPA) with 7257 points.

W/VE Multi-Op Categories

Also scoring a "two-fer" in the W/VE Multioperator Single Transmitter category were a group from the North Coast Contesters, who operated K8AZ (OH) to a second consecutive win in the Multi-Single category. Two Yankee Clipper Contest Club teams both operating from eastern Massachusetts filled the next two slots with K1IR at 4,184,544 in 2nd place and WT1T at 3,561,345 third. The K5TR team in south Texas made an excellent effort to finish 4th with 3,455,910 points.

The extremely competitive Multioperator Two Transmitter category featured the closest finish of the 2003 contest, with the Virginia team at K4JA edging Pennsylvania's N3RS by 9,566,580 to 9,527,637. K4JA was 99 contacts off the lead but was able to make up the difference with 12 extra multipliers to take the victory. K1KI in Connecticut was a close third with 8,781,804.

The Multioperator Multitransmitter category featured a close race among three battle-seasoned contest teams. It was KC1XX in New Hampshire taking victory over Maryland's W3LPL and the K1XM crew operating from W1KM's QTH in eastern Massachusetts—13,784,511 to 12,682,272 to 12,288,051.

DX High Power

Puerto Rico...Palm trees...Lawn chairs in the sun...Clear skies...Beautiful beachfront hotels...It even smells like "vacation" from a distance. On the other hand, one could always go to Puerto Rico and stay awake for 48 straight hours, not go outside, sleep on the floor of a half-finished building and rent a car for four days that you don't drive anywhere. Who else but a committed radio contester would subject himself to this?

Society of Midwest Contesters President Paul Gentry, K9PG, journeyed from Illinois to the WP3R club station in Puerto Rico to do exactly that and was rewarded with the Frankford Radio Club DX High Power plaque. Paul's line score of 5375 QSOs and 343 multipliers was good for 5,530,875 points and a first place finish. This is Paul's first High Power victory in ARRL DX CW; he was the CW low power winner in 1996 operating FS5PL from French St Martin. Congratulations!

Coming up right behind WP3R in a close race to the finish were Jim Neiger, N6TJ, operating from Aruba as P4ØT, and Alexander Teimurazov, 4L5A, who operated D4B from the Cape Verde Islands off the west coast of Africa. P4ØT and D4B both had score totals in the mid-5 million range but Paul just squeaked past them for the victory. All of the top 3 finishers were in essentially a dead heat for QSO total and multipliers with WP3R at 5375/343, P4ØT at 5353/339 and D4B at 5345/328. Small margins can make the difference!

High score from Oceania was our 2002 winner Mike Gibson, KH6ND, who operated KH7X to a 6th place High Power finish with a 4938 QSO, 325 multiplier effort for 4,814,550 points.

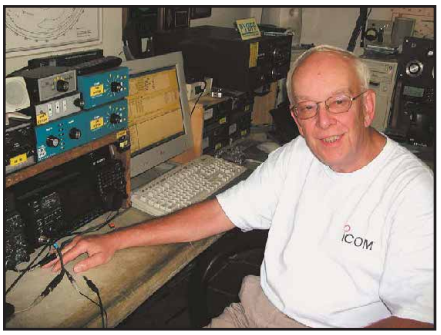
Top European finisher was Jacques Saget, F6BEE, who finished just outside the top 10 with a score of 2,754,360.

DX Low Power

Puerto Rico...Palm trees...Lawn chairs...Wait a minute. I think we've already discussed this!

As WP3R was streaking to victory in the High Power category, another contender on the same island was dit-dahing his way to the win at the 100-W level. It was Barney Bandrack, DK8ZB, operating KP4KE to take the Dauberville DX Association Low Power plaque. His line score of 4309 QSOs and 328 multipliers for 4,240,056 was a decisive victory, his first DX Low Power win, and was within striking distance of the Low Power single op record of 4,542,060 set by 6V6U (K3IPK, op) in 1995.

Naturally, the Caribbean is a favorite spot for expeditioners to target for ARRL DX CW, and it comes as no surprise that



Bill, W9VA, took another trip to PYØFF and pulled in a victory in the DX Single Band 10 Meter category.

the next three finishers also picked islands to operate from. Bill Vanderheide, N7OU, ventured to the Isle of Hispanola to operate N7OU/HI9 from the Dominican Republic to a second place Low Power finish with a total of 4034/268 for 3,243,336 points. Kurt Pauer, W6PH operated from Bermuda as VP9/W6PH to finish third with 3427/304 for 3,125,424. St Maarten was the site of Ronald St Laurent's 4th place operation as PJ7/ND5S, with a line score of 2856/296 for 2,536,128 points.

Low Power continental leaders outside of North America were OA4DKC for South America (who also finished 5th overall in the Low Power category), F6EYB for Europe (10th place overall), VK5GN for Oceania, JH4UYB in Asia, and EA8CN for Africa.

DX QRP

Olivier Le Cam, F5MZN, operating FY5KE from French Guiana is our 2003 winner in the DX QRP category. His line score of 2658/245 for 1,953,630 bests the previous DX QRP category record of 1.79 million set in 1998 by VP9ID (AJ2U, op). Olivier took advantage of the somewhat disturbed high band conditions during the contest to make nearly 1000 contacts on 10 meters to come in for a runaway victory and the new benchmark.

Finishing second, operating from Hungary was Gyorgy Kasper, HA1CW, with 823/172 for 424,668 points. High North American DX QRP score was from (take a guess?) Puerto Rico, with WP4JXD finishing at 191,391 to take 5th place overall.

Aside from FY5KE and WP4JXD, Europeans filled out the remaining 8 spots in the top 10, with HA1CW, I1BAY, GØDCK, HB9BMY, I3BBK, DL3KVR, ON6NL and IØZUT all making the box. Top Asian operator was Japan's JR4DAH at 112,716 and top Oceania QRP score was submitted from the Philippines by N7ET/DU7 at 23,244.

DX Single Op, Assisted

Not even close is the only way to describe the DX Single Op, Assisted category

Top Ten—DX CW

DX CW Single Operator High Power

WP3R (K9PG, op)	5,530,875
P40T (N6TJ, op)	5,444,001
D4B (4L5A, op)	5,259,480
P40Y (AE6Y, op)	4,959,342
TG0AA (K7BV, op)	4,851,051
KH7X (KH6ND, op @ KH7R)	4,814,550
V31DJ (W0CP, op)	4,652,775
EA8BH (N7NG, op)	4,458,510
FM5BH (AJ6V, op)	4,409,358
6Y0T (K3TEJ, op)	4,052,535
V47KP (W2OX, op)	3,198,180

DX CW Single Operator Low Power

KP4KE (DK8ZB, op)	4,240,056
N7OU/HI9	3,243,336
VP9/W6PH	3,125,424
PJ7/ND5S	2,536,128
OA4DKC	2,032,128
P4/K2LE	1,935,360
VP9/K9CC	1,754,049
LU5FF	1,124,364
F6EYB	1,017,360
VK5GN	916,266

DX CW Single Operator QRP

FY5KE (F5MZN, op)	1,953,630
HA1CW	424,668
I1BAY	251,424
G0DCK	223,740
WP4JXD	191,391
HB9BMY	178,920
I3BBK	171,717
DL3KVR	169,920
ON6NL	158,400
LZ2RS	139,536

DX CW 10

PY0FF (W9VA, op)	338,247
PT5T	329,730
PY3DX	321,786
LU1FAM	290,103
LT5F (LU4FPZ, op)	287,802
LQ7D (LW9DA, op)	209,670
M7M (G0CKP, op)	186,450
LW9EOC	173,826
LU3HIP	173,565
LU8DW	172,086

DX CW 15

XT2WP (G4BWP, op)	440,376
ZF1A (W5ASP, op)	358,956
M5X (G4TSH, op)	246,036
CX7BY	232,638
M0TTT	229,038
IR4T	224,967
PY2KN (PY1KN, op)	201,609
F5IN	198,012
YU1ZZ	191,922
9A5Y (9A3NM, op)	189,312

DX CW 20

IU9S (IT9BLB, op)	262,218
9G5ZZ (DL1 CW, op)	260,130
GM3POI	241,605
EI4BZ	209,922
7S2E (SM2DMU, op)	192,444
G4BUO	179,208
OH8L (OH8LQ, op)	172,260
S57DX	169,920
OH4A (OH6QU, op)	159,036
PY2NY	157,491

DX CW 40

HP1/DJ7AA	302,940
ZW5B (PY2NDX, op)	228,240
CO2JD	194,169
C6ALK	190,704
YT7A (4N7DW, op)	170,868
9A3IQ	166,344
HA9SU	153,105
OM5M (OM2RA, op)	151,728
IU3X (IV3SKB, op)	150,138
UW5Q (UR3Q CW, op)	142,854

DX CW 80

C6AKQ (N4BP, op)	175,275
YV5OHW	162,279
YV4GLD	106,008
G0IVZ	101,100
OR3T	85,248
SO2R (SP2FAX, op)	57,669
IR2C (IK2NCJ, op)	55,728
HG8C (HA8EK, op)	53,016
DJ0MDR	43,992
OL8M	43,920

DX CW 160

KV4FZ	65,208
CM6RCR	26,676
T31MY (KM9D, op)	22,680
CO8TW	10,692
G4VGO	7,125
F6FGZ	6,525
IK4MGP	5,355
YV5MBX	3,672
DJ3TF	1,440
JA8NFV	798

DX CW Single Operator Assisted

V26G (N2ED, op)	4,023,825
DK3GI	1,897,500
IK0YVV	1,547,913
LY7Z (LY2TA, op)	1,123,128
IK2AHB	1,121,676
PY8AZT	966,600
PA5KT	946,815
LY2CY	651,501
OE8CIQ	573,516
DJ9RR	400,824

DX CW Multioperator Single Transmitter

ZF2NT	5,949,768
9Y4TBG	5,602,182
PJ4G	5,165,532
PJ2T	5,152,284
TM5C	3,423,126
HG1S	2,457,036
V47WW	2,410,545
OM7M	2,354,160
IR4A	1,637,559
JA8RWU	1,181,454

DX CW Multioperator Two Transmitters

VP5LP	7,891,914
6D2YFM	6,840,444
9A7A	3,239,502
HG6N	2,662,983
RU1A	2,201,580
OL7W	1,879,956
V31YN	1,798,920
JH5FXP	1,787,256
LZ9W	1,729,308
DL1MGB	357,435

DX CW Multioperator Unlimited Transmitters

TI5N	6,453,540
CS6V	5,913,303
9A1A	4,331,151
RW2F	3,050,784
HG3DX	2,646,270
JA3YBK	2,476,671
RO4M/6	2,209,662
OZ5W	1,794,672
8S5X	1,648,746
LY7A	1,166,160

Plaque Winners

Plaque Category	*Winner*	*Plaque Sponsor*
W/VE Single Operator High Power CW	KT1V (NT1N, op)	Frankford Radio Club
W/VE Single Operator Low Power CW	VE3EJ	Dauberville DX Association
W/VE Single Operator QRP CW	K2DM	Tod Olson, K0TO
W/VE Single Operator Assisted CW	W2UP	Harold Ritchey, W3WPG Memorial
W/VE 3.5 MHz CW	W1MK	SM3DMP
W/VE 7 MHz CW	N4PN	Northern Arizona DX Association
W/VE 14 MHz CW	N2MF	QSLs by W4MPY
W/VE 21 MHz CW	W4KZ (K4BAI, op)	Carl Luetzelschwab, K9LA
W/VE 28 MHz CW	W4ZV	Green River Valley, IL ARS, K9WM
W/VE Multioperator Single Transmitter CW	K8AZ	Northern Illinois DX Association
World Single Operator High Power CW	WP3R (K9PG, op)	North Jersey DX Association
World Single Operator Low Power CW	KP4KE (DK8ZB, op)	Jim Stevens, K4MA
World Single Operator Assisted CW	V26G	Willamette Valley DX Club
World 1.8 MHz CW	KV4FZ	Fred Race, W8FR, In Memory of DL1FF
World 28 MHz CW	PY0FF(W9VA, op)	Fort Wayne DX Association
World Multioperator Two Transmitter CW	VP5LP	Tom De Meiss, K2TD, Memorial
World Multioperator Unlimited CW	TI5N	H. Stephen Miller, N0SM
Single Operator Asia High Power CW	P3F(5B4AGN, op)	Alamo DX Amigos
Single Operator North American High Power CW	TG0AA (K7BV, op)*	Potomac Valley Radio Club
Asian Multioperator Single Transmitter CW	JA8RWU	Yankee Clipper Contest Club
Europe Multioperator Two Transmitter CW	9A7A	Jim George, N3BB
Europe Multioperator Unlimited CW	CS6V	Texas DX Society
Japan Low Power All Band CW	JH4UYB	Western Washington DX Club
Ninth Call Area All Band CW	N9RV	Northern Illinois DX Association
Seventh Call Area All Band CW	KC7V	Willamette Valley DX Club
Central Division High Power All Band CW	K9SD*	Society of Midwest Contesters
Central Division Multioperator Single Transmitter CW	WN9O	Society of Midwest Contesters
Central Division Low Power All Band CW	KK9A	Society of Midwest Contesters
Rocky Mountain Division Single Operator Low Power CW	W0ETT	Grand Mesa Contesters of Colorado

If you would like to purchase an unsponsored plaque for a Division, Call Area, Continental or Overall Category win, please contact **contests@arrl.org** or phone 860-594-0295. Plaques are $60 each.

*Plaque awarded to second-place finisher; winner awarded higher-level finishing plaque.

for 2003. Not only did winner V26G (Ed Wlodarski, N2ED, op) outdistance the pack by a huge margin, his score was good enough to set the SO/A category record with a line score of 4127 QSOs and 325 multipliers for 4,023,825 points.

Second place finisher and top European score was Roland Mensch, DK3GI, with 1,897,500 points. Top South American finisher was the 6th place score of Luciano Silva, PY8AZT at 966,600 points. #1 Asian finisher was OD5/OK1MU in Lebanon, operating one of his last contests from there before returning to Europe. Thanks for the OD multiplier for all those years, Pavel!

DX Single Band

Bill Smith, W9VA, ventured to Fernando de Noronha to operate PY0FF to victory in the DX 10 meter single band category with a line of 1911/59 for 338,247, narrowly edging past two Brazilians in the second and third positions to take the win. It was Oms, PY5EG, operating PT5T taking second at 329,730 and Paul Toledo, PY3DX, finishing third at 321,786. South America represented 9 of the top 10 positions in the category, with M7M (G0CKP, op) coming in at #7 the lone European.

WRTC-2002 competitor Fred Handscombe, G4BWP operated as XT2WP from Burkina Faso in west Africa to take the top 15 meter single band spot with a score of 440,376. This was also good enough to break the previous DX 15 meter single band record set by VP5TT (K2KW, op) in 2000. Second place went to Joe Staples, W5ASP, who operated ZF1A and finished with 358,956—exactly the same score that VP5TT ended with to set the previous record.

Twenty meters featured a very tight race with WRTC-1996 competitor Giuseppe La Parola, IT9BLB, operating as IU9S with a score of 262,218, edging out second place finisher 9G5ZZ (Arno Polinsky, DL1CW, op) at 260,130.

Forty meters was won decisively from Panama by Wil Gottschald, DJ7AA, operating as HP1/DJ7AA and coming in with a line score of 1683/60 for 302,940 points. Second place went to Rafael Martins, PY2NDX, operating as ZW5B.

Bob Patten, N4BP, winner of the 40 meter single band plaque in 2002, moved to 80 meters for 2003 to take the win from the Bahamas, operating as C6AKQ. 160 meters was won by Herb Schoenbohm, KV4FZ, with a score of 65,208.

DX Multi-Op Categories

It was a team of operators working from the island house owned by Bruce Sawyer, N6NT, that are this year's winner in the DX Multi-Operator Single-Transmitter

Continental Leaders

Single Operator QRP
Asia
JR4DAH 112,716
Europe
HA1CW 424,668
North America
WP4JXD 191,391
Oceania
N7ET/DU7 23,244
South America
FY5KE 1,953,630

Low
Africa
EA8CN 783,156
Asia
JH4UYB 708,948
Europe
F6EYB 1,017,360
North America
KP4KE (DK8ZB, op) 4,240,056
Oceania
VK5GN 916,266
South America
OA4DKC 2,032,128

High
Africa
D4B (4L5A, op) 5,259,480
Asia
P3F (5B4AGN, op) 1,055,799
Europe
F6BEE 2,754,360
North America
WP3R (K9PG, op) 5,530,875
Oceania
KH7X (KH6ND, op @ KH7R) 4,814,5503
South America
P40T (N6TJ, op) 5,444,001

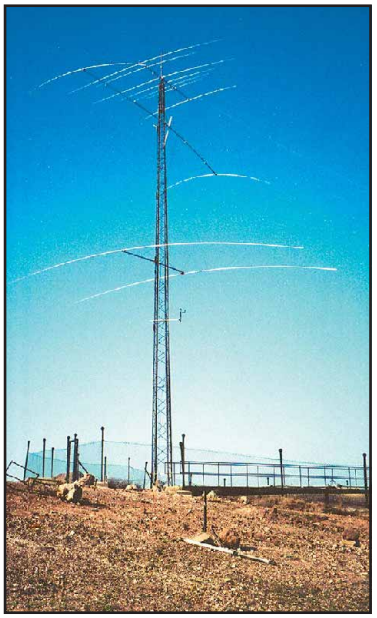
Single Operator Single Band
Asia
JA8NFV 798 160
Europe
G4VGO 7,125 160
North America
KV4FZ 65,208 160
Oceania
T31MY (KM9D, op) 22,680 160
South America
YV5MBX 3,672 160
Asia
JM1LRQ 3,627 80
Europe
GØIVZ 101,100 80
North America
C6AKQ (N4BP, op) 175,275 80
Oceania
DU9/NØNM 4,860 80
South America
YV5OHW 162,279 80
Asia
JH1AEP 87,291 40
Europe
YT7A (4N7DW, op) 170,868 40
North America
HP1/DJ7AA 302,940 40
Oceania
ZL3GA 5,742 40
South America
ZW5B (PY2NDX, op) 228,240 40
Africa
9G5ZZ (DL1CW, op) 260,130 20
Asia
UA9KM 85,470 20
Europe
IU9S (IT9BLB, op) 262,218 20
North America
NP4FW 6,786 20
Oceania
YB2MTA 3,381 20
South America
PY2NY 157,491 20
Africa
XT2WP (G4BWP, op) 440,376 15
Asia
JH3AIU 140,292 15
Europe
M5X (G4TSH, op) 246,036 15
North America
ZF1A (W5ASP, op) 358,956 15
South America
CX7BY 232,638 15
Africa
9G5GA (DL3GA, op) 147,744 10
Asia
JF1SQC 34,650 10
Europe
M7M (GØCKP, op) 186,450 10
North America
HT4T (YN4SU, op) 150,684 10
Oceania
A35RK 161,370 10
South America
PT5T 329,730 10

Single Operator Assisted
Asia
OD5/OK1MU 85,440
Europe
DK3GI 1,897,500
North America
V26G 4,023,825
South America
PY8AZT 966,600

Multioperator Single Transmitter
Asia
JA8RWU 1,181,454
Europe
TM5C 3,423,126
North America
ZF2NT 5,949,768
South America
9Y4TBG 5,602,182

Multioperator Two Transmitter
Asia
JH5FXP 1,787,256
Europe
9A7A 3,239,502
North America
VP5LP 7,891,914

Multioperator Unlimited Transmitter
Asia
JA3YBK 2,476,671
Europe
CS6V 5,913,303
North America
TI5N 6,453,540



The EA8BH antenna system in the Canary Islands where Wayne, N7NG, posted an 8th place finish in the Single Operator High Power DX category.

W/VE Region Leaders

Tables list call sign, score and power (A = QRP, B = Low Power, C = High Power).

CW

Northeast Region (New England, Hudson and Atlantic Divisions; Maritime and Quebec Sections)			Southeast Region (Delta, Roanoke and Southeastern Divisions)			Central Region (Central and Great Lakes Divisions; Ontario Section)			Midwest Region (Dakota, Midwest, Rocky Mountain and West Gulf Divisions; Manitoba and Saskatchewan Sections)			West Coast Region (Pacific, Northwestern and Southwestern Divisions; Alberta, British Columbia and NWT/Yukon Sections)		
KT1V (NT1N, op)	6,226,974	C	K1TO	5,480,952	C	N9RV	3,081,471	C	K5GN	3,529,812	C	KC7V	1,606,479	C
KQ2M	5,675,454	C	N4ZR	2,836,872	C	K8GL	2,645,985	C	W5KFT (K5PI, op)	2,550,366	C	WA6O (@ N6RO)	1,545,480	C
VY2ZM (K1ZM, op)	5,490,114	C	K4EU	2,341,083	C	VE3AT	2,459,250	C	K5NA	2,467,920	C	W2VJN	1,414,008	C
K5ZD (W4PA, op)	5,458,815	C	W4NZ	1,732,728	C	K9SD	1,896,552	C	N3BB	2,404,224	C	W7GG	1,274,064	C
N2NT	4,914,630	C	W4/G4BUE	1,555,866	C	N9CK	1,877,631	C	KØSR	1,420,710	C	N6AA	1,225,890	C
N1UR	1,895,070	B	WJ9B	1,498,941	B	VE3EJ	2,484,000	B	N5AW	1,618,875	B	N6NF	693,504	B
W3EF	1,844,814	B	K4GKD	1,257,138	B	KK9A	1,653,900	B	W5AC (NT5TU, op)	647,064	B	WN6K	494,100	B
K2PS	1,749,150	B	N4IG	1,183,656	B	N4TZ	1,430,244	B	N5PO	628,002	B	K6TA	481,800	B
W1WAI	1,621,224	B	W4AA	1,132,638	B	VE3ANX	1,198,368	B	N0FP	434,565	B	K8IA	377,325	B
W2TZ	1,585,503	B	NA4K	1,079,850	B	VE3XB	992,772	B	KA5KLU	295,776	B	K7HBN	370,116	B
K2DM	1,022,055	A	N4KG	773,388	A	K8ZT	222,264	A	KG5U	481,425	A	N7IR	374,742	A
K3TW	433,497	A	W9WI	371,280	A	WB8RTJ	216,540	A	N0UR	221,400	A	W6JTI	358,545	A
K2JT	376,650	A	WB3BEL	303,810	A	N8IE	206,025	A	WA8ZBT	165,540	A	W7YAQ	208,662	A
N1TM	326,151	A	NU4B	267,741	A	VA3DF	134,406	A	K5IC	96,642	A	W6QU	186,624	A
K3AJ	319,872	A	WD4GBW	209,160	A	VE3WZ	84,201	A	NØTK	43,680	A	NQ7X	83,889	A

category. Operating as ZF2NT from the Cayman Islands, they led the category in both QSOs and multipliers to take the top spot with a score of 5,949,768. This was only 30,000 points shy of the DX M/S category record, also set from the Caymans in 1990.

The next three positions were filled by stations off the coast of South America with a German team operating from Trinidad and Tobago as 9Y4TBG finishing second with 5,602,182. Third and fourth were teams operating from the A-B-C island chain off the coast of Venezuela, with PJ4G on Bonaire third with 5,165,532 and PJ2T on Curacao fourth with 5,152,284.

Top European M/S score was France's TM5C at 3,423,126. Top Asian score was JA8RWU at 1,181,454.

The DX Multi-Operator Two Transmitter category featured a runaway win by a group operating from Turks and Caicos as VP5LP. Their score of 7,891,914 was more than 1 million points ahead of second place finisher 6D2YFM at 6,840,444. Top M/2 European score was 9A7A with 3,239,502.

In the battle of the DX big boys, it was TI5N taking the DX Multi-Operator Multi-Transmitter category from Costa Rica with a score of 6,453,540. Second place finisher and top European score was Portugal's CS6V with 5,913,303 points. Top score for M/M from Asia was the JA3YBK club at 2,476,671.

Coda

"Sunspots, we hardly knew ye." A mutation of the traditional Irish ballad, for sure, but no less true. While scores are down, participation in ARRL DX CW remains high, with 2354 logs submitted for the 2003 running. This represents a slight decline from the last two years but is still the third highest log submission total recorded to date. Despite the solar variations, let's hope that participation levels continue to be stable in the years to come. Be prepared…February 21-22 will bring more than snow and ice in 2004…It will bring the opportunity to test your skills once again in one of the premier contest events. 73!

By **Lew Malchick, N2RQ**

School Club Roundup 2003

The 17th School Club Roundup once again brought smiles to the faces of hundreds of young people as they worked other SCR stations—and anyone else they came across—during the week of February 10-14, 2003. In the elementary school group, N2WG with 84,672 points nearly doubled last year's top score and KB3BRT repeated at second place. Entries from Junior High and Middle Schools dropped from 20 to 11. K7BZN moved up from 5th place to first and KØEMS went up from 9th to second, both with increased scores. AD8B dropped to third, perhaps because of the absence of the NØZ special call sign. The high schools division race tightened between perennial leader KC7KFF and W6PRB. KB3GWS moved up to third, more than doubling their score with their new club call sign.—K3NHC. The number of high schools remained constant from last year at 17. Although College/University entries fell to 6 from 15, ON4HTI returned in the DX group. W7ASU and W5YW repeated outstanding performances for Arizona State University and Louisiana State University.

After an absence of non-school club entries in 2002, K3FBI returned, but was topped by WB2JKJ. (Joe explained that although he is retired from the New York City Public School system, he continues the work of the JHS 22 Foundation.) Jack, KB3AGZ, topped the list of individual entries.

For more information about the School Club Roundup, try our e-mail reflector. You can subscribe at **www.groups.yahoo.com/group/SCR-L** or by sending e-mail to **SCR-L-SUBSCRIBE@yahoogroups. com**.

SOAPBOX

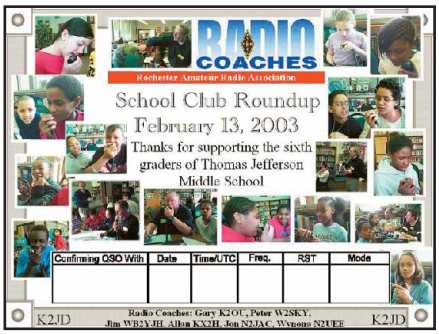
"This was my first time to work with fifth graders. These ten and eleven year olds were quite remarkable. The hams we contacted were all very understanding and supportive of the kids. This was my best School Club Roundup yet."—*Bill Wetherill, N2WG*

"This was our best SCR ever! Over 100 sixth grade students talked on the radio from Jefferson Middle School in Rochester, NY. The students were thrilled, as were their teachers and school supervisors. This four hour "production" was accomplished by 6 radio coaches: N2UEE, WB2YJH, N2JAC, KX2H, K2OU and W2SKY. We used the K2JD call sign operating in the school library on HF and EchoLink to connect with Thailand. Hams at the other end of our QSOs were exceptionally skilled at engaging our students with enjoyable conversations. It doesn't get any better than this."—*Peter Fournia, W2SKY*

"The School Club Roundup has become a tradition here at our elementary school. Classes from Kindergarten through Fifth Grade visited the club station during the week to take part and to check out the 'big map' showing all the contacts. As always, the ham community did a great job helping introduce amateur radio to young people. Special thanks go to all the patient operators who took time to visit with nervous students. By the end of the week, they weren't nervous any more." —*Bruce D. Weaver, K3LTM*

The 2003 SCR contest was the best ever for W6PRB! We had a great group of young operators, several returning for their second, third or fourth year in the contest. Conditions were better than usual, enabling us to contact many more schools than any of our previous efforts. Our students were amazed at the number of schools on the air, as they watched our school tally rise throughout the week. This year we replaced our C3S tri-bander with a C4E, which gave us capability on 40 meters. Working DX in the late evening and early morning hours was a lot of fun. I was surprised at the number of students who were motivated enough to stay in the shack during those late evenings and early mornings to catch the DX, even when we were operating CW. As in previous years I am, once again, impressed at how this event motivates my students to get involved in our hobby. We have three students working on their General tickets, and five new recruits working on their Technician licenses. Paso Robles High School ARC sends out a big thank you to the ham community for taking time to respond to those many young people calling "CQ School Club Roundup." See you next year!—*Rob Thoresen, AG6RT*

Plan ahead for SCR 2004, to be held February 9-13.



This QSL certificate depicts some of the 100 students who participated in the 2003 School Club Roundup from the Jefferson Middle School in Rochester, New York.

Codington Elementary School Amateur Radio Club team picture with Dr Morris, Superintendent of Schools in New Hanover County and Mrs Henry, Codington Principal in the front row. That's Bill Wetherill, N2WG, in the back cheering with the kids.

Students from the Paso Robles High School (club station W6PRB) enjoyed taking part in the 2003 School Club Roundup.

2003 School Club Roundup Scores

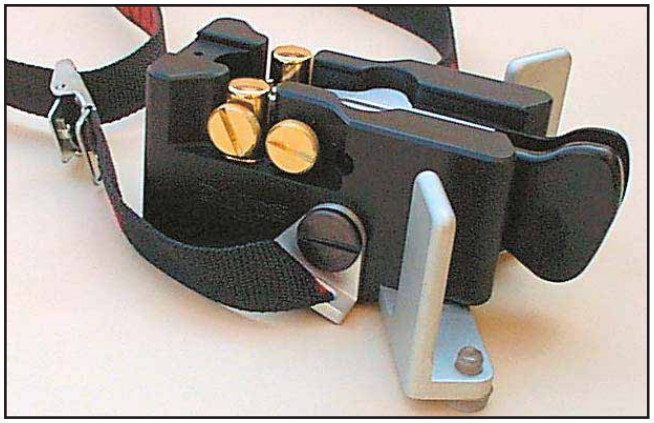
Call Sign	Score	Rank	QSOs	States	Can Prov	Countries	Clubs	Schools	Hours	Operators	Club Name	School
Elementary School												
N2WG	84672	1	287	46	4	14	5	44	24	41	Codington Amateur Radio Club	Codington ES
KB3BRT	23160	2	120	30	2	10	3	29	21	24	Cowanesque Valley School ARC	Westfield Area Elementary
KD7CJV	13080	3	110	34	0	2	4	13	24	8		Mill Park Elementary
W3NCS	12672	4	99	24	0	5	2	19	8	2	N Clarion School ARC	North Clarion County ES
KB2VBU	3720	5	40	20	0	1	1	14	9	53	Intervale School ARC	
K6LSR	2765	6	29	15	1	2	3	11	7	6	Lodi Schools Radio Clubs	Nichols ES
KK8STA	2562	7	38	18	1	0	1	8	3	4	St Antoninus School Radio Club	St Antoninus School
W4MIT	1387	8	19	14	0	0	2	11	5	1	BEARS Brentwood Elementary ARS	Brentwood Elementary
N1IFP	363	9	11	7	0	1	0	5	2	1	Bean School ARC	James Bean School
W4MIT	84	10	6	4	0	0	0	2	2	1	WARC	Wiley Elementary
KA7SKY	84	11	7	7	0	0	0	1	3	22	Sonoran Sky ARC	Soronon Sky
WA2YCJ	24	12	2	2	0	0	0	2	2	1	Mawbey Street School ARC	Mawbey Street School
Junior High/Middle School												
K7BZN	72898	1	287	45	3	11	5	37	13	8	Sacajawea Middle School HRC	Sacajawea Middle School
K0EMS	39990	2	215	35	4	3	7	26	23	68	East Middle School ARC	East Middle School
AD8B	39516	3	178	31	4	7	5	34	20	41	Zion ARC	Zion Lutheran School
K4BMS	14596	4	89	30	0	18	3	22	20	1	Blacksburg Middle School ARC	Blacksburg Middle School
AB0OA	4576	5	52	20	1	2	0	13	6	11		Winfield Middle School
KS5CMS	3696	6	39	21	1	0	1	12	6	8	Carpenter Middle School ARC	Carpenter Middle School
WD4OHD	2604	7	28	16	0	0	1	15	8	31	Baylor School ARC	Baylor School
KC2ILA	2088	8	24	11	0	1	0	15	7	5	Central Square Middle School ARC	Central Square MS
KC2KJN	1836	9	27	18	0	0	0	10	4	4	Gowanda CDS ARC	Gowanda MS
K5OMS	1300	10	26	18	0	0	1	6	3	1	Olle Radio Club	Olle Middle School
K2JD	144	11	9	5	0	1	0	2	4	3	RARA Radio Coaches	Thomas Jefferson MS
High School												
KC7KFF	368784	1	900	49	9	33	14	55	24	8	Carl Hayden Community HS ARC	Carl Hayden Community HS
W6PRB	328716	2	778	50	8	47	21	50	24	17	Paso Robles High School ARC	Paso Robles High School
K3NHC	96913	3	469	46	0	24	7	23	22	21	North Hills HS Amateur Radio & Electronics Club (AREC)	North Hills HS
KC0CXB	36562	4	181	36	0	6	5	30	20	14	Palisade HS ARC	Palisade High School
ND8GA	30400	5	152	38	2	9	3	29	13	3	Gilmour Academy ARC	Gilmour Academy
K1BBS	27792	6	144	26	2	11	2	30	20	30	Burr And Burton ARC	Burr and Burton Academy
AA3TH	21248	7	124	32	4	16	2	22	19	10		Clarion Area HS
KB0SAL	20370	8	97	30	1	1	4	34	12	3	Waco High School ARC	Waco High School
N4LZJ	15876	9	98	32	2	7	3	23	19	9		Colonial Forge HS
KB3BKW	12222	10	97	29	3	7	1	17	7	5	Belle Vernon HS ARC	Belle Vernon High School
KC2AIF	12040	11	86	31	3	4	1	20	20	4	Pioneer HS ARC	Pioneer High School
KC0LZD	11176	12	88	26	0	2	2	19	13	24	Morgan County R-2 Ham Club	Morgan Co R-2 Schools
W2CXN	8450	13	65	23	0	7	0	20	10	10	Brooklyn Technical HS ARC & Soc	Brooklyn Technical HS
KC0LRQ	6760	14	52	20	2	4	2	20	12	4	Francis Howell North HS ARC	Francis Howell HS
KC0ENB	5510	15	58	23	1	0	3	13	8	2	Russell High School Radio Club	Russell High School
AD4SY	2484	16	25	15	0	2	0	15	12	8	CGS Spotsylvania	Commonwealth Governor's School
W5CHS	735	17	21	10	0	0	0	5	4	6	Catholic HS ARC	Catholic High School
College/University												
W7ASU	480810	1	863	50	7	34	28	74	24	4	Amateur Radio Society at ASU	Arizona State University
W5YW	132107	2	407	46	4	7	8	50	23	2	Amateur Radio Society at LSU	Louisiana State University
W9NIU	74226	3	266	42	7	2	6	43	16	5	NIU Amateur Radio Club	Northern Illinois University
W6YRA	43935	4	303	47	4	3	3	17	6	3	UCLA ARC	UCLA
WA2NPP	21414	5	158	32	0	4	4	17	11	3	Rutgers University ARC	Rutgers University
W0GQ	605	6	11	10	0	0	0	9	2	1		Kirkwood Community College
DX College/University												
ON4HTI	14193	1	142	6	1	37	7	5	18	2	STARCOM	Ostend Polytechnic University (KHBO)
Clubs (Non-School)												
WB2JKJ	38080	1	224	46	1	6	1	23	24	14	Radio Club of JHS 22	
K3FBI	27984	2	128	29	2	16	1	22	16	3	Federal Bureau of Investigation ARA	
Individual												
KB3AGZ	3822	1	26	17	0	0	0	26	7	1		
AB7PG	3240	2	24	15	0	0	24	11	1			
WB2TLQ	1976	3	19	12	0	0	1	18	5	2		
WO8L	1890	4	18	15	0	0	0	18	4	1		
KA2NRR	1530	5	18	14	0	1	0	14	9	1		

NEW PRODUCTS

MAGNETIC TRAVELER LIGHT CW PADDLE FROM BEGALI

◊ The Magnetic Traveler Light is an iambic CW paddle intended for the traveling or backpacking ham. It combines many of the design elements and features of Begali's Simplex and Magnetic Classic models. Folding "wings" protect the finger pieces during transport, and in the open position they provide lateral stability. This "Light" version (a heavier version intended for desktop use is expected to be available soon) uses a lightweight alloy for the base and the "wings," and weighs in at about 1.5 pounds.

Price: $248 (plus S/H). For more information, contact Begali, Via Badia 22, I-25060, Cellatica, Italy; tel +39 (0)30 322203; fax +39 (0)30 314941; **pibegali@tin.it**; **www.i2rtf.com**.



2003 ARRL International EME Competition Announcement

Dates: October 18-19 (first weekend) and November 15-16 (second weekend)

0000 UTC Saturday through 2359 UTC Sunday

How to participate: Any amateur station on any band 50 MHz and up may be worked utilizing the earth-moon-earth path. Both single operator and multioperator stations may participate as either multi-band or single-band entries.

What to say: All stations give both call signs and a signal report in a mutually understood format, plus a complete acknowledge-ment of the calls and report.

Special interest: You may work a station once per band for credit. Single band entries may make contacts on additional bands, and should report them in their entry.

Quirks: Stations must be worked over the earth-moon-earth path, regardless of how strong or weak a nearby station's terrestrial signal may be. Multioperator stations may work from different sites, provided the sites are no less than 50 km (30 miles) apart. Unless prohibited by your nation's rules, if operating from separate sites, a multioperator station uses the same call sign. In the US, if your call sign number does not properly indicate the call area from which you are operating, you must append the correct call area to your call (example: N1ND operating in Indiana should sign as N1ND/9.)

Rule changes this year: The total transmitter output power for a high power entry in any category is either 1500 W PEP or the maximum allowable power level established by the national licensing authority of your country, whichever is lower. Digital modes are now eligible for use in the event, including new technologies such as *WSJT* and *JT-44*.

Best reason to participate: Whether an old-timer or newcomer, there is great pride in hanging the certificate for completing your first EME contact on the wall of your shack. If you haven't tried EME before, this is a great opportunity, because many of the "Big Guns" will be on the air looking for new stations. For some information about operating EME, see **www.arrl.org/tis/info/moon.html**.

Relative challenge: To many, EME represents the height of technological challenge and achievement in Amateur Radio. Modern technology has made it somewhat easier to pull weak signals from the noise threshold, but the watchword for EME enthusiasts is still "Patience!"

Scoring: Score 100 QSO points for each completed EME contact. You receive a multiplier for each US and Canadian call area worked, plus each non-W/VE DXCC entity worked via EME on each band. Final score is the total QSO points times the total multipliers.

How to report your score: Your entry must be postmarked or e-mailed by December 16, 2003. Cabrillo formatted logs are not required for the EME Competition but may be used provided a completed summary sheet also accompanies the entry. E-mail electronic submissions to **EMEcontest@arrl.org** or send paper logs and complete summary sheet to EME Contest, ARRL, 225 Main St, Newington, CT 06111.

Complete rules: The complete rules may be found at **www.arrl.org/contests/forms**. You will also find links to the General Rules for all ARRL Contests, General Rules for ARRL Contests on bands above 50 MHz (VHF) and other forms and operating aids, log sheets for submitting your entry. If you don't have Web access, you can obtain the complete rules and forms by sending a self-addressed, stamped envelope with postage for 2 oz to EME Contest Rules, ARRL, 225 Main St, Newington CT 06111.

For more information: e-mail **contests@arrl.org** or phone 860-594-0232. QST

NEW PRODUCTS

NEW HAMTRONICS UHF FSK DATA TRANSMITTER

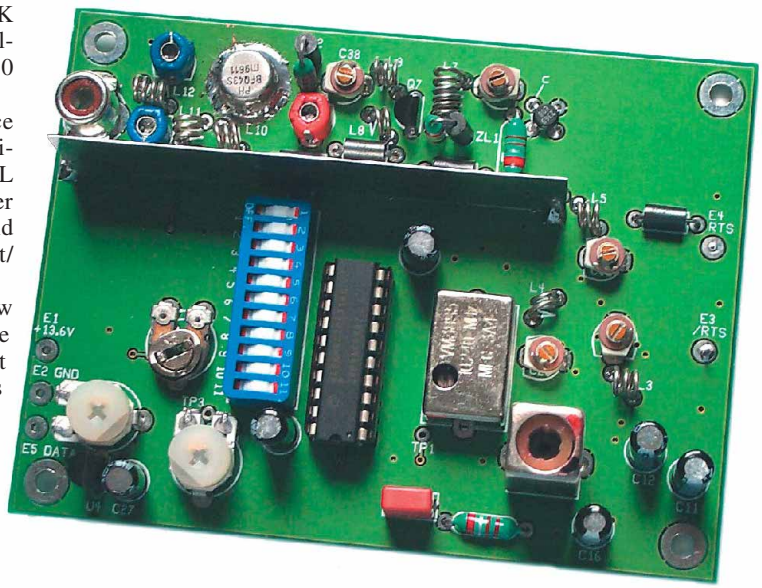
◊ Hamtronics has a new UHF exciter module designed for FSK transmission of data at rates up to 9600 baud. The T306 is available in several models to cover various segments of the 420-450 MHz ham band.

The new T306 exciter is similar to the popular T304 FM voice exciter, but it has a data modem built in and has modulation optimized for data transmission. It can be interfaced with any TTL level data signals, such as a TNC or an embedded microcon-troller in control or telemetry equipment. It accepts a Request to Send or PTT signal to key the transmitter; so a separate transmit/receive switch is not required.

Other features include DIP switch frequency selection, low noise synthesizer, TCXO for tight frequency accuracy in a wide range of environmental conditions, and fast delivery with no wait for channel crystals. Power output is 2-3 W. Power amplifiers are available for higher power levels if needed.

For the receive end of the link, Hamtronics offers the R304HS receiver and the MO-96 modem. The R304HS is a special version of their UHF voice receiver, but optimized for data applications.

Price: T306, $229. For more details, visit their Web site at **www.hamtronics.com** or call Hamtronics at 585-392-9430.



CONTEST CORRAL

Feedback

In the 2002 ARRL 160-Meter Contest the entry of **VE7UF** was omitted. The score was 44,643 with 294 QSOs and 69 multipliers. It is first place in the Single Operator High Power category in the BC section.

In the 2003 ARRL January VHF Sweepstakes, the entry for **N6VMO** has been reclassified as Single Operator Low Power. This makes the Southwestern Division winner in the Single Operator Portable category **KQ6EE**.

W1AW Qualifying Runs are 10 PM EDT Thursday, Sep 4 (0200Z Sep 5) (10-40 WPM), and 7 PM EDT Wednesday, Sep 17 (2300Z Sep 17). The K6YR West Coast Qualifying Run will be at 9 PM PDT Wednesday, Sep 24 (0400Z Sep 25). 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 publication.

Sep 1-2

MI QRP Labor Day CW Sprint, 2300Z Sep 1-0300Z Sep 2 (see Jan *QST*, p 97 or **www.qsl.net/miqrpclub/**).

Sep 6-7

All-Asian DX Contest—Phone, 0000Z Sep 6-2400Z Sep 7 (see June *QST*, p 95 or **www.jarl.or.jp/English/0-2.htm**).

IARU Region 1 Field Day—SSB—sponsored by IARU Societies, 1300Z Sep 6-1300Z Sep 7 (see June *QST*, p 95). Frequencies: 160-10 meters. Categories: SOAB (LP, QRP), MS (HP, LP). Exchange: RST and serial number. QSO points: non-EU to EU—3 pts, with portable EU stations—4 pts. Score: QSO points × DXCC and WAE entities counted once/band. For more information—**www.iaru.org** or IARU Region 1 society Web sites. Send logs to the appropriate national societies (NA hams to RAC or ARRL).

North American Sprint—CW, 0000Z-0400Z Sep 7 (see Feb *QST*, p 103 or **www.ncjweb.org**).

DARC 10-Meter Digital Contest—Digital Modes—sponsored by the Deutsche Amateur Radio Committee, 1100Z-1700Z Sep 7. Frequencies: 28.050-28.150 MHz on RTTY, Pactor, PSK31, Amtor, Clover. Categories: SO, SWL. Stations may be worked on each mode, but count for multipliers only once. Exchange: RST + serial number. QSO points: 1 pt/QSO. Score: QSO points × WAE countries + DXCC entities + W/VE/JA districts. For more information—**www.darc.de/referate/hf/contest/.** Logs due 4 weeks after the contest to **df5bx@darc.de** or Werner Ludwig, DF5BX, PO Box 1270, D-49110 Georgsmarienhuette, Germany.

First PSK63 Contest—Sponsored by the Digital Radio Reflector, 0000Z-2359 Sep 6. Frequencies: 80-10 m, just above PSK31 frequencies (consider wider bandwidth for PSK63). Categories: SOAB, SOSB, SWL, packet spotting allowed. QSO points: own country—5 pts, own cont—10 pts, diff cont—15 pts. Score: same as SARTG RTTY contest, QSO points × DXCC entities + W/VE/VK/JA call areas. For more information, including PSK63 software assistance—**www.netsync.net/users/obrienaj/quickpsk.htm**. Logs due Oct 10 to **obrienaj@netsync.net** or QUICK PSK Contest, Andrew O'Brien, 9082 Concord Dr, Fredonia, NY 14063.

Sep 13-15

YLRL Howdy Days—CW/SSB—sponsored by the YL Radio League, 1400Z Sep 10-0200Z Sep 12, work 24 out of the 36 hour period. Exchange: YLRL Member or not. QSO points: non-YLRL member—1 pt, YLRL members—2 pts. Score is total points. For more information—**www.qsl.net/ylrl/ylcontests.html**. Logs due 30 days after the contest to Jeanie Parker WA6UVF, 28400 Vista del Valle, Hemet, CA 92544.

WAE DX Contest—SSB, 0000Z Sep 13-2359Z Sep 14 (see Aug *QST*, p 91 or **www.darc.de/referate/dx**).

ARRL September VHF QSO Party, 1800Z Sep 13-0300Z Sep 15 (see Aug *QST*, p 103 or **www.arrl.org/contests**).

North American Sprint—SSB, 0000Z-0400Z Sep 14 (see Feb *QST*, p 103 or **www.ncjweb.com**).

Second-Class Operators Club (SOC) Marathon Sprint—CW, from 1800Z to 2400Z Sep 13. (Most sprints run four hours, but since we're Second Class Op's, we need more time!) Frequencies: 160-6-meters. Categories: SOAB. Exchange: RST + SPC + SOC number or power output. QSO points: SOC member—5 pts, non-member same continent—2 pts, different cont—4 pts. Score: QSO points × SPC counted once per band × Power multiplier (<250 mW × 15, <1 W ×10, <5 W ×7, >5 W ×1). Multiply by 1.5 if using a homebrew paddle. Logs due 30 days after the contest to **n4bp@arrl.net** or Bob Patten, N4BP, 2841 NW 112 Terr, Plantation, FL 33323.

3rd Annual FISTS Coast to Coast Contest—CW—sponsored by FISTS Northwest Club, K7FFF, 0000Z-2400Z Sep 14. Frequencies: 80-10 m. Categories: SOAB, MS. Exchange: RST, name, state or DX prefix, and FISTS number or power. QSO points and scoring depends on number of times club is worked. For more information—**www.tomochka.com/k7fff/fnw_c2c03.html**. No logs required; just send total score and list of clubs contacted to **FistsC2C@yahoo.com** within 30 days of the contest.

Louisiana QSO Party—CW/Phone—sponsored by the Twin City Ham Club, 1400Z Sep 13-0200Z Sep 14 and 1400Z-2000Z Sep 14. Frequencies: 80-2 meters. Categories: SOAB (QRP <5 W, LP <150 W, HP, CW, Phone, Mixed Mode), MS (QRP, LP, HP, Mixed Mode only). Exchange: RST and SPC or LA parish. QSO points: Phone—2 pts, CW—3 pts. Score: QSO points × LA parishes (LA stations use SPC) counted once per band. For more information—**www.tchams.org/users/contest/laqp/laqprules.html**. Logs due Oct 31 to **laqp@tchams.org** or TCHC Contest Committee, PO Box 1871, West Monroe, LA 71294.

Tennessee QSO Party—CW/Phone—sponsored by the Tennessee Contest Group, 1800Z Sep 14-0100Z Sep 15. Frequencies (MHz): CW—1.815, 3.540, 7.040, 14.040, 21.040, 28.040; SSB—1.855, 3.900, 7.240, 14.280, 21.390, 28.390; Novice/Tech—3.700, 7.130, 21.140, 28.140, 28.390; VHF/UHF—50.195, 144.195, 146.55, 223.5, 446.0. Exchange: RS(T) and TN county or SPC. QSO points: HF phone—2 pts, HF CW—3 pts, VHF Phone—4 pts, VHF CW—6 pts. Score: QSO points × TN counties (TN stations add SPC) counted only once. TN stations claim one additional multiplier for every five QSOs with the same TN county. Bonus points: 100 points for each QSO with K4TCG and TN mobiles add 500 points for each TN county activated. For more information—**www.k4ro.net/tcg/tqp/tqp03_rules.html**. Logs due Nov 12 to **w9wi@w9wi.com** or TN QSO Party c/o Doug Smith, W9WI, 1385 Old Clarksville Pike, Pleasant View, TN 37146-8098.

Sep 20-21

ARRL 10 GHz + Up Cumulative Contest, 0600 local Sep 20-midnight local Sep 21 (see July *QST*, p 105 or **www.arrl.org/contests**).

Scandinavian Activity Contest—CW—sponsored by Suomen Radioamatooriliitto (SRAL), 1200Z Sep 20-1200Z Sep 21 (Phone, 1200Z Sep 27-1200Z Sep 28). Frequencies: 80-10 meters. Categories: SOAB (QRP <5 W, LP <100 W, HP), MS, SWL. Exchange: RS(T) + serial number. QSO points: EU stations—1 pt, Non-EU—1 pt on 20—10, 3 pts on 80-40. Final score is QSO pts × Scandinavian call areas counted once per band. For more information—**www.sk3bg.se/contest/text/sacnsc.txt**. Logs due Oct 31 to **sac@contesting.com** or to SACCW or SACSSB, SRAL, PL 44, FIN-00441, Helsinki, Finland.

Washington State Salmon Run—CW/SSB—sponsored by the Western Washington DX Club, 1600Z Sep 20-0700Z Sep 21 and 1600Z-2400Z Sep 21. Frequencies: 160-6 meters. Categories: SO (CW, SSB or Mixed Mode, QRP <5 W, LP <200 W, HP), MS, Washington Club Station, Mobile, Washington County DXpedition, SWL. Exchange: RS(T) and SPC or county (for WA stations). QSO points: SSB—2 pts, CW—4 pts. Work Portables and Mobiles from each county, log county line QSOs as 2 separate QSOs. Score: QSO points × WA counties (WA stations use SPC + WA counties) counted once only. QSOs with W7DX add 500 bonus points for each mode—total 1000 points. For more information—**www.wwdxc.org**. Logs due Oct 31 to **salmonrun@wwdxc.org** or Western Washington DX Club, PO Box 395, Mercer Island, WA 98040.

South Carolina QSO Party—Phone/CW/Digital—sponsored by the Sumter Amateur Radio Association (SARA), 1300Z Sep 20-2100Z Sep 21. Frequencies (MHz): CW: 1.805 and 50 kHz from band edge, Phone: 1.845, 3.860, 7.260, 14.270, 21.370, 28.370, 50.125, 144.200, 146.58, 223.50, 446.00. No repeater or crossband QSOs, work stations again from each county. Categories: SOAB, SC Mobile. Exchange: Serial Number and SC county or S/P/C. QSO points: Phone—1 pt, CW—2 pts, Digital—3 pts. Score: Total QSO points × power multiplier (<5 W ×5, <150 W ×2, >150 W ×1) × SC counties (counted only once) × SC counties activated (SC Mobile only). 300 bonus points for QSO with N2ZZ or W4GL. For more information—**www.geocities.com/CapeCanaveral/2695/SCQSOWeb.htm**. Logs due Oct 18 to SARA SC QSO Party Entry, PO Box 193, Sumter, SC 29151-0193.

Fall QRP Homebrewer Sprint—CW/PSK31—sponsored by New Jersey QRP Club, 0000Z-0400Z Sep 22. Frequencies: QRP CW and PSK31 frequencies on 80-10 meters, CW and PSK31 are considered separate bands. Exchange: RST + SPC + output power. QSO points: Commercial Equipment—2 pts, Homebrew Xmtr or Rcvr—3 pts, Homebrew Xmtr and Rcvr—4 pts, Homebrew PSK31 station—5 pts. Kits okay as homebrew. Power multiplier: 0> 250 mW = ×15, 250 mW >1 W = ×10, 1-5 W = ×7, >5 W = ×1. Score: QSO points × SPC (counted once per band) × power multiplier. For more information—**www.njqrp.org/data/qrphomebrewersprint.html**. Logs due 30 days from the contest to **n2cq@arrl.net** (text format) or Ken Newman, N2CQ, 81 Holly Dr, Woodbury, NJ 08096.

The Classic Exchange—CW/Phone—sponsored by Classic Exchange and AM International, 1300Z Sep 28-0700Z Sep 29. Frequencies (MHz): CW—1.810, 3.545, 7.045, 14.045, 21.135, 28.180; AM—1.890, 3.880, 7.290, 14.286, 21.420, 29.000; SSB—3870 to 75, 7280-85, 14.270-75, 21.370-75, 28.490-95. Exchange: Name, RST, SPC, Rcvr and Xmtr type, AMI number (if available). Okay to change equipment and work stations again on each band and mode. Count the total number of receivers (Rx) and transmitters (Tx). Score: QSOs × (Rx

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+ Tx + SPC counted on each band and mode) × CX mult. The CX multiplier is the total of the ages of all equipment used for 3 QSOs or more. Transceivers count ×2. Homebrew age is min. 25 years, unless documented as older. For more information—**qsl.asti.com/CX**. Send logs to **WQ8U @arrl.net** or "Mac" MacAulay, 6235 Wooden Shoe Ln, Centerville, OH 45459-1557.

QRP Afield—CW/Phone/Digital—sponsored by the New England QRP Club, 1500Z Sep 20-0300Z Sep 21, submit a log for the best 6 hr period of the contest. Frequencies: 160-10 meter QRP calling frequencies, work stations once per band and mode. Categories: SO and MS. Exchange: RS(T), SPC, and NE-QRP number or power. QSO points: HP (>5 W) fixed station—1 pt, HP mobile or portable—2 pts, QRP fixed—5 pts, QRP mobile or portable—10 pts. QSOs with WQ1RP score triple points. Score: QSO points × SPC (counted once only). For more information—**www.qsl.net/wq1rp/main.htm**. Logs due Oct 15 to **k1cl@arrl.net** or Chuck Ludinsky, K1CL, 6 Prancing Rd, Chelmsford, MA 01824-1922.

Collegiate QSO Party—CW/SSB/Digital, sponsored by the Collegiate Amateur Radio Association (CARA), 1200Z Sep 20-0400Z Sep 21. Frequencies: 160-10 meters. Categories: SO, MS, MM, packet spotting is allowed for all categories, no self-spotting. Exchange: serial number and name of institution (for clubs) or operator (SO). QSO points: 1 pt/QSO, see Web site for bonuses. Score: QSO points × clubs worked, counted once per band and mode. For more information—**www.qth.com/collegiate/qsopartycentral.htm.** Logs due Oct 6 to **qsoparty@collegiatehams.com** or CARA, PO Box 150232, Alexandria, VA 22315-0232.

Sep 27-28

CQ WW RTTY DX Contest—sponsored by *CQ Magazine* from 0000Z Sep 27-2400Z Sep 28. Frequencies: 80-10 meters. Categories: SOAB (LP, HP>150 W), SOSB, Assisted (AB only), MS (LP, HP), M2, MM. Exchange: RST + CQ Zone (W/VE stations also send state/province). QSO points: own country—1 pt, different country, same continent—2 pts, diff cont—3 pts. Score: QSO points × S/P/C (incl WAE countries) + CQ Zones counted once per band. For more information—**www.cq-amateur-radio.comawards.html**. Logs due Oct 31 in Cabrillo format only to: **rtty@cqww.com**.

Scandinavian Activity Contest—SSB—1200Z Sep 27-1200Z Sep 28 (see Sep 20-21).

Arkansas QSO Party—CW/SSB/PSK31—sponsored by K1ARK, 0002-0600 Sep 28, and 1400Z Sep 28-0100Z Sep 29. Frequencies (MHz): CW—3.550, 7.050, 14.050, 21.050, 28.050; Phone—3.980, 7.260, 14.260, 21.360, 28.360, 145-147; PSK—3.580, 7.070; 14.070; 21.080; 28.120. Categories: SO, MS, Mobile, (HP >150 W, LP, QRP <5 W) PSK (QRP and non-QRP). Exchange: RST, state or province, DX stations send "DX." (Arkansas stations send county.) QSO points: PSK—3 pts, CW—2 pts, SSB—1 pt. Score: QSO points × AR counties (AR station count states, provinces and AR counties) counted once per band. Work mobile stations again when they change counties. Bonus stations: W5YM (25 pts per band/mode), Arkansas ARRL affiliated club station (10 pts). For more information—**www.arkan.us**. Logs due 30 days after the contest to **k1ark@arrl.net** or to Bill Smith, K1ARK, 2164 Magnolia Dr, Fayetteville, AR 72703.

Texas QSO Party—CW/Phone/Digital—sponsored by Northwest Amateur Radio Society (NARS), 1400Z Sep 27-0200Z Sep 28 and 1400Z-2000Z Sep 28. Frequencies: CW—40 to 60 kHz above bottom of band, Phone—25 kHz above edge of General segments and 28.300-28.500, VHF—50.2, 144.2 MHz. Categories: SO, SO-QRP (<5 W CW, <10 W Phone), SO-CW Only, MO, Texas SO, Texas MO. Exchange: RST + SPC or MM region, TX stations send RST + TX county. QSO points: Phone—2 pts, CW/Digital—3 pts. Score: non-TX stations—QSO points × TX counties, TX stations—QSO points × TX counties + SPC. Multipliers counted once only. For each TX mobile worked in 5 counties, add 500 points to final score plus 500 points for each 5 additional counties. Add 1000 points to your *final score* per every county covered with at least five different contacts. For more information—**www.txqp.org**. Logs due Oct 31 to **k5cx@arrl.net** or Texas QSO Party Committee, 16880 East Maglitto Cir, Tomball, TX 77377-8414.

Alabama QSO Party—CW/Phone—sponsored by the Central Alabama HF/VHF Contesting Club, 1800Z-2400Z Sep 27. Frequencies: 160 m-70 cm, SSB, CW and FM contacts count separately. Categories: SO, MS, Rover, QRP(<5 W), LP (<200 W), HP. Exchange: RST and SPC. Work Rover stations in each county. QSO points: 1 pt/QSO. Scoring: AL stations—QSOs × states + AL counties + DXCC entities counted once per band. Non-AL stations—QSOs × AL counties counted once per band. For more information **web.dbtech.net/~dxcc/rules1.htm**. Logs due 30 days after the contest to **dxcc@dbtech.net** or Alabama QSO Party, 4525 Eastern Hills Ln, Cottondale, AL 35453.

Rattletap Contest—CW—sponsored by College Amateur Radio Association (CARA), 2100Z Sep 27-0100Z Sep 28. Frequencies: all amateur bands, use a bug to make QSOs or work stations using bugs. Categories: SO. Exchange: send BUG in place of RST during the QSO. Submit a list of stations worked, the type and model of bug you used in the event, your vote for best bug operator you worked, soapbox and photographs. For more information—**www.qth.com/collegiate/rattletap.htm**. Logs due Oct 16 to **rattletap@collegiatehams.com** or RattleTap, PO Box 150232, Alexandria, VA 22315. QST

SPECIAL EVENTS

Greenbelt, MD: Central Maryland Amateur Radio Club, WC3MAR. 1600Z **Aug 30**-0200Z **Sep 1**. Greenbelt Labor Day Festival and Parade. 28.370 21.370 14.270 7.270. Certificate. CMARC, PO Box 788, Greenbelt, MD 20768. **mywebpages.comcast.net/jctilton/cmarc/index.html**.

Paterson, NJ: Robert D. Grant United Labor Amateur Radio Association, N2UL. 1200Z-2400Z **Sep 1**. CQ Labor Day, Great Fall Festival. 28.420 21.360 14.260. Certificate. RDGULARA, c/o WA2VJA, 112 Prospect St, Nutley, NJ 07110-0716.

Schaumburg, IL: Schaumburg Amateur Radio Club, K9S 1400Z-2400Z **Sep 1**. Septemberfest. 28.450 21.340 14.250 7.250. QSL. Schaumburg Amateur Radio Club, PO Box 68251, Schaumburg, IL 60168-0251.

Alexandria, MN: Runestone Amateur Radio Club, WØW. 1300Z **Sep 1**-2100Z **Sep 14**. Commemorating Discovery of the Kensington Runestone. 21.250 14.250 14.070 3.910. Certificate. Bill Klundt, 509 Pine Street S, Sauk Centre, MN 56378.

Rantoul, IL: Willy Victor Reunion Group, WV2AEW. 1500Z **Sep 5**-2200Z **Sep 6**. US Navy Airborne Early Warning, from US Navy WV-2 radio operators' position at Chanute Aerospace Museum. 14.265 14.030 7.244 7.030. Certificate. Samuel E. Leach, K3KLC, PO Box 741, Lexington Park, MD 20653. **www.willyvictor.com**.

McPherson and **Liberal, KS:** McPherson Amateur Radio Club, WØTWU, and Southern Plains Amateur Radio Klub, WØCM. 1300Z-2200Z **Sep 6**. Commemorating the 1541 expedition of Coronado to Kansas. 21.320 14.280 7.280 3.928. Certificate. Craig Spencer, NØUYA, 1390 12th Ave, McPherson, KS 67460, Dan Cox, WØKKS, 1940 N Webster, Liberal, KS 67901.

North Judson, IN: Starke County Amateur Radio Club, W9JOZ. 1300Z-2100Z **Sep 6**. Railroad Festivities from the Hoosier Valley Railroad Museum. 14.240 7.240. QSL. Starke County Amateur Radio Club, 405 W Jackson St, Knox, IN 46534.

Roselle, IL: Schaumburg Amateur Radio Club, K9S. 1400Z-2400Z **Sep 6**. Radio Day Exhibition. 28.450 21.340 14.250 7.250. QSL. Schaumburg Amateur Radio Club, PO Box 68251, Schaumburg, IL 60168-0251.

San Bernardino, CA: Citrus Belt Amateur Radio Club, N6A-N6M. 0000Z **Sep 6**-2400Z **Sep 14**. 4th Annual Route 66 On The Air. 28.466 21.266 14.166 7.266. Certificate. Citrus Belt Amateur Radio Club, PO Box 3788, San Bernardino, CA 92413. **www.qsl.net/w6jbt**.

Hutchinson, KS: Reno County Kansas Amateur Radio Association, WØC. 1600Z **Sep 11**-0100Z **Sep 12**. September 11th during the Kansas State Fair. 14.250 21.350 28.400. QSL. RCKARA, 1710 N Adams, Hutchinson, KS 67502.

Anderson, IN: Chief Anderson Amateur Radio Club, WA9EOC. 1300Z-2300Z **Sep 13**. White River Watchers Fall River Clean-up. 52.520 50.130 14.280 7.245. Certificate. Chief Anderson Amateur Radio Club, 1732 Lindberg Rd, Anderson, IN 46012.

Boulder, CO: Boulder Amateur Radio Club Youth Auxiliary, NØW. 1600Z-2200Z **Sep 13**. Ten years of Boulder's commitment to youth in Amateur Radio. 146.70 21.250 14.250 7.250. Certificate. Richard Weingarten, 1133 Northridge Dr, Erie, CO 80516.

Brooklyn, NY: Kings County Repeater Association, KC2RA. 1300Z-1900Z **Sep 13**. KCRA September 11th Memorial Station. 28.340 21.340 14.250. QSL. Kings County Repeater Association, PO Box 285, Brooklyn, NY 11228.

Hamersville, OH: USS *Jurassic*, K8SSJ. 1600Z-2000Z **Sep 13**. USS *Jurassic* 9th anniversary and Ohio 200th anniversary. 14.250 7.250. Certificate. Carolyn Donner N8ST, PO Box 158, Hamersville, OH 45130. **www.qsl.net/k8ssj**.

Jamestown, NC: Tri-County ARC, NC4AR. 1400Z-1800Z **Sep 13**. 87th Anniversary of Thomas Built Buses. 14.279 7.268. Certificate. NC4AR, PO Box 747, Trinity, NC 27370.

Vinita, OK: Northeast Oklahoma Radio Amateurs, K5F. 1400Z-2200Z **Sep 13**. Vinita Calf Fry Festival. 28.390 14.310 7.250 3.910. Certificate. Patrick Murphy, PO Box 234, 436 S Pine St, Big Cabin, OK 74332.

Cedar Rapids, IA: Collins Amateur Radio Clubs (Cedar Rapids, Dallas, & Melbourne), WØCXX, W5ROK, W4CRC. 0000Z **Sep 13**-2359Z **Sep 14**. 100 years of flight, 70 years of Collins, and Collins ARC 20th anniversary. 28.470 21.270 14.270 7.270. Certificate. Collins Amateur Radio Club, 10211 Hall Road, Cedar Rapids, IA 52411. **collinsclubs.com**.

Corona, CA: Corona Norco ARC, W6PWT. 0000Z **Sep 13**-2400Z **Sep 14**. Barney Oldfield Days. 28.450 21.350 14.250. QSL. Fred Roberts, W6TKV, 5464 Peacock Ln, Riverside, CA 92505.

Henri-Chapelle, Belgium: GDV Group/ON4GDV/Verviers, ON4USA. 0800Z **Sep 13**-1800Z **Sep 14**. Honoring the memory of all GIs

who gave their lives in WWII. 28.044 21.044 14.210 14.044. QSL. ON4GDV, Post Office Box 11, Verviers 1, Belgium B-4800. **www.qsl.net/on4usa**.

Burley, ID: Burley Amateur Radio Club, W7A. 1500Z **Sep 13**-1500Z **Sep 15**. Idaho Mini-Xpedition. 14.262. QSL. W7JQ c/o KJ7WN, PO 1277, Port Orchard, WA 98366.

Lolo Pass, ID: Hellgate Amateur Radio Club, W7PX. 1500Z **Sep 13**-0200Z **Sep 15**. 198th anniversary of Lewis and Clark Expedition on Lolo Pass. 28.365 21.365 14.265 7.265. QSL and Certificate. HARC, PO Box 3811, Missoula, MT 59806-3811. **www.riversdreams.com/k7vk**.

Atlantic City, NJ: Southern Counties Amateur Radio Association, K2BR. 1400Z **Sep 15**-0400Z **Sep 21**. Special Event Station during the Miss America Pageant. 28.325 21.325 14.250 7.250. QSL. SCARA, PO Box 121, Linwood, NJ 08221. **www.geocities.com/siliconvalley/vista/4638**.

Windsor, CT: ARRL/TAPR, W1AW/1. 1400-2000Z **Sep 19**-1400-2000Z **Sep 20**. Celebrating the ARRL/TAPR Digital Communications Conference. PSK31, PSK63, MFSK16, Hellschreiber and RTTY. QSL. ARRL, Attn: DCC, 225 Main St, Newington, CT 06111. **www.tapr.org/tapr/dcc/**.

Freedom Township, OH: Portage Amateur Radio Club, KB8UUZ. 1800Z **Sep 19**-0200Z **Sep 22**. National POW/MIA Awareness. 28.450 14.300 7.240. Certificate. Tom Parkinson, KB8UUZ, 9992 State Route 700, Mantua, OH 44255.

Eldon, MO: Lake of the Ozarks ARC, WØW. 1600Z-2200Z **Sep 20**. Annual Early Days Power and Tractor Show. 28.400 21.340 14.240 7.240. Certificate. John Baremore, KCØCRO, 182 Bear Paw Cir, Camdenton, MO 65020.

New Cumberland, WV: Triangle Amateur Radio Club, K8BLP. 1400Z-2000Z **Sep 20**. Hancock County Fair. 28.460 21.260 14.260 7.260. Certificate. TARC, PO Box 964, East Liverpool, OH 43920.

Pennsburg, PA: Pottstown Area Amateur Radio Club, W3H. 1400Z-2000Z **Sep 20**. 12th Annual East Coast Hobo Gathering, "Hoboes On The Air." Gen SSB 15, 20, 40 m. Certificate. PAARC, 1693 Farmington Ave, Pottstown, PA 19464-1345.

Slidell, LA: Ozone Amateur Radio Club, W5SLA. 1400Z-2300Z **Sep 20**. Celebrating 39 years of service and radio fun. 14.250 7.240. QSL. OARC, PO Box 553, Slidell, LA 70459.

Dover, OH: Tusco Amateur Radio Club, W8ZX. 1200-2400Z **Sep 20** and 1400-2100Z **Sep 21**. Zoar Community Association Civil War Encampment and Battle. 14.275 7.275 146.730 (PL 71.9). Certificate. Tim Ashcraft, WB8BTL, 502 Oakdale Dr, Dover, OH 44622. **www.noard.com/tuscoarc.htm**.

Hill City, SD: Crazy Horse Amateur Radio Club, NØDUX. 1600-2300Z **Sep 20**-1600-2300Z **Sep 21**. Hill City's annual 1880 Train Railroad Days Celebration. 146.850 29.000 14.280 7.280. QSL. CHARC, PO Box 371, Hill City, SD 57745. **www.1880train.com**.

Turlock, CA: Turlock Amateur Radio Club, W6BXN. 1500Z **Sep 20**-0300Z **Sep 21**. 75th anniversery of club's founding. 21.345 18.150 14.320 7.255 PSK 10 or 15 m. QSL. Turlock Amateur Radio Club, PO Box 2821, Turlock, CA 95381.

Belleville, MI: Yankee Air Museum, W8YAF. 1200Z-2000Z **Sep 21**. Yankee Air Force Founder's Day Open House. 7.270. Certificate. Frank A. Nagy, N8BIB, 24315 Waltz Rd, New Boston, MI 48164-9167.

Kingwood, WV: Preston County Amateur Radio Operators, W8B. 1400Z **Sep 25**-0200Z **Sep 28**. 62st Annual Buckwheat Festival. 10 20 40 m; PSK31 10 20 m. Certificate. Richard Wolfe, KA8UEU, PO Box 512, Kingwood, WV 26537.

Schaumburg, IL: Motorola Amateur Radio Club, K9MOT. 1400Z **Sep 26**-2359Z **Sep 27**. 75th anniversary of Motorola. 7.240. Certificate. Ed Picha, 21363 Pheasant Tl, Deer Park, IL 60010. **www.qsl.net/k9mot/75**.

St John's, Newfoundland, Canada: Society of Newfoundland Radio Amateurs, VO1SAR. 1200-2100Z **Sep 26** and **Sep 27**. 64th anniversary of the US Coast Guard and 25th anniversary of the Canadian Coast Guard Auxiliary, and International Search and Rescue Competition 2003. 28.400 21.375 14.275 7.275. QSL. Society of Newfoundland Radio Amateurs, Box 23099, St John's, NL, Canada A1B 4J9. **www.ccga-gcac.org/isar2003**.

Cincinnati, OH: United States Coast Guard Auxilliary-Div 5-8ER, W8E. 1300Z-2100Z **Sep 27**. To celebrate 64th USCG and 25th Canadian CG Auxiliary Anniversaries. 28.350 21.345 14.250 7.250. QSL. D.F. Stroup, 6095 Drumhill Ln, Milford, OH 45150.

Coram, NY: US Coast Guard Auxiliary, K2K. 1300Z-2400Z **Sep 27**. USCG Auxiliary 64th Anniversary. 28.400 21.300 14.240. QSL. Larry R. Cohen, K2KGB, 15 Canterbury Dr, Coram, NY 11727.

Danville, VA: Danville Amateur Radio Society and Lynchburg Amateur Radio Club, N4W. 1300Z-2300Z **Sep 27**. Commemorating the 100th anniversary of the wreck of the old 97 train. SSB 14.297 7.297 3.897; CW 14.097 7.097. QSL. Fred Fraley, W4DF, 213 Huntingwood Blvd, Lynchburg, VA 24503.

Fairmount, IN: Grant County Amateur Radio Club, W9EBN. 1500Z-2200Z **Sep 27**. James Dean Country Where Cool Was Born and Car Show. 146.79 28.430 14.243 7.244. Certificate. L. B. Nickerson, K9NQW, 517 N Hendricks Ave, Marion, IN 46952. **www.grantarc.com**.

Flower Branch, GA: US Coast Guard Auxiliary, W4A. 1300Z-2100Z **Sep 27**. USCG Auxiliary 64th and Canadian CG Auxiliary 25th Anniversaries. 146.550 FM 21.375 14.275 7.275. QSL. Albert Miles FSO-CM-26, 3325 Rangers Gate Dr, Marietta, GA 30062.

Noblesville, IN: Hamilton County ARES Club, N9I. 1300Z-2300Z **Sep 27**. Bison Stampede—56th Anniversary of Indiana Radio Club Council. 28.450 14.250 7.230 3.850. QSL. N9I, 19486 Diamond Way, Noblesville, IN 46060. **www.hcares.hamilton.in.us/bison**.

Philadelphia, PA: US Coast Guard Auxiliary District 5-NR, K3G. 1400Z-2200Z **Sep 27**. Commemorating USCG Aux 64th Anniversary. 28.330 21.330 14.270 7.270. QSL. Daniel F. Amoroso, 196 Dam View Dr, Media, PA 19063.

Raymond, ME: US Coast Guard Auxiliary D-1NR Radio Raymond, K1G. 1300Z-2100Z **Sep 27**. 64th USCG Auxiliary, 25th Canadian CG Auxiliary anniversaries and ISAR Special Event Radio Day (VO1RAC). 28.320 21.310 14.260 7.260. Certificate. Keith C. Morton, W1NDH, PO Box 809, Raymond, ME 04071-0809.

Ruskin (Tampa Bay Area), FL: USCG Aux Flotilla 7-7-5, N4C. 1300Z-2100Z **Sep 27**. United States Coast Guard Auxiliary 64th and Canadian Coast Guard Auxiliary 25th Anniversary. 28.340 21.320 14.240 7.230. QSL. Michael Glennon, KB4JHU, 1503 Highcrest Cr, Valrico, FL 33594.

St Thomas, USVI: US Coast Guard Auxiliary, N2A. 1200Z-1600Z **Sep 27**. 64th Anniversary of the US Coast Guard Auxiliary. 28.355 21.380 14.290. QSL. Deborah Thomas, PO Box 9280, St Thomas, VI 00801.

Midland, TX: Commemorative Air Force ARC, W5CAF. 0000Z **Sep 27**-2400Z **Sep 28**. 100 Years of Flight in conjunction with the CAF Airshow 2003. 21.360 14.260 7.260. QSL. MARC, PO Box 4401, Midland, TX 79704.

Milton, ON Canada: Mississauga Amateur Radio Club, VE3MIS. 1400Z **Sep 27**-2000Z **Sep 28**. Fall Festival of Leaves. 21.315 28.480 14.240 7.227. Certificate. MARC, c/o Michael Brickell, 2801 Bucklpost Crescent, Mississauga, ON, Canada L5N 1X6. Note: US postage is not usable in Canada.

Youngstown, OH: Mahoning Valley Amateur Radio Association, W8O. 1300Z **Sep 27**-2200Z **Sep 28**. Ohio Bicentennial/Oktoberfest. 28.450 21.350 14.250 7.250. QSL. Mahoning Valley ARA, PO Box 2950, Youngstown, OH 44511.

Whiskeytown, CA: Amateur Radio Club of Anderson, NC6I. 1600Z-2200Z **Sep 28**. 40th Anniversary of Dedication of Whiskeytown Dam. 14.250 14.230. Certificate. Gary Fryer for ARCA, 7034 Bohn Blvd, Anderson, CA 96007.

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.

Special Events Announcements: For items to be listed in this column, you must be an Amateur Radio club, and use the ARRL Special Events Listing Form. Copies of this form are available via Internet (**info@arrl.org**), or for an SASE (send to Special Requests, ARRL, 225 Main St, Newington, CT 06111, and write "Special Events Form" in the lower left-hand corner). You can also submit your special event information on-line at **www.arrl.org/contests/spevform.html**. Submissions must be received by ARRL HQ no later than the 1st of the second month preceding the publication date; that is, a special event listing for **Nov** *QST* would have to be received by **Sep 1**. Submissions may be mailed (Attn: Maty Weinberg), faxed (860-594-0259) or e-mailed (**events@arrl.org**) to ARRL HQ. QST

STRAYS

WAS can take a while...
John B. Egger, K3GHH, of Towson, Maryland, started his quest for the Worked All States Award like a hare, but ended it like a tortoise. John confirmed 48 states while he was a teenager from 1958-60, but wasn't able to secure the final two—Nevada and Hawaii—until 2001. "After a 25-year hiatus for college, family and career, I returned to radio in the late 1980s," he writes.

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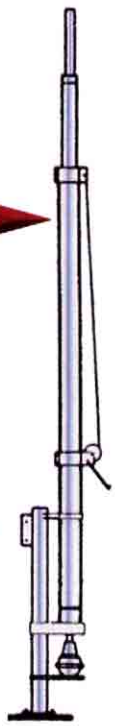

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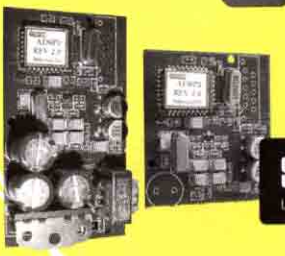

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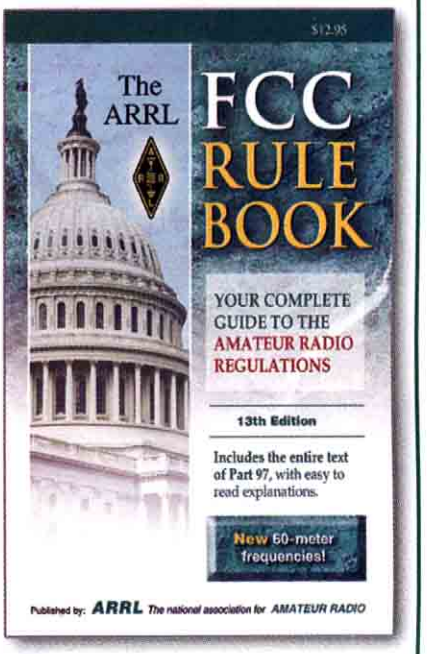

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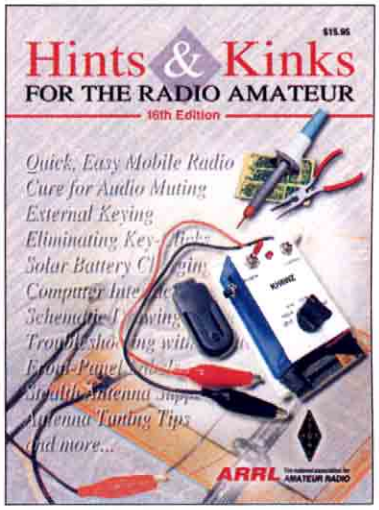

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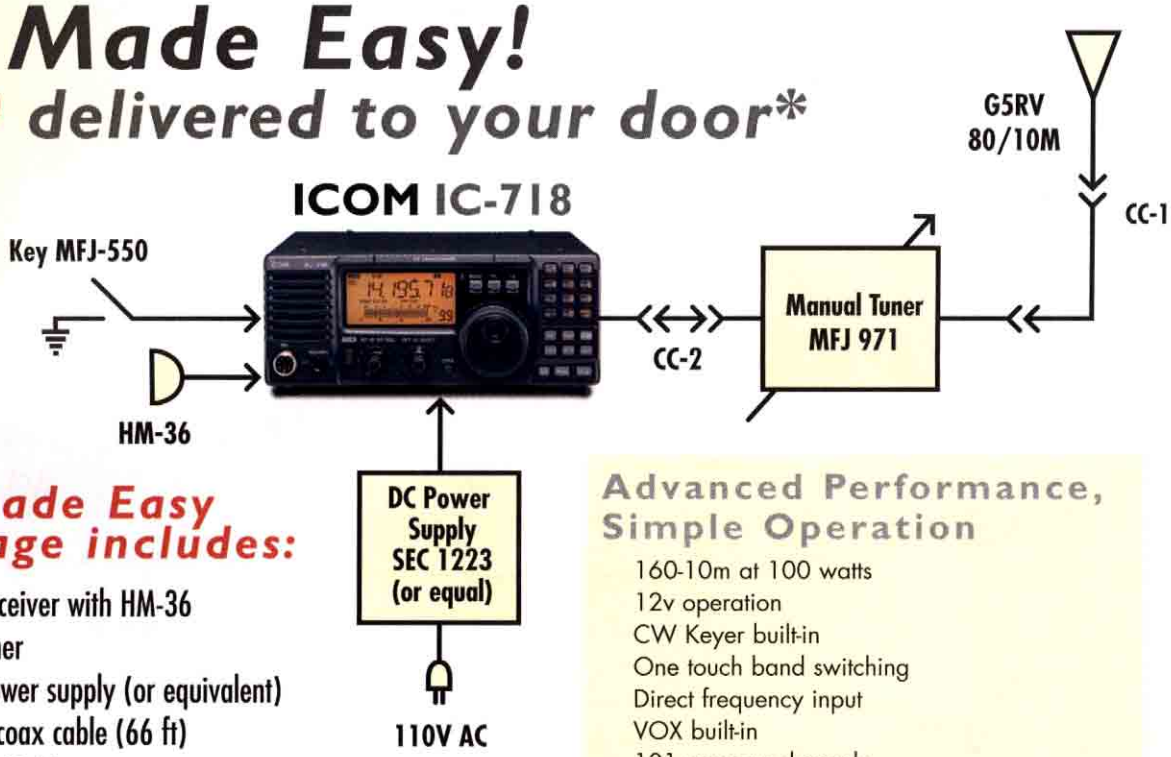

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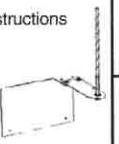

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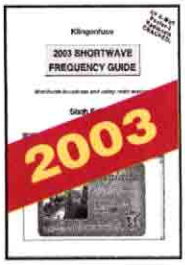

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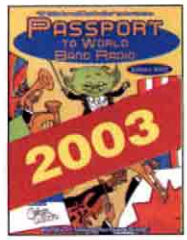

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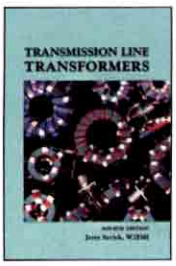

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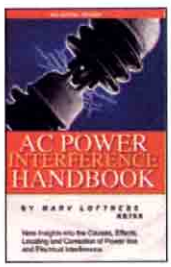

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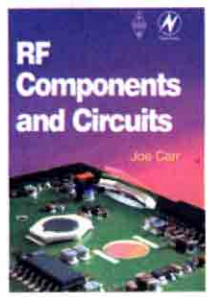

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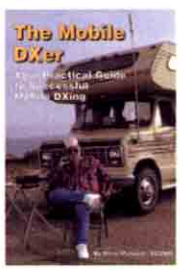

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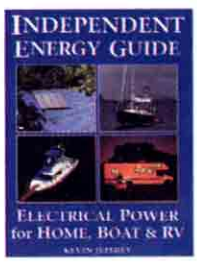

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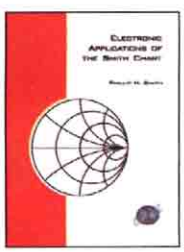

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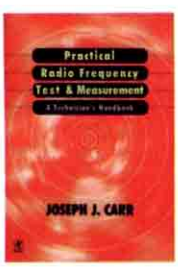

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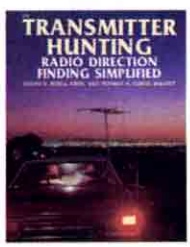

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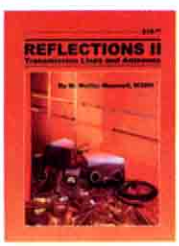

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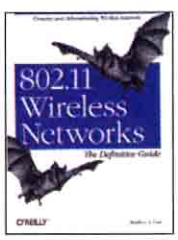

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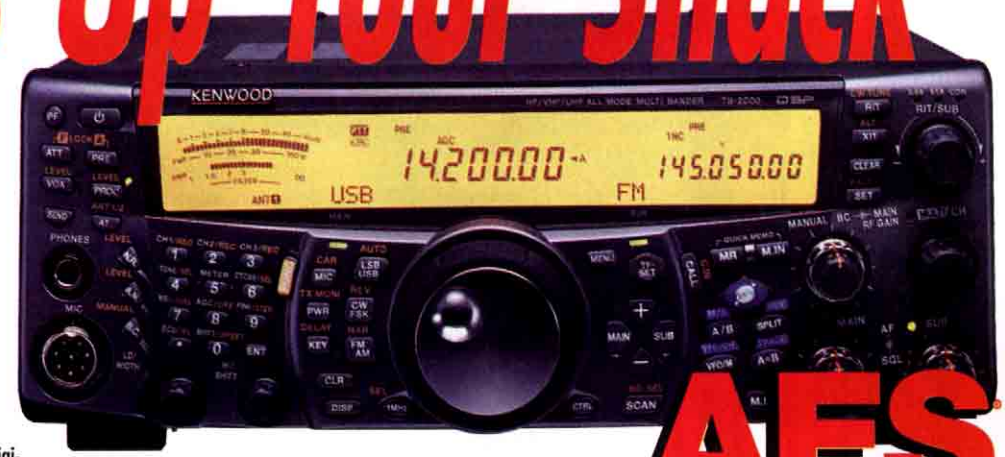

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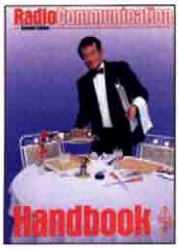

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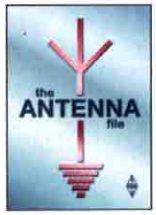

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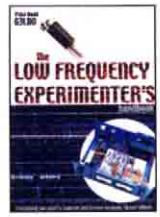

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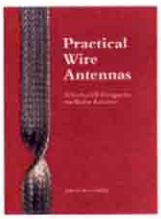

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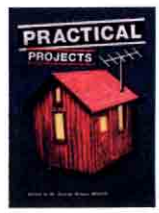

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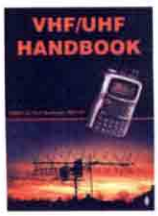

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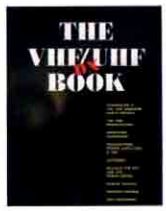

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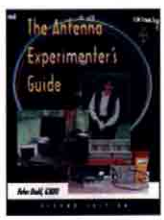

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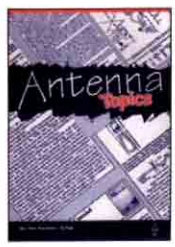

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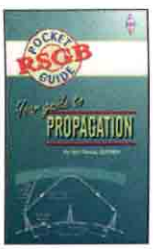

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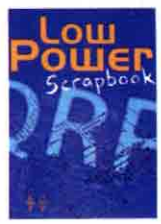

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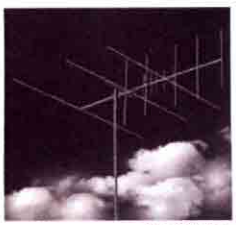
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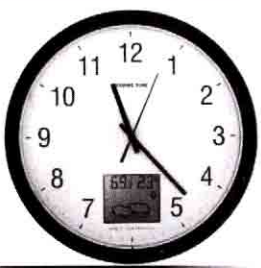

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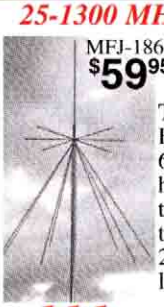

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415 to 470 MHz Range features

Just plug in your UHF antenna coax, set frequency and read SWR, return loss and reflection coefficient simultaneously. You can read coax cable loss in dB and match efficiency.

You can adjust UHF dipoles, verticals, yagis, quads and others and determine their SWR, resonant frequency and bandwidth.

You can test and tune stubs and coax lines. You can manually determine velocity factor and impedances of transmission lines.

You can adjust/test RF matching networks and RF amplifiers without applying power.

Has easy-to-read LCD *logarithmic* SWR bargraph and SWR meter for quick tuning.

Much Better Accuracy

New 12-bit A/D converter gives much better accuracy and resolution than common 8-bit A/D converters -- *an MFJ-269 exclusive!*

Super Easy-to-Use

Select a band and mode. Set frequency. Your measurements are instantly displayed! Smooth reduction drive tuning makes setting frequency easy.

Take it anywhere

Take it anywhere - to remote sites, up towers, in cramp places. Fully portable -- battery operated, compact 4Wx2Dx6¾ in., weighs 2 lbs. *Free* "N" to SO-239 adapter.

Has battery saver, low battery warning and built-in charging circuit for rechargeables.

Use 10 AA Ni-MH or Ni-Cad or alkaline batteries (not incl.) or 110VAC with MFJ-1315, $14.95.

MFJ SWR Analyzer Accessories

MFJ-39C, $24.95.

Tote your MFJ-269 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-39C 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 -- use your MFJ *SWR Analyzer™* without ever taking it out of your case. *Authentic MFJ leather logo distinguishes the real thing from imitators!*

MFJ-66, $19.95.

Plug these MFJ dip meter coupling coils into your MFJ *SWR Analyzer™* and turn it into a sensitive and accurate *band switched* dip meter. Set of two coils cover 1.8-170 MHz depending on your MFJ-269 *SWR Analyzer™*.

MFJ-99C, $34.95.

***SWR** Analyzer Power Pack.* 10 Pack MFJ *SuperCell™* Ni-MH batteries, and MFJ-1315 Power supply for MFJ-269 SWR analyzers. *Save $5!*

MFJ-98, $54.85.

***MFJ-269** Accessory Pack.* MFJ-39C *custom* Carrying Pouch, MFJ-66 dip coil adapters, MFJ-1315 power supply for MFJ-269. *Save $5!*

MFJ-98B, $77.85.

***MFJ-269** Deluxe Accessory Pack.* Complete accessory pack! MFJ-39C Pouch, 10 Ni-MH batteries, dip coils, power supply. *Save $7!*

Free MFJ Catalog

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http://www.mfjenterprises.com for instruction manuals, catalog, info

DXshack FG, J6, 3W, XU, XW TRX+kWAMP+Beam ANT & Bed. URL: // qth.com/dxshack email: xu2a@fsinet.or.jp

FOR SALE: 4/2/2 IN PROSPER, TX, 40 MILES NORTH OF DALLAS. 2500 sq ft Ranch style on 1 acre. 135' Rohn 55 with various HF antennas. Representing N8SM's widow, please contact Dick, AA5NT, at dick.hoff@Kodak.com or 972-672-5110

MAUI HAWAII - Vacation with a Ham. Since 1990. www.seaqmaui.com 1-808-572-7914 or kh6sq@arrl.net

Sun City, AZ: Attractive 2-bedroom, 2-bath home with family room, double garage and huge covered patio, 1347 sq. ft. All appliances included. Easy living retirement community, big yard, antennas welcome. $126,500. Taxes $587. N7RH@AZqth.com, Don Steele, Ken Meade Realty, 623-521-5254.

SUN FAMILY VACATION - Nature Island of Caribbean Dominica. Great DX J73HPL cottage, tower, HF ready to operate or your own Blue Ridge, VA , mountain top QTH. KK4WW, 540-763-2321, www.va-mountainland.com

TO BUY A HOME for that antenna tower in Palm Beach county, Florida, call me, **Mort Penn, K1MP, Realtor with Coldwell Banker**, 561-642-1900 or 561-308-6676

TURKS AND CAICOS: 3br/2 bath; pristine beach; XYL approved deluxe accommodations; rigs; amps; antennas. www.qth.com/vp5 270-259-4530; k4isv@k105.com **For rent or sale**

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ANTIQUE WIRELESS ASSOCIATION. The organization for all enthusiasts of antique and historical radio! Publishes OLD TIMER'S BULLETIN, covering vintage ham gear, keys, telegraphy, contests, broadcast receivers, vacuum tubes, historical, technical articles, restoration, and much more. AWA produces the famous annual Rochester, NY meet. Maintains world-famous historical radio-electronics communications museum. Membership only $20/year USA, $25 elsewhere. Antique Wireless Association, Box E, Dept. 1, Breesport, NY 14816. Check our Website: http://www.antiquewireless.org

BROADCAST MICROPHONES and accessories (call letter plates, stands) wanted: early carbon, condenser, ribbon, dynamic models. Cash or trade. James Steele, Box 610, Kingsland, GA 31548. 912-729-6106. jsteele@k-bay106.com; http://www.k-bay106.com/mics.htm

CLASSIC RADIOS — www.radiofinder.com finder@radiofinder.com

CODE PRACTICE OSCILLATOR MUSEUM: http://www.n4mw.com

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.

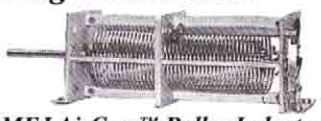
The rugged world famous MFJ-989C handles 3 KW PEP SSB amplifier input power (1500 Watts PEP SSB output power). Covers 1.8 to 30 MHz, including MARS and WARC bands.

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. 10¾x4½x10⅞ 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.

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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*

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MFJ . . . the world leader in ham radio accessories!

MFJ *Pocket size* Morse Code Reader™

Hold near your receiver -- it instantly displays CW in English!

Automatic Speed Tracking . . . Instant Replay . . . 32 Character LCD . . . High-Performance Modem . . . Computer Interface . . . Battery Saver . . .

Is your CW rusty? MFJ-461 **$79.95**

Relax and place this tiny pocket size MFJ Morse Code Reader near your receiver's speaker . . .

Then watch CW turn into solid text messages as they scroll across an easy-to-read LCD display.

No cables to hook-up, no computer, no interface, nothing else needed!

Use it as a backup in case you mis-copy a few characters - - it makes working high speed CW a breeze - - even if you're rusty.

Practice by copying along with the MFJ-461. It'll help you learn the code and increase your speed as you instantly see if you're right or wrong.

Eavesdrop on interesting Morse code QSOs from hams all over the world. It's a universal language that's understood the world over.

Automatic Speed Tracking

MFJ *AutoTrak*™ automatically locks on, tracks and displays CW speed up to 99 Words-Per-Minute.

Simply place your MFJ-461 close to your receiver speaker until the lock LED flashes in time with the CW.

Four Display Modes

1. Bottom line scrolls and fills with text, then that entire line is displayed on top line until bottom line refills -- makes reading text extra easy! Automatically displays speed in WPM.

2. Same as **1**, without speed display -- gives you maximum text display.

3. Top line scrolls, bottom line displays speed in Words-Per-Minute.

4. Both top and bottom lines scroll.

Two-line LCD display has 32 large 1/4 inch high-contrast characters.

MFJ Instant Replay

The last 140 characters can be instantly replayed. This lets you re-read or check your copy if you're copying along side the MFJ-461.

High Performance Modem

Consistently get solid copy from MFJ's high performance *PLL* (*phase-lock loop*) modem. Digs out weak signals. Even tracks slightly drifting signals.

Of course, nothing can clean up and copy a sloppy fist, especially weak signals with lots of QRM/QRN.

Computer Interface

The MFJ-461's serial port lets you display CW text full screen on a bright computer monitor -- just use your computer serial port and terminal program.

More Features

When it's too noisy for its microphone pickup, you can connect the MFJ-461 to your receiver with a cable.

Battery saving feature puts MFJ-461 to sleep during periods of inactivity. It wakes up and decodes when it hears CW.

Uses 9 Volt battery (not included).

True Pocket Size

Fits in your shirt pocket with room to spare - smaller than a pack of cigarettes. Tiny 2¼x3¼x1 in. 5½ ounces.

No Instruction Manual needed!

Super easy-to-use! Just turn it on -- it starts copying instantly!

Accessories

MFJ-26B, $4.95. Soft leather protective pouch. Clear plastic overlay for display, push button opening, strong, pocket/belt clip secures MFJ-461.

MFJ-5161, $14.95. MFJ-461 to computer serial port cable (DB-9).

MFJ-5162, $5.95. Receiver cable connects MFJ-461 to your radio's external speaker 3.5 mm jack.

MFJ *Pocket* Morse Tutor

Learn Morse code anywhere with this tiny *MFJ Pocket-sized Morse Code Tutor*™! Practice copying letters, numbers, prosigns, punctuations or any combination or words or QSOs. Follows ARRL/VEC format. Start at zero code speed and end up as a high speed *CW Pro!* LCD, built-in speaker.

MFJ-418 **$79.95**

MFJ Code Oscillator

MFJ-557 Deluxe Code Practice Oscillator has a Morse key and oscillator unit mounted together on a heavy steel base -- stays put on your table! Portable. 9-Volt battery or 110 VAC with MFJ-1312, $14.95. Earphone jack, tone and volume controls, speaker. Adjustable key. Sturdy. 8½x2¼x3¾ in.

MFJ-557 **$29.95**

MFJ *Pocket* CW Keyer

MFJ-403P **$69.95**

Built-in Iambic Paddle. Thumbwheel speed control. Adjustable weight. Adjustable sidetone with speaker. Iambic modes A or B. Fully automatic or semi-auto "bug" mode. Reversable paddle. Tune mode. RF-proof. Battery Saver. Tiny 2¼x3¼x1 in.

MFJ *miniature* Travel Iambic Paddle

MFJ-561, $19.95. 1¾Wx1¾Dx¾H in. *Formed* phosphorous bronze spring paddle, stainless steel base. 4 ft. cord, 3.5 mm plug.

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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.

MFJ *Speech Intelligibility* Enhancer

. . . makes barely understandable speech highly understandable!

MFJ-616
$169.95

"What did you say?" Can you hear but . . . just can't always understand everything people are saying?

As we get older, high frequency hearing loss reduces our ability to understand speech. Here's why . . .

Research shows that nearly *half* the speech intelligibility is contained in 1000 to 4000 Hz range, but contains a miniscule 4% of total speech energy.

On the other hand, the low frequencies, 125 to 500 Hz have most of the speech energy (55%) but contribute very little to intelligibility -- only 4%.

To dramatically improve your ability to understand speech, you must:

First, drastically increase the speech energy above 500 Hz, where 83% of the speech intelligibility is concentrated.

Second, drastically reduce speech energy below 500 Hz where only 4% of speech intelligibility lies.

The MFJ-616 splits the audio speech band into four overlapping octave ranges centered at 300, 600, 1200 and 2400 Hz. You can boost or cut each range by nearly 20 dB.

A balance control and separate 2½ Watt amplifiers let you equalize perceived loudness to each ear so both ears help.

By boosting high and cutting low frequencies and adjusting the balanced control, speech that you can barely understand become highly understandable!

Even if you *don't* have high frequency hearing loss, you'll dramatically improve your ability to understand speech. You'll get an edge in contesting and DXing and enjoy ragchewing more.

Here's what *QST* for April, 2001 said . . . *"I expected a subtle effect at best, but I was astonished . . . The result was remarkably clean, understandable speech without hissing, ringing or other strange effects . . . made a dramatic improvement . . ."*

Immuned to RFI. Has phone jack, on/off speaker switch, 2 inputs, bypass switch. 10Wx2½Hx6D". Needs 12 VDC.

MFJ-1316, $19.95. For 110 VAC operation. Provides 12 VDC/1.5 Amps.

MFJ-72, $58.80. *All-in-one MFJ-616 Accessory Pack.* Includes MFJ-392 headphones, two MFJ-281 speakers and MFJ-1316 power supply. ***Save $7!***

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 Contest Voice Keyer

Transformer-coupled -- No RFI, hum or feedback . . . 75 seconds total, 5-messages . . . Records received audio . . .

MFJ-434
$179.95

Let this *new* microprocessor controlled MFJ *Contest Voice Keyer*™ call CQ, send your call and do contest exchanges for you in your own natural voice!

Store frequently used phrases like "CQ Contest this is AA5MT", "You're 59" . . . "Qth is Mississippi" . . . Contest by pressing a few buttons and save your voice.

Record and play back five natural sounding messages in a total of 75 seconds. Uses *eeprom* -- no battery backup needed.

You can repeat messages continuously and vary the repeat delay from 3 to 500 seconds. Makes a great voice beacon and calling CQ is *so* easy.

You can also record and play back off-the-air signals -- great help if you didn't get it right the first time! No more "*Please repeat*".

A playing message can be halted by the *Stop Button*, your microphone's PTT/VOX, remote control or computer.

Has jack for remote or computer control (using CT, NA or other program). Lets you select, play and cancel messages.

Your mic's audio characteristics do not change when your MFJ-434 is installed.

All audio lines are RF filtered to eliminate RFI, audio feedback and distortion. An audio isolation transformer totally eliminates hum and distortion caused by ground loops.

It's easy to use -- just plug in your 8 pin mic and plug the MFJ-434 cable into your transceiver. Internal jumpers let you set it to your rig. Use your mic or its built-in mic for recording.

Built-in speaker-amplifier. Speaker/phone jack. Use 9 Volt battery, 9-15 VDC or 110 VAC with optional MFJ-1312D, $14.95. 6½Wx2½Hx6½D in.

MFJ-73, $29.95. MFJ-434 Remote Control with cable.

60 dB Null *wipes out* noise and interference

MFJ-1026
$179.95

Wipe out noise and interference *before* it gets into your receiver with a 60 dB null!

Eliminate all types of noise -- severe power line noise from arcing transformers and insulators, fluorescent lamps, light dimmers, touch controlled lamps, computers, TV birdies, lightning crashes from distant thunderstorms, electric drills, motors, industrial processes . . .

It's *more effective* than a noise blanker! Interference much stronger than your desired signal can be completely removed without affecting your signal.

It works on *all modes* -- SSB, AM, CW, FM -- and frequences from BCB to lower VHF.

You can null out strong QRM on top of weak rare DX and then work him! You can null out a strong local ham or AM broadcast station to prevent your receiver from overloading.

Use the MFJ-1026 as an *adjustable phasing network.* You can combine two antennas to give you various directional patterns. Null out a strong interfering signal or peak a weak signal at a push of a button.

Easy-to-use! Plugs between transmitting antenna and transceiver. To null, adjust amplitude and phase controls for minimum S-meter reading or lowest noise. To peak, push reverse button. Use built-in active antenna or an external one. MFJ's exclusive *Constant Amplitude Phase Control*™ makes nulling easy.

RF sense T/R switch automatically bypasses your transceiver when you transmit. Adjustable delay time. Uses 12 VDC or 110 VAC with MFJ-1312D, $14.95. 6½x1½x6¼ in.

MFJ-1025, $159.95. Like MFJ-1026 less built-in active antenna, use external noise antenna.

MFJ *tunable* Super DSP filter

MFJ-784B
$249.95

Only MFJ gives you *tunable* and *programmable* "brick wall" DSP filters.

You can continuously *tune* low pass, high pass, notch and bandpass filters and continuously *vary* bandwidth to pinpoint and eliminate interference.

Only MFJ gives you 5 factory pre-set and 10 programmable pre-set filters you can customize. **Automatic** notch filter searches for and eliminates multiple heterodynes. Advanced adaptive noise reduction silences background noise and QRM.

Free MFJ Catalog
Visit: http://www.mfjenterprises.com or call toll-free 800-647-1800

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FAX:(662)323-6551 8-4:30 CST, Mon.-Fri. ***Add shipping.***

http://www.mfjenterprises.com for instruction manuals, catalog, info

JOBS

TECH TALK

IC-2720H - Expanding Your FM Mobile Horizons

Want to add new-found fun and excitement in your mobile pursuits? Check out Icom's new IC-2720H Dual Band FM mobile transceiver. It's loaded with today's hottest features, a joy to operate, and it will do crossband repeat. This unique transceiver is comprised of a small main unit, a remote-mount control head and an 11 foot interconnecting cable. It installs in a snap and produces a custom "built-in look" everyone will envy.

ROAD FRIENDLY, SURVIVAL READY! The IC-2720H features full duplex 2M/70CM operation, plus it simultaneously receives signals - the right side is a wide band receiver covering 118-174, 375-550, & 810-999.990 MHz, while the left side covers the ham bands between 118-550 MHz. Each band has its own tuning, squelch and volume controls for easy operation, and all operating parameters are directly accessible from the supplied multifunction mic. This transceiver has it all!

IC-2720H

The IC-2720H delivers 50 watts output/2M, 35 watts/70CM and lower power selections of 15 and 5 watts per band. Additionally, it has 212 memories, 10 banks that can store up to 200 mix-and-match memories each, as desired. For weather watchers, the IC-2720H is preprogrammed with NOAA weather channels, and has a weather alert system that sounds an alarm when receiving a NOAA weather alert or bulletin.

Particularly attractive is the IC-2720H's inclusion of both CTCSS and DTCS encoders and decoders. Plus there's a tone-scan system that determines a repeater's required access tone and automatically loads it in CTCSS or DTCS memory. Either decoder can also be used to silently monitor a continuously-busy repeater and respond with alert beeps when receiving a specific tone or code. Further, the CTCSS decoding system is directly compatible with CTCSS encoders in all makes and models of FM transceivers (although other stations may wish they too had an IC-2720H for silent monitoring)!

CROSSBAND REPEAT TOO! Like high tech fun? The IC-2720H is capable of crossband repeat operation; It's like having a 50 watt rig right in your hand! Avoid unauthorized operation by activating either the CTCSS or DTCS for "Closed Repeater" operation. For information about acceptable crossband repeat operation, contact Icom's literature request hotline at 425-450-6088 and ask for our crossband repeat brochure. This document is downloadable from the web.

Ready to open new dimensions in FM mobile enjoyment and stay survival ready for emergencies too? Icom's new IC-2720H is the key. Check it out at your favorite dealer today!

THE ICOM ADVANTAGE

Visit your authorized Icom dealer today to see our full product lineup!

Why not? You deserve it!
www.icomamerica.com

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October Issue	Deadline: August 19, 2003	Ships Mid September 2003
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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

TIMES MICROWAVE LMR® COAX

LMR-400	$.59/ft
LMR-400 Ultraflex	$.89/ft
LMR-600	$1.19/ft
LMR600 Ultraflex	$1.95/ft

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

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.

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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

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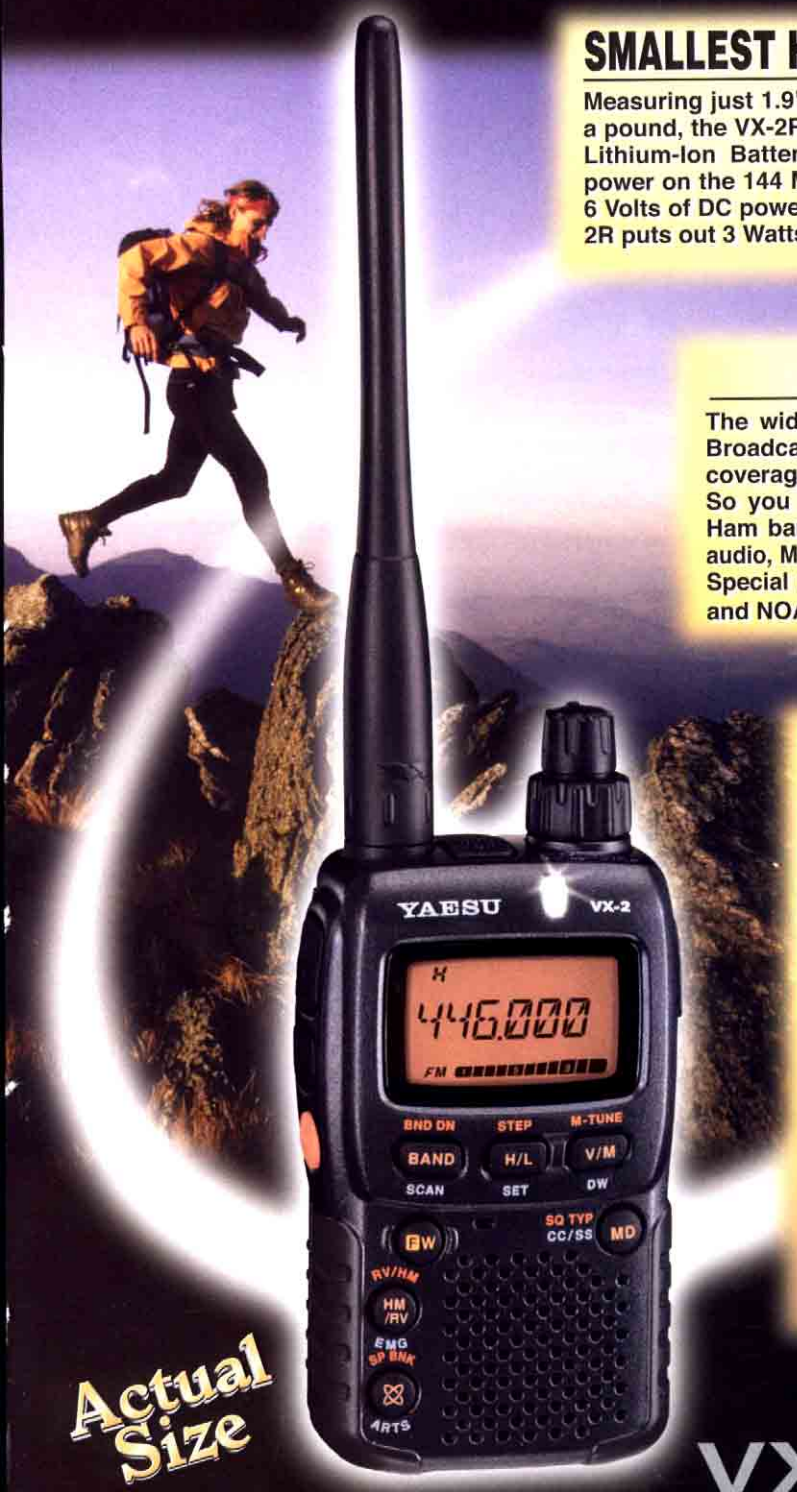
*1.5 W/144 MHz, 1 W/430 MHz



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*Simulated LCD.

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