Official Journal of
ARRL
The national association
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QST

devoted entirely to
AMATEUR RADIO

January 2004

QST reviews

Ten-Tec Orion Model 565
HF transceiver

SGC ADSP[2]
Add-on Audio DSP

A low power ac wattmeter

Build a *wireless* wireless key

Annual Vintage Radio Issue

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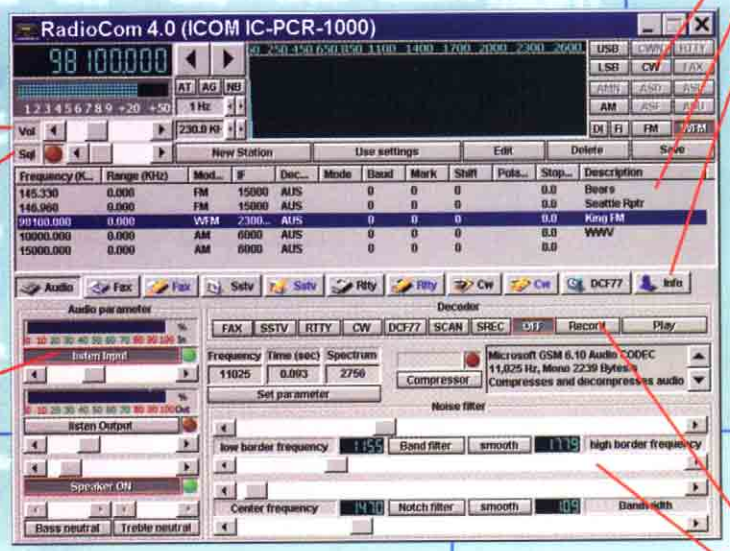
IC-PCR1000

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

Now with Bonito Software!



- 100 kHz – 1.3 GHz†
- AM, FM, WFM, USB, LSB, CW
- Unlimited Memory Channels
- Real Time Band Scope
- IF Shift
- Noise Blanker
- Digital AFC
- Voice Scan Control
- Attenuator
- Tunable Bandpass Filters
- AGC Function
- S Meter Squelch
- CTCSS Tone Squelch
- Computer Controlled DSP

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

Basic Radio Control functions with spectrum scope

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

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

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

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

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

See your authorized Icom dealer for more details.

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Get $15 off an ARRL Membership.
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Download at www.icomamerica.com. Click Receivers>IC-PCR1000>IC-PCR1000 software (updated)

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ICOM

Go QRP with the '703!

Get out and win that contest! Especially with the bands down, see how QRP and the low floor noise of the great outdoors can combine to bring you out on top! Visit your authorized Icom dealer and go QRP with the '703!

- **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, pull out the weak signals! Automatic Notch and Noise Reduction is included.
- **Smart Power Mode.** The '703 knows when to throttle back the current to prolong battery life.
- **Low Current Consumption.** With current drain as low as 300mA on 9.6VDC, this QRP rig rivals some handheld radios. The '703 is designed for maximum efficiency!
- **CW Memory Keyer.** Contest QRP is sweet with the internal CW Memory Keyer. Three memories capable of holding 50 characters each. Variable pitch control (300-900Hz) with a bug, paddle, or straight key.
- **Big Ears.** Sensitivity of 0.16μVat 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!
- **Optional Backpack.** A must have accessory! With room for batteries and other gear! *See below.*
- **No Assembly Required.** The '703 is ready to go when you are!

ACCESSORIES

LC-156 Backpack

Designed by hams, for hams! Take your hobby with you into the great outdoors. The LC-156 offers plenty of room to store and protect your '703, batteries, antenna, and other gear! (So cool, even '706 owners want one!)

Controller Case

Great for portable use, the handy controller case can be easily removed from the backpack and attached to your belt.

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hy-gain Rotators

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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

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AR-40

$289.95

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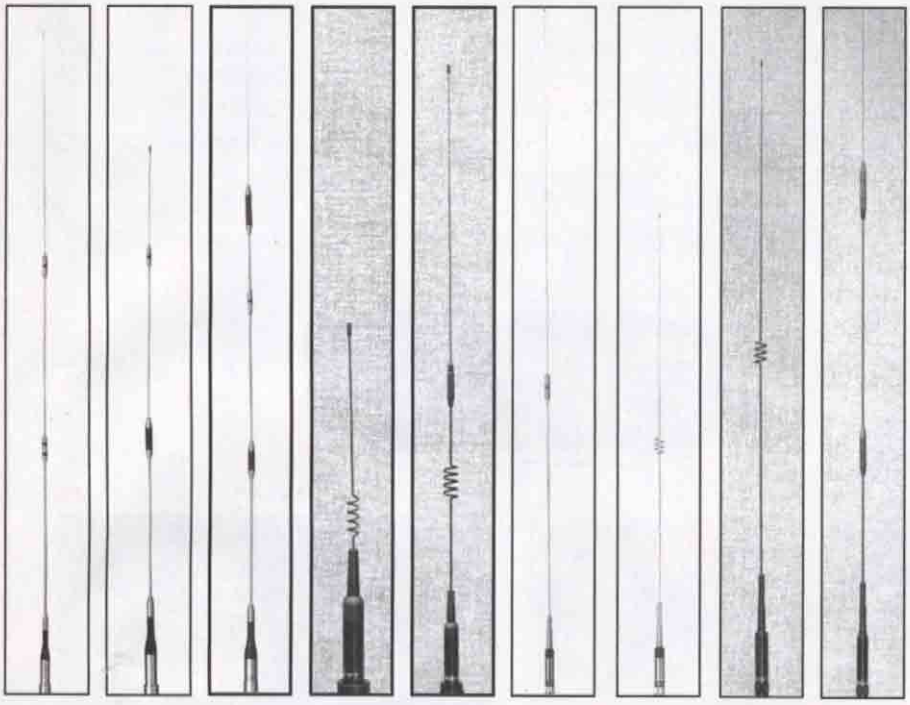

SG2000HD · SG7500A SG7500NMO · SG7900A · NR72BNMO · NR73BNMO · NR2C · NR770HA NR770HB · NR770HNMO NR770HBNMO · CR627B CR627BNMO

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
NR770HA7	2m/70cm	200	UHF	40.2	1/2λ, 2-5/8λ
NR770HNMO8	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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Departments

Our Cover
Brian Wood, WØDZ, hard at work on his dream restoration project—a Heathkit DX-100 transmitter. You can follow his progress in the article that begins on page 28. Other items with a vintage theme are sprinkled throughout this issue. Photo by Jinny Wood.

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Length: 17" • Conn: BNC
Super flexible featherweight whip

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Wave: 2M 1/4 wave • 70cm 9/8 wave • Length: 21" • Conn: PL-259 • Max Power: 60W

Maldol **NEW AX-75** • Dual-band 2M/70cm w/fold-over
Wave: 2M 1/2 wave center load • 70cm 5/8 wave x 2 • Length: 30" • Conn: PL-259 • Max Power: 60W

Maldol **NEW AX-95** • Dual-band 2M/70cm w/fold-over
Wave: 2M 1/2 wave center load • 70cm 5/8 wave x 2 • Length: 38" • Conn: PL-259 • Max Power: 60W

COMET **B-10/B-10NMO** • Dual-band 146/445MHz cellular look-a-like
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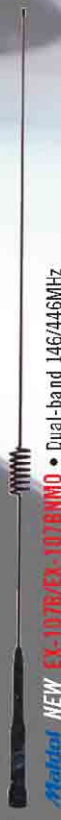
COMET **SBB-2/SBB-2NMO** • Dual-band 146/446MHz
Wave: 146MHz 1/4 wave, 446MHz 5/8 wave center load • VSWR: 1.5:1 or less • Length: 18" • Conn: PL-259 or NMO Style • Max Pwr: 60W



Maldol **NEW EX-107B/EX-107BNMO** • Dual-band 146/446MHz
Wave: 146MNHz 1/2 wave, 446MHz 5/8 wave x 2 • VSWR: 1.5:1 or less • Length: 29"
• Conn: PL-259 or NMO Style • Max Pwr: 100W

COMET **SBB-5/SBB-5NMO** • Dual-band 146/446MHz w/fold-over
Wave: 146MHz 1/2 wave • 446MHz 5/8 wave x 2 • Length: 39" • Conn: SBB-5 PL-259/SBB-5NMO NMO • Max Pwr: 120W

COMET **SBB-7/SBB-7NMO** • Dual-band 146/446MHz w/fold-over
Wave: 146MHz 6/8 wave • 446MHz 5/8 wave x 3 • Length: 58" • Conn: SBB-7 PL-259/SBB-7NMO NMO • Max Pwr: 70W

COMET **NEW C757/C757NMO** Challenger Series • Dual-band 146/446MHz w/fold-over
Wave: 146MHz 1/2 wave, 446MHz 5/8 wave x 2 • VSWR: 1.5:1 or less
• Length: 38" • Conn: PL-259 or NMO Style • Max Pwr: 80W

COMET **NEW CP-5M/5NMO/3/8-24**
Universal mount and coax cable combos.
(SO-239, NMO, 3/8-24/PL-259) Heavy-duty, adjustable RS-730 trunk/van/ SUV/truck door mount and deluxe cable assembly. 16' 6" length w/18" mini RG-188A/U type coax. Max antenna 70". 3 different models.

COMET **NEW C767/C767NMO** Challenger Series • Dual-band 146/446MHz w/fold-over
Wave: 146MHz 1/2 wave center load, 446MHz 5/8 wave x 2 center load • VSWR: 1.5:1 or less
• Length: 40" • Conn: PL-259 or NMO Style • Max Pwr: 80W

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Bring Ham Radio along on your next hiking, camping, or business trip with Yaesu's amazing new FT-817 Multimode HF/ VHF/ UHF Portable Transceiver!

●Ultra Compact: 5.3" x 1.5" x 6.5" WHD (135 x 38 x 165 mm) ●Multimode Design: SSB, CW, AM, FM, FM-Wide(RX), Packet, Digital ●Power Output: 5 Watts (selection of 0.5/1.0/2.5/5 W) ●Wide choice of power sources: AA Battery Holder included; optional FNB-72 Ni-Cd Battery Pack (9.6 V, 1000 mAh); external DC cable included for 13.8 V operation ●Two Antenna Ports: BNC on front panel,UHF (Type "M") on rear panel ●Built-in CW Electronic Keyer ●Built-in CTCSS and DCS Encoder/Decoder circuits ●208 Memory Channels ●Dual-Color Liquid Crystal Display ●Spectrum Scope

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FT-817

HF/50/144/430 MHz Multimode Transceiver

ATAS MICRO ATAS-25 Manually-Tuned Portable Antenna

ATAS-25

The ATAS-25 is a manually-adjusted portable antenna ideal for field use with the FT-817. Designed for mounting on a standard camera tripod (1/4" stud), the ATAS-25 is tuned by sliding the shorting ring of the loading coil up or down and selecting the appropriate number of top sections. Counterpoise wires are supplied.

The ATAS-25 is constructed of high-grade materials for maximum efficiency, and it's the perfect traveling companion for your FT-817!

Freq. Range:	Amateur Bands 7-450 MHz.
Max. Power:	HF/50 MHz: 100 W SSB/CW (50% Duty, 1 min. TX/RX)
	AM/FM: 50 W
	144/430 MHz: 50 W
Size:	Max. Length 7'3" (2.2 m)
	Min. Length for Carrying: 2' (0.6 m)
Weight:	2.1 lb. (930 g)

*Coaxial Cable and Tripod not supplied.

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LDG Autotuners will match your antenna with an SWR up to 10:1 down to 1.5:1 or less!

- Gone are the days of endlessly spinning knobs on a manual tuner
- Switched L network gives you the most efficient power transfer to your antenna
- All tuners are microprocessor controlled and operate on +12VDC
- Interfaces available for many popular radios but are not required for operation

AT-1000 Hi Power Autotuner

- Up to 1000 watts SSB, 750 watts CW, 500 watts Digital
- Coverage to 54 MHz
- Analog Power/SWR meter

$599

RC-1000 Remote Control

- Remote Control Head for the AT-1000
- Controls Power Bypass, Tune, and Fine Tuning
- Includes ten foot interface cable

$99

NEW!

AT-897 Autotuner

- Bolts on Yaesu FT-897
- Coverage to 54 MHz
- Powered from CAT Port
- Latching relays, no fan

$199

AT-11MP Desktop Autotuner

- 5 to 150 watt power range
- Coverage to 30 MHz
- Analog Power/SWR meter
- Tuning time 0.1 to 5 seconds, 3 seconds average

$239

Z-11 QRP Autotuner

- 0.1 to 60 watts peak
- Coverage to 30 MHz
- Latching relays
- Auto sleep mode
- 1.5 sec tuning (avg.)

$179

Z-100 Low Cost Autotuner

- 0.1 to 125 watts
- Coverage to 54 MHz
- Latching relays
- LED status and SWR indicators
- 200 fast memories

$149

NEW!

RT-11 Remote Autotuner

- 0.1 to 125 watts peak
- Coverage to 54 MHz
- Water resistant case
- Optional Remote Head **RT-11 RH**
- Perfect for remote installation

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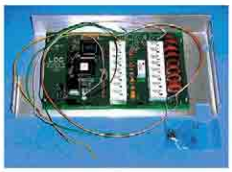

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ARRL is an incorporated association without capital stock chartered under the laws of the State of Connecticut, and is an exempt organization under Section 501(c)(3) of the Internal Revenue Code of 1986. Its affairs are governed by a Board of Directors, whose voting members are elected every three years by the general membership. The officers are elected or appointed by the directors. The League is noncommercial, and no one who could gain financially from the shaping of its affairs is eligible for membership on its Board.

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

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

Membership inquiries and general correspondence should be addressed to the administrative headquarters; see pages 14 and 15 for detailed contact information.

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"IT SEEMS TO US..."

Nine Decades

This year we celebrate the 90th anniversary of the founding of the ARRL. Few other membership associations have survived for so long with their founders' vision still intact. That the ARRL has done so is testimony to the quality of that original vision as well as to the dedication of subsequent generations of members.

To say that we have remained true to the vision of our founders is not to say that nothing has changed in nine decades. Hiram Percy Maxim and Clarence Tuska would marvel at what radio amateurs have built upon the foundation they laid in 1914. The original impetus for the formation of a "radio relay league" was the difficulty that Mr. Maxim encountered in sending a message from Hartford to Springfield, a radio path we now traverse without a second thought. From those beginnings, amateurs have gone on to conquer countless obstacles and continue to do so with a regularity that would gratify "The Old Man."

Every one of those nine decades has seen its share of challenges and accomplishments.

The world went to war when the fledgling organization was just a few months old. In 1917 the United States entered the fray, amateurs were silenced (and enlisted in droves), and the ARRL suspended operations until early 1919. At that time *QST*, until then a private venture of Mr. Tuska's, was purchased using bonds sold to ARRL members who had no guarantee of ever being allowed back on the air. The rise of broadcast listening in the early 1920s led to interference problems that to some spelled "the end of Amateur Radio as we know it." The League celebrated its 10th anniversary with the discovery that if they picked the right "wavelength," amateurs could communicate worldwide.

The second decade, 1924-34, was surely a Golden Age for Amateur Radio. Using vacuum tubes "borrowed" from the family broadcast receiver, amateurs could and did build globe-girdling transmitters that brought the achievement of "Worked All Continents" within anyone's grasp. But the amateurs' discovery of the "short waves" came at a price. While Amateur Radio enjoyed the support of the U.S. government, commercial and government interests elsewhere pressed for dramatic reductions in our bands. New Year's Day 1929 saw the narrowing of the 160, 40 and 20 meter bands, forcing the ARRL to emphasize stability and selectivity in equipment designs.

Our third decade began in the depths of the Depression and ended in the throes of World War II. Amateur stations again went silent, but amateurs themselves put their skills and knowledge into service to their country. Thanks to the value of their contribution, this time there was no doubt that amateurs would be allowed back on the air as soon as possible after the war was won.

The ARRL remained in operation throughout World War II and provided important support to the war effort. Key *QST* advertisers such as Al Kahn, K4FW, then of Electro-Voice and still active today at age 97, helped keep the magazine in circulation and the organization afloat. Thanks, Al! The postwar flood of surplus equipment fueled a boom in operating activity, including VHF and microwave experimentation based on wartime advances in technology. A license restructuring controversy gave birth to the Novice and Technician licenses in 1951, at a time when television interference (TVI) was becoming the latest "end of Amateur Radio as we know it."

Decade #5, 1954-64, saw amateurs claim their rightful place in the Space Age with the first moonbounce contact in 1960 and launch of the first OSCAR in 1961. Amateur Radio boomed thanks to the Novice license, and VHF became popular thanks to the Technician license. Crowding in the HF phone bands accelerated the shift from AM to SSB. The ARRL's 50th anniversary was a gala affair, with a National Convention featuring a Presidential candidate (Senator Barry Goldwater, K7UGA) and a postage stamp honoring Amateur Radio.

Another license restructuring controversy came to a head in 1967 with the FCC's resumption of "incentive licensing" to encourage amateurs to upgrade their skills. Around the same time, ARRL instituted Life Membership and introduced Five Band DXCC to encourage amateurs to explore the DX potential of the 80 and 40 meter bands. AMSAT-OSCAR 6 ushered in the era of "permanent" amateur satellites in 1972, ultimately lasting $4^1/_2$ years. VHF operation shifted from AM to FM on a massive scale, with repeaters popping up like mushrooms and autopatches presaging cellular telephones.

In 1974, ARRL began a concerted worldwide effort to protect and expand amateur frequency allocations at an upcoming World Administrative Radio Conference. New bands at 10, 18 and 24 MHz and new amateur-satellite bands were among our WARC-79 achievements. Owen Garriott, W5LFL, became the first amateur to operate from space in 1983. Decade #7 ended with amateurs administering FCC examinations and embracing digital radio technology via packet radio and AMTOR.

Decades #8 and #9 are too recent to be considered history (and besides, we're running out of room) but it's worth noting that the FCC made a codeless amateur license available in 1991 and dropped the code speed for an HF license to 5 words per minute in 2000. It also bears mention that during this time ARRL members embraced the Internet and the World Wide Web not as a replacement for radio, but as tools to expand its use and enjoyment.

What does the last decade before ARRL's Centennial Year, 2014, hold in store? Will Broadband Over Power Lines be "the end of Amateur Radio as we know it" or a bit of forgotten technological trivia? Will digital voice revolutionize the ham bands the way SSB reshaped HF in the '60s and the way FM reshaped VHF in the '70s? Will software defined radios give us powerful new tools to "farm" the radio spectrum? The answers to these and countless other questions will be found right here—in the pages of future issues of *QST!*

—David Sumner, K1ZZ

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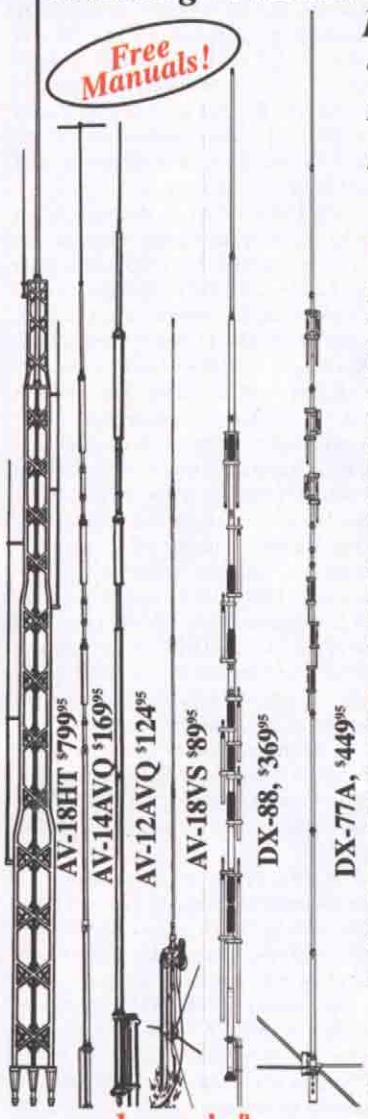

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AV-14AVQ	**$169.95**	**10,15,20,40**	**1500 W PEP**	**18 feet**	**9 pounds**	**80 MPH**	**1.5-1.625"**
AV-12AVQ	$134.95	10/15/20 M	1500 W PEP	13 feet	9 pounds	80 MPH	1.5-1.625"
AV-18VS	**$89.95**	**10 - 80 M**	**1500 W PEP**	**18 feet**	**4 pounds**	**80 MPH**	**1.5-1.625"**
DX-88	$369.95	10 - 40 M	1500 W PEP	25 feet	18 pounds	75 mph no guy	1.5-1.625"
DX-77A	**$449.95**	**10 - 80 M**	**1500 W PEP**	**29 feet**	**25 pounds**	**60 mph no guy**	**1.5-1.625"**

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ARRL in ACTION

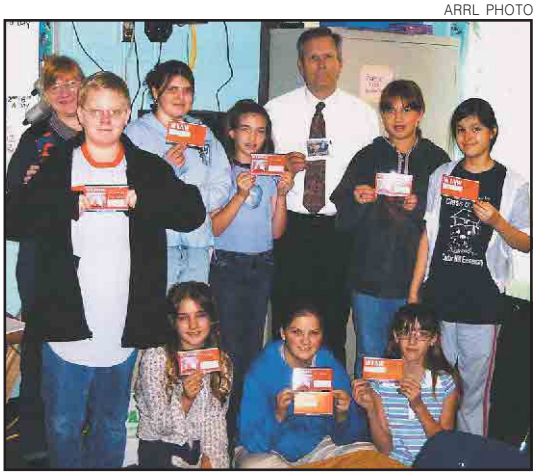
***YOUR* membership at work**

By Dave Hassler, K7CCC, dhassler@arrl.org

"Big Project" Touches All Areas of Curriculum in Georgia

ARRL Education and Technology Program Coordinator Mark Spencer, WA8SME, got to see it up close: the full integration of the Big Project curriculum into a middle school classroom. During a trip to the Georgia Section Convention November 1 and 2, Spencer stopped into the classroom of Sharon Carter, a teacher at J. E. Richards Middle School in Lawrence, to hand-deliver a stack of QSL cards from a recent contact he had had with Carter's students from W1AW.

ARRL PHOTO



Sharon Carter's middle school class at J. E. Richards Middle School in Lawrence, Georgia show off the W1AW QSL cards hand-delivered to them by ARRL Education and Technology Program Coordinator Mark Spencer, WA8SME, who was in area to attend the ARRL Georgia Section Convention.

"Mrs Carter is using Amateur Radio to very good effect," Spencer said. "Her focus is not on ham radio alone, but as an enriching ancillary that ties her whole curriculum together." He said that the class was very interested in science, and asked some surprisingly advanced questions about radio, lasers and other topics. Spencer demonstrated the new Mars Lander Robot kit project (see "ARRL in Action," Nov 2003, p 13) and showed off his new solderless code practice oscillator project (plans for which can be found on the Web at **www.arrl.org/news/features/2003/10/30/1/**). The children were ecstatic about both, but the CPO brought questions from the kids that led to Spencer donning his old teacher's hat and giving a short lesson in Morse code. "I taught them six similar letters: A, N, R, K, E and T. In less than 20 minutes, the kids were all sending and receiving simple words made of those letters," he said. "They ate it up. We would have done more, but the bell rang for classes to change."

That kind of enthusiasm doesn't happen in a vacuum. Carter gets a lot of support from the Alford Memorial Radio Club of Stone Mountain, her husband William, KG4FXG, who is often in the classroom, and an encouraging school administration. Add to that the curriculum, equipment and networking resources afforded schools that are part of the Big Project, and you have a recipe for success. If you, or your radio club, would like to get involved with a Big Project school, contact Spencer by telephone at 860-594-0396, or by e-mail at **wa8sme@arrl.org**.

Hare Takes BPL Presentation on the Road

In *The Art of War*, Sun Tzu wrote, "Know thy enemy, know thyself; in a thousand battles, a thousand victories." To that end, ARRL Lab Manager Ed Hare, W1RFI, took a presentation on the road to clubs and gatherings in October and November, outlining the facts about broadband Internet delivery over commercial power lines (BPL). "The presentation is aimed at the average ham, describing the technology that makes BPL possible and how it gets from the provider to the end user, the problems associated with the technology and delivery systems, and a 7-minute video of a field test ARRL conducted in a BPL test area," Hare explained.

ARRL PHOTO

ARRL's resident expert on BPL, Laboratory Manager Ed Hare, W1RFI, was recently selected to serve as chair of an IEEE C63 subcommittee on RFI immunity.

The presentations were made to clubs in Newington and Brookfield, Connecticut and in Worcester and Holyoke, Massachusetts. He also addressed the Hudson Division's annual awards dinner November 8. On October 27, Hare addressed the Southern New England chapter Society of Broadcast Engineers convention near Boston with a more technical lecture. Hare also attended the October meeting of the IEEE C63 Accredited Standards Committee on Electromagnetic Compatibility and was elected to serve as chairman of C63's subcommittee on RFI immunity. "I'm happy to serve on this committee as its chair and glad that Amateur Radio gets to be a part of the process," he said.

Northern New Jersey SM Spearheads State EmComm Conference

Seeing an opportunity and doing something about it. Northern New Jersey Section Manager Bill Hudzik, W2UDT, embodied that philosophy when he advanced the concept of a statewide emergency communications and disaster preparedness workshop November 18 in Atlantic City that highlighted the role Amateur Radio can play in volunteer support communications.

Hudzik is the Assistant Coordinator at the Office of Emergency Management in Long Hill. He sent his idea for a ham-oriented workshop to the state Office of Emergency Management, and the New Jersey State League of Municipalities incorporated the event into its annual statewide conference. After state police officials gave an overview of the state emergency management structure, Hudzik addressed the gathering of municipal officials on what Amateur Radio's role in the public service arena.

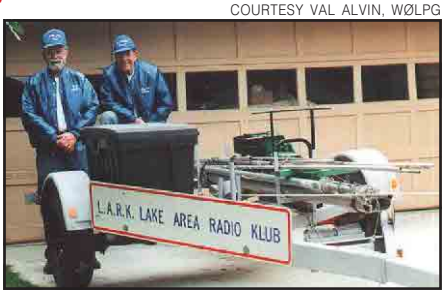
Northern New Jersey SEC Steve Ostrove, K2SO, shared a number of case histories of how ham radio operators have responded to various emergencies. Also invited to speak to the conference was New Jersey State Red Cross Disaster Specialist Holly Chmil, KC2HDK, who spoke on coordinating municipal needs with the Red Cross.

South Dakota Hams Join Agencies for Wal-Mart Safety Day

Right alongside the National Guard, highway patrol, fire department and American Red Cross, ARES members of the Lake Area Radio Klub demonstrated Amateur Radio's capabilities to the public at the Watertown, South Dakota Wal-Mart's annual Safety Day October 4, 2003.

The club brought in an antenna for 75 meters and set up VHF/UHF voice and packet operations for public demonstration. A large sign attracted folks to the display, where literature on SKYWARN, ARES and other topics was available.

COURTESY VAL ALVIN, WØLPG



Codington County EC Val Alvin, WØLPG, and LARK member Laurel Foss, KB8HMR, have the club trailer loaded up with antennas and equipment in preparation for the Wal-Mart Safety Day in Watertown, South Dakota.

Buried Treasure

ARRL Station Manager Joe Carcia, NJ1Q, recently unearthed a ham radio treasure in the basement of W1AW—a series of photo albums and other historical artifacts relating to the early days of the ARRL Headquarters stations—W1MK and, later, W1AW, as well as Amateur Radio in the 1920s and '30s. The photos were taken by long-time ARRL Communications Manager F. E. Handy, W1BDI. This one, taken in 1928, shows station 2ALU in Brooklyn, New York. Note the size of that transmitting tube!

Working under the direction of the Historical Committee of the ARRL Board of Directors, ARRL Archivist Perry Williams, W1UED, with assistance from volunteer Charles Griffen, W1GYR, has been sorting through and cataloguing the literally thousands of items of historical interest that are in the ARRL's possession.

League Volunteers Roll Up Their Sleeves at Science Night

Members of the Gwinnett, Georgia ARES group participated in Science Night at Berkeley Lake Elementary School. Under banners of the club, the ARRL and Gwinnett ARES, group members gave multiple demonstrations for 747 eager students and their parents. Southeastern Division Vice Director Sandy Donahue, W4RU, and Georgia Section Manager Susan Swiderski, AF4FO, answered questions and provided follow-up materials for interested show attendees.

Georgia Section Official Observer Coordinator Mike Swiderski, K4HBI, wowed visitors both young and old with his "Mr Wizard"-like demonstration of modulating a simple RadioShack laser pointer with his voice to actually allow students to talk over the light. Other demonstrations included Morse code, packet radio, EchoLink, ARES and an HF station.

Communications Professionals Discuss BPL's Interference Potential at ARRL-Sponsored Session

On November 7, ARRL sponsored a meeting of 25 communications professionals to discuss the interference potential of Broadband over Power Line (BPL). The meeting was hosted by the National Association of Broadcasters at its Washington, DC, headquarters.

"Listening to everyone introduce themselves and explain why they had come made the trip to Washington worthwhile all by itself," said ARRL CEO David Sumner, K1ZZ, who offered opening remarks and guided the discussion. Sumner showed excerpts from the ARRL BPL field test videos, which graphically demonstrate that BPL's interference potential at HF is real, not just theoretical.

ARRL General Counsel Chris Imlay, W3KD, reviewed the status of last April's FCC's *Notice of Inquiry* on BPL and noted that more than 5000 comments were filed with the Commission—most of them from Amateur Radio operators. ARRL Technical Relations Manager Paul Rinaldo, W4RI, provided a technical review of BPL.

President Haynie Promotes Ham Radio at Homeland Security Conference

At a Volunteers in Homeland Security conference in early November, ARRL President Jim Haynie, W5JBP, used ARRL's *Amateur Radio Today* CD to promote the potential of Amateur Radio as a part of homeland security at the community level. Haynie served on a panel of national Citizen Corps affiliates during the conference. ARRL became an affiliate of Citizen Corps—an initiative within the Department of Homeland Security—in June during the ARRL 2003 National Convention. Haynie said *Amateur Radio Today* turned out to be the proverbial picture worth 1000 words for the 300 who attended.

"When it was finished and they turned the lights back up, everybody applauded," he said. "I didn't have to say another word." Haynie said several public officials on hand at the event also praised the capabilities of their local Amateur Radio communities in providing assistance during emergencies and disasters.

Briefly Noted

✔ ***Logbook database growing; now available to Mac users***: In its first six weeks, Logbook of The World accepted logs from 4000 users from 158 DXCC entities. These users—all with secure digital certificates—have uploaded over 20 million QSO records into the system. Those contacts have so far resulted in 335,196 QSL records being generated.

Speaking of LoTW, it's now operational on the Macintosh OS X operating system. Mac enthusiast Steve Palm, N9YTY, compiled a version of TrustedQSL to work with newer Macintosh computers. The program was built using MacOS version 10.2—"Jaguar"—and was tested on versions 10.2 and 10.3, the new "Panther" upgrade.

✔ ***That's a lot of churning pencils!*** As of November 21, the ARRL/VEC had processed 4973 test sessions, representing 32,776 exam elements. Number of persons served through November 21 by the ARRL/VEC: 26,297. The 2003 pass rate is 70.6%, just under the 2002 rate of 71.2%.

✔ ***That's a lot of cards!*** DXCC Manager Bill Moore, NC1L, reports that his staff has checked and returned 656,652 cards through November 21, 2003. The full calendar year 2003 estimate of 775,000 cards compares favorably with the 677,007 cards processed during 2002.

Guide to ARRL Member Services

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

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ARRLWeb www.arrl.org

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ARRL Headquarters is open from 8 AM to 5 PM Eastern Time, Monday through Friday, except holidays. Call **toll free** to join the ARRL or order ARRL products: **1-888-277-5289** (US), Monday-Friday only, 8 AM to 8 PM Eastern Time. From outside the US, call 860-594-0355. The fax number is 860-594-0303 (24 hours a day, 7 days a week).

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

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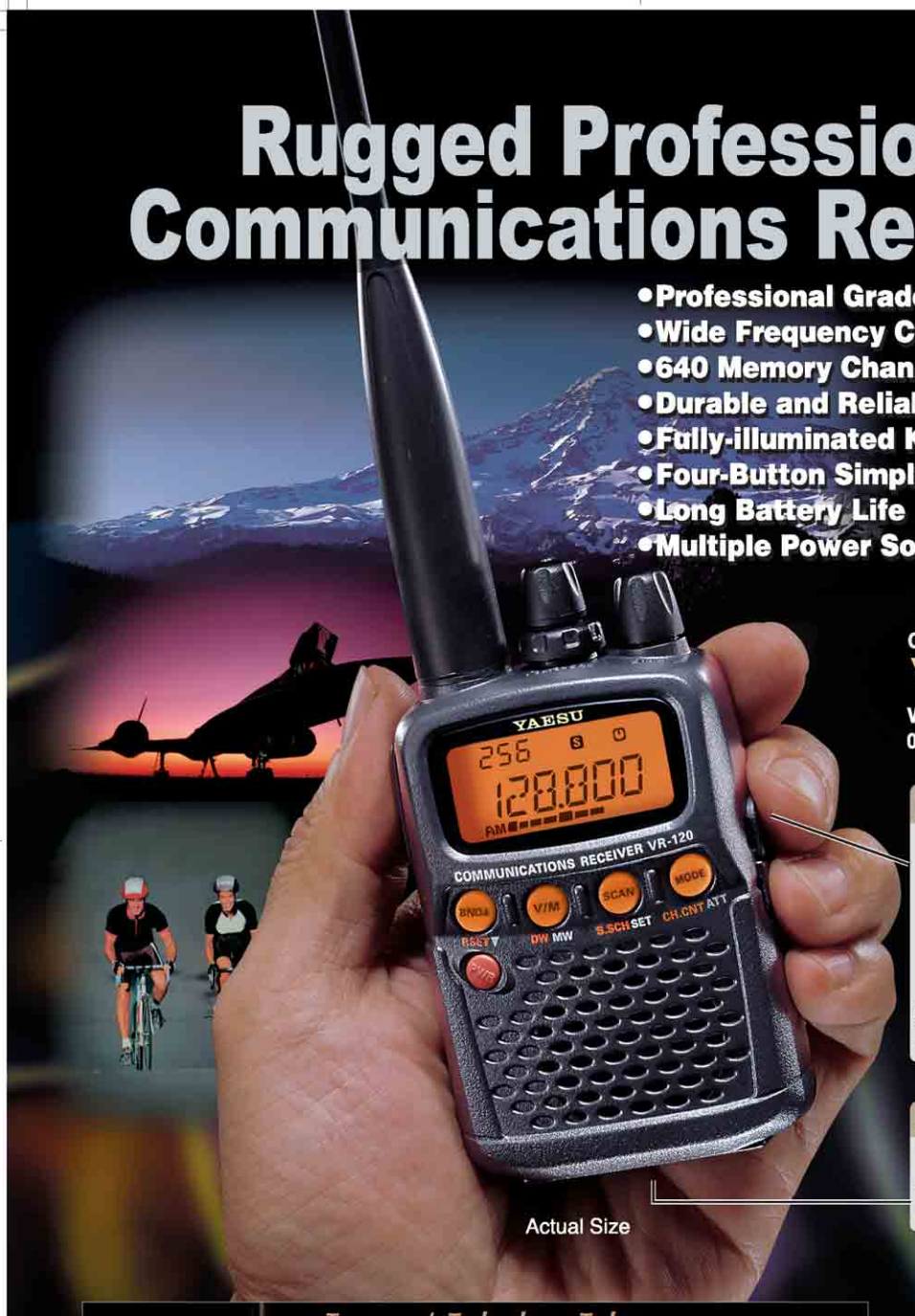

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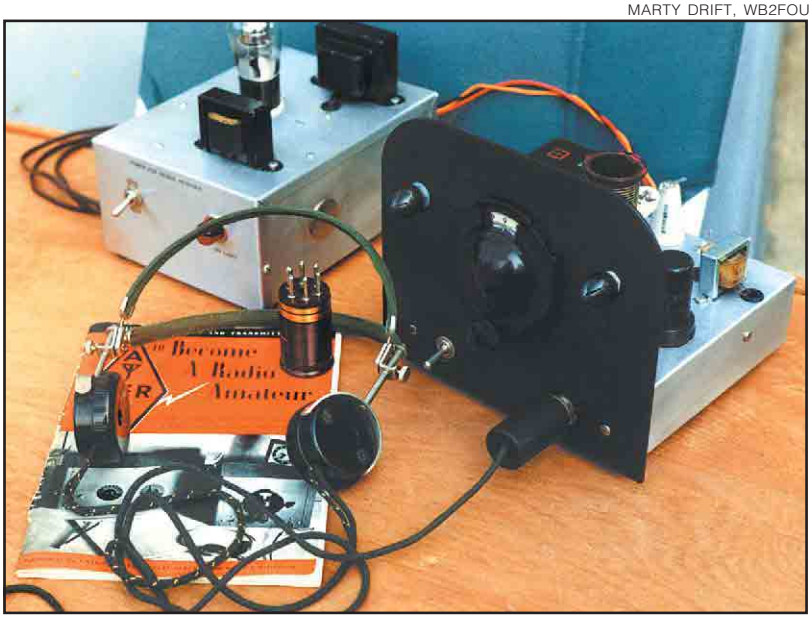
MARTY DRIFT, WB2FOU



Wrinkle-faced beauty: **"While almost every amateur builds his own transmitter," the article begins, "many of them buy factory-built receivers because the complex multi-stage receivers can be had from dealers for little more than the cost of the components..." While that was true in 1942, the popular ARRL book *How to Become a Radio Amateur* featured a beginner's receiver project all the same. Marty Drift, WB2FOU, of Blawenburg, New Jersey, "fell in love with this wrinkled beauty" and set out to find parts. Between those he had on hand, others supplied by a ham friend, and a choke and power supply scrounged from an old military frequency meter, he was ready to heat up the soldering iron. "The receiver was built as the ARRL book showed," he writes. "Its overall performance was great!"**

GERHARD HOYER, DJ1GE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Unusual K4 card: **In the process of collecting items of historical interest for the German IARU member-society, the Deutscher Amateur Radio Club, Gerhard Hoyer, DJ1GE, of Hamburg, found this 1927 QSL card. He explains: "In the years 1926-28, Germany held the prefix K4 by international allocation, followed by three letters for officially licensed stations and by two letters for so called 'unlis' stations."**

Hand-crafted AM rig donated to Oklahoma museum: Jim Garrett, K5BTV, of Emory, Texas, writes: "It was my long time goal to place my Dad's (W5KBE/WØIMZ) and my AM rig, hand-crafted and operated in Oklahoma, in a museum to preserve some ham radio memories. After my Dad became a SK 10 years ago, I restored the AM rig to full operation and on a recent trip to downtown Oklahoma City, visited the Oklahoma Historical Society, where I offered it to them along with other vintage ham gear. The timing was perfect, as it is the only ham equipment they had seen. When they saw the 866A mercury vapor tubes flickering with modulation current, all the museum folks gathered around saying 'Cool'! They are affiliated with the Smithsonian and are building a terrific new building, The Oklahoma History Center, across from the state capitol."

JIM GARRETT, K5BTV

K5BTV recently donated this impressive AM gear to the Oklahoma Historical Society.

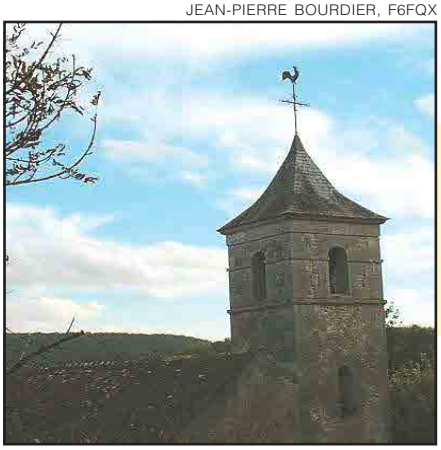
TOM TAORMINA, K5RC

Reunited after nearly 40 years: **As a young college student on Long Island, WA2GGB worked part-time for Amplidyne Labs, a startup company of hams manufacturing VHF receiving converters and transmitters. These days, living on the other side of the country in Virginia City, Nevada, Tom, K5RC, has recently acquired a rare Amplidyne Labs Model 621 Transmitter. It runs 50 W of plate modulated AM on 6 and 2 meters, crystal controlled. By the production lot and date code, it is certainly one he built in 1964. Amplidyne Labs went out of business in 1965 when that newfangled SSB mode was rapidly replacing AM and VFOs were replacing crystals.**

RUSS PEECOOK, AG4RJ

"Ship's Radio": **Although he normally paints seascapes and clipper ships, Russ Peecook, AG4RJ, of Fort Lauderdale, Florida, changed his subject matter a bit to produce a work that incorporates his love of old radio and telegraphy.**

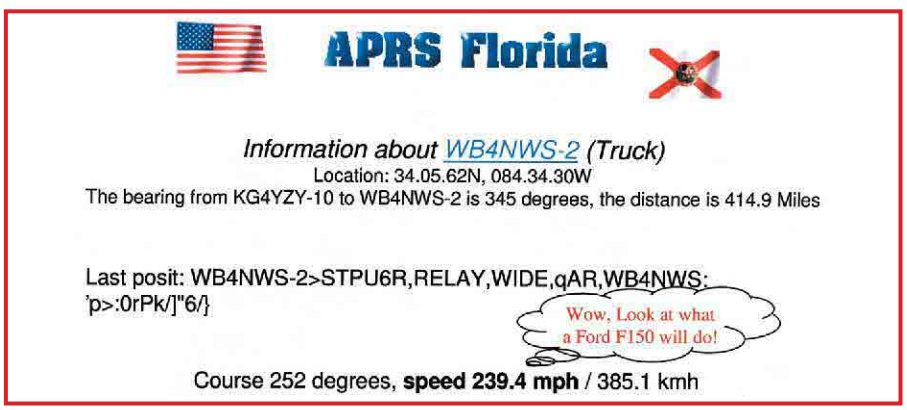
JEAN-PIERRE BOURDIER, F6FQX



He no doubt followed "The Amateur's Code": **Jean-Pierre Bourdier, F6FQX, an ARRL member from Voisins-le-Bretonneux, France, came across a tiny church recently in the village of Chevroches —*Sainte-Amateur*.**

KELLY MANUK, KC8UIX

BPL donation: **Eric Jessen, N8AUC, president of the Lake Erie Amateur Radio Association (left), presents a check for $575 to ARRL Great Lakes Division Director Jim Weaver, K8JE. The donation, which took place at the club's October meeting after N8AUC had presented a talk on the BPL threat, will help bolster the ARRL's Broadband over Power Lines Defense Fund. $100 of the total was donated by a single club member who chose to be anonymous.**



Look out for Smokey!: **"Down here in the South we have certain 'trade secrets' on our engine and fuel mods," writes Jim Millsap, WB4NWS, of Woodstock, Georgia. The photo shows a readout of his positioning system indicating that he was traveling at what could be called a high rate of speed. "As I took the kids to school one morning," he writes, "my GPS sent info through APRS that I was speeding in a school zone—maybe the geomagnetic storms we were experiencing at the time did affect GPS!"**

SHELDON L. EPSTEIN, K9APE

It's up!: **In the April 2003 issue, Sheldon Epstein, K9APE, an attorney representing a ham from Park Ridge, Illinois, described the arduous but ultimately successful process of securing a permit for WA9GFP's antenna system. The photo shows Carmen Ambroggio with his with his 58 foot retractable tower and homebrew triband cubical quad antenna on October 23, 2003, the day he received final inspection approval from the City of Park Ridge. The tower is in its retracted position.**

WAYNE VAN METER, N7TAE

Lewis and Clark slept (near) here: **In September, the Hellgate ARC of Missoula, Montana, marked the upcoming bicentennial of the Lewis and Clark expedition by setting up special event station W7PX in the Lolo Pass Visitor Center near the Montana-Idaho border. Lewis and Clark set up camp nearby, where the town of Lolo now stands, twice—traveling west in 1805 and on the return eastbound trek the following year. The club is planning other special event operations as the bicentennial approaches.—*Wayne Van Meter, N7TAE***

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A THRILL TO WORK mp

♦ In December's "50 Years Ago" column [p 82], the *QST* cover featured a picture of W1AW Chief Op "mp" or Murray Powell. Back then, W1AW would stand by for CW contacts after code practice (or was it after the CW bulletins?) and for me it was a thrill to work "mp" from our Headquarters station in 1962. I also worked "fm," T. F. McMullen, the same way in 1949 and received a 469x, an honest report with the "x" indicating that the purity of my signal sounded like it was crystal controlled. When you have heard that recently? —*Nate Goetz, K4ZH, Naples, Florida*

COVER PLAQUE AWARD

♦ One day, the Cover Plaque Award should go to the person who designs your covers. November and December were especially good.—*Roy A. Raney, KØOVQ, Denver, Colorado*

[*QST* covers (and a *bunch* of other stuff) are designed by Graphic Design Supervisor Sue Fagan.—*Ed.*]

HORRENDOUS

♦ It's terrible, awful, horrendous and literally criminal. It is yet another issue that must be dealt with. Rogue CB operators are taking over our 10 meter band, and many of them are being quite relentless about it. Take a listen in the CW portion of the band from 28.0 to 28.1 on any given evening and instead of hearing a lot of CW like you should, you will hear CB operators using USB and LSB trying to talk from coast to coast. The really sad part of this predicament is that instead of us hams policing our own frequencies, we are allowing the CBers to run us off our own band!

It is quite evident that these CB operators are not going to yield their illegal activities until the FCC steps in "hot and heavy" and starts cracking the whip. Maybe then they will get the message. It is up to each of us to "take care of our own," so I propose that with the help of the ARRL we petition the FCC to take stronger action against these CBers.—*Joseph M. Wilson, KG4NCK, Live Oak, Florida*

[Chuck Skolaut, KØBOG, ARRL Field and Regulatory correspondent, replies: The problem continues to exist with unlicensed operators from both the US (primarily truckers) and our neighbors to the south. The FCC most recently addressed this issue in May 2003, when it requested the aid of ARRL Official Observers for a period of six months to collect information and forward it to them. The story was included on the ARRLWeb page. A reminder was sent out in October asking for input by all amateurs. The FCC sent at least four warning notices in June and July to individuals or businesses for unlicensed 10 meter operation. Also, two different firms advertising on the Internet were sent a warning letter and one a citation for offering for sale noncertified Citizens Band transceivers. Any amateur wishing to report unlicensed 10 meter activity can send specific information directly to the FCC by e-mail at **fccham@fcc.gov**. Your message should include the date, time, frequency, location and if involving truckers, the name of the truck line and license tag identification. We encourage anyone hearing this activity to collect information and report it.]

AFTER HALF A CENTURY

♦ In the "75, 50 and 25 Years Ago" column [December 2003, p 82], I noticed my call sign in the summary of the content of the December 1953 issue. The column editor, Al Brogdon, W1AB, notes a *QST* "Stray" in which the late Ed Tilton, W1HDQ, mentions that I solved a TVI problem with a third-floor neighbor by marrying the complainant. Actually, Ed made a slight error back then. The TVI complainant lived on the sixth floor, not the third floor as published. My bride and I celebrated our 50th wedding anniversary on November 22, 2003—and she still complains occasionally about TVI.—*Marv Stern, W2AOC, Jackson, New Jersey*

BIRD ON A WIRE (OR BEAM)

♦ I just read about K9ON's problem with birds in the November 2003 issue ["The Doctor is IN," p 67]. I had a similar problem. I fixed it easily. I cut a foot of magnetic film from cassette audio tape and attached it from one end of the element to close to where the birds liked to perch. They dislike the light spots and recoil from the sun reflecting off the tape surface.

It works, at least with Spanish birds. —*Ramon Vicente, EC5AKA, Valencia, Spain*

♦ Here in Nevada we have the same problem and owls do not help. I have found a solution here that works for me. The family next door raises and feeds birds so there are 100 plus birds within 300 feet. My solution was to rotate the antenna whenever I saw a bird (birds) on it. Seems they don't like the sudden movement. It doesn't have to be more than 3 or 4 degrees—just enough to cause movement. It took about a month and most birds quit sitting on the beams because they never knew when it would move. Now I only have to rotate the beams about once a week or less when a new guy comes around. Seems they have learned not to sit on the antennas. I still get droppings on the tower but that unfortunately does not rotate and the birds will sit on a cross member and do their thing. I sometimes go out and bang on the tower legs and that also will scare them off. Hope this helps you, Greg.—*Tom Cordich, W7TC, Gardnerville, Nevada*

CONCOCTED *QST* MIC PAID DIVIDENDS

♦ Reading Tom Morton's March 2003 article on building a high quality crystal microphone ["Of Mics and Men," pp 32-35] brought back memories of around 1939 and a crystal mike I concocted from an article in *QST*.

I was in high school and had invested my meager savings in the parts to build a sound amplifier—based on a push-pull pair of 6L6G's from the *ARRL Handbook*—to play records for school dances. Knowing that a microphone would be a handy accessory, and funds about exhausted, I saw in *QST* that a crystal headphone would work as a mike.

A nickel plated parking light from a junked car served as a case, window screening covered the opening, and a length of chrome plated half inch pipe from a plumbing supply house served as an average height support. An old brake drum was the base.

Shortly after the makeshift mike made my equipment a "real" PA system, I got a call from the nearby University of Vermont. An out of state band had arrived to play for a big dance, but didn't have a sound system. The college didn't have one, either. Could I help out?

For a ten dollar fee I could. The speak-

ers were placed, the mike put in front of the band, the somewhat surprised diminutive girl singer provided with a raised platform so that her mouth and the mike shared a similar elevation. The band played, the girl sang and the dance was on.

I collected my fee and used it to buy a real adjustable mike stand.—*George Holden, KJ7JZ, Tempe, Arizona*

DISAPPEARING

♦ As more and more of the real OTs QSY to that great QTH in the sky, some of the colorful terms of the '20s and '30s are disappearing. I've made a quick list of the first 10 that come to mind.

• Lecher wires • self quenching • TNT • wing coils • ECO • resonant filter • California kilowatt • Dr Uda • loop modulation • Lake Erie swing

I have plenty more!—*Alan T. Margot, W6FZA, Palm Desert, California*

WHY HAM RADIO

♦ Why ham radio? I am asked that question a lot, and I answer by telling them about being able to communicate with people far away, and about helping our neighbors in my community by helping in emergencies or local events.

However, the real reason is a lot more complicated than that.

The real reason is the people in the hobby. I have had a great many hobbies, but I have never met so many people who are interested in helping out another person in the hobby. I have met people from all walks of life, all races and religions and have noticed that it doesn't matter what or who you are. If you have a problem with understanding something, they will take the time to explain; if you need help setting up an antenna system, they will be there.

But it goes a lot deeper; the people become friends for life. I am one of the lucky men in ham radio whose wife is also a ham. As a couple we have made wonderful friends who we share like experiences with.

I truly feel that ham radio has and is making my life richer and fuller.—*Mark Kimmel, N1ZYG, Athol, Massachusetts*

PUTTING *RADIO* BACK IN HAM RADIO

♦ I would like to make a comment with regard to the Op-Ed article in the November 2003 issue ["Let's Put *Radio* Back in Ham Radio," p 104]. I have a very good friend who is active on EchoLink and he made a statement to me about the Internet process, as follows: Some of our "OTs" are now retired to nursing homes, etc, and are not allowed to operate a transmitter any more. These hams like the idea of just chatting with each other via computer. What's wrong with that? Is it not what Amateur Radio is all about, anyway?

I don't have any desire to operate "computer CW" myself, but many hams do. Good for them.—*Anthony Manser, AF7J, Centerville, Utah*

♦ Sumner Weisman hit the metaphorical nail on the head with his comments on IRLP. I'm proud to have been active in Amateur Radio since I was first licensed in December 1977 (then WD6EOS). IRLP is indeed not truly amateur "radio." Certainly it has its place in the larger scheme of the hobby, and it can be a valuable supplemental tool to regular radio communications, but IRLP is really nothing more than remote control of another radio (a repeater, in this case) via a wireline network.

Since I got my first license, I've been a "tinkerer," heavily involved with homebrew projects and the conversion of commercial and military equipment to amateur service. Doing so for all these years has been of immense help in building my electronics skills both on and off the job.

There was a time when the vast majority of Amateur Radio operators were more than just operators. By the very nature of the hobby, they were required to be just as much "technician" as "operator," and this vast pool of technical talent was a strong resource that our country could draw on in times of disaster or other need.

Radios today are made so small, with so many surface-mount components, that the mods and experimentation so many of us enjoy doing are simply not practical without a substantial investment in specialized tools and test gear.

Does all this mean that no one should consider becoming a ham unless they're ready to pick up a soldering iron in one hand and an oscilloscope probe in the other? Of course not. That's silly. Amateur Radio has something to offer anyone, tech or non-tech alike. All I'm saying is that the experimental and technical side of the hobby is important—I would even say critical—and I think it needs a lot more attention than it has been getting in the last couple of decades.

If you really want to put the "radio" back in Amateur Radio, learn a little (or a lot!) about the actual radio equipment and antennas, and how they do their thing. Or, to paraphrase a once-popular advertising scheme: "On the Road of Amateur Radio, there are Users and there are Tinkerers. Tinkerers wanted."—*Bruce Lane, KC7GR, Kent, Washington* QST

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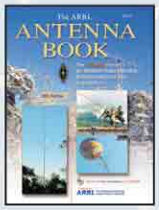

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QST 1/2004

By Brian Wood, WØDZ

The Incredible Saga of a DX-100 Restoration Run Amok

How WØDZ learned to stop SSBing and love AM phone.

What's a 48-year-old tube rig, running "ancient modulation" no less, doing in the pages of *QST*? Isn't this the future, where transmitters are made out of nanotechnology, implanted under your skin and all you have to do to communicate with someone is to think about them? Well, okay, maybe *that* future isn't here yet, but it does seem like rigs are getting so small that a lot of us can barely see the knobs. Doesn't it seem all too easy these days to make contacts when all you have to do is dial the frequency and start talking? Of course you can always work on your own rig when it breaks, right? Hah! Fidelity isn't a big deal, either, is it? After all, the bands are crowded and 2.1 kHz ought to be enough room for anybody. As for modes, SSB, FM, CW and PSK31 rule, right?

Well, er, no. Turns out, there's a cure for small knobs, low fidelity, dial-and-talk operation, unrepairable rigs and fast, meaningless QSOs—boatanchor restoration and use on AM phone. In this article, I'll relate the story of my restoration of a Heathkit DX-100 transmitter, arguably one of the most popular amateur transmitters ever, and still in use in many AM stations. Along the way, I'll provide some tips on how you can do a nice restoration—where to get parts, how and how *not* to clean old radios, interesting mods you can do and what to watch out for.

Anchors Away

The term "boatanchor," once a derogatory term for old, heavy, tube-laden equipment, is now used affectionately. Coaxing one of these babies to life is an art being taken up by more and more amateurs these days and the thrill of using one on the air is indescribable. Because of this, AM phone has made an astounding comeback. Why? For one thing, the sound of a good AM station is stunning—full range audio and a clarity that proudly says to the world "This is Radio Station <your call here>." But make no mistake; you have to like talking. AM operation is very different from SSB and FM. Ragchews are the norm. Rapid-fire QSOs are not only harder to do, they're frowned upon! Many modern rigs offer AM mode in addition to the others. If your rig has AM capability, try the frequencies shown in Table 1 to see if you like this different way of operating. When 10 meters is wide open, during peaks of the sunspot cycle, AM is popular there. For Technician licensees, there's also growing use of this mode on 6 and 2 meters. There's also a good incentive to upgrade so you can use AM on the HF bands where most of the activity takes place.

Table 1
Common AM Frequencies

75 meters:	3.885 MHz
40 meters:	7.290 MHz
20 meters:	14.286 MHz
10 meters:	29.000-29.200 MHz

A word about courtesy is in order. When the HF bands are crowded, SSB stations and AM stations often compete for the same space. Unfortunately, the modes don't coexist very well. SSB operators hear heterodynes from AM carriers, and AM operators hear muffled "Donald Duck" modulation from SSB. Even though there's a gentleman's agreement that establishes AM calling frequencies, SSB and AM operators often find themselves at odds with each other, particularly on 75 and 40 meters. Let's face it—AM operation uses at least twice as much spectrum as does SSB. Common courtesy should prevail on both sides. If the frequency is in use, try an adjacent one. AM ops can help by not operating during phone contests, and SSB ops can help by recognizing those AM calling fre-

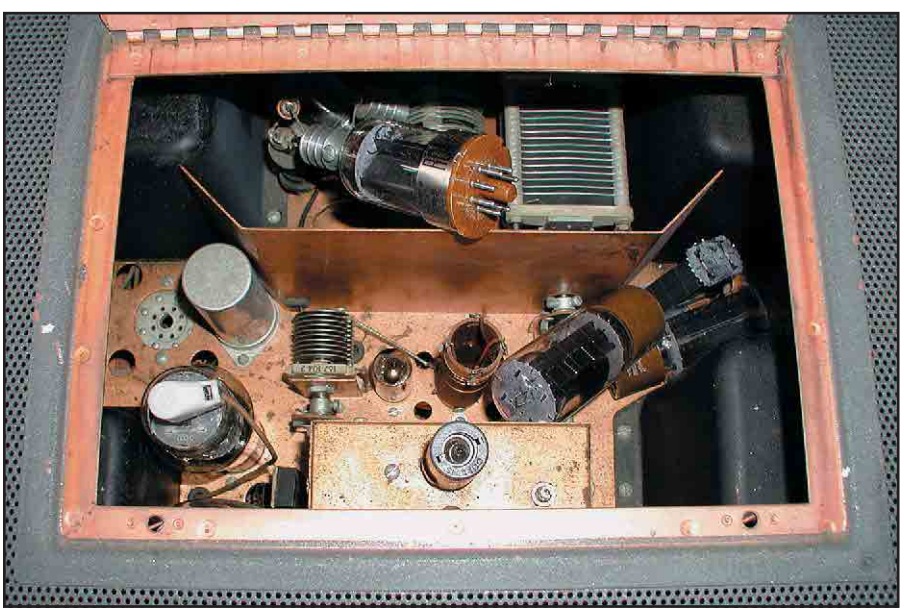

Figure 1—An array of loose tubes, glass and grime awaited me when I first opened the lid of my newly acquired DX-100.

quencies and moving a few kHz away.

Once you've gotten your feet wet on AM using a modern rig and have heard the incredible audio coming out of many stations, you'll want to try using a boatanchor, too. Some of the most coveted rigs are those made by Barker & Williamson, Collins, Hallicrafters, Hammarlund, Heathkit, E.F. Johnson, National and RME.

Once you've operated one of these transmitters, you may not want to go back. The ambience of these rigs is hard to resist. They were, after all, hand crafted. They had heart, which some find lacking in today's rigs. But sometimes finding one in good shape is tough. Many have been poorly treated, and they often have many decades of dirt and grime on them. Tubes will be missing or broken and other parts, especially filter capacitors, may be out of spec or worse. But if you long for the smell of solder wafting through the air, restoration is for you!

Worked Last Time it Was Used

Chuck Penson, WA7ZZE, a renowned expert on Heathkit Amateur Radio gear, is fond of saying that "Worked last time it was used" and "No way to test it" both mean, "It's dead." But I took a chance on one that was offered on eBay with the description, "Lights up, original manual included." Lucky me—I was the high bidder. It took constant nagging, but the seller finally "found a box big enough" and shipped it FedEx Ground three weeks after receiving my money order. When it arrived, it looked like one of the boxes that washed ashore in the movie *Cast Away*! Suspicious that anything inside could have survived, and knowing I might have to file an insurance claim, I took photos as I opened the box.

Broken glass on top of the rig was not a good sign. This DX-100 had been put in the more compact DX-100B cabinet with an access panel on top, so I opened the lid to find tubes askew and broken and lots of grime, as seen in Figure 1. Pulling the hundred pound rig out of the box as carefully as I could, I discovered that despite the internal tube damage, the outside was relatively unscathed. One knob that had been present in the eBay photo had mysteriously disappeared but, overall, it looked passable, despite some sticker residue on the front panel, probably from a previous owner's call letter plate.

There was lots of grime on the copper-plated steel chassis, along with black oxidation spots. Back in 1955, when Heathkit created the DX-100, steel had been used because it was undoubtedly a lot cheaper than aluminum—and stronger, for those heavy transformers and chokes! Copper plating was used to provide better conductivity with a certain degree of RFI shielding. It also looked sharp. But copper has a tendency to tarnish quickly, so Heath coated it with a water-based lacquer that slowly degraded over the years. I learned about the lacquer from a question I put to the Heathkit moderated e-mail list (**www.tempe.gov/lists/control.asp?list=HEATH**) that was answered by a former Heathkit employee. Similar lists abound on the Internet for aficionados of other rigs. See **www.ac6v.com/mail.htm** for a complete list.

Cleanliness is Next to—Impossible

It just didn't seem right to simply replace the tubes and try it out. It had to be cleaned first. I asked around to see what products people used to clean old radios and got quite a response. *Simple Green*, *Tuff-Stuff* and vinegar and salt surfaced, to name a few. In the case of the copper-plated DX-100, *Brasso* and *Wright's Copper Cream*. I tried 'em all. The problem is that it's tough to clean around existing parts and still have it look as if you hadn't *tried* to clean it. I took a few of the larger and easier to remove parts off and cleaned some more, with a toothbrush and even a motorized tool fitted with a small cotton pad! The result was okay, but not up to the standards I wanted. Figure 2 shows how it looked at this stage.

The DX-100 chassis has two pieces: a flat top plate and a folded and welded bottom. Having removed a fair number of parts from the top plate already, I asked myself, "How hard can it be to just take all the rest of the parts off the top, push the tube sockets down into the chassis and remove the top plate so I can really clean it well?" That meant removing the VFO, the front panel, the power transformers, and chokes, lots of parts and *lots* of screws, nuts and washers. This project was no longer a simple cleanup. It had now become a quest. Figure 3 is a view of the top plate with the parts removed. As you can see, parts removal was necessary. The grime had built up around the parts and could not be cleaned well while those components remained attached. You can also see the color difference between the areas under the parts and the "cleaned" portion.

As any faithful Heathkit builder knows, when you build a kit it is your duty to commandeer all the muffin tins in the house to hold parts during assembly. Heathkit may not be making kits anymore, but you can experience that same construction joy by rebuilding one. With Heathkit's extraordinary manuals with the large, detailed pictorials, you *know* you can't go wrong. So, despite having removed a lot of parts, I felt fairly confident I could successfully put it all back together again.

Figure 2—A cursory cleaning resulted in a chassis that wasn't quite what I was looking for.

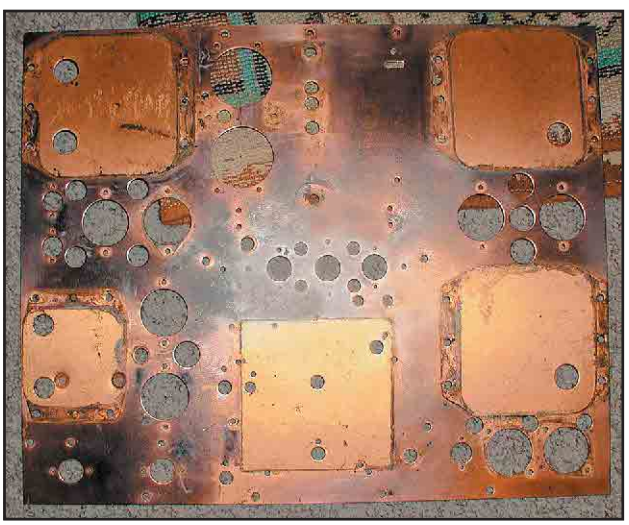

Figure 3—The copper plating hidden *under* the transformers was really what I wanted the entire chassis to look like.

Figure 4—Now this is what a copper-plated chassis should look like.

Figure 5—Relacquering the newly replated chassis in the bathroom tub. With luck, other household members will understand!

All that cleaning still left me underwhelmed, and it even looked like some of the thin copper plating had come off with the grime. There was no choice now—it had to be replated. I found a plating shop in Denver on "Antique Row" that could do copper. They recommended blasting the parts with glass beads and then acid/copper washing them. I gave them the chassis top plate, VFO covers, final amplifier shield, final amplifier subchassis and several internal brackets. When I picked them up a week later, the parts were clean and copper-colored, but had water streaks and were not shiny. That was quickly solved with some *Nevr Dull*, a fascinating product that consists of cotton wadding impregnated with a buffing compound. You simply tear off a small piece and rub it in gently until the surface is covered, then polish it with a clean, very soft, cotton towel. The parts took on a real shine as you can see in Figure 4. I also used *Nevr Dull* on the bottom chassis, with the wiring harness and other parts still inside, to get as much of the grime off as possible.

The newly plated parts still had to be lacquered to prevent them from tarnishing. As mentioned earlier, I had to find a water-based lacquer. The Web came to the rescue and I located a product made by SSS Chemicals in California, called *Trilac-747* (**www.patinas.com/trilac747.htm**). It's stable at high temperatures, dries clear, and is nonflammable. I bought a gallon (about $50) and poured it into a large plastic storage case that served as a dip tank, which I then placed in a bathtub. I put a curtain rod over the tub, propped between the bathtub wall and the sink cabinets. A couple of pants hangers served adequately as hooks to hold the chassis pieces. Figure 5 shows some of the pieces drip-drying. I hand-painted the lacquer on the base chassis.

Rebuilding

It was time to put the rig back together. I cleaned the pins of the tube sockets with 99% isopropyl alcohol, using special tube socket brushes available from *DynaClear*.[1] I then screwed the top plate to the chassis bottom and gently maneuvered the tube sockets back into place. One by one, the screws, lockwashers and nuts went back on—a very tedious process. Because some of the nuts and lockwashers ended up going back in almost inaccessible places, extreme patience was required. Here's a tip to help get those lockwashers and nuts back in—put some double stick tape on your index finger and affix the nut or lockwasher to it. Another trick is to use about a 6 inch length of heat-shrink tubing and heat it just enough to close around the nut. This makes a poor man's version of the venerable Heathkit nut-starter and it can flex enough to go into some tight spots.

I used a can of good quality contact cleaner and some cotton swabs to remove the grime from the wafer switches and to put some sparkle on some dull parts. I mixed a solution of *Simple Green* and *Tuff-Stuff* to clean all the hardware and the final amplifier tank coils. You can see me putting the finishing touches on the rig in Figure 6.

The sticker residue on the front panel was just too stubborn. Nothing would remove it! I was even able to remove some of the paint (drat!) using finger nail polish remover, but the residue remained. I also learned one real no-no—don't use *Formula 409* to clean any portion of these old rigs. It contains a chemical that discolors screws and it left the front panel unsightly. So, it was back to the Heathkit e-mail list for help. Mike Shelton, KE4LGX, of NC Total Electronics in North Carolina came to my rescue.[2] He makes high-quality front panel replicas for many old boatanchors, including the DX-100. Within a few weeks I had the final piece. Figure 7 shows the completed unit ready for testing.

Mining for Unobtainium

When working on old gear, it's inevitable that some parts will need to be replaced. Parts that are hard to find are often humorously referred to as "unobtainium." I managed to break a couple of resistors just moving the innards around. Resistors in old rigs are mostly 1/2 W and above, and RadioShack carries a limited number. Other online parts companies such as Digi-Key (**www.digikey.com**) and Mouser (**www.mouser.com**) have a large selection and fast, efficient ordering and delivery.

Of all the parts you're likely to need to replace, the most problematic are electrolytic capacitors. Old radios tend to have several chassis-mounted single or multisection can-type electrolytics. They should be checked with an ohmmeter to make sure they act like high-value capacitors (a quick deflection of the meter toward 0 Ω, then a gradual return back to infinity). If they don't do that, be sure to replace them. The electrolyte paste that was originally put in those half-century-old caps may be pretty dried out by now; that tends to reduce the capacitance, causing more ripple from the power supply

[1]Notes appear on page 32.

and consequently, hum on your carrier.

Unfortunately, though, if you want to keep the rig looking original, you will want to replace the caps with something that looks the same, and they are hard to come by today. One approach is to gut the capacitors, leaving only the shell intact and then insert a modern capacitor inside the shell. Another is to leave them in place, but disconnected, and connect replacement tubular capacitors below. Today it's possible to get much better quality electrolytic capacitors in higher values and smaller sizes than it was in days of yore. I suggest trying the radio with the existing caps and then looking at the ripple with a scope to see if it's acceptable. You can always add extra capacitors under the chassis if needed. Replacing, rather than "adding" capacitors is preferred, however.

In my DX-100, the tubes that hadn't broken in shipment weren't in bad shape visually, but it's important to test all of them anyway. Tube characteristics change with time and the filaments can, and do, burn out. Some specialty electronics stores still have tube testers and you can sometimes find a local ham who has a tester and will be happy to test tubes for you.

Tubes are, surprisingly, not all that hard to find. I found some good quality 6146 final amplifier tubes (the DX-100 needs the original 6146 or the 6146A, not the later 6146B, which has a different neutralization requirement), 1625 modulator and 5V4 and 5R4 rectifier tubes at a local hamfest. They're obtainable on eBay, as well, at prices of around $5 to $10 each. An interesting Web site that has a lot of information about tube manufacturing today is Vacuum Tube Valley (**www.vacuumtube.com**), which also publishes a magazine. Antique Electronic Supply (**www.tubesandmore.com**) has a comprehensive listing of available tubes and other parts for early radio and audio restoration and repair. They, and others, carry "NOS" tubes (New Old Stock—unused old tubes still in the original box). Several Russian and Chinese companies continue to make tubes today, largely for the growing tube audio market, and they're not hard to find on the Internet.

Figure 6—The author during the electrical rebuilding phase.

There are also solid-state drop-in replacements available for the power-hungry rectifier and regulator tubes used in the DX-100 and many other old rigs. These devices run cooler and use a lot less power than their tube counterparts. The Weber Co in Kokomo, Indiana[3] makes rectifier and regulator tube replacements they call "Copper Caps." These are designed to limit inrush current, simulate the tube characteristics, and withstand a 100% overload. They look nice, too. But try the original tubes first. You might like the way they glow.

Don't Let the Smoke Out!

An old joke says that what flows inside electronics is not electrons, but smoke. After all, if you let the smoke out, the devices don't work anymore, right? Many restorers believe that with ac line voltages today higher than in the 1950s and with electrolytic capacitors that haven't had power applied in a long time, you should use Variac or Powerstat variable autotransformers to bring up the voltage slowly to avoid "letting the smoke out." If you can't obtain a Variac or Powerstat, another technique that can be used to limit damage is to make a fixture that includes one or more light sockets in series with the ac line. By inserting various wattage bulbs, you can divide the line voltage between the radio and the bulb while you make current measurements in the radio. I measured my line voltage and found it to be less than 120 V_{rms}, so I took the chance that I could get away without a variable transformer. But do what feels right in your case.

I double-checked to make sure I hadn't left any wires unsoldered and that everything was tight. The moment of truth was upon me. I held my breath and flipped the power switch to ON. No arcs, no smoke, filaments on, lights on, meter not pegged. I let it sit there for a minute just hoping it would stay that way. It did! I measured a few voltages and they were normal, so it was on to "peaking the grid current" and calibrating the VFO. Following the steps in the manual (certainly a clear advantage of restoring a rig that started as a kit, especially a Heathkit), I was able to get grid current and make the oscillator oscillate. Eventually I got it tweaked so that the VFO dial even matched the output frequency.

B+, The Final Frontier

Okay, up to now we've done the easy stuff. Still to come was applying the high voltage and trying to coax an RF signal out of the final amplifier. The DX-100 has an innocuous looking toggle switch for this purpose, labeled simply PLATE. Flipping this switch would cause lots of electrons to go where no electron had gone for a long time.

I rigged a lightbulb to the output and flipped the switch. Now, tuning a tube final amplifier is a tricky thing. You don't want the plate current to go too high for too long or the plates start glowing bright orange. The goal is to adjust the tuning capacitor for a dip in plate current without letting it get too high for very long, then to increase the loading capacitor control slightly. This amounts to decreasing the loading capacitance. You will start with the loading capacitor at a "0" index, which is maximum capacity in a pi network. This procedure is repeated until a desired level of plate current is reached.

As fate would have it, the loading capacitor did nothing. I removed it and discovered that it was shorted. It was amazing that the rig was putting out 40 W into a nominal short. Ah, the wonders of RF! It turns out that the DX-100 series has had many mods available for it over the years. A previous owner had done one of them—replacing the fixed capacitors that were switched in for coarse loading and a variable cap for fine loading with a single 3-section variable capacitor. The replacement had a trimmer strap on the side, but it hadn't been removed as was normally done in applications like this and it was shorting the rotor to the stator. I removed the strap, and that fixed the loading problem. Figure 8 shows it driving a 100 W light bulb. The long dormant DX-100 was working!

The Mod Squad

I was ready to hook it up to an antenna and make a contact. The DX-100 and many old transmitters had a high impedance microphone input, so I found a couple of Astatic D-104 mics that were, and still are, very popular with these old radios. I hooked one up and called CQ. It sounded a little tinny in my earphones. I got a response, but the operator said my audio sounded pretty bad. Drat! Could the audio amplifier circuitry in the DX-100 be bad? I went back to the Heathkit e-mail list and the AM Window Web site[4] and asked around. The consensus was that the D-104 was probably bad but, while waiting for that answer, I discovered an excellent list of audio and general enhancements for the DX-100 made by Ed Santavicca, AA8TV. Most of the parts he suggests using are available from Digi-Key and Mouser. I ordered the parts, and had them the next day. I made many of

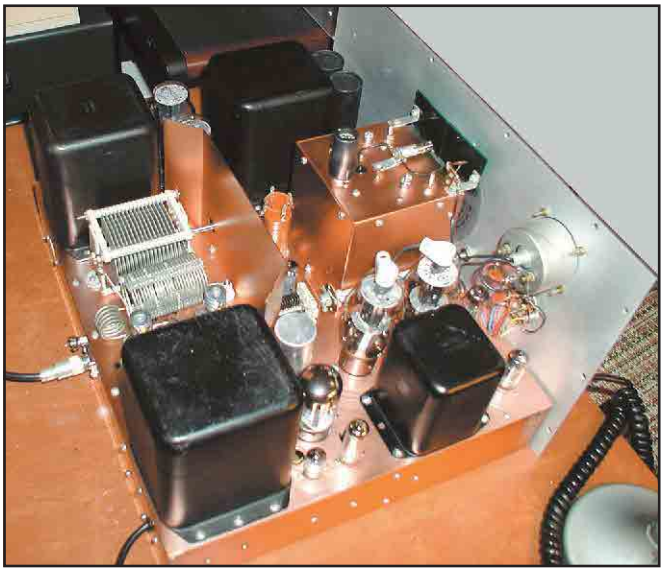

Figure 7—Ready for testing! The completed DX-100 looks like it's ready to model for a Heathkit ad of the '50s.

Figure 8—The finished DX-100 delivering power to a load. It's great to see that bulb lit by RF.

Ed's "general" mods (safety, heat and power supply related) and most of his audio mods (mostly coupling and bypass capacitor replacements) while waiting for a replacement crystal element for the D-104.[5]

One mod I highly recommend is the replacement of the double-fused two-prong plug with a modern three-wire cord (green wire to chassis) and plug. I put a single fuseholder on the inside of the chassis, on the back of the audio shield bracket, using a hole that was already there. I connected it to the black power lead. This mod should be done to any old equipment that has a two-wire power cord.

Some purists believe that restoration should stop when the rig operates and looks the way it was designed. That may be okay if you want to put it on a shelf and stare at it or put it in a museum, but if you plan to operate it, I'd recommend doing at least some of the mods. Modern technology can work some wonders with these old rigs.

When I finally put the DX-100 back on the air, it sounded really good! Audio reports have been outstanding, and in fact made the whole effort worth every minute and every dollar. It has been one of the most enjoyable things I've done in my 36 years of hamming. The total cost of the restoration including the original purchase price was about $500.

Fate Steps In

A previous owner, Jim Newton, KØDNI, had written his name, address and call on the manual. I wondered—was he the original builder, and could I find him to tell him the news? I looked him up in the ham database and found that he was listed at the same address as he had been in the 1950s. According to the records, he's 87 now and with the long expiration time of today's licenses, I thought the odds were slim of locating him. I called Directory Assistance anyway, got a phone number for him and called it. To my delight, he answered. We had a wonderful discussion about ham radio and about that DX-100. He sent me a picture of himself at that rig taken in 1958. He turns out to have been a Collins tech who tested the radios used in the Apollo lunar modules.

He told me that he had bought the rig from Don Needham, another Collins employee who had actually built it. He found Don's address, so I wrote to him. I received a nice letter in return from his wife, who said Don had passed away in December 1999. She wrote, "He would have been so proud to get your letter and pictures. Ham Radio was his first love since he was about 14 or 15 when he and his Dad built his first rig on an old library table in his bedroom." Don's call letters were WØDCZ, so close to mine (WØDZ) as to be eerie. It would appear that I was fated to own this DX-100. To Don and Jim—thanks, guys, for starting this rig on its journeys. I hope I can continue to do it justice. The "new" transmitter is now poised to begin its next set of adventures. See you on AM!

Notes

[1]PO Box 215, Oradell, NJ 07649; tel 201-262-4077.

[2]2708 May Dr, Burlington, NC 27215; tel 336-229-5671; **www.angelfire.com/nc/totalelectronics**; **ke4lgx@yahoo.com**.

[3]**www.webervst.com/ccap.html**.

[4]**www.amwindow.org**.

[5]Part no. PMC320, $19.99 from Astatic (**www.astatic.com**).

All photos by the author.

Brian Wood, WØDZ, has been a ham since 1966. First licensed as WA7FIK in Scottsdale, Arizona, he moved to Loveland, Colorado after graduating from the University of Arizona in 1973 with a BS in Electrical Engineering. Working as an R&D engineer at Hewlett-Packard, he became part of Agilent Technologies when it became a spinoff of HP in 1999. He is currently a Technical Marketing Engineer at Agilent. Brian has an Amateur Extra ticket and is a life member of the ARRL. Married, with a 22 year old son, his Amateur Radio interests include CW, the digital modes, DX, homebrew construction and Field Day (he runs the Colorado Mountain Moguls Field Day group in Loveland). He can be contacted at 710 Grove Ct, Loveland, CO 80537-9325; **w0dz@arrl.net**.

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By Glenn Brown, W8JZI

Restoring a Homebrew Transmitter

Restore your faith in the hardware of Amateur Radio's rich past.

As a newly licensed Novice class radio amateur in 1952, I constructed my first transmitter from an article in the 1948 edition of *The Radio Amateur's Handbook*. The article was titled "A Simple Single-Tube Transmitter" and it was built on a homemade wooden chassis with wiring and coils of cotton-covered "bell wire." The coils were tied off with string and mounted on sucker sticks stuck into the chassis. That little transmitter was built and used successfully on the air. It was a young man's delight—very inexpensive and easy to build—a foundation for Amateur Radio.

The pages that followed that "one-tuber" described a similarly constructed wooden chassis radio, "An Inexpensive Two-Tube Transmitter." What a step up that would be! Those early transmitters, inspired by orange-crate wood, bell wire and sucker sticks, were unique "works of art" to a teenage boy. They would not be forgotten a half-century later.

A 21st Century Find

I was browsing on eBay under the *Ham Radio* category in early November of 2002, when an auction photo caught my eye. The item offered was a slightly modified version of the 1948 two-tube transmitter! A few anxious days later the auction closed and the transmitter was mine. It was on its way to the slightly older "kid" who had always wanted that two-tube version of the wooden work of art.

Taking Stock

The transmitter arrived soon thereafter and appeared as shown in Figure 1. The construction of this transmitter didn't differ much from the 1948 *Handbook* schematic, but it did include some added features that made it one of a kind. The original builder had:

- Combined the power supply chassis with the transmitter chassis, and constructed a wooden front panel the length of the combined chassis.
- Installed a 100 mA meter in place of the 60 mA dial lamp that was used as a tuning indicator in the original circuit.
- Installed a CW key jack on the front panel.
- Provided a line switch, a high voltage switch and a meter bypass switch.

Figure 1—The two-tube transmitter as received.

Certain features of the transmitter helped determine that the build date was the late 1940s or early 1950s. Those features included:

- Aerovox type *GL* electrolytic capacitors, with their vintage black and gold labels.
- A metallic-gray Duco paint finish on the chassis and front panel as was suggested in the original 1948 article.
- A Barker & Williamson (B&W) type JEL80 plug-in coil. (B&W was the plug-in coil of choice in the 1940s and '50s.—*Ed.*)
- The exclusive use of old-style mica high-voltage transmitting capacitors under the chassis.

A Restoration Plan

A plan for restoration was needed. I decided that the finished transmitter should have the following characteristics. It should:

- Be fully operable on the air.
- Be *safe* to operate.
- Emit a clean signal equal to current transmitter standards.
- Employ new components, especially where reliability or safety would be enhanced.
- Keep its original appearance as much as possible.
- Be neat, have a good parts layout and be carefully wired. In other words, it should look like the "work of art" that I remembered.

On the Road to Recovery

The transmitter chassis included a loose socket holding a type VR150 (0D3) vacuum tube voltage regulator (VR) which was attached to the circuit with a long set of wires. It was removed, as the original circuit didn't use a VR tube.

Many of the components and wires hung unconnected. There was evidence

Figure 2—A rear view of the restored transmitter. Note that the power supply is common to the transmitter chassis.

Figure 3—The front panel. The milliammeter, key jack and power supply switches were modifications by the original builder.

of cold solder joints. Because the chassis was wood, the original circuit called for a 14-gauge bare ground wire running the length of the chassis. The ground wire in this example of the transmitter appeared to be undersized.

The original sockets were ceramic with silver-plated pins. Many of the wires to these socket pins were simply tacked on and they fell off with minimal heat. It looked like resoldering of most of the connections would be in order. The crystal socket was missing.

It was discovered that most of the mica capacitors were of the wrong value (and wrong type) as compared to the original schematic.

Because of these problems all of the capacitors, resistors and many of the wires, including the ground wire, were removed. Resistors and capacitors of correct value and type were tagged for reuse in the transmitter. A rear view of the transmitter after restoration can be seen in Figure 2, with a view of the front panel in Figure 3.

One Step at a Time—The Power Supply

High voltage transformers are expensive to replace. I decided to rebuild and test the power supply section first. If it worked, the transmitter section would follow.

A continuity check of the transformer windings was made. The filament windings (both the 5 V ac winding for the rectifier tube and the 6.3 V ac winding for the other tubes) showed continuity and very low resistance. The high voltage windings read slightly higher resistance, with continuity between both legs and the center tap winding. A new ground wire bus was run the length of the chassis. Terminal strips were installed for mounting new electrolytic capacitors. The original electrolytic "cans" were removed from the circuit but left in place for the "classic" look they added to the transmitter.

The B+ circuit consisted of a pi-section filter using two 16 µF, 475 V dc capacitors and a 10 H filter choke. These were followed by a 20 kΩ, 10 W, wirewound bleeder resistor. An ohmmeter check of the choke showed continuity and the bleeder resistor value was correct. After rewiring the power supply, the circuit was rechecked against the schematic. The type-80 rectifier tube was placed in its socket. A voltmeter, set on the 500 V dc scale, was connected between the high voltage end of the bleeder resistor and ground. The initial test would be *hands off!*

Starting Up the Power Supply

Since this transmitter had an ac power switch and a high voltage (center-tap to ground) switch, I plugged in the line cord, turned on the power, and watched the rectifier tube come to life. After the tube filament warmed up, the high voltage was turned on. The voltmeter indicated almost 450 V dc on the newly rebuilt circuit. All seemed well with the power supply. When the high voltage switch was turned off, the high voltage quickly bled off as indicated on the voltmeter (*never* operate high voltage power supplies without a bleeder resistor and *never* assume that filter capacitors are discharged). The power supply was now up and running. (The original bleeder resistor ran quite warm and was replaced with a 50 kΩ, 25 W version. The power supply was tested again and the high voltage still dropped to zero within seconds of shutdown and the new resistor ran much cooler.)

Transmitter Restoration—The Parts

Parts for the transmitter were collected. Where the original circuit called for paper capacitors, new tubular metal-film capacitors with a 630 V dc rating were ordered.[1] The same source stocks silver mica capacitors and a wonderful supply of parts for radio restoration. Fair Radio Sales[2] is also a good source for wirewound resistors as well as mica capacitors, both NOS (new old stock) and surplus. The 6V6GT and 6L6GT tubes were checked and found good.

Rewiring

After the parts were collected, the circuit was reassembled. A crystal socket was installed. Wiring began at the crystal and worked towards the output circuit. I made a rough sketch of the circuit as the components were added and used an ohmmeter as a continuity checker to ensure that parts actually did connect from "point A" to "point B." Parts should wrap around the junctions where they are terminated; I didn't depend on solder for strength and I used good soldering technique.

A look at the underside photo in the original article showed that the parts were arranged in a neat and orderly fashion. This practice is acceptable for 80 and 40 meter circuits, but shorter and more direct lead lengths and paths are more important as the wavelengths become smaller and the frequencies higher. It is always good practice to follow the original layout and design in construction technique.

[1]Notes appear on page 35.

The filament wires were checked and found to be in good condition, including some old rubber tape used to make splices. Where possible, the old cotton-covered wire was left intact. After the wiring was completed, the work was laid aside for another day, ready for a fresh look that might disclose additional problems. A close-up of the new underchassis wiring can be seen in Figure 4.

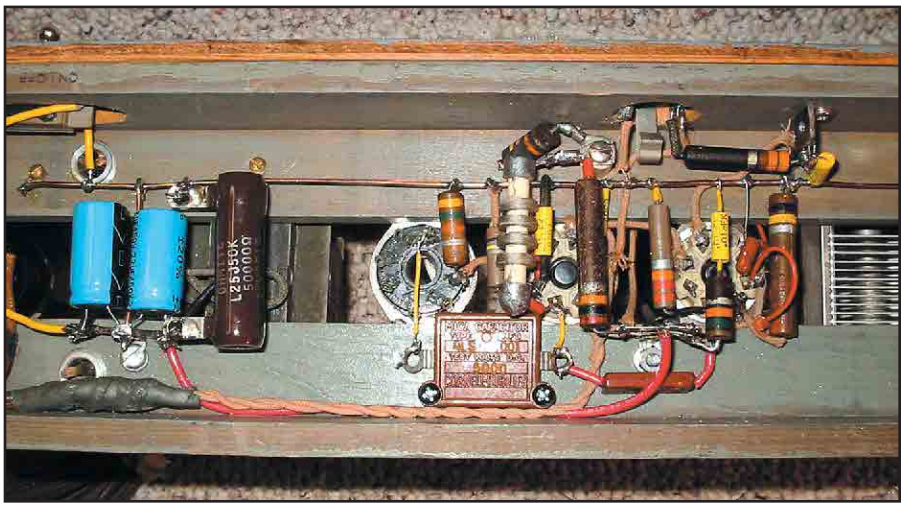

Figure 4—A close-up of the below-chassis wiring. Transmitter wiring closely follows the original 1948 article in *The Radio Amateur's Handbook*.

Transmitter Testing

The final inspection of the reworked transmitter took place with a clean bench, lots of light, and the indispensable ohmmeter. Tracing the circuit components and looking for unsoldered or poorly soldered connections, solder bridges or other shorts would help ensure a successful start-up. A final check of the high voltage wiring with an ohmmeter should show a resistance to ground of a minimum of 10 kΩ or more, depending on the value of the bleeder resistor. A lower resistance may mean a B+ short and a higher resistance could mean the bleeder resistor isn't in the circuit. In either case, the problem must be resolved before proceeding.

Everything checked okay and a 20-25 W light bulb was connected as a dummy load between the ANTENNA post and chassis "ground." The tubes, plug-in coil and a crystal were installed. The station receiver was tuned to the crystal frequency and a straight key was plugged into the front panel jack. As was done in the power supply test, a voltmeter set to the 500 V dc scale was hooked up between high voltage and chassis ground.

With the meter switched in-circuit and the high voltage switch off, the unit was plugged in and power turned on. The tubes began to glow immediately. After warm-up, the high voltage switch was turned on. The voltmeter indicated almost 450 V dc. The type 80 tube didn't show any plate color (red plates are an indication of shorts) and it was not overheating, a good sign.

The key was closed momentarily and immediately the transmitter carrier was heard in the station receiver. The milliammeter moved up to about three-quarter scale and the high voltage dropped to just below 400 V dc, as current began to flow. I followed the tune-up procedure outlined in the original article and, within seconds, the light bulb dummy load was glowing quite brightly. Transmitter restoration was a "glowing" success!

The tube characteristic charts for a 6L6 show that, as a Class C amplifier, output can be expected to be 11 W for a plate voltage of 325 V dc and a plate current of 70 mA. The RF input power is the final tube plate current times the plate voltage. A plate voltage of 325 V dc and a plate current of 70 mA results in an input power of about 22 W. The ratio of the input and output powers, expressed as a percentage, is the efficiency of the circuit (in this case, 50%). Part of that lost energy is heat and light—it's one of the attractions of vintage tube equipment (Although we would have to factor filament power into the efficiency equation if we also consider light!)

An On-the-Air Test

On a nice Sunday afternoon, a 3706 kHz crystal was plugged into the crystal socket. The station antenna was tuned to a low SWR at frequency, using an MFJ 259B analyzer and a tuner. The transmitter was then fed through a low pass filter to the antenna tuner and antenna and the transmitter was tuned for maximum output. The initial test transmission would be monitored on a Realistic DX-150A receiver with 10 feet of wire strung in the basement. The receiver rf gain would control receive level between transmit and receive. After a quick "CQ," the receiver gain was turned up. No stations were heard anywhere near the calling frequency. Let's try again. A second call was made and N4ACF could be heard returning my call! Ralph is located in Mooresville, North Carolina. He reported my signal as RST 559—not bad for less than 10 W on the 80 meter band in daytime. N4ACF further reported there were no key clicks or chirps present on the signal. That little transmitter could be heard again and now had a "new lease on life"!

Future Plans

There are several things that would improve the safety and operational quality of the transmitter. A "cage" of perforated metal around the chassis would prevent access to high voltage during operation. An antenna relay between the transmitter and receiver would allow dual use of one antenna. Further operation of the transmitter on both 40 and 20 meters is contemplated, as these frequencies were available in the original design. Some labeling would help to dress up the front panel.

It would be great to find a home for my project in some Amateur Radio museum. If that doesn't happen, listen for me this New Year's Eve during Straight Key Night—I'll actually be using this wonderful piece of Amateur Radio history on the air.

Notes

[1]Antique Electronic Supply, 6221 S Maple Ave, Tempe, AZ 85283; tel 480-820-5411; **www.tubesandmore.com**.

[2]Fair Radio Sales Co, 2395 St Johns Rd, PO Box 1105, Lima, OH 45802; tel 419-227-6573; **www.fairradio.com**.

All photos by the author.

Glenn Brown, W8JZI, made his first contact as a new Novice licensee in April of 1952 and he earned his General ticket about a year later. He ran a commercial two-way radio business from 1971-1984 and was also a Communications Technician with the Columbus, Ohio Division of Public Safety. Glenn has two years of engineering at Ohio State University and an Associate's degree in business from Franklin University, Columbus, Ohio. He's enjoyed building his own gear for many years, including both low power and high power transmitters. He can be contacted at 35122 State Rte 31, Mount Victory, OH 43340; **w8jzi@arrl.net**.

By Mark Spencer, WA8SME

Remote Your Morse Key Using an RF Link

Too much clutter on the operating desk and tied to a key line? Get "detached" with a wireless wireless key.

"Wireless communication technology sure has advanced lately. The capabilities are improving and prices are falling."

"Yes…and your point is?" my wife asks suspiciously in response to my latest solitude in the shack.

"I'm working on remoting my key. I've always wanted to connect my Morse key remotely so that I don't have the cable between the key and the rig. It will allow me to move the key around the operating table to make it easier to operate and I won't have the tangled cable cluttering up my shack."

"Yeah, right!" she retorts in disbelief as she surveys the accumulation of clutter and wires in the shack that she long ago learned is one of those unchangeable situations that is better left unaddressed.

The Solution

What follows is a description of a simple circuit that will allow you to connect your Morse key to the rig remotely via an RF link. This link will allow you to move the key around the shack for operating comfort without concern for an interconnecting cable that is usually too long or too short or gets in the way. Additionally, you may find other applications for this technology.

Wireless technology has truly made amazing strides recently. The foundation of this project is a set of transmitter/receiver modules from Parallax, Inc.[1] These small modules use surface mount technology to produce a very low-power digital RF link on a frequency of about 433 MHz (yes, it's on a ham band, but as an unlicensed Part 15 device) with a range up to 300 feet using integrated 1/4 wave vertical antennas. The modules are designed for experimental purposes only and are not approved by the FCC for inclusion in a finished commercial product. One of the benefits of ham radio is that experimenting is supported and encouraged by the FCC.

Circuit and Construction

As illustrated in the schematic of Figure 1, connections to the modules are very simple. They consist of +5 V dc (V_{cc}), ground and data input and output connections. The modules are designed to accept digital data with baud rates between 600 and 2400 baud. In this application, however, I'm using them at much lower data rates without difficulty (CW keying). A "high" on the transmitter data (TXD) line as transmitted to the receiver produces a corresponding "high" on the re-

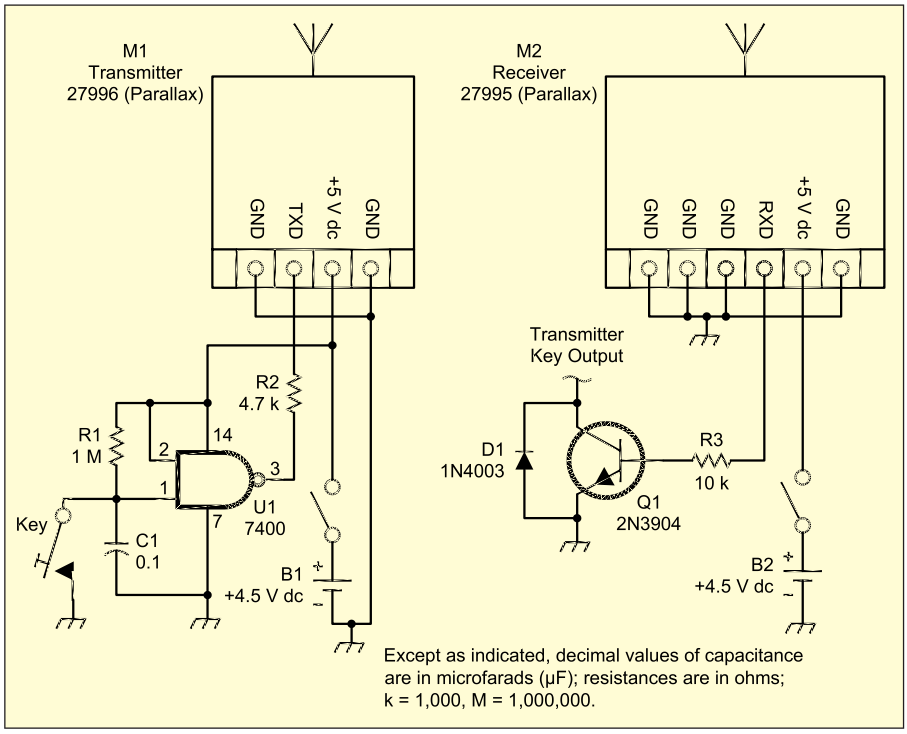

Figure 1—The schematic and parts list for the RF linked wireless key. Supplementary parts are available from Mouser Electronics (www.mouser.com), Ocean State Electronics (www.oselectronics.com), Digi-Key (www.digikey.com) or RadioShack (www.radioshack.com).

B1, B2—4.5 V battery pack (3 AA cells in RadioShack 270-409 holder).
C1—0.1 µF capacitor (RadioShack 272-135 or 272-1069).
D1—1N4003 diode (RadioShack 276-1102).
M1—Transmitter module, Parallax 27996 (see text).
M2—Receiver module, Parallax 27995 (see text).
Q1—Transistor, 2N3904 or MPS3904 (RadioShack 276-2016).
R1—Resistor, 1 MΩ, 1/4 W.
R2—Resistor, 4.7 kΩ, 1/4 W.
R3—Resistor, 10 kΩ, 1/4 W.
U1—SN7400N NAND gate.

[1]Notes appear on page 37.

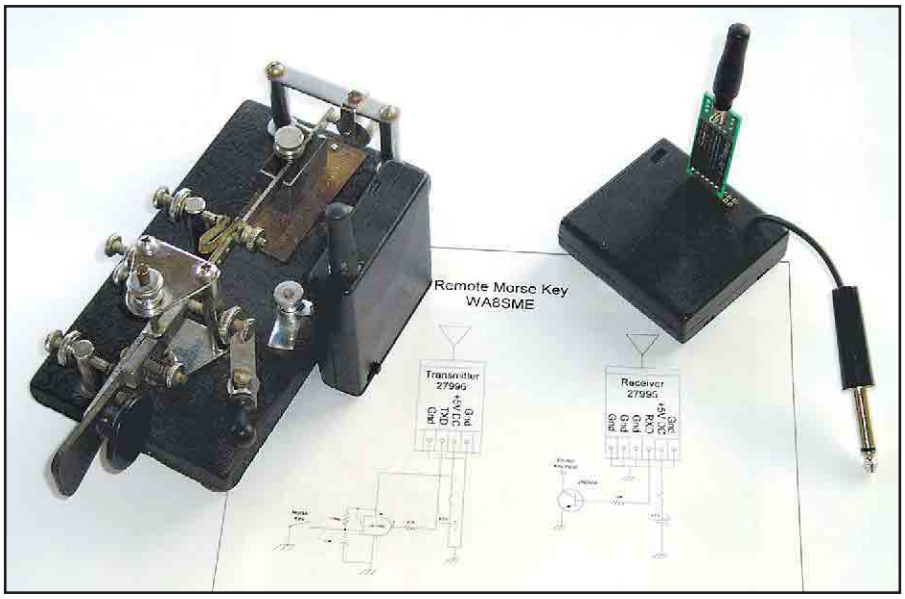

Figure 2—The completed remote key RF link transmitter and receiver packages. The transmitter is mounted on a 1943 US Army Signal Corps "bug" produced by Vibroplex.

ceiver data (RXD) line. The Morse key switches the voltage on the TXD line and the RXD line drives a keying transistor that actually keys the rig. That's all there is to it.

The transmitter and receiver modules are mounted in RadioShack AA Battery Holders.[2] Three AA batteries (4.5 V dc) are used as the power source and the open bay is used to hold the components of the circuit. The transmitter module is small enough to be mounted inside the battery holder. The 7400 NAND gate is epoxy-glued to the transmitter module on its back, in "dead-bug" fashion, and the resistor and capacitor components are soldered directly to the exposed pins. The receiver module is a little larger than the transmitter and therefore is mounted on the outside of the battery holder through a small socket epoxy-glued to the case. Figure 2 shows the transmitter mounted to the key next to the receiver and Figure 3 is a close-up view of the transmitter module with interface.

I like to slow down my "bugs" so that the sending speed is more comfortable and matches my operating taste. Semiautomatic keys tend to have a minimum designed speed of 18 to 20 wpm. It is easy to slow down these keys by adding weight to the dot spring mechanism. It's been my experience, however, that when additional weight is added, the dot switch contacts become scratchy and do not always send crisp code elements. I added a simple de-bounce circuit to the link to improve or reduce this scratchiness. A 7400 NAND gate with an RC circuit on the key input provides some de-bounce of the bug contacts. The NAND gate also inverts the key switched voltage to the proper polarity for keying the transmitter module.

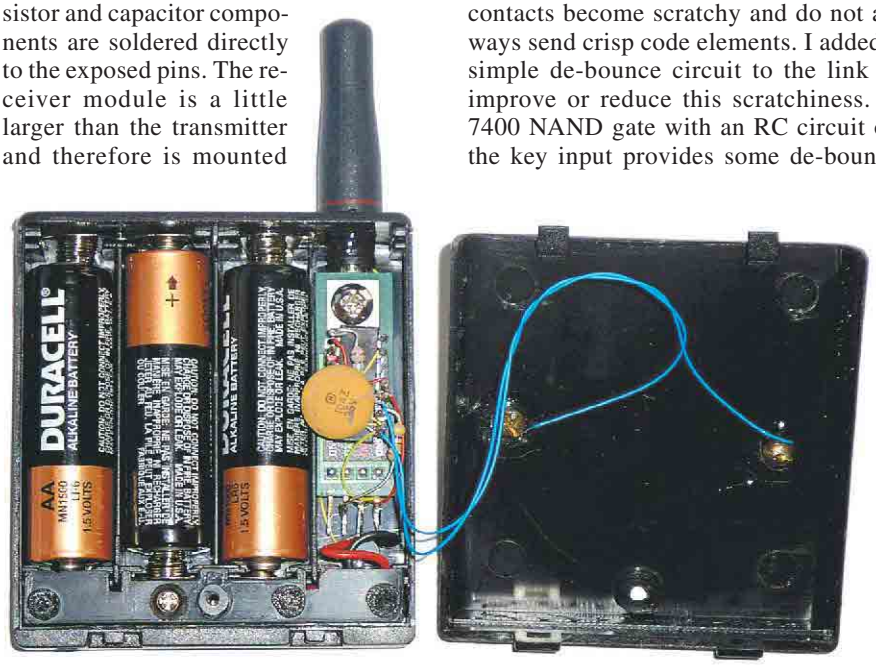

Figure 3—Inside the transmitter package. The Parallax 27996 RF transmitter module can be seen to the right of the battery holder. The 7400 NAND gate is mounted "dead bug" fashion and components are soldered to the exposed IC pins.

I am keying a Kenwood TS-930S with this link. The keying circuit of the rig operates at 12 V dc. A keying transistor is thus required between the link and the transceiver. The output RXD line of the receive module causes the 2N3904 keying transistor to conduct and essentially shorts the key line of the rig to ground to key the transmitter. This circuit can be easily modified to suit your unique equipment and operating conditions. Without modification, this link should work with most keys: straight, semiautomatic or electronic. The keying transistor may need to be modified to handle the voltage and current requirements of your rig.

The circuit will key most modern solid-state transceivers with low voltage positive key lines. If your transmitter uses opposite keying polarity, grid-block keying or cathode keying you'll need a suitable keying transistor, configured appropriately. Alternatively, a small 5 V dc reed relay (RadioShack 275-232) can be placed in series with the key output (Q1 collector) and the battery. The relay can then be used to key the transmitter. A 0.01 μF capacitor should be placed across the relay contacts.

The link has been operating flawlessly for some time now. I have not detected any corruption of my fist as a result of having the link in line between my key and the rig. I hope this project will stimulate you to experiment with other applications of wireless technology around your shack.

Notes

[1]Parallax type 27995 receiver; 27996 transmitter. Available from Parallax Inc, Ste 100, 599 Menlo Dr, Rocklin, CA 95765; tel 916-624-8333; **www.parallax.com**.

[2]RadioShack 270-409 (**www.radioshack.com**).

All photos by the author.

Mark Spencer, WA8SME, was first licensed in 1965. He's also held the calls G5EPV, DA1OY and HL9AW. Mark has a BSE in Metallurgical Engineering from the University of Michigan and an MA in Communications from the University of Northern Colorado. He retired from the US Air Force after an extensive flying career in T-38, B-52, TR-1 and U-2 aircraft and is a decorated combat veteran of Desert Storm. Mark has taught high school mathematics, computer programming, physical science and physics, and has been an elementary and high school administrator. Currently ARRL Education and Technology Program Coordinator, Mark can be contacted at **mspencer@arrl.org**.

By Srecko (Fex) Moric, YU1DX

Baker Island, K1B—Crabs, Seabirds and Radio

It's hard to find a more remote speck of land than Baker Island. That's one of the reasons it hadn't been activated until a multinational group of hams decided to brave the crabs, sun and wind to set up what became a record-breaking effort.

This is the story of 12 ham radio enthusiasts from 7 different countries who came together around the same idea: To be the first on the air from one of the most remote places on the planet—Baker Island, an uninhabited and inhospitable US territory in the middle of the Pacific.

While operating K1B, the 12 of us lived and breathed as one. It was not important who was who and where one came from or what language one spoke. We trusted each other and acted as one. The driving force was our inexhaustible passion for the greatest hobby in the world: ham radio.

Our DXpedition adventure was extreme and very dangerous and pushed us to the limit, but we not only made it, we made happy tens of thousands of radio enthusiasts all over the planet, from well over 200 countries. In total, we made 95,127 QSOs on all HF bands and all modes, setting a new world record for the number of contacts in one DXpedition.

The Adventure Begins

After our first DXpedition to Conway Reef, which ended in March 2001, and the more successful one in October 2001 (3D2CI/3D2CY), the decision was made to make the new DXpedition in May 2002 to Baker Island.

Why did we decide to go to Baker? Well, it was at fourth place on the list of most wanted countries, and more importantly because there never had been any activity from there. Many amateurs already had the country credit for DXCC, together with nearby Howland Island, which has been visited by numerous DXpeditions.

After two mid-Pacific DXpeditions in 2001, it was much easier to plan another one in the same (generally speaking) region. We felt like experienced "sailors" and highly skilled "DXpeditioners." The plan was very simple—each of us with his part of equipment would show up at Los Angeles International Airport on April 20. From there we were planning to go to Fiji, and eventually to make the last hop, from Fiji to Baker.

Actually, we had planned to split into two groups. The first was to fly directly to Funafuti, Tuvalu (T2) and operate from there for three days, while the second, with most of the equipment, was planning to sail onboard the rented ship *Princess II*, aim-

Figure 1—The west coast of desolate Baker Island comes into view.

ing to join the first group and eventually make the trip to Baker Island.

On the Way to LA

In Budapest, the first stop from Belgrade for Hrane, YT1AD, Miki, YU1AU and Fex, YU1DX, we checked eight pieces of luggage and carried on three laptops. We were lucky that we did not need to carry transceivers, since Dave Anderson, KW4DA (now K4SV), a member of our team, had arranged for six brand new IC-756PROII transceivers donated by ICOM America to be delivered directly to Funafuti, our last stop before Baker Island.

Two more members joined us in Frankfurt, our next stop: Andy Fedorov, RW3AH (also 9XØA/WL7AP), and Harry Booklan, RA3AUU (VKØIR DXpedition member). Andy arrived from Pristina (YU8), where he works as a telecommunications engineer, while Harry arrived directly from Moscow.

Exactly half of our team was now assembled.

The flight to Los Angeles was pretty smooth. We were welcomed by KW4DA and Doug Faunt, N6TQS, and two more who will go with us to Baker Island: Doug Forsell, a US Fish and Wildlife Service official, and Jordan Naydanov, co-owner of the ACOM Co, which donated linear amplifiers for our DXpedition. He will be the cameraman and have the helper's role.

A couple of hours later, three more team members arrived at LAX. Roman Thomas, RZ3AA, arrived directly from Moscow, while Mario Miletic, S56A, and Vlada, ZS6MG, arrived via London. The last team member, Sasha Maksimov, LY3NUM, was expected to join us in Fiji.

With a couple of hours left before our flight to Fiji, Hrane, YT1AD, had earlier arranged for all of us who did not have US ham radio licenses or who wanted to upgrade to take the necessary exams. The reason was the rule that no non-US licensed operators can operate from US possessions. Wil, K6ND, KW4DA and N6TQS acted as the Volunteer Examiner team. Wil arrived with all necessary materials for the exam: Application forms, tests and even the tape player for the CW test. For the next couple of hours, one of the airport offices was converted into a classroom. The VEs did not need too much time to check our results, using plastic templates, and soon announced that we had all passed the exams we had applied for.

Immediately after the test we received the CSCE (Certificate of Successful Completion of Examination), authorizing us to operate from US possessions, while the call signs will be issued after the exam results are sent to the FCC for processing. Wil promised that we would receive the call signs on our return trip to Dayton in a few weeks. The promise was kept, and newly licensed operators were Mome, Z32ZM=KG6KZJ, Miki, YU1AU=KG6KZK, Fex, YU1DX=KG6KZL, and Jordan, KD7RDC.

Fiji, for the Third Time in 18 Months

The flight to Nadi, on southern Fiji island Vitu Levu, was smooth, and we arrived there April 22 at 0240 local Fiji time (UTC +13). On the way, we crossed the Equator and the Date Line. For Hrane and myself, the only two operators on the two previous Conway Reef DXpeditions, this was the third visit in 18 months. Our numerous bags had all arrived down to the last piece, contrary to the two previous DXpeditions to the area.

Arriving at Nadi, Hrane learned that the last member of our team, Sasha, LY3NUM, had already been quarantined for two days in the airport building. He had arrived from Tokyo, and was traveling with a Lithuanian passport, for which a Fiji visa is required. Although it was early Sunday morning on Fiji, Hrane arranged guarantee from Suva, the capital, and Sasha finally joined the team two hours later.

Now that we were all together, the equipment and the team were split into two. The first group—Hrane, Roman, Harry, Andy, Dave and Jordan—left for Suva for a connecting flight to Funafuti, Tuvalu. They were to wait there for the rest of the team, which was to arrive by ship. The second group—Miki, myself, Mome, Vlada, Mario, Doug, Sasha and Doug Forsel—were to leave for Savusavu, on the northern Fiji Island Vanua Levu, where the ship *Princess II* was ready for our embarkation.

Heeding the Ecologist

The main reason for our visit to town was to go shopping. We were looking for a brand new set of sandals. They had to be new and never used before. We also needed detergent for washing and rubbing

Figure 2—Setting up the first base—the USA camp.

Figure 3—Two members of the group reinstall the 160 meter vertical after a storm.

of our antennas, towers, cables, wires and even tables and chairs. Doug Forsel had explained to us earlier that this is the standard procedure recommended by USFWS. Baker Island is a National Wildlife Refuge, a natural habitat for wild animals, and no one may interfere with, or damage, anything on the island. The new sandals and the equipment cleaning were to prevent any possible contagious disease that we may bring from the outside world. Doug Forsel also asked us not to make any rapid movements on the island, to avoid making crabs or birds "nervous." If anything wrong happens, he has full authorization of the US Government to terminate the DXpedition at any point he deems it necessary.

The Voyage Begins

In the lounge of the *Princess II*, Captain Selvyn officially introduced his crew members and told us what we needed to know about life on the vessel during a week-long trip. The first and only stop will be Funafuti, where the rest of the team was about to complete their short-lived T2 operation.

Mome and Doug installed a 2 element 50 MHz beam and the IC-706 in the Captain's bridge, just to let everyone know we were there. Needless to say, our daily menu was heavily dependent on the fish catch-of-the day.

On the second and third day, Mome spent most of time working on 50 MHz, mostly with JA and VK stations. I was using the ship's radiotelephone to operate 20 and 40 meters, signing YU1DX/mm, and made lots of contacts with VK, ZL, US and other Pacific stations. Several QSOs I remember very well: PY7HW/mm was also aboard a ship, but in another ocean, the Indian Ocean, halfway between Perth and Johannesburg; VK3WF and VK2ACC (ex-4N4ED), both originally from the Former Yugoslavia, as well as Dragan, VE3FF, from Toronto. I even had a QSO with WH7Y, who was driving her car on Hawaii.

During the second and third day of our trip we heard the other part of our team operating from T2. They were operating in pileup fashion from the hotel room in Funafuti, on the higher HF bands.

Funafuti, Republic of Tuvalu

The Republic of Tuvalu comprises about 10 islands, shaped in the form of an irregular horseshoe, with a lagoon in the middle having an average depth between 20 and 30 meters. The biggest of the islands has the same name as the capital city Funafuti, which is about 6 km long, and 50 to several hundred meters wide. The population of the country is 12,000, with 4000 on Funafuti Island—the most densely populated island in the Pacific.

Meanwhile, our T2 team loaded the six new ICOM IC-756PROII transceivers. We also received two Ameritron AL-811 linears.

Heading for Baker

It was late afternoon on Funafuti, April 25. Finally, we were all aboard: 12 hams, 1 cameraman, 7 crew members and 1 ecologist. All reservoirs were tanked (water and gas), all equipment properly tied up, and at 1705 we left Funafuti in the direction of Baker Island.

At 0700, the navigational instruments in the captain's bridge showed that we were exactly 871 nautical miles from Baker Island, and were traveling at only 9.5 knots. We used this time to make our preparations: loading the latest version of *CT* into our laptops, switching all linears from 110 V to 220 V ac, and cleaning our antennas, inside and out, to satisfy Doug Forsel.

The Landing Plan

The first group to land, using a small Zodiac, will include Hrane and Doug Forsel, who will locate the place for our first temporary camp. This camp will be used to shelter the equipment—and people in case of bad weather. A 4.5 kW gas generator, two beams and two transceivers will be set up in the shortest possible time to allow us to start the operation as soon as possible. The unloading will continue until the first camp is completed.

After completion of the temporary camp, we will proceed with setting up three more permanent camps: American, Serbian and Russian. They will be sufficiently separated so that with a number of filters for all bands it should be possible to have six stations operating at any time without mutual interference.

My job was to prepare rope with our flags, which will be fixed on two antenna towers. On one there will be flags of Serbia, Macedonia, USA, Russia, South Africa, Slovenia and Lithuania, and on the other the flags of our major donors, NCDXF, ICOM, Heil and ACOM.

History in the Making

In Belgrade, it was 0300 Saturday,

About Baker Island

The following facts about Baker Island were taken from *The World Factbook* (**www.cia.gov/cia/publications/factbook/**).

The US took possession of the island in 1857, and its guano deposits were mined by US and British companies during the second half of the 19th century. In 1935, a short-lived attempt at colonization was begun on this island—as well as on nearby Howland Island—but was disrupted by World War II and thereafter abandoned. Presently the island is a National Wildlife Refuge run by the US Department of the Interior; a day beacon is situated near the middle of the west coast.

American civilians evacuated in 1942 after Japanese air and naval attacks during World War II; occupied by US military during World War II, but abandoned after the war; public entry is by special-use permit from US Fish and Wildlife Service only, and generally restricted to scientists and educators; a cemetery and remnants of structures from early settlement are located near the middle of the west coast; visited annually by US Fish and Wildlife Service.

The island is treeless, sparse, and scattered vegetation consisting of grasses, prostrate vines, and low growing shrubs; primarily a nesting, roosting and foraging habitat for seabirds, shorebirds and marine wildlife.

The Baker-Howland region was in the spotlight in 1937 during the mysterious disappearance of Amelia Earhart, the famous pilot. See the full story at **www.ellensplace.net/ae_lflt.html**.

Island data relevant to ham radio activity:

Zone: WAZ-31 ITU-61	QTH Locator: AJ10rf
IOTA: OC-089	Coordinates: 0° 13´ N, 176° 31´ W

April 27, when we saw the white little dot in the distance (see Figure 1). Onboard the *Princess II*, it was still 1400 Friday, time for our final approach. In effect, the expedition arrived one day earlier than planned.

Lots of things were on our minds: Would we really be the first to make it, and fulfill our, as well as other people's, dreams? Would we really be the first to make happen what others had only dreamt about for decades? What have we all gone through, and what distance did we travel by plane, by car, by boat, to find ourselves dead tired somewhere in the middle of the Pacific, almost on the Equator, and almost half the planet from home.

The *Princess II* reduced its speed approaching Baker Island. Twenty minutes later, we were able to see the lighthouse on the island, and five tiny towers. Doug Forsel explained that those towers, built back in 1943, were designed to assist landing on the small runway that was operational at that time.

At 1500 the anchor was dropped from the bow of the ship, unwinding the long chain. We were anchored about 100 meters from the island in line with the lighthouse. The depth of the water was about 20 meters, and a welcoming committee of an enormous number of sharks was clearly visible. The wind was extremely strong, ideal for surfing, with temperatures well above 50ºC under the scorching sun.

The most difficult part of our journey was about to begin.

Almost a Tragedy

As per our plan, the first group of Baker Island Conquistadors arrived safely, and the small Zodiac returned to the ship. In the second round, Miki, YU1AU, traveled with the power generator and the gear for temporary camp. During the unloading, the incident happened that could have terminated the whole DXpedition.

"Surfing" size waves were sweeping the shore every 10 seconds. We all needed to be extra careful not to be swept away by those waves. After we unloaded the generator and the rest of the equipment, an enormous wave lifted the Zodiac 2 meters in the air. As it was about to fall on Hrane's shoulder—together with its 40 hp engine—Miki threw his famous tool box at the Zodiac, while placing his foot between Hrane and the blades of the Zodiac's engine.

We say "Luck Awards the Brave," and it was proven again. Miki was lucky to get "only" a minor foot injury, which gave him trouble during the entire DXpedition and a couple of months after returning home. Today, everything is okay with him and his foot.

The disembarkation of the remaining gear and people took place in the next two hours without incident, and the first temporary camp was set up on the sandy beach between the lighthouse and the shore. We assembled the shack under the tent, with two IC-756s and two beam antennas.

Soon after we showed up on the air, there were large pileups. We decided to "reinforce" this camp into a permanent one later that night. We also decided to put up the other two camps as soon as possible.

Next morning, on the blue colored west shore of Baker Island, the picture of amateur dreams became real with all three camps ready. Just a few meters away from the Pacific there were three blue tents, one for each camp, with associated verticals and beams. There were 10 towers altogether, two of which were special, with flags of all the countries from which the 12 member DXpedition had arrived.

Three power generators were howling continually, and on the scorching beach sand there were thousands of crabs, with their dark-orange bodies and white hulls. In the blue sky there were thousands of various "sea hunters" flying at different heights. The most outstanding was the frigate, a huge bird with a yellow beak and red balloon on its neck.

QRZ DE KILO ONE BAKER

The camps were 250 to 300 meters away from each other. There were a total of nine transceivers, with one 6 meter beacon, 10 towers, several dipoles and slopers for low bands, and three power generators with total power of 15.5 kW. The sidebar shows how the camps were divided.

In the first 30 hours of our operation there were already 15,000 QSOs in our log. There were always six stations on the air, on all modes and all bands. Although most of us had experienced at least one DXpedition of such proportions before, we had never seen such pileups. Each of us tried to achieve his own maximum, and as per the guest book on our Web site, we must have been close to this goal. The site was visited more than 70,000 times during the DXpedition, from all over the world, and many guests left their positive remarks about the DXpedition.

Each day on Baker Island was very demanding. There was a strong wind 24 hours a day, with temperatures under the gazebo close to 50ºC. Millions of crabs, particularly at night, did not allow a fraction of a second for sleep. They continually tried to bite you and see if you

Figure 4—The Serbian base sported two beams, a vertical and two inverted Vs for the low bands.

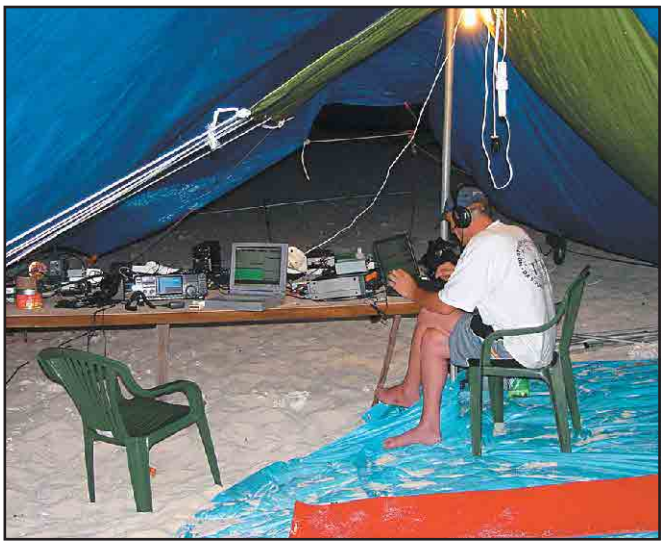

Figure 5—Miki, YU1AU, racks up late-night QSOs.

The Three Camps

American camp:

Operators: Dave, KW4DA; Doug, N6TQS; Mome, Z32ZM, and Mario, S56A
Rigs: 2 IC-756PROII, 3 laptop computers
Linears: 1 LA 400W
Antennas: 1 A3S beam, 1 MA5B beam, 1 5 el beam (10/18/24 MHz), 1 5 el beam (50 MHz), 1 GP (7 MHz), 1 dipole (3.5 MHz)
Power: Gas power generator 4.5 kW
Modes: RTTY/SSTV/PACKET/PSK + CW on 10/18/24 MHz

Serbian camp:

Operators: Hrane, YT1AD; Fex, YU1DX; Miki, YU1AU, and Vlada, ZS6MG
Rigs: 2 IC-756PROII, 1 TS-570D, 1 IC-706 (50 MHz + beacon), 2 laptops
Linears: 1 ACOM-1000, 1 AL-811
Antennas: 1 A3S beam (14/21/28 MHz), 1 MA5B beam (14/18/21/24/28 MHz), 1 5 el beam (50 MHz), 1 GP (3.5 MHz), 1 GP (7/10/14/18/21 MHz), 2 Inv V (3.5 and 7 MHz)
Power: Gas power generator 4.5 kW
Mode: CW

Russian camp:

Operators: Roman, RZ3AA; Harry, RA3AUU; Andy, RW3AH, and Sasha, LY3NUM
Rigs: 2 IC-756PROII, 1 FT-100; 3 laptops
Linears: 1 ACOM-1000, 1 AL-811
Antennas: 1 A3S beam (14/21/28 MHz), 1 MA5B beam (14/18/21/24/28 MHz), 1 GP (1.8/3.5/7 MHz), slopers (1.8 and 3.5 MHz)
Power: Diesel power generator 5.5 kW
Mode: SSB

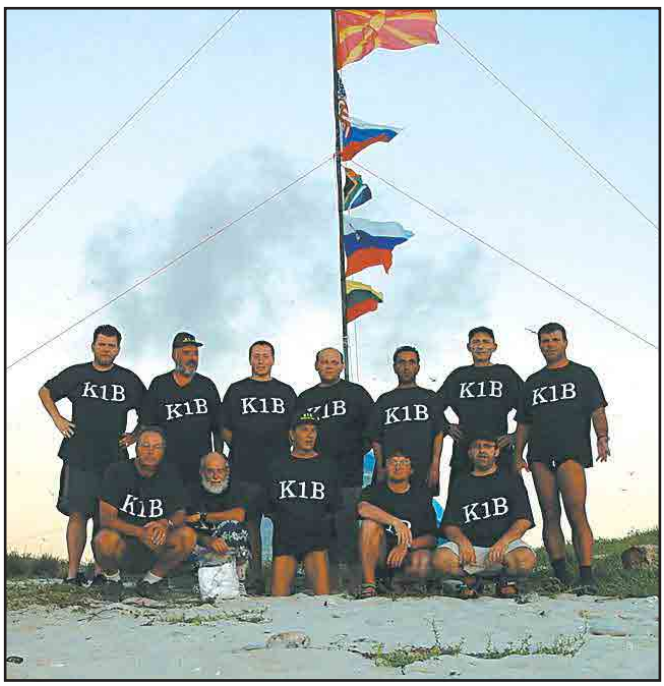

Figure 6—The K1B DXpedition group (standing—RZ3AA, S56A, RA3AUU, LY3NUM, Z32ZM, YU1AU and YT1AD; kneeling—KW4DA, N6TQS, YU1DX, RW3AH and ZS6MG) poses in front of the antenna mast with flags of each nation represented—Serbia, Macedonia, USA, Russia, South Africa, Slovenia and Lithuania.

matched their diet. The only way to stop them was to have a screened-in "cage" made of steel and lock yourself in during the entire operation.

The ship's crew brought us food, water and fuel twice a day. The menu was dependent on the fish catch of the day. On two occasions, due to high waves, the Zodiac was capsized and we had an unplanned "change in diet." The constant pileups made us forget these setbacks, however.

New World Record

Hour after hour, day after night, night after day, the QSO counter was going up and up, with the QSO rate no less than 300/hour. Starting the third day of operation there was a competition between three camps. Frequently we worked with two and very often three stations from each camp.

On the eighth day with 74,500 QSOs in the log, we were wondering if it was possible to set the new world record for a "bring everything to live and operate" DXpedition. We knew that the Campbell Island DXpedition (ZL9CI) had made 96,004 QSOs, and we had only 30 hours left to reach this record.

With that goal in mind, many OMs/YLs from all over the world encouraged us to continue working the pileups. This encouragement gave us an extra burst of energy to continue, and to forget all the obstacles and challenges we had overcome: American ham radio exams; rough seas; Zodiac and Miki's injured foot; drying and cleaning tools and spare parts from Miki's tool box recovered from the ocean; erecting antenna masts under the scorching sun on hot sand; fixing one linear and the Russian power generator; crabs that gave us daily troubles and nightly nightmares; the requirements of the ecologist; the unbearable heat and wind….

By the night of May 6-7, even before the final assembly of all the logs, it became obvious that we had become one of the top three DXpeditions with well above 95,000 QSOs.

Going Home

Finally, after completing this gigantic task, we were going home from Fiji to different parts of the globe. The most interesting was for those who were going home via Dayton. Several of us made a presentation at the ICOM booth, dressed in DXpedition T-shirts. Many visiting hams had the chance to talk to us directly and express their gratitude for our efforts. Behind us were crabs, seabirds and pileups.

On everyone's mind was the question: What's next?

This article was translated from Serbian by Nenad Stevanovic, VE3EXY.

Photos by the author.

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By Richard J. Thompson, Jr

"...And We Had Crystals"

The development of the thin wafers of quartz we now take for granted played a significant role in the Allied victory in World War II.

September 1943. The predawn traffic through Washington was light; the wartime capital had yet to stir. Virgil Bottom, who a few months earlier had been teaching physics at Colorado A&M University, now found himself a civilian employee of the US Army. No one had to tell him the importance of his "mission" that morning. He knew the contents of the crate in his trunk were needed desperately by the Army Air Corps in England. Arriving at Bolling Air Field just as the sun rose above the horizon, he drove directly out to the tarmac where a cargo plane was waiting, engines running. Seconds later the plane roared down the runway beginning a long and arduous trip toward the "front."

As a member of the US Army Signal Corps' "Quartz Crystal Section," Bottom knew how critical dependable radio communications were to the highly mobile military units currently scattered across the globe. Due to his decades-long interest in radio electronics, he was also aware of the secret to the success or failure of radio communications: the tiny slivers of quartz crystal that formed the heartbeat of the electronics. Quartz crystal units, such as those he had just helped on their way to England, were the single most important component of the transmitters and receivers to which men were currently trusting their lives. To paraphrase a Signal Corps officer: Without crystals, there was radio; with crystals, there was communications.

Perhaps the most important component of a radio transmitter or receiver is the "filter circuit," which determines the frequency on which the radio operates. Early radio technology depended on various combinations of coils and capacitors for frequency control. This was fine in theory, though not a terribly robust system in practice (being susceptible to changes in temperature, humidity and physical handling). In fact, the armored branch of the Army argued in 1939 that it was "practically impossible" to tune such sets while vehicles were in motion. By far the best system of frequency control utilized the piezoelectric properties of quartz. Being a natural oscillator itself, the inclusion of a thin wafer of quartz into a radio circuit made for an extremely stable frequency filter (see Figure 1).

The civilian market turned to crystal control during the late 1920s. Individual radio hobbyists bought crystal units when they could and, more often, ground their own in basement workshops. The military, however, plodded on with its outdated technology for more than a decade. In mid 1940, field maneuvers showed radio sets utilizing crystal control to be vastly superior in their performance to those without. In spite of well founded fears as to the ability of the handful of crystal manufacturers to supply the needed quantities of units, the military decided to switch all military radio equipment to crystal control.

The Quartz Crystal Section is Formed

The prewar military planners realized that the need for crystal oscillators would increase sharply in the years to come, and that the crystal industry would need help in overcoming the "virtually insurmountable problem" of meeting those needs. Ultimately, the Quartz Crystal Section (QCS) was formed in March 1942 with responsibility to collect, collate and then distribute the available information on crystal oscillator science, engineering and production. Furthermore, they were tasked with developing machinery to mass produce the crystal units. To assist with this effort, a crystal laboratory group was formed at the Signal Corps General Development Laboratory in Fort Monmouth, New Jersey.

In order to staff this new section, the Signal Corps went looking for professionals with experience with quartz, especially in the use of crystal oscillators for radio circuits. The first men to answer the call were primarily PhD mineralogists such as Clifford Frondel of Harvard and Dick Stoiber of Dartmouth. Others were geologists such as Wally Richmond and Hugh Waesche. Ultimately, physicists such as Karl van Dyke of Wesleyan University and Virgil Bottom joined the group.

To assist the fledgling industry, information and equipment "pools" were created to serve as resources for manufacturers new to the field of crystal oscillators. The information pool consisted of technical data collected from manufacturers or gleaned by Signal Corps inspectors

Figure 1—A bar of cultured quartz alongside examples of the types of wafers that might be sawed from it. (The bar is 20.5 cm long and 2.5 cm thick; the blanks are only 0.35 mm thick.)

Figure 2—Examples of the types of holders used in crystal oscillator units.

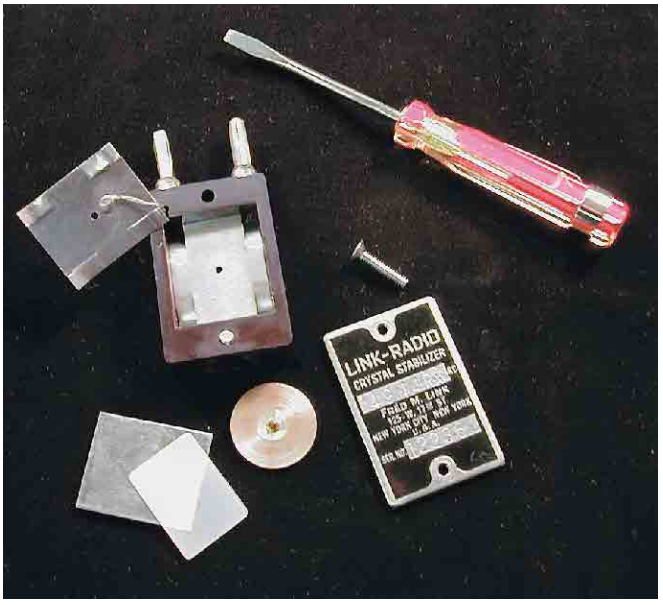


Figure 3—A common crystal unit shown disassembled. Notice the quartz wafer at bottom-center. The metal plates and disk serve as electrical contacts.

as they traveled the country. The equipment pool was an attempt by the Signal Corps to impose some sort of standardization of equipment and technique on the industry. The costs for this equipment pool (ultimately totaling $1.5 million) were underwritten by the Defense Supplies Corporation.

After the initial efforts at collecting information and developing machinery, the men of the QCS (and ultimately a few women inspectors) began to travel the country in two to three person teams acting as consultants and troubleshooters for the dozens of new manufacturers joining the industry. The work of these men paid impressive dividends in the vastly increased production of crystal oscillator units; production numbers and product quality that not only met the requirements of the Signal Corps, but regularly exceeded them. By war's end, the industry was producing on average 2.5 million units per *month* (compared to the prewar level of 100,000 per *year*).

Government and Industry Respond to Crystal Shortages

The only known source of "radio grade" quartz was Brazil. Even before Pearl Harbor, the US government worked busily with the Brazilian government to reserve all of the raw quartz for the Allies. By June of 1941, the US Government had managed to secure the rights to purchase essentially the entire output of Brazil's quartz mining industry. The Brazilian quartz mining operations, however, were far from being well developed. In fact, a large fraction of the crystals eventually sold in Rio de Janeiro were collected by hand by local villagers looking to trade them to merchants for supplies. Dick Stoiber traveled to Brazil to see what could be done about improving the mining situation. His recommendations for mechanized mining equipment were followed, though the remoteness of the mining regions, lack of roads and shortage of fuel for the equipment conspired to work against any real improvement in the situation.

As the Quartz Crystal Section began to get organized, farsighted men within the industry such as Paul Galvin, founder of the Galvin Manufacturing Corporation (now Motorola) also sprang into action. Galvin, being one of the larger radio manufacturers, found itself inundated early on with orders from the Signal Corps. Realizing that the orders far outpaced his company's ability to acquire crystal oscillators, he hit upon the idea of creating a network of subcontractors. This network enabled a great many manufacturers to enter the crystal industry. Some companies, such as the Goodall Manufacturing Company of Ogallala, Nebraska, had previously made electronics products. Others that had previously produced such "nonessential" consumer goods as lampshades or refrigerated display cases took out loans from the Reconstruction Finance Corporation and contracts from Galvin, retooled their factories and went to work making crystals. The fabled ingenuity of American small business was never in evidence more so than in the quartz crystal field. Many of these new crystal manufacturers were able to contribute quickly to the rest of the industry by developing new machines or production techniques.

Perhaps the advance that did the most to alleviate the shortage of usable quartz was the development of techniques for sawing blanks from small pieces of raw quartz. Initially, crystals smaller than 500 grams were considered too small to be of use and were rejected by inspectors. Industry and government labs carried out simultaneous experiments to see if techniques couldn't be developed to take advantage of the large quantities of smaller crystals piling up in the industrial and governmental stockpiles. Using X-ray orientation techniques, processes were developed for correctly positioning the crystals so cuts could be made along the proper axes. Once the techniques for positioning were worked out, machinery for working on the smaller crystals was built, and the industry carried on, essentially ending the supply crisis in the US.

Aging Crisis

By mid 1943, with problems related to supply and production apparently under control, the fledgling crystal industry was producing hundreds of thousands of units per month. Reports began to trickle in concerning malfunctioning crystals. Some crystals would mysteriously undergo an increase in natural frequency; others would simply stop vibrating altogether. Ultimately, a crash program of research was instigated to find the root of the problem and effect a solution.

In an effort to expedite the program, the Army transferred Virgil Bottom to the Signal Corps Engineering Laboratory at Fort Monmouth, New Jersey. Bottom's initial investigations focused on understanding the causes for the complete failures of

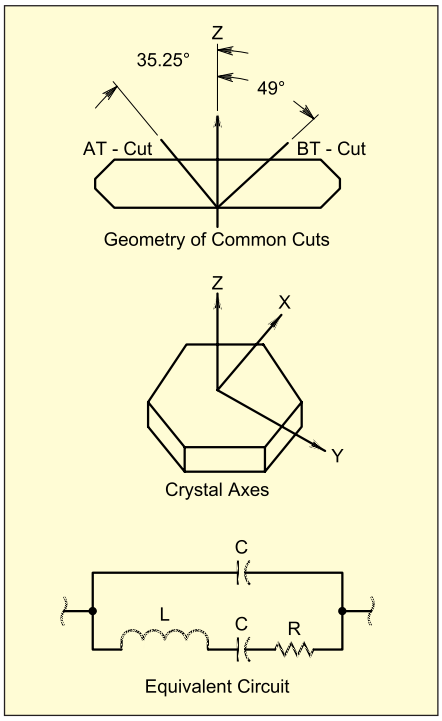


Figure 4—The geometric and electronic characteristics of quartz. The upper diagram shows the geometry of two common types of cuts for making oscillator blanks from a mother crystal. The center diagram defines the crystal axes with respect to the faces. The lower diagram shows the "equivalent circuit" for a quartz oscillator; a radio engineer could predict the behavior of a crystal unit in a circuit in terms of this equivalent circuit.

some of the crystal units. Bottom and his coworkers found that chemicals within the holders were reacting with the wire leads, resulting in a complete loss of "activity" of the units. Changing the materials from which the crystal holders were manufactured appeared to solve this problem. The sudden increase in fundamental frequency was a much tougher problem to solve.

At the lab, Bottom began to follow up on a hunch that high temperatures and humidity were playing a role in the malfunction. To test his theory, he built what was called "the swamp," a test chamber that could maintain a temperature of 100°F and a humidity of 100%. Crystals tested under these conditions failed rapidly in just the manner reported from the field. It had been discovered earlier by factory workers that crystals rubbed with a wool cloth after grinding suffered from the aging problem much less frequently. This clue led to the understanding of the problem: the grinding process was leaving bits of quartz embedded in the surface of the wafers. After a time of use, coupled with high temperature and humidity, these bits of crystal would come loose from the surface, decreasing the mass of the wafer and increasing the vibrating frequency.

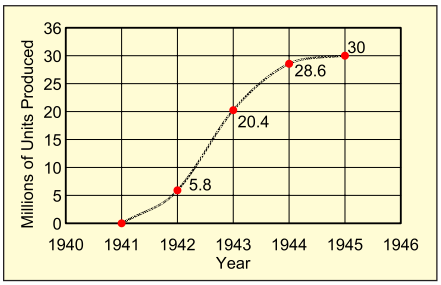


Figure 5—The graph illustrates the dramatic increases in quartz crystal oscillator production throughout World War II.

Another method of producing quartz wafers of the proper thickness was to dissolve away the outer layers with strong acids. This "etching to frequency" technique, pioneered at Bell Laboratories, had been considered too expensive an option for the prewar industry. Tests were run at Fort Monmouth to see whether crystals that were etched in acid suffered from aging. They did not. At a conference of crystal manufacturers held soon after, Bottom gave a presentation on the cause of the aging problem and on the new etching process that would have to be adopted by all manufacturers. Once the industry put the new process into operation, aging was no longer a problem.

Historical Context

As an industry, the quartz crystal electronics industry is unique. It essentially came into being as a result of the war. From its beginnings as a virtual cottage industry, it grew to produce millions of crystal oscillator units. At the start of the war, there was no real industry to expand upon and none existing in any other countries to provide a blueprint from which to build one in this country. The crystal industry was essentially *invented* by a handful of engineers, scientists and industrialists. A large network of subcontracting manufacturers was raised, recruiting members with related electronics experience as well as those with nothing more to contribute than an empty building and a desire to remain solvent.

Communication and cooperation among manufacturers was not itself unique, though the extent to which the crystal industry made use of it was remarkable. This level of support was what enabled those factory owners who had once made lampshades or other non-electronics products to retool their factories, retrain their employees and make a real contribution to the war effort. Without the development of mass production machinery and techniques, the industry, large as it was at its peak, would not have been able to produce the numbers of crystal units needed by the military. Without the influence of the war, many of these techniques might never have been developed. Figure 5 illustrates the explosive wartime growth of crystal production.

The story of the development of this technology is one of great effort and personal sacrifice on the part of the men and women of the Quartz Crystal Section and the Signal Corps Engineering Labs. The story of how the scientists and engineers overcame the aging crisis is a classic story of a race to solve theoretical and laboratory problems, while very real practical issues hung in the balance.

Conclusion

The radios containing these crystal units were weapons—not as obvious as rifles or tanks, but weapons nonetheless. The GIs in the field knew this very well. They were aware of both their importance and their dependability. They knew they could depend on their radios for continuous contact with rear-area units. Whether they needed to report on enemy positions, call for reinforcements or communicate with fighter bombers patrolling overhead, they could count on their equipment. The German infantryman also knew how dependable these radios were; though frequently outnumbering the American units with which they came in contact, they often attempted to evade detection to avoid having to deal with the forces those radios could bring to bear. As Henry Klingler, a young tank commander in Europe put it, "Our communications helped win that war."

As a young machine-gunner in a frontlines reconnaissance unit, Irwin Gottlieb saw almost continuous action from the beaches of Normandy, through the hedgerow country, to the rush across eastern France and into Germany. He, like many of his comrades, came to understand the importance of their communications equipment and the vibrating quartz wafers contained within. Though rather small in size, these recon units were able to hold their own against oftentimes much larger German units. When asked years later how his unit managed to do so well against the enemy, Gottlieb would frequently reply: "We were heavily armed, and we had crystals."

All photos by the author.

Richard Thompson is the chairman of the physics department at McMurry University in Abilene, Texas. For the past several years, he has been researching the origins of the crystal oscillator industry. He has written a book-length manuscript on the topic entitled Crystal Clear: the Struggle for Reliable Communications Technology in World War II*, which is currently under review by Texas A&M Press. You can contact the author at* **thompsor@mcmurryadm.mcm.edu**.

By Gil McElroy, VE3PKD

Seeing Things: A Short History of Panoramic Reception

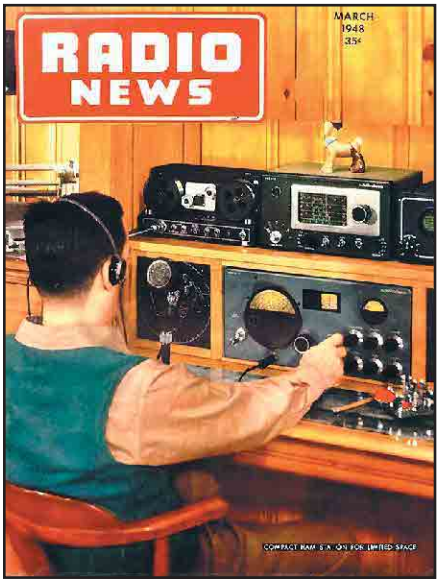
Before *DigiPan*, there was panoramic reception, invented by a French ham in 1932.

One of the most popular new communications technologies on the ham bands today is PSK31, a digital mode *QST* Editor Steve Ford, WB8IMY, described in the January 2001 issue as "a high-octane cousin of RTTY."[1] Like many other forms of digital communications, PSK31 owes its very existence to the rise of the personal computer and the vitally important place it has come to occupy in the ham shack. But it arguably owes a large part of its popularity to a receiving technique devised 70 years ago and that first came to prominence during World War II: panoramic reception.

Marcel Wallace, Inventor

Panoramic reception was the brainchild of Marcel Wallace, a French-born engineer and ham once licensed as F3HM. In 1932, while living in Paris, he came up with the design for the "spectrum analyzer." Using the CRT screen of a conventional oscilloscope, Wallace's invention enabled a radio engineer to capture an instantaneous picture of a portion of the radio spectrum, making RF signals visible, identifiable by mode and subject to visual analysis to uncover possible problems.

Wallace was interested in developing broad commercial applications for his invention, and came up with a device that would permit a radio operator to visually find a clearing in the forest of AM and CW signals on a band. The invention could also keep an eye on the activity taking place in various portions of the radio spectrum and what kind of signals were in fact present. This technique was to prove invaluable to the military during World War II and to hams experimenting with new modes after the war. Panoramic reception was born, and in the early postwar years everything seemed to point to it as a technology whose time had come.



The cover of the March 1948 issue of *Radio News* featured the Skyrider Panoramic SP-44.

Well, it took a little longer than Marcel Wallace no doubt envisioned, but with the arrival of a new millennium panoramic reception has at long last found its place as an invaluable tool in the ham shack. It takes the form of a computer software program like *DigiPan* (short for "Digital Panoramic Tuning") written by Howard "Skip" Teller, KH6TY, and Nick Fedoseev, UT2UZ, for use as a visual tuning aid by users of PSK31. It's a long way from the CRT screens and tube technology of Wallace's original invention, but the idea of the value of actually *seeing* other signals hasn't changed.

Hams and Panoramic Reception

As early as 1936, *QST* had recognized the importance of the oscilloscope as more than simply a workbench accessory few hams knew much about, noting that "the cathode ray tube makes an excellent tuning indicator for the receiver."[3] It wasn't panoramic reception, but it was a start toward making hams think of the AM and CW signals of the day as something actually worth looking at. The first articles to appear in *QST* aimed at introducing amateurs to panoramic reception itself, however, were published in 1942, right in the middle of World War II—when ham radio was officially shut down.

George Grammer, W1DF, then Technical Editor of *QST*, described the circuitry for "A Compact Panoramic Radio Spectroscope Adapter" in the July issue, the second article that year devoted to this new receiving technology. And a month later in the August issue, panoramic reception made its first commercial appearance in *QST* when Hallicrafters took out a full page advertisement to announce its first panoramic receiver. The ad promised that it would be "only one of the many new developments Hallicrafters will be the first to introduce when short wave equipment is again available for civilian use." (The Skyrider Panoramic SP-44 would finally debut in the pages of *QST* in January 1947, and appear on the cover of *Radio News* magazine the next year because of its prominent role in the first great DXpedition, the 1947-48 Gatti-Hallicrafters expedition to Africa.[2])

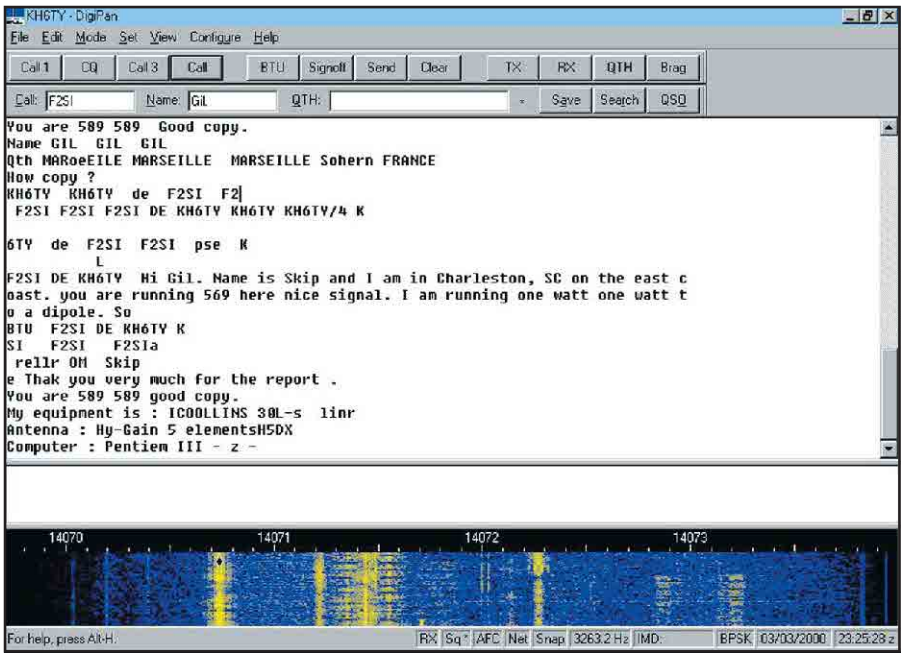
In March 1946, with the war finally over, *QST* was able to dramatically describe the vital role panoramic reception had played during hostilities. Panoramic receivers had been widely used by all branches of the American military for everything from visual monitoring of frequencies in use by both Allied and enemy ground troops, to coordination of communications between aircraft carriers and carrier-based airplanes, to a pivotal role in early radar countermeasures used to

[1]Notes appear on page 47.

combat enemy jamming of frequencies.

The two writers of that article, J. R. Popkin-Clurman, W2LNP, and B. Schlessel, were employees of the Panoramic Radio Corporation, the New York City-based company Marcel Wallace (by this time living in the United States) had founded to manufacture commercial and amateur electronic equipment based on his invention of the spectrum analyzer. The first product the company marketed directly to hams was the Panadaptor, a 10 tube superheterodyne device incorporating a CRT screen for visual reception of signals that was hooked directly into the IF of a ham's existing receiver. Panoramic's first advertisement for a Panadaptor—the PCA-2—appeared in the February 1946 issue of *QST*. For a whopping $99.75 (more than $900 in today's money!), hams could for the first time literally keep an eye on up to 200 kHz (or actually, kc, as "hertz" was not yet then in wide use) of band activity at a time.

Panoramic pushed the Panadaptor hard, advertising regularly in *QST* throughout 1946. In September of that year, their ad focused on the reopening of the 20 and 40 meter bands for amateur use, showing photographs of a Panadaptor screen monitoring band activity at the moment the bands reopened, even displaying the official ARRL message broadcast by W1AW announcing the event. But the Panadaptor was an expensive addition to the ham shack. Confident in their ability to find their way around the bands using their ears, most hams took a pass on the technology.



The modern equivalent of panoramic reception is this *DigiPan* screen displaying a PSK31 signal.

Struggling for Acceptance

The advent of single sideband in the late 1940s gave panoramic reception an early brush with acceptance. Panadaptors hooked up to standard receivers were popular with early SSB experimenters, allowing them to find each other quickly on the bands, based on the appearance of signals on the panadaptor's CRT screen. It was easy to visually distinguish between AM, CW and the few sideband signals then around. But the interest of a few SSBers wasn't enough for panoramic reception to make its commercial breakthrough.

There was a lull in advertising for panadaptors in the pages of *QST* that lasted until July 1954 when the first of a series of advertisements from Neo-Tech Products, Inc, for Panoramic PR-1 Panadaptors appeared. (Not coincidentally, Neo-Tech did business out of Mount Vernon, New York, where Wallace had relocated his struggling and now renamed company, Panoramic Electronics, Inc.) In September of that year, *QST* would try again with another panoramic building project, "Build Your Own Panoramic Adapter," and in November with "The Lazy Man's Panoramic Adapter." And once again, panoramic reception failed to ignite any widespread enthusiasm among hams.

A second lull in interest ensued, lasting until the early 1960s when a number of ham-oriented electronics companies began marketing their own versions of the panadaptor. The first, Radiophone, advertised its version of the panoramic receiver, the Band Scanner Model 44, in the pages of *QST* in 1962. Two years later, Heathkit came out with its Ham Scan HO-13 Spectrum Monitor (which a *QST* product review prophesied would finally make panoramic receivers a standard feature in most ham shacks), quickly followed by the SS-1V Video Bandscanner from Squires-Saunders.

Fallen on hard times, Marcel Wallace's Panoramic Electronics became a part of the Singer Company's Metrics Division in the mid-1960s. As it turned out, they'd not entirely given up on finding a market for panoramic receivers, for in January 1966, *QST* reviewed Singer Metrics's PR-1 Panadaptor. Even Heathkit kept at it, releasing their updated SB-620 Scanalyzer in 1968. In June of that year, the article "An Automatic Band Scanner Transmitter Monitor" in *QST* showed hams how to adapt a workbench oscilloscope for panoramic duty. Things had come full circle since *QST* first suggested the idea of hooking an oscilloscope to a receiver to use as a tuning indicator back in 1936, but yet again panoramic reception failed to make any real headway with hams.

A number of contemporary electronics firms who today cater to the ham market have manufactured their own versions of the panoramic receiver, including Kenwood (the SM-220 monitor scope, which could be adapted for panoramic use), Sherwood Communications (the SCA-7000 signal monitor) and Yaesu (the YO-901 Multiscope panadaptor). But panoramic hardware is disappearing. Old Panadaptors may be prized by collectors of vintage ham gear, but panoramic reception's future now appears to lie in the form of software. With a computer monitor having found a permanent home in the ham shack, it seems that Marcel Wallace's idea of actually keeping an eye on our signals has at long last arrived.

My thanks to Ludwell Sibley, KB2EVN, for his help in researching this article.

Notes

[1]Steve Ford, WB8IMY, "The HF Digital 'Tower of Babel,'" *QST*, Nov 2001, p 52.

[2]Mike O'Brien, N0NLQ, "Gatti-Hallicrafters: The First Grand Ham DXpedition," *QST*, Dec 1993, p 59.

[3]Edwin C. Ewing, W9HYO, "Cathode-Ray Monitoring of Receiving Signals: Pointers on Connecting the Oscilloscope to a Superhet," *QST*, Apr 1936, p 35.

[4]Marcel Wallace was a long-time member of the IRE (Institute of Radio Engineers) dating back to 1930, just two years before his invention of the spectrum analyzer.

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By Rod Vlach, NNØTT

The Challenge of Being a Little Pistol

Looking to snag some big DX stations from your small city lot? Follow the author's tips for DX success.

I must admit, there have been times I wish I had a kilowatt amplifier to bust through a rare DX pileup, but then I think, "Where's the challenge in that?" My station is about as barebones as it gets, and that's the way I like it. I take pride in slowly adding to my DXCC total with patience, a little bit of skill and some luck, rather than 1000 W of amplified power.

For those who may not be aware, a "little pistol" is someone who operates with the "barefoot" power that is built into the radio, generally about 100 W, and a modest antenna. When I bust a pileup, I feel really good about it. I hear the "big guns"—high power stations with directional antennas—blasting away, but more often than not, I eventually get my turn, too, and sometimes I can work the DX before they do.

Here are some hints as to how we "little pistols" can get our fair share of the DX pie, too. Lest someone should think an expensive station and a 100 foot tower with a Yagi antenna is required, I have made all my contacts with a modest—but modern—shack consisting of a medium-priced transceiver, power supply, keying paddles and a vertical antenna. That's it. I make an occasional SSB contact, but I know that with barefoot power, Morse code operating can result in more DX QSOs.

Even the simplest of stations—a small 100 W transceiver going out to a vertical antenna—tucked into a corner of the house can make some amazing DX contacts.

Split Mode and Pileups

Rare DX stations will often operate "split," transmitting on one frequency and listening for responses on another, usually higher, frequency. I have found that I have a good shot at working a DX station that is listening up 2 to 5 kHz from the transmitting frequency, but when it gets crazy, like up 10 to 15 kHz, my chances go way down. This seems to occur mostly when the DX entity in question is very rare. Not that my signal isn't getting out, but with lower power, I am just one in hundreds of call signs being heard in a 15 kHz range, and it is more a matter of luck than skill if you're noticed by the DX operator. Even when tracking the movements of the DX station, the chances of being chosen are slim—it depends on how much time, patience and effort I think it is worth.

I am particularly proud of my QSL card from VP8THU, a DXpedition station in the South Sandwich Islands in 2002. It's a long way from Minnesota to VP8! The "Micro-Lite Penguins DXpedition Team" announced that they would not be using amplifiers at this rare island, so I knew it would be a tough battle. My contact was on 40 meters using Morse code, and the interference and noise were just terrible. On the back of this card, the QSL manager wrote "Congratulations, Rod." I really appreciated that comment, as that was one of the roughest, toughest rare DX contacts I have ever made, and many operators had to really earn their confirmations. When both the DX and the other station are running barefoot power, a little bit of skill and determination can help!

I do pretty well in head-on pileups, when the DX station is transmitting and receiving on the same frequency. A trick I have learned is that if the pileup is getting intense, use the XIT control (transmitter incremental tuning) to offset your transmit signal up or down about 25 Hz. This makes the signal stand out a little from the crowd, and causes no serious waste of frequency from being exactly on frequency by such a small amount. Besides, not everybody participating in the pileup will be zero-beat with the DX station, anyway. I am surprised how many times this has resulted in a quick QSO for me, while others are hammering away on the main frequency.

Be the Early Bird

A little sacrifice in terms of time can pay off big when you're DXing with lower power. When the VP6DI group operated from the brand-new DXCC entity of Ducie Island in 2002, the pileups were out of sight. I wasn't getting anywhere in the "up 15" mess, so I decided to get up early and set a trap. I knew by then that VP6DI was sticking mostly to their announced frequencies, so I left my rig on their 15 meter CW frequency the night before. The next morning, I started monitoring. I was one of the first ones to nab VP6DI in that particular run of QSOs. The advantage of being one of the first is that the DX usually listens up only 1 or 2 kHz—or sometimes even stays on frequency—when starting a run, and then increases the listening range as the pileup grows. Your chances increase dramatically when the listening range is small.

Another unusual event that happened to me in 2002 was that at the beginning of one of their early morning runs I heard

XRØX on San Felix Island send QRL? DE XRØX in Morse. I responded, on frequency, with XRØX DE NNØTT. I was the first to nab a QSO in that particular run, and I imagine the DX operator was surprised to get an instant call without even starting a CQ! Sometimes, acting quickly can help ensure a QSO. It was the first time that I actually had the opportunity to send the call sign of a rare DX station before signing my own call.

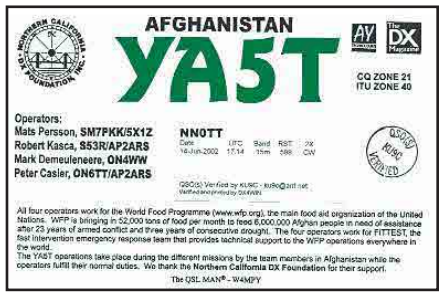
Sometimes dumb luck plays an important part in the life of a DXer. All DXers sooner or later experience the joy of working new ones they weren't expecting. Although all new DX contacts are fun, I enjoy the unexpected ones the most because of the surprise factor. We can anticipate and hope to work an expedition, but contacting one we didn't know was there is exciting. One that fell into this category for me in 2001 was 4U1ITU, the International Telecommunication Union station in Geneva. It was particularly interesting because ARRL CEO David Sumner, K1ZZ, who was attending an ITU meeting at the time, was operating the station and confirmed the QSO.

An unexpected catch was 4U1ITU, operated that day by Dave Sumner, K1ZZ.

Operating out of your normal on-air times can help you find some interesting DX stations you may never have heard before. Due to job requirements and other responsibilities, many of us can usually be on the air only during certain times of day. If you have the flexibility, however, try to occasionally operate out of your normal schedule. You may be surprised how many DX stations are on the air when you usually are not. I have worked some new DX entities during lunch breaks, including YA5T in Afghanistan. Keep in mind that there can be large time differences between your location and the DX station. I have worked many a "midnight QSO"—and sometimes early morning, if I can drag myself out of bed—to nab some new ones. It is unlikely that you will reach the higher DXCC totals unless you have some flexibility in your operating times and take advantage of short opportunities to operate.

The Weird Ways of Propagation

I have worked several new DX by checking the upper HF bands, such as 15 and 10 meters, later at night, when they appear to be inactive. By carefully tuning across these bands a few times, I have made several contacts to new DXCC entities, often on the first call. Sometimes, the action is where you wouldn't think it to be. While late night openings on the upper HF bands will decrease as the sunspot cycle wanes, it doesn't take long to spin the tuning dial a few times and it never hurts to check.



Taking advantage of the odd hour here and there can really pay off—YA5T was worked during a lunch break.

Radio frequency propagation via the ionosphere can be the weirdest thing. A band can sound totally dead and then suddenly a signal comes booming in from Australia. Or sometimes, we can hear many hams calling a DX station, but we can't hear the DX operator at all. And sometimes it's the other way around! A band can be dead, and then open at midnight to Europe or the Pacific. The only thing we can be sure of with propagation is that it is not completely predictable. Still, it helps to know a little bit about propagation reports, such as those issued by WWV and found on a number of Web sites, including ARRL's (**www.arrl.org/w1aw/prop**). I'm still trying to figure out all the propagation terms, but when solar flux is up, and the K index is down, conditions should result in better HF communications. If I'm looking for a new DXpedition, I often glance at the solar reports to get an idea how "good" the bands are. There were no better conditions for me than when I got active again in 1998, experiencing a few great years of late night contacts on 20, 15, and sometimes 12 and 10 meters, as the sunspot cycle was peaking.

Another indispensable tool for band scouting and evaluation is the NCDXF/IARU worldwide beacon system on 20, 17, 15, 12 and 10 meters. This coordinated set of propagation beacons will let you know exactly where a band is open to and to what degree. If an upper band is open you'll hear the beacons, including call signs and power levels. Then, if you don't hear anybody having a live QSO, just call CQ a few times—the results can be amazing. See **www.ncdxf.org/beacons.html** for information on how to use the system. Scanning the recent activity on a DX packet cluster can also give you an idea of what bands are open, as well as tell you which stations are on the air.

Good Equipment Helps

I estimate that my current station cost about $2000—and that includes accessories, coaxial cable and everything else. That is modest by some standards, but it is the first brand new station I have ever owned; you can put together a station with used equipment for less. Today's transceivers do a great job and I am pleased with my medium-priced rig. Several very good new 100 W transceivers are available for right around $500, some with digital signal processing. I use a vertical antenna, mainly because I don't want the equivalent of the Eiffel Tower sitting in my backyard. There must be something to the claim that the low angle of radiation from vertical antennas is good for DX. I have heard plenty of great incoming signals originating from inexpensive dipoles and random wires, too, so antenna cost doesn't have to be a big factor. Work within your constraints—but get on the air and work!

It's also important to know your station, especially the capabilities and controls of your radio. Sometimes, you need to act fast if there's to be any hope of nabbing that rare DX station with a lower-powered station. With packet clusters, a pileup can appear very quickly. If you have a modern transceiver, it will be capable of split-mode and incremental transmit and receive. I have learned how to activate these modes swiftly, to have a better chance against the growing "wolf pack." Also know the other features your rig offers, such as noise reduction, IF shift/passband tuning and filters, which can all help you to "hear" that rare one when the going gets tough. Actually *reading* the operator's manual to discover the full capabilities of your rig is a good idea, too!

Hang in There

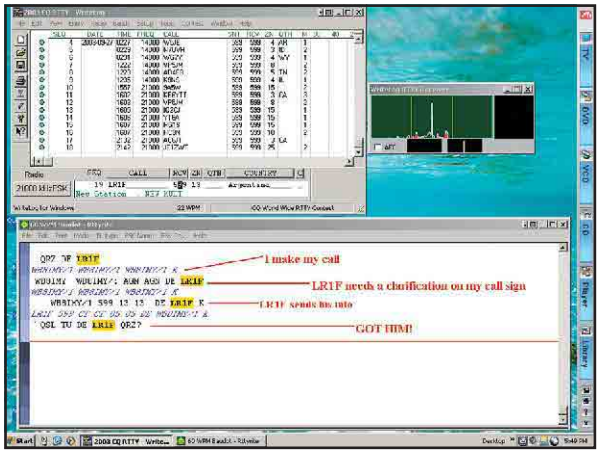
As a little pistol, I realize that I won't work every DXpedition or individual DX operator I hear, but my attitude is, "I'll get 'em next time!" There are dry spells, when I won't work a new DX station for several weeks or months (and the higher your DXCC total, the more you will depend on DXpeditions for a new entity). But I'm content to know that my simple station has already contacted the four corners of the globe, and it won't be too long before I nab that next new one.

ARRL member Rod Vlach, NNØTT, and his wife Diane reside in Willmar, Minnesota. He has been licensed since 1965, but got active in 1998. His current DXCC total is 270 on CW. He can be reached at **nn0tt@arrl.net**. QST

By Steve Ford, WB8IMY

Zen and the Casual RTTY Contester

Winning isn't everything, grasshopper. Just playing the game is its own reward.



Operating the 2003 CQ RTTY Contest using *WriteLog* software. Notice my exchange with LR1F (I've added notes in the RTTY window). My transmissions are in blue type.

With a modest station and a hunk of wire in a backyard tree, my odds of placing in the Top Ten of an Amateur Radio contest are comparable to my odds of walking on the Moon—not impossible, but highly unlikely. So, why bother with contesting at all?

The answer is found in the maxim that the journey is often more important than the destination. If you've ever spent an afternoon fishing, you know what it is like to cast your line into the water and watch the bobber as it floats serenely on the surface. You become one with the bobber and the water—a true Zen experience.

Suddenly the bobber plunges into the murky depths and the line goes taut. It's a hit! You grab the pole with your heart pounding and start reeling in...an algae-encrusted twig. Okay, it wasn't an award-winning bass after all, but for a few precious seconds you savored the exciting possibility. You unhook the twig and cast your line again. Maybe next time.

The thrill of contesting is very much the same. A Zen contest master knows that the reward is not in the win, but in the pursuit. The reward is found in pushing the limits of your physical and mental stamina to achieve whatever goal you've set for yourself—even if that goal is defined as making 50 contacts while re-roofing your doghouse. You may never achieve the Olympian summit of the Top Ten, but you're always a "winner" nonetheless.

I am what is known as a *casual contester*, at the "grasshopper" end of the Zen scale. We are legion in the Amateur Radio contesting world. As much as we'd love to spend an entire weekend doing battle with our radios, life makes other demands. There are lawns to cut, homes in need of repair, families in need of our attention and so on. We have to fit our contesting enjoyment into our otherwise busy schedules and do it in a way that is compatible with everything else going on around us. When life becomes a domestic juggling act, RTTY looks awfully attractive from a contester's point of view.

The Tao of RTTY

With the possible exception of CW, RTTY is one of the oldest digital operating modes in Amateur Radio. In simple terms, you communicate with RTTY by generating a radio signal that shifts between two frequencies at a rapid rate. This is what gives a RTTY signal its distinctive *blee-blee-blee* rhythm. At the receiving end, the shifting signal is decoded into letters, numbers and a limited punctuation set.

In the good old days, RTTY operators used *terminal units* to generate the transmitted signals and decode the received signals. Some hams still use terminal units, but the majority have switched to RTTY software that uses the computer sound card to perform the same task.

Although it isn't as narrow as a CW or PSK31 signal, RTTY still manages to concentrate energy within less than 500 Hz of spectrum, which enhances its ability to be received and decoded when band conditions are marginal. This is why RTTY remains popular among digital DX hunters and contesters.

RTTY isn't the fastest digital mode, but it is reasonably peppy, streaming along at about 45 words per minute. Brevity is the soul of wit in a contest—and so is speed.

The fact that modern RTTY is a computer-based mode makes it highly attractive to the casual contester. All your tools are gathered in one place. The computer not only sends and receives RTTY, with the proper software it can maintain your contest log, too. And thanks to *macros*—pre-programmed tasks that your computer executes with the press of a single key, such as responding to a CQ—you can become a versatile multitasker, hunting RTTY contest contacts and doing other things with your computer at the same time. (I once checked my daughter's homework while participating in a RTTY contest.)

What Do You Need to Get Started?

The shopping list for a casual RTTY contest station is remarkably short:

- An HF SSB transceiver
- A computer with a sound card
- A sound-card-to-transceiver interface
- Software

My guess is that you already have most of the above or you wouldn't have read this far. Of the remaining items,

the sound card interface is the hardware that allows you to shuttle audio between your radio and your computer. It also handles transmit/receive switching. You can buy an interface from *QST* advertisers such as MFJ Enterprises (**www.mfjenterprises.com**), West Mountain Radio (**www.westmountainradio.com**) or TigerTronics (**www.tigertronics.com**). You can also make your own.

The software can be just about anything that will use your sound card to do the tricks necessary to transmit and receive a RTTY signal. A partial list is shown in the "RTTY Software" sidebar. Some software titles are free.

Strictly speaking, you don't need contest-logging software, but it sure makes life easier. Not only does the software log all your contacts, it automatically checks for duplicate contacts, better known as *dupes*. Depending on the rules of the contest, you may only be allowed to contact the same station once, or once per band. Duplicate contacts are a waste of time and should be avoided.

There are contest-logging software packages that include the ability to send and receive RTTY. Others allow you to incorporate standalone RTTY programs. Browse the Web and the advertising pages of *QST* and you'll find that you have many choices.

I could devote several pages describing how to set up a RTTY station, but there is an excellent resource that is as close as your computer keyboard. RTTY contest master Don Hill, AA5AU, has a superb Web page that will give you all the detail you need. Get on the Web and go to: **www.aa5au.com/rtty**. Also, the manuals that accompany commercial sound card interfaces offer guidance on how to set up your station.

It's important to mention that once you've established your RTTY station, you can use the same hardware to operate PSK31, MT-63, Hellschreiber, slow-scan television and many other modes. All you have to do is load a different program. That's a powerful incentive to get started!

Big Guns vs Little Pistols

With Big Gun contest stations, *big* is the operative word—big antennas and big power. We're talking towers and kilowatts. Some contest operations consist of several operators working several transceivers at the same time. This is the *multi-multi* juggernaut. If you ever have an opportunity to join a multi-multi team, I highly recommend it. The team atmosphere is intoxicating. It's more fun than a ham should be allowed to have.

What about the rest of us? We're the Little Pistols (or Little Pop Gun, in my case). Believe it or not, we are highly valuable to the Big Guns despite our reduced profiles. Can you guess why? The answer is that every station, no matter how small, represents a point in a contest. And if you are lucky enough to live in a place that has few RTTY operators in residence, you are even more desirable as a rare *multiplier*.

RTTY Software

This is only a partial list. See the advertising pages of *QST* or search the Web for more.

Windows
RCKRTTY: **www.rckrtty.de/**
WriteLog: **www.writelog.com**
MMTTY: **www.qsl.net/mmhamsoft/**
TruTTY: **www.dxsoft.com/**
MixW: **www.nvbb.net/~jaffejim/mixwpage.htm**

Mac
Multimode: **www.blackcatsystems.com/software/multimode.html**

Linux
LinPSK (RTTY and PSK31): **linpsk.sourceforge.net/**

The Value of Multipliers

Every contest has multipliers. These are US states, DXCC entities, ARRL sections, grid squares and so on, depending on the rules of the contest. A multiplier is valuable because it multiplies your total score.

Let's say that DXCC entities are multipliers for our hypothetical contest. You've amassed a total of 200 points so far, and in doing so you made contacts with 50 different DXCC entities.

$200 \times 50 = 10{,}000$ points

Those 50 multipliers made a huge difference in your score! Imagine what the score would have been if you had only worked 10 multipliers?

If given a choice between chasing a station that won't give me a new multiplier and pursuing one that *will*, I'll spend much more time trying to bag the new multiplier. So will the Big Guns.

Hunting and Pouncing vs Running

The common sense rule of thumb is that a Little Pistol station should only hunt and pounce. That means that you patrol the bands, watching for "CQ TEST" on your monitor and pouncing on any signals you find. The Big Guns, on the other hand, often set up shop on clear frequencies and start blasting CQs. If conditions are favorable, they'll be hauling in contacts like a trawler. This is known as *running*.

In many cases, Little Pistols are probably wasting valuable time by attempting to run. There are situations, however, where running *does* make sense. If you've pounced on every signal you can find on a particular band, try sending a number of CQs yourself to catch some of the other pouncers. If you send five or 10 CQs in a row and no one responds, don't bother to continue. Move to another band and resume pouncing.

You can also run successfully if you are a rare multiplier. No matter how weak your signal may be, all the other stations will come to *you!*

As you make each contact, keep your exchanges short. The goal is to communicate the required information clearly. Anything else is extraneous. Let's say that you're involved in a contest where the object is to exchange a signal report and state…

[RIGHT] K1RO 599 CT CT DE WB8IMY K

WB8IMY gives K1RO a 599 signal report (they are all "599"—one of the peculiarities of contesting) and then repeats his state abbreviation twice (CT—Connecticut) before quickly ending the transmission.

[WRONG] K1RO DE WB8IMY...Thanks for the contact. You are 599 here in the state of Connecticut. Weather here is wonderful. My wife is divorcing me and my cat is coughing up a hairball in my lap. K1RO DE WB8IMY K

This is more information than K1RO is likely to want—even outside of a contest! In contesting, time is critical. Say what you have to say clearly and *quickly*. In addition, the longer you transmit, the more opportunities there will be for errors caused by fading, noise or interference.

The ARRL RTTY Roundup

One of the most popular RTTY contests is right around the corner: the ARRL RTTY Roundup, January 3-4, 2004. You'll find the announcement in your December 2003 *QST* and the complete rules on the ARRLWeb at **www.arrl.org/contests/forms/**.

The Roundup is a great way to start the year. And once you've whetted your appetite with the RTTY Roundup, prepare for the BARTG RTTY Sprint in late January (see **www.bartg.demon.co.uk/**).

The rewards of casual contesting, like fishing, are in the eye of the beholder, or the Zen master. A few dozen contacts to test the waters may suffice. Or you may choose to bang out as many contacts as your time allows. In the end you'll take home a collection of soggy branches (minus some hooks and bobbers), or you might land the mother of all muskies. Either way, you'll leave fulfilled, at one with the contest universe.

Steve Ford, WB8IMY, is the Editor of QST. *You can contact him at* **sford@arrl.org**.

The Doctor is IN

Q From Bill, KD5WCT, comes the following: I am preparing to install a mobile rig in my car. I'm trying to find a way to route the power cables through the firewall into the engine compartment. I've searched the Web, but I don't find much information specific to my car. I'd like to avoid drilling a hole through the firewall, but I've inspected the car a couple of times and don't see any obvious exit hole.

A I don't have any specific experience with your vehicle, but I have installed wires through firewalls in several vehicles without drilling holes. Typically, I look for places where the existing wires and cables already pass through the firewall. There is usually a wire harness passing through a rubber boot/grommet at some point. There may be, additionally, a plugged hole in the firewall used for a harness your vehicle doesn't use. It may take some looking to find it, as these are sometimes well hidden.

The pass-through bushings on modern vehicles are well integrated with their harnesses and form a very tight fit—it may take a bit of work to get an additional cable through. I push the wires or cable through the hole in the grommet. If necessary, a lubricant (like petroleum jelly) on the wire can help. If things are very tight, a stiff wire—such as a coat hanger—can be pushed through initially, but be careful; it's easy to damage cables with that sharp end. Tie a string to one end of the hanger and pull the string through the grommet. The string is then used to pull the wires through the firewall. If there are in-line fuses on the wire, the wires can be cut in order to make the pass-through easier. The cable then spliced after routing and everything can be tied down with nylon cable ties. Figure 1 shows an example of a dc power cable coming through a firewall grommet. Note the high current connector. This will make it easier to route the remaining cable to the battery. The cable should be routed away from and around any heat-producing areas in the engine compartment.

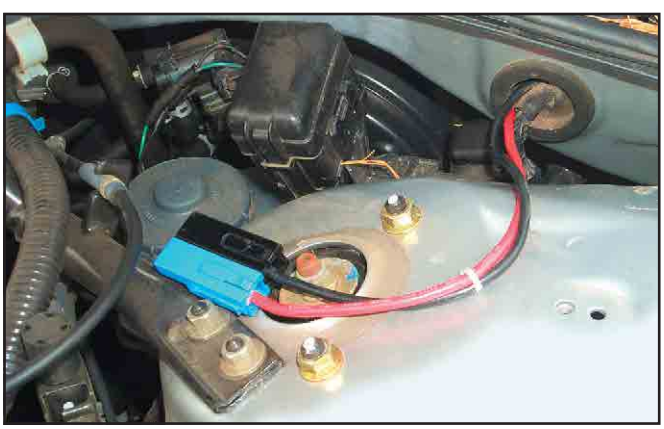


Figure 1—An example of a dc power cable firewall grommet installation. Note the high current connectors. These will make it easier to route the remainder of the line to the battery terminals.

Some mobile operators find that shielding the dc power leads helps to reduce electro-magnetic interference (EMI) from electrical/electronic components within the engine compartment (engine management electronics, fuel injectors, ignition distribution). A good choice for this cable would be RG-8/U type coaxial cable with the shield grounded; its center conductor is amply sized for any reasonable current demand. Just make sure the shield is sufficiently tied back along the center conductor—loose shield strands can short to the "hot" lead. Use a separate cable for hot and ground; don't rely on the shield for the ground conductor.

If you're totally stumped as to finding a suitable firewall exit point, go to a neighborhood auto audio equipment installer. They usually know the layout of many vehicles (they've lots of practice!) and, if you give them a prepared cable, they will usually be able to install it for you at nominal cost.

Q Usher Thomason, NN4EE, writes: Do you know a manufacturer that sells a switching circuit device that would switch a repeater from the 120 V ac power grid to a 12 V battery that is serving as a backup power supply upon power failure? We want to install emergency power back-up on our repeater.

A The Doctor referred this question to Joe Carcia, NJ1Q, the W1AW station manager. W1AW uses a mains transfer system to activate our emergency power generator in case of an ac systems outage. Joe replied: "We use a Kohler switch here. The automatic transfer switch is used to take us off the mains and onto the emergency generator. Here's a link to the Kohler residential site: **www.kohlerpowersystems.com/residential.html**."

The Doctor advises that you also check with your local power company. Some utilities have stringent requirements for emergency power backup systems and changeover switches. They are rightly concerned about safety issues and protection for their power line technicians, because of the danger of putting ac voltage back on the distribution system. If the transfer isn't done properly, it's possible to put 120-240 V_{rms} ac on the local distribution transformer secondary, which then gets transformed to high-voltage on the input side of the pole transformer and out to the lines. An unsuspecting power company technician, working on a supposed "dead" line, could find it not so dead after all, with dire consequences.

Q George, KG4PIL, asks: What's the best feed line for a legal limit dipole? RG-213/U seems a little heavy to me. I used RG-8X with a foam center but it failed very quickly.

A The answer to that question depends on the anticipated SWR on the line. In addition, it depends on your budget and the amount of loss you can tolerate. A high SWR will

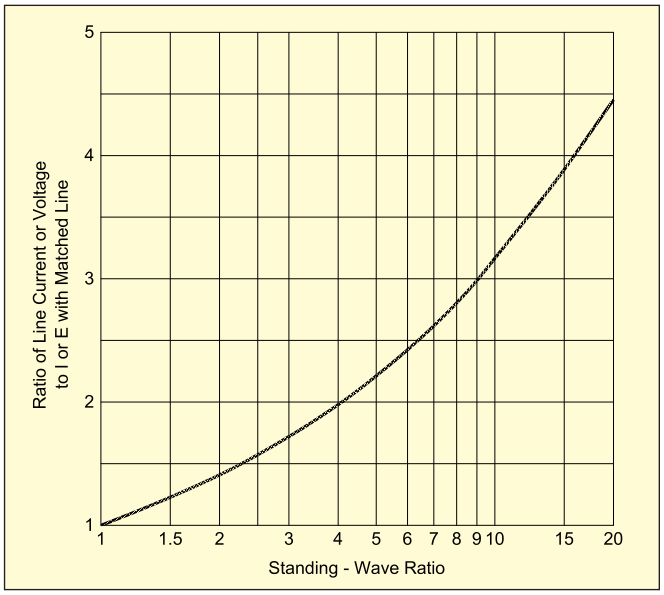


Figure 2—Here's how the SWR on a transmission line affects the voltage and current on the line. Note that the line voltage and current are directly proportional to the square root of the SWR.

contribute to the feed line loss and will result in a high voltage on the line and heating of the cable. The peak voltage will be governed by the input power to the line, the characteristic impedance and the SWR. The following equation computes that voltage:

$$E_{peak} = \sqrt{P \times Z_0 \times SWR} \times 1.4$$

For maximum legal power (1500 W) and a Z_0 of 50 Ω, this becomes:

$$E_{peak} = 387 \times \sqrt{SWR}$$

A graph showing how SWR affects the voltage and current on a transmission line is shown in Figure 2. RG-8X coax is specified for a maximum voltage of 300 V_{rms} or about 424 V_{peak} (the Underwriters Laboratories specification). That peak voltage is already exceeded (458 V) with an SWR of 1.4:1 and that SWR would be expected when feeding a typical dipole at average height with a 50 Ω transmission line. The bottom line is that I would definitely not use RG-8X at maximum legal power to feed any antenna.

Ladder line is relatively cheap and very low loss, but that may not be something you would want because of its installation requirements (it needs to be kept clear of surrounding structures and it is a balanced feed line, requiring a balun transformer or a properly configured antenna tuner to interface to unbalanced output). 450 Ω ladder line with large enough conductors (14 gauge) will be able to handle a legal limit transmitter with ease. RG-213/U is a good coaxial cable that should do the job, as well. RG-8/U is popular and a bit cheaper, but it also has slightly higher attenuation characteristics. More information about cables and the effect of SWR on loss and voltage appears in both *The ARRL Handbook* and *The ARRL Antenna Book*.

Q Here's an interesting question from Woody, K4JWP: I'm looking for a 525 kHz quartz crystal needed for the restoration of my 1935 Single Signal Superhet receiver. I built this receiver, at the time, from its description in the May 1935 issue of *QST*. My crystal was in a Bliley holder. The crystal was cube shaped, as I recall. Unfortunately, it disappeared when I was away during WW II. Now the main obstacle to restoration of the receiver is finding a suitable crystal. I believe that a 455 kHz quartz (or ceramic) crystal might work.

A There are several routes to go. First, it may be relatively easy to find a 455 kHz crystal from an older receiver. These were quite popular and were used in crystal filters in receivers of the '40s and '50s. If you can find one of these, it should be possible for you to shift the IF frequency 70 kHz lower in frequency by a slight change in local oscillator frequency and then re-tune the IF amplifiers. I note that the IF transformers are 500 kHz types and are shunted by 100 pF trimmers. If a 455 kHz crystal is used in the crystal filter, try putting an additional 27 pF capacitor across the trimmers of the IF transformers and re-tune the IFs for 455 kHz. You would also have to re-tune the beat frequency oscillator (BFO), but that shouldn't be a problem.

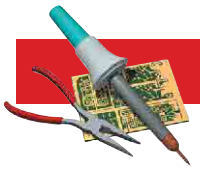
Another possibility is to re-grind a 455 kHz crystal to 500 kHz. *QST* has published many articles on crystal grinding, and this is not as difficult to do as you might think. The ARRL Periodicals Search Web site will help (**www.arrl.org/members-only/qqnsearch.html**). The IF transformers should easily tune to 500 kHz, as they were originally designed for that frequency.

Crystals are still custom ground by manufacturers such as JAN Crystals (**www.jancrystals.com**) and International Crystal Manufacturing Co (**www.icmfg.com/crystals.html**). If you supply them with a suitable holder, they might even be able to grind a blank to fit that holder. Your original crystal or at least a holder for it may be able to be found at a hamfest or on eBay or the several reflectors and newsgroups on the Web that are devoted to antique radio and "boatanchor" equipment.

Q Ken, WA1UMD, writes: I'm looking for a company that sells software for drawing a schematic and I couldn't find anything. I don't need design software—I already have the design. I'm looking for a way to produce a professional looking schematic without having to use drafting tools on paper. Is there anything available under $100?

A As you've noticed, schematic drawing software can be expensive. We use *AutoCAD* (**usa.autodesk.com**) here at *QST*, both for general drafting and schematic drawing. It offers an extensive symbol library, but it would be prohibitively expensive for an individual user and it probably offers a lot more than you'd need. Several programs that might work for a casual user are available and, best of all, two of them are free! *ExpressPCB* (**www.expresspcb.com**) is a company that offers free schematic drawing and PC board layout software. You can download drawing software directly from their site. Another is *CircuitMaker* (**www.circuitmaker.com**). They offer circuit design, simulation and drawing software at moderate cost. A student version of their schematic software (CM 60) can be downloaded free of charge. Another source is *DeltaCad* (**www.dcad.com**). They offer general drafting software; you'll have to make your own schematic symbols, but that doesn't appear to be too difficult. Their program sells for about $40. There are more, but these should get you going.

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



THE HELP DESK

The Considerate Operator's Frequency Guide

The following frequencies are generally recognized for certain modes or activities (all frequencies are in MHz).

Nothing in the rules recognizes a net's, group's or any individual's special privilege to any specific frequency. Section 97.101(b) of the Rules states that "Each station licensee and each control operator must cooperate in selecting transmitting channels and in making the most effective use of the amateur service frequencies. No frequency will be assigned for the exclusive use of any station." No one "owns" a frequency.

It's good practice—and plain old common sense—for any operator, regardless of mode, to check to see if the frequency is in use prior to engaging operation. If you are there first, other operators should make an effort to protect you from interference to the extent possible, given that 100% interference-free operation is an unrealistic expectation in today's congested bands.

1.800-1.810	Digital
1.810	QRP CW calling frequency
1.800-2.000	CW
1.843-2.000	SSB, SSTV and other wideband modes
1.910	SSB QRP
1.995-2.000	Experimental
1.999-2.000	Beacons
3.500-3.510	CW DX
3.560	QRP
3.590	RTTY DX
3.580-3.620	Data
3.620-3.635	Automatically controlled data stations
3.710	QRP Novice/Technician CW calling frequency
3.790-3.800	DX window
3.845	SSTV
3.885	AM calling frequency
3.985	QRP SSB calling frequency
7.040	RTTY DX
	QRP CW calling frequency
7.075-7.100	Phone in KH/KL/KP *only*
7.080-7.100	Data
7.100-7.105	Automatically controlled data stations
7.171	SSTV
7.285	QRP SSB calling frequency
7.290	AM calling frequency
10.106	QRP CW calling frequency
10.130-10.140	Data
10.140-10.150	Automatically controlled data stations
14.060	QRP CW calling frequency
14.070-14.095	Data
14.095-14.0995	Automatically controlled data stations
14.100	IBP/NCDXF beacons
14.1005-14.112	Automatically controlled data stations
14.230	SSTV
14.285	QRP SSB calling frequency
14.286	AM calling frequency
18.100-18.105	Data
18.105-18.110	Automatically controlled data stations
18.110	IBP/NCDXF beacons
21.060	QRP CW calling frequency
21.070-21.100	Data
21.090-21.100	Automatically controlled data stations
21.150	IBP/NCDXF beacons
21.340	SSTV
21.385	QRP SSB calling frequency
24.920-24.925	Data
24.925-24.930	Automatically controlled data stations
24.930	IBP/NCDXF beacons
28.060	QRP CW calling frequency
28.070-28.120	Data
28.120-28.189	Automatically controlled data stations
28.190-28.225	Beacons
28.200	IBP/NCDXF beacons
28.385	QRP SSB calling frequency
28.680	SSTV
29.000-29.200	AM
29.300-29.510	Satellite downlinks
29.520-29.580	Repeater inputs
29.600	FM simplex
29.620-29.680	Repeater outputs

Note: ARRL band plans for frequencies above 28.300 MHz are shown in *The ARRL Repeater Directory* and *The ARRL FCC Rule Book*.

VHF/UHF/EHF Calling Frequencies

Band (MHz)	*Calling Frequency*	
50	50.125	SSB
	52.525	National FM simplex frequency
144	144.010	EME
	144.100	CW
	144.200	SSB
	146.520	National FM simplex frequency
222	222.100	CW/SSB
	223.500	National FM simplex frequency
432	432.010	EME
	432.100	CW/SSB
	446.000	National FM simplex frequency
902	902.100	CW/SSB
	903.100	Alternate CW/SSB
1296	1294.500	National FM simplex frequency
	1296.100	CW/SSB
2304	2304.1	CW/SSB
3456	3456.1	CW/SSB
5760	5760.1	CW/SSB
10000	10368.1	CW/SSB

VHF/UHF Activity Nights

Some areas do not have enough VHF/UHF activity to support contacts at all times. This schedule is intended to help VHF/UHF operators make contact. This is only a starting point; check with others in your area to see if local hams have a different schedule.

Band (MHz)	*Day*	*Local Time*
50	Sunday	6 PM
144	Monday	7 PM
222	Tuesday	8 PM
432	Wednesday	9 PM
902	Friday	9 PM
1296	Thursday	10 PM

NEW PRODUCTS

2004 GUIDE TO UTILITY RADIO STATIONS

◊ This guide includes hundreds of new screenshots from a leader in advanced digital data systems and teleprinter monitoring and decoding. Information on new HF e-mail radionets is provided. Screenshots are also available on the Klingenfuss hotfrequencies Web page—free of charge. The 600 page guide is sized at 6.7×9.5 inches.

For information, contact Klingenfuss Publications, Hagenloher Str 14, D-72070 Tuebingen, Germany; tel 49-7071-62830, **www.klingenfuss.org**. Price: 45 Euros including worldwide postage.

EchoMac 1.12

◊ Dog Park Software has announced that version 1.12 of N9YTY's *EchoMac* client has been released and can be downloaded from **www.DogParkSoftware.com/EchoMac.html**. *EchoMac* is a program written for MacOS X, based on the *echoLinux* (**www.cqinet.sf.net**) program by Jeff Pierce, WD4NMQ, that gives licensed Amateur Radio operators the ability to access the Echolink system (**www.echolink.org**). New features of v1.12 include: Station information is now maintained via the preferences, not in a separate file; now recompiled for Panther (MacOS X 10.3); crashes with USB Audio devices when changing volume have been eliminated. For more information, contact Steve Palm, N9YTY, at **n9yty@n9yty.com**.

MultiPSK

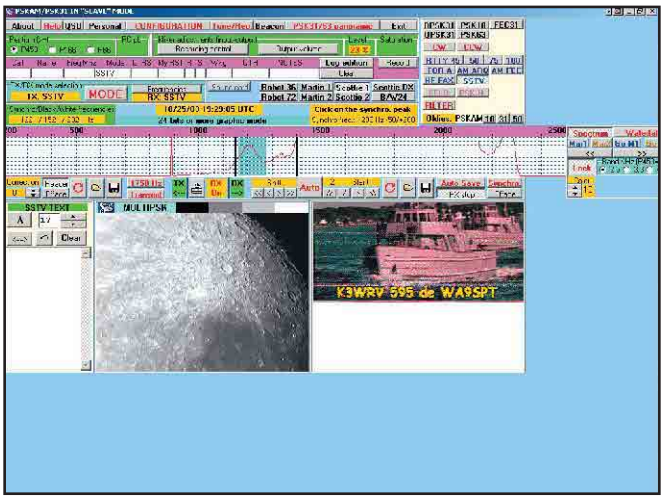
Is there such a thing as a free lunch? In the world of Amateur Radio software, it *does* occasionally happen.

Take Patrick Lindecker, F6CTE. He has developed a soundcard application for *Windows* known as *MultiPSK*. Thanks to some clever coding, *MultiPSK* allows you to converse with a cornucopia of digital modes including BPSK31, QPSK31, PSK63, PSK10, PSKFEC31, CW, Coherent CW, SSTV, RTTY, AMTOR (FEC) and Hellschrieber. It also includes receive-only ability with several other modes such as AMTOR (ARQ), NAVTEX and more. *MultiPSK* adds contact logging, with ADIF exporting for ARRL's Logbook of The World, and even DSP audio filtering. Perhaps the most remarkable thing about *MultiPSK* is that it is 100% free—no strings attached.

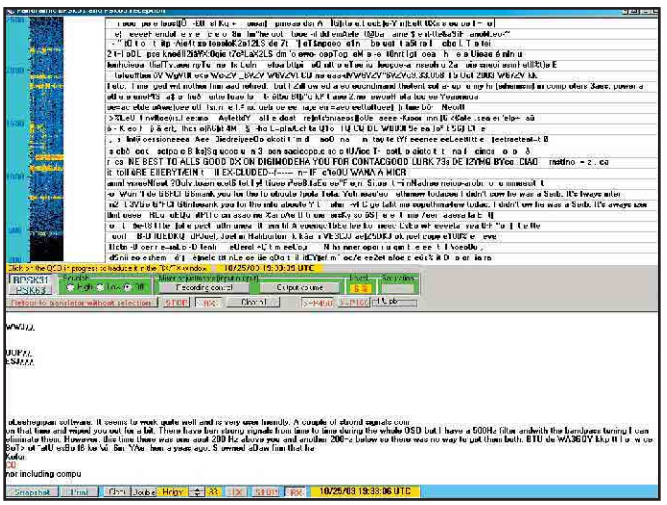
Patrick has written some interesting features into *MultiPSK* that are generally not found in other multimode programs. For example, not every amateur owns a powerhouse PC, so *MultiPSK* can adapt to slower machines. If you're using a 166 MHz Pentium, for example, you can click a button in the main window and *MultiPSK* will reconfigure accordingly. *MultiPSK* runs best with at least a 450 MHz Pentium, but it can function with a 66 MHz PC if necessary.

MultiPSK can print the active window at any time by clicking on a single button. This can be convenient when you need to preserve the text to paper. The print function prints the *entire* window, however, including graphic elements such as the buttons, etc.

With *MultiPSK* you can choose a "panoramic" display that will decode ("translate," as Patrick calls it) two dozen QSOs at the same time. The traditional waterfall display and a spectral display are available as well.



Slow-scan television (SSTV) with *MultiPSK* was great fun. Here I'm copying, with some noise and interference, an image being sent by WA9SPT.



In the panoramic mode, *MultiPSK* copies many PSK31 QSOs at once. Some of the text is gibberish "noise," but there are also several coherent streams. Double click on one of the moving streams and *MultiPSK* will switch to the single-signal mode.

Performance

I was able to try *MultiPSK* in several modes and found it to be a very capable program. PSK31 performance was excellent. The panoramic mode was fascinating, although it was confusing to wade through so many simultaneous streams of text. The familiar vertical waterfall display seemed to work best for me.

RTTY reception was good. It isn't at the performance level of something like *MMTTY*, but I think *MultiPSK* would be adequate for most contest and DX operating.

SSTV with *MultiPSK* was a blast. Tuning is easy with the spectrum display and slant correction was simple and straightforward. (A couple of mouse clicks and you're done.)

On CW, *MultiPSK* offered adequate copy as long as the sending is perfect. No surprises here. I've yet to see software that can copy sloppy sending as well as the wetware between your ears. I tried Coherent CW, but I couldn't find anyone operating CCW during the review period.

The DSP audio filters were fun to play with. Many modern transceivers have DSP filtering built-in, but with *MultiPSK* you gain some additional performance and flexibility.

Hits and Misses

MultiPSK hits the target when it comes to flexibility and overall performance. Patrick has written *MultiPSK* with the idea of giving users as many choices as possible. Unique conveniences, such as a button to "release" the sound card so that other applications can use it without shutting down *MultiPSK*, really shine.

Misses include the lack of the MFSK and MT63 modes. Neither mode has a large following, but you will hear them on the air from time to time. Also, Patrick has done his best to translate the button labels and help text from French to English, but there are several instances where the translation doesn't quite work. This can be a little jarring. I found myself pondering a couple of sentences on the help screens, trying to discern what Patrick really intended to say.

But as a friend of mine used to say, "Wadda ya want? It's free, fer cryin' out loud!" That's the point you need to keep in mind when using *MultiPSK*. For a freeware application, the positives far exceed the negatives.

Manufacturer: Patrick Lindecker, F6CTE. Download from the Web at **members.aol.com/f6cte/**. *Download is 1.42 Mbytes in a ZIP file.*

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

By Bob Shrader, W6BNB

Could You Use a Low Power AC Wattmeter?

What's what with your watts? Build this ac wattmeter and see how much power your gear really draws.

While I was talking to another ham on the air a while back, the subject came up regarding how many watts our computers were drawing from the 115 V_{rms} ac lines. He said that his was drawing 450 W. That seemed to be pretty high because I thought that mine was only drawing about 200 W. Since my computer is homebrew and I have never had an ac wattmeter or an adequate ac ammeter, I had never determined what my computer was really drawing. When I began thinking about it, I wondered about the power demands of lots of things around the shack. How could I measure the power draw of my equipment when all I had was a common multimeter that measured volts, ohms and current?

The Basic Circuit

The first thing was to develop a circuit that would allow power to be measured, using as many available junk-box parts as possible. The simplest thing to do would be to insert a low value resistor in series with the power line and measure the ac voltage-drop across it when the computer or other load was turned on. This voltage-drop could be used to determine the current in the line. The multimeter could be used to measure the line voltage to allow the power to be calculated using the formula, P = EI, or W = VA. The diagram in Figure 1 seems to be about the simplest circuit that would do the job. But fiddling around with clip leads and "hot" ac wires while trying to insert a resistor in the power line and measuring voltages could possibly wind up giving a person a nasty shock. That was not very appealing. A hay-wired circuit could be built on a 2 inch × 5 inch piece of dry board, but that still leaves a lot of hot wires accessible to unprotected fingers. The obvious solution would be to put the parts in some kind of protective enclosure.

The Wattmeter Device Project

It was decided that the circuit would be built into a RadioShack plastic 5 × 2.5 × 2 inch "project enclosure" that comes with both an aluminum and a plastic panel as part of the package. Any other enclosure, however, would probably do just as well. The parts can be assembled on the back side of whatever type of panel is used.

Most power line equipment today uses three-blade ac line plugs (U-ground duplex). Any wattmeter connected to those lines will require a duplex ac line socket to accept the equipment to be tested. It must also have a duplex plug to go into the ac wall outlet. The best solution to this requirement is to use an 8 foot or longer extension cord having U-ground duplex fittings. Cut it into two equal lengths, allowing the

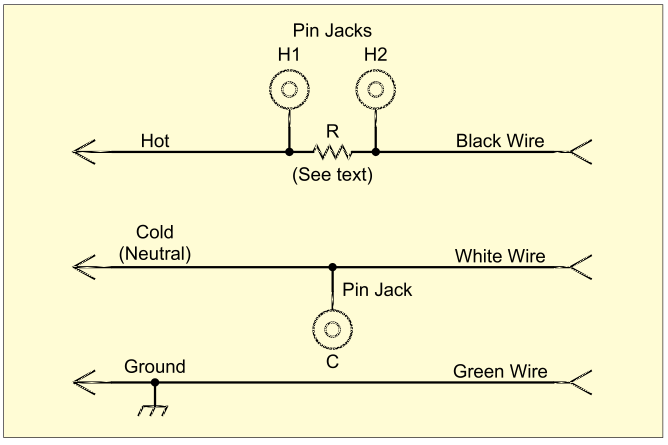


Figure 1—Basic wattmeter device circuit. R is the current sampling resistor and should be a value of 0.3-0.5 Ω at 10-20 W.

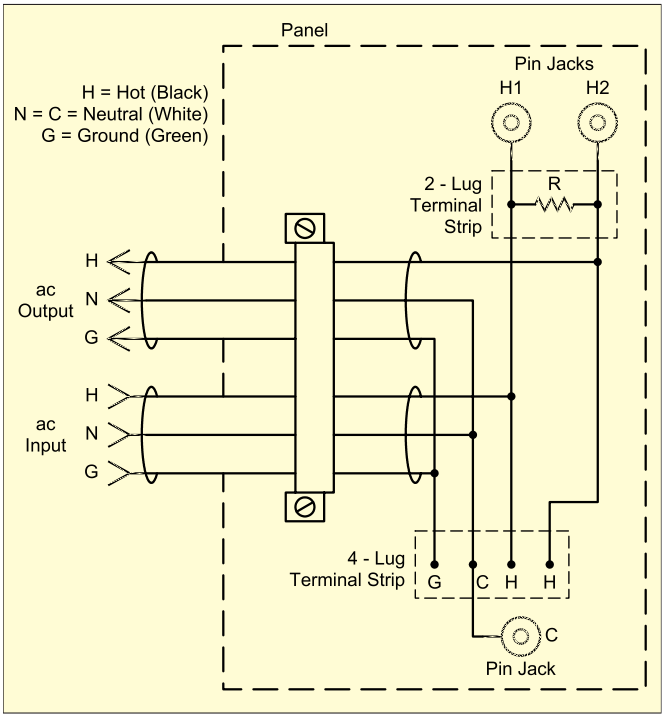


Figure 2—A possible arrangement of parts on the back of the enclosure panel.

Figure 3—Wattmeter parts mounting on the enclosure panel. Note the current sampling resistor at the lower left of the panel.

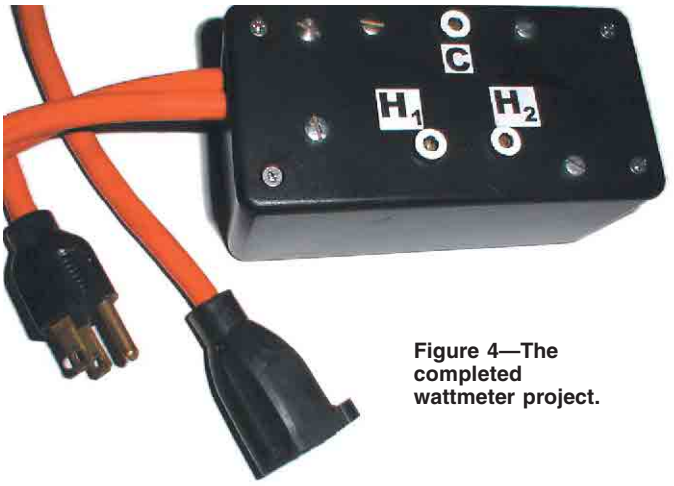


Figure 4—The completed wattmeter project.

wattmeter to be operated 4 or more feet away from were the equipment plugs into the power outlet. This distance of 4 feet is handy because equipment outlets always seem to be located behind a computer or transmitter, under an operating table or at some other hard-to-get-to place. The two cords should be loosely twisted together and tied about a foot from their end fittings.

Any equipment having a line cord with a two-blade plug at its end will fit into any three-blade, U-ground, duplex socket. If it's an older home it may have only two-blade wall outlets. In this case a three to two blade "grounded plug adapter" can be used. Use the adapter and ground its lead to the wall outlet screw. Don't make a habit of removing U-grounds from wall plugs. They're there for your safety and they should *not* be defeated.

In addition to the extension cord and whatever type of enclosure is used, the project requires the following:

- a four-lug tie-point
- a two-lug tie-point
- three pin-jacks for the multimeter probes
- a 10 W or higher wire-wound resistor, 0.3 to 0.5 Ω

A possible placement of parts on the back of a panel is shown in Figure 2. How and where they are mounted depends on the size of the parts and enclosure panel being used. The power cord wires can be soldered to the four-lug tie points. The resistor is mounted on the single two-lug tie point. Two of the pin jacks are connected to the resistor, and the third is connected to the "cold" ac lead. Figure 3 shows the parts mounted on the back of the panel. The completed project is shown in Figure 4.

The long, round, third blade (U-ground) on any three-blade ac line connector is always the true ground lead and should have a green insulated wire connected to it. One of the other two so-called "hot" leads is actually a "cold" lead because it is connected, eventually, to the building ground. This is the "neutral" lead. Looking at the wall outlet from the front, with the ground pin at the bottom, the wider, upper left opening should be the cold lead, and it will usually have a white wire attached. The smaller outlet opening should test as 115 V_{rms} ac (nominally) when measured with respect to the grounded hole (or the neutral lead) and this is the true "hot" wire. It usually has black insulation on its wire and it is labeled H in the figures. Any wire labeled C is a cold (neutral) wire. A wire labeled G is a true-ground wire.

Do not connect any H wires or C wires to any tie point lug that touches a metal panel or has a bolt coming through a plastic panel that might be touched from outside. The two cords must be clamped to the panel with a homebrew aluminum or other sheet metal clamp. The color coding of the extension cord wires must be maintained.

It will be necessary to saw, or drill and file, a small opening at one end of the enclosure to allow the two extension cords to slip down into the enclosure when the panel is mounted.

Testing the Project

When the wiring and the enclosure hole are completed, the panel can be screwed to the open side of the project case. The three pin jacks for the multimeter will be available for use from the outside of the enclosure as shown.

Check your wiring by holding an ohmmeter across all combinations of the three male prongs. No resistance reading should be found. Repeat with the three female contacts. Then check for continuity—a low resistance indication—between all three extension-cord male and female fittings.

Plug a portable drop light having a brand new 100 W lamp into the female fitting of the extension cord, but *not* into the wall outlet yet. Be careful of so-called "long life" lamps. They are actually designed for 130 V_{rms} ac service and do not draw 100 W at a line voltage of 115 V_{rms} ac. Use a standard light bulb. You should now get a fairly low resistance reading between the H and C pin jacks. Disconnect the multimeter from the wattmeter device. You are now ready to calibrate your wattmeter.

Calibrating the Wattmeter

With the 100 W drop-light plugged into the extension cord female fitting and the male fitting plugged into the wall outlet, the lamp should glow brightly. Set the multimeter to some ac voltage scale over 120 V_{rms} ac and plug its test prods into pin jacks H2 and C. Make a note of this line voltage (it should be about 115 V_{rms} ac).

Warning! Any time you use meter test prods to measure any line voltages, never touch the metal portion of the meter probes. In this case, both pin jacks H1 and H2 are connected to the hot wire of the ac line. (If you are not grounded in any way you *might* not receive a shock even if you do touch them, any more than a bird sitting on a high voltage wire does. If you are grounded when touching one of the metal probes you could receive a substantial and life-threatening shock!) If the meter prods are less exposed, the likelihood of receiving a shock will be reduced. All but the end quarter inch can be insulated with tape or coated with so-called "liquid electrical tape."

Next, insert the meter probes into the H1 and H2 pin jacks. This voltage will be quite low, so carefully switch to the lowest ac voltage scale on the multimeter to make the reading. Make a note of this voltage drop (it should be about 0.3 V_{rms} ac).

You now have two voltages—one is the line voltage (about 115 V_{rms}), E_L, and the other is the voltage drop across the re-

sistor, E_R (about 0.3 V_{rms}). The latter voltage is related to the current flowing in the circuit. A conversion factor must now be calculated that can be used to compute the actual current value for all power measurements.

Since the low-Ω resistor value is not known accurately, with a line voltage of 117.5 V_{rms} there will be some unknown current value that will light up the 100 W lamp. The voltage drop (about 0.3 V_{rms}) multiplied by some number (F) will provide the needed current value.

To compute F: Substituting from the power formula, P = E × I, where I is going to have to equal E_R × F, substituting known numbers, 100 W =117.5 V multiplied by (0.3 × F). To solve for F: First, 100/117.5 = 0.85, so F = 0.85/0.3, or F = 2.83. This number proves to be correct when it is substituted in the power formula, P = E × I, where E_R × F is substituted for I. So, the complete formula to determine the load power will always be P = E_L × (E_R × 2.83). To prove this:

P = E_L × (E_R × 2.83)
P = 117.5 × (0.3 × 2.83)
P = 117.5 × 0.85 = 99.9 W (close enough)

When the F factor is found, then E_R × F will always be your line current. This times the line voltage (where P = I × E) will be the power drawn for the load being tested. The line voltage may vary several volts at different times of the day. Your transmitting equipment will therefore not always be operating at the same power input. If it is solid-state, however, and has voltage-regulated power supplies, the power output should not vary.

Accuracy?

How accurate will this wattmeter device be? First, the meter will have a small percent error in both of the scales used. A new 100 W lamp will only have that value at one line voltage value, which should be at about 117.5 V_{rms}. (It is important to use a new lamp when calibrating because a used lamp will have lost filament molecules increasing its resistance, decreasing its current, resulting in its drawing less than 100 W.) If your line voltage is 117.5 V_{rms} your factor should give fairly accurate power values. If your line voltage is different you will have somewhat less accuracy. To improve your accuracy a little, you might try two or three new 100 W lamps and use the average of their factors. Check other new 75, 60 and 30 W lamps. They should compute close to their power ratings. The values you measure should be relatively accurate, and will probably tell the approximate values wanted, up to 400 or 500 W.

If power measurements of more than 500 W are required, the fraction-of-an-ohm resistor should have a power dissipation of 20 W or more to prevent it from warming and possibly changing its resistance value. If possible, make voltage readings as rapidly as possible to prevent the resistor from heating and changing its resistance.

A DC Wattmeter

This little device can also be used to measure dc power. Of course, the multimeter will have to be switched to read dc voltages instead of ac. Since dc equipment often operates at lower voltages than power line ac equipment does, it will draw proportionally more current for the same power output.

Direct current operated equipment will not normally use U-ground duplex plugs, so heavy duty clip leads may have to be used to connect to the power supply and to the equipment under test.

Be careful of dc polarities. First, the connections from the power supply to the device should be tested to see if the polarity is correct by using the dc voltmeter properly. The polarity of the leads from the equipment must be tested to make sure the positive equipment wire goes to the positive potential output, and the negative to the negative. Color-coding of the extension cord wires can help in this respect.

My Results

I found it most interesting that my computer coupled to its 17 inch monitor draws only 143 W when working, regardless of what it is doing.

My 20 year old solid-state transceiver, with a built-in ac power supply, idles at 87 W when turned on. With the key

A Factor to Consider

By Stu Cohen, N1SC, Technical Editor, *QST*

This device can be used to effectively measure the true power of *resistive* loads, but not the *real power* of *reactive* loads. The real power in an ac circuit is P = E×I×cosθ, where θ is the angle between the voltage and the current. This device reports *apparent power*, which is V_{rms}×A_{rms}. If the load is a motor that has reactance, we need to account for something called *power factor* (PF). PF is the cosine of the angle between the current and voltage in an ac circuit. For most loads (which are resistive) the voltage will be in phase with the current, the angle will be 0°, and the PF will be 1. For inductive loads, however, like the motor in a drill press, the current will lag the voltage and that phase angle could be 30°, resulting in a PF of 0.87 (the cosine of 30°). If the line voltage is 115 V_{rms} and the motor current is 2 A_{rms}, this device will give a measurement of 230 W. The real power, however, will be 230 W × 0.87 = 200 W.

What happened to that extra 30 W? That power is the difference between the apparent power and the real power and is called *reactive power* or VAR. In this case, the VAR is used by the motor to generate its magnetic field, then returned to the circuit. The power company typically bills residential users for real power, not apparent power. They will assess a reactive power surcharge if the power factor is consistently low, as their equipment must handle the reactive power that's not paid for.

It's advantageous to both the user and the power company to correct a low PF and bring it closer to 1. That way the user doesn't have to pay for power that's not doing useful work and the power company doesn't have to handle it. As it turns out, that's relatively easy to do. PF can be corrected and brought nearly to 1 by adding one or more capacitors across the load. Remember that capacitive reactance is always negative and inductive reactance is positive. If we shunt the load (motor) with a negative reactance, we can cancel some of the motor's reactance and bring the power factor closer to 1. Utility PF correction capacitors are quite common. They are sometimes seen (rectangular gray boxes topped with ceramic insulators) on utility poles outside factories and industrial complexes that use lots of high power motors, transformers or welding equipment.

How do we measure power factor on the workbench? It's not easy; usually an oscilloscope is required with a current sensor. Commercial ac power meters that account for, and measure, power factor are available, however. A product announcement of one of these, the *Kill A Watt* meter[1] appeared in *QST* (Jan 2003, p 60). This meter computes W, PF, V_{rms}, A_{rms}, Hz, VA and cumulative kWh, and has an accuracy of 0.2%. Consider PF when you use this little device to measure the power of reactive loads and remember that the apparent power you measure will be higher than the real power (that you pay for) for inductive loads with uncorrected power factors of less than 1.

[1]**www.p3international.com/products/special/P4400/P4400-CE.html#**.

down and an SWR of 1:1, it draws 584 W of input power to transmit 100 W of CW (only 17% efficient). At an SWR of 3:1 it draws 567 W and puts out about 50 W because its automatic load control (ALC) protection circuit reduces RF power amplifier collector current when the SWR is high. When switched to SSB using an SWR of 1:1 and with the microphone switch off, the transceiver circuits draw 87 W. With the mic switch closed, the input power increases to 183 W because several sections of the transceiver are now put into operation. With loud speech or a whistle, the power input is driven up to 367 W for peak RF signals of 100 W output. The average RF power indication on the transceiver power meter is about 35 W. The power input does not increase appreciably with loud or weak received signals.

My 1 year old solid-state transceiver uses a separate 13.6 V dc power supply. With the transceiver off, but with the supply turned on, it draws 34 W. With the transceiver on and receiving, the power input increases to 68 W. With the key down and transmitting 100 W of RF output the power input is 435 W (23% efficiency). When switched to SSB the input power is 68 W. When the mic switch is pushed the input power is 135 W. The loudness of the speech into the microphone determines the power output. With a loud whistle the power draw is 367 W. The last 20 years seems to have improved the efficiency of transceivers!

My ink-jet printer runs about 10 W idling and about 20 W while printing.

My laser printer draws 550 W during its warm-up period, then runs 10 W idling, alternating between 550 W and 30 W while printing.

My solid-state oscilloscope only draws about 10 W when displaying, regardless of whether a signal is being shown or not.

How much power does your equipment draw? Did you ever figure out, if electricity costs an intermediate 12 cents per kWh, how much it would cost to operate your computer, printer and radio equipment for 8 hours? That might be interesting, or… would you rather not know?

All photos by the author.

Licensed for 72 years, since 1931, Bob Shrader, W6BNB, has been a seagoing radio operator, a deputy sheriff, a teacher and a Fire Chief. He taught radio and electricity to cadets at the US Merchant Marine Academy at Kings Point, New York and radio communication at Laney College in Oakland, California. He retired from teaching in 1969. Bob has published over 45 articles in QST, CQ, 73, Ham Radio *and* Worldradio. *In addition, he is the author of* Electronic Communication, Electrical Fundamentals for Technicians *and* Electronic Fundamentals for Technicians, *all published by McGraw-Hill, with* Electronic Communication *now in its sixth edition. Bob has held an Amateur Extra class ticket since 1952 and he can be contacted at 11911 Barnett Valley Rd, Sebastopol, CA 95472;* **w6bnb@aol.com**.

STRAYS

W6RCL WINS MURROW AWARD

◊ Alan Kaul, W6RCL, is among the handful of NBC News producers who have won the 2003 Edward R. Murrow Award from the Radio Television News Directors' Association. *NBC Nightly News with Tom Brokaw* was cited as "the best newscast" for its coverage of the arrest of the Washington, DC snipers. Television newsman Kaul produced a segment for the broadcast that focused on one of the sniper suspects who had lived previously in Tacoma, Washington.

A *QST* author and a major contributor to the *Amateur Radio Today* video, Kaul was also part of the NBC News team honored with a Murrow Award for its coverage of the death of Mother Teresa in Calcutta, India.

WØWGZ

Look out! **Although it looks as though the hot air balloon over Arnold Bucksbaum's station in Cedar Rapids, Iowa, is about to meet its demise, courtesy of the satellite antenna at WØWGZ, it's actually far above the fray.**

SHUTTLE COLUMBIA RECOVERY EFFORT SPECIAL EVENT

◊ Nacogdoches Amateur Radio Club invites everyone who actively participated in the Shuttle Columbia Recovery Effort to operate with them at their special event February 1, 2004. For more information contact Kent Tannery, KD5SHM, at **mkt3920@yahoo.com**.

FEEDBACK

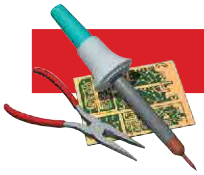
◊ In the December 2003 "Up Front in *QST*" column, the call sign of nine-year-old Matt Melachrinos should have been written as KB3JJV.

NEW PRODUCTS

SGC MAC-200 MASTER ANTENNA CONTROLLER

◊ SGC's MAC-200 "Master Antenna Controller" brings SGC's coupler technology to the radio room to control up to five antennas automatically. The MAC-200 is a fully automatic switch and tuner integrated into a single box. Antenna selection is automatic under internal computer control based on the frequency of operation. Once the antenna is selected, the tuning settings for the frequency are applied to ensure a match. Front panel meters provide an indication of power and SWR for use in evaluating operation.

For more information, contact SGC Inc, 13737 SE 26th St, Bellevue, WA 98005, tel 425-746-6310; **www.sgcworld.com**. Price: $359.95.



By Steve Ford, WB8IMY

Amateur Radio Glossary

A single-page guide to common *hamspeak*.

Amateur Radio, like any other specialized avocation, has a hybrid language all its own. It's a mixture of English, arcane acronyms and good old-fashioned jargon. Some features of the ham lexicon, such as Q-signals, evolved from CW operating. Others evolved from sources that are more obscure.

Here are some brief definitions of the more common terms you're likely to encounter in *QST,* on the air and elsewhere…

73—Best regards.

Alligator—Slang term meaning "all mouth and no ears." A station that transmits well, but receives poorly.

APRS—Automatic Position Reporting System. A network of packet radio stations that regularly report their position coordinates, often using Global Positioning System (**GPS**) receivers. Station positions are displayed on computer-generated maps.

ARES—Amateur Radio Emergency Service. Licensed amateurs who have voluntarily registered their qualifications and equipment for communications duty in the public service when disaster strikes. Every licensed amateur, regardless of membership in ARRL or any other local or national organization, is eligible for membership in the ARES.

Autopatch—A device that allows repeater users to make telephone calls through repeaters.

Beam antenna—A directional antenna. A beam antenna must be rotated to provide coverage in different directions.

BPL—Broadband over Power Lines: a proposed system for providing Internet access to consumers using existing ac power lines. The ARRL opposes BPL because it is likely to cause substantial interference to hams.

Busted call—A call sign that is logged incorrectly.

CTCSS—Continuous tone coded squelch system. A subaudible tone system used on some repeaters. When added to a transmitted signal, a CTCSS tone allows a receiver to accept the signal. Also called *PL*, which is an abbreviation for *Private Line*, a Motorola trade name.

DTMF—Dual-Tone Multi-Frequency. More popularly known by the trade name *TouchTone*, an audio signaling system using pairs of tones. There is a "low tone" and a "high tone" associated with each button (0 through 9, plus * (star) and # (octothorpe or pound symbol) on a DTMF keypad. The low tones vary according to what horizontal row the tone button is in, while the high tones correspond to the vertical column of the tone button. Many amateur handheld transceivers are equipped with DTMF keypads for use with **autopatches** and other functions.

Dummy load—A station accessory that allows you to test or adjust transmitting equipment without sending a signal over the air. Also called a *dummy antenna*.

Dupe—In contesting, a duplicate contact.

DX—Long distance.

DXCC—The ARRL DX Century Club award program.

DXpedition—A temporary operation from a location that seldom sees Amateur Radio activity.

Earth-Moon-Earth (EME) or Moonbounce—A method of communicating with other stations by reflecting radio signals off the Moon's surface.

EchoLink—A networking system based on sound-card software that uses the Internet to relay signals over long distances.

Elmer—Slang term for an Amateur Radio guide or mentor.

GPS—Global Positioning System. A constellation of satellites that transmit microwave signals used by receivers on the ground to pinpoint their locations. **APRS** relies on GPS receivers to track moving objects.

IRLP—Internet Radio Linking Project. A network of dedicated access stations, or "nodes," that use the Internet to relay signals over long distances.

Meteor scatter—Communicating over long distances by bouncing signals off the ionized trails of meteors as they enter the atmosphere.

Multimode transceiver—Transceiver capable of SSB, CW and FM operation.

Net—An abbreviation for "network." An on-air gathering, often on a single frequency, for a specific purpose.

OM—"Old Man." Used to refer to any male.

Packetcluster—A network of automated packet radio stations dedicated to sharing reports of DX and contest activity. Similar to Internet systems known as *Webclusters*.

Pileup—A chaotic situation that occurs when many stations are calling one station simultaneously.

Ping jockey—Slang for a **meteor-scatter** operator.

Q signals—Three-letter symbols beginning with Q. Used on CW to save time and to improve communication. Common Q signals include QTH (location), QSL (receipt to verify a contact), QRV (ready to receive; "listening"), QSO (conversation), QRM (interference from other transmitters), QRN (noise interference). You can find a complete list on the ARRLWeb at **www.arrl.org/FandES/field/forms/fsd218.html**.

Shack—The room where an Amateur Radio operator keeps his or her station equipment.

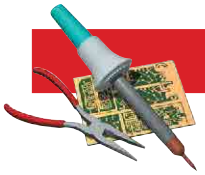
WSJT—A software package written by Joe Taylor, K1JT, which permits **meteor scatter** and **EME** communication with modest station hardware.

Yagi—The most popular type of amateur directional (beam) antenna. It has one driven element and one or more additional elements.

YL—"Young Lady." Used to refer to any female.

XYL—"Ex-Young Lady." Married female.

Steve Ford, WB8IMY, is the Editor of QST. *You can contact him at* **sford@arrl.org**.



Experiment #12—Field Effect Transistors

Welcome to the second year of "Hands-On Radio." After an introduction and 11 experiments, we've covered a lot of ground but it seems like we've only scratched the surface! Radio electronics is a pretty broad field, so there are lots of experiment topics remaining.

The field effect transistor, or FET, is an attractive replacement for bipolar transistors in switches and amplifiers. Why? The FET offers high input impedance, excellent gain, and easy biasing. We'll revisit the first "Hands-On Radio" experiment and find out how these characteristics fit the common-emitter design.

Terms to Learn

- *Transconductance*—The measure of change in output current caused by a change in input voltage.
- *Channel*—The semiconductor material between an FET drain and source through which current flows.
- *Enhancement and depletion mode*—In enhancement-mode FETs, increasing gate voltage causes channel conductivity to increase. For depletion-mode FETs, the opposite is true.
- *On-resistance*—The drain-to-source resistance of an FET's channel at maximum conductivity.

Background

While you may know that John Bardeen, Walter Brattain and William Shockley constructed the first bipolar transistor in 1948, you may not know that the idea behind the FET was patented in 1926 by Julius Lilienfield. A working (but very slow) amplifier was made using salt by Robert Pohl in 1938. The FET is actually the oldest transistor and its operation is much closer to the vacuum tube than the bipolar transistor.

Figure 1 shows the rudimentary construction and symbols for the two primary types of FETs, the junction FET (JFET) and the metal-oxide-semiconductor FET (MOSFET), that we met in experiment #9. Metal electrodes attach leads to the semiconductor material. The junction in a JFET is formed by the different material types (P and N) of the gate and the channel. MOS describes the construction of the gate; a metal electrode coating an insulating layer of oxide (usually quartz, silicon dioxide or SiO_2) which, in turn, contacts the channel material directly. FET and bipolar transistors have terminals with similar functions—gate and base, collector and drain, and emitter and source.

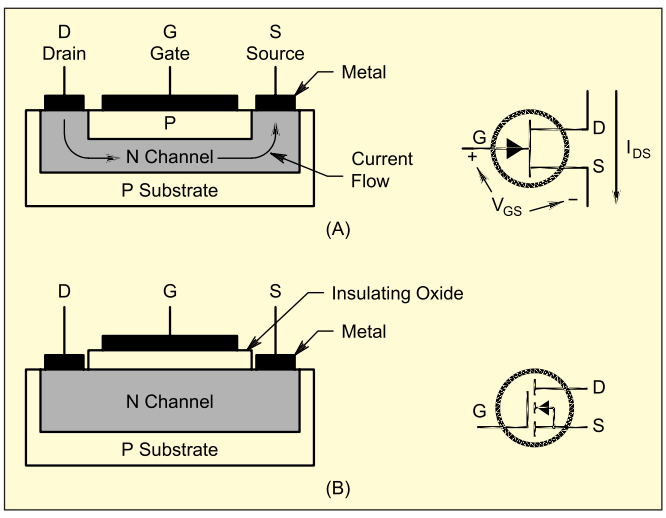


Figure 1—JFET (A) and MOSFET (B) construction are shown along with their symbols. N-channel, enhancement-mode devices are shown.

Where the bipolar transistor uses input current to control output current, the FET uses input voltage. In place of the bipolar transistor's pair of P-N junctions placed back-to-back between collector and emitter, the FET has a *channel* of either P-type or N-type material. In the bipolar transistor, current flows from the base to emitter, controlling current flow through the two P-N junctions. In the FET, gate voltage changes the conductivity of the channel and so the current flowing between drain and source also changes. Very little current flows in the gate of an FET.

Like the bipolar transistor's NPN and PNP devices, the FET comes in different flavors, but it has *four* instead of two. Figure 1 shows N-channel devices, but the channels can be made of either N or P-type material and the device can be designed so that increasing gate voltage causes more or less current to flow in the channel. If more channel current flows with increasing gate voltage, it is an *enhancement-mode* device. Conversely, *depletion-mode* devices have less current with increasing gate voltage. The most widely used device is the N-channel enhancement-mode FET.

The change in output current caused by a change in input voltage is called *transconductance*. Analogous to a bipolar transistor's current gain or beta, its symbol is g_m and its units are siemens (S) because it measures the ratio of current to voltage.[1] The input voltage, V_{GS}, is measured between the FET gate and source. The output current, I_{DS}, flows from drain to source.

$$g_m = \Delta I_{DS} / \Delta V_{GS} \text{ and } \Delta I_{DS} = g_m \Delta V_{GS} \qquad \text{[Eq 1]}$$

The voltage gain of the FET amplifier in Figure 2 depends on the FET transconductance because varying the current in the FET drain causes a varying voltage across the drain resistance. The model for the FET is the variable resistive divider shown in Figure 2A, with V_{GS} controlling the value of R_{DS}. If V_O is measured at the drain terminal (just as the common-emitter output voltage is measured at the collector), then

$$\Delta V_O = -\Delta I_{DS} R1 = -g_m \Delta V_{GS} R1 \qquad \text{[Eq 2]}$$

Substituting this relationship gives voltage gain in terms of transconductance and the drain load:

$$A_V = \Delta V_O / \Delta V_{GS} = -g_m R1 \qquad \text{[Eq 3]}$$

[1]Siemens (pronounced "see-mins") is the international unit for conductance, formerly mhos. Its symbol is a capital "S" and 1 siemens = 1 A/V.

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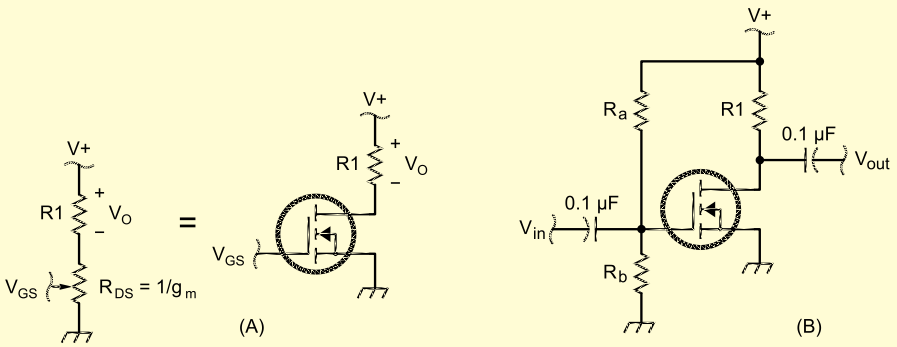


Figure 2—(A) A MOSFET common-source amplifier can be modeled as a variable voltage divider between the drain load and the FET. (B) A simple MOSFET amplifier with a voltage divider for supplying gate bias.

The minus sign results from the output voltage decreasing as drain current increases, just as with the common-emitter amplifier.

A key difference between the FET and bipolar transistor is that the channel of an FET acts like a variable resistance. That means that drain-to-source voltage can become quite low—lower than a completely saturated bipolar transistor's V_{CE}. Note that the *on-resistance* for power FETs can be very low—in the milliohm range. This allows them to switch heavy loads while dissipating little power. In amplifiers, this also allows more output voltage swing.

Another important parameter of FETs is the gate-to-source voltage at which no more current flows through the channel. This is called the *pinch-off voltage*, V_P. Imagine the gate voltage as a pair of fingers tightening or loosening around a hose carrying a stream of water and you'll have a pretty good idea of the mechanics involved. When V_{GS} reaches V_P, the area of the channel through which current flows is reduced to zero. Depending on the type of FET, V_P can be positive or negative. Switching MOSFETs are generally designed to have V_P greater than zero to make interfacing with digital logic easier. The voltage at which the MOSFET begins to conduct current is usually shown as $V_{GS(TH)}$, the *gate threshold voltage.*

Testing a MOSFET Common-Source Amplifier

This experiment will use a common switching MOSFET, the IRF510. This is a large transistor capable of handling several amps of drain current, but it demonstrates the mechanics of MOSFET amplifiers well. You may want to download the data sheet for the transistor.[2]

- When using a single power supply, it's necessary to bias the gate so that output voltage can both increase and decrease. Bias is supplied by R_a and R_b which act as a voltage divider—$V_{GS} = R_b / (R_a + R_b)$. For the divider, use a 10 kΩ potentiometer with the wiper connected to the FET gate and the remaining leads connected to V+ and ground. Start with the potentiometer set so that the wiper is nearly at ground voltage. Leave the input signal source disconnected.
- The IRF510 can handle a lot of current, but we'll limit drain current to 12 mA by using a 1 kΩ resistor for R1.
- Monitor the FET drain voltage and slowly adjust the bias pot so that gate voltage increases. When the gate threshold voltage is reached, the FET will start conducting and drain voltage will fall rapidly to zero. Record the gate threshold voltage as well as the voltage when the FET drain is 1 V below V+ and 1 V above ground.
- Set the signal generator to output a 0.1 V_{p-p} 1 kHz sine wave. Set the bias voltage halfway between $V_{GS(TH)}$ and V+. Connect the input signal. Observe the output voltage and experiment by adjusting the bias voltage to get the largest undistorted output.
- Calculate voltage gain, A_v = – (drain voltage change) / (gate voltage change) and transconductance, $g_m = -A_v / R1$. My FET showed a voltage gain of –18 and a transconductance of 0.018 S.
- Experiment by varying R1 and observing the effect on voltage gain. Readjust the bias setting and input voltage to get the maximum undistorted output voltage for each value of R1.

You may be asking yourself why your measured transconductance is so low compared to the specified minimum of 1.3 S in the data sheet. The answer lies in the graph of transconductance versus drain current (Figure 12 in the data sheet). The IRF510 transconductance is optimized for drain currents of several amperes and it falls off drastically at low currents.

Suggested Reading

Begin by reading the ARRL *Handbook* sections on FETs, beginning on pages 8.23 and 10.32. *The Art of Electronics* devotes all of Chapter 3 to FETs, with sections 3.07 and 3.08 covering amplifier design.

Shopping List

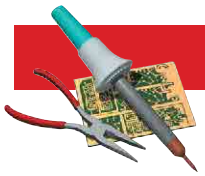
- IRF510 transistor (RadioShack 276-2072)
- 10 kΩ potentiometer (multi-turn preferred, but not required)
- Two 0.1 µF capacitors
- 1 kΩ, 1/4 W resistor

Next Month

We have focused on active circuits throughout the first year of "Hands-On Radio." It's time to consider a passive circuit for a change. Next month, we'll explore several types of attenuators and their design equations.

The Hands-On Radio Web site is **www.arrl.org/tis/info/html/hands-on-radio/**. QST

[2]The IRF510 data sheet may be downloaded from **www.rigelcorp.com/__doc/8051/IRF510.pdf**. (Note: There are two consecutive underscores prior to "doc.")



HINTS & KINKS

ALTERNATIVE PARTS FOR THE TWO TUBE TUNA TIN TRANSMITTER (T5)

◊ I enjoyed reading the January (2003) *QST* article about a vacuum-tube version of Doug DeMaw's Tuna Tin transmitter.[1] Steve Johnston, WD8DAS, was lucky enough to come across a "lifetime" supply of 5763 tubes at a reasonable price. For others interested in building the transmitter, there are readily available substitutes for the 5763. In the mid-1960s, transmitter construction projects in *QST* and *The ARRL Handbook* started using the 6GK6 as a low-power driver stage for a pair of 6146 amplifier tubes. Table 1 compares characteristics of the 5763 and 6GK6.

Other possible substitutes are the 12BY7A and the 6CL6. These two substitutes have lesser maximum plate dissipations and will have less output power than the 5763 or the 6GK6. Don't forget that the substitutes all have different pin arrangements.

If the T5 is to be used on frequencies above 80 meters, the values of the two RF chokes in the plate circuits (L2 and L3) should be reduced. A 1 mH choke has a self-resonant frequency of around 6 MHz, which is suitable for 80 meters, but may have series resonances on the higher amateur bands. For operation from 80 meters to 20 meters, choke values of 120 µH would keep self-resonance above 14 MHz. The only change needed is to increase the inductance of the π-network coil slightly to account for the parallel inductance of the plate choke. If single-band operation is planned, the values of the two plate chokes can be selected for the specific band. Good values to avoid self-resonance problems are: 40 meters, 220-270 µH; 30 meters, 150-220 µH; 20 meters, 100-120 µH. *—Mal Crawford, K1MC, 19 Ellison Rd, Lexington, MA 02421;* **Malcolm_Crawford@Raytheon.com**

[1]S. Johnston, WD8DAS, "The Two Tube Tuna Tin Transmitter (T5)," *QST*, Jan 2003, pp 39-42.

Table 1
Tube Characteristics

Tube	*5763*	*6GK6*	*12BY7A*	*6CL6*
Maximum Plate Voltage (V)	350	330	330	300
Maximum Screen Voltage (V)	250	330	190	300
Filament Current (A)	0.76	0.76	0.60	0.65
Grid Capacitance (pF)	9.5	10.0	10.2	11.0
Plate Capacitance (pF)	4.5	7.0	3.5	5.5
Grid-Plate Capacitance (pF)	0.3	0.14	0.063	0.12
Plate Dissipation (W)	13.5	13.2	6.5	7.5
Transconductance (mS)	—	11.3	11.0	11.0

Table 2
Tube Base Connections

	Pin Number			
Tube	*5763*	*6GK6*	*12BY7A*	*6CL6*
EIA Base Code	9K	9GK	9BF	9BV
cathode	7	1	1	1
control grid	8, 9	2	2	2, 9
screen grid	6	8	8	3, 8
suppressor grid	3	3, 9	3, 9	7
plate	1	7	7	6
heater 1	4	4	4	4
heater 2	5	5	5	5
heater center tap	—	—	6	—

SLOW-SPEED EXTERNAL FAN COOLS TRANSCEIVER

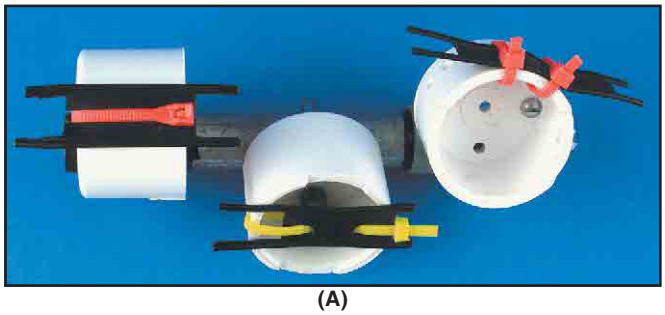
◊ I always objected to the high noise level from the cooling fan inside my Kenwood TS-570. I decided to position a small, external 12 V dc fan, pointed at the heatsink on the back panel of the transceiver. When connected to 12 V, however, the little fan "screamed" at a level almost as obnoxious as the internal fan.

In my junk box, I found an old wall wart dc power supply originally intended for a Black & Decker electric drill. It is rated to deliver 7.5 V dc at 400 mA with a supply voltage of 120 V ac.

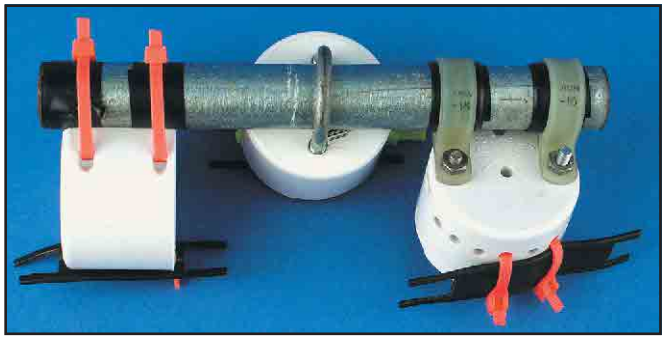
The 7.5 V drives the little 12 V fan at a slower RPM than does 12 V, but it still moves a lot of air. The wall-wart case runs cool to the touch, and the fan provides enough cooling air on the transceiver heatsink so that the internal fan never comes on. I power the wall wart from the same power strip that supplies ac to my transceiver power supply, so there is no need for another switch to control the external fan.—*Steve Swaim, W5LXG, 219 La Costa Dr, Montgomery, TX 77356;* **w5lxg@arrl.net**

A WINDOW-LINE SUPPORT

◊ A popular parallel-wire transmission line is a 450 Ω version encased in brown polyethylene with cutouts in the web, called "Ladder Line" or "Window Line." Because its fields are external to the wires, it works best when spaced away from metal masts, roofs, gutters, fascia, fences and the like. Any support needs to be low-loss, weatherproof, readily available, easily



(A)



(B)

Figure 1—A front view (A) shows several ways of securing window line to PVC caps used as standoffs. A rear view (B) shows several ways of securing PVC caps to a pipe. The caps could be secured to flat surfaces with appropriate screws through the cap and into the surface. Appropriate screws would be wood screws for a wood wall, sheet metal screws for thin metal or wood screws with plastic anchors for masonry.

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

worked, versatile and inexpensive. Believe it or not, a single shape, a PVC plumbing pipe cap in 1 1/2 inch size (actually 2 1/4 OD 1 1/2 inches deep) meets all these requirements. You can mount it horizontally or vertically, to any kind of structure, by its top or side, with screws, bolts, clamps or straps. You can notch it to accept the line, then drill two places to accept a nylon cable tie. By using two or more ties, you can change the line direction by wrapping it partway around the circumference. If you need more clearance, stack two caps side-by-side, end-to-end or side-to-end. Beware, however, that the hidden danger in using encased line is that it can develop invisible broken wires from constant flexing from the wind. So, to be safe, use more, not fewer, supports.—*W. A. "Spud" Monahan, K6KH, 817 Pacific Ave, Manhattan Beach, CA 90266-5849*

INCREASE LAMP LIFE

◊ I found the article on solid-state pilot lamps interesting.[2] I didn't know that LEDtronics and Lumex had complete assemblies available.

If the purpose of creating the LED assemblies was to reduce lamp burnout, why not simply put a small resistor in series with the lamp? Lamp life is an exponential function of voltage, so a very small change in voltage will produce a very large increase in lamp life.

I was burning out many lamps in my Heathkit AR-29 stereo receiver, until I put a 1.2 Ω 1/8 W resistor in series with each lamp. The light output is reduced slightly, but I have not burned out a single lamp in 27 years. I've had similar results with my old tube Drake equipment. This is certainly a lot less work than creating the LED assemblies.—*Steve Lund, K6UM, 10180 Mill Station Rd, Sebastopol, CA 95472-9655*

AD5X Responds

Actually, I used LEDs to reduce the power of the lamps (as well as stop burnout). My lamps are enclosed in very old meters and dials with no air circulation at all. The incandescent lamps were generating over a watt each, so I worried that they might damage the housings.—*Phil Salas, AD5X*

Different Lamps may Help, Too

With the dealer charging $150 to open the instrument panel, I waited years to replace several burned out dial lamps in my Subaru, and then I did the work myself. When I found the replacements, they were rated for only 500 hours. That's a *terrible* engineering choice for something so expensive to replace. A quick review of the lamp catalog revealed similar lamps using slightly less current (less light) but offering 2500 hours of life.—*Bob Schetgen, KU7G*

GROUND-ROD INSTALLATION—SAFETY FIRST!

◊ Be sure to find the location of buried electrical lines, water lines and gas lines before driving a ground rod as described in the May 2003 column! Many natural-gas utilities use polyethylene pipe for service lines. Using a driver as described, you would never know when you hit a gas line and cause a very dangerous situation.—*Larry L. Lehmann, KCØDA, 528 West Ave, Minden, NE 68959-1421;* **kc0da@arrl.net**

HISTORY OF HINTS AND KINKS—A TIMELINE ERROR

◊ The last line of the timeline in the November column is incorrect. The first Hints and Kinks book was published in May 1933. Many readers caught this error. Thanks to you all for keeping a close watch on me!—*Bob Schetgen, KU7G, Hints and Kinks Editor*

TOWER FOOTING HINTS

◊ I enjoyed Bart Pulverman, WB6WUW's article "Self-Supporting Tower and Antenna Installation" (*QST*, July 2003, pp 33-37). It reminded me of the cold January evening years ago when I used a wheelbarrow to move 12,000 pounds of concrete (by myself!) from the ready-mix truck to my crank-up tower foundation; the reason I had to do that is a story in itself.

Nonetheless, I have a few suggestions to make the excavation easier if you plan to dig by hand as I did. Because the space to work is so limited (in my case, the hole was only 42 inches on a side), I found an old garden shovel and then sawed off most of the handle. This produced a "shorty" shovel with which I could easily move the loosened soil up and out of the hole. I encountered fairly hard clay at a depth of about two feet, which made hand digging slow and difficult even though our wet Pacific Northwest winter ensured that the soil was wet and well lubricated. A helpful tool rental center owner suggested a solution: an electric jackhammer equipped with a spade tip. For $45 (1991 prices), I rented the machine for a day and quickly completed the excavation. Because of the restricted workspace, I rigged a block and tackle to lift the jackhammer out of the hole before using the shorty shovel to remove the loosened soil.

By the way, the best method I have found to drive ground rods is to remove the tip from the electric jackhammer and then place the machine on top of the ground rod. Pull the trigger and down goes the rod! When it encounters a buried rock, the rod pauses until the jackhammer pulses fracture the rock, then rapidly continues burying itself. I took advantage of the tool rental to drive three eight-foot ground rods near the tower foundation and three other ones around the property. The total time to drive six rods was under half an hour! Resist the temptation to place your tower ground rods in the foundation hole; a lightning strike could severely damage the concrete.

My tower manufacturer's hole dimensions required 2.5 cubic yards of concrete, but my concrete supplier quoted the same price for 3 yards as for 2.5. I decided to accommodate the additional half-yard by digging the hole a few inches deeper and then expanding the bottom outward, giving the excavation a "bell" shape and lowering the foundation's center of gravity significantly. Although not at all necessary, this change provided a significant safety margin for the tower's stability.

Finally, on advice of a friend who was an industrial bricklayer, I decided to rent an electric vibrator (known as a "stinger" in the trade) to ensure that the concrete would be as dense as possible. I was amazed at the large volume of trapped air that the vibrator released. I believe that the vibrator was essential to produce a foundation of the highest integrity, and it was much faster than using the manual method suggested in WB6WUW's article.—*Michael Mraz, N6MZ, 15526 SE 50th St, Bellevue, WA 98006-3611;* **n6mz@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

[2]P. Salas, AD5X, "Solid-State Those Pilot Lamps," *QST*, Sep 2003, pp 38-39.

[3]R. Wagner, WD8SBB, "Ground-Rod Installation, Inexpensive and Easy," *QST*, May 2003, pp 61-62.

PRODUCT REVIEW

Ten-Tec Orion Model 565 HF Transceiver

Reviewed by Rick Lindquist, N1RL
ARRL Senior News Editor

There's a new Tennessee top dawg! The Orion has replaced the OMNI VI Plus as the Ten-Tec flagship HF radio. The Orion also carries a price tag befitting its pedigree and performance, because the Orion *does* perform. Indeed, its ultimate performance is what you will love most about this transceiver, and Ten-Tec has piled on some excellent features, including a completely separate main receiver and sub receiver. In short, the Orion is maximum steak with minimal sizzle.

As with a high-performance automobile, users will derive the best possible results through a lot of experimentation and tweaking. Some features that most high-end transceivers long ago automated are essentially manual operations on the Orion. Users who consider performance king will overlook most of these. Amateurs spoiled by today's more automated "appliances" may find disconcerting the level of personal attention and care the Orion can require. In short, the more I used this radio, the better I came to appreciate it.

The September 2003 version of the operator's manual, available on the Ten-Tec Web site, is intelligently and thoughtfully written as well as instructive. It makes the assumption that you're familiar with transceivers and what makes them tick. Unlike some other manuals we've seen, this one contains no cute little cartoon characters or smiley faces and doesn't talk down to you by reading like the booklet that came with your toaster oven. The downside is that the manual will not always be up to date with the Orion's latest upgrades.

Maybe the manual should include this suggestion: "If you don't understand this manual, consider the Orion for a *future* radio purchase and start out with one of the lesser transceivers on the market to get your feet wet." The Orion is definitely *not* a beginner's rig.

A New Paradigm in Radio Design?

Ten-Tec says the Orion "represents an entirely new concept in high-performance HF transceivers" that will permit "the finest performance level to date" from an Amateur Radio transceiver. Orion principally diverges from traditional transceiver designs by employing a combination of automatically or manually selectable front end crystal "roofing" filters—up to seven are possible—and dual 32-bit floating-point DSP processors. The result is superb selectivity and dynamic range.

With the Orion, Ten-Tec also has wisely firmed up its embrace of software defined radio (SDR) techniques. The Orion's character traits reside in flash ROM firmware. This means that Orion users may quickly and easily upgrade their transceivers to the "latest model" via the Internet. Although at least one software update came along after we were into the review process, we stuck with software version 1.357, released in August 2003, for the sake of consistency, with the one exception of the AM power output which required 1.358 to operate with proper ALC action. A summary of all operating software revisions is available on **www.rfsquared.com/Orion/565Hist.txt**.

The "numbers" (see Table 1) tell much of the Orion story. We'll have more to say about them and the other factors that—at least for now—make this radio one of a kind.

A "Working Amateur's" Radio

The Orion's substantial box and the big-screen display signal something new and different from the folks next door to Dollywood. At just 20 pounds, it's also surprisingly lightweight.

The focus of the Orion's busy front panel is the 320×240 pixel backlighted LCD display measuring $3^3/_8 \times 4^1/_2$ inches and shown in close-up in Figure 4. Contrasted with the glitzy, multihued displays on some of today's high-end radios this, bespeaks classic Ten-Tec—a straightforward and utilitarian design. The display is best viewed dead on, near to eye level if possible. Readability degrades once the viewing angle exceeds about 45°.

Bottom Line

The Orion is a triumph of substance over frivolous style. It's an impressive performer that will get the job done, but be prepared to invest a little more work to get optimal results.

Turn, Turn, Turn!

Behind each of the eight knobs on the Orion's front panel is an encoder that turns and turns and turns. These include the two large, nicely balanced tuning knobs for the main and sub receivers and six smaller knobs—in two rows of three. One, the MULTI knob, serves as the primary adjustment tool for menu and memory choices. Users initially might find these encoders a bit disconcerting. For instance, when you turn "down" the MAIN AF or SUB AF controls, they don't stop! Pushing either encoder mutes the audio—well, mostly, anyway; a little still bled through while using headphones. Nudge one of these, and the audio is back on.

Two that you'll be using a lot are dual-function controls—the H/L CUT (high and low cut) and PBT/BW (passband tuning/bandwidth) knobs. You press the encoder to toggle between its functions. You'll grow to love the freedom in terms of being able to tailor the receiver's passband for the ideal setting to suit mode and conditions.

Buttons populate the rest of the front panel. Twenty-seven of them frame the LCD display alone, and there are 36 in all, including the numerical keypad/band selection buttons. All bear labels, and several "dedicated" buttons also serve to select menu functions or settings. Users will be pleased to find that menu choices are in plain English. Would that other manu-

Joel R. Hallas, W1ZR ♦ Assistant Technical Editor ♦ w1zr@arrl.org

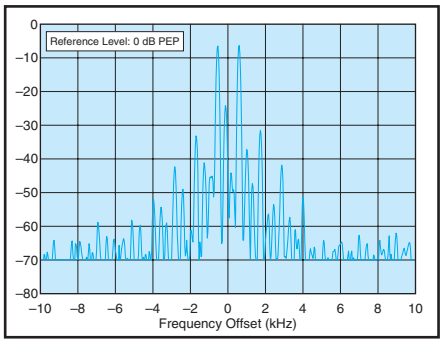


Figure 1—Worst-case spectral display of the Ten-Tec Orion transmitter during two tone intermodulation distortion (IMD) testing. The worst-case third-order product is approximately 32 dB below PEP output, and the worst-case fifth order product is down approximately 42 dB. The transmitter was being operated at 100 W PEP output at 21.250 MHz.

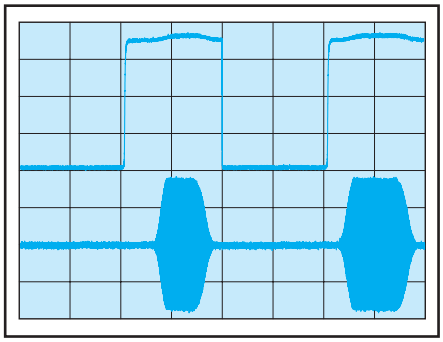


Figure 2—CW keying waveform for the Ten-Tec Orion showing the first two dits in full-break-in (QSK) mode using external keying. Equivalent keying speed is 60 WPM. The upper trace is the actual key closure; the lower trace is the RF envelope. Horizontal divisions are 10 ms. The transceiver was being operated at 100 W output at 14.2 MHz.

Table 1
Ten-Tec Orion, serial number 03C10773

Manufacturer's Specifications	*Measured in the ARRL Lab*
Freq coverage: Sub receiver, 0.1-30 MHz; main rcvr and xmtr, 1.8-2, 3.5-4, 5.25-5.4, 7-7.3, 10.1-10.15, 14-14.35, 18.068-18.168, 21-21.45, 24.89-24.99, 28-29.7 MHz.[1]	Receive and transmit, as specified.
Power requirement: Receive, 2.0 A typical; transmit, 25 A (max).	Receive, 3.1 A; transmit, 17.4 A. Tested at 13.8 V.
Modes of operation: SSB, CW, AM, FM.	As specified.
Main Receiver	***Receiver Dynamic Testing***
SSB/CW sensitivity, 2.4 kHz bandwidth, 10 dB S/N: <0.18 µV (typical).	Noise floor (MDS), 500 Hz filter.[2] *Preamp off* / *Preamp on* 3.5 MHz: –124 dBm / –134 dBm 14 MHz: –128 dBm / –136 dBm
AM sensitivity, 10 dB S/N: <1.5 µV.	10 dB (S+N)/N, 1-kHz, 30% mod. *Preamp off* / *Preamp on* 3.8 MHz: 7.0 µV / 1.8 µV
FM sensitivity, 12 dB SINAD: <2.5 µV.	For 12 dB SINAD: *Preamp off* / *Preamp on* 29 MHz: 4.5 µV / 1.2 µV
Blocking dynamic range: Not specified.	Blocking dynamic range, 500 Hz: Spacing: 20 kHz / 5 kHz *Preamp off/on* / *Preamp off/on* 3.5 MHz: 130/128 dB / 130/127 dB 14 MHz: 129/128 dB / 130/129 dB
Two-tone, third-order IMD dynamic range: 101 dB (typical), 20 kHz and 5 kHz spacing.[3]	Two-tone, third-order IMD 500 Hz: Spacing: 20 kHz / 5 kHz *Preamp off/on* / *Preamp off/on* 3.5 MHz: 94/95 dB / 92/94 dB 14 MHz: 95/94 dB / 92/93 dB
Third-order intercept: +25 dBm at 20 kHz, +24 dBm at 5 kHz spacing (typical).	Spacing: 20 kHz / 5 kHz *Preamp off/on* / *Preamp off/on* 3.5 MHz: +20/+9.9 dBm / +20/+9.9 dBm 14 MHz: +23/+13 dBm / +22/+11 dBm
Second-order intercept: +75 dBm (typical).	Preamp off/on, +63/63 dBm.
FM adjacent channel rejection: Not specified.	20 kHz spacing, 29 MHz, 77 dB.
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz spacing, 29 MHz, 73 dB.
S-meter sensitivity: 50 µV for S9.	14 MHz: preamp off/on, 135/33 µV.
Squelch sensitivity: Not specified.	Preamp on: SSB, 14 MHz, 0.97 µV; FM, 29 MHz, 4.0 µV.
Receiver AF output: 2.0 W at 3% THD into 4 Ω.[4]	1.7 W at 3% THD into 4 Ω.[5]
IF/audio response: Not specified.	Range at –6 dB points, CW (500 Hz filter): 448-960 Hz; SSB: 76-3060 Hz (2984 Hz); AM: 54-2830 Hz (2776 Hz).
IF and image rejection: 70 dB.	First IF rejection, 14 MHz, 116 dB; Image rejection,14 MHz, 75 dB.

facturers follow suit.

The MENUS button accesses some, but not all, of the menus available on this radio, and these provide a tremendous amount of operational flexibility. Pressing the "dedicated" button next to the various on-screen menu options lets you enter that sub-menu. For example, to access the TX sub-menu, you press the hardware ATTN button.

The USER1 and USER2 buttons are great, but use them with great care. These let you save two (of five possible) "user profiles"—basically, everything on the radio, including menu settings, perhaps customized for other family members, or operators in a contest environment.

Filterer on the Roof

Let's get down to what really sets the Orion in a class apart from its more pedestrian peers: Selectable *roofing filters*. Your typical transceiver has a 20 kHz wide front end filter. Think of the roofing filter as the front gate through which all signals entering the receiver must pass. A 20 kHz roofing filter means that any signal within its passband can (and often does) affect performance, even if you can't directly hear it.

While much narrower filters in subsequent IFs follow the typical 20 kHz roofing filter, the Orion offers a *selection* of narrow filters right at the front end of the radio! You can let the radio select them automatically, or—as with many of the preferences on this radio—you can set them yourself. The improved dynamic range translates into spectacular "close-in" selectivity.

We were able to confirm and quantify the results in the ARRL Lab (see Table 1), but first a little tutorial. As we've explained in other product reviews, the higher a receiver's dynamic range numbers (measured in decibels), the greater its ability to let you copy a weak signal in the presence of much stronger signals in the receiver's passband (keep that typical 20 kHz roofing filter in mind).

Okay, let's return to the numbers. For many years, we have measured blocking dynamic range (BDR) and something called two-tone, third-order intermodulation distortion dynamic range (2T3O IMD DR) at a spacing of 20 kHz—the bandwidth of the typical roofing filter. At the 20 kHz spacing on 14 MHz, the Orion's

Sub Receiver

SSB/CW sensitivity, 2.4 kHz bandwidth, 10 dB S/N: <0.35 μV.	
AM sensitivity, 10 dB S/N: Not specified.	10 dB (S+N)/N, 1 kHz, 30% mod: 1.0 MHz 5.0 μV 3.8 MHz 0.89 μV
FM sensitivity, 12 dB SINAD: Not specified.	For 12 dB SINAD, 29 MHz,1.3 μV.
Blocking dynamic range: Not specified.	Blocking dynamic range, 500 Hz: Spacing 20 kHz 5 kHz 14 MHz 97 dB* 73 dB*
Two-tone, third-order IMD dynamic range: Not specified.	Dynamic range, 500 Hz filter: 14 MHz 86 dB* 59 dB*
Third-order intercept: +5 dBm, 20 kHz spacing.	3.5 MHz +1.5 dBm –25 dBm 14 MHz +5.0 dBm –23 dBm
Second-order intercept: +71 dBm.	+43 dBm.
FM adjacent channel rejection: Not specified.	20 kHz spacing: 29 MHz, 62 dB.
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz spacing: 29 MHz, 66 dB.*
S-meter sensitivity: 50 μV for S9.	Max indication, 14.2 MHz: 920 μV.[6]
IF and image rejection: 70 dB.	First IF rejection, 14 MHz, 86 dB; image rejection, 14 MHz, 94 dB.

Transmitter

Power out: SSB, CW, FM, 100 W, 5 W low; AM, not specified (with rev. 1.358 or later).	CW, SSB, FM, typ 100 W, 3 W low, AM 19.1 W carrier.
Spurious and harmonic suppression: ≥50 dB.	53 dB; meets FCC requirements.
SSB carrier suppression: >50 dB.	70 dB.
Undesired sideband suppression: >60 dB.	75 dB.
Third-order IMD: Not specified.	See Figure 1.
CW keyer speed range: Not specified.	10 to 54 WPM.
CW keying characteristics: Not specified.	See Figure 2.
Transmit-receive turnaround time PTT release to S9 signal, 25 ms.	50% audio out: <20 ms.[4]
Rcv-transmit turnaround time (tx delay): Not specified.	SSB, 25 ms; FM, 23 ms. Unit is suitable for use on AMTOR.
Composite transmitted noise: Not specified.	See Figure 3.

Size (height, width, depth): 5.3×17×18.8 inches; weight, 20 pounds.

Note: Unless otherwise noted, all dynamic range measurements are taken at the ARRL Lab standard spacing of 20 kHz.
*Measurement was noise-limited at the value indicated.
[1]With additional 10 kHz margin at band edges for MARS operation. Specifications apply above 1.8 MHz (sensitivity degrades below 1 MHz).
[2]DSP bandwidth; see text for details.
[3]See text.
[4]Identical for main and sub receivers.
[5]2.1 W out for 10% THD.
[6]Sub receiver uses bar segments, reached a maximum at 5 on a scale of 7 bars.

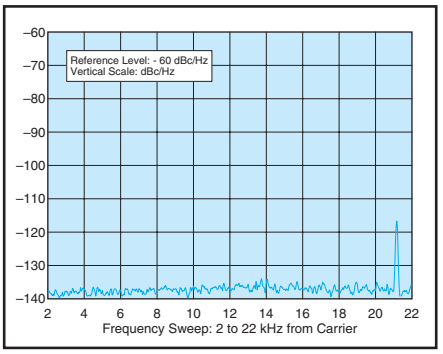


Figure 3—Worst-case spectral display of the Ten-Tec Orion transmitter output during composite-noise testing. Power output is 100 W at 14.25 MHz. The carrier, off the left edge of the plot, is not shown. This plot shows composite transmitted noise 2 to 22 kHz from the carrier, the lowest we've measured for a multiband transmitter.

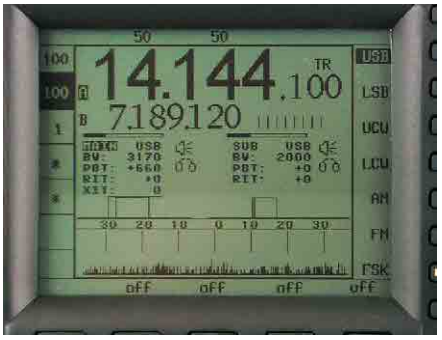


Figure 4—Close-up of the Ten-Tec Orion display.

2T3O IMD DR is 95 dB for this sample—very respectable but just shy of Ten-Tec's own published 101 dB "typical" specification. There is, of course, some uncertainty based on measurement accuracy as well as somewhat different definitions of test approach.

More recently, the ARRL decided to routinely measure and publish a 5 kHz dynamic range figure. The idea was that taking a close-in measurement would much better represent real-world performance. It's at the 5 kHz spacing that the Orion stands out in comparison to its competition. In fact, it's without peer in this regard.

ARRL Lab measurements show that the dynamic range hardly changes at the narrower spacing. From 95 dB (preamp off) at 20 kHz on 14 MHz it drops to 92 dB (preamp off) at 5 kHz. Taking into account measurement uncertainty, the practical difference between the readings at 20 kHz and at 5 kHz on the Orion is negligible.

For the sake of comparison, highly touted competitors that populate the shacks of the most discriminating amateurs today commonly have come up with 2T3O IMD DR numbers in the vicinity of 70 to 75 dB at the 5 kHz spacing. That 20 dB or so of degradation between the 20 kHz spacing and the 5 kHz spacing in other equipment can mean a world of difference when it comes to hearing the weak ones, and it's here that the Orion shines.

The concept of switching in narrower roofing filters seems like a no-brainer. In fact, someone had suggested it several years ago after one of the very first all-DSP-filtering radios showed up on the market to a lukewarm reception from CW enthusiasts. With the Orion, Ten-Tec is the only manufacturer so far to implement this approach in an amateur product.

The Orion's standard crystal roofing filters are 20 kHz, 6 kHz, 2.4 kHz and 1 kHz. Optional filters are available at 1.8 kHz, 500 Hz and 250 Hz. Our review unit had the 500 Hz optional filter. At any time, you can pick one of these via the menu for the main receiver or let the Orion's logic select it for you.

ARRL found during testing that using the optional 500 Hz crystal roofing filter and overriding the automatic filter selection produced poorer receive performance. Our theory was that this degradation resulted from the addition of an amplifier stage to compensate for filter insertion loss. We found that with no antenna connected, the receiver's noise rises dramatically with the 500 Hz filter enabled.

Just for fun, I generated a 20 dB over S9 signal adjacent to a weak CW signal. I

found I could get within 500 to 700 Hz away and still copy the weak station (which was not even showing up on the S meter). I discovered that using the very narrowest bandwidth setting (100 Hz) was not always the best, by the way. Getting away from the 500-Hz filter by moving above a bandwidth of 360 Hz plus a little passband tuning (PBT) went a long way.

Sub Receiver Statistics

The Orion contains a completely separate general-coverage sub receiver. While it exhibits commendable performance, it is not the equal of the main receiver. Blocking dynamic range is, in a word, unexceptional. We measured it at 97 dB, noise-limited (ie, the receiver's internally generated phase noise prevented measuring the dynamic range beyond that point).

On 14 MHz at the 20 kHz spacing, the two-tone, third-order IMD dynamic range numbers for the sub receiver were on the order of 10 dB worse than the main receiver and also were noise-limited. To put things into perspective, these are the kinds of numbers—86 dB or so—that we've found in much more modest receivers. The dynamic range was *far* worse at the 5 kHz spacing—on the order of 59 dB, again noise-limited.

Sensitivity of the sub receiver compares favorably to the main receiver with the preamp turned on (the sub receiver's preamp is *always* on). Still, at 14 MHz, the third-order intercept (TOI) was in the positive numbers at +5.0 dBm (the TOI for our main receiver is way up there at +23 dBm). First IF and image rejection numbers also were decent; in fact, image rejection at 14 MHz on the sub receiver was superior to that of the main receiver (94 dB vs 75 dB).

Nuking Noise

Engaging the Orion's noise reduction (NR) system—even at its least aggressive setting (there's an arbitrary 1-9 range) drastically reduces the level of background "white noise." It's so quiet that you might believe there's something wrong with the transceiver when you first encounter this. During SSB operation, the NR almost acts as though a gentle squelch system is employed. DSP noise reduction is independently adjustable for the main and sub receiver.

In addition to noise *reduction*, the Orion actually has *two* noise blankers—both a conventional "hardware" noise blanker and a software (DSP) noise blanker. The manual neglects to distinguish more thoroughly between the two noise blankers other than to say that you can use them in tandem or independently.

The hardware NB seems to work very well. On 75 meters, for example, the hardware noise blanker—it's either on or off via a menu selection—eliminated about one S unit of background crud from local sources that included some persistent power line noise. The software noise blanker had no apparent effect on S5-level noise from a vacuum cleaner running perhaps 25 feet from the antenna (and right near the open-wire feed line feeding it). On 160 meters, where we were hearing some kind of on/off static resembling power line noise, the software NB was more effective than the hardware NB, and working in combination they reduced it significantly.

A Notch or Two

The AUTO NOTCH works fine—if not spot on immediately—to null heterodynes, but in at least one instance it would not fully null one especially annoying whistle of just under 2 kHz or so, even at the highest setting (the range is 1-9). The manual NOTCH was able to make it go away altogether, however. Neither was fully effective on multiple, very closely spaced, carriers (one from a broadcaster, one from a tuner-upper).

The notches also impart a bit of "digital" sound to the audio. You probably do not want to leave them engaged when they're not needed.

The manual NOTCH is very effective on CW. It easily eliminated an impertinent carrier that turned up right next to a CW signal we were trying to copy. The notches work at IF level, and the manual notch permits setting both a center frequency (the range is from 20 Hz to 4090 Hz) and a notch width (between 10 Hz and 300 Hz). At other times, it can be effective in eliminating or minimizing certain types of noise—in effect, permitting a bit of additional filter shaping.

Memory Madness

Storing a frequency in memory is a simple matter of pressing VFOA>M or VFOB>M. Either choice lets you put the frequency and mode of *either* VFO into one of the 200 available memories. Ten-Tec says it did this so you could store into the memory as intended even if you pushed the wrong button.

Pressing RECALL lets you recall memories. While the Orion does *not* retain some of the other typical settings that many transceivers' memory systems store, it does (as of software version 1.341) save the bandwidth filter setting in addition to frequency and mode in both memories and band-stacking registers. The operator's manual doesn't mention this welcome feature, however, nor does the bandwidth setting appear in the memory window while saving or recalling. For the sake of comparison, my early 1990s-vintage Kenwood TS-850S—not an atypical transceiver—preserves frequency, filter settings (for each IF), mode and preamp setting.

Something that made me a little crazy: There's no decimal point or unit of measure for the frequency displayed when saving or recalling a memorized frequency. For example, I put the frequency and mode of a weekly SSB schedule—7.190 MHz LSB—into a memory. The memory and memory recall display reads 7190000. Perhaps Ten-Tec can deal with this in a future firmware update by adding the appropriate decimal point or unit of measurement.

Another way to save frequency/mode/bandwidth settings is to take advantage of the four band-stacking registers available for each band. These also save filter bandwidth settings in addition to mode and frequency—although you might have to press and hold the PBT/BW encoder to recover the bandwidth setting and/or to zero out an inappropriate or unwanted passband tuning setting. This "feature" is a bit confusing, and we discovered it only by playing with the radio.

The Orion contains a three-memory digital voice recorder. SEND 1 and SEND 2 are pretty minimal, letting you record 4.5 second squibs—perhaps just barely long enough to get out a quick "CQ contest" or to record your call sign to drop into a pileup. SEND 3 lets you lay down a 28.1-second vocal opus. The rub with the DVR is that while the first two memories are nonvolatile, the contents of the longer third memory disappear once you power down the radio. This does not happen with the CW memories, which also have more capacity (see below).

(Nearly) Instant Upgrade

Being able to upgrade the transceiver's feature set by downloading a new version of firmware ("flash ROM") via the Internet is fairly simple. Visit the site **www.rfsquared.com**, select the proper firmware update, and it will download to your PC. Then just run the *update.exe* file. The file you're seeking will be named something like "565v1357.ruf" depending on the version number. It took about five minutes to download the new file on a high-speed Internet connection, but it installed very quickly. Following a master reset, the new firmware version loaded and showed up on the display during powerup, which takes about 10 seconds in all.

Audacious Audio

A lot of today's transceivers permit you to tailor the audio on transmit and receive, and the Orion is no exception. In addition, the Orion lets you route the audio output to best suit your operating hab-

its and take advantage of the main and sub receivers. Pressing the AUDIO button brings up a menu that lets you, for example, feed the output of the main receiver into your left ear while listening to the sub receiver in your right ear. Or you can feed both receivers into both ears—or either or both into the much-better-than-average 4 inch top-firing speaker.

Via this menu, users also can take advantage of the binaural "Panoramic Stereo" receive feature available for both receivers. This feature simulates "three-dimensional" audio that permits the listener to perceive audibly a signal's location within the receiver's passband. A signal on one side of the desired frequency will show up more prominently in one ear. Tuning to it will move it "front and center" in your stereo headset. This works for both CW and SSB. I found that the filters need to be opened up a bit to appreciate the audible panoramic effect.

The same menu also lets you adjust equalization. You can adjust equalization ±20 dB for transmit audio as well as for audio from either receiver. On transmit, this takes different voice timbres into account. On receive, it can help to compensate for the other station's rolloff.

Pressing the MENUS button, then the SSB button yields another sub-menu from which you can adjust the transmit filter bandwidth and low-frequency rolloff. What this lets you do is set up the audio bandwidth of your SSB signal—something you might need to do to meet the current SSB bandwidth requirement on 60 meters, among other things. We got outstanding audio reports with the Orion while using a Heil Pro-Set Plus.

CW Rules

In my experience, many Ten-Tec radio owners are primarily CW operators, and the Orion is a thinking man's CW radio.

Just for starters, beyond the ability to crank down the bandwidth to a bare minimum, there's the vaunted and flawless Ten-Tec full-break-in (QSK) keying, a menu that lets you set QSK delay, CW weighting, and the rise/fall time of the keying waveform. The internal keyer (the speed readout goes from 10 to 60, but we measured the speed range from 10 to 54 WPM) works great, and the three CW memories have *plenty* of space.

Press and hold SEND 1, 2 or 3 to record a CW message. Press the same button to send it. Touch your key or keyer paddle, and the Orion stops sending from memory.

Not only is the CW keying waveform excellent—with just some shortening of the initial dit—the actual CW signal is very clean. We got favorable reports on the air, with keying sidebands falling away from the carrier frequency more rapidly than any other transceiver we've tested.

This and That

- In line with the extreme level of flexibility the Orion offers, the AGC is programmable. This feature lets you separately program the hang, decay and signal threshold for the main and the sub receiver AGCs. The faint of heart may find the default slow, medium, fast (or off) settings more than adequate. For the more adventurous, the manual goes into some detail on the topic of programming the PROG AGC position.
- I did not find the BAND SWEEP function very useful. It shows the strong signals, and then, so what? Even rudimentary band scopes on lesser radios let you mark and tune to spotted signals—although as a tradeoff the other radios often also mute the receiver while scanning, while the Orion doesn't.
- The Orion has a *very* basic analog S/power meter (it looks pretty much like the one on the Argonaut V, except the Orion's backlighting turns orangey when the radio is ready to roll). There's also an on-screen, uncalibrated software S meter for the sub receiver. The Orion's analog S meter works okay, but it cannot be set to hold peaks—something that's helpful when you're trying to critically evaluate signals, such as when someone wants that inevitable "antenna 1" vs "antenna 2" comparison. On the other hand, on transmit the analog meter essentially is only peak-reading. The needle holds steady at whatever power level you've set.
- The optional internal antenna tuner worked magnificently, finding a match for just about anything my multiband dipoles threw at it. Ten-Tec says it will match from 6 Ω to 800 Ω or up to a 10:1 SWR. Press the TUNE button (assuming the tuner is enabled) to set things into motion. The tuner sometimes made some scary noises, however. The Orion's emits audible whirring and other unusual sounds. But once you're rewarded with a "tuned" legend on the display and a perfect or nearly perfect SWR, all is well with the world. An SWR legend (eg, SWR 1.0:1) replaces the on-screen sub receiver S meter whenever you're transmitting. Unlike tuners in many modern transceivers, the Orion's does not remember settings. It also will not automatically readjust if the SWR goes up as you shift frequency in the same band.
- Reception on AM sounds excellent. It offers a maximum 6 kHz bandwidth on

Notes on the Orion from Two Active Contesters

The Orion's performance will be of particular interest to serious contesters and DXers. We are fortunate to have the comments of two notable contesters and Dxers who had an opportunity to have an early look at the Orion.

Comments from Jim Parise, W1UK, based on his use in the CQWW SSB DX contest:

I did side by side comparisons with two popular contest rigs. Switching from them to the Orion during the CQWW SSB test was a real pleasure. One other rig's AGC was thumping away as it usually does with strong adjacent signals, making copying difficult. The Orion provided a sharp contrast. No IF blow-by or crud leaking into the passband.

One of the more striking features the radio offers is variable bandwidth. On CW, even with the bandwidth narrowed up to a couple of hundred hertz, the signals just pop out. Bottom line is it easy to find the right combination of passband tuning and bandwidth for every situation I experienced. Just amazing flexibility! Panoramic Stereo option is a pretty slick function, too. Overall, the audio from the Orion just sounds good.

To sum up, I would say Ten-Tec has a great radio here. If every ham considering an Orion purchase had the same opportunity I just did to really spend time with it, their decision would be a no-brainer.

And from John Devoldere, ON4UN, as published in the January/February 2004 *National Contest Journal*:

I first saw a prototype of the Orion at the 2002 HamCom in Dallas. I liked the looks. When I saw the specs I liked the radio even better. I picked up my new Orion in mid-June 2003. My first impression has not changed—clean layout, knobs and controls positioned just where they should be, good-sized tuning knobs with a good feel. In a couple of words, "It all fits my hands and fingers." It does not have the look of mass consumer electronic gadgets. This is a sober and very functional radio, which is what I like.

I have been playing with the Orion in a few contests, where it gets really crowded, especially on 40 meters. Amazing—in between signals, the band sounds quiet. No blurps, beeps and other alien weak signals. What you hear is what's really there! The narrow front end filters really do their job.

AM (some would consider that narrow), plus the separate menu controls to adjust the equalization curves for the main and sub receiver.

● The optional cooling fan slides easily onto the cooling fins on the radio's rear. It's sizeable and somewhat noisy, and you probably won't need it unless you're planning to use the Orion for 100 percent duty cycle modes or for hot and heavy contesting or in a place that lacks sufficient ventilation.

● Adjusting the dial drag by holding the tuning knob skirts and turning the knob turned out to be essentially impossible, in part because the dial skirts are smooth and fairly narrow. The first time we tried, the rubber grip that covers the aluminum knob slid off instead.

Manufacturer: Ten-Tec Inc, 1185 Dolly Parton Pkwy, Sevierville, TN 37862; tel 800-873-8383; **www.tentec.com**. Price: $3300; with internal antenna tuner: $3599; accessory filters: $109 each; 963 power supply: $168; 310 cooling fan: $39.95; 701 hand mic: $28; 706 desk mic: $99.95.

SGC ADSP^2 Add-on Audio DSP

Reviewed by Joel R. Hallas, W1ZR
Assistant Technical Editor

No doubt some Amateur Radio operators are in a position to buy the latest radio each time there is a leap in technology or features that pique their interest. For the rest of us, circumstances often dictate that we continue with our current stations for a generation or two of technology. The logical result is an interest in products that bring the promise of providing new features into our old radios. Turning old rigs into new has, after all, been a hot sell since the days of Aladdin!

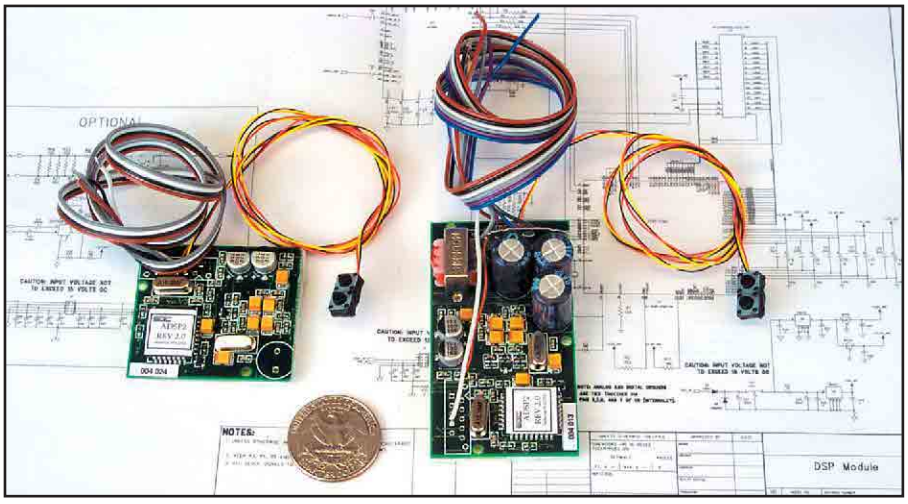


Figure 5—SGC ADSP^2 low audio (left) and high audio PC board modules surround a quarter. Note the miniature push button switches to the right of each unit.

So Just What is this Little Thing?

SGC first announced their *second generation* Advanced Digital Signal Processor (ADSP^2) as an upgrade to their popular SG-2020 line of portable HF transceivers. They now offer two circuit board modules and a standalone speaker-mounted version of their ADSP^2 as separate products designed to be used to upgrade almost any receiver or transceiver. The units offer a combination of noise reduction, automatic notch filtering and bandwidth setting in widths designed for both CW and voice.

The two circuit board offerings (Figure 5) are designated as *low audio* or *high audio* versions. The high audio variety is designed to work at an input level of 0.1 to 5 V_{rms}, corresponding to communications receiver speaker level. This unit provides up to 5 W output, and is designed to be inserted between the receiver and its speaker. The low audio unit is designed for insertion into the receiver just ahead of the volume control (10 to 150 mV_{rms} level).

Both units require a 12 V supply and use the same miniature two-button switch to control functionality. One button controls the band-pass selection with successive applications cycling through voice (1.8 kHz), CW wide (500 Hz), CW narrow (100 Hz) and no bandwidth restriction. The second button cycles through noise reduction *one* (similar to their first generation at 13 dB), noise reduction *two* (26 dB) and no noise reduction. The automatic notch filter (ANF) is on with either noise reduction mode. Note that unlike many ANF arrangements, this one has a delay so it will not notch out CW signals and thus is usable in all modes.

The module is also offered as a complete noise reduction speaker assembly. This has just one button and offers noise reduction and automatic notch filtering only.

Hooking it up and Checking it Out

For this review, we selected the two circuit board versions, since the speaker-mounted unit has the same specs as the high level unit for noise reduction and automatic notch filtering. I selected the high audio unit and adapted it with plugs and jacks for temporary connection to my Ten-Tec Paragon transceiver. It started up the first time and operated just as they said it would! I was quite pleased with the performance in all modes (see Table 2). I operated my test unit outside the radio. Both PC board units come with double sided tape to allow installation anywhere there's enough space in or out of the radio. The pushbutton assembly's wires can be led out to a convenient spot and the assembly attached with mounting tape. I checked with SGC and found that there's nothing special about their buttons, so if you had space, there's no problem replacing them with more substantial ones. The button assembly provided is small enough to fit almost anywhere and works fine after a bit of practice.

The bandwidth reduction is very sharp and has steeper slopes by far than earlier analog filters offered to the amateur market. This is quite evident from a look at Figures 6 and 7. Using the narrow CW position (see Figure 6), I was able to completely eliminate all traces of a much stronger CW signal about 200 Hz from a desired signal just above the noise level. Note that with *any* audio filtering, the stronger signal will still get into the automatic gain control (AGC) process, and the gain of your receiver may be reduced by the strong adjacent signal. The cure is to

Bottom Line

SGC ADSP^2 second generation DSP modules can bring new life to older radios through modern digital signal processing techniques.

Table 2
SGC ADSP² DSP Boards

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
High Audio	
Power requirements: 12 V dc, 0.5 A (full output).	0.43 A, tested at 12 V.
Audio output: 5 W.	As specified.
Noise reduction: "X1," 13 dB; "X2," 26 dB.	"X1," 10 dB; "X2," 26 dB.
Tone reduction: "X1," 50 dB; "X2," 65 dB.	As specified.
Audio response: Voice, 300-2100 Hz; CW: wide, 400-900 Hz, narrow, 600-700 Hz.	See Figure 7. See Figure 6.
Size (height, width, depth): 1.0×2.7×1.5 inches; weight, 1.1 ounces.	
Low Audio (same as high audio except as noted)	
Power requirements: 12 V dc, 0.08 A.	0.08 A, tested at 12 V.
Audio output: 0.5 V_{rms}.	As specified.
Size (height, width, depth): 0.4×1.7×1.5; weight, 0.6 ounces.	

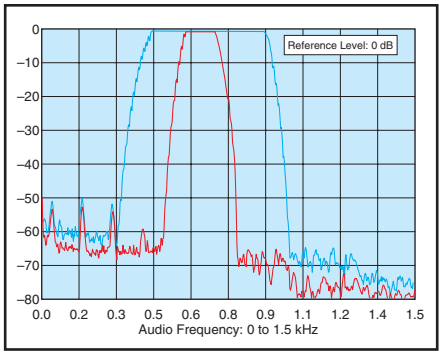


Figure 6—Filter response curves in CW mode. Blue line is CW wide. Red line is CW narrow.

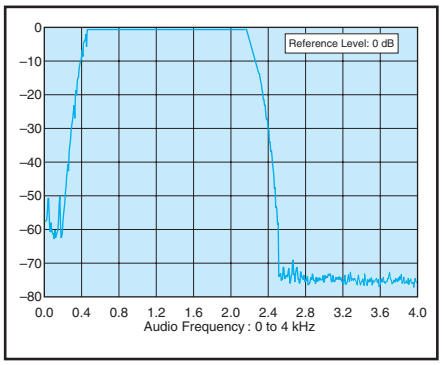


Figure 7—Filter response curve in Voice mode.

turn off the AGC and reduce the RF gain until the receiver is not overloaded.

The noise reduction is quite impressive. Level one gets you a significant reduction in background noise. With level two it's almost gone. I found it was easier to tune the receiver in level one than in level two, selecting the heavy processing only after I had tuned in a signal. Note that the bandwidth filtering and noise reduction can both be used at the same time, so significant noise reduction is possible by using them in combination. The DSP works best on random background noise, although it helps with some impulse noise as well. The DSP does require a certain level of signal to process, so this will not make an inaudible signal readable, but will make tough copy much easier. Signals somewhat less than 2 S-units above the noise level (around 10 dB S/N minimum from lab tests) become easy copy. Weaker signals tend to disappear with the noise.

The automatic notch filter is dramatic. I first tested this by listening to AM broadcast signals in SSB mode and tuning slightly off-carrier to generate a beat. Push the NOISE REDUCTION button and the beat is gone in about two seconds with no noticeable distortion of the audio. A station tuning up within your bandwidth is there just long enough for you to notice, then presto he's history.

Why Would You Want One?

While this won't totally transform your aging Heathkit HW-100 into an Orion in one step, it does offer a lot of improvement to earlier generation radios and can raise the performance of many recent radios up a notch. If your radio doesn't offer multiple bandwidths, or you never got the filters and they're no longer available, this can provide a lot of benefit for about what one filter would have cost. Even if you have all the filters you need, the noise reduction and notch filter functions can make tough copy much easier (40 meter SSB after dark comes to mind).

What to Watch For

When they say *speaker level* that's what they mean! I first plugged the high audio unit into the headphone jack and tied it to a speaker. My transceiver has attenuation between the audio output and headphone jack. I could drive a speaker, but I had to turn up my AF GAIN control to the point that I was causing distortion. Heavy DSP processing of distorted audio isn't pretty! Even driving headphones didn't work well with this arrangement since the input level was too low to allow proper processor operation. The best arrangement I found was to use the speaker output as the ADSP² input (surprise, just as the instructions said) and then use a 200 Ω resistor in series with the headphones to allow sufficient input signal for good processing without blowing my ears out.

The other caution about the high audio unit is that neither side of the speaker (ADSP² output) can be grounded. This may be easy to do for the speaker itself, but if you install this in the radio, watch out for the grounded headphone or external speaker jack!

SGC provides detailed installation instructions for a number of popular radios on their Web site. SGC will also provide installation service in your radio if you wish.

Manufacturer: SGC Inc, 13737 SE 26th St, Bellevue, WA 98005; tel 425-746-6310; fax 425-746-6384; **www.sgcworld.com**. Price: either PC board model, $180; factory installation in your radio, $50; ADSP² Standalone Speaker, $129.95.

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TECHNICAL CORRESPONDENCE

MORE ON THE "ST LOUIS SWITCHER"

By Tasos Thomaidis, SV8YM, 9-11 Therianou Str, Zakynthos GR 291 00, Greece; **sv8ym@hotmail.com**

◊ While, in general, I too believe that switching power supplies from computers can *sometimes* be used to power some *particular* kinds of loads, I strongly feel that a word of caution is in order regarding the propositions made by Matt Kastigar, WØXEU, in his article.[1]

I will present information with the intention of showing that using such a supply to power a ham transceiver (especially a 100 W unit) is not a safe practice at all, and it should be avoided for several reasons.

While Matt and George, N2APB, may have been lucky to obtain a relatively good quality unit (judging from the pictures in the article and the ARRL lab test results), I fear that other hams may not turn out to be so lucky. The results could range from *annoying*, in the case of a poorly designed supply that doubles as a source of EMI, to *catastrophic*, especially if the supply's 12 V section is used to power a 100 W transceiver, as the article proposes.

There are many manufacturers of computer power supplies, but not all of them have the same quality and design standards. While a small percentage of these supplies may be of decent quality, most of them (especially the extra-cheap, imported units) suffer from extremely poor—"bare-bones" design, lowest quality components and no attention whatsoever paid to electromagnetic compatibility issues.[2]

In fact, after studying the failure modes in several hundred failed units (one of my non-ham friends owns a computer shop and replaces failed power supplies in computers at a rate of several *a day*), I am amazed that some of these supplies ever functioned *at all!*

Let's be more specific and examine the pitfalls one may encounter using a generic computer PSU to power his/her equipment, because there is danger, even if the supply is perfectly okay to use *with a computer*!

What are the criteria that distinguish a "good" computer power supply? First of all, let's take a look at the ac mains input circuits. There *must* be a mains line filter there, in the form of a network of *several* cored inductors and capacitors. This filter is *absolutely essential!* It serves a double purpose:

1. It provides protection from EMI emanating from the switching process which is taking place in the supply.
2. It protects the supply's primary circuits from line transients that can destroy them in microseconds, with unpredictable results for the secondary circuits and the load (your computer or your expensive, delicate transceiver).

Please notice that this filter is usually installed on the PC board of the power supply. I'm not referring to the filtered ac connector (very, *very* rare in cheap supplies) that may be installed on the supply's enclosure! If both kinds of filter are present, that is so much the better, but the constants in an ac connector with an integrated EMI filter *are not capable* of properly filtering out some lower frequency transients that may occur on the mains line! They're effective at RF, and mainly protect against EMI interference *from* the supply.

The importance of the proper mains filters can't be stressed enough. I'm sad to say most of the failed power supplies I have examined *had no such filters at all!* There were places on the PC boards for the filter components, but they were *jumpered*! Talk about cutting corners! No wonder the usual failure mode in those units is through the destruction of the switching transistors. The omission of the mains line filters by some power supply manufacturers is simply the worst engineering practice. Don't ever use supplies that don't have a mains filter installed!

So, if we do find a line filter in place, should we use the power supply for our "ham" purposes? I doubt it, save perhaps to power a QRP unit such as the FT-817 in Matt's article photo. Yet why is that so?

Because even "good" computer supplies are generally *not* designed to power heavy, *rapidly changing* loads. They like to "see" a more or less constant current load, which a computer is, but a 100 W ham transceiver certainly is not. In other words, those supplies generally don't have good *dynamic regulation* (the ability to maintain the proper output waveform under rapidly changing load demands).

[1]Notes appear on page 73.

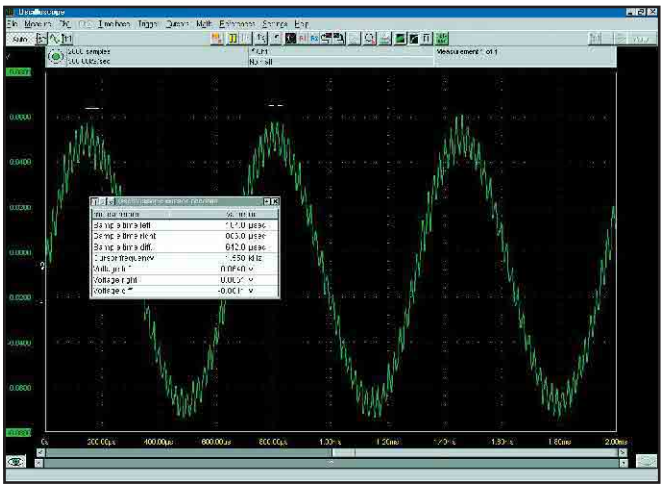


Figure 1—A new 300 W computer supply tested with a 12 V, 4 A load shows 130 mV (pk-pk) ripple.

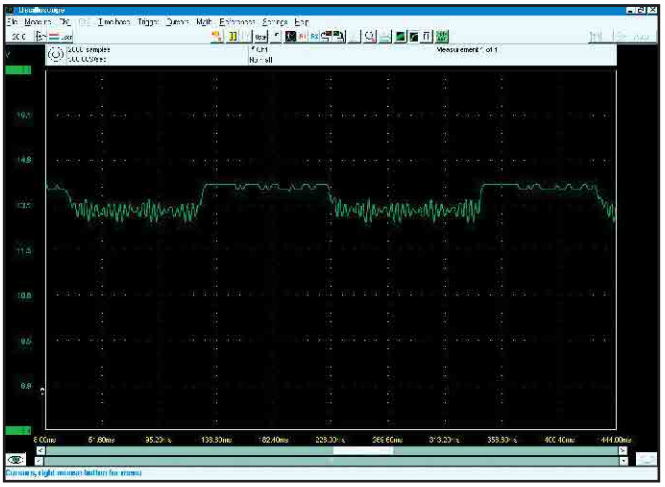


Figure 2—The 300 W supply output during two CW dits, while powering an HF transceiver to 80 W of RF. There is a 1 V drop with substantial ripple when the key is down.

Bob Schetgen, KU7G ♦ Senior Assistant Technical Editor ♦ tc@arrl.org

As a test, I bought a *new, unused* computer ATX power supply, rated at 300 W total output (3.3 V @ 28 A; 5 V @ 30 A; 12 V @ 15 A, 5 V standby at 2 A and some negative output voltages with smaller current capabilities). I modified the supply according to the instructions provided in the article (which, I must say, is otherwise very well written). Mind you, this supply isn't low quality or a "cheapie," and it has all the proper circuits in place. In fact, it doesn't produce *objectionable* hash during reception on HF.

I connected a 55 W, 12 V auto headlamp to serve as the load (about 4 A) and used a *Tie-Pie* TP-508 digital storage oscilloscope to examine the output waveform. Figure 1 shows a captured screen of that measurement. There is ripple at about 1.5 kHz (perhaps due to self-oscillation in the feedback loop of the supply) with an amplitude of about 130 mV (pk-pk). The high frequency (about 50 kHz) switching noise in the output is very obvious, "riding" the main "stray" 1.5 kHz waveform—and this was at *only* 4 A of steady load current!

The regulation wasn't spectacular either. The no-load output was 13.9 V (after I modified the value of a feedback control resistor) and with a steady 4 A load, the dc output dropped to 13.4 V.

I then connected my HF transceiver to the supply, kept my fingers crossed and started sending a series of fast CW dots (into a dummy load) to test the dynamic regulation. Figure 2 presents the results. At about 80 W of RF output (12 A peak load current). One can easily observe the large 1 V voltage drop and the pronounced ripple that appears during each transmission period.

Well, "not so bad after all," you say?

Based on my previous experience, this is *good* performance from computer power supplies. I have never measured one that is really better in several years of experimentation with them, but I surely have seen many worse ones!

Suppose now that we have found a computer power supply that has no cut corners and delivers a clean enough and stable waveform. Can we *safely* use the 12 V section to power our 100 W transceiver? In my opinion, the answer is again, *no*.

Generally, the 12 V output section in computer power supplies is not adequately built for a load of the order of 15-20 A—*even if the label on the supply says that it is!* The Schottky rectifiers in the 12 V section are typically 15-20 A common-cathode dual units, and this level of load pushes them dangerously close to their limits. Furthermore, the output filter network is usually not adequate for a heavy and changing load such as a 100 W transceiver, which additionally requires a decent waveform to function properly.

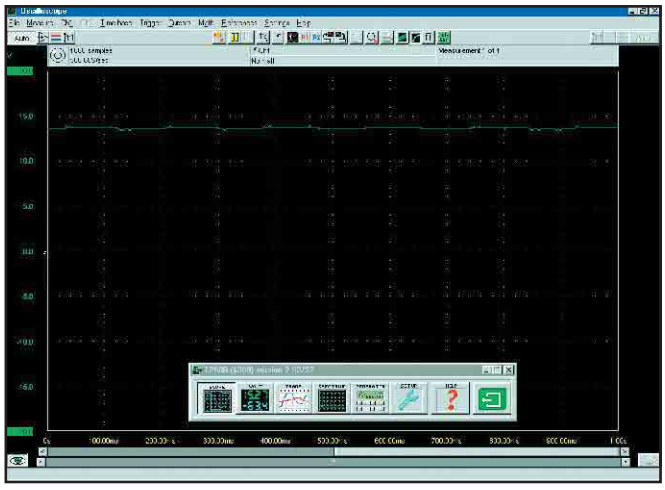


Figure 3—The output of a 12 V supply built from parts salvaged from several computer power supplies. This is the way to power your radio with computer power supplies.

If the rectifiers do fail, the forecast for the transceiver's health isn't good. I have seen filter capacitors in the output lines of computer supplies that had *exploded* and spilled their guts all around the case following the failure of the Schottky rectifiers.

I then loaded my power supply's 12 V section with two auto headlamps (about 9 A) to test its power handling capabilities (that was a load of about 110 W). The output waveform didn't change dramatically—still more ripple and noise. After about 10 minutes, and although the supply had a fan, I started smelling the odor of overheated circuitry. The toroid inductor at the secondary filter, as well as the heat sink of the secondary rectifiers, were too hot to touch. The electrolytic capacitors in the 12 V section also became noticeably warm. Remember, the supply's label states that the supply is capable of delivering 15 A continuous at 12 V (180 W), along with power at other voltages, for a total of 300 W! That's where I stopped testing.

I have come to believe that the power rating appearing on the label of many computer power supplies is rather optimistic, to say the least. If you subject a generic unit to nearly the full power load it is labeled to be able to handle, it usually fails in short order, and it seems a 200-W-input transceiver represents more than the "full load"!

What's the bottom line? *Don't* use computer power supplies, new or (even worse) old, with your *high power* ham gear—they're just not up to it! Perhaps, a good computer power supply modified in the way WØXEU proposes could be used to power a QRP transceiver, but nothing that draws more than 5 to 10 peak amperes of intermittent current.

Extensive modification, if at all applicable, addressing all of the "weak" design points, should be performed to a computer power supply to render it suitable for the proper powering of our high power gear. You must also be capable of assessing the results, using the proper test equipment and procedures, before trusting a supply with your pet gear's "care and feeding."

So, after all, what are we to do with those supplies? Throw them away? *Certainly not*! They're full of parts that *can* be used to give life to a "ham use certified" power supply. Such a supply is not exactly a "beginner's project," but once built along sound engineering guidelines like those provided by the excellent *1999 ARRL Handbook* "13.8 V, 40 A Switching Power Supply" project by XQ2FOD,[3] success is almost guaranteed. I, for one, have built three such supplies, and each one of them "consumed" parts from at least three computer power supplies (especially at the secondary side) to get in proper (wave) shape and be reliable. The output waveform is very clean *at 20 A of load current.* (Take a look at Figure 3; it's the same dynamic test as for Figure 2, but the ripple is almost nonexistent, and the voltage drop is only 0.3 V.) It doesn't produce EMI.

Notes

[1]M. Kastigar, WØXEU, "The St Louis Switcher," *QST*, May 2002, pp 35-38.

[2]Computer power supply design guides may be found at the **www.formfactors.org/** Web site or elsewhere on the Internet.

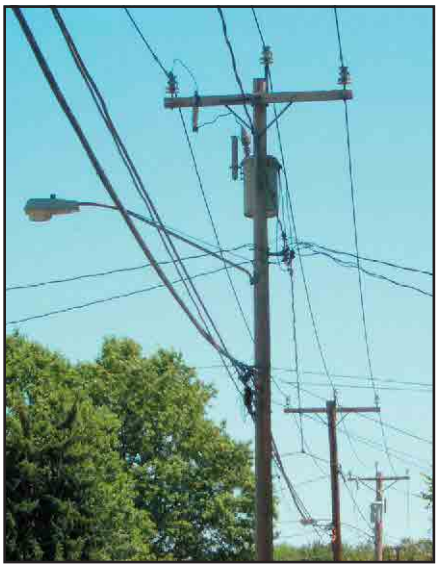
[3]M. Mornhinweg, XQ2FOD, "A 13.8-V, 40-A Switching Power Supply," *1999 ARRL Handbook*, Ch 11, p 11.28.

Technical Correspondence 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.

Letters to this column may be sent to Technical Correspondence, ARRL, 225 Main St, Newington, CT 06111, or via e-mail to **tc@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. The publishers of *QST* assume no responsibility for statements made herein by correspondents. QST

Virginia BPL Startup Sparks ARRL Response

The ARRL has put officials in Manassas, Virginia, on notice that the League will act to ensure full compliance with FCC regulations when the city's Broadband over Power Line (BPL) system starts up this year. The city council in the Washington, DC, suburb voted unanimously October 16 to grant a 10-year franchise to Prospect Street Broadband to expand a BPL field trial into a citywide rollout and offer high-speed Internet service over municipal power lines. ARRL CEO David Sumner, K1ZZ, faxed Manassas Mayor Marvin L. Gillum to point out BPL's dark side—the potential for RF interference from and to any BPL system.



"Your advisors no doubt have made the Council fully aware of the great potential for radio interference from such a system," Sumner said. "In particular, you are no doubt well aware that Title 47 CFR §15.5 requires that no harmful interference is caused to any radiocommunication service, and that the operator shall be required to cease operation upon notification by a Federal Communications Commission representative that the device is causing harmful interference." Sumner noted that the same FCC Part 15 rule also provides no protection to BPL against interference from licensed services.

"Tests conducted by ARRL technical personnel have shown that the system planned to be deployed in Manassas causes harmful interference to the Amateur Radio service," Sumner said. "We also have reason to believe that the system will be susceptible to interference from normal amateur station operations."

An article in *Potomac News.com* touted the impending Manassas BPL deployment as the first of its type in the US. Sumner said he wrote to alert the City of Manassas on behalf of League members "who live in and use the public thoroughfares of Manassas" that the ARRL "will ensure that there is full compliance with the FCC regulations" once the city's BPL system is in operation.

The Manassas BPL field trial is one of the smallest under way and involves fewer than a dozen homes and businesses. It was installed in an area that has underground utility wiring and no nearby Amateur Radio licensees.

BPL articles in major media have proliferated, many of them painting the service in rosy hues and neglecting to point out the potential for radio interference to and from BPL by other HF spectrum occupants. An October 13 article in *The Wall Street Journal*, "A New Outlet," by Walin Wong, quotes one trial user who

FCC COMMISSIONER'S OFFICE CLARIFIES "BROADBAND NIRVANA" REMARKS

The office of FCC Commissioner Kathleen Q. Abernathy has expressed regrets that her remarks in a September speech may have failed to make Abernathy's concerns sufficiently clear about potential interference from Broadband over Power Line (BPL).

"We regret that the Commissioner's remarks may have been interpreted as suggesting an absence of concern over harmful interference," said Abernathy Senior Legal Adviser Matthew A. Brill, responding to complaints from the ARRL and individual amateurs. From a policy perspective, Brill said, Abernathy is "keenly interested" in seeing multiple broadband platforms develop, but that she didn't intend to suggest that BPL "necessarily will emerge as a viable platform or that it does not present interference issues."

In her September 22 speech to the United Powerline Council's annual conference, Abernathy expressed unabashed enthusiasm for BPL and suggested it was a step along the pathway to "Broadband Nirvana." Brill noted that near the end of her remarks, Abernathy—referring to the FCC's approach to PCS regulation—said the Commission was "right to adopt strict interference rules to prevent competitors from externalizing their costs. The same principle will apply to BPL."

Brill assured the ARRL that "ensuring that BPL and all new technologies avoid causing harmful interference to licensed RF users is a bedrock position for Commissioner Abernathy." He issued similar responses on Abernathy's behalf to several amateurs who had challenged her remarks.

FCC

FCC Commissioner Kathleen Q. Abernathy.

ARRL Chief Executive Officer David Sumner, K1ZZ, expressed delight at Abernathy's clarification, calling it "most welcome and reassuring news." From the outset of the FCC's BPL *Notice of Inquiry* in ET Docket No. 03-104 last April, Sumner said, the League's goal has been to hold the FCC to its statement in the *NOI* that authorized services, including Amateur Radio, "must be protected from harmful interference."

Following Abernathy's "Broadband Nirvana" remarks, Sumner had faxed her on the League's behalf to point out that technical showings submitted by the ARRL and others in response to the *NOI* "clearly establish that BPL is a significant source of radio spectrum pollution" and that BPL "cannot be implemented without causing harmful interference to over-the-air radio services."

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

calls the service "fantastic." But Wong also noted that one "Achilles' heel" of BPL is that serving rural areas would require installing costly repeaters every mile or so along the power line. The article also deals with the reluctance on the part of some electric utilities to embrace the technology.

ARRL's extensive comments, reply comments and technical exhibits are available on the ARRL Web site, **www.arrl.org/tis/info/HTML/plc/**. To support the League's efforts in the BPL fight, visit the ARRL's secure BPL Web site, **https://www.arrl.org/forms/development/donations/bpl/**.

HAMVENTION SIGNS CONTRACT FOR 2004 SHOW AT HARA ARENA

Hamvention will take place at Hara Arena near Dayton, Ohio, at least for another year. General Chairman Gary Des Combes, N8EMO, announced the single-show contract in October. Hamvention's previous contract with Hara Arena was for five years. Des Combes also expressed confidence that behind-the-scenes management changes he's instituted since taking over July 1 will translate into success for "the world's largest Amateur Radio gathering and trade show."

"Overall, I think things are going very well," Des Combes said of progress toward pulling together Hamvention's 53rd show, which will take place May 14-16. "I'm confident we're going to be successful." The always popular annual gathering attracted slightly more than 22,100 visitors in 2003, down by more than 10 percent from 2002 and the third year in a row of declining attendance.

Des Combes is banking that the management team and "best business practices" approach he's put into place for this spring's show will turn things around. One significant change is a shift away from jobbing out Hamvention's production to paid professionals and returning to the strong reliance on volunteers that was a hallmark of past Hamventions. Most of the volunteers for the 2004 show are from the sponsoring Dayton Amateur Radio Association (DARA).

The new order at Hamvention means that Garry Matthews, KB8GOL, is out as the show's paid production manager (see "How Hamvention Happens" *QST*, Apr 2000). Matthews had served as the backstage impresario for more than three decades of Hamventions. Des Combes said he intends to spread out Matthews' former duties among several volunteers.

"We have to just work smarter and tougher," he said, adding that the management changes will be invisible to "John Q. Ham." A project management professional, Des Combes says he anticipates the all-volunteer approach will make it possible for Hamvention to more economically mount a show that's of the same quality or better than those of past years. "I think it's going to be good for everybody," he said.

There's more information on the Hamvention Web site, **www.hamvention.org**.

TEXAS ANTENNA CASE SHOWS PRB-1 IS NO PAPER TIGER

A Texas amateur antenna case has affirmed again that the limited federal preemption known as PRB-1 has teeth when it comes to compelling municipalities to "reasonably accommodate" Amateur Radio communication. It took some time, persistence and a considerable number of hassles, but in the end the US District Court for the Southern District of Texas—Houston Division ruled in favor of Orin Snook, KB5F, of Missouri City. The court determined in late August that Snook could keep his 114-foot antenna structure.

In a 63-page *Findings of Fact and Conclusions of Law*, US District Judge David Hittner said the city "failed to meet the FCC's requirement of reasonably accommodating Snook's amateur communication needs in accordance with PRB-1." Missouri City had attempted to limit Snook's tower to 65 feet, limit the size of his antenna array and required removal of the 100-foot structure for which it already had granted him a building permit. Snook, who is ARRL Fort Bend County Emergency Coordinator and an Official Emergency Station, argued that he needed the higher structure to permit him to operate VHF and UHF effectively in an emergency.

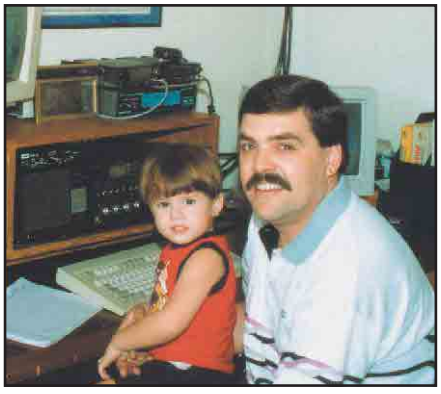
The court declared the city's height restrictions, antenna array restrictions and structure removal requirement "preempted, void and unenforceable." Hittner ordered the city to grant Snook a specific use permit allowing his tower and antennas to remain, although Snook must maintain an existing screening of mature trees surrounding the tower. The judge found that the city "failed to attempt to negotiate a satisfactory compromise with Snook" and rejected consideration of any height extending above the trees.

For Snook, Hittner's decision was half a loaf because he failed to prevail on several other non-PRB-1 issues, including purported malicious prosecution and his convictions on 21 counts of violating city statutes in the course of the years-long row. Snook alleges that his wife also lost her job with the city as a result of the dispute, and he estimates the battle left him some $35,000 poorer.

"It's a tough victory that's extremely hollow right now," Snook told ARRL. "The 21 criminal convictions of ordinances written after the antenna went up were largely ignored." Hittner determined that the city had, indeed, changed its ordinance, then required Snook to comply with it, even though it already had issued him a building permit in 1999. In addition, Snook said, the city gets to keep its ordinance—which he'd tried to get thrown out. "The judge ruled strongly in our favor but protected the city as best he could too," he added.

Well known amateur antenna case law served as a basis for Hittner's ruling.

The Dayton 2003 outdoor vendor area, a-k-a "the flea market."



Orin Snook, KB5F, and Christopher, in Snook's well-equipped ham shack.

Among decisions cited was *Pentel v City of Mendota*, argued successfully by attorney and ARRL Dakota Division Director Jay Bellows, KØQB. Also cited was *Marchand v Town of Hudson*, in which ARRL New England Division Vice Director and Volunteer Counsel Mike Raisbeck, K1TWF, handled written and oral arguments before the New Hampshire Supreme Court and ARRL General Counsel Chris Imlay, W3KD, filed an *amicus* brief. Imlay and Bellows both discussed Snook's case with him by telephone.

LEGENDARY DXPEDITIONER DANNY WEIL, EX-VP2VB, SK

DXer Danny Weil, ex-VP2VB, of YASME fame died October 3. He was 85. The British-born Weil was active under a variety of call signs in the 1950s and early 1960s while sailing one of three *YASME* yachts. His adventures inspired a generation of Amateur Radio DXers as he operated from various exotic ports of call. In late 2002, Weil suffered a stroke and had been living in an extended-care facility in San Antonio, Texas.

The DXploits of Weil and of Lloyd and Iris Colvin, W6KG and W6QL, are the subject of the book *YASME, The Danny Weil and Colvin Radio Expeditions* by James D. Cain, K1TN. The book was commissioned by the YASME Foundation and published by ARRL.

JIM CAIN, K1TN

Weil is seen here with his dog, Spunky, in a September 2001 photo.

Inspired by Thor Heyerdahl's Kon-Tiki voyages of the late 1940s, Weil completed his first solo crossing of the Atlantic in 1954, landing in Antigua. He came to appreciate the potential value of Amateur Radio as a means of communication on future voyages. A watch and clockmaker by trade, Weil ended up largely teaching himself the radio theory and Morse code he needed to know to obtain a British Amateur Radio license.

As Cain's book relates, among Weil's early ham radio acquaintances was Dick Spenceley, KV4AA (SK)—an Amateur Radio legend in his own right—who mentored Weil during his studies. It was Spenceley who also first appreciated the potential benefits for Amateur Radio if Weil could get on the air from various rare spots as he sailed the globe. Spenceley—who died in 1982—eventually secured the ham gear that Weil would use on the first *YASME* voyage, which began in 1955 and took him to the South Pacific.

One of the original inductees into the

FCC News

FCC SPECTRUM POLICY TASK FORCE REPORTS ON PROGRESS, INITIATIVES

The FCC's Spectrum Policy Task Force in November reported on steps the Commission has taken during the past year to implement spectrum policy reform and initiatives planned for the next 12 to 18 months. The Task Force noted the FCC already has made significant progress in modernizing the policies guiding allocation and utilization of FCC-administered spectrum resources.

"The FCC continues to move toward innovative approaches to spectrum policy that are designed to maximize the public benefits derived from the use of the radio spectrum," the Commission said in a public notice. The Task Force also announced plans to launch a research tool on its Web site, **www.fcc.gov/sptf**, that will allow the public to track the progress of all FCC spectrum-related rulemaking proceedings and initiatives in one place.

FCC Chairman Michael Powell established the Spectrum Policy Task Force in June 2002. In November 2002, the Task Force issued a report containing specific recommendations for spectrum policy reform. Among its principal recommendations: Migrate from current command and control model of spectrum regulation to market-oriented exclusive rights and unlicensed device/commons models; implement ways to increase access to spectrum in all dimensions for users of both unlicensed devices and licensed spectrum; and implement a new paradigm for interference protection.

Last January, the ARRL registered some mixed feelings about the report. Calling it "a positive first step" in developing a comprehensive national spectrum management approach, the League said it also "fails to address the needs and goals" of the Amateur Service. The ARRL urged the FCC not to abandon longstanding allocation policies based on engineering.

"Spectrum policy reform should be viewed as an ongoing process, not as a wholesale paradigm shift to be accomplished in half a year," the League said. The ARRL said it was "encouraged," that the FCC had worked to involve all portions of the telecommunications industry in developing a spectrum policy.

Amateur Enforcement

♦ **FCC mulls response to complaints alleging interference:** The FCC is considering the explanation of a Maryland ham in the wake of complaints that he disrupted an Amateur Radio Emergency Service (ARES) net last September during Hurricane Isabel. FCC Special Counsel for Enforcement Riley Hollingsworth wrote Charles E. Cox Sr, WA3AE, on October 16, enclosing complaints alleging deliberate interference to emergency communications conducted on 2 meters by W3AAC at the Anne Arundel County emergency operations center.

"The allegations, if true, raise serious questions about your qualifications to be a Commission licensee and warrant enforcement action," Hollingsworth told Cox. The US Postal Service returned as undeliverable the FCC's certified letter to the Mount Airy address the Commission had on record for Cox. Commission personnel eventually tracked him down to a residence in Laurel.

In a handwritten note, Cox told the FCC that he was on the air, but he asserted that he was only trying to help and didn't believe he was interfering with the emergency net. "There is a major misunderstanding," Cox wrote, adding that he felt the situation was being blown out of proportion. Cox also said he would change his mailing address with the FCC.

Several complainants—two FCC employees among them—tell a different story. A station identifying as WA3AE came on the net and uttered "irrelevant comments many times," according to one net control station, who also said that the operator was rude, "seemed intoxicated" and used inappropriate language. Cox told the FCC he has a speech impediment that makes him sound inebriated. The NCS contended that Cox ignored numerous requests to keep the frequency open for emergency communications, but Cox disputed that in his reply.

Hollingsworth said the FCC has Cox's response to the complaints under review.

CQ DX Hall of Fame, Weil eventually gave up Amateur Radio. In the 1960s, he married an American—his wife, Naomi predeceased him—settled in Texas and became a US citizen.

Memorial contributions are invited to the Wild Animal Orphanage, PO Box 690422, San Antonio, TX 78269. More information about Danny Weil is available on the Danny Weil, VP2VB, page, **www.qsl.at/common/weil.html**.

FALLON KEEPS HUDSON DIVISION DIRECTORSHIP

ARRL Hudson Division Director Frank Fallon, N2FF, beat back a challenge from Vice Director Steve Mendelsohn, W2ML, to retain his seat on the ARRL Board of Directors. The vote was 1933 to 1470. The Hudson Division's was the only contested seat in the 2003 director/vice director election cycle. Directors and vice directors in the Central, Hudson, New England, Northwestern and Roanoke divisions otherwise ran unopposed and were declared elected. For his nearly 500-vote margin Fallon, who's retired, credits his ability to devote full time to ARRL, and to Hudson Division members' apparent appreciation for what he's been able to accomplish.

ARRL Hudson Division Director Frank Fallon, N2FF

"That's what made the difference," Fallon said. "I'm real happy with the way the vote turned out." He said work already is under way to secure Amateur Radio antenna bills in New York and New Jersey. Parts of both states fall within the Hudson Division.

A resident of East Williston, New York, Fallon has served as director since 1997. The former high school English teacher has been a ham for 41 years and is an ARRL Life Member.

During his tenure as Hudson Division Director, he's been a member of all standing committees and now sits on the Administration and Finance Committee. In addition, Fallon has served on the ARRL Executive Committee for four years and is on the ARRL Foundation Board.

The election result leaves Mendelsohn—a veteran ARRL officeholder—again without a role in the League's leadership. Joyce Birmingham, KA2ANF, of Ridgewood, New Jersey, was the lone candidate for the vice director's seat that Mendelsohn vacated to run for the division's top spot.

Three-year terms of office for successful director and vice director candidates begin at noon on January 1, 2004.

Media Hits

■ Morse code and its use in Amateur Radio was the focus of "A Dash of History" in the November 2003 issue of *The Elks Magazine*, a publication for Elks club members. The article highlighted the various ways in which Morse code has been used over the years and focused on its use in ham radio circles, both as an enjoyable mode of communications and as an aid for disabled hams. Among the Morse code enthusiasts author Karen Ferrick-Roman interviewed were the FISTS CW Club US President Nancy Kott, WZ8C, and ARRL Senior News Editor Rick Lindquist, N1RL. Current circulation for *The Elks Magazine* stands at 1.12 million.

■ Ham radio's use during the New York City Marathon got a mention in a "behind-the-scenes" article in *USA Today*. Longtime director of marathon communications ARRL Hudson Division Vice Director Steve Mendelsohn, W2ML, offered information about the role that more than 400 ham radio operators play during the event each year.

■ In a recent column called "The World's Greatest Hobby" in Florida's *The Ocala Star-Banner* ARRL member and "Neighbors" section editor Emory Schley, N4LP, shared his passion for ham radio. The piece covered the basics of obtaining a license and included information on upcoming classes. Schley also recalled contacts with hams in far-flung, exotic locations.

■ Ham radio was the featured topic during a recent edition of "This and That" on WVOX-AM in New Rochelle, New York. Guest Clifford Goff, KC2CXL, offered information on everything from getting started in Amateur Radio to some of the newer technologies hams are using. He also reminded listeners to contact ARRL for more information on ham radio.

SECTION MANAGER ELECTION NOTICE

To ARRL members in the Illinois, Indiana, Maine, Northern Florida, Oregon, Santa Clara Valley, Vermont, and Wisconsin sections: You are hereby solicited for nominating petitions pursuant to an election for Section Manager (SM). Incumbents are listed on page 16 of this issue.

To be valid, a petition must contain the signatures of five or more full ARRL members residing in the section concerned. Photocopied signatures are not acceptable. No petition is valid without at least five signatures, and it is advisable to have a few more than five signatures on each petition. Petition forms (FSD-129) are available on request from ARRL Headquarters but are not required. We suggest the following format:

(Place and Date)

Field & Educational Services Manager,
ARRL
225 Main St
Newington, CT 06111

We, the undersigned full members of the _____ ARRL Section of the _____ Division, hereby nominate _____ as candidate for Section Manager for this section for the next two-year term of office.

(Signature___ Call Sign___ City__ ZIP __)

Any candidate for the office of Section Manager must be a resident of the section, a licensed amateur of Technician class or higher and a full member of the League for a continuous term of at least two years immediately preceding receipt of a petition for nomination. Petitions must be received at Headquarters by 4 PM Eastern Time on March 5, 2004. Whenever more than one member is nominated in a single section, ballots will be mailed from Headquarters on or before April 1, 2004, to full members of record as of March 5, 2004, which is the closing date for nominations. Returns will be counted May 18, 2004. Section Managers elected as a result of the above procedure will take office July 1, 2004. If only one valid petition is received from a section, that nominee shall be declared elected without opposition for a two-year term beginning July 1, 2004. If no petitions are received from a section by the specified closing date, such section will be resolicited in the July 2004 *QST*. A Section Manager elected through the resolicitation will serve a term of 18 months. Vacancies in any Section Manager's office between elections are filed by the Field & Educational Services Manager. You are urged to take the initiative and file a nomination petition immediately.—*Rosalie White, K1STO, Field & Educational Services Manager*

REPEAT NOMINATING SOLICITATION

Since no petitions were received for the Michigan Section Manager election by the deadline of September 5, 2003, nominations are herewith resolicited. See the above for details on how to nominate. QST

Ham Radio was Ready for Isabel

Hurricane Isabel vented much of her fury on North Carolina and Virginia after coming ashore on North Carolina's Outer Banks the afternoon of September 18, 2003. It also shut down Washington, DC. Amateur Radio volunteers had been keeping an eye on the storm for several days prior to its arrival, however, and they were ready to assist in providing communication support and weather spotting. The Hurricane Watch Net secured its operation at 0100 UTC September 18 after two full days and nights of dealing with Isabel.

"Many thanks to the dozens of dedicated reporting stations in the path of the storm for their support," said HWN Manager Mike Pilgrim, K5MP, "and most of all to all Amateur Radio operators who patiently stood on the sidelines while helping to maintain a clear frequency on 14.325 MHz during this high-priority operation." The HWN worked with WX4NHC at the National Hurricane Center to provide ground-level weather information for hurricane forecasters.

In North Carolina, ARRL Section Manager John Covington, W4CC, said that at one point some 75 shelters were opened to provide refuge for those forced to evacuate coastal communities before the storm struck. NC4EB participated in the statewide Tar Heel Emergency Net on 75 meters, which backed up logistical communication between the state and county and local EOCs, and sometimes provided a primary link when government systems went down. Mike Langley, KD4MTT, cited Perquimens and Washington counties as examples of localities where amateurs were recruited to fill the gap after local emergency responders lost communication services.

In Virginia, Section Emergency Coordinator Tom Gregory, N4NW, said he had plenty of volunteers in the early going but could have used more as the emergency wore on. "A few did a lot," he summed up. He urged all involved in Amateur Radio emergency communication to install emergency power systems in their homes and on their repeaters.

The Old Dominion Emergency Net/Virginia Emergency Net Alpha was activated on HF to help support communication between the state EOC and local EOCs.

Maryland SM Tom Abernethy, W3TOM, rode out the storm from his home on Accokeek, just south of Washington, DC. Abernethy reports he monitored nearly 70 Amateur Radio emergency nets on 2 meters in the Delmarva region. At one point, Amateur Radio operators supported some 100 mostly Red Cross shelters set up in Maryland. "When the public safety officials' cell phones quit working, Amateur Radio was the only way to get through," Abernethy said.

SARI KRIEGER

Manassas, Virginia resident John Heartney, KG4NXT, used his Amateur Radio experience to help others during Hurricane Isabel.

ARES teams in Delaware, Pennsylvania, New Jersey and West Virginia were also activated for Isabel. The storm made itself known as far north as southern New England and as far west as eastern Ohio.

The Story from Manassas, Virginia

By Sari Krieger

John Heartney, KG4NXT, manned his post until 4:30 AM on September 19, 2003, as a member of the Amateur Radio Emergency Service. Heartney arrived at the makeshift Red Cross shelter at Stonewall Jackson High School in Manassas, Virginia, at 4 PM on September 18, just as Hurricane Isabel began her ominous descent on the area. He had his Amateur Radio equipment in tow, just in case the storm made his services necessary.

"Basically if the phones go down, we're communications," John Heartney said. Heartney and fellow volunteer Phil Colling, AC4PL, who worked the day shift at Stonewall, said ARES members received e-mails on September 17 asking for volunteers, and many people were willing to spring into action.

"We're all volunteers; we're like minutemen," Colling said. "Like on 9-11, people just got on their radios and asked if help was needed." ARES anticipated that the hurricane could terminate cell and landline phone communications, and more reliable Amateur Radio communications would be necessary.

"If the folks in Virginia Beach couldn't use the telephone to tell grandma they're okay, we could," Heartney said. Government officials and emergency workers would also be able to use the airwaves to communicate, and they had first priority.

Power endured in the shelter, but Heartney had his antenna propped on a soda machine outside the "command room," and he sat in wait. He used a local repeater, with a backup on nearby Mount Weather. But the mountaintop repeater was used mostly for Amateur Radio operators to transmit up-to-the-minute weather data to the National Weather Service, according to Heartney. Heartney and his wife Theresa, who arrived at the shelter later that night, are both certified "spotters."

Through the SKYWARN program, the Heartneys have radioed information about hail and heavy rain in other severe weather events, as many others did during Hurricane Isabel.

Heartney passed some messages through his radio that stormy night, even though telephone communications were stable. A nearby Woodbridge, Virginia, shelter lost power and asked Heartney about the situation in Manassas. Also, the Red Cross Chapter house radioed Heartney for information, possibly because of poor cell reception in the Stonewall shelter.

"At one point people in our shelter weren't answering cell phones, so we did get an inquiry about the number of people in the shelter, and we did get the information back to them," Heartney said. "It was about 80 at that time."

Many in Manassas considered the city lucky to have had relatively few storm related problems, as opposed to many jurisdictions in the northern Virginia area that lost power for days. But the ARES volunteers were ready to work had the situation become worse. "Basically if there's a power outage, we'll become really busy." Colling said. And they were willing to provide their services for a while if necessary. "We have backup batteries," Colling said.

Steve Ewald, WV1X ♦ Public Service Specialist ♦ sewald@arrl.org

ICS and Amateur Radio Communication Teams—Part 2

[Continued from the December 2003 Public Service column.]

By David W. Thorne, K6SOJ
ARRL Sacramento Valley Section Emergency Coordinator

ARCT Ordering Resource Guide

In order to bring Amateur Radio emergency and auxiliary communication (EMCOMM) resources into compliance with Incident Command System practice and procedures, the following nomenclatures should be used when Amateur Radio EMCOMM services are "ordered" during an ICS event. Each "TYPE" team is designed to provide 24/7 coverage, and will be dispatched with its own supervisor who will also serve as the liaison to the incident Communications Coordinator (COMC).

It is proposed that this will be included in the NICC Resource Ordering manual and be used by ICS Logistics personnel for all major (including non-fire) events.

ARCT Type 1—(Full field station and 4 mobile/portable units)
• Complete Amateur Radio emergency/auxiliary communications team for single or multiple agency communications.
• Capability: Short range (VHF/UHF) and long range (HF) voice and digital communications for tactical, logistics, health/welfare, administrative, and other radio traffic. Is not dependent on any outside power source or infrastructure.
• 12 operators including one supervisor and one assistant supervisor. Supervisors must hold General class license or above.
• Equal to one ARCT Type 2 and four Type 4 units (mobile or portable).

ARCT Type 2—(Field/base station)
• Capability: Short range (VHF/UHF) and long range (HF) voice and digital communications for tactical, logistics, health/welfare, administrative, and other radio traffic. Is not dependent on any outside power source or infrastructure.
• 4 (or more) licensed and registered AROs with one or two vehicles.
• 2 must be General class (or higher).
• May be assigned to a specific agency, or for AUX/EMCOMM at a staging area, Command Post, EOC, etc. For multiple agency service.

ARCT Type 3—(Field/base station/no digital)
• Same as ARCT TYPE 2 but without digital capability (VHF packet and/or HF pactor).

ARCT Type 4—(Mobile/portable field units)
• 2 licensed and registered AROs with one or two vehicles.
• Technician class or higher (at least 1 General or higher if available).
• VHF FM (minimum) equipped, HF mobile/portable desired.
• May be assigned to a specific agency or to supplement/relieve an existing multi-agency ARCT.

ARCT Type 5—(Mobile/portable field supplementary support unit)
• 1 individual licensed and registered ARO with vehicle.
• Technician class or higher.
• VHF FM (minimum) equipped.
• Rarely (if ever) ordered singly.
• May be assigned to a specific agency or to supplement/relieve an existing ARCT.

ICS Logistics Officers and/or Communications Unit Leaders should be provided with a current list of persons to notify to activate an ARCT.

Field Organization Reports

Compiled by Linda Mullally, KB1HSV

Public Service Honor Roll
October 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 emergen-cy 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.

560 N2LTC
465 W7TVA
450 W2MTA
391 AB2IZ
335 KB2SNP
327 N9VE
310 KA2ZNZ
305 KC2DAA
270 W2LC
265 N2YJZ
234 N2ECR
230 K7BFL
217 KA2GJV
215 AC5VN KD1LE
212 N2RTF
210 KB1HDO WB2KNS KB2CCD
208 NN2H
200 WA9ZTY KB5ILY
195 KB2ETO
194 WA1QAA
193 K9JPS K2ABX
187 N7CEU KB0DTI
183 WB6UZX
182 KW7DSP N2IK KK3F
174 W4AUN
170 KA9HRO
166 KA2BCE
165 K4RLD
160 WB5ZED
155 KD4EFM
154 NN7H
152 W3ZQN
150 AG9G KD4GR N2GJ KB2KOJ
149 N7TOD
146 KV4AN
145 KA0DBK AC5XK WI2G
144 WB2LEZ
142 N2OPJ
140 N8IO KB2VRO W3BBQ K0IBS W3YVQ
138 N1IST
135 N2HQL N1LKJ
134 K4YVX K3JL
132 W5ARS
133 K4BEH
130 N2JBA KC5OZT KA5KLU W5IM N5OUJ
129 K5DPG N3YTD
128 KG4CHW
125 K5MC KG4ZID K4WWV
120 AB4XK KB2RTZ KA9RZL W1GMF KW1U KA4FZI KK1A W8YS K6YR KG0GG KB5JBV
K5UPN W4EAT K4IWW
118 KB3GFC
116 W5XX
115 KD5ITA K9LGU KG4OQA K7UGT WB8RCR WA9JWL
114 W7TC
113 KE4UOF W6QZ N0ZIZ
111 N4TAB
110 K5ER W5PY NJ5M N5IKN N3SW AF4NS K2UL N7EIE W7QM N7YSS AG4DL WX4H WA4YL W7GB N7YSS KB8NDS N8NMA KD5YMW KE4JHJ K8AE W0LAW
109 W9BHL K4DND K0YEB WA5KQU
108 K4FQU
107 WA1JVV
106 N2YBB N2JWW
105 AD5KE AB0WR
104 W4ZJY
103 N3WAV WD4LSS
102 KB9KEG W1PLW
101 N1LAH W4NTI
100 W4DLZ K5IQZ NF5B WA5OUV KA4UIV K4SCL W9NXC W7LG W9CBE N1IQI KB1JEC NR2F N9MN WA4EIC WA9VND K7GXZ N8OD WA8SSI KC8UTL N3RB K3SS N7CM W7GHT N5BSD KB5TCH N5SIG AF2K KC2EOT WB2QIX AA3SB AA8SN N8ZJU KB2KLH KC2GOW N2AKZ WA0TFC N0UC
99 N8FXH W0HXB
98 W3CB
97 KG4FXG N1TPU
96 KJ7SI
95 W1ALE
94 KB5PGY AB0UY
93 WD9FLJ
92 W3GQJ
91 AG4AC KO4OL WD9F
90 W4WXA K4FUM WB4GGS WB4BIK WA2CUW N3KB W8IM K1JPG K4KAM KF4WIJ W4CKS KJ5YY N1JX K3CN W7RRC KC7SGM WD8DHC KA8WNO KF6OIF WB6GHA N0UKO KG2D WB2IJH N3WK AA3GV N3OR K3IN K32SX
89 K4BG
W2CC KO4SY
87 W5OMG
86 W7DPW W8CPG
85 W2QOB W8MMN
84 KG4MLC
83 K8KHZ
82 K4ZC AA4BN W6JPH WD0GUF
80 W5NK AA2SV W2MTO KL7OR KF7GC K2YYF K8KV WA0LYK
79 K4WKT KG4MLD W4DGH
78 KC2IYC W4FAL W4LN
77 KA2YKN
76 N2ULY
75 K8CQF
74 KA0O KD6YJB
73 KC6SKK
72 KK7TN
70 KC6NBI

The following stations qualified for PSHR in previous months, but were not recognized in this column: (September) WA9JWL 115, KJ9J 114, AD5KE 105, KO4SY 103, W1QU 100, W8MMN 96, K9PUI 90, W3GQJ 86, KC9BHJ 79. (August) KC9BHJ 196, WA9JWL 135, W8MMN 122. (July) WA9ZTY 170, W8MMN 168. (June) W8MMN 105.

Section Traffic Manager Reports
October 2003

The following ARRL Section Traffic Managers reported: AK, AL, AR, AZ, DE, EB, EMA, EPA, EWA, GA, ID, IL, IN, KS, KY, LA, MDC, ME, MI, MN, MO, NC, NFL, NH, NLI, NNJ, NNY, NTX, NV, OH, OK, OR, ORG, SB, SD, SFL, STX, TN, VA, VT, WCF, WI, WNY, WPA, WV, WWA, WY.

Section Emergency Coordinator Reports
October 2003

The following ARRL Section Emergency Coordinators reported: AK, AR, AZ, EWA, IL, IN, KS, KY, LA, MN, MO, NC, NLI, NV, SD, SFL, SJV, SNY, STX, SV, WMA, WNY, WPA, WTX.

Brass Pounders League
October 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*
KK3F	34	1682	1640	42	3398
W1GMF	0	605	2375	17	2997
W4ZJY	0	1318	1352	0	2670
WB5ZED	70	1304	1226	22	2622
KA5KLU	0	1015	1326	11	2352
N2LTC	2	958	953	48	1961
W4EAT	0	895	882	1	1778
KW1U	0	646	597	15	1258
K7BDU	12	596	551	596	1163
K9JPS	0	470	39	454	963
WX4H	-	470	386	-	856
N5SIG	56	390	289	68	803
N1IQI	538	150	12	0	690
KF4WIJ	3	306	299	21	629
KA4FZI	1	325	261	7	594
AK6DV	0	289	265	24	578
W0WWR	0	341	286	25	552
W6DOB	10	204	284	34	532
K5UPN	19	293	210	6	528

BPL for 100 or more originations plus deliveries: N9VE 110, N7CEU 110, and W7TVA 107.

ARRL Travels

Telecom 2003

This past October 12-18, 2003, the Palexpo in Geneva was the site for the world's premier telecommunications event—the International Telecommunication Union (ITU) TELECOM World 2003. King Juan Carlos of Spain, EAØJC, gave a warm welcome to Telecom visitors and exhibitors during a colorful opening ceremony in the Palexpo Arena. Swiss officials were also a part of the regal ceremony: Mr Pascal Couchepin, President of the Swiss Confederation and Mr Laurent Moutinot, President of the Government of the Republic and Canton of Geneva, were proud to welcome visitors from all over the world to Switzerland.

The International Amateur Radio Union (IARU) had a team of people throughout the week at the IARU stand in Palexpo's Hall 1. Headed by IARU President Larry E. Price, W4RA, IARU volunteers included: Gerald Lander, HB9AJU; Yoshiji Sekido, JJ1OEY; Hans Ehlers, DF5UG; Attila Matas, OM1AM, trustee of the ITU International Amateur Radio Club station 4U1ITU, and Jean Pierre Coudert, HE9JPC. ARRL Technical Relations Specialist Jon Siverling, WB3ERA, was the IARU Stand Manager.

The World Telecom provides an excellent opportunity to meet telecommunications regulators from around the globe and to promote Amateur Radio in their countries. The ITU management were essential to the success of the event. Mr Yoshio Utsumi, Secretary General of the ITU, led a Special Session of the Forum on "The World Summit on the Information Society." Director of the ITU Radiocommunications Bureau or BR, Mr Valery Timofeev, participated in the Telecom Forum. Mr Hamadoun I. Touré, Director of ITU's Telecommunication Development Bureau, participated in the Youth Forum session "Investment and Finance." Director Touré later paid a call on IARU President Price to discuss several issues regarding Amateur Radio, including a second (revised) edition of the *ITU Handbook on Disaster Communications*.

Oyekunle B. Ajayi, 5NØOBA, Secretary, Nigeria Amateur Radio Society (NARS), visited the IARU stand. "Kunle," as he is known the world over to his amateur friends, was a powerful force as the spokesman for the African Telecommunications Union (ATU), helping to achieve the great results on the 7 MHz issue during this past summer's World Radiocommunication Conference 2003.

Larry Price, W4RA, IARU President, with Mr Hamadoun I. Touré, Director of Telecommunication Development Bureau, ITU.

STIG LINDBLOM, LA7JO

Oyekunle B. Ajayi, 5NØOBA, Secretary, Nigeria Amateur Radio Society (NARS), visits Larry Price, W4RA, and Jon Siverling, WB3ERA in the IARU stand at Telecom World 2003.

Future ITU Telecom events planned include the ITU Telecom Africa 2004, Cairo, Egypt, May 4-8, 2004; ITU Telecom Asia, Busan, Korea, September 8-12, 2004; ITU Telecom Americas 2005; and ITU Telecom World 2006.

Larry E. Price, W4RA, is President of the International Amateur Radio Union. He served as ARRL President from 1984 until 1992. You can reach him at **w4ra@iaru.org**. Jon Siverling, WB3ERA, is a technical relations specialist on the staff of the ARRL's Technical Relations Office in Washington, DC. You can reach him at **wb3era@arrl.org**.

Ruth Erazo, HR2RJE (center), displays the International Champion Award, given by FRACAP in 2003 as a result of her participation in the FRACAP operating contest in July 2003. She is flanked on her right by her father, Atilio, HR2AEV, and on her left by her husband, Vinicio de Leon, HR2MVD. Vinicio is showing off his award as the National Champion for Honduras.

Alejandro Escarcega, XE1CK, gave a presentation about his collection of telegraphy keys at the FMRE Convention in Puerto Vallarta.

WB3ERA Attends Events in Central America

Jon Siverling, WB3ERA, in September, attended the 2003 Regional Convention of the Federation of Radio Amateurs of Central America and Panama (FRACAP) in Panama City, and the National Convention of the Mexican Federation of Radio Experimenters (FMRE) in Puerto Vallarta—the latter which ARRL International Affairs Vice President, Rod Stafford, W6ROD, also attended. Stafford gave a presentation on ARRL's Amateur Radio Education and Technology Project. Siverling presented the results of WRC 2003 at both conventions.

General Question Pool Changes on the Horizon

Effective July 1, 2004, a revised Element 3 General class question pool takes effect for examinations. VECs and VEs will have new test designs for use in exam rooms effective that date. All question pools can be found at **www.arrl.org/arrlvec/pools.html**.

The newly revised pool was released in December by the Question Pool Committee (QPC) of the National Conference of VECs. The General syllabus was reviewed during 2003.

Skip a Year, then the Extra Pool Review is Here

Next up for review is the Element 4 Extra class question pool. The syllabus for this revision will be developed in the coming months. Public input is invited on the syllabus, as well as on the Extra pool questions, answers or distractors. Input can be directed to the entire QPC via e-mail to **qpc@arrl.org**, or to the individual committee members: Chairman Scotty Neustadter, W4WW (**w4ww@arrl.net**); Fred Maia, W5YI (**fmaia@texas.net**); John Johnston, W3BE (**johnston.john1@worldnet.att.net**), and Bart Jahnke, W9JJ (**w9jj@arrl.org**).

When you submit new question material or suggest changes to existing questions, please limit question length to 210 characters and answer or distractor lengths to 140 characters. For new questions or modifications to existing questions, please indicate the subelement reference number and topic, and existing question number, if any, with your submission, eg, "**E9B Free-space antenna patterns....**"

Testing of Relatives—Still Taboo!

ARRL VEC has seen a recent increase of test sessions in which VEs are serving as examiners for their relatives. This is a violation of Section 97.509(d) of FCC Rules ("No VE may administer an examination to his or her spouse, children, grandchildren, stepchildren, parents, grandparents, stepparents, brothers, sisters, stepbrothers, stepsisters, aunts, uncles, nieces, nephews, and in-laws"), and is a violation of certification "item 2" on all ARRL VE applicant certifications.

What's of equal concern is that, since the examination system requires at least three VEs be present to provide the examination service, not one *but all three* VEs present apparently concluded that administering such an examination was acceptable.

Nothing goes to the heart of the integrity of the VE system more than the conflict-of-interest clause prohibiting the testing of relatives. While VEs must pay attention to many things when administering examinations, identifying the few applicants to whom VEs cannot provide services (per FCC Rules) is crucial if the program is to retain its highly regarded status.

VEs signed up to serve at a test session where another VE has an apparent relative present should *not* administer any tests until all VEs agree that any conflict-of-interest issues have been addressed.

Test designs: If you do have an ample supply of VEs who have no conflict, take the extra precaution of obtaining or assembling a special test design that neither the applicant (nor VE relative) has had earlier access to. This will ensure that the test design being used will not have been compromised earlier—even by casual access, such as the VE being the holder of testing supplies routinely used by the team.

VE Team Members taking tests: Similarly, if a regular team member is present to be served as an examinee (such as a General class VE team member looking to take the Element 4 Extra class written test), take some simple precautions to preserve the integrity of that person's test, and of that of your team. The best solution is to assemble or obtain a special test design not normally found in the team's exam supplies. To borrow a popular phrase, "*Be careful out there!*"

2004 ARRL/VEC Test Fee—$12

For calendar year 2004, all applicants at ARRL VEC-coordinated Amateur Radio test sessions will be charged a $12 fee. This fee remains unchanged from calendar year 2003. This fee is charged to anyone applying for a new amateur license or upgrading their operating privileges. The single $12 fee permits an applicant take any one, two, three or all four exam elements (without retaking an element) one time at your test sessions. Applicants failing an exam element at ARRL sessions where examiners permit retesting on the same exam element using a different test design must submit a retest fee of $12.

The maximum reimbursement ARRL VEC allows ARRL volunteer examiner (VE) teams to retain to directly offset their prudently incurred out-of-pocket expenses will remain at $6 in 2004.

ARRL Provides License Services

The ARRL provides FCC Amateur Radio license renewals, address changes and other license modification services *free* to current ARRL members. Beginning in January 2003, we made this service available to nonmembers as well, for a fee.

Nonmembers: For a $12 fee, the League will renew a nonmember's Amateur Radio ticket (the license must be within 90 days of expiration), file an application to change address or name, or request issuance of a new sequential call sign (ARRL is not able to process Vanity call sign requests). The ARRL Volunteer Examiner Coordinator Department is processing these applications at ARRL. QST

ARRL Spring and Fall National Exam Days

Spring National Exam Days (weekend)—Annually, the last full weekend in April; for 2004, Saturday and Sunday April 24-25.

Fall National Exam Days (weekend)—Annually, the last full weekend in September; for 2004, Saturday and Sunday, September 25-26.

Question Pools

The current question pools and their four-year effective periods:

- Current Technician class Element 2: Expires at midnight June 30, 2007
- Current General class Element 3: Expires at midnight June 30, 2004
- Current Extra class Element 4: Expires at midnight June 30, 2006
- New General class Element 3: Effective July 1, 2004 through June 30, 2008

Bart Jahnke, W9JJ ♦ ARRL/VEC Manager ♦ vec@arrl.org

Project Star Reach—The Five Star DXers Association's 3B9C-Rodriguez DXpedition

Remember the 2001 D68C DXpedition to the Comoros Islands? Yes, the one that made an amazing 168,722 QSOs in 18 days. Members of the Five Star DXers Association are ready to go on another DXpedition. They have been planning their next trip for close to two years and in early November 2003 they announced they are once again going south of the border into the Indian Ocean. This time they have set their sights on the island of Rodriguez for a March/April 2004 operation.

Rodriguez Island (3B9), a dependency of Mauritius (3B8), is located about 800 km (500 miles) east of Madagascar (5R8). This 104 sq km island has a population of just fewer than 40,000, including one Amateur Radio operator, Robert, 3B9FR. The island was discovered in the 16th century by the Portuguese. Rodriguez was colonized in the 17th and 18th centuries by the French and was taken by the English in 1810.

Why Rodriguez?

Some may ask why Rodriguez Island? The last major operation was that of 3B9R in 1999, which made some 47,000 QSOS. Also on the island is Robert, 3B9FR, who is active most days. The team says "With the best will in the world, one individual cannot meet the world's needs for a DXCC entity." They also note that 3B9 has once again worked its way up the "Most Wanted" lists. The 2002 *DX Magazine* states Rodriguez Island ranks #81 on the worldwide list. But if you look at some of the band and mode most wanted lists you will see that it ranks #27 in Europe on SSB. In the central areas of the US it is between 30th and 50th on CW and SSB. On AA5AU's 2002 RTTY Most Wanted it ranks #46. The group also states that many of these Most Wanted lists are a result of the serious DXers who are on or near the Honor Roll and that DXers and Amateur Radio operators who are not as serious don't participate in such polls or surveys. In other words, go to a semi-rare place and they will call!

Just before the D68C DXpedition, DXers were asking why the Comoros Islands? It really wasn't one of the rarest DXCC Entities yet they managed to work 45,300 unique stations! Another amazing fact about that operation was that even during the last few days of the operation they were still logging some 20% first time QSOs with unique stations. So there is something to be learned here. There are a lot of Amateur Radio operators who want to work DX. They may not call themselves DXers; however, they are out there and wanting to work those rare and exotic locations around the globe!

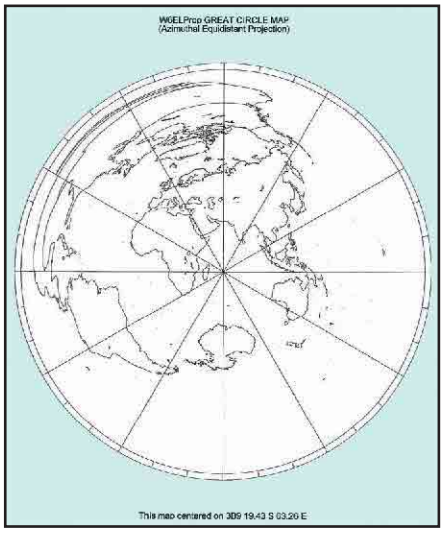


Figure 1—Great circle map based on Rodriguez Island (3B9).

Figure 2—The Five Star DXers Association was formed after the very successful February 1998 CDXC 9MØC Spratly Islands DXpedition by seven UK amateurs who organized this DXpedition.

Figure 3—The 2004 3B9C logo.

Just prior to press time the Mauritius authorities issued the group the call sign 3B9C. The group has once again chosen the preferred suffix "C" (9MØC—Spratly Islands 1998 and D68C), which stands for the Chiltern DX Club (CDXC). Once again, they are making every effort for this one to be "no ordinary DXpedition." In order to do this they are backing it with lots of hardware and a lengthy operation to make this an even bigger operation than the D68C operation. Plans are to have 10 complete stations including amplifiers and monobanders for a 24 hour round-the-clock operation for four weeks during the spring equinox of 2004.

The group notes that many DXpeditions are aimed at the "best-equipped amateurs" and that "many others then feel disenfranchised." Thus the 3B9C is taking many steps in order to work even more stations. In order to do this they have launched their "Project Star Reach" program. This includes a lot of prep work, including pre-DXpedition articles, a Web site (**www.fsdxa.com/3b9c**), pre-presentations, an awards program and much more. One of the goals of this DXpedition is to "reignite an interest in HF operation among the Amateur Radio community."

Before the D68C DXpedition to the Comoros Islands the team put together a "how to" article in the RSGB's *RadCom* magazine. The results were that an overwhelming 3400 UK stations were worked. This was an extremely "high proportion of those who, at that time, had HF licenses." The Five Star DXers Association is once again going to do this simple "how to" concept only this time "on a multi-national basis."

3B9C Objectives

This operation has two main goals. First is to give every Amateur Radio operator (even QRP and very simple antenna stations) the possibility to make at least one QSO with 3B9C. They are also hoping to work the top DXers on as many as

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G3XTT

Figure 4—The Cotton Bay Beach is where a majority of the 3B9C antennas will be located. The Cotton Bay Hotel will be the home of the 3B9C operators for four weeks.

G3XTT

Figure 5—A typical street scene in Port Mathurin, the capital city of Rodriguez Island.

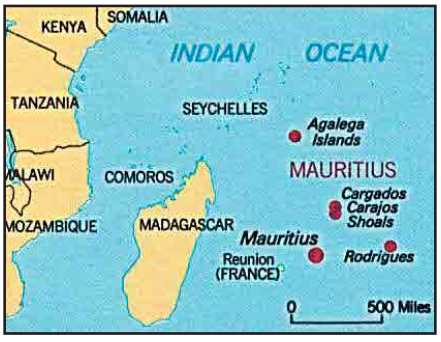

Figure 6—Rodriguez Island is located approximately 653 km east of Mauritius.

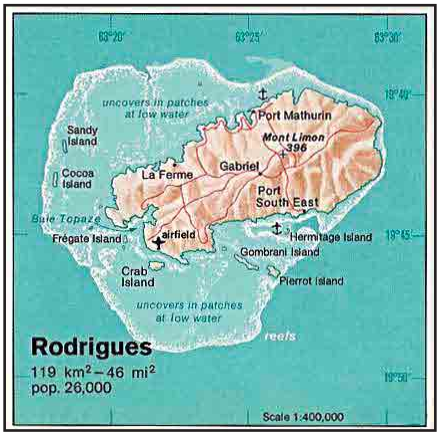

Figure 7—The 3B9C team will be operating from the Cotton Bay Hotel, located on the northeast corner of the island.

18 different "band/mode slots." The team also will be working closely with the locals in "various activities" that are currently in the planning stages. They will also be using StarSoftware, a server-based DXpedition software package, with the intent to allow future DXpeditions to use it on upcoming operations. 3B9C will be one of the first major DXpeditions to "link fully" with the Logbook of The World (LoTW). One other objective will be to encourage Amateur Radio operators to try new bands and modes, including 10 meter FM, PSK31, AO-40, EME and SSTV.

Sponsors

An operation of this magnitude could not be possible without sponsors. Each of the operators is responsible for taking care of their own individual traveling expenses. The group is seeking donations by DX foundations, clubs and individuals. They are in the process of contacting organizations as we go to press. One other factor to consider is that 3B9C will be one of the first major DXpeditions to make use of the LoTW, which will seriously slow down the donations (normally thrown in with QSL card requests). There are several ways (donation points and methods) to help contribute to the 3B9C DXpedition. Here in the US donations may be sent to Wes Lamboley, W3WL. You can contact him via his CBA or by e-mail to **blamboley@aol.com**. Please check the 3B9C Web site (see above) for complete details. Yaesu will be providing 10 complete stations.

3B9C Team

The 3B9C team has been assembled and includes both experienced DXpedition operators and some new faces. As of press time the list of participants is as follows: Neville Cheadle, G3NUG (Team Leader); Don Beattie, G3BJ (co-leader); John Linford, G3WGV (co-leader); Tony Canning, GØOPB; Mike Devereux, G3SED; Don Field, G3XTT; Bob Beebe, GU4YOX; Nigel Peacock, G4KIU; Justin Snow, G4TSH; Tim Kirby, G4VXE; Kazuo Ogasawara, JA1RJU; Jens Sperling, DL7AKC; Paul O'Kane, EI5DI; Ivan Davies, G3IZD; Jim Henderson, KF7E; John Kennon, N7CQQ; Pat Hess, NK7C; Dave Bowman, GØMRF; Derek Moffatt, G3RAU; Dave Robinson, G4FRE; Meg Robinson (YL), N2NQI; Maury Peiperl, W3EF; Jun Tanaka, JH4RHF; Mark Haynes, MØDXR; Daniel Clapp, MØGMT; Hilary Claytonsmith, G4JKS; Mike Parker, G4IUF; Chris Lewis, G3NHL, and John Gould, G3WKL.

DX NEWS FROM AROUND THE GLOBE

3Y—PETER I ISLAND POSTPONED

The Peter I DXpedition team (see December's "How's DX?") has decided to postpone their DXpedition to Peter I Island, Antarctica, until January 2005. A last minute glitch developed in the transportation plan even as the team was preparing to meet in Atlanta to train and to pack the sea container for shipment. Weather windows precluded a rescheduling for 2004. No one is more disappointed than we are, but the 2005 expedition will be bigger and better! Our team is intact, our permissions are not a problem, and the expedition equipment including six Arctic shelters, flooring, antennas, masts, kitchen equipment, power cables and generators, coax, etc, are all in storage in Atlanta. We wish to thank all of our sponsors for their support; look for additional updates in the spring. For the team, Bob, K4UEE, and Ralph, KØIR.

HI—DOMINCAN REPUBLIC

John, G4RCG, and Bruce, KI7VR, will team up in the Dominican Republic as G4RCG/HI9 and KI7VR/HI9 January 17-31, 2004 including the CQ 160M CW contest. QSL to their home calls.

HH—HAITI

Hans, DL7CM, announced he will be going back to Haiti for his second DXpedition. He will be traveling with Sid, DM2AYO; Manfred, DK1BT, and Juergen, DL7UFN. Activity is expected between January 28 and February 15. They will use special call sign 4V2ØØYH (Four Victor Two Hundred Years of Haiti). Look for them to be QRV on 6 through 160 meters CW, SSB, RTTY, PSK and SSTV. Three stations will be set up, with two of them QRV around the clock. Antennas will include a 27 meter ground plane, 3 element 5 band beam, HF9V and a 4 element 6 meter Yagi. They will have a Web page, which will include a log search at **www.qsl.net/dl7cm/haiti2.htm**. QSL via DL7CM.

WRAP UP

Well, that is all for this month. Keep an eye on your favorite DX bulletin for any updates on this and other DXpeditions. A special thanks to Don, G3XTT, and Neville, G3NUG, for info on photos that made this month's column possible. Going on a DXpedition? Don't forget to let your editor know. Thanks to those who continue to send your DX Club newsletters. Until next month, see you in the pileups!—*Bernie, W3UR*

Fly Me to the Moon

CAROL LIEBMANN

Figure 1—A little gathering of EMEers at Jay, K5JL's location prior to the Central States VHF Conference. From left to right: Gary, KB8RQ; Bob, KØYW; Jay, K5JL; Gerry, K5GW; Dave, W5UN, and Joe, K1RQG in front.

One of the requirements for any conductor of the World Above 50 MHz is a suitable knowledge of the entire VHF+ continuum in all of its aspects. Over the years I have been fortunate to participate in many of these facets. I've worked stations from my own location and portable from mountaintops via almost every means imaginable, but the one mode that has escaped me, however, is moonbounce. My own location and the surrounding homes all have large numbers of oak trees more than 30 meters tall. Given my relatively small lot and tall oak trees, EME is a nonstarter at my location beyond a few contacts on moonrise here and there.

To experience some of the joys of EME, I have resorted to portable operation during ARRL VHF contests. My latest brush with EME began last summer when Jay Liebmann, K5JL, invited me to spend a few days with him prior to the Central States VHF Conference. Jay has a real EME station with a 9 meter dish that can be configured to work 2 meters through 13 cm. Over the next few days, a few other folks showed up to discuss the nature of life off the moon on the VHF bands: K1RQG, K5GW, W5LBT, W5UN, W7CNK KB8RQ and KØYW. You can see some of this august group in Figure 1. At that point, I was rapidly getting a distinct feeling that I needed more practical operating knowledge.

Enter Al Katz, K2UYH, who was at the conference although he arrived too late to join us at Jay's house some 150 km away. Along with Joe, K1RQG, Al has been one of my sources of EME operating information. Knowing my interest in contests, Al suggested that I might want to see how an EME contest worked. Thus was born the idea of doing a multi-operator effort in the ARRL EME contest in the fall.

K2UYH Station

Like many active in EME, Al Katz' station is a mixture of homebrew and commercial equipment. The key to any EME station is the antenna(s). In this case, it is a well known 8.5 meter Kennedy dish with a dual-dipole feed that can be rotated to either horizontal or vertical polarization on 70 cms. There's also a VE4MA scalar feed built by K2AH that generates circular polarization for 23 cm (see Figure 2). There is an FHX35G HEMPT preamplifier on 70 cm and a modified SMØPYP-designed preamplifier built by K2AH for 23 cm. Aiming a dish this size—especially on 23 cm—is far from a trivial task. Here, there is a combination of mechanical and electrical readouts, and if the sky is clear at night, a camera can be mounted on the dish and you can see if the dish is pointed at the moon.

The inside of the station is built around a Kenwood TS-2000 and a pair of Yaesu FT-726Rs. On 70 cm, a 4CX250B drives a homebrew 1500 W 8938 amplifier, and on 23 cm a pair of 7289s drives a KB2AH-modified 6×7289 water-cooled ring amplifier running about 450 W.

Since the dish has a dual feed (with 23 cm geometrically centered and 70 cm offset by 6°), changing bands is just a matter of plugging the right output cable into the 22 mm air-dielectric Hardline behind the racks.

Among the more interesting devices is the CW generator. A keyboard is connected to a functional IMSAI 8080 computer. Now that is not something you'd see in every shack! The operating position computer displays a continuously running waterfall (*Spectran* – I2PHD) and determines moon position and Doppler information from a copy of *WSJT* (K1JT). For a mode that involves an ever-changing Doppler shift on received signals and signals that are often at the limits of audibility, these programs are invaluable aids to find stations who are calling you.

This Month

Jan 4	Quadrantids meteor shower
Jan 11, 25	GOOD EME Conditions*
Jan 24-25	ARRL January VHF SS

*Moon Data from W5LUU

Operating EME

Making contacts on EME is more challenging than in the average contest. All of our contacts were random; thus, the protocols for schedules were not used. The moon is far away and a poor reflector (less than 7%). Therefore, it takes a large antenna system and the most sensitive receivers to make any contacts. The use of digital techniques like JT44 gives you another 10 db or so to play with, but you still need a good station. The contest periods are deliberately chosen to provide the best possible conditions (closest to perigee and least possible signal degradation), but one must be aware of solar conditions. A highly active sun degrades the signal-to-noise ratio (S/N). Libration fading is a rapid signal fading caused by multipath reflections off the irregular lunar surface. It can be a problem at all frequencies, but it is usually worse on the lower bands. The result is similar to the loss of parts of characters from polar flutter on HF. To compound the situation at

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70 cm and below, stations use linear polarization; spatial polarization shifting can cause polarization mismatches as can Faraday rotation through the atmosphere. Al combats this with a feed system capable of changing polarity from horizontal to vertical. On 23 cm, Faraday rotation is much less of a problem and circular polarization is commonly used. With the addition of Doppler shift problems, you can see this will not be a contact-a-minute contest.

The Contest

Al had already warned me that while we would do well, we couldn't expect to win because over the years trees, many on his neighbors' property, essentially block the dish until it reaches 20º elevation. To me however, it was much like working the microwaves in a multi-operator station. Every contact is like a magic show. Al and I alternated doing the sending (with that IMSAI 8080) and both of us listened at the same time. The TS-2000 worked well, but I was surprised that the FT-726 did almost as well.

The first contact went in the log on 70 cm at 0554Z, almost two hours after moonrise. No surprise—it was DL9KR. An hour later, we corralled JW/SM2BYA, the big contest expedition for 70 cm DXCC country #81 and initial #665. Signals were good, but not much better than from the 8×FO22 array I've used from K8GP. A quick calculation shows that the 30 dBi gain of the dish at 70 cm is ~6 dBi better than the Yagi array. We ran about 10 contacts before it slowed down and we shifted to 23 cm at 0740Z, where we stayed for almost the next 2½ hours. On 23 cm, it was a different story. The dish with its 39 dBi gain was awesome, and we put 23 more contacts in the log. After another eight contacts on 70 cm, we had an encounter with Mr Murphy. Right after working SM3AKW, I detected a bad smell and soon saw some smoke pouring out the back of the rack. I now had my own personal initial—the smell of a burning Variac. The power supply for the 4CX250 70 cm driver was *kaput*. Al went into troubleshooting mode, and both the power supply and a control panel were repaired about three hours later. The good news is that the problem came at the end of the European window, at a time when activity always drops significantly, so we probably did not lose many contacts. We returned to the air to work JAs on both 70 and 23 cm.

As expected the second day was much slower, but there was an interesting variety of contacts including ZS6AXT on 23 cm and our final contact on 70 cm with VK3UM. At 1445UTC, I saw firsthand the effect of polarization while working KE2N/4 on 70 cm. In order to complete the contact, I was forced to rotate polarity on each transmission. I could hear him only while listening vertical; he could hear me only while I was transmitting horizontal. Contacts with a number of stations both days were hampered by libration fading. Pieces of characters just seemed to disappear into thin air. I was pleased that I was able to copy most of these weak signals almost as well as Al. Of course, I would probably still be listening for those like JH4JLV, had Al not been there. Finally, Al's encyclopedic knowledge of station capabilities led to the highlight of the contest. I was working JA6ANB on 70 cm and Al told me he had the ability to QSY quickly to 1296 MHz. After asking him to move to 1296.020 in five minutes, I was pleased to work him even more strongly on 23 cm. So even on EME, "instant" band changing is not out of the question.

Figure 2—At right, the well known 8.5 meter Kennedy dish at K2UYH. At left, a new 4 meter dish for 10 GHz.

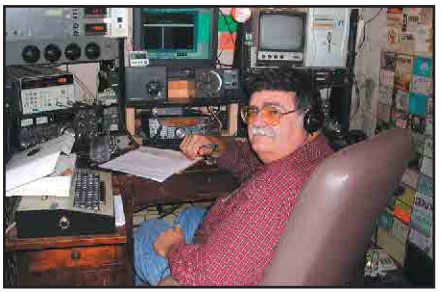

Figure 3—Your conductor at the controls of K2UYH during the ARRL EME contest.

Overall, it was a pretty good weekend. We had 35 QSOs and 22 multipliers on 70 cm and 37 QSOs and 24 multipliers on 23 cm for an interim score of 340k.

Next Weekend

The ARRL EME contest is a two-weekend affair. In November, Bob, N4HY, will be at Al's house with his software-defined receiver, the SDR-1000. I've played a little bit with the SDR-1000—it sounds very good. How will it do compared to the TS-2000? We'll see. Al intends to put at least one more band on the air—either 3 cm (remember that big TWT) or 13 cm (another TWT). I think it will be very interesting to say the least.

ON THE BANDS

October is a month that can produce some interesting tropospheric ducting and auroral propagation. It is also the month when F2 first appears—if it is going to appear. With the solar cycle at its present point, no one expected much and to be honest, it was the first month in a long time with nothing exciting happening—that is, until October 29. Then we got the largest aurora so far for the declining years of Cycle 23. I will treat the aurora in detail next month. In the meantime 6 meters was the main feature this month.

Six meters stirred to life on October 7-8 with a weak opening from Sam, K5SW (EM25), to LW3EX and LU3DCA. Jon, NØJK (EM17), also heard LW3EX and reports W4CHA/B at that time, while ZF1DC was hearing an LU beacon. Sam heard no E_s and questions the mode. While this one may have been an E_s/TEP link, according to Jim Kennedy, KH6/K6MIO, it is consistent with a direct non-specular refraction from an F layer whose MUF is barely at the working frequency. Thus, the greatest distance is achieved when signals are at their worst and such openings are very short. On the seventh, Raj, VU2ZAP, reports a solid F2 opening to PA, DL and later to A61AH. On the eighth, he was into A61AH and HZ1MD followed by XZ7A. A post X-flare disturbance over the period October 19-21 led to some long-distance fun. Ken, WB2AMU (FN30), heard LW3EX on the 19th. John, W5UWB (EL17), worked LU, PY and ZP. Chuck, K5IX (EL29), was into PY, LU, YN and VK. Gary, NW5E (EL98), reports KP4 and TI via E_s and LU, CX, PY and his first ever TE observation of the ZD8VHF beacon. On the 21st, Pat, W5OZI, was solidly into VK, KH6 and FK8EB. K4RX (EM70) and W2GFF (EM60) were also heard working the Pacific. Doug, ZP6CW, had a huge opening with contacts to NH7NO and CN2R with a minute of one another. Hatsuo, JA1VOK, reports the first Japanese F2 success this season with CEØ/SP9EPV on October 23. About an hour later, KØGU (DN70) made it into CEØY. Another X-class flare triggered the best E_s opening of the month, which fortuitously coincided with the fall 6 meter Sprint on October 25-26. Excellent rate conditions from the Midwest and Southwest to the East Coast were reported by a number of stations including John, NEØP (EM04), and Jon, NØJK (EM17). Jay, KØGU, got started late but wound up with 231 QSOs in 91 grids including a 90 hour at 0200UTC. He noted a number of double-hop contacts with Florida. The big X17.2 flare-driven auroras at the end of the month also produced one of the best widespread openings from the US mainland to KH6 in some time. I note in particular reports of many stations in all KH6 grids from Hawaii [Lee KH6BZF (BL11)], all parts of the West Coast [Fred WA7TZY (CN87), Dave N7DB (CN85), Bob K6QXY (CM88) and Roger K6LMN (DM04)] West

Microwave Standings

Published Microwave Standings include only regional leaders as of December 1. For a complete listing of all stations, check the VHF/UHF/Microwave Standings Boxes at **www.arrl.org/announce/standings/**. To ensure that the Standings Boxes reflect recent activity, submit reports at least every two years by e-mail to: **standings@arrl.org**. Printed reporting forms are available by sending a request with SASE to: Standings, ARRL, 225 Main St, Newington, CT 06111. Stations are grouped into regions based on call area.

33 cm (902-928 MHz)
Minimum Terrestrial DX = 800 km

Call Sign	QTH	States	DXCC	Grids	Best DX† (km)
K1TEO	CT	17	2	50	1125
AF1T*	NH	17	1	24	849
K1UHF	CT	14	1	30	821
W1AIM	VT	9	2	19	1078
WA1ECF	MA	9	1	20	1126
KU2A	NH	8	1	10	814
K2DH*	NY	16	2	40	—
K2AXX	NY	16	2	28	888
K2AN	NY	14	2	28	1401
W3RJW	PA	15	1	33	927
WA2FGK	PA	14	2	34	940
W4DEX	NC	8	1	10	1214
KØVXM/4	FL	3	1	8	1747
W5LUA*	TX	21	2	60	1725
W5RCI	MS	12	6	20	1200
AA5C	TX	12	1	38	1596
N5QGH	TX	5	1	20	1062
K5LLL	TX	5	1	15	1041
N6CA	CA	4	3	19	3978
W6CPL	CA	1	2	17	825
WA8RJF	OH	11	2	31	1238
K2YAZ	MI	11	1	38	960
N8KOL	OH	9	1	17	1006
K3SIW/9	IL	18	2	59	1265
WØLD	CO	5	—	5	984

23 cm (1240-1300 MHz)
Minimum Terrestrial DX = 1000 km

Call Sign	QTH	States	DXCC	Grids	Best DX† (km)
K1TEO	CT	18	2	53	1125
W1JR*	NH	13	4	36	1054
W1AIM	VT	12	2	30	1103
WA1ECF	MA	11	2	20	1126
K2DH*	NY	39	31	105	—
K2AN	NY	14	2	35	1401
W3RJW	PA	19	2	53	1123
W3ZZ	MD	15	2	38	1140
K4QI*	NC	34	29	147	—
W4TJ*	VA	22	23	64	—
W4DEX	NC	14	1	23	1078
W4WTA	GA	9	1	16	1023
KØVXM	FL	3	1	14	1696
W5LUA*	TX	41	40	257	2060
WD5AGO*	OK	39	37	210	1705
W5RCI	MS	17	5	68	1200
K5UR	AR	17	1	82	1102
AA5C	TX	17	1	60	1721
K5SW	OK	15	1	55	1583
N5QGH*	TX	14	7	45	1545
W5UWB	TX	7	1	14	1664
W5HNK	TX	7	1	—	1272
K5LLL	TX	4	1	20	1540
N6CA*	CA	8	11	44	3978
K6QXY	CA	4	2	18	3794
W6CPL	CA	3	3	27	3984
K2YAZ/8	MI	18	2	58	1300
WB8TGY	MI	17	2	46	1487
N8KOL	OH	15	2	34	1006
WA8RJF	OH	13	2	39	1037
W8PAT	OH	12	2	29	1342
K3SIW/9	IL	23	2	78	1265
WB9SNR	IL	16	2	52	1250
WØOHU	MN	15	2	44	1310
NØHJZ	MN	15	1	44	1530
NØLL	KS	13	1	46	1321

13 cm (2300-2310, 2390-2450 MHz)
Minimum Terrestrial DX = 800 km

Call Sign	QTH	States	DXCC	Grids	Best DX† (km)
K1TEO	CT	16	1	33	1125
K1UHF	CT	10	1	19	880
AF1T	NH	8	1	9	1005
KU2A	NH	3	1	5	814
K2AXX	NY	14	2	21	888
K2DH*	NY	13	8	40	—
W3RJW	PA	14	1	26	1029
WA2FGK	PA	11	1	23	900
W4DEX	NC	7	1	9	1030
KØVXM	FL	3	1	9	1609
W5LUA*	TX	22	22	101	1533
W5RCI	MS	10	5	21	920
AA5C	TX	8	1	26	1596
N5QGH	TX	5	1	15	1013
K5LLL	TX	3	1	16	1524
N6CA	CA	3	3	20	3978
WB8TGY	MI	9	1	20	1487
K2YAZ	MI	8	1	27	924
K3SIW/9	IL	14	1	52	1109
WB9SNR	IL	6	1	15	812
NØHJZ	MN	7	1	14	1086

9 cm (3300-3500 MHz)
Minimum Terrestrial DX = 400 km

Call Sign	QTH	States	DXCC	Grids	Best DX† (km)
K1TEO	CT	11	1	22	590
KU2A	NH	3	1	4	814
K2AXX	NY	12	2	19	604
K2DH	NY	11	2	20	996
W3RJW	PA	8	1	12	719
W4DEX	NC	5	1	6	714
W5LUA*	TX	10	6	35	1353
AA5C	TX	5	1	16	1048
WB5AFY	TX	4	1	14	454
N6CA	CA	3	3	20	3978
W6CPL	CA	1	2	8	508
N6CA/6*	CA	1	—	11	986
WA8RJF	OH	5	2	10	591
K2YAZ/8	MI	4	1	6	843
K3SIW/9	IL	10	1	42	936
WB9SNR	IL	5	1	14	518
KØRZ	CO	4	1	16	490
WØLD	CO	3	—	6	828

5 cm (5650-5925 MHz)
Minimum Terrestrial DX = 300 km

Call Sign	QTH	States	DXCC	Grids	Best DX† (km)
K1TEO	CT	8	1	13	541
W1GHZ	MA	7	1	9	367
K2AXX	NY	10	2	28	604
WB2AMU	NY	9	1	10	325
K2DH	NY	7	2	10	996
W3RJW	PA	4	1	8	367
W4SW	VA	3	1	5	321
W5LUA*	TX	7	14	43	1187
AA5C	TX	5	1	21	1134
WD5AGO	OK	3	1	6	342
N6CA	CA	3	3	20	3978
W6OYJ	CA	1	1	1	344
N6CA/6	CA	1	—	10	986
K2YAZ	MI	6	1	13	924
WA8RJF	OH	4	2	5	591
K3SIW/9	IL	8	1	34	841
WB9SNR	IL	5	1	12	614
KØRZ	CO	5	1	18	490

3 cm (10-10.5 GHz)
Minimum Terrestrial DX = 500 km

Call Sign	QTH	States	DXCC	Grids	Best DX† (km)
K1TEO	CT	13	1	20	634
K1UHF	CT	12	1	21	898
AF1T/1	MA	11	1	18	772
WA1ECF	MA	10	1	8	843
AF1T/1	RI	9	1	14	593
N1JEZ	VT	8	2	17	595
W1AIM/1	NH	8	2	16	595
W1GHZ/1	NH	8	2	14	549
W1GHZ/1	VT	8	1	14	501
W1MKY	NH	8	1	11	593
K2AXX	NY	12	2	28	698
W2KV	NJ	11	1	25	756
K2DH	NY	10	2	20	996
W3RJW	PA	11	1	16	719
W4DEX	NC	13	1	15	1030
W3IY	VA	6	1	6	829
W5LUA*	TX	11	16	66	617
AA5C*	TX	7	16	45	475
WA6EXV*	CA	5	2	39	911
N6CA	CA	2	2	19	1142
W6OYJ	CA	2	2	16	916
KR7O	CA	1	2	13	610
W6CPL	CA	1	2	9	510
W6ASL/6	CA	1	1	15	770
WA6QYR	CA	1	1	8	919
K2YAZ	MI	5	1	15	843
K3SIW/9	IL	7	1	23	553
WB9SNR	IL	5	1	14	742

12 mm (24-24.5 GHz)
Minimum Terrestrial DX = 125 km

Call Sign	QTH	States	DXCC	Grids	Best DX† (km)
N1JEZ	VT	4	1	5	205
W1GHZ	MA	2	1	2	126
K2DH	NY	1	2	7	200
W3IY/4	VA	4	1	3	200
W4SW	VA	1	1	3	204
W5LUA*	TX	3	3	8	542
WW2R/5	MS	1	1	2	543
N6CA	CA	1	1	5	171
W6CPL	CA	1	1	5	175
W6OYJ	CA	1	1	3	147
WA6QYR	CA	1	1	2	136
WA6EXV	CA	—	1	6	267
WB9SNR	IL	2	1	2	179
KØRZ	CO	2	1	6	125

6 mm (47-47.2 GHz)
Minimum Terrestrial DX = 10 km

Call Sign	QTH	States	DXCC	Grids	Best DX† (km)
W2SZ/1	MA	3	1	7	106
K2DH	NY	1	1	1	25
W3IY	VA	3	1	1	175
W2SZ/4	VA	1	1	5	114
W4SW	VA	1	1	1	174
WA1ZMS/4	VA	1	1	1	79
WW2R/5	TX	1	1	3	110

4 mm (75.5-81 GHz)
Minimum Terrestrial DX = 10 km

Call Sign	QTH	States	DXCC	Grids	Best DX† (km)
W2SZ/4	VA	1	1	5	114
WW2R/5	TX	1	1	1	55

2.5 mm (119.98-120.6 GHz)
Minimum Terrestrial DX = 10 km

Call Sign	QTH	States	DXCC	Grids	Best DX† (km)
WA1ZMS/4	VA	1	1	1	30

2 mm (142-149 GHz)
Minimum Terrestrial DX = 10 km

Call Sign	QTH	States	DXCC	Grids	Best DX† (km)
W2SZ/4	VA	1	1	54	80
WA1ZMS/4	VA	1	1	1	80
WW2R/5	TX	1	1	1	8

1.25 mm (241- GHz)
Minimum Terrestrial DX = 10 km

Call Sign	QTH	States	DXCC	Grids	Best DX† (km)
WA1ZMS/4	VA	1	1	1	12

1 mm and Above (300+ GHz)
Minimum Terrestrial DX = 1 km

Call Sign	QTH	States	DXCC	Grids	Best DX† (km)
WA1ZMS/4	VA	1	1	1	2

†Terrestrial
—Information not supplied
*Some stations worked as EME

[Mark K5AM (DN62) and Bruce KØYW (DM67)], Southwest (W5UWB) Midwest [NØJK/Ø (EM18), KØETC (EM27) and KØFF (EM49)] and as far eastward as Peter, VE3AX (FN02), and a heard report from Chris, W3CMP (FN10).

Aurora

Besides the big doings at the end of the month, Rick, AK3E (FM19), provides the only other aurora report. On October 14, he worked several stations in the upper Midwest on 6 meters and WØVB (EN34) on 2 meters.

HERE AND THERE

ARRL January VHF Sweepstakes

This most active of the ARRL VHF contests features the most intense club competition. The contest begins at 1800 UTC on January 24 and ends at 0300 UTC on January 25. Additional details are available in December 2003 *QST* and on the Web at **www.arrl.org/contests/**. Forget about the cold weather with its poor propagation—there will be many people to work. Whether you belong to a participating club or not, plan to spend some time in this granddaddy of all the VHF contests.

EME Conditions for 2004

Each year Derwin King, W5LUU, provides the EME community with the Moondata Update, a prediction of the best days for EME communication for the coming year. Other things being equal, best EME conditions occur when the moon is: (1) at the best possible perigee and (2) near the right ascension and declination of the coldest sky along its path. Derwin calculates signal-to-noise degradation (DGRD) from these two variables, in decibels referenced to the best possible conditions. During a monthly lunar cycle, this factor can vary by more than13 dB at 144 and 8 dB at 432. Conditions may be worse, due to ionospheric disturbances but not better than indicated. Based on these calculations, Derwin rates EME conditions for 144 MHz; DGRD from excellent (under 1.0 dB) to very poor (over 5.5 dB). These ratings appear in the "This Month" sidebar in this column.

Quadrantids

This short-lived shower (±7 hr) peaks at 0601 UTC on January 4. Between 40 and 100 meteors per hour are possible at speeds around 41 km/s.

Transatlantic Beacon

VE2PIJ reports that VO1ZA/R in GN37js in Carbonear, Newfoundland, is now operational on 144.400 MHz running 250 W to an 11-element Cushcraft beam at 10 meters height pointed at Europe.

Wake Island

Terry Hoffart, K7ASU, writes that he will be operating through AO-40 from Wake Island (KH9) from early January until late February 2004. He will use an ICOM IC-910H and a 1.8 m dish. See **members.cox.net/k7asu/** for latest details.

K2RTH SK

It is with great sadness that I report that well respected VHFer Bruce Sternstein, K2RTH, passed away on October 14. Bruce was a stalwart figure on the VHF bands from southern Florida. He will be sorely missed. Farewell, old friend!

The Microwave Low Noise Amplifier—*Part 1*

Quite often we employ RF amplification prior to the first mixer in our receivers. In situations where the sensitivity of the receiver system is low, and especially where there is loss before the mixer, it is helpful to preamplify signals. There are also situations where preamplification does not help, or is not worth the cost. In two parts we will explore these situations and the workings of the preamplifier itself. Today we will explore the circuits and construction of low noise amplifiers. The next issue will continue with an understanding of noise and what improvements to expect when applying an LNA.

Over the course of the past few decades, technology advances have improved our ability to amplify low-level signals at high frequencies without introducing lots of noise. Packaged LNAs for all amateur bands through 24 GHz are now readily available. These advances have both increased the frequency of operation and reduced the noise contribution to the point where we have very effective low noise amplifiers (or LNAs) for frequencies up to and above 100 GHz. The Amateur Radio 10 GHz unit pictured in Figure 1 is from DB6NT, and sold in the US through SSB Electronic.

SSB ELECTRONIC USA

Figure 1—Here is a modern packaged high performance LNA for the 10 GHz band.

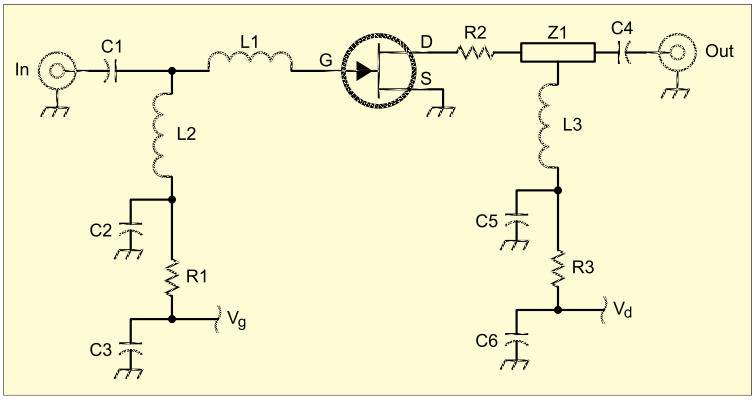

Figure 2—Schematic of a microwave PHEMT LNA.

How are they Made?

The modern LNA employs field effect transistors. These semiconductor devices have several very impressive performance characteristics that make them nearly ideal for use in VHF and above LNAs. When properly biased, the FET can have gain of over 10 dB, noise figures below 1 dB (noise figure will be explained in the next installment of this column) and dissipate very little power. There are two types in common use, the GaAs FET (gallium arsenide FET) and the PHEMT (pseudomorphic high electron mobility transistor). The former is best for application in circuits running below about 1.5 GHz, and the latter is much more suitable for circuits running above about 1 GHz.

The circuit components that surround the FET in a modern microwave LNA provide bias, filter the power, control (reduce) low frequency gain, and match impedances. Several circuit design approaches have been taken to provide these functions. Some of them have advantages such as bandwidth control, improved stability, and ease of construction or tuning. Because of the common application of the PHEMT for frequencies above 1 GHz, we will examine circuits that are appropriate for this type of LNA.

In Figure 2, the schematic shows the elements of a modern microwave PHEMT LNA, suitable for a part such as the Agilent ATF36077. This basic design is useful from about 1296 MHz through 24 GHz, although the actual implementation of the circuit will change above 10 GHz. Figure 3 shows a particular LNA design that can be used with minimal modification from 2 GHz through 5 GHz.

Amateur Radio LNAs are almost always fabricated on two-sided printed circuit board, where the bottom of the board is a ground plane, and the circuits on top form controlled impedance using microstrip. Care must be taken with lead lengths at any VHF and higher frequency. This is especially true when making the source connections to the FETs used in LNAs. Just the smallest amount of inductance can change impedances and cause instability resulting in oscillations.

The Circuit

Let's examine the different sections of the circuit and the implementation. At frequencies below 1 GHz, self-biasing techniques that electrically lift the source from ground work well, but at higher frequencies they are not stable. Therefore, our circuit will have a very well grounded source, in terms of both dc and RF. Bias will have to be supplied with a negative dc voltage applied to the gate.

A reasonable amount of on-frequency gain for a single stage is between 10 and 20 dB. Because these devices have typically much more gain at lower frequencies, and this gain could easily lead to oscillation, low frequency gain must be limited in the circuit, and all bias paths must be bypassed very well.

The RF input circuit to the FET starts with a decoupling capacitor to keep stray dc charges or return paths at the input from affecting bias. Next is a pair of high quality air wound or printed inductors that match the FET to the 50 Ω input. L1 is in series with the FET and L2 goes to RF ground and supplied dc bias. L1 must be adjusted for best match at the design frequency. L2 is an RF choke for gate bias. C2 provides the majority of RF ground reference for the input circuit. The resistor R1 provides some low frequency loading (because L2 and C2 are not a large enough value to remove VHF components). R1 also provides some isolation to keep the RF out of the gate supply leads. C3 provides gate supply bypassing.

Tom Williams, WA1MBA ♦ wa1mba@arrl.org

Quite often, quarter wave stubs are applied to bias lines at appropriate spots to provide superior RF reference grounds and bypassing. In the design shown in Figure 3, a stub is used in place of C2. Also, it is common to use printed circuit decoupling chokes that are implemented as either straight or serpentine very thin lines, and this kind of choke is used for L2 as shown in Figure 3. At the frequency that the preamp shown operates, the value of L1 is so low that the microstrip provides sufficient inductance.

The RF output circuit, or drain circuit, has a resistor immediately following the drain (R2). This component, not found in lower frequency or GaAs FET LNAs provides isolation between input and output and provides a stable load at all frequencies. Even though this results in less gain, it also reduces the likelihood of oscillation and provides some dc voltage drop. This resistor has an additional benefit in that the amplifier is less susceptible to external influences on the output port. Improper output loading or connection to a mixer will cause reflections, notably at frequencies outside the normal operating frequency. The resistor dissipates some of this (attenuates it) so that the FET is less likely to create intermodulation products. Next are the matching network and the output capacitor, which respectively match the FET output to the 50-Ω load and remove the drain bias from the output connector.

Drain power is supplied through a resistive network in a fashion similar to the input circuit. A resistor is connected through an RF choke (L3) to a chip capacitor C5 that provides better wideband decoupling than a stub would. Again, the choke is simply a thin line on the PCB. Another resistor (R3) that can be a leaded part for easy substitution to adjust bias. This is followed by C6, another power decoupling capacitor.

Bias Supply

Recall that the current drawn by an FET increases as the gate voltage moves from a more negative to a less negative value. If the gate voltage were to drop (raise) to zero, the device might draw excessive current and burn out. Because of this, the bias circuit for an LNA (where the FET uses a grounded source configuration) requires that the negative bias voltage be present prior to the application of the drain voltage. Usually, these preamplifiers are supplied externally from a +12 Vdc nominal source.

Internally to the preamp, there must be a circuit that regulates the +12 to a reasonable drain power voltage such as 5 or 6 V prior to series resistances that will drop it to about +3 V at about 40 to 60 mA (a good operating point for a PHEMT). In order to develop the negative gate voltage a voltage inverter integrated circuit such as the 7660 is employed. This is essentially a fast operating solid state switch that charges an electrolytic capacitor and then reverses its polarity to supply voltage to the circuit. An internal oscillator drives the switch. Although this can supply only low current, it is plenty for the gate bias.

Figure 3—As described in the text, this is an implementation of a modern microwave PHEMT LNA, designed by WB5LUA and sold through Down East Microwave. The gate supply is at the bottom of the image.

To prevent the drain from coming on until the gate voltage is present, some designs employ a transistor in the drain regulator circuit, which is switched on by the negative supply. However, if appropriately high values of drain bypass capacitance and series resistance are chosen, it will naturally come up to voltage after the gate bias has settled. Once all the biases are correctly set, this bias circuit will operate flawlessly for many years.

Tuneup and Bias Adjustment

The bias for a PHEMT is fairly complicated to adjust, and during tuneup it is possible to destroy the device if the right sequence is not followed. The problem is that the gate-to-drain maximum voltage is only 6 V. One always follows the practice, when energizing an FET, of applying the gate bias first. The other common practice is to apply a starting gate bias that will be sufficiently negative to pinch off the device so that no current will draw on the drain when that voltage is applied. This is done to limit the current drawn. However, and this is important, because the PHEMT can only withstand 6 V drain to source, it is mandatory to set the gate voltage to a turned-on value, such as –0.7 V, prior to applying the drain supply.

Why is this so important? The reason is that usually the drain circuit is supplied with a +5 V regulator. If the gate is at pinch off and the drain supply is turned on, there is almost no current draw, so there is no voltage drop across the drain series resistors and the full +5 V appears on the drain terminal. With pinchoff voltage, such as –1 V or greater (more negative) on the gate, this puts more than 6 V between the gate and drain, and the device will fry in a few milliseconds. To ensure this won't happen, it is advisable to temporarily place a diode in the gate bias circuit to limit the gate voltage to –0.7 V. Then bias adjustments can be made according to the manufacturer's or designer's instructions. PHEMTs will often provide the best performance with a drain voltage around 2 to 3 V.

Because at higher frequencies circuits are much less tolerant of component and circuit material variations, it is common to design into the circuit board a means of tuning out these variables. To do this, designers place a series of small pads at key spots to form tuning stubs. By bridging the pads with solder (or braking those bridges) small amounts of reactance can be adjusted to bring the circuit back into spec. These effects are usually very small, and unless every last bit of performance is needed, can be left untuned. To perform proper tuning, a noise-figure meter is required. Fortunately, these rather expensive meters are often available at microwave and VHF conferences to help us out.

The Future

Some LNAs are now being implemented as MMICs (Monolithic Microwave Integrated Circuits). As such, they may contain several stages of amplification, complete bias networks and some decoupling. These devices can be used with some external bias bypassing resulting in simpler PCB designs with surprising performance. Such MMICs are now available at up to 100 GHz for various specialized applications. No doubt, there will be Amateur Radio 24 and 47 GHz LNAs that utilize these devices in the near future.

I wish to thank Al Ward, W5LUA; Steve Kostro, N2CEI; Paul Wade, W1GHZ, and Jerry Rodski, K3MKZ, for their help with this column and their contributions to making modern amateur microwave LNAs available.

In the next issue we will delve into the nature of noise and the way we characterize LNAs. We will also explore the advantages and in some cases diminishing returns associated with using very low noise figure LNAs.

Resources

Down East Microwave Inc, **www.downeastmicrowave.com/**

SSB Electronic USA Inc, **www.ssbusa.com/**

LABRATS Club Fosters Technology

First contact for the newly established Redd School Amateur Radio Station in Houston, Texas, was made by 12 year old Daniel Scarlett, KD5YIT, during their school's Open House on August 26, 2003. Daniel is a member of the Redd School LABRATS Project (Learning About Research and Technology through Science). LABRATS cosponsors Tanya Cantrell, KD5WZN and Lollie Garay, KD5WZM, developed the project to provide students a meaningful way to strengthen research and technology skills. The Radio Club is one of three components of the project. Ms Garay tells the story:

"The idea for the ham radio club came from a class I attended as a graduate student in the Physics and Astronomy Department of Rice University. After learning more about amateur radios, and seeing the potential for developing a program for her students, I was hooked! I turned to my professor and mentor Dr Patricia Reiff, KD5IZK, Director of the Rice Space Institute. Dr Reiff provided guidance for structuring the program and signed on as the project's advisor. She provided study materials, a 2 meter band radio and equipment for developing their first class of ham enthusiasts.

"The first order of business was to get licensed. The LABRATS Radio Club (12 students) was only meeting once a week, so preparing for the test became a real challenge. Having started test preparations at mid-semester in the spring, the clock was ticking! As the weeks wore on, many students decided to wait until the fall semester to take the test."

[To be continued.]

LOLLIE GARAY, KD5WZM

Meet the LABRATS Radio Club: Standing, from the left, Daniel Scarlett, KD5YIT; Tanya Cantrell, KD5WZN; Giovanna Castellanos; Lollie Garay, KD5WZM; Brandon McClendon; Cal White, WF5W; Dr Patricia Reiff, KD5IZK; Jon Baer, and Randy Burgen. Kneeling, from the left, Andrew Pomfrett and John Marsh. Not shown: John Ellis, W5PDW; Kevin Clayton, KD5YLM, and Carver Way.

Our Future...

As our ham population ages, we know that the future of the hobby will require a great infusion of young, enthusiastic participants. What we find interesting today may be superseded by stunning technical advance—and we must keep an open mind when encouraging budding young scientists to innovate, experiment and play. Your generous donations and sponsorship of any of our programs that foster youth education can mean a very happy future indeed. The smarter the kids, the livelier the hobby—and a solid start on fruitful career paths that benefit society. Join us in this happy mission by sending your tax-deductible contribution to The ARRL Foundation, 225 Main St, Newington, CT 06111.

Contributor's Corner

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

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Kenneth D. Hopper, KD7KH, and Barbara O. Hopper, in loving memory of Richard P. Wells Sr, W2ORX, and Mrs Zoe Wells and Richard P. Wells Jr, WA2VAQ
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Steel City ARC, Inc (Pennsylvania), in fond memory of Francis "Frank" Preusser, WA3DKY

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As received and acknowledged during the months of **May through October**.

Mary E. Lau, N1VH ♦ Secretary, ARRL Foundation Inc ♦ n1vh@arrl.org

Home Brew

I've always appreciated well-made homebrew equipment, probably because I had to build most of my early stations on used chassis from scrounged parts. No, my early stations were not well made. They were hastily thrown together monstrosities made from pieces of blue wire, old radio and TV parts, and became known as "rats-nests," as my mother called them. Mom was smart—she refused to dust anywhere near those "death-traps," another name she had for them. Somehow I learned and gradually became better at laying out the parts first, and I began to put some thought into safety.

It was after I went to work for Western Electric and the training I received there that I became obsessive about building well-thought-out projects, built on new chassis, with new parts. And now I began to use several different colors of hook-up wire to connect everything together, not just the single 18-gauge blue wire from the 500 foot roll someone had given me early on.

Today I get really excited when I find a great piece of homebrew gear. I appreciate the thought and care that was put into the project. This year, as the column starts its fifth year in *QST*, I will feature some nice projects every couple of months. If you have something in your collection you think would be of interest, please e-mail me and include one photo if you can. I'll get right back to you.

This month's project (see Figure 1) was built about 1935 by Wilson Smith, WB3ICR, from Nescopeck, Pennsylvania, when he was first getting interested in ham radio. Wilson is now a SK, but his work lives on. This was some project, much more than I would have tackled when I wanted to learn the code.

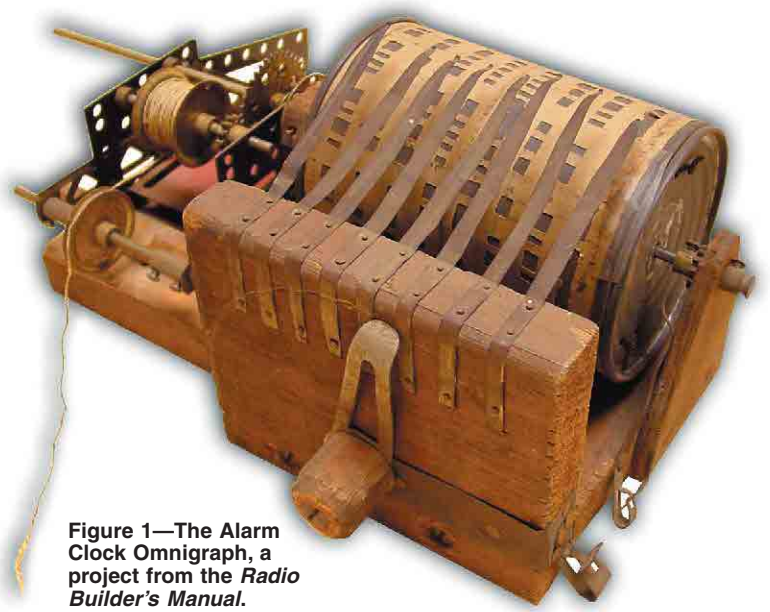
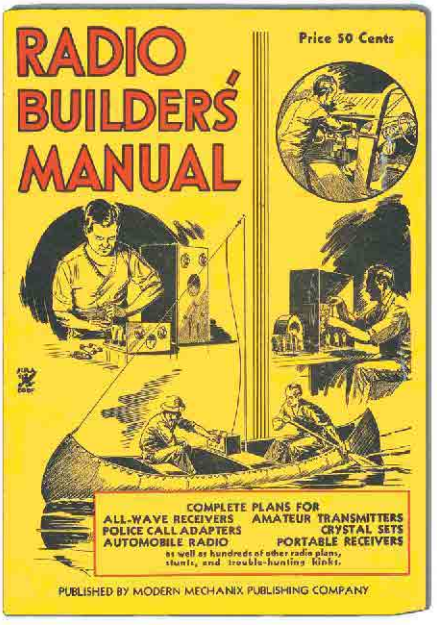


Figure 1—The Alarm Clock Omnigraph, a project from the *Radio Builder's Manual*.



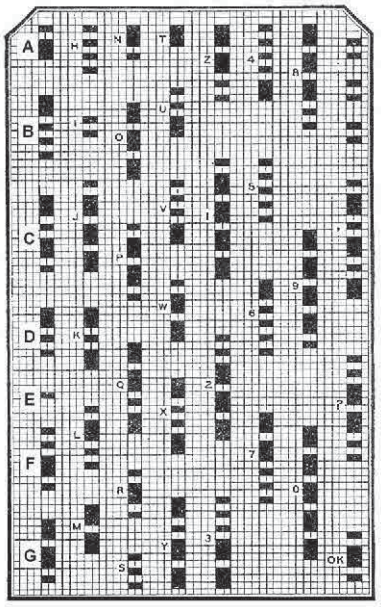


Figure 2—Sample paper code lesson.

Radio Builder's Manual

About 10 years ago I was given a great 1935 paperback book by a ham who was first licensed around the same time, John Roberts, N2DSX, now a SK. John was a young W9 from Michigan at the time. He entered WW II as a radioman in the Army. He told me it was his favorite book and he took it with him everywhere he went while he was in the service. I have enjoyed reading his book many times since then.

Consisting of 130 pages of radios and radio-related projects, it was titled *Radio Builder's Manual* and published in 1935 by Modern Mechanix Publishing Company. Aimed at the beginner, it had detailed physical drawings of the parts layout, with pictorial schematics and regular schematics. Projects ranged from simple to complex, from receivers and transmitters, from gadgets to Morse code keys and simple test equipment—everything a budding ham would need to get started and more.

It must have been the article "Alarm Clock Omnigraph—Teaches Code to Radio Fans" that I remembered. One day while looking on eBay, there it was—a project from the book, and no one was bidding on it. I entered a bid, and eventually won that auction.

The Omnigraph

The omnigraph was a device designed for sending precoded Morse code through a buzzer. One would listen to the letters while learning the code. There was a control of some sort, where the speed could be increased as you learned. And there was a way to change the order of letters to help eliminate anticipating the next letter being sent.

John Dilks, K2TQN ♦ 125 Warf Road, Egg Harbor Township, NJ 08234-8501 ♦ k2tqn@arrl.org

It's obvious that Wilson Smith had this book, because it is almost exactly like the article. Wilson must have spent hours cutting out the wood, tin and brass pieces, and putting them all together. It even has a universal joint between the motor device and the rotating drum, just like in the article. It must have taken him hours and hours to build, probably longer than it took to learn the code once it was running.

What convinced Wilson to build this and how does it work? It's interesting to read from the article:

> The principal features of the instrument can be seen in the accompanying drawings. The clock works rotate a tin can, which is connected to the minute hand shaft. A simple universal joint is used to couple the clock and can.
>
> In preparing the clock works for use on the Omnigraph the escapement mechanism must be removed and also the main spring. A small wooden spool is then mounted on the main spring shaft. The clock works is operated by a cord wound around this spool and force applied by means of a weight.
>
> The tin can drum is covered with a paper held in place by rubber bands, as illustrated in the figure. The dots and dashes are cut in this paper and a contact spring makes contact through the holes in the paper as the can is rotated, thus completing an electrical circuit and making the radio signals.

The one difference between Wilson's Omnigraph and the one in the article is that Wilson used Erector Set parts to build the clock works, rather than an old clock for the parts. The result is the same: The string is wound around the spool. A weight is attached to the end of the string, and the drum turns as the weight pulls the string on its way toward the floor. The speed is adjusted by the amount of weight applied.

The article continued and told how to make the paper code lessons by using graph paper and putting $^1/_8$ inch wide holes in the paper. Dots should be $^1/_{20}$ to $^1/_{16}$ inch long and dashes should be three times as long as a dot. Spaces between dot and dashes should be equal to one dot. The spaces between letters should equal four dots, and the space between words should equal eight dots. (See Figure 2, which has all the alphabet, numbers 0 through 9 and basic punctuation. Note the period at upper right is the old *di-dit di-dit di-dit*.)

The switch arm is interesting. It allows the operator to move between eight different rows of letters. The operator will not be able to guess the next letter by changing the switch at random while the can is turning. Also by turning the paper upside-down on the drum, it changes the row the letters are on. Other charts can be made for additional practice as the operator gains experience.

Figure 3 shows a detail drawing of all the various pieces. From this plan you could make one for yourself, if you wanted to. Also included is a schematic diagram to show how the unit was wired to a buzzer and batteries. The 0.002 µF condenser helps eliminate sparking. See Figure 4.

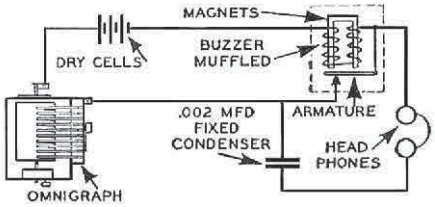


Figure 4—The schematic shows how it was wired to the batteries and buzzer.

Figure 5—The Natrometer, a commercial version of the Omnigraph.

A Commercial Omnigraph

Omnigraphs could be purchased from several sources. The Capital Radio Institute offered one as part of their radio courses that is very similar in design to the one described above. They manufactured it under the name "Natrometer Corporation." It has a spring-wound motor, which will allow the encoded drum to turn for many revolutions. See Figure 5.

You can see in the photo that there is a drum with nine tracks of precoded letters and numbers. Also there are nine contact springs, which contact the drum one track at a time. The Natrometer had a set of pins that could be inserted into any of the five small holes near the top edge of the drum. When the pins would pass a small cog-gear under the drum, it would turn the gear and advance the vertical shaft, raising the old and lowering the next contact spring, to touch the drum on the next track. (Five pins are shown in their storage locations just below the vertical track-changing shaft.) If more than one pin was inserted into the drum, then the tracks would change more often making the next letter very hard to anticipate. Extra drums could be purchased and changed when needed.

My February 2002 column, "Learning the Code and Code Machines," shows still another Omnigraph, with a more elaborate method of changing tracks.

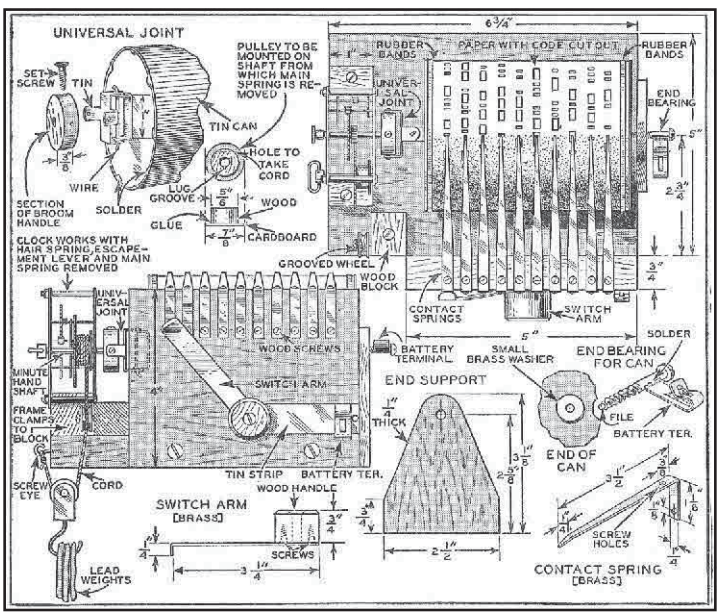


Figure 3—The various pieces making up the Omnigraph, from the *Radio Builder's Manual*.

Want to Build One?

For anyone wanting to build a tin can Omnigraph, I have scanned and placed the entire three page article on my Web page at **www.eht.com/oldradio/arrl/index.html**.

Thanks for your support the last four years; I really appreciate all the e-mail I receive. You give me great ideas for the column, and I read every message. Remember—if you have something in your collection you think would be of interest, please e-mail me and include one photo if you can.

Look for my hat at the hamfests, and say hello.—*K2TQN*

Happy Anniversary to the Vermont YL Net

"CQ YLs, CQ YLs" Have you heard that recently? If you have, it probably wasn't on your local VHF/UHF repeater. Or was it?

If you live in Vermont and tune in 146.880 MHz on Sunday night at 7:30 that's just what you'll hear. Radiating from the top of Killington Peak, a popular ski area as well as the location of the W1ABI repeater, you can count on Dorothy Burden, KA1LDS, and Deborah Clark, NN1C, to call the YLs to attention. This January starts their 11th year of running the Vermont YL Net and they still have just as much enthusiasm for the net as when they started.

How did they get involved in such a longstanding net? "We moved to Vermont in 1992 when my husband Bill, WB1BRE, retired," Dorothy, KA1LDS, wrote me recently. Licensed since 1983, she jumped right in, teaching Novice and then General license classes as her own skills increased. "I've always enjoyed sharing things in the hobby, so I guess the idea of a net really started when I met Deb [NN1C]. We talked about doing something that would encourage more YLs to get active in Amateur Radio." The two women thought a weekly net for YLs on 2 meters using a wide-coverage repeater would be a logical place to start.

"We hoped to establish a series of programs and presentations that would be of interest to Amateur Radio operators and that would encourage a deeper involvement in the many aspects of the hobby," Dorothy said. They put together a mission statement, got the approval of the repeater owners (NFMRA—Northeast FM Repeater Association) and promoted the opening of the net in local club newsletters. And at 7:30 PM on January 30, 1994 the Vermont YL Net was on the air!

The purpose of the net was not only to encourage YL participation, but also to provide education in operating procedures and encourage an exchange of ideas and discussion of subjects related to Amateur Radio. They knew that in order to keep things interesting there would have to be a variety of topics, so they reached out to others and asked them to act as "resource persons" in specific areas.

Their list of topics is *very* impressive and for anyone who is thinking of starting a YL net, here are some suggestions of what to talk about from their actual net discussions:

- Antennas (Types, Favorite and least favorite—What's best for a new car?)
- Amateur Radio Promotion (Why become a ham? How to publicize, attracting youth and seniors to the hobby, Things you like best about the hobby)
- ARRL (Structure, Membership, Awards and Certificates available, Continuing Education programs, SAREX, Cabinet meeting, Operating W1AW, Touring ARRL headquarters)
- Code (Morse, of course! Hints on copying, Comments on eliminating code as a requirement)
- Computers (Use with Amateur Radio, DX Cluster)
- Contesting (Operating, Introduction to DX)
- DXpeditions (Planning an imaginary trip, Operating in another country)
- Elmer (Being one, Who was yours?)
- Emergency Preparedness (ARES, RACES, SKYWARN; Operating with emergency power)
- FCC (NPRMs, Renewing licenses)
- Field Day (Preparing, operating)
- Fox Hunting (Planning, Running, First-hand experiences)
- Fun with Amateur Radio (Most interesting contact, Radio on vacations, Why did you get licensed? Personal achievements, First contact experiences)
- Getting Started as a New Ham (Mike fright, Making first contact, What to talk about)
- Gifts (Holiday/Birthday wish lists—Under $50 or no limit!)
- Goals (Personal goals in radio, What was your New Year's Resolution?)
- Grid Squares and Zones
- Ham Shacks (Describe your personal shack, Changes planned)
- Interference (Causes and eliminating)
- Kit Building
- License Plates (Getting special ham plates)
- Modes in Amateur Radio (AMTOR, packet, SSB, SSTV, QRP, PSK31, 2 meters, 6 meters, 10 meters)
- Nets (Types, Proper Operating Procedures, Mistakes heard on the repeater)
- Phonetics (Use of, Creating call sign "nicknames")
- Propagation (Indexes for, Sunspots, Solar flares)
- Public Service Events (Types, Working on, First-hand experiences)
- Q Signals and Abbreviations
- QSL Cards (Keeping logs, proper preparation, outgoing and incoming bureaus)
- Radio Clubs (Why belong? Different meeting places)
- Repeaters (Guidelines, Workings of "88," proper etiquette, mistakes heard, Experiment with simplex communications, Autopatch, CTCSS tones)
- Rigs (Buying and selling, Bells and whistles on radios, Using handheld transceivers, Personal favorite and least favorite)
- Safety (RF, Towers, Antennas, Grounding)
- Satellites (Operating, AMSAT, ISS)
- Special Events (Operating and paper chasing, Sponsoring)
- Suggestions (Ideas for future net topics)
- Towers (Installation and safety)
- Traffic (Handling traffic, Emergency, Health and welfare)
- Upcoming Events (Announcements for club meetings, Contests, Hamfests and flea markets, Public Service events, VE sessions)
- UTC (Why and how to calculate)
- Winterizing (Radio equipment and shack, Travel and car equipment)

"There are six hams who have been with the net all 10 years," Dorothy said. "Many made their first contact on the net." She also recalled some unusual mobile check-ins, "We had everything from a ham on horseback to a ham sailing on Lake Champlain. Visitors have joined us while hiking in the mountains, from a ski lodge or a friend's home." More than 380 hams have become part of their net.

Both Dorothy, KA1LDS, and Deborah, NN1C, say they have learned a lot from the VT YL Net and hope that other hams have, too. "We have never claimed to be experts...just fellow hams who love the hobby and wanted to share that feeling. We have had some remarkable discussions and we are grateful for the enthusiastic response."

Congratulations and Happy Anniversary to the Vermont YL Net!—*33, Diane K2DO* QST

Diane P. Ortiz, K2DO ♦ PO Box 296, Bellport, NY 11713 ♦ k2do@arrl.org

SILENT KEYS

It is with deep regret that we record the passing of these amateurs:

W1HHP, Harry C. Marotto, Cheshire, CT
W1NCM, Arnold M. Werlin, Peabody, MA
*W1OHB, John H. Mackinaw, Holbrook, MA
W1ULR, Stanley Cokas, Swampscott, MA
W1VTX, Anthony Ross, Harwich, MA
AA1YK, Robert Cesca, Torrington, CT
W2AKZ, Cody F. Totman, Phoenix, AZ
W2JDH, Walter L. Petersen, Morriston, FL
K2MFN, Paul Torraca, Coram, NY
KA2QHL, Sebastian C. Ross, Oneonta, NY
K2RTH, Bruce Sternstein, Miami, FL
W2RXM, Charles L. Rovoldt, Shrewsbury, MA
N2UXV, Glenford C. Snyder, Tupper Lake, NY
KB2WSC, William H. Corcoran, Rochester, NY
K3AYV, Thomas E. Howell, Petersburg, PA
K3BH, John G. Hall, Port Allegany, PA
N3CGQ, John D. Grove, Crescent City, FL
W3GXR, Roy B. Bonsall, Media, PA
K3GXU, Sterling I. Trimmer, Dover, PA
W3RMF, Ivan Wilkinson, North East, PA
AA3TY, Edd Dudley Jr, Linden, VA
KC3VL, Milton S. Maclasky, Plymouth Meeting, PA
KD4AWQ, Edward R. Ellers, Louisville, KY
K4BXD, Emil F. Scholz, Inverness, FL
KB4GSX, Claude E. Robertson, Nashville, TN
KU4LE, Gordon W. Tucker, Largo, FL
W4LYV, Charles D. Harris, Lexington, NC
W4NTU, Howard S. DeVaughn, Jacksonville, FL
WA4ODA, James E. Spilman, Cookeville, TN
W4PMP, Bellwood C. Adams, Nashville, TN
*W4QKK, Richard S. Bowers, Winter Park, FL
W4RRD, George F. Grady Sr, Orange Park, FL
W4TBK, Howard C. Manning, Friendsville, TN
W4TXO, Atlee B. Hall, Arab, AL
WA4UGH, Thomas Y. Christopher, Columbus, GA
KA4VIT, Marvin B. Howell, Red Ash, VA
KE4XG, Julian C. McKinley, Macon, GA
WA4ZPL, Anne M. Kobres, Tampa, FL
W5AAR, Orrin S. Kiker, Denton, TX
WD5AAR, Marilyn R. Redman, Florence, CO
N5DOA, Barry J. Norton, Mason, TX
W5INJ, Terry Cox, Anson, TX
W5JMV, Wendell Couch, Hernando, MS
W5LET, James B. White, Farmerville, LA
W5LLS, Roland U. Belk, San Antonio, TX
KB5LLV, Hollis L. Ham, Houston, TX
N5OU, Ruth M. Collom, Atlanta, TX
KK5QS, Arthur F. Geary, Van Buren, AR
KZ5RO, Ronald M. Guilliams, Farmville, VA
KR5T, Arthur H. McLeod, Roswell, NM
AA6A, Orlin A. Covert, Middletown, CA
KH6BKL, Raymond R. Freitas, Kula, HI
K6EGR, Edward J. Tye, Eugene, OR
W6EOS, Howard B. Bard Jr, Chula Vista, CA
WA6IAB, Daniel W. Nunn, Sacramento, CA
K6QIF, Keith Crandall, Sacramento, CA
KF6QQ, Virgil F. Baldwin, Escondido, CA
KH6RU, Restituto C. Ulep, Waialua, HI
K6SAY, Herbert L. Fullenwider, Sheboygan, WI
ex-WA6ZVJ, Robert W. Jones, St George, UT
K7DEO, Arnold M. Donovan, Sedro Woolley, WA
W7DYM, Edward C. Dahl, Tacoma, WA
AC7KN, Clyde A. Best Jr, Smithfield, UT
W7LRO, Thomas M. Keenan, Great Falls, MT
N7NVF, Wesley R. Parker, Coulee City, WA
KG7UB, Raymond P. Ubis, Snohomish, WA
WX7YZ, David M. Sites, APO, AE
*WD8BAE, Fred Linxweiler, Dayton, OH
W8EPX, Dudney L. Anderson, Loveland, OH
W8JJK, Francis N. Freppel, Toledo, OH
KA8KVU, Mathilda A. Davis, East Palestine, OH
KC8RYP, Steven E. Drake, Celina, OH
N8UCZ, Nancy Jo. Swain, Las Cruces, NM
N9BOQ, Eunice M. Olds, St Charles, MO
NZ9C, Abel Perlman, Madison, WI
*K9DAF, Robert A. Thorne, Neenah, WI
W9EXQ, Charles R. Stone, St Charles, IL
ex-W9JS, Clyde Carl Richelieu, Oregon, WI
*W9JUJ, Peggy Coulter, Muncie, IN
W9KGL, George T. Majewski, Chicago, IL
KA9NKZ, Frances H. Carman, Richmond, IN
N9XGD, Dean A. DiCarlo, Homewood, IL
‡W9YZS, Joseph W. Priebe Sr, Rhinelander, WI
WØDNF, William C. Strother, Overland Park, KS
WØDPN, John P. Cunningham, Kansas City, MO
KØGWL, John L. Potzmann, Eldon, MO
WBØIVP, Charles Stiel, Benson, MN
KBØKDG, Kurt W. Carufel, Bismarck, ND
KØLFI, Robert T. Mobley, Independence, MO
WØRLS, Bill Mommertz, Kansas City, MO
NØUJG, Ronald A. Smith, Pierre, SD
KGØW, Anthony J. Etienne, Pueblo, CO
ZS2LL, Lambert Ledoux, Cradock, South Africa

*Life Member, ARRL
**Charter Life Member, ARRL
‡Call sign has been re-issued through the vanity call sign program.

Note: Silent Key reports must confirm the death by one of the following means: a letter or note from a family member, a copy of a newspaper obituary notice, a copy of the death certificate, or a letter from the family lawyer or the executor. Please be sure to include the amateur's name, address and call sign. Allow several months for the listing to appear in this column.

Many hams remember a Silent Key with a memorial contribution to the ARRL Foundation or to ARRL. If you wish to make a contribution in a friend 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

NEW PRODUCTS

AUTOMATIC ANTENNA TUNERS FROM MFJ

◊ MFJ has announced three new automatic antenna tuners. They each are designed to quickly tune to a wide range of antenna impedances and include 2000 memory locations to allow the return to previously obtained settings.

The MFJ-993 "IntelliTuner" tunes balanced or unbalanced antennas with an L network said to cover 6 to 1600 Ω. It is rated at 300 W SSB or 150 W CW. Frequency coverage is said to be 1.8 to 30 MHz. This model includes both cross-needle and digital (LCD display) SWR and power meters as well as an aural SWR indicator. Also included are an antenna switch for two antennas and a 4:1 current balun for balanced lines. The MFJ-993 supports radio tuner interfaces such as provided in the ICOM IC-706 series radios. Size (HWD): 10×2$^{3}/_{4}$×9 inches. Power required: 12-15 V dc at 1 A. Price: $259.95.

The MFJ-991 is similar to the '993 but handles 150 W SSB or 100 W CW and matches 6 to 3200 Ω. It does not include the digital SWR/Wattmeter/LCD display, aural SWR indicator, antenna switch or balun. Price: $219.95.

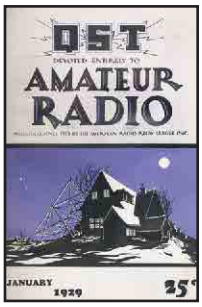
The MFJ-994 is their higher powered version. It is rated at 600 W SSB or 300 W CW (tuning must be done at low transceiver power with the amplifier bypassed) and is said to match 12 to 800 Ω. The '994 does not include the digital SWR/Wattmeter/LCD display, aural SWR meter, antenna switch or balun. Price: $359.95.

Accessories include the MFJ-990RC remote control, priced at $39.95 and a 120 V ac supply for $19.95.

To order or to locate a dealer, call MFJ Enterprises at 800-647-1800, or order at **www.mfjenterprises.com**, fax 662-323-6551; or write MFJ Enterprises, Inc, 300 Industrial Park Rd, Starkville, MS 39759.

75, 50 AND 25 YEARS AGO

January 1929

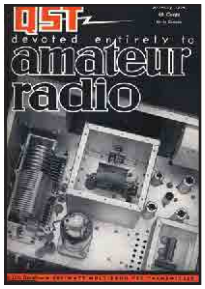


♦ The cover drawing shows a moonlit scene of a home with a large wooden structure beside it that supports a 10-meter wire beam antenna. The editorial looks at the New Year, with "…January 1st mark[ing] the dividing line between the old and the new in amateur radio."

Ross Hull reviews "The Status of 28,000-kc. Communication" in a splendid 8-page discussion. T. C. Cooper, W1CGR, tells how to get "A Crystal Note without a Crystal." Television is becoming a reality, causing The Old Man to comment on "Rotten Television." Clair Foster, W6HM, tells the humorous tale of his receiver experiments, in "The Total-Loss Receiver." In the "Experimenters' Section Report," Jim Lamb describes using "The 7,000-kc. Zepp. for 3,500-kc. Operation." Harold Wiseman presents "Antenna Systems—A Rehash," and Stuart Seaton discusses "Increasing Transmitting Antenna Efficiency." "Strays" reports that the humor column of the Duluth *Herald* comments on the expertise of hams by saying, "A professional radio operator seems to be one who connects with lost explorers after amateurs show him how."

January 1954

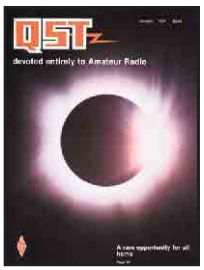
♦ The cover photo shows the 500-watt multiband VFO transmitter described in this issue. The editorial reviews the year 1953, with Amateur Radio continuing to grow, new phone bands opened on 40 and 15 meters, c.w. bands opened for RTTY operation, and operating activities continuing with high levels of participation.



Vern Chambers, W1JEQ, tells about his "Three-Control Six-Band 813 Transmitter." Jim Turner, W9LI, uses switched vertical elements in "A Compact Beam for 40 and 20 Meters." George Grammer, W1DF, clears up misconceptions about the power gain of SSB, in "The A.M. Equivalent of Single Sideband." Anson Haughton, W3PNR, tells about "An Unusual 75-Meter Mobile Antenna"—a monster. Ed Tilton, W1HDQ, provides information on "A Crystal-Controlled Converter for 432 Mc." By Goodman, W1DX, tells about "Getting the Most out of Your Receiver." Warren Andrew, W3AM, discusses "Adding a Mechanical Filter to the 75A-1." A "Strays" item responds to inquiries from several baseball nuts: "So far as we know, December *QST* author B. A. Wambsganss, W6WOY, is not related to the Bill Wambsganss who made the 1920 World Series unassisted triple play."

January 1979

♦ The cover is a photo of a solar eclipse, with an article in this issue telling of the opportunity for hams to study propagation effects during the upcoming eclipse. The editorial discusses "Clouds on the Horizon," in the form of the FCC's proposing "zones of protection" around their monitoring stations, wherein ham stations would not be allowed to operate.



Carl Bixby, W1TKG, and Jim Morris, K1UJ, give pointers on "The Art and Science of DXing." Doug DeMaw, W1FB, and Marian Anderson, WB1FSB, describe a club project, "The YY Special Beginner's Receiver." Stan Gibilisco, W1GV, asks, "What Does Your SWR Cost You?" Dave Lewis, W2HMT, in "The Effects of a Solar Eclipse on the Ionosphere," invites hams to listen for enhanced propagation on frequencies below 10 MHz during the February 26 eclipse. Stan Lieberman, WA4SFP, examines "Digitized Speech," which can be transmitted using pulse modulation. John Troster, W6ISQ, tells about adding a 40-meter two-element delta loop to a triband beam and then loading one loop for 80 meters, resulting in "The Expanded Tribander." In "Strays," the League solicits ideas for an ARRL flag. "The CW Filter-Limiter," by Milton Trzaska, WA2QIQ, applies digital technology to interference reduction. Wayne Overbeck, N6NB, tells about the Flying Samaritans, who provide free medical care in remote parts of Mexico, in "These 'Samaritans' Are Flying Hams." In "The World Above 50 MHz," Bill Tynan, W3XO, carries an obituary written by Ed Tilton, W1HDQ, reporting the passing of legendary VHFer Sam Harris, W8UKS/W1FZJ, W1BU. 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 1.8175, 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

SWOH DIGITAL SYMPOSIUM

January 10, Middletown, OH

The Southwest Ohio Digital Symposium (18th Annual Symposium), sponsored by the Dial Radio Club, will be held at Miami University, Thesken Hall, Middletown Campus; from I-75 exit at SR 122 (Exit 32), go W toward Middletown; continue to Breiel Blvd, turn right (N), continue on Breiel to 6th traffic light; this is entrance to University, second building is Thesken Hall. Doors are open 9 AM to 4 PM. Features include presentations on digital operating modes. There will be no flea market—this is a technical society conference/seminar only. Talk-in on 146.61, 224.96, 444.825. Admission is free. Contact Hank Greeb, N8XX, 6580 Dry Ridge Rd, Cincinnati, OH 45252-1750; 513-385-8363; **n8xx@arrl.net**; **www.swohdigi.org**.

NEW YORK CITY/LONG ISLAND SECTION CONVENTION

January 18, Oyster Bay

The New York City/Long Island Section Convention, sponsored by the Long Island Mobile ARC, will be held at the East Woods School, 31 Yellow Cote Rd; from Long Island Expressway take Exit 41, Rte 106 N to Rte 25A E, go 2 miles and turn left onto Yellow Cote Rd to School on left. Doors are open 8 AM. Features include "Ham Radio University 2004" (a day of education about Amateur Radio), technical education with forums about different aspects of Amateur Radio, many demonstrations, satellite communications, emergency communications, antenna modeling, Amateur Radio Clubs and organization tables, Special Event Station, VE sessions, refreshments. Talk-in on 146.85 (136.5 Hz). Admission is $2. Contact George Tranos, N2GA, Box 296, Bellport, NY 11713; 631-286-7562; **n2ga@arrl.org**; **www. hudson.arrl.org/nli/hru2004** or **www.limarc.org**.

MISSISSIPPI STATE CONVENTION

February 6-7, Jackson

The Mississippi State Convention (Capital City Hamfest 2004), sponsored by the Jackson ARC, will be held at the Mississippi State Fairgrounds Trade Mart Building, NE of the Coliseum; exit I-55 at High St (Exit 96B), go W to second traffic light, turn left into main entrance of Fairgrounds, Trade Mart is first building on left. Doors are open for dealer setup Friday at 1 PM, non-dealer setup at 3 PM, Saturday 7 AM; public Friday 5-8 PM, Saturday 8 AM to 4 PM. Features include flea market; dealers; forums (MARS, Baptist Ham Fellowship, APRS, ARES, QRP, DX, ARRL, satellite, traffic net meetings); special guest from ARRL Hq Media Relations Manager Jennifer Hagy, N1TDY; test bench; "Introduction to Ham Radio" (Friday, 6 PM); VE sessions (Saturday, 8 AM; all classes of FCC license at the Trade Mart); RV camper space available on fairgrounds (hook-ups $15). Talk-in on 146.76. Admission is $5, under 13 free. Tables are $15 (non-dealer flea market), $20 (dealers). Contact Ron Brown, AB5WF, Box 55643, Jackson, MS 39296-5643; 601-956-1448; **ab5wf@arrl.net**; **www.jxnarc.org**.

FLORIDA STATE CONVENTION

February 7-8, Miami

The Florida State Convention (44th Annual "Tropical Hamboree"), sponsored by the Dade Radio Club of Miami, will be held at the Dade County Fair and Exposition Center, 10901 SW 24th St (Coral Way); Florida Turnpike to SW 8th St Exit, go E on 8th St to SW 107th Ave, turn right onto 107th Ave, follow to SW 24th St, turn right, go to main parking entrance. Doors are open Saturday 9 AM to 5 PM, Sunday 9 AM to 4 PM. Features include swap and shop, major manufacturers, commercial booths, exhibitors, dealers, vendors, computers, forums (DX, ARRL, and more), demonstrations, organizational meetings, SFL Cabinet Meeting, VE sessions, on-site campground with full hookups ($30 per night; Frank Sullivan, NJ4S, 305-667-1047; **nj4s@arrl.net**). Talk-in on 147.0, 442.35 (94.8 Hz). Admission is $7 in advance, $8 at the door; under 10 free. Contact Evelyn Gauzens, W4WYR, 2780 NW 3rd St, Miami, FL 33125; 305-642-4139; fax 305-642-1648; **w4wyr@gzinc.com**; or John Hall, WD4SFG, 305-226-5346; **wd4sfg@bellsouth.net**; **www.hamboree.org**.

February 10-15
Wally Byam Caravan, Christmas, FL

February 13-15
Southeastern Division, Orlando, FL

February 28
Vermont State, Milton

Attention Hamfest and Convention Sponsors:

ARRL HQ maintains a date register of scheduled events that may assist you in picking a suitable date for your event. You're encouraged to register your event with HQ as far in advance as your planning permits. Hamfest and convention approval procedures for ARRL sanction are separate and distinct from the date register. Registering dates with ARRL HQ doesn't constitute League sanction, nor does it guarantee there will not be a conflict with another established event in the same area.

We at ARRL HQ are not able to approve dates for sanctioned hamfests and conventions. For hamfests, this must be done by your division director. For conventions, approval must be made by your director and by the executive committee. Application forms can be obtained by writing to or calling the ARRL convention program manager, tel 860-594-0262.

Note: Sponsors of large gatherings should check with League HQ for an advisory on possible date conflicts before contracting for meeting space. Dates may be recorded at ARRL HQ for up to two years in advance. QST

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 **January 1** to be listed in the **March** issue. Hamfest information is accurate as of our deadline; contact sponsor for possible late changes. For those who send in items for Hamfest Calendar and Coming Conventions: Postal regulations prohibit mention in *QST* of prizes or any kind of games of chance such as raffles or bingo.

(Abbreviations: *Spr* = Sponsor, *TI* = Talk-in frequency, *Adm* = Admission.)

†Arizona (Glendale)—Jan 10, 6 AM to 2 PM. *Spr:* Thunderbird ARC. Glendale Community College, 6000 W Olive Ave; 59th Ave, N of Olive, turn on Vogal Ave, proceed to N parking lot. *TI:* 146.7 (162.2 Hz). *Adm:* $2. Tables: $5. Steve Grouse, W1ADW, 7523 W Ironwood Dr, Peoria, AZ 85345; 623-510-1036; **w1adw@arrl.net**; **www.w7tbc.org**.

†Florida (Arcadia)—Jan 31. *Spr:* DeSoto ARC. Turner Civic Center, 2250 NE Roan St; turn E onto Gibson St and follow to end, road turns into Roan, Turner Center is on left. Free tailgating (with paid admission), VE sessions, hot breakfast served on site. *TI:* 147.075 (100 Hz). *Adm:* $5. Tables: $10. Doug Christ, KN4YT, 1593 NE Livingston St, Arcadia, FL 34266; 863-491-0618; **kn4yt@arrl.net**.

Florida (Miami)—Feb 7-8, Florida State Convention. See "Coming Conventions."

†Illinois (St Charles)—Jan 25, 8 AM to 1 PM. *Spr:* Wheaton Community Radio Amateurs. Pheasant Run MegaCenter, 4051 E Main St; just W of DuPage Airport, W of intersection of Rtes 59 and 64 (North Ave). Ham Radio/Computer/Electronics flea market, commercial booths, major vendors, VE sessions (on site), handicapped accessible, free parking. *TI:* 145.39 (103.5 Hz). *Adm:* advance $6, door $8. Tables: $25 (no electricity). Make check payable to WCRA and send with business size SASE by Jan 1 to WCRA, Box QSL, Wheaton, IL 60189. Bruce Plantz, K9OZ, 630-968-1844 or 630-604-0157; **info@wheatonhamfest.org**; **www.wheatonhamfest.org**.

†Kansas (LaCygne)—Feb 7, 9 AM to 1 PM. *Spr:* Mine Creek ARC. LaCygne Community Building, Broadway St in downtown LaCygne; take US 69 to K152, go W 5 miles to town; or take K7 Hwy to K152, go E 8 miles to town, turn N on Broadway; 45 miles S of Kansas City. *TI:* 147.285. *Adm:* Free. Tables: $10. Ron Cowan, KBØDTI, Box 36, LaCygne, KS 66040; 913-757-4455; **kb0dti@arrl.net**.

†Louisiana (Hammond)—Jan 17, 8 AM to 3 PM. *Spr:* South East Louisiana ARC. University Center, 800 W University Ave; I-55 to Exit 32, go E 1¼ miles, University Center is on N side of road. Swap tables, dealer displays, forums, VE sessions, free parking. *TI:* 147.0. *Adm:* Free. Tables: $15. Forrest Clark, KD5PKS, Box 1324, Hammond, LA 70404; 504-451-1111; **trees@bellsouth.net**; **www.selarc.org/selarchamfest.htm**.

†Maryland (Odenton)—Jan 25, 8 AM to 1 PM. *Spr:* Maryland Mobileers ARC. Odenton Volunteer Fire Department Hall, 1425 Annapolis Rd (Rte 175); 9 miles E of I-95/MD 175 interchange, midway between Baltimore and Washington, DC. Indoor vendors, tailgating, VE sessions. *TI:* 146.805 (107.2 Hz). *Adm:* $5. Tables: $12. Frank Winner, N3SEO, 283 Oak Ct, Severna Park, MD 21146; 410-647-3335; **n3seo@aol.com**; **www.qth.com/mobileers/**.

†Michigan (Flushing)—Jan 17; set up Friday 6-8 PM, Saturday 6 AM; public 8 AM to 1 PM. *Spr:* AR and Youth Club. St Robert's Catholic School, 214 E Henry St; I-75 to Pierson Rd Exit, go W on Pierson, Pierson merges with Flushing

†ARRL Hamfest

Gail Iannone ♦ Convention Program Manager ♦ giannone@arrl.org

Rd, continue on Flushing Rd, turn right on McKinley Rd, go 1½ blocks to school on left. Swap and Shop, vendors, dealers, electronics and accessories. *TI:* 147.1 (100 Hz). *Adm:* $5, under 12 free. Tables: $8 (8-ft). Clay Hewitt, KF8UI, 1109 Ossington Ave, Flint, MI 48507; 810-233-7889; **kf8ui@arrl.net**; **www.arayclub.org**.

†Michigan (Hazel Park)—Jan 18; set up 6 AM; public 8 AM to 1 PM. *Spr:* Hazel Park ARC. Hazel Park High School, 23400 Hughes St; I-696 to Couzens Rd, S on Couzens to Woodward Hts, E on Woodward Hts to Hughes St. Swap and Shop, vendors. *TI:* 146.64 (100 Hz). *Adm:* $5. Tables: $14 (8-ft, must be ordered in advance; limited number of 6-ft tables will be available at the door for $10 each, cash only). Jeff Albrecht, N8WR, c/o HPARC, Box 368, Hazel Park, MI 48030; 248-642-3608; **n8wr@arrl.net**; **www.qsl.net/w8hp**.

†Michigan (Negaunee)—Feb 7; 10 AM to 3 PM. *Spr:* Hiawatha ARA. Negaunee Township Hall, 42 County Rd M-35, midway between Negaunee and Marquette; turn S at intersection of US-41 and M-35, about 1 mile to Township Hall on right. Swap and Shop, vendors, electronics, computers, refreshments. *TI:* 147.27. *Adm:* $4. Tables: $6. Bob Serfas, N8PKN, 1600 Bayview Dr, Marquette, MI 49855; 906-225-6773; **n8pkn@aol.com**; **www.qsl.net/k8lod/**.

Mississippi (Jackson)—Feb 6-7, Mississippi State Convention. See "Coming Conventions."

†Missouri (St Joseph)—Jan 17, 9 AM to 3 PM. *Sprs:* Missouri Valley and Ray-Clay ARCs. Ramada Inn, 4016 Frederick Blvd; Exit 47 off I-29, just 47 miles N of Kansas City. VE sessions, free parking. *TI:* 146.85, 444.925. *Adm:* advance $3 each or 2 for $5; door $3.50 each or 2 for $6. Tables: $15 each (with free ticket). Carlene Makawski, KAØIKS, 3704 Meadow Oak Ln, St Joseph, MO 64503; 816-279-3406; **nem3238@ccp.com**.

†Missouri (Willard)—Jan 10, 8 AM to 2 PM. *Spr:* 145.49 Repeater Group. Willard Recreation Center, 108 N State Highway Z; from I-44 and Highway 160 Exit go N for 6 miles to Willard; go to second traffic light, turn right (N), go 1 mile to Highway Z, continue N for ¼ mile to Willard City Park and Recreation Center on left side of highway. CW contest, VE sessions. *TI:* 145.49 (136.5 Hz). *Adm:* $3. Tables: $8. Michael Blake, NØNQW, Box 246, Willard, MO 65781; 417-839-2071; **n0nqw@arrl.net**; **www.qsl.net/49ers**.

New Mexico (Albuquerque)—Jan 24. Tom Ellis, K5TEE, 505-291-8122.

†New York (Lockport)—Jan 31; set up 6 AM; public 7 AM to noon. *Spr:* Lockport ARA. South Lockport Firehall, S Transit Rd (Rte 78), corner of Ruhlman Rd. Vendors, refreshments. *TI:* 146.82 (107.2 Hz). *Adm:* $5, under 12 free. Tables: $5 (8-ft). Duane Robinson, W2DLR, Box 142, Ransomville, NY 14131; 716-791-4096; **w2dlr@arrl.net**; **lara.hamgate.net**.

New York (Oyster Bay)—Jan 18, New York City/Long Island Section Convention. See "Coming Conventions."

†North Dakota (Grand Forks)—Feb 7. *Spr:* Forx ARC. UND Student Union, University Ave; 1 block N of Columbia Rd. Guest speakers, VE sessions. *TI:* 146.94. *Adm:* $5. Tables: first is free, $5 each additional. Gary Garritson, KCØJPP, Box 12413, Grand Forks, ND 58208; 218-791-3616; **kc0jpp@arrl.net**.

†Ohio (Mansfield)—Feb 8, 7 AM to 3 PM. *Spr:* InterCity ARC. Richland County Fairgrounds Buildings, 750 North Home Rd; from I-71 N or S, take Exit 176 (US Rte 30), turn W onto Rte 30, go 7.4 miles to Trimble Rd/Fairgrounds Exit, turn N onto Trimble Rd, turn left (W) onto Longview Ave, go to end of road, turn right (N) onto Home Rd, Fairgrounds entrance on right. Mid*Winter Hamfest/Computer Show, flea market, large dealer representation, VE sessions, forums and meetings, refreshments. *TI:* 146.94 (71.9 Hz). *Adm:* advance $5 (by Feb 1), door $6. Tables: $12 (advance only, by Feb 1). Jack Weeks, K8RT, 1210 E Hanley Rd, Mansfield, OH 44903; 419-756-5301; **bigdogg@richnet.net**; or Dean Wrasse, KB8MG, 419-522-9893; **www.maser.org**.

Ohio (Middletown)—Jan 10, SWOH Digital Symposium. See "Coming Conventions."

†Ohio (Nelsonville)—Jan 18, 8 AM to 1 PM. *Spr:* Sunday Creek AR Federation. Tri County Joint Vocational School, on State Rte 691; take Rte 33 E to Nelsonville, go through town to 5th light, turn right onto Rte 691, go about ⅛ mile just past the Ramada Inn to Vocational School. Hamfest/Computer Show, flea market, vendors, VE sessions (noon), free parking, refreshments. *TI:* 147.15, 147.225. *Adm:* $5. Tables: $5. Russ Ellis, N8MWK, 8051 Kochis Rd, Glouster, OH 45732; 740-767-2226; **n8mwk@arrl.net**.

†Ohio (New Philadelphia)—Jan 25; set up 6 AM; public 8 AM to 2:30 PM. *Spr:* Tusco ARC. New Towne Mall, 400 Mill Ave SE; Exit 81 off I-77 to SR 250, E to SR 416 Exit, at end of ramp turn left at light (under SR 250 bridge), turn right at first light, New Towne Mall is on left. Dealers, ham radio equipment, computers,VE sessions (by appointment), forum (with ARRL Great Lakes Division Director Jim Weaver, K8JE, "Amateur Radio Now and in the Future"), free parking, refreshments. *TI:* 146.73 (71.9 Hz). *Adm:* $4. Tables: $11 (reserve and pay in advance by Jan 20; bring your own extension cords). Gary Green, K8WFN, 32210 Norris Rd, Tippecanoe, OH 44699; 740-922-4454; **k8wfn@tusco.net**.

Pennsylvania (Philadelphia/Lafayette Hill)—Jan 14. Richard Moll, W3RM, 215-659-4200. (Auction-Fest).

†South Carolina (North Charleston/Ladson)—Feb 7; set up Friday 5-9 PM, Saturday 6:30 AM; public 8:30 AM to 4 PM. *Spr:* Charleston ARS. Exchange Park Fairgrounds, 9850 Hwy 78; Exit 203 off I-26, College Park Rd. 31st Annual Hamfest/Computer Show, tailgating ($6 per space plus admission), dealers, forums (ARRL, Natural Disasters, APRS, weather), VE sessions (on site at 1 PM, walk-in basis only; Ed, KC4ED, 843-871-4368; **efrank@dycon.com**), campsites available with full hookups ($20 per night), acres of free parking, refreshments. *TI:* 146.79, 145.25, 147.045, 145.41. *Adm:* $5, under 12 free. Tables: advance $6 (by Jan 23), door $8. Jenny Myers, WA4NGV, 2630 Dellwood Ave, N Charleston, SC 29405-6814; 843-747-2324; **brycemyers@aol.com**; **www.qsl.net/wa4usn/hamfest.htm**.

Attention All Hamfest Committees!

Get official ARRL sanction for your event and receive special benefits such as donated ARRL publications, handouts, and other support.

It's easy to become sanctioned. Contact the Convention and Hamfest Branch at ARRL Headquarters, 225 Main St, Newington, CT 06111. Or send e-mail to **giannone@arrl.org**.

Promoting your event is guaranteed to increase attendance. As an approved event sponsor, you are entitled to advertise your event in *QST* at special rates. Make your hamfest a success by taking advantage of this great opportunity. Call the ARRL Advertising Desk at 860-594-0207, or e-mail **ads@arrl.org**. QST

NEW BOOKS

INSTRUMENTS OF AMPLIFICATION

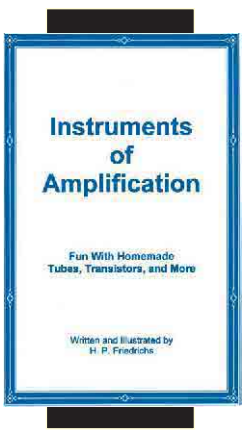
By H. Peter Friedrichs, AC7ZL

297 pages, 5½×8½ inches, black and white illustrations. Published by the author. Available from the ARRL, 225 Main St, Newington, CT 06111; tel (toll free) 888-277-5289; **www.arrl.org/shop**. *ARRL Order No. 9163—retail $19.95.*

Reviewed by Steve Ford, WB8IMY
QST *Editor*

◊ The title seems dry and even imposing, but the book is another matter entirely. *Instruments of Amplification* is a delightful foray into "extreme radio," as the author, H. Peter Friedrichs, AC7ZL, calls it.

If the author's name is familiar, perhaps you recall *The Voice of the Crystal*, the previous book by Friedrichs that explored every conceivable homespun method of detecting a radio signal. It was reviewed in the May 2000 *QST*.



Instruments of Amplification takes *The Voice of the Crystal* to the next logical step—amplification using homebrew components. Friedrichs guides the reader on an amazing journey from electromechanical amplification to vacuum tubes and finally solid-state devices. Along the way he explains the basics of amplification in a conversational, easy-to-understand style. Take a look at this passage from a discussion of how atoms in gas molecules can interfere with free electrons during thermionic emission…

"To visualize this type of interference, picture yourself trying to run a straight path through the plaza of a crowded shopping mall. You may advance a short distance, but the odds are that, somewhere along your course, you'll eventually collide with another patron. If the other shopper is large enough, he may well send you back from whence you came!"

When I was first learning electronics in high school, no one bothered to illustrate the importance of a vacuum-tube vacuum this way. I would have grasped it in an instant if I had a copy of *Instruments of Amplification* at hand.

Not only are the explanations of basic amplifiers enlightening, the projects used to illustrate the explanations are astonishing, at least to 21st century sensibilities. Friedrichs doesn't just talk about mechanical, vacuum tube and solid-state amplifiers, *he builds them out of component parts*. Friedrichs shows you how he has built mechanical microphonic amplifiers from balancing scales, and even homebrew vacuum tubes from discarded hamster water bottles, canning jars and votive candle jars, among other things. He also details hand-made semiconductors. Yes, all these projects really work!

Instruments of Amplification isn't a slick commercial book with professional illustrations, but the writing is top notch. Even if you don't end up assembling your own tubes and transistors, just reading about the author's efforts is educational and entertaining. I'll be waiting for the next progression up the extreme-radio ladder: an amateur transceiver built entirely from homebrewed tubes or transistors!

SPECIAL EVENTS

Atkinson, NH: Atkinson Amateur Radio Club, K1D. 0501Z **Dec 21**-0500Z **Jan 5**. Celebrating Kid's Day and Amateur Radio Awareness. 28.380 21.380 14.280 7.230. QSL. Peter Schipelliti, 7 Dearborn Ridge Rd, Atkinson, NH 03811.

Davidsonville, MD: Anne Arundel Radio Club Jr, W3W. 1300Z **Jan 17**-1800Z **Jan 18**. Celebrating 3rd Anniversary of a club dedicated to kids. 28.335 21.365 14.265 7.237. Certificate or QSL. Andrew Kelly, K3ASK, 1561 Efford Rd, Pasadena, MD 21122. **kidshamradio.com/specialevent.html**.

Oyster Bay, NY: ARRL NY City/Long Island Section, W2V. 1300Z-2200Z **Jan 18**. Ham Radio University 2004. 21.270 14.270 7.270. Certificate. George Tranos, PO Box 296, Bellport, NY 11713. **www.hudson.arrl.org/nli/hru2003.htm**.

Quincy, IL: Western Illinois Amateur Radio Club, K9E. 0000Z **Jan 23**-2359Z **Jan 25**. Arrival of the Bald Eagles on the Mississippi River. 7.250 14.250 21.350 28.350. Certificate. Robert G. Mitchell, 816 Long Dr, Quincy, IL 62305.

Green Bay, WI: Bay Area Relay League, W4P. 1200Z **Jan 24**-1800Z **Jan 25**. Packers Ice Bowl Remembered. SSB General bands; CW General and Novice bands. Certificate. George Russell, WN8VIX, 2530 Sun Terrace, Green Bay, WI 54311.

San Diego, CA: Challenger Middle School ARC, KI6YG. 1500Z-2400Z **Jan 28**. 18th Anniversary of the Challenger Disaster. 28.450 21.350 14.250 146.52 FM. QSL. Frank Forrester, KI6YG, Challenger Middle School, 10810 Parkdale Ave, San Diego, CA 92126.

Punxsutawney, PA: Punxsutawney Area Amateur Radio Club, K3HWJ. 1400Z-2100Z **Jan 31**. Commemorating Groundhog Day. 14.240 7.240 7.125 146.715. Certificate. Sherman Hollopeter, W3QOS, Box 20216 E Main St, Big Run, PA 15715. **www.qsl.net/k3hwj**.

Topeka, KS: Local Area Amateur Radio Operators, NØG. 1600Z-2200Z **Jan 31**. KS National Guard Museum Tribute. 28.400 21.350 14.310. Certificate. Steve Hamilton, 2523 SW Carlson Rd, Topeka, KS 66614.

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 **Mar** *QST* would have to be received by **Jan 1**. Submissions may be mailed (Attn: Maty Weinberg), faxed (860-594-0259) or e-mailed (**events@arrl.org**) to ARRL HQ. QST

Maty Weinberg, KB1EIB ♦ Special Events ♦ events@arrl.org

LIFE MEMBERS ELECTED NOVEMBER 9, 2003

Efrem Acosta, W2CZ; Valeriy G. Agabekov, N2WW; Robert F. Ahrens, K6RFA; Vincent J. Alianiello Jr, W1VJA; Joseph A. Ames Jr, W3JY; Homer Amos, KE8SA; Bradford P. Anderson, KE6PWM; David M. Anderson, KG4YZY; Richard W. Anderson, W9BNO; Kymm L. Balinth Regan, KY2MMM; Emmanuel T. Barrido, WG8M; Kevin Barrows, N7GXZ; David L. Bassett, KE6AYI; Kathryn R. Bassett, KD6KFA; Nancy C. Beattie, N2FWI; William "Hawk" Bennett, K5HWK; Gregory J. Beveridge, WB7AHO; Richard O. Blanchard II, WA1VVX; Daniel C. Blasberg Jr, KA8YPY; Keith L. Boatman, AB9CC; Michael C. Boatright, KO4WX; Robert E. Boone, KZ4ZZ; Kevin J. Brandstetter, K8VUS; Alan L. Bridges, K4ALB; Frederick A. Brown Jr, WAØZQX; Brent D. Bruns, WWØM; Mark J. Buliszak, N1OS; Judy A. Burns, KC6UTF; Robert L. Burns, K4RXR; John E. Burt, N9DVM; Guy K. Carlsen, K4CNF; Alexandra L. Carter, KH6XK; Leland W. Casto, KCØBZE; Andrew J. Cerier, N1XZI; Jim Chay, N7QO; Leon S. Ciereszko III, N4TCW; Andrew W. Clegg, W4JE; Thomas P. Cloyes, KI8IZ; William E. Coleman Jr, N4ES; Donald C. Cox, W2EZA; Sally Jo Cripe, N3MYZ; Mark J. Culross, KD5RXT; Gary E. Dahlerup, NØAYK; Keith D. Daniel, N2WZU; Kristin M. Dankert, K6PEQ; Michael J. Dassero, NØMUD; Marie D. Davis, KA7IRT; William J. Davis Jr, W8KJF; Marshall L. Deets, NØGAF; Adam D. Desantis, AA8SU; Chip Diamond, W3FJD; Robert S. Dixon, W8ERD; F. V. Doerner, K5VD; Scott M. Doherty, KA2QYF; Catherine M. Downs, KA3QPU; Donald B. Downs, WA4AVU; Pavel Dudek, OK8CW; David R. Dull, WB9BRX; Richard C. Duncan, WD5B; Kenneth J. Durham, KE4KCB; Rege Dvorsky, WA3LKT; Grady E. Ebert, KB5SDU; Jordan F. Edelman, WO6D; Bonnie R. Edwards, KB5HAA; John G. Egolf, KD4NKU; Dennis J. England Sr, KA4DHI; David C. Engle, W6DE; Arthur A. Farrington, W5GCM; Robert L. Feldman, K3JQB; Jeffrey T. Ferriell, K8ZDA; Sean C. Fleeman, KG4YZZ; Joe B. Ford, K4NVJ; Ann Foster, KØANN; Ronald S. Freeman, K5MM; Andrew Fuller, KG4OWO; Mary C. Fullerton, KC7YLY; Toshihiko Furuya, WB6Z; Anthony B. Gaito, KCØCSG; Susan M. Gaito, KCØCSH; Melford C. Garvin, KB8YBA; Sam Ghaleb, KG6EMT; Spencer L. Gibbs, N9DVL; Gerald B. Gibson, KB5FDA; John R. Golomb Jr, N2NC; Michael Gomez III, N2WGC; Philip K. Goodman, AE6DI; Jay C. Greenberg, WA4VRV; Robert W. Grimmick, N6OX; Ronald N. Hamby, KF4GNV; Drayton L. Hanna, KF4AME; Jim K. Hansen, WDØDIA; Wayne M. Hartsfield, KW5M; B. T. Haskell, K1BTH; Christopher B. Hays, WC5RR; Roger D. Hayward, KA7EXM; Michael T. Heideman, N7MH; Carl Heidenblad, N1CUU; Richard G. Heller, WA6IZH; Stanley K. Hess, N3KDA; Kristine A. Hickerson, WB9SLM; Thomas E. Hufnell, WA3BDV; Peter A. Hughes, N3PH; David R. Hunter, N2EZY; Seigo Ito, JE1QMS; Carolyn Fay Jacobson, N9FA; William C. Jakubowski, N6XIV; Kenneth A. Johnson, WA4GHY; Michael Johnson, N8MBZ; Robert F. Johnson Sr, W4YQ; Glen J. Joslin, NØUEE; William H. Kahn, WB8ZEJ; Leonard J. Kelter, K9LJ; Michael J. Kionka, KIØGO; Stanley B. Kocsis, WB2LZM; Philip J. Kurman, K4AAR; Joseph H. Langjahr, KJ7DG; Stephen H. Lawrence, AA8AF; Larry Lamar Lawson, KK5KE; Daniel Leahr, N8KCM; Martin H. Leider, AC9Z; Richard N. Lewis, K8UE; Darryl G. Lindberg, KD5QJA; Rik Line, W2RIK; Timothy R. Logan, NZ7C; James A. Lovett, KD5HSS; Ralph W. Lucas, W6RWL; Arthur E. Lund III, NQ3A; Keith Lyon; Brian S. Macherone, AB2IU; Richard Clyde Macneel, KB3FEX; Matthew W. Markland, KFØUD; Stephen A. Mathis, N3PZ; William D. Mauldin, WG4R; Halford J. Mc Clain, K5MV; James R. B. McClain, KG4HHW; Kenneth R. McGuire, KC8LTL; Timothy E. Mc Laughlin, KT4LB; S. Riley Mc Lean, W7RIL; Keith C. McMullen, KC5LOY; E. Scott Medlin, KF4GNL; Garland Meredith, K5VY; James Messer, AG4DX; Joseph R. Michalko, KG4FBQ; Gerald R. Migely, WA9KXZ; Randy J. Miller, AA5OZ; Richard A. Miller, K4IFG; James W. Monroe, KE6LWU; Carmelo Montalbano, KF2RI; David A. Moore, WB4VAM; William O. Muxworthy, N5OUX; Kiyoshi L. Nakamura, AD2R; Tom O' Brien, WU8E; Ronald J. Oberloh, WAØKDS; John M. Odonish, KB3EFF; Charles L. Penry, WA5VHU; Paul P. Perkins, WN8FTC; Paul E. Perry, WB2ERY; Edmund Peters, K2EMJ; Leslie Peters, N1SV; Wayne F. Poole, K4WFP; Bert Put, KG4BEC; Jayson A. Quilantan, KCØITF; Roy C. Rabey III, AD5KZ; Ralph Ratta, K9RWR; Gary M. Reardon, N1EDZ; Robert W. Reed, WA2ZOU; Alex J. Regan, KC2FWQ; Jeff H. Regan, NJ5R; Johnathan A. Regan, KC2FWH; Michael-Anne S. Regan, KC2FWG; Bruce W. Reid, K9SHT; Randall S. Renne, W9KZ; Mark S. Robbins, W2MR; Gary C. Roberts, AB7MX; Frank Rodeffer, AFØK; Edwin M. Roos, KC6ZHY; Doug B. Rotramel, KE6TVM; Andrew Sackheim, WA4FYD; Neil Savin, W7SVN; Marc A. Schneider, W4NVY; Claude E. Sessions Jr, K5HFY; Robert D. Shankle Jr, AL7NO; Francis E. Siderski, N1CAJ; Dale Sinclair; Benny Joe Smith Jr, WØJOE; David D. Smith, WW1O; Don D. Smith, KC8REM; Leroy C. Smith, N7EIE; Randall E. Smith, WB8WNV; Robert A. Snyder, N2KGO; Larry D. Sonnie Jr, N3LS; James M. Spence, KO9A; Peter S. Spence, KG4VDR; Eric J. St. Palley, W9STP; Daniel S. Starkenburg, ABØRE; Richard W. Strycharz Jr, KD1XP; Richard L. Swain, KK8O; Carl R. Swanson, K6CRS; Allen A. Sweet, KG6HM; Rev. Fran Sweet, KF6UVB; Thomas R. Swisher Jr, WA8PYR; Steven Szombathy, W7UDI; Mark W. Tellier, AB9CD; Barry S. Tepperman, AC4US; John E. Thomason III, K5VG; Scottie W. Thomas, KC8TYT; Bridget S. Thompson, KS4YT; Sylvia K. Thompson, N1VJ; David E. Tiller, K4DET; Marco Tonini, IK4LHE; Greg L. Turnquist, KCØISU; John Uhl, W5ZE; Galen Umscheid, WBØTXI; Donald R. Unruh, NØYO; Joseph H. Urban, NØZFN; Norman Urich, NU4DO; Rob Vance, N6ROB; David K. Vernier, WT8L; Mark B. Viers, KU4MP; Joseph S. Vislocky, N8KTM; Richard P. Vitello, W1RV; Manuel E. Vizinho, KG6IQL; Michael J. Waranis, KF4PVN; Erik Werner, KD5CTJ; Tommy C. Werst, N9YJT; Erik R. Westgard, NY9D; Robert L. Whittenburg, KD7WH; David M. Wiesner, KGØXM; Angela D. Williams, WN4C; Dora E. Williams, KF4YSH; Truman Williams Jr, NN4C; Wesley M. Wills, W5FJO; Richard D. Witte, K6KMA; Eric A. Wittmayer, KD7EYV; Kristi J. Wold Fineberg, KC7AKN; David R. Wood, N8FBE; Gary C. Wysocki, N2WLS; Kenneth A. Yaw, KC2KXA; John T. Young, N8JY; Larry M. Ziemba, W2QY; Louis H. Zimmermann, W9FAN; Ernest J. Zingleman, KS4Q

CONTEST CORRAL

Feedback

Several entries have been added to the 2003 Field Day results. The revised PDF file and the Web database are both available at **www.arrl.org/contests/results**.

In the photo caption on page 93 we managed to give an incorrect call sign for both Southwestern Division Director Art Goddard, W6XD, and Vice President Fried Heyn, WA6WZO.

W1AW Qualifying Runs are 10 PM EST Friday, Jan 9 (0300Z Jan 10), and 9 AM Thursday, Jan 22 (1400Z Jan 22) (35-10 QRSR). The K6YR West Coast Qualifying Run will be at 9 PM PST Wednesday, Jan 14 (0500Z Jan15). 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, HP—High Power >150 W, LP—Low Power >5 W and <150 W, QRP is <5 W.

No contest activity on 30, 17 and 12 meters. Refer to the contest Web sites for information about awards. Unless stated otherwise, regional contests only count QSOs with stations in the region. Publication deadline for Contest Corral listings is the first of the second month prior to publication. In order to publicize the maximum number of contests, readers will be referred to an earlier issue of *QST* if the rules have been published within the past year.

Jan 1-Dec 31

UBA-SWARL 365 Day Contest—All modes—sponsored by the Royal Society of Radio Amateurs (UBA) and the Short Wave Amateur Radio Listening (SWARL) during 2004. Participants log DXCC entities on all amateur bands from 160-10 meters, including 10, 18 and 24 MHz, according to the IARU band plans. Only one category—Mixed Mode, including all digital modes. Each entity logged counts one point per band. Logs are due at three times through the year—March 31, June 30 and September 30—to **ONL4299@skynet.be** (e-mail only). For more information: **www.uba.be/**.

Jan 1

There are a number of short events celebrating the New Year. For more information, view the Web sites for each contest.

ARRL Straight-Key Night—see p 96 of Dec 2003 *QST* or **www.arrl.org/contests**.

New Years Snowball Contest—sponsored by the Activity Group of Belarus (AGB)—**www. qsl.net/eu1eu/index_e.htm**.

HA Happy New Year Contest—sponsored by the Budapest Society of the Hungarian Radio Amateur Society and the Puskás Tivadar Radio Amateur Club—**radioklub.puskas.hu/ha5khc/web/**.

SARTG New Year RTTY Contest—sponsored by the Scandinavian RTTY Activity Group (SARTG)—**www.sartg.com**.

Jan 3-4

ARRL RTTY Roundup—1800Z Jan 3-2400Z Jan 4; see p 97 of Dec 2003 *QST* or **www.arrl.org/contests**.

Kid's Day—Phone, sponsored by the Boring Amateur Radio Club from 1800Z to 2400Z Sunday, Jan 4; see p 50 of Dec 2003 *QST* or **www.arrl.org/FandES/ead/kd-rules.html**.

Jan 10-12

North American QSO Party—CW, sponsored by the *National Contest Journal* from 1800Z Jan 10-0600Z Jan 11. Frequencies: 160-10 meters. Categories: SOAB and M2, 100 W power limit, operate a maximum of 10 hours (off times must be at least 30 min and M2 entries may operate the entire contest). Exchange: Name and SPC. Score: QSOs × States + Provinces + NA DXCC entities (count each once per band). For information: **www.ncjweb.com/naqprules.php**. Logs due Feb 10 to **cwnaqp@ncjweb.com** or Bruce Horn, WA7BNM, 4225 Farmdale Ave, Studio City, CA 91604. The same mailing address will be used for both modes of this contest.

Hunting Lions in the Air—CW/Phone, sponsored by the South African District 410B of the International Association of Lions Clubs from 0000Z Jan 10-2400Z Jan 11. Frequencies: 160-10 meters, work stations once per band regardless of mode. Categories: SOAB, MS. Exchange: RST and serial number, Lions club members also sign /L or LION and send name, district and club name. The Midrand Lions station ZS6LCM/L will act as the Melvin Jones Memorial club this year. QSO points: non-Lion station—1 pt, with Lions—5 pts, 25 points with ZS6LCM/L. Score: QSO points × number of Lions clubs worked (count only once). For more information: **www.sarl.org.za/public/contests/lionita.asp**. Logs due Feb 28 to **rad.handfield-jones@pixie.co.za** or to Lion Rad Handfield-Jones ZS6RAD, Lions Club of Midrand, PO Box 1548, Halfway House, 1685, South Africa.

DARC 10-meter Contest—CW/SSB, sponsored by the Deutscher Amateur Radio Club from 0900Z-1059Z Jan 11. Frequencies: CW 28.000-28.200 MHz, SSB 28.300-28.700 MHz, work stations once only. Categories: SO-Mixed Mode and SO-CW. Exchange: RS(T) and serial number, DL stations add DOK code. QSO points: 1 pt/QSO. Score: QSOs × WAE and DXCC entities + DOK codes. For more information: **www.darc.de/referate/dx/fedcz.htm**. Logs due Jan 31 to **10m-contest@darc.de** or Frank Steinke, DL8WAA, PO Box 1188, D-56238 Selters, Germany.

Jan 17-19

ARRL January VHF Sweepstakes—1900Z Jan 17-0400Z Jan 19; see p 97, Dec 2003 *QST* or **www.arrl.org/contests**.

North American QSO Party—Phone, 1800Z Jan 17-0600Z Jan 18 (see Jan 10-12). Logs due Feb 17 to **ssbnaqp@ncjweb.com** or Bruce Horn WA7BNM, 4225 Farmdale Ave, Studio City, CA 91604.

MI QRP Club January CW Sprint—1200Z Jan 18-2400Z Jan 19. Frequencies: 160-6 meters. Categories: SOAB with classes A (<250 mW), B (<1 W), C (<5 W), D (>5 W). Exchange: RST, SPC and MI-QRP number or power output. QSO points: MI-QRP members—5 pts, nonmember W/VE—2 pts, DX—4 pts. Score: QSO points × SPC counted once per band. If homebrew RX or TX, multiply by 1.25. If both RX and TX are homebrew, multiply by 1.5. For information: **www.qsl.net/miqrpclub**. Logs to **n8cqa@arrl.net** or L. T. Switzer, N8CQA, 427 Jeffrey Ave, Royal Oak, MI 48073-2521.

LZ Open Championship—CW, sponsored by the LZ1KPP Radio Club from 1200Z-2000Z Jan 17. Frequencies: 3.5 and 7 MHz. Categories: MS, SO and SO-QRP. Exchange: 6-digits, serial number and serial number received in previous QSO. Eg, the first QSO exchange is 001 000. A station can be worked once every 30 minutes. QSO points: same entity—1 pt, different entity—2 pts. Score: total QSO points. For more information: **www.qsl.net/lz1fw/lzopen/index.html**. Logs due 30 days after the contest to **lz1fw@yahoo.com** or LZ1KPP—Radioclub, PO Box 79, Sofia 1606, Bulgaria.

HA DX Contest—CW, sponsored by the Hungarian DX Club from 1200Z Jan 17-1200Z Jan 18. Frequencies: 160-10-meter bands. Categories: SOAB, SOSB, MS, MM and SWL. Exchange: RST and serial number, HA stations send county or HADXC member number. QSO points: Own DXCC entity—1pt, same continent—1 pt, different cont—3 pts, HA stations—6 pts. Score: QSO points × HA counties and members on each band. For more information: **www.mrasz.hu/engver/mraszen.html**. Logs due 30 days after the contest to **contest@enternet. hu** or MTTOSZ, Gyôr Városi Rádióclub, 9200 Gyôr, PO Box 79, Hungary.

070 PSKFest—sponsored by the Penn/OH DX Society (PODXS) from 0000Z-2400Z Jan 18. Frequencies: 80-10 meters. Categories: SOSB-QRP, SOAB-QRP,-MP (<50 W), -HP. Exchange: RST and SPC. QSO points: 1 pt/QSO. Score: QSO points × SPC counted only once. For more information: **www.podxs.com/html/pskfest.html**. Logs due Feb 17 to **PSKFest@podxs.com**, **n9nds@yahoo.com** or Brad Robertson, 53 E Robert Weist Ave, Cloverdale, IN 46120.

Jan 24-25

CQ WW 160-Meter Contest—CW, sponsored by *CQ* Magazine from 0000Z Jan 24-2359Z Jan 25 (Phone is Feb 21-22). Exchange: RST and SPC. Categories: SO-QRP (<5 W) -LP(<150 W) -HP, MO categories. Enter as MO if packet or spotting nets are used. QSO points: own entity—2 pts, same continent—5 pts, diff cont—10 pts, /MM stations count 5 points, but no multiplier. Score: QSO points × states + VE call areas (VYØ added this year) + DXCC entities (KH6 and KL7 count as DXCC only). For more infor-mation: **www.cq-amateur-radio.com/infoc.html**. Logs due by Feb 28 to **cq160cw@kkn.net** (Cabrillo format only) or CQ 160 Contest, 25 Newbridge Rd, Hicksville, NY 11801.

REF French Contest—CW, sponsored by the Reseau des Emetteurs Francais, 0600Z Jan 24-1800Z Jan 25 (Phone is Feb 21-22). Contact French stations including Corsica, Overseas Territories and EU Council station TP2CE. Frequencies: 80-10 meters. Categories: SOAB, MS and SWL. Exchange: non-French stations send RST and serial number, French send RST and department number or prefix. QSO points: different continent—3 pts, 1 pt otherwise. Score: QSO points × departments and prefixes counted once per band. For more information: **www.ref.tm.fr**. Logs are due Mar 15 (CW) or April 15 (SSB) to **f5lbl@ref-union.org** or Reseau des Emetteurs Francais, REF Contest, BP 7429, 37074 Tours Cedex, France.

BARTG RTTY Sprint—sponsored by the British Amateur Radio Teletype Group from 1200Z Jan 24-1200Z Jan 25. Frequencies: 80-10 meters. Categories: SO-Expert, SOAB, MO and SWL. Operators with a Top Ten log in the past three years must enter as an Expert. Exchange: serial number only. QSO points: 1 pt/QSO. Score: QSO points×DXCC entities + W/VE/JA/VK call areas + continents counted only once. For more information: **www.bartg.demon.co.uk**. Logs in Cabrillo format due Mar 1 to **ska@bartg.demon.co.uk** with the call and entry class in the subject line and the log included as an attachment or by mail to John Barber, GW4SKA, PO Box 611, Cardiff, CF24 4UN, Wales (only logs with 50 or fewer QSOs may be submitted as printed logs).

Jan 31-Feb 1

UBA Contest—Phone, sponsored by the Royal Union of Belgian Amateur Radio from 1300Z Jan 31-1300Z Feb 1 (CW is Feb 28-29). Frequencies: 80-10 meters, according to the IARU band plan. Categories: SOAB, SOAB-QRP, SOSB, MS, packet is allowed for all classes. Exchange: RST and serial number, ON stations add their province abbr. QSO points: QSOs with ON stations—10 pts, with other EU—3 pts, outside EU—1 pt. Score: QSO points × ON provinces + ON prefixes + European DXCC entities counted once per band. For more information: **www.uba.be**. Logs due 30 days after the contest to **berger@cyc.ucl.ac.be** or Michel Le Bon, ON4GO, UBA HF Contest Manager, Chée de Wavre 1349, B-1160 Bruxelles, Belgium. QST

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

By **Bill Seabreeze, W3IY**

Results, 2003 June VHF QSO Party

After a long winter's nap…

After a long winter's nap, VHF and above activity begins to recreate itself every spring. As the weather improves, the amateurs interested in the higher bands begin to dream of outdoor activities, new antennas, station repairs, and better propagation. Rovers begin to dream of good locations, mountaintops, and what they can erect on their rover-ships. The dedicated 6 meter operators usually notice the occurrence of occasional E_s propagation weeks before the contest.

This year they were rewarded by a monster band opening that seemed to explode during the weekend of June 14-15. Six meters always has a great equalizing effect on VHF contest scores. With 6 meter E_s on the scene, even small stations have the chance to accumulate large numbers of QSOs and multipliers. The weather was not a major factor, and most rovers and portable stations that were able to get out and have a great weekend on the bands.

Summary

The total number of logs submitted was up significantly this year to 818 compared to 673 last year. This is the largest number of June contest logs in the last 5 years, a very positive sign for VHF and up Amateur Radio operators.

The number of single op-low power (SOLP) logs grew dramatically from 319 to 445 logs! There were 157 single op-high power (SOHP) logs received, identical to last year's tally.

There were 93 rovers who submitted logs this year as opposed to 85 last year. 10% growth is a good sign, and I'm convinced that this category will continue to grow. The limited multi-op category (LM) produced 55 logs, up from 49 last year. There were 38 multi-op-unlimited (MU) logs received compared with 36 in 2002. The in-box also found Single Op-Portable logs, up 10% from last year.

Propagation

Make no mistake about it… if you weren't on 6 meters, you just weren't in the game this year. Widespread E_s dominated the contest scoring, providing coast-to-coast excitement. Looking at KMØT's results, the E_s clouds enabled paths from northwest Iowa to all corners of the US. The best and longest-duration 6 meter E-skip occurred on Saturday. Other parts of the country weren't far behind, giving some insight into this widespread nature of this 6 meter opening. Double-hop E_s brought the East and West Coasts together numerous times. European and Central American DX made it into several logs in the east. Balancing the 6 meter activity with average conditions and good activity on the higher bands was a challenge that left few operators bored for very long.

On the West Coast, the 6 meter propagation was reported to be best on Saturday. Many new microwave stations and several new rovers did a great job of generating activity in the Southern California region. In the northwest, some respectable north-south tropo was reported on 144 and 222 MHz.

Nationwide Perspective

Top honors in the single-op low-power category go to Bob, K2DRH/9. This is the first time Bob has won the category. From 6-land, N6MU (operating from N6NB) put in a great effort on bands 6 meters through 1296, less 903. A bigger total on 6 meters from John couldn't quite compete with the effort on the higher bands from Bob.

The top spot in SOHP was again captured by Jeff, K1TEO. From his great location in CT, Jeff combined years of contesting experience with good equipment and propagation on 6 meters to outdistance 2nd place winner, Mike, KMØT, by about 53k. Hearty congratulations to Jeff for a first place finish for the 7th year in a row! Finishing 2nd overall in SOHP, KMØT continued to capitalize on good rover activity in the midwest from NØDQS/R and others, while keeping the QSOs pouring in on 6 meters. It's also no small feat to finish 2nd from NW Iowa. The skip in FL was mainly north-south until around 2100Z, when Gary, NW5E, noticed a westerly shift in the band. At about 2230Z, they were working 6s, 7s and some TG9 DX. After this, the band seemed to open to many areas of the country from FL. NW5E was 2nd in the nation for SOHP total QSOs on 6 meters.

The multi-operator classes were a huge factor for all in this exciting contest. The gold medal for the limited multi (LM) class goes to K9NS operating from the "Mount Frank" K9HMB QTH. This is a significant accomplishment, as this category is usually dominated by stations located closer to the activity centers on the East Coast. An outstanding 792k score smoked the nearest competition by almost 330k points. An incredible 861 QSOs in 233 grids on 6 meters was a key contribution to the effort. The 2nd place spot went to a great effort (463k) from K3YTL on their mountaintop QTH in central PA. Third and 4th place LM spots went to K5TR and W4IY, both turning in great efforts.

Expanded Results, Line Score Printouts Available

For complete contest results online, please visit **www.arrl.org/contsts/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.

Top Ten

Single Operator, Low Power

K2DRH	274,942
N6MU	221,088
K9HUY	188,244
WA7JTM	177,313
N2BJ	145,343
K5MA	141,361
WB1GQR (W1SJ, op)	132,300
W5PR	129,888
NU6S	117,180
N0LL	113,796

Single Operator, High Power

K1TEO	443,240
KMØT	389,754
K1RZ	369,633
NW5E	351,226
KC4PX	337,845
K5AM	322,839
WA2FGK (K2LNS, op)	284,553
N4IS	282,753
WB9Z	263,900
K3DNE	248,980

Single Operator Portable

K6MI	106,950
N7IR	77,331
K9AKS	60,615
NR5O	50,065
NØHJZ	22,080
N3EG	20,331
KG4LEV	19,355
W7KK	18,321
N7QF	9,758
K8RS/3	9,660

Limited Multioperator

K9NS	792,427
K3YTL	463,572
K5TR	426,070
W4IY	390,885
W3SO	341,728
AA4ZZ	300,032
K8CC	254,172
N7LQ	237,150
W1QK	203,196
W5KFT	128,953

Multioperator

W2SZ	2,019,814
K8GP	1,727,691
K3EAR	1,383,316
W3CCX	793,134
N2PA	524,830
K1WHS	363,814
W4NH	295,320
W9ICE	282,252
W4ZRZ	232,716
W6NS	219,490

Rover

W3IY (+ON1CFX)	270,200
N6TEB (KG6EPM)	230,048
W6TOI (KE6HPZ	217,978
KC3WD (+KA1TB)	162,652
N2JMH (+N2WVK)	116,688
N6NB	116,290
VE3NPB (+VE3OIL)	88,900
K6FZZ (+ K6FZY)	88,561
W4VHF (+K4MQG)	86,172
WB6NTL (+KG6HXI)	85,272

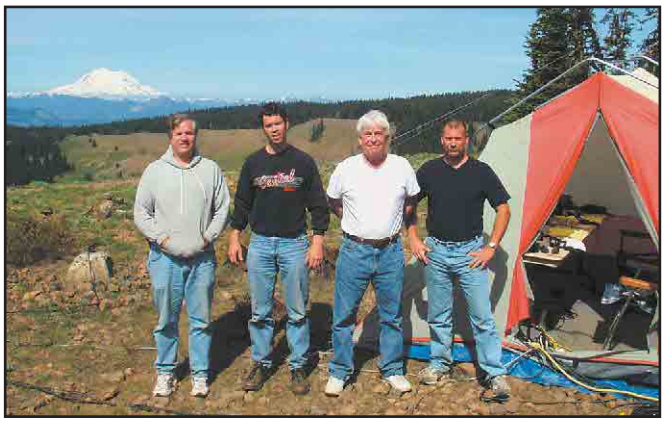
Club Competition

Club	*Entries*	*Score*
Medium		
Potomac Valley Radio Club	23	3,696,618
Society of Midwest Contesters	24	1,978,878
South Mountain Contest Club	3	1,399,470
Mt Airy VHF Radio Club	5	928,356
Northern Lights Radio Society	21	899,226
North East Weak Signal Group	14	629,079
Northern California Contest Club	9	580,174
Yankee Clipper Contest Club	9	528,481
Grand Mesa Contesters of Colorado	8	451,202
Western States Weak Signal Society	7	396,324
Carolina DX Assn	6	388,933
Badger Contesters	12	378,503
Rochester VHF Group	6	362,161
Florida Contest Group	5	351,263
Pacific Northwest VHF Society	16	340,928
Mad River Radio Club	5	274,997
Downey ARC	3	234,926
Central Texas DX and Contest Club	4	223,815
Contest Club Ontario	9	107,571
Tennessee Contest Group	7	92,240
South East Contest Club	6	32,555
Lawton Fort Sill ARC	3	27,693
Local		
North Texas Microwave Society	3	117,864
Roadrunners Microwave Group	3	97,256
Dominion DX Group	7	45,747
Delaware Valley VHF Society	4	44,007
Rappahannock Valley Radio Club	3	39,688
Medina 2 Meter Group	3	14,966
Dauberville DX Assn	6	13,098
Meriden ARC	3	3,999
South Jersey Radio Assn	3	3,078

The multi-op unlimited (MU) top spot again went to W2SZ/1 operating from Mount Greylock in FN32. No other station in the country even comes close to these guys on the microwaves. The 2.02M points from this group outdistanced the effort from K8GP in WV by some 293k points. K8GP did a great job from Spruce Knob, WV, although unexpected receive problems on 2.3 and 5.7 GHz kept many usual QSOs out of their logs this time. A strong 3rd place MU showing by K3EAR in FM19hx gave many East Coast operators a lot of action from 6 meters through 24 GHz. All of the MU efforts deserve great respect, as the amount of work involved is a huge labor of love. We are all benefactors of this, and we owe them many thanks for all that glorious RF.

The rover category shows a whopping 93 entries this year. It was a pleasant surprise for yours truly (W3IY) to capture the no. 1 spot. The effort was largely made possible by my rover partner ON4IY (ex-ON1CFX), who brought lots of expertise and enthusiasm into the rover-mobile. Brian, ND3F/R, also had a great performance, but a computer glitch unfortunately ate his logs. Brian's strong enthusiasm has helped a large group of East Coast rovers get things going. A strong 2nd place effort in the rover sector was submitted by Dave, N6TEB/R, on the West Coast, co-piloted by Greg, KG6EPM.

The all-time multi-region Single Op-Portable award has to go to Pete, N6ZE, for most miles traveled. He started the contest in FN20, followed by FN30 near Times Square, NYC, DN30, 31, 40 and 41 near Salt Lake City. He arrived in Seattle, just before the end of the contest to cover CN87. Totals were 38 QSOs in 15 grids, and many miles covered (Pete's an airline pilot). John, K6MI, won the Single-operator portable (SOP) category from the Santa Barbara section of CA with an amazing 107k! Ten bands were carefully utilized to create this powerful record-setting score. N7IR and K9AKS captured 2nd and 3rd place, nationwide, in this class with nice efforts from AZ and MN, respectively. As you can see, there certainly were winners from all over the country this time due to the great propagation, and some FB operating.



The W7AV Limited Multioperator team from Bald Mountain in the EWA section. Wonder what it would take to get them to compete from that great location in the background…

Regional Highlights

The 6 meter conditions provided opportunity for stations in different categories to do well, all over the country. The 6 meter totals were biggest from FL, TX and NM. The most 6 meter multipiers were worked by Ivars, KC4PX, in the SOHP class from Merrit Island, FL. A close 2nd and 3rd in the grids-worked arena were Mark, K5AM, in NM, and Gary, NW5E, in FL, both with 260 grids on 6 meters! Conditions or not, it takes great operating skills to work this many grids on any band. Several SOLP stations weren't far behind as Jim, K9HUY, managed 240 multipliers on 6 meters from Englewood, FL, and Peter, WA7JTM pulled 210 grids out of the QRM from Arizona.

Northeast

The Northeast region is blessed with good activity levels, and several large multi-op stations. K5MA landed top SOLP honors for the region from Cape Cod, MA. Jan racked up 141k, operating on just the lower four bands. A close 2nd place finish in SOLP was captured by WB1GQR, operated by Mitchell, W1SJ. The Single Op-Portable class was won by K8RS/3, and a great rover effort from Jim, N2JMH (with co-pilot N2WVK) captured the top position for rovers in the Northeast region.

Southeast Region

Jim, K9HUY, dominated the SOLP class with a 188k performance from West Central FL. Second and third places were grabbed by KE4KVW and WC4H with great scores. KG4LEV turned in the top SO-Portable score from NC using just four bands. The battle for the LM flag was won by the W4IY group near Harrisonburg, VA with 391k. This effort was followed closely by the tenacious AA4ZZ entourage from the NC mountains with 300k points. A great rover effort from Matt, KC3WD/R (with co-pilot John, KA1TB) followed W3IY/R with an impres-

Northeast Region (New England, Hudson and Atlantic Divisions; Maritime and Quebec Sections)

K5MA	141,361	A
WB1GQR (W1SJ, op)	132,300	A
AF1T	81,534	A
K1TEO	443,240	B
K1RZ	369,633	B
WA2FGK (K2LNS, op)	284,553	B
K8RS/3	9,660	Q
WB2AMU	966	Q
N3OBY/MM	816	Q
K3YTL	463,572	L
W3SO	341,728	L
W1QK	203,196	L
W2SZ	2,019,814	M
K3EAR	1,383,316	M
W3CCX	793,134	M
N2JMH (+N2WVK)	116,688	R
N2MH	56,160	R
AA2YG (+N2SLN)	43,442	R

Southeast Region (Delta, Roanoke and Southeastern Divisions)

K9HUY	188,244	A
KE4KVW	92,120	A
WC4H	77,488	A
NW5E	351,226	B
KC4PX	337,845	B
N4IS	282,753	B
KG4LEV	19,355	Q
W4RXR	8,736	Q
N3AWS	1,620	Q
W4IY	390,885	L
AA4ZZ	300,032	L
KV4T	77,914	L
K8GP	1,727,691	M
W4NH	295,320	M
W4ZRZ	232,716	M
W3IY (+ON1CFX)	270,200	R
KC3WD (+KA1TB)	162,652	R
W4VHF (+K4MQG)	86,172	R

Central Region (Central and Great Lakes Divisions; Ontario Section)

K2DRH	274,942	A
N2BJ	145,343	A
KB8U	102,483	A
WB9Z	263,900	B
K8TQK	154,804	B
K8MD	115,800	B
WN8ATM	6,552	Q
N8XA	5,800	Q
K8FH	4,278	Q
K9NS	792,427	L
K8CC	254,172	L
N8ZM	105,248	L
W9ICE	282,252	M
K9RN	184,680	M
WW8M	179,988	M
VE3NPB (+VE3OIL)	88,900	R
AL1VE	48,720	R
K9ILT	42,320	R

Midwest Region (Dakota, Midwest, Rocky Mountain and West Gulf Divisions; Manitoba and Saskatchewan Sections)

W5PR	129,888	A
NØLL	113,796	A
W3XO/5	97,110	A
KMØT	322,839	B
K5AM	389,754	B
KØGU	204,700	B
K9AKS	60,615	Q
NØHJZ	22,080	Q
N7QF	9,758	Q
K5TR	426,070	L
W5KFT	128,953	L
W5LCC	109,848	L
W1XE	185,265	M
WØEEA	125,643	M
KAØMR	47,263	M
NØDQS	84,640	R
N5RZ	52,608	R
NØIO (+KCØLEG)	24,648	R

West Coast Region (Pacific, Northwestern and Southwestern Divisions; Alberta, British Columbia and NWT Sections)

N6MU	221,088	A
WA7JTM	177,313	A
NU6S	117,180	A
AF6O	244,812	B
AA7A	211,715	B
K6KLY	166,056	B
K6MI	106,950	Q
N7IR	77,331	Q
NR5O	50,065	Q
N7LQ	237,150	L
KR7O	102,025	L
W6DTA	86,208	L
W6NS	219,490	M
W6MMM	182,736	M
K7CW	180,648	M
N6TEB (KG6EPM)	230,048	R
W6TOI (KE6HPZ, KB6WKT)	217,978	R
N6NB	116,290	R

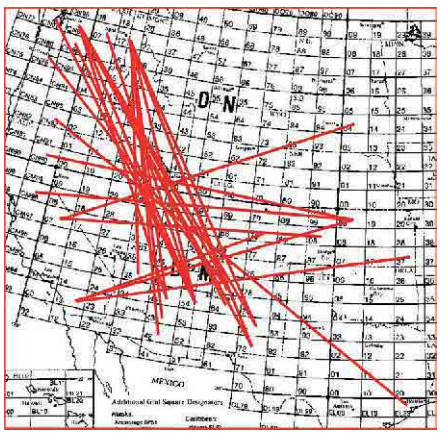
sive 163k score. W4VHF/R, N8UM/R and N4OF/R also hit the roadways, and turned in good efforts, passing out QSOs to grid-hungry contesters everywhere.

Central Region

Activity from this part of the country produced many big scores. Following K2DRH's overall top score in SOLP was Barry, N2BJ, and Russ, KB8U. Experienced contester Jerry, WB9Z, again won the SOHP class with an excellent 264k. Big scores from Bob, K8TQK, and Mark, K8MD, helped their calls into many logs across the country. SO-Portable was nailed by Mark, WN8ATM. A great LM effort by K8CC landed 2nd place in the region. In the MU category, W9ICE came out on top, and placed 8th nationally with 282k. Impressive rover efforts were put forth by Murray, VE3NPB/R (with VE3OIL), Tim, AL1VE/R, Pat, K9ILT/R, Tim, KØPG/R, and John, K9JK/R.

Midwest Region

Charles, W5PR, took the no. 1 spot in the SOLP category. Larry, NØLL, and Bill, W3XO/5, found the next two positions on this totem pole with nice efforts. Coming in just behind 2nd place national winner KMØT in the SOHP class was Mark, K5AM, from NM, operating his awesome-homebrew station. Mark's 323k earned him the 6th spot nationwide. K9AKS won the SO-Portable class, and also pegged the no. 3 position on the national scene. The LM category was won by the K5TR team, who also came in 3rd in the national competition with their 426k. George reports that they had 2 hours of action on 6 with over



A graphical look at some of the 2 meter E-skip during the contest.

200 QSOs…an experience that only great operators with great equipment and conditions ever indulge. First runner-up here was W5KFT followed by W5LCC. A top unlimited effort was advanced by the W1XE group in the Midwest region. A first-class rover score was turned in by Gene, NØDQS/R. Gene's 85k was followed by Ralph, N5RZ/R, with 53k.

West Coast Region

Taking 2nd place SOLP in this region was Pete, WA7JTM, with 177k from AZ. The SOHP category saw several great performances, topped by Ron, AF6O operating from OR. Big efforts were also in evidence from Ed, AA7A, Russ, K6KLY, Dave, W6TE, and K7RAT (piloted by Tree, N6TR). A large number of significant SO-Portable operations were conducted by in this region including Gary, N7IR, Mike, NR5O, Earl, N3EG, and Dave, W7KK. The LM class was led by N7LQ, followed by KR7O. The unlimited class was won by W6NS followed by W6MMM, and K7CW, K6SSN, and KF6YYV. The rover class saw lots of spirited operating, with Dave, N6TEB/R, leading the region with a 2nd place finish, nationwide. This big rover effort was followed by W6TOI/R operated by Glenn, KE6HPZ, and Bill, KB6WKT; Wayne, N6NB/R, and Phil, KF6ZZ/R, all with very respectable scores. Evidence of big rover activity here spells lots of action for West Coast region VHFers.

Club Competition

New for June 2003 was the introduction of club competition. Being part of a group is a good thing, as enthusiasm for VHF contesting is contagious, and can be more fun when you share experience with other like-minded hams.

Wherever you were, you probably had many opportunities to find some exciting action, either via the 6 meter E_s, or from some portable or rover activity. Looking at the winning grid totals, it's easy to see what's required to be competitive in this contest. It's always great to see small stations find the elusive DX from remote locations with enhanced conditions. Whether you're a highly competitive contester, or a casual hilltopper, there's a lot to like about the June contest. Whatever the propagation brings us next year, we are now a little better able to understand what can happen on a nice weekend in June. See you next year on the bands. Listen for the weak ones… QST

By Lew Malchick, N2RQ

18th Annual School Club Roundup: 2004

Each year, hams across the country and around the world find that the School Club Roundup is a great way to get young operators on the air. Very often a new operator will be intimidated and not know what to say. A designated exchange helps to overcome this fear in a low-pressure format.

If you are retired or have weekdays off from work, you can help introduce young prospective hams to the fun of working a contest. Contact your local school district or your child's or grandchild's teacher and suggest setting up a station for the second week of February. We have heard from stations that were set up in classrooms, libraries, building lobbies and parking lots and other outdoor locations.

School Club Roundup is sponsored by the Council for the Advancement of Amateur Radio in the New York City Schools (CAAR/NYCS), the ARRL and its Hudson Division Education Task Force to foster contacts with and among school radio clubs.

Award certificates will be issued for separate Elementary, Middle/Intermediate/Junior High School, High School and College/University levels for USA and DX entries.

Rules: Complete rules are available at **www.arrl.org/contests/rules/2004/scr.html**.

1. **Object:** Exchange information as below with any stations, especially school stations.

2. **Contest period:** February 9-13. See **www.arrl.org/contests/rules/2004/scr.html** for time limitations.

3. **Entry classes:** single transmitter only:

(I) Individual or Single Operator (non-club);

(C) Club or multioperator group (non-school);

(S) School club or group (grades k-12, colleges and universities; this includes any group formed for the sole purpose of participating in the SCR).

If multiple transmitters are used, such as for demonstration purposes, include the results from one at a time.

4. **Exchange:** Your call sign, RS(T), class (I, C or S), US state, Canadian province or DXCC country. (Multioperator stations must use only one call sign during the entire contest.)

5. **Scoring:** Stations may be contacted once each on phone and CW (all other modes count as CW). No repeater contacts except satellite and "real time" packet. Count one point for each phone QSO and two points for each CW QSO.

Multiplier: [*Number of US states plus Canadian provinces plus DX countries*] plus 2× [C class QSOs] plus 5× [S class QSOs]. School stations and Marty, KA2NRR, get a multiplier of 5, which make them the most desirable stations to work. (KA2NRR, was the founding Chairman of the CAAR/NYCS and creator of the contest that became the SCR.)

Final score: Multiply QSO points by multiplier. *Please use our summary form to avoid errors, especially if this is your first time in the SCR.* (See 6 below.)

Suggested frequencies: All amateur bands except 30, 17 and 12 meters are permitted. See **www.arrl.org/contests/rules/2004/scr.html** for complete frequency information.

More info: Sample Log and Entry forms and the latest version of *SCR-LOG* written by AD8B can be downloaded from the files section of our e-mail reflector, **groups.yahoo.com/group/SCR-L/**.[1] You can also subscribe to the reflector by sending an e-mail to **scr-l-subscribe@yahoogroups.com**. Paper forms are available by sending a large self-addressed stamped envelope (SASE) or an address label and postage. KC7MOD's logging software *LogIt!* may be found at **www.asu.edu/clubs/amateur_radio_ society/logit/index.html**. Also, check **www.arrl.org/contests**.

Address questions to **SCR-L@yahoogroups.com** or **n2rq@arrl.net**.

6. **Reporting:** Clearly list the call sign used, entry class, type of school, return address, phone number, e-mail address, number of operators/loggers and number of hours. Logs must include exchange information, bands and signature of all operators (and authorized club official or trustee and address, phone number and e-mail). Dupe check sheets are *required* for entries over 100 QSOs. (Computer entries on disk are appreciated. Use *SCR-LOG* or follow the ARRL Format. Please include a printed summary sheet and instructions including file names and formats.) Entries should be sent to SCR, c/o Lew Malchick, N2RQ, Brooklyn Technical High School, 29 Fort Greene Pl, Brooklyn, NY 11217. Entries must be postmarked before March 15, 2004.

Awards: 8.5×11 inch certificates for the top three entries in each class. The school club class will be divided into elementary, middle, high school and college/university. See **www.arrl.org/contests/rules/2004/scr.html** for complete award information. Note: Requests for contest results and certificates that do not include a large (9×12 inch) self-addressed, stamped envelope (or a mailing label and sufficient postage or IRCs) cannot be honored.

[1]*SCR-LOG for DOS* has been revised for 2004. There is no *Windows* or Macintosh version.

Suggested SCR Frequencies

Phone (kHz)	*Novice Phone*	*CW (kHz)*	*Novice CW*
1855-1865		1800-1810	
3850-3880		3530-3580	3685-3705
7225-7255		7030-7080	7110-7130
14,250-14,280		14,030-14,060	
21,300-21,330		21,050-21,080	21,110-21,130
28,550-28,580	28,350-28,400	28,050-28,080	28,110-28,130

DAVE VONDIELINGEN, AD8B

During an after school session, sixth grader Brandon Walter enjoys participating in the 2003 School Club Roundup. Other students from Zion Lutheran School in Missouri anxiously wait for their turn.

By **Dan Henderson, N1ND**
Contest Branch Manager

Results, The 2003 ARRL August UHF Contest

Many things go into operation on the UHF and microwave bands…Home stations… experimenting…training…hilltopping… roving…added bands…

It all starts with the stalwarts—the home stations. They might be single or multi-operator…High power or low… Some with tall towers and some just beginning…Many caught the UHF bug while operating VHF contests…

Then come the experimenters… homebrewing or modifying equipment to add a new band or to see if their latest find in the flea market has value…

Add a dash of hilltopping activity… Drag the microwave dish, radio, transverters and power up a mountain…

Top it all off with a healthy dose of rovers… They dash about from site to site, long enough to slay the available dragons at one locale then quickly move to the next challenge…

Sounds like a recipe for fun, doesn't it? And for many UHF and microwave enthusiasts, the ARRL August UHF Contest provides a great stage to challenge their skills. Different from the other major ARRL events above 50 MHz in that it doesn't include the 6 and 2 meter bands, the UHF Contest is better known for Gunnplexers and innovation than stacked Yagis and armchair copy. In 2003, entries from 140 stations were received representing 49 of the ARRL/RAC Sections. A total of 9357 QSOs were reported by the participants, with 432 MHz being the most popular band (3629 QSOs), followed by 222 MHz (2526) and 1296 MHz (1240).

Don't be lulled into the impression that the lack of 6 and 2 meters means this contest is not fun or not competitive. The satisfaction of a long E-skip QSO on 6 is easily replaced by the joy of making a new grid on 1296 or realizing that the piece of gear you modified for 3.4 GHz works!

If you don't think it can be *competitive* just ask Bob, K2DRH (IL), Dale, AF1T (NH), or Russ, KB8U (MI). This trio slugged it out in the **Single Operator Low Power** category. Dale employed more bands (nine) but was edged out by Bob who eked out eight more QSOs but won the multiplier war handily. Russ had a 20 multiplier advantage on Dale, but Dale's higher point QSOs on the higher bands allowed him to hold on by a scant 4.4k points.

NØDQS

The NØDQS Rover—chasing electrons across the Midwest.

So it's not a *serious* event? Don't mention that to Bill, AA2UK; Jeff, K1TEO, or Don, WW8M, the top three finishers in the **Single Operator High Power** category. All three of these aficionados flexed their muscles and easily surpassed the rest of the competition, each posting better than 230k.

So how do newer operators learn their way around operating at the highest frequencies? As with HF, many operators are *trained* by assisting at one of the large **Multioperator** stations. Unlike HF, where the major lobe of a Yagi might encompass 60°, a couple of degrees off in your dish orientation may well mean a missed QSO. Many of the top VHF operators have gained valuable experience by working with multioperator stations such as W2SZ, the RPI Amateur Radio Club. Mount Greylock again reigned supreme, more than doubling the valiant efforts of the N3EMF group.

Of course, you cannot overlook that one of the biggest parts of this hobby is the bottom line—it's *fun*! And few have more fun during this event than that hearty group that finds their "escape from the asylum" of everyday humdrum as **Rovers.** We are willing to bet that no one had more fun that the top rover Bill, W3IY. With his faithful sidekick Christophe, ON4IY, Bill pumped enough RF into the ether from 10 grids to bring home another win! A great battle for second place was fought between Paul, N6DN, and Lloyd, NE8I, with Paul taking second by only a scant 667 points! Lloyd employed three more bands than Paul and pulled in one additional multiplier, but Paul was able to hold off the challenge with more QSOs. QST

Expanded Results, Line Score Printouts Available

For complete contest results on-line, please visit **www.arrl.org/contests/results**. ARRL members without Internet access may obtain a printout of the complete line scores by sending a self-addressed, stamped envelope to ARRL Contest Results, 225 Main St, Newington, CT 06111. Please be sure to include the contest name and year.

Table 1
Top Ten

Single Operator Low Power	
K2DRH	57,684
AF1T	45,864
KB8U	41,496
WA3GFZ	29,106
W3HMS	16,983
NØURW	16,638
W1PM	16,632
N6RMJ	11,286
WB2SIH	11,124
K3HCE	10,302
Single Operator High Power	
AA2UK	296,205
K1TEO	245,802
WW8M	232,065
KMØT	127,008
K1RZ	65,817
WØGHZ	48,312
N2BJ	39,618
N6NB	39,168
WØZQ	34,920
W6TOI (KE6HPZ, op)	27,342
Multioperator	
W2SZ	613,068
N3EMF	242,550
WA3UGP	42,594
WD8USA	17,766
K4EJQ	16,470
W1XM	9,270
W6TE	6,930
N3JFM	4,290
K1NKR	3,933
KT8O	2,772
Rover	
W3IY (+ON1CFX)	114,696
N6DN	58,296
NE8I	57,627
NØDQS	51,414
N1JEZ	50,856
K9JK	43,152
K1DS	28,776
WB8BZK	16,428
WØAMT (+KCØLBT)	12,069
N1MU/VE3 (+N2NAO)	11,979

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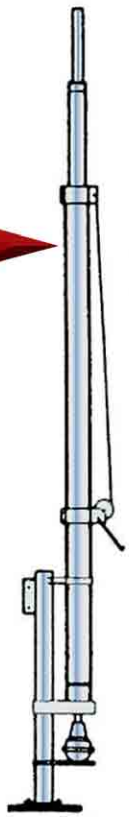

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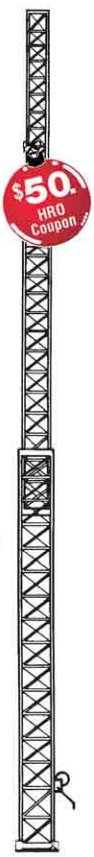

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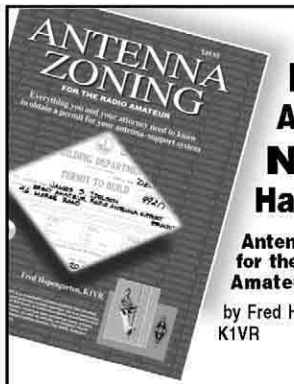

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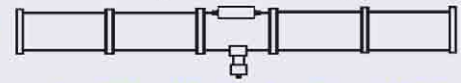

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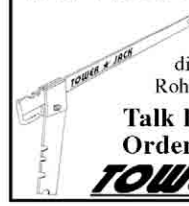

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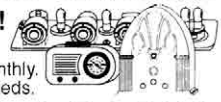

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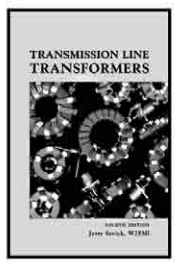

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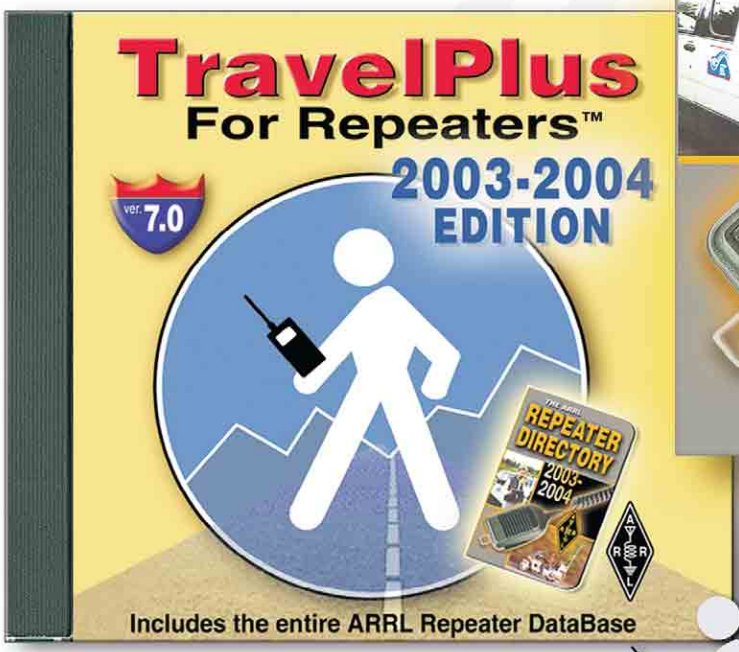

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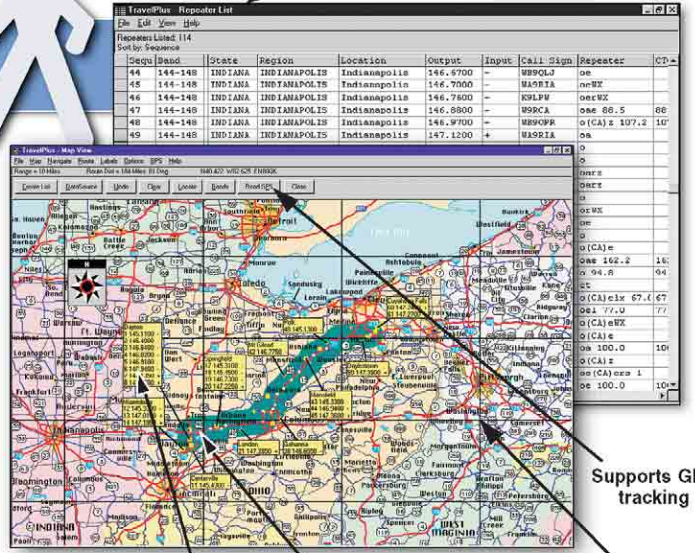

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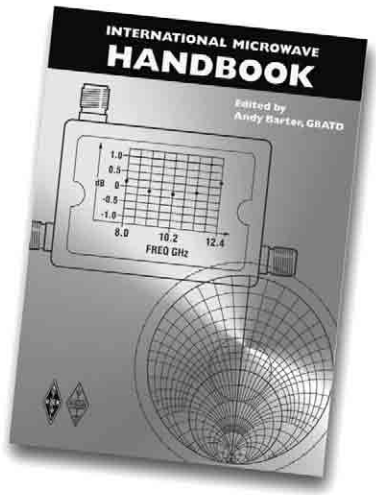

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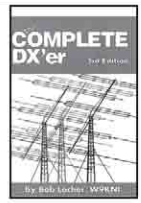

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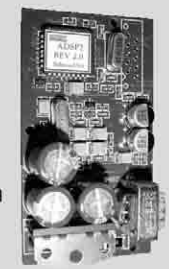

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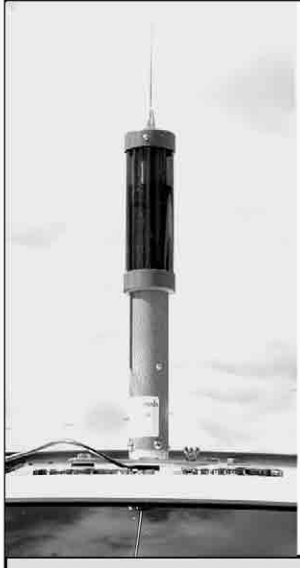

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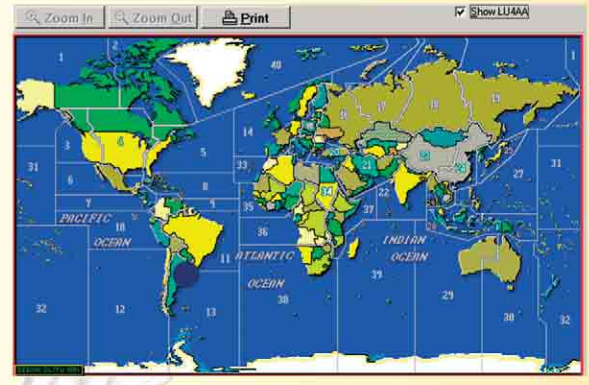

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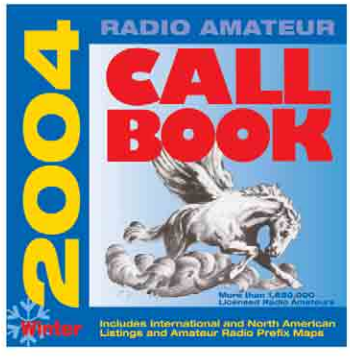

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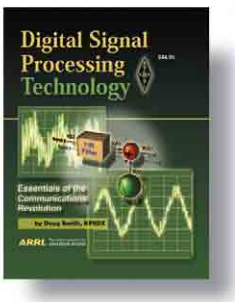

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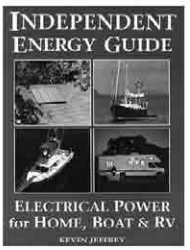

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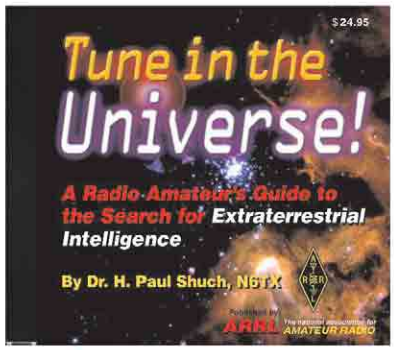

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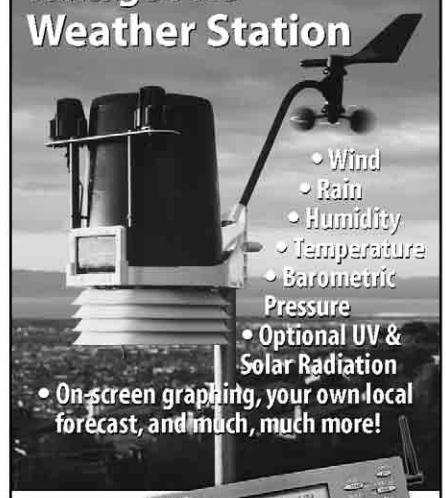

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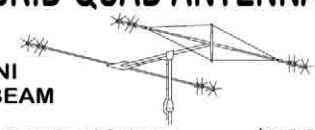

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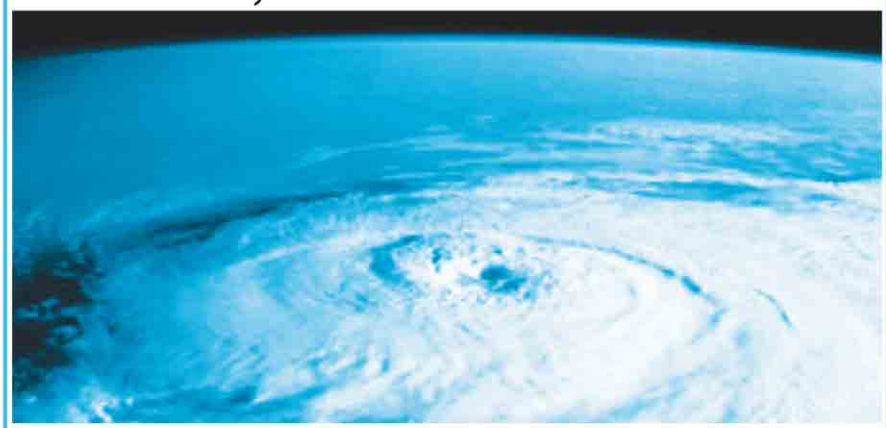

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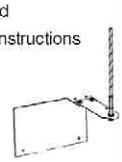

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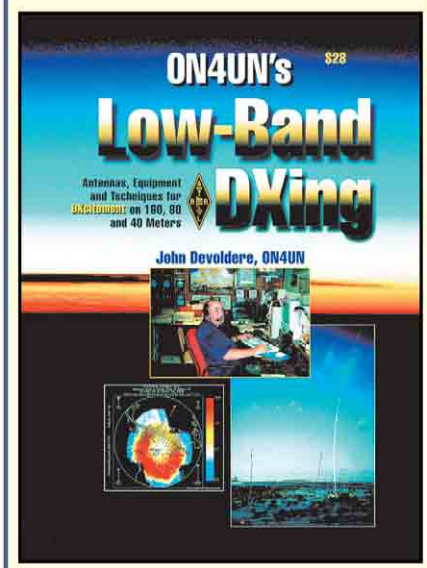

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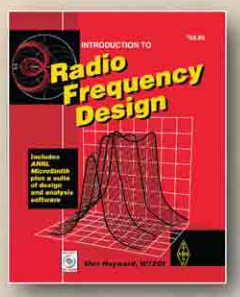

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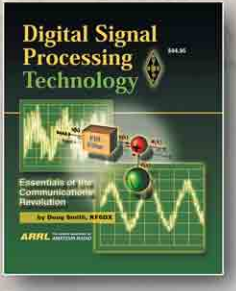

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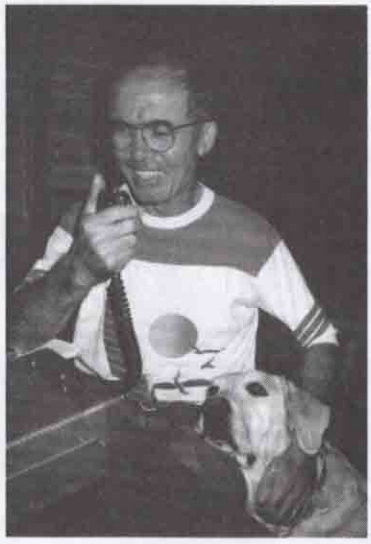

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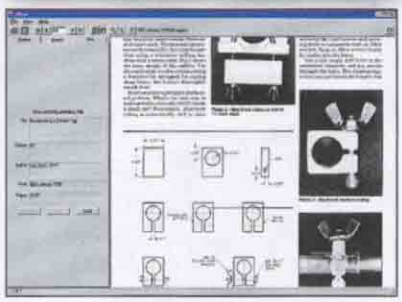

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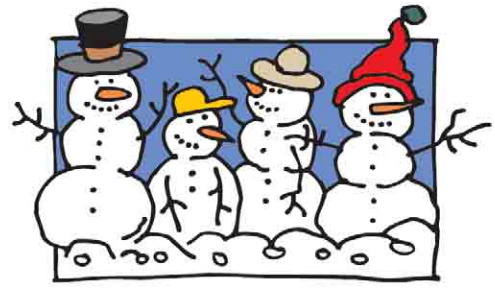

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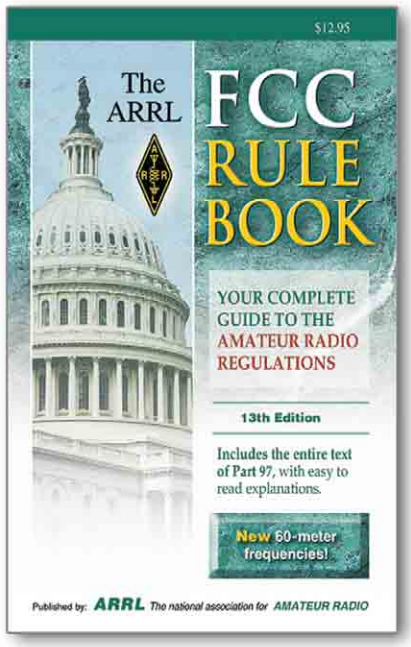

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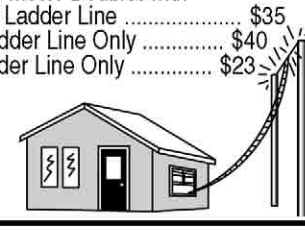

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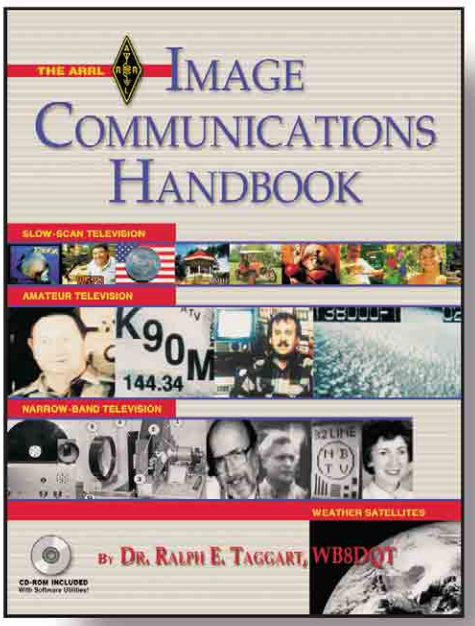

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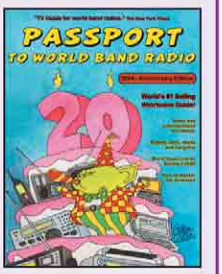

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- **Cross-Needle Meter**
- *6 Position Antenna Switch*
- *Built-in 4:1 Balun*
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HFT-1500

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Two heavy duty 4.5 kV transmitting variable capacitors and a massive high current roller inductor gives you arc-free operation up to 2 kW PEP SSB.

Precision Resetability

A sturdy hand cranked roller inductor lets you quickly fly from band to band. A precision 5-digit gear driven turns counter lets you accurately return to your previous settings.

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You can tune your SWR down to the absolute minimum!

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A shielded directional coupler and backlit Cross-Needle meter displays accurate SWR, forward and reflected power simultaneously. Reads both peak and average power on 300/3000 Watt scales.

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A 4:1 Ruthroff voltage balun feeds dual high voltage Delrin terminal posts for balanced lines. HFT-1500 is 5.5x12.5x12 inches. Has *VECTRONICS'* splendid one year limited warranty.

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8 position antenna switch, built-in 50 Ohm dummy load, peak reading backlit cross-needle SWR Power meter, 4:1 balun for balanced line antenna. Scratch-proof Lexan front panel. 10.2x9.4x3.5 inches. Weighs 3.4 pounds.

300 Watt Mobile Tuner

VC-300M **$109.95**

The VC-300M *Mobile* Antenna Tuner is compact, lightweight, easy-to-operate and is our most economical tuner.

It's compatible with *any* mobile antenna and any mobile HF transceiver and is compact enough to fit in the most compact car.

It can also be used at home with dipoles, vees, verticals, beams or quads fed by coax.

Backlit dual movement meter simultaneously monitors Power and SWR. Covers 1.8 to 30 MHz. Handles 300 Watts SSB PEP, 200 Watts continuous, (150 Watts on 1.8 MHz). 7.25x8.75x3.6 inches. Weighs 3.4 lbs.

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1500 Watt dry Dummy Load

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As Featured in a July 2003 *QST* "Short Takes" Review!

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Snap Circuits, Jr, (SC-100) **$29.95**
Contains over 30 parts. Build over 100 different circuits!

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MFJ-993
$259.95 **New!**

The MFJ-993 *IntelliTuner*™ lets you tune any antenna *automatically* balanced or unbalanced -- *ultra fast*.

It's an automatic antenna tuning *console* complete with SWR/Wattmeter, antenna switch for two antennas and 4:1 current balun for balanced lines.

MFJs exclusive *IntelliTuner*™, *Adaptive Search*™ and *InstantRecall*™ algorithms give you *ultra fast* automatic tuning with over 2000 *non-volatile* revolving memories.

You get a highly efficient L-network, wide 6-1600 ohm matching at *full* 300 Watts SSB/150 Watts CW, 1.8-30 MHz coverage, Cross-Needle and *digital* meters, aural SWR meter, *backlit* LCD display, remote control port, radio interface, heavy-duty 16 amp/1000 volt relays and more.

It learns while you're having fun

As you're ragchewing, contesting or DXing, *your MFJ-993 is learning!*

When you transmit, the MFJ-993 automatically tunes for minimum SWR and remembers your frequency and tuner settings. The next time you operate on that frequency and antenna, these tuner settings are instantly restored and *you're ready to operate in milliseconds!*

Each of two antennas can learn and remember over a thousand frequencies and tuner settings. They are safely stored in *non-volatile* revolving memory.

Highly Intelligent ultra fast tuning

MFJ *InstantRecall*™ first checks its memory to see if you have operated this frequency before. If so, tuning is instantaneous and you're ready to operate.

If not, MFJ's *IntelliTuner*™ algorithm - - based on MFJ's famous SWR Analyzer technology - - kicks in. It *measures* the complex impedance of your antenna. Next, it *calculates* the components it needs and instantly *snaps* them in. Then, it fine tunes to minimize SWR -- you're ready to operate. It's all done in a *fraction* of a second.

When the impedance is within its measurement range, the MFJ-993 is the *fastest automatic antenna tuner in the world.*

If it can't accurately determine impedance, MFJ's *AdaptiveSearch*™ algorithm goes into action. Frequency is measured and relevant components values are determined. Only those values are searched for ultra-fast tuning.

For even faster searches, you can set the target SWR to 2 (settable 1.0 to 2.0).

You can manually tune when you can't transmit (for listening out of ham bands).

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Lighted Cross-Needle and *digital* SWR/Wattmeters lets you accurately read SWR, forward and reflected power at a glance.

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Turn on a highly visible, instant response SWR LCD bargraph when you need it.

Backlit LCD Display

An easy-to-read *backlit* LCD displays SWR, forward/reflected power, frequency, antenna 1 or 2, L and C tuner values, on/off indicators and other information.

Remote Control Port

Plug in the **MFJ-990RC, $39.95**, remote control and put your tuner at your antenna or elsewhere and control it remotely.

The MFJ-993 supports radio tuner interfaces such as the ICOM 706 series. *Interface cables are available.*

The MFJ-993 is a compact 10Wx2¾ Hx9D inches. Use 12-15 VDC/1 amp or 110 VAC with **MFJ-1316, $19.95**.

Tune any Antenna

You can tune any antenna -- dipoles, verticals, beams, phased arrays, inverted vees, quads, random wires, mobile antennas, limited space antennas -- any antenna.

A 4:1 true current balun lets you tune any *balanced* antenna -- horizontal loops, vertical loops, multi-band doublets, quads, folded dipoles, Zepps.

150 Watt Automatic Tuner

MFJ-991,
$219.95 **New!**

MFJ-991, *150 Watt IntelliTuner*™ automatic antenna tuner. Similar to MFJ-993 but handles 150 Watts SSB/100 Watts CW, matches 6-3200 Ohms. Does not have digital SWR/Wattmeter/LCD display, aural SWR meter/audio feedback, antenna switch or 4:1 current balun for balanced lines.

600 Watt MFJ Automatic Tuner

MFJ-994,
$359.95 **New!**

MFJ-994, *600 Watt IntelliTuner*™ automatic antenna tuner. Similar to MFJ-993 but handles 600 Watts SSB/300 Watts CW, matches 12-800 Ohms. Does not have digital SWR/Wattmeter/LCD display, aural SWR meter/audio feedback, antenna switch or 4:1 current balun for balanced lines. Tuning must be done at low transceiver power with the amplifier bypassed.

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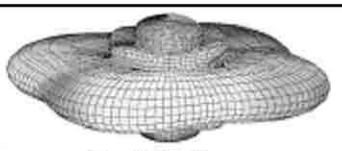

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MFJ *Balanced Line* Antenna Tuner

Superb balance . . . Very wide matching range . . . Covers 1.8-54 MHz . . . Cross-Needle SWR Wattmeter . . . Handles 300 Watts . . . Compact size . . .

The MFJ-974H is a* fully balanced true *balanced line antenna tuner. It gives you superb current balance.

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Johnson Matchbox

For decades, the Johnson Matchbox has been the standard of comparison for balanced line antenna tuners. But, it had a severely limited matching range and covered only 80, 40, 20, 15 and 10 Meters.

***The** MFJ-974H is its successor*. It meets today's needs and even surpasses the Johnson Matchbox outstanding performance.

Everything You Need

The MFJ-974H gives you excellent current balance, very wide matching range(12-2000 Ohms) and covers 1.8 through 54 MHz *continuously* including all WARC bands, 160 Meters, 6 Meters and the new 60 Meter band. Handles 300 Watts SSB PEP and 150 Watts CW.

Tuning is fast and easy - - just three tuning controls. You can adjust for highly efficient broadband low-Q operation or use higher Q when you encounter extreme loads.

A large three-inch lighted Cross-Needle SWR/Wattmeter lets you read SWR, peak or average forward and reflected power *all at a glance* on 300/60 or 30/6 Watt ranges.

A ground post is provided to ground one output terminal so you can also tune random wires and coax fed antennas.

Compact 7½Wx6Hx8D in. fits anywhere.

Tunes any Balanced Line

The MFJ-974H tunes any balanced lines including 600 Ohm open wire line, 450/300 Ohm ladder lines, 300/72 Ohm twin lead - - shielded or unshielded.

Superb current balance minimizes feedline radiation that can cause troublesome TVI /RFI, painful RF bites, mysterious RF feedback problems and radiation pattern distortion.

Excellent Balance, Excellent Design

The MFJ-974H is a *fully balanced* wide range T-Network. *Four* 1000 Volt air variable capacitors are gear driven. A high-Q air wound tapped inductor is used for 80-10 Meters with separate inductors for 6 and 160 Meters. The tuning components are mounted symmetrically to insure electrical balance.

A 1:1 *current* balun is placed on the low impedance 50 Ohm input side to convert the balanced T-Net-work to unbalanced operation. An efficient balun is made of 50 ferrite beads on RG-303 *Teflon*™ coax to give very high isolation. It stays cool even at max power.

MFJ-974H **$189.95**

Balanced Line = Extremely Low Loss

Balanced lines give extremely low loss.

Doublet, horizontal loop, vertical loop, quad, double extended Zepp, Lazy H, W8JK antennas all give efficient multi-band operation when fed with balanced lines.

6-80 Meter Balanced Line Tuner

MFJ-974 **$169.95** New!

MFJ-974, $169.95. Same as MFJ-974H but for 6-80 Meter operation (no 160 Meters).

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Choose super versatile 5-way binding posts AND/OR Anderson PowerPole(R) connectors

Anderson PowerPole® is a registered trademark of Anderson Power Products.

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Choose MFJ's *super versatile* super heavy duty 5-way binding posts (spaced for standard dual banana plugs) and/or *Anderson PowerPole®* outlets.

Each *Anderson PowerPole®* is individually fused as needed. Standard color coded automobile fuses plug in externally. Extra *PowerPole®* connectors, contacts, fuses are included at *no extra cost*.

Versatile 5-Way Binding Posts

MFJ-1118 **$74.95** **Power** two HF and/or VHF rigs and six accessories from your main 12 VDC supply. *Built-in 0-25 VDC voltmeter*. Two pairs 35 amp 5-way binding posts, fused and RF bypassed for transceivers. Six pairs RF bypassed binding posts with master fuse, ON/OFF switch, and "ON" LED provide 15 Amps for accessories. 12½x2¾x2½ in.

All PowerPoles®

MFJ-1128 **$99.95** ***12 outlets, each fused, 40 Amps total.*** Three high-current outlets for transceivers. Nine *switched* outlets for accessories. Mix and match in-cluded fuses as needed (one-40A, one-25A, four-10A, four-5A, three-1A fuses installed). *Built-in 0-25 VDC Voltmeter*. Includes *extra* 12 pairs of *PowerPole®* contacts and *extra* 10 fuses (2 each: 1, 5, 10, 25, 40A) -- *no extra cost*. 12Wx1¼Hx2¾D in.

MFJ-1126 **$79.95** ***8 outlets. each fused, 40 Amps total.*** Factory installed fuses: two 1A, three 5A, two 10A, one 25A, one 40A. *Built-in 0-25 VDC Voltmeter*. Includes *extra* 6 pairs of *Anderson PowerPole®* contacts and *extra* 5 fuses (1, 5, 10, 25, 40A) -- *no extra cost*. 9Wx1¼Hx2¾ inches.

PowerPoles® AND 5-Way Binding Posts

MFJ-1129 **$109.95** *The best of both worlds!* ***10 outlets, each fused, 40 Amps total.*** Three high-current outlets for rigs -- 2 *PowerPoles®* and 1 versatile high-current 5-way binding post. Seven *switched* outlets for accessories (20A max) -- 5 *PowerPoles®* and 2 versatile binding posts. Mix and match included fuses as needed (1- 40A, 2-25A, 3-10A, 3-5A, 2-1A installed). *Built-in 0-25 VDC Voltmeter*. Includes *extra* 7 pairs of *PowerPole®* contacts, and 10 fuses (2 each,1,5,10, 25, 40A) -- *no extra cost*.12½Wx1¼Hx2¾D in.

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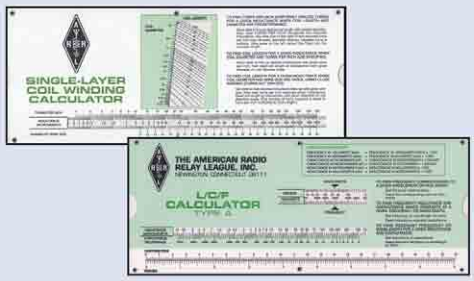

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Tiny 4½x2¼x3 inch tuner handles full 150 Watts! Covers 80-10 Meters, has tuner bypass switch, tunes nearly anything!

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Operate anywhere, anytime with a quick easy set-up! Tune out SWR on your mobile whip from inside your car. Operate in your apartment with a wall-to-wall antenna or from a motel room with a wire dropped from a window or from a mountain top with a wire over a tree limb. Great for DXpeditions or field day. Be prepared for emergencies.

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$79.95 **New!**

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ALL-in-one! MFJ-904H, same as MFJ-902 *Tiny Travel Tuner* but has *4:1 balun for balanced lines* and Cross-Needle SWR Wattmeter. Read SWR, forward and reflected power all at a glance in 300/60 and 30/6 Watt ranges. Has 5-way binding posts for balanced lines and random wire. 7¼Hx2¼Hx2¾D inches.

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MFJ-915 *RF Isolator*
MFJ-915
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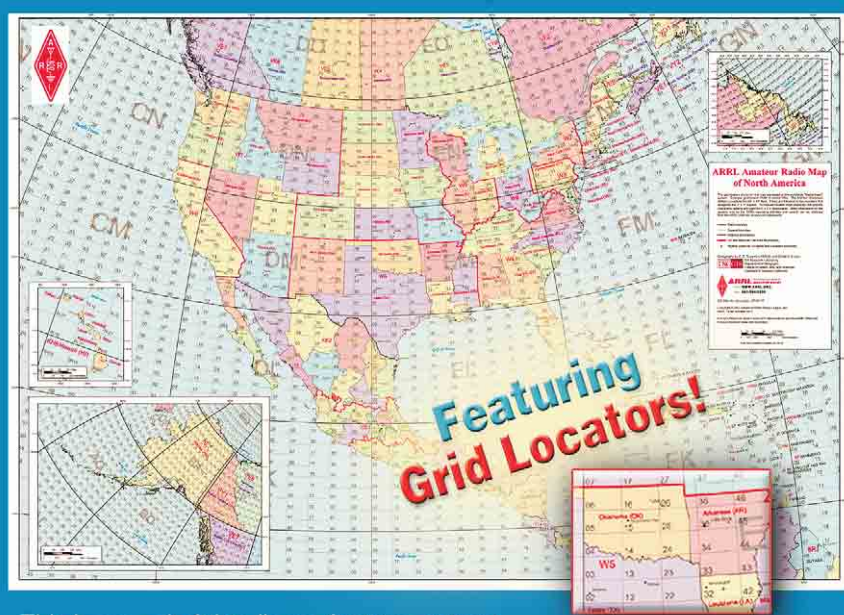

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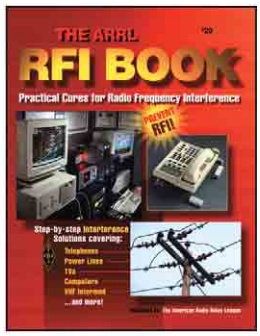

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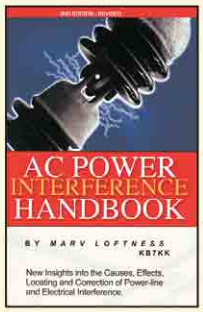

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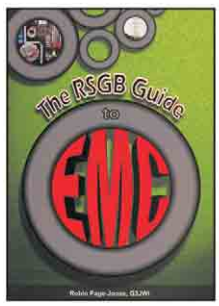

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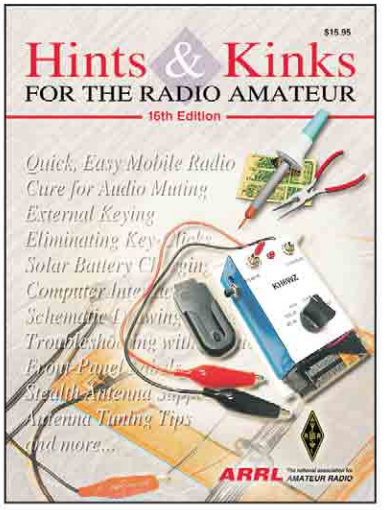

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TECH TALK

Get Started in HF with Icom's IC-718

Ready to expand your amateur radio horizons and join the globe-spanning fun of HF communications? Getting started in HF is surprisingly easy, especially when you think smart and gear up with an economical new transceiver and effective antenna rather than trying to use older items prone to breakdowns. Success right from the start is vitally important!

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DSP. Like to make your IC-718 an extra-special performer? Just add the optional UT-106 DSP unit. The module installs in a snap and reduces constant or fixed-level band/background noise a regular noise blanker misses, plus it eliminates those pesky "tune-up" tones or carriers you hear on SSB. It is an absolute gem!

Antenna Systems. When planning your antenna system, remember the element(s) of both wire and aluminum-type antennas intercept and radiate signals best "broadside" or at right angles to their elements—just like the way light emanates from a long neon tube. The antenna should also be mounted in a clear, rather than a confined or blocked area. Mounting a vertical antenna so its base is slightly above a roof line or positioning a doublet antenna at a right angle rather than parallel to TV, telephone and power lines (and station gear) is encouraged. It minimizes TVI, telephone interference and RF feedback. Position the antenna between 30 and 70 feet from your station, interconnect it via new low loss cable like RG-8X, then fine-tune its sections for an SWR of 1.5 to 1 or lower in your favorite band sections. Like a short cut here?

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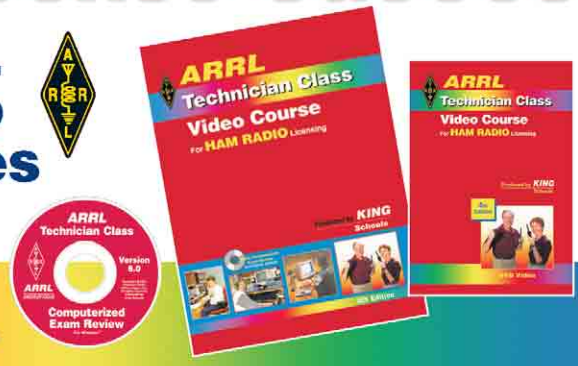

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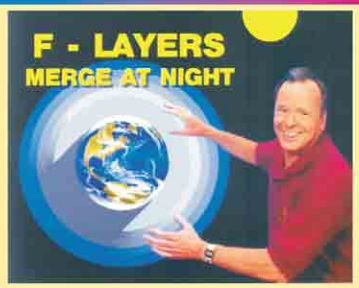

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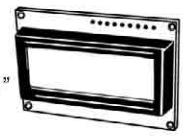

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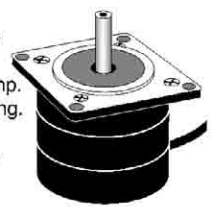

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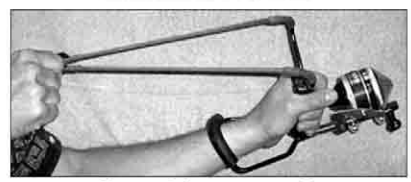

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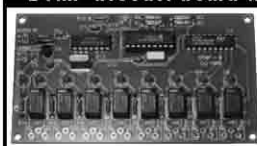

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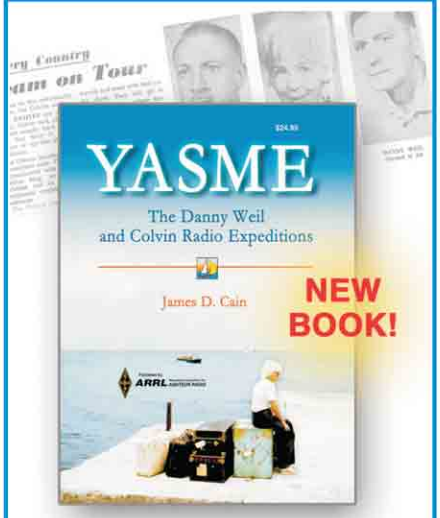

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949E	$139
969	$169
986	$289
989C	$309
1798, 80–2m Vertical	$249
1796, 40/20/15/10/6/2m Vert.	$189

Big MFJ inventory–please call

COAX CABLE

RG-213/U, (#8267 Equiv.)	$.36/ft
RG-8X, Mini RG-8 Foam	$.19/ft
RG-213/U Jumpers	Please Call
RG-8X Jumpers	Ple ase Call

Please call for more coax/connectors.

TOWER HARDWARE

3/8"EE / EJ Turnbuckle	$11/1
1/2"x9"EE / EJ Turnbuckle	$16/1
1/2"x12"EE / EJ Turnbuckle	$18/1
3/16" / 1/4" Big Grips	$5.

Please call for more hardware item

TIMES MICROWAVE LMR® COAX

LMR-400	$.59/ft
LMR-400 Ultraflex	$.89/ft
LMR-600	$1.19/ft
LMR600 Ultraflex	$1.95/ft

HIGH CARBON STEEL MASTS

5 FT x .12" / 5 FT x .18"	$35/
10 FT x .18" / 11 FT x .12"	$129/
16 FT x .18" / 17 FT x .12"	$179/1
20 FT x .25" / 21 FT x .18"	$315/2
22 FT x .12" / 24 FT x .25"	$149/3

GAP ANTENNAS

hallenger DX	$289
hallenger Counterpoise	$29
hallenger Guy Kit	$19
agle DX	$299
agle Guy Kit	$29
tan DX	$329
tan Guy Kit	$29
oyager DX	$409
oyager Counterpoise	$49
oyager Guy Kit	$45

lease Call for Delivery Information.

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/G7-144B	$109/179

Hustler Resonators in stock–call.

ANTENNA ROTATORS

M2 OR-2800P	$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 (#18)	$.32/ft.
R81/82	$.25/ft./.39/ft.
R84	$.85/ft

PHILLYSTRAN GUY CABLE

HPTG1200I	$.45/
HPTG2100I	$.59/
PLP2738 Big Grip (2100)	$6.0
HPTG4000I	$.89/
PLP2739 Big Grip (4000)	$8.5
HPTG6700I	$1.29/
PLP2755 Big Grip (6700)	$12.0
HPTG11200	$1.89/
PLP2758 Big Grip (11200)	$18.0

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IC-756PROII..... Icom Special!
The Icom IC-756PROII is an all mode HF and 6m transceiver featuring 32-bit digital signal processing, auto 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 hand mic and DC power cord.

PW-1..... In Stock!
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 XCVR 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 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 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..... Special!
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, auto tuner, and more. With up/down hand microphone and DC power cord.

Quadra System..... In Stock!

FT-897..... 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 microphone and DC power cord.

IC-703..... New, In Stock!
IC-703PLUS..... New, In Stock!
The Icom IC-703 is a compact HF XCVR, with built-in auto tuner, DSP, and more! The IC-703PLUS adds 6m coverage.

IC-706MK2G..... Icom Special!
The Icom IC-706MK2G is a compact HF/6m/2m/70cm all mode XCVR with DSP, CW keyer, built-in CTCSS encode/decode/scan, 107 memoriess and more. A detachable front panel offers convenient mounting, even in compact vehicles.

IC-718..... New Lower Price!

IC-2720H..... New!
Dual band 2m/70cm FM XCVR. Features remote control panel, CTCSS tone encode/decode/scan, cross band repeat, data jack, dual RX, extended RX, 212 memories, and more. Supplied with a DTMF hand mic, separation cable, mounting brackets, and a fused DC power cord.

IC-V8000..... 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..... In Stock!
Quad band mobile XCVR covers 10m/6m/2m/70cm, with cross-band repeat.

FT-8800R..... New, In Stock!
Great 2m/70cm dual band mobile, 45/35 Watts, removable front panel, and more!

FT-7800R..... New, Please Call!
New, 2m/70cm dual band mobile XCVR.

FT-2800M..... In Stock!
Rugged, 50W 2m mobile transceiver.

FT-857..... Now In Stock!
Ultra-compact all mode XCVR for HF/6m/2m/70cm. Features CW memory keyer, CTCSS encode/decode, 200 memories, optional DSP, and more. Supplied with a hand microphone, a fused DC power cord and mounting bracket.

FT-817..... In Stock!
A truly tiny self-contained all mod e HF/6m/2m/70cm QRP XCVR featuring tone encode/decode, 200 memory channels, VOX, and more! With hand microphone.

IC-T2H Sport.... Great Low Price!
IC-Q7A..... Great Low Price!
IC-T7H..... Icom Special!
IC-V8..... Great Low Price!
IC-W32A..... Now In Stock!
IC-T90A..... New, In Stock!

IC-208H..... Great Low Price!
A great 2m/70cm dual band mobile XCVR, featuring CTCSS tone encode/decode, 500 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 memories, and more.

IC-PCR1000..... In Stock!
IC-R8500/R75..... In Stock!
IC-R3/R5/R10..... In Stock!

G-2800DXA..... $1089
Heavy duty antenna rotator handles 34 sq. ft. of antenna load, and features 450° rotation, preset and variable speed.

G-1000DXA..... $499
G-800SA/DXA..... $329/409
G-450A..... $249
G-5500..... $599
G-550..... $299

FT-50RD..... New Lower Price!
VR-120D..... In Stock!
VR-500..... In Stock!
VX-2R..... New, In Stock!
VX-5R..... New Lower Price!
VX-7R..... New Lower Price!
VX-150..... New Lower Price!

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All-Terrain Performance

On or off the road, Kenwood's new TM-271A delivers powerful mobile performance with 60W maximum output and other welcome features such as multiple scan functions and memory names. Yet this tough, MIL-STD compliant transceiver goes easy on you, providing high-quality audio, illuminated keys and a large LCD with adjustable green backlighting for simple operation, day or night.

144MHz FM TRANSCEIVER

TM-271A

▮ 200 memory channels (100 when used with memory names) ▮ Frequency stability better than ±2.5ppm (-20~+60°C) ▮ Wide/Narrow deviation with switchable receive filters ▮ DTMF microphone supplied ▮ NOAA Weather Band reception with warning alert tone ▮ CTCSS (42 subtone frequencies), DCS (104 codes) ▮ 1750Hz tone burst ▮ VFO scan, MHz scan, Program scan, Memory scan, Group scan, Call scan, Priority scan, Tone scan, CTCSS scan, DCS scan ▮ Memory channel lockout ▮ Scan resume (time-operated, carrier-operated, seek scan) ▮ Automatic repeater offset ▮ Automatic simplex checker ▮ Power-on message ▮ Key lock & key beep ▮ Automatic power off ▮ Compliant with MIL-STD 810 C/D/E/F standards for resistance to vibration and shock ▮ Memory Control Program (available free for downloading from the Kenwood Website: ***www.kenwood.net***)

KENWOOD

Amateur Radio Products Group

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